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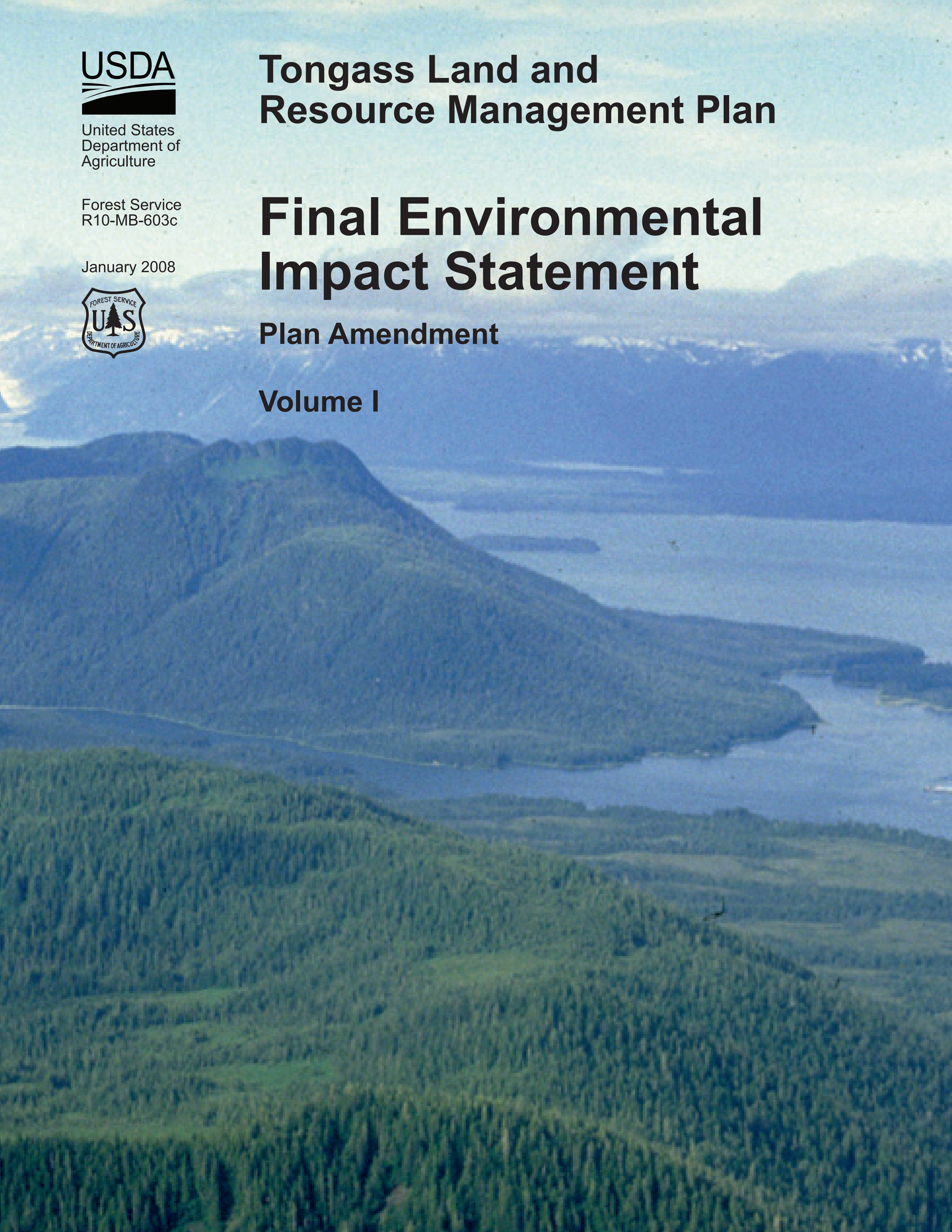
Tongass Land and Resource Management Plan

Final Environmental Impact Statement

Plan Amendment

Volume I



Tongass Land Management Plan Amendment

Final Environmental Impact Statement

January 2008

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Cooperating Agency: State of Alaska

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Abstract:

A Ninth Circuit Court ruling (2005) and the 5-Year Forest Plan Review (completed in January 2005) indicated the need to consider amending the Tongass National Forest Land and Resource Management Plan. This Final EIS responds to the Court and the 5-Year Review by analyzing seven alternatives for amending the Plan, including the No-Action alternative. Maps accompanying this Final EIS depict the land use designations proposed under each alternative. A separate document, called the Proposed Land and Resource Management Plan (Forest Plan), was published with the Draft EIS and was revised, as indicated in Chapter 2 of this Final EIS, to represent the Final Proposed Forest Plan. The action alternatives incorporate this Final Proposed Plan entirely, or with modifications. A number of issues are addressed, but three key issues are identified: 1) protecting high-value roadless areas from road development and timber harvest activity in order to protect roadless area values; 2) providing a sufficient timber supply to meet the market demand and help maintain a vibrant economy in Southeast Alaska; and 3) protecting the wildlife habitat and biodiversity of the Tongass, which is affected by road development and timber harvest activities. The seven alternatives are designed to provide a range of options for addressing these issues. Direct, indirect, and cumulative effects of the alternatives are quantified and compared in Chapters 2 and 3, based on inventory data and modeling.

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ACRONYMS AND ABBREVIATIONS

ACHP	Advisory Council on Historic Preservation
ACMP	Alaska Coastal Management Program
ADEC	Alaska Department of Environmental Conservation
ADF&G	Alaska Department of Fish and Game
ADNR	Alaska Department of Natural Resources
AFHA	Anadromous Fisheries Habitat Assessment
AHRS	Alaska Heritage Resource Survey
AKEPIC	Alaska Exotic Plants Information Clearinghouse
AMHS	Alaska Marine Highway System
AMS	Analysis of the Management Situation
ANCSA	Alaska Native Claims Settlement Act of 1971
ANHP	Alaska Natural Heritage Program
ANILCA	Alaska National Interest Lands Conservation Act of 1980
APC	Alaska Pulp Company
ASQ	allowable sale quantity
AVSP	Alaska Visitor Statistics Program
BIA	U.S. Bureau of Indian Affairs
BLM	Bureau of Land Management
BMP	Best Management Practice
BP	before present
BTU	British Thermal Unit
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CMAI	Culmination of Mean Annual Increment
Corps	U.S. Army Corps of Engineers
DBH	diameter at breast height
DCBD	Division of Community and Business Development
DCED	Department of Community and Economic Development
DEIS	Draft Environmental Impact Statement
DGC	Division of Governmental Coordination
DOL	Department of Labor
DOT&PF	Department of Transportation and Public Facilities
EA	environmental assessment
EFH	Essential Fish Habitat
EIS	Environmental Impact Statement
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act
EVC	existing visual condition
°F	degrees Fahrenheit
FCRPA	Federal Cave Resources Protection Act
FERC	Federal Energy Regulatory Commission
FG	foreground
F.I.R.E.	finance, insurance, and real estate
FORPlan	Previous Forest Planning Model

Contents

FRESH	Forest Resource Evaluation System for Habitat
FSM	Forest Service Manual
FY	fiscal year
GIS	geographic information system
GMU	Game Management Unit
GSA	General Services Administration
HCA	Habitat Conservation Area
HSI	Habitat Suitability Index
IDT	Interdisciplinary Team
IFA	Inter-Island Ferry Authority
IPM	Integrated Pest Management
IRA	Inventoried Roadless Area
km	kilometer
KMDA	known mineral deposit area
KPC	Ketchikan Pulp Company
kV	kilovolt
LSTA	Logging Systems and Transportation Analysis
LTF	log transfer facility
LTSY	long-term sustained yield
LUD	Land Use Designation
LWD	large woody debris
MG	middleground
MM LUD	Minerals Land Use Designation
MBF	thousand board feet
MDP	mineral development potential
MEP	mineral exploration potential
MIRF	Model Implementation Reduction Factor
MIS	Management Indicator Species
MMBF	million board feet
MOU	Memorandum of Understanding
National Register	National Register of Historic Places
NEPA	National Environmental Policy Act
NFMA	National Forest Management Act of 1976
NHPA	National Historic Preservation Act
NIC	non-interchangeable component
NMFS	National Marine Fisheries Service
NFS	National Forest System
NPS	National Park Service
NRDC	Natural Resources Defense Council
NVCS	National Vegetation Classification Standard
NVUM	National Visitor Use Monitoring
NWI	National Wetland Inventory
OGR	old-growth reserve
OHV	off-highway vehicle
ORV	off-road vehicle
P	Primitive

PAOT	persons at one time
PNV	Present Net Value
POG	productive old growth
POW	Prince of Wales
PPI	Producer Price Index
ppm	parts per million
R	Rural
RARE	Roadless Area Review and Evaluation
RM	Roaded Modified
RN	Roaded Natural
RNA	Research Natural Area
ROD	Record of Decision
ROS	Recreation Opportunity Spectrum
RPA	Resources Planning Act of 1974
RVD	Recreation Visitor Day
SATP	Southeast Alaska Transportation Plan
SDEIS	Supplemental Draft Environmental Impact Statement
SEACC	Southeast Alaska Conservation Council
SEIS	Supplemental Environmental Impact Statement
SHPO	State Historic Preservation Office
SIO	Scenic Integrity Objective
SPM	Semi-Primitive Motorized
SPNM	Semi-Primitive Non-Motorized
TES	threatened, endangered, and sensitive
TRUCS	Tongass Resource Use Cooperative Survey
TTRA	Tongass Timber Reform Act of 1990
U	Urban
USGCRP	U.S. Global Change Research Program
USDA	United States Department of Agriculture
USDI	United States Department of the Interior
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
VCU	Value Comparison Unit
VQO	Visual Quality Objective
WAA	Wildlife Analysis Area
WARS	Wilderness Attribute Rating System
WTP	willingness to pay

Contents

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CHAPTER 1
PURPOSE AND NEED

Purpose and Need

Introduction

Forest land and resource management planning is a process for developing, amending, and revising land and resource management plans for each of the National Forests in the National Forest System (NFS). Forest plans are required by the National Forest Management Act of 1976 (NFMA). The 16.8-million-acre Tongass National Forest was the first forest to complete a Land and Resource Management Plan (Forest Plan or Plan) under the NFMA in 1979. The original Forest Plan was amended in 1986 and 1991 and revised in 1997. A Supplemental Environmental Impact Statement (SEIS) was completed in 2003, which further evaluated roadless areas for their wilderness potential. The revised Plan has been amended 24 times since 1997, primarily to adjust Old-Growth Habitat Reserve boundaries and for electronic/communication site designation.

A recent Ninth Circuit Court ruling (2005) and the 5-Year Plan Review (completed in January 2005) indicated the need to amend the current Tongass National Forest Land and Resource Management Plan. This Final EIS responds to the Court and the 5-Year Review by thoroughly analyzing six alternatives for amending the Plan in addition to the No-Action Alternative (Alternative 5). The analysis is being published in two volumes: the first volume contains the main EIS, and the second volume contains the appendices to the EIS. A separate document titled Land and Resource Management Plan (Forest Plan or Plan) is also being published and represents the complete Forest Plan including all amendments. This document represents the Forest Plan that is used in all alternatives, except for differences that are outlined in Chapter 2. Finally, the Record of Decision (ROD), describing the decision and rationale for that decision, is also being published.

This EIS analyzes a possible amendment to the current Forest Plan and is tiered to the 1997 Tongass Land Management Plan Revision EIS and the 2003 Supplemental EIS for Roadless Area Evaluation for Wilderness Recommendations.

Forest Planning History on the Tongass National Forest

NFMA, passed in 1976, required each national forest to develop a land and resource management plan and revise its plan every 10 to 15 years. The Tongass became the first forest to complete a Forest Plan under NFMA in April 1979. The Alaska National Interest Lands Conservation Act (ANILCA) passed December 2, 1980. The 1979 Forest Plan was amended in 1986, reflecting changes mandated by ANILCA. The Forest Plan revision process began in 1987 and a Draft EIS was published in June 1990. In November 1990, the Tongass Timber Reform Act (TTRA) was passed. The Forest Plan was amended in February 1991 to incorporate the TTRA changes. The Forest Plan Revision process continued with a Supplement to the Draft EIS published in September 1991, which incorporated all changes required by TTRA and evaluated a new set of alternatives. Because Congress had just acted on the wilderness issue following completion of the June 1990 Draft EIS, the Forest Service did not reconsider roadless areas for potential wilderness recommendation. The Forest Service prepared a Final EIS in the fall of 1992, but did not publish an associated Record of Decision (ROD). The Regional Forester found there was new information that should be collected to respond to 36 CFR 219.19. That process led to the 1997 Final EIS and the Forest Plan Revision ROD (1997 ROD).

The 1997 Forest Plan was the subject of 33 separate appeals by organizations and individuals. In 1999, the Under Secretary of Agriculture affirmed the Regional Forester's decision regarding all 33 appeals, based on the 1997 Tongass Forest Plan Revision Final EIS and planning record. The Under Secretary also issued a new ROD (1999 ROD) for the 1997 Tongass Land Management Plan Revision.

Two lawsuits challenged the 1997 and 1999 RODs in the U.S. District Court for the District of Alaska. The Alaska Forest Association and some Southeast Alaska communities challenged many aspects of the 1997 Plan and the process by which the 1999 ROD was issued. The Sierra Club and other environmental groups challenged the lack of wilderness area consideration and potential recommendations in the 1997 Plan Revision, FEIS and ROD. The Court issued a single opinion for both cases in March 2001.

In the Alaska Forest Association case *(Alaska Forest Ass'n v. United States Dep't of Agric.* No. J99-0013 CV [JKS] [D. Alaska]), the U.S. District Court upheld the 1997 ROD against all challenges, but held that the 1999 ROD was not properly adopted. The Court vacated the 1999 ROD and enjoined the Forest Service from implementation. The Court further directed the Forest Service to prepare an SEIS addressing the changes from the 1997 Tongass Forest Plan. Because of the extensive public involvement and scientific review in the 1997 ROD, and its thorough policy and legal review of the administrative appeal process and by the District Court, the Forest Service did not propose changes to the 1997 ROD similar to those enjoined by the District Court.

In the Sierra Club challenge of the 1997 Tongass Forest Plan Revision FEIS (*Sierra Club v. Lyons*, No. J00-0009 CV [JKS] [D. Alaska]), the Ninth Circuit Court found the 1997 Tongass Forest Plan should have considered making wilderness recommendations in the Final EIS. The Court ordered the Forest Service to prepare an SEIS evaluating wilderness recommendations for roadless areas on the Tongass and provide the relative contribution to the National Wilderness Preservation System in its Analysis of the Management Situation. The Forest Service issued a Final SEIS and ROD for Roadless Area Evaluation for Wilderness Recommendations in February 2003.

The Natural Resources Defense Council (NRDC) filed a lawsuit (referred to as NRDC I) in the U.S. District Court of Alaska in December 2003 challenging the 1997 Forest Plan and six timber sales. In January they filed a separate lawsuit on a seventh timber sale (referred to as NRDC II) and another lawsuit challenging an eighth sale in March 2004 (referred to as NRDC III). The District Court upheld the 1997 Forest Plan and related National Environmental Policy Act (NEPA) documents on all claims in September 2004. NRDC appealed this ruling to the Ninth Circuit Court of Appeals. The Ninth Circuit Court issued a ruling on NRDC I and NRDC II in August 2005. It found inadequacies primarily relating to the NEPA process for the 1997 Forest Plan. These inadequacies dealt with the timber demand estimates, the range of alternatives related to timber demand, and the cumulative effects analysis related to activities on non-NFS lands. While this process was taking place, the Forest completed a 5-Year Review of the Forest Plan. This review identified a number of items that could lead to adjustments to the Plan.

Purpose and Need

The purpose and need for this EIS is to respond to the Ninth Circuit Court's decision in *Natural Resources Defense Council vs. U.S. Forest Service* (421 F.3d 797, August 5, 2005). In that decision, the Court held that the EIS and ROD for the Forest Plan adopted in 1997 had errors relating to the use of projected market demand for timber, the range of alternatives considered relative to the market demand calculations, and the cumulative effects of activities on non-NFS lands. In addition, there is a need to consider adjustments to the Plan based on information generated during the recent 5-Year Review of the Forest Plan. Therefore, the purpose and need for this EIS primarily relates to the August 2005 Court decision, the 5-Year Plan Review, and other minor clarifications and updates.

Forest Location and Description

The 16.8-million-acre Tongass National Forest (Tongass or Forest) occupies about 7 percent of the area of Alaska. The Tongass is located in the southeastern portion of the state (the area commonly called the panhandle of Alaska or Southeast Alaska) and extends from Dixon Entrance in the south to Yakutat Bay in the north, and is bordered on the east by Canada and on the west by the Gulf of Alaska. The Tongass extends approximately 500 miles north to south and approximately 120 miles east to west at its widest point. Figure 1-1 is a vicinity map of the Forest.

The Tongass includes a narrow mainland strip of steep, rugged mountains and icefields and more than 1,000 offshore islands known as the Alexander Archipelago. Together, the islands and mainland have nearly 11,000 miles of meandering shoreline, with numerous bays and coves. A system of seaways separates the many islands and provides a protected waterway called the Inside Passage. Federal lands comprise about 95 percent of Southeast Alaska, with about 80 percent in the Tongass National Forest and most of the rest in Glacier Bay National Park and Preserve. The remaining land is held in state, Native corporations, and other private ownerships.

Most of the area of the Tongass is wild and undeveloped. Approximately 73,000 people inhabit Southeast Alaska, primarily in 32 communities located on islands or mainland coastal areas. Only eight of the communities have populations greater than 1,000 persons. Most of these communities are surrounded by, or adjacent to, NFS land. Only three communities are connected to other parts of the mainland by road: Haines and Skagway in the north, and Hyder in the southeast.

The economies of Southeast Alaska's communities rely on the Tongass National Forest to provide natural resources for uses such as fishing, timber harvesting, recreation, tourism, mining, and subsistence. Maintaining the abundant natural resources of the Forest, while providing opportunities for their use, is a major concern of Southeast Alaska residents.

Ranger District offices on the Tongass National Forest are located in Yakutat, Juneau, Hoonah, Sitka, Petersburg, Wrangell, Thorne Bay, Craig, and Ketchikan. There are also two National Monuments, Admiralty Island with an office in Juneau and Misty Fiords with an office in Ketchikan (Figure 1-1).

Public Issues

Identification of issues helps define or predict the resources or uses that could be most affected by the management of NFS lands. These issues are used as a basis to formulate management alternatives or to measure differences between alternatives.

Ten public issues were originally identified in 1988 for the Forest Plan Revision. These original issues included scenic quality, recreation, fish habitat, wildlife habitat, subsistence, timber harvest, roads, minerals, roadless areas, and local economy. The 1991 Forest Plan Revision Supplemental Draft EIS (SDEIS) added an additional concern, identifying and considering for recommendation potential wild, scenic, and recreational rivers.

After the release of the 1991 SDEIS, considerable new information pertaining to the Tongass Forest Plan Revision became available. Out of this information emerged five additional issues, determined by the Regional Forester to need more study and evaluation before a final revised Forest Plan could be adopted. Some of these issues were aspects or extensions of the ten public issues previously considered; others were new as issues or had not been considered as issues in themselves. The five issues were wildlife viability, fish habitat, karst and caves, alternatives to clearcutting, and socioeconomic considerations. These issues were assessed in the 1996 Revised SDEIS and the 1997 Tongass Forest Plan Revision Final EIS.

1 Purpose and Need

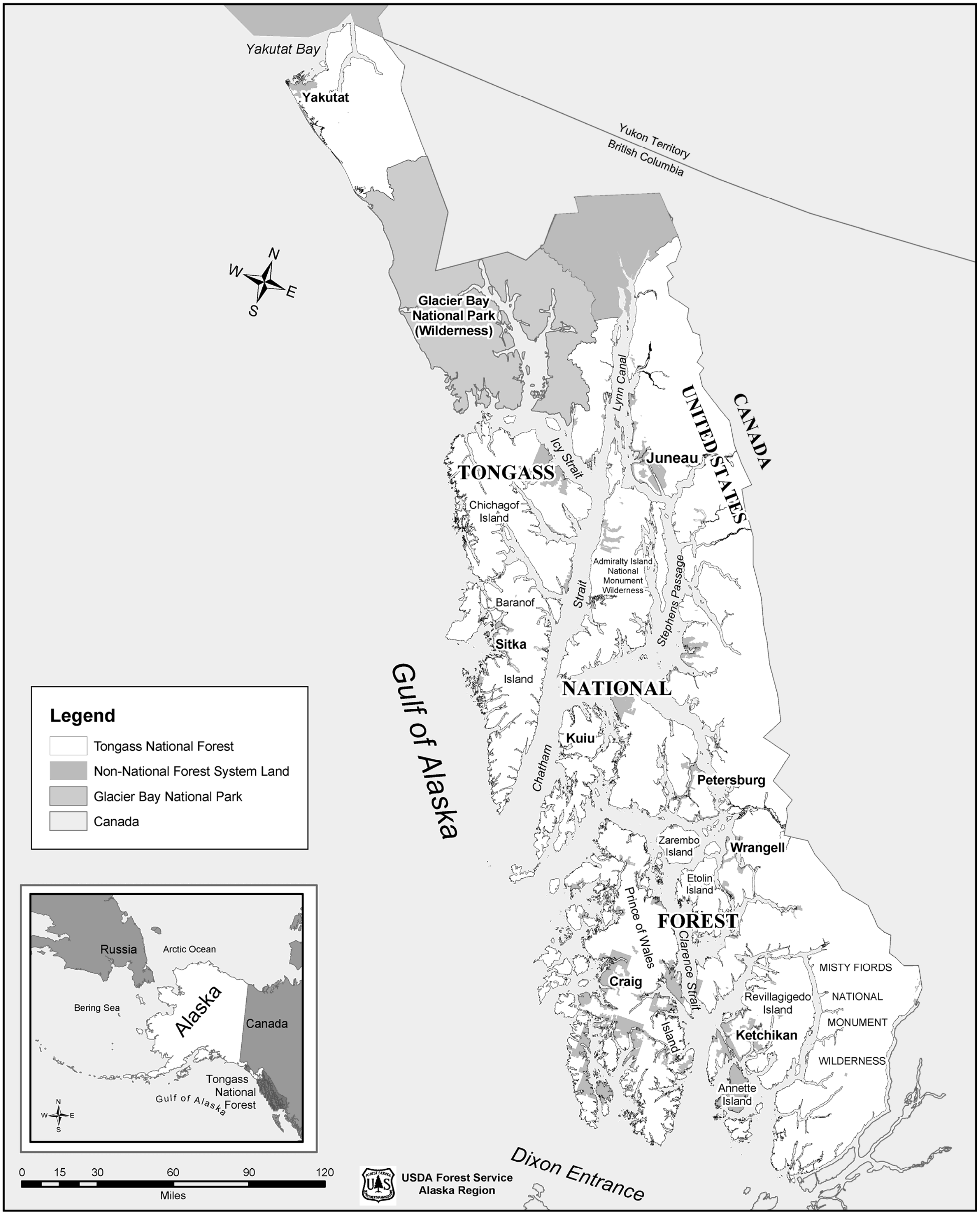


Figure 1-1.
Tongass National Forest Vicinity Map

The 2003 SEIS reviewed and evaluated roadless areas and analyzed alternative groupings of roadless areas for wilderness recommendations. Two broad issue categories, referred to as key issues, were identified as the major issues driving the alternatives of the SEIS analysis. They included 1) the long-term protection of roadless areas and associated values, and 2) the social and economic well-being of the communities of Southeast Alaska.

Public Input

The scope of this EIS was initially determined by the Court in its 2005 ruling, and by the 5-Year Review of the Forest Plan. Additional information was considered to help clearly define the issues and for use in the development and analysis of alternatives. For this Final EIS, comments and information from a wide variety of public input that related to amending the Forest Plan were considered. This information included the following:

- Public comments generated during the 1997 Tongass Forest Plan Revision process;
- Tongass Forest Plan Revision appeals;
- Public input specific to the Tongass National Forest on the Forest Service's 2001 National Roadless Area Conservation Rule;
- Public comments generated relative to the 2003 Supplemental EIS;
- Public input expressed during project-level NEPA analyses over the past 10 years or so; and
- Public input received in response to the Notice of Intent and the Web site for this EIS.

The planning record of the Tongass includes public input encompassing most of the last 2 decades. Of special note are the extensive public meetings held in Southeast Alaska for the 1997 Forest Plan Revision, the 2001 National Roadless Area Conservation Rule, and the 2003 SEIS.

In addition to the above, public involvement has occurred during the development of this EIS. Public involvement activities that have taken place during this time frame include the following:

- The Notice of Intent was published in the Federal Register in March 2006.
- A Forest Plan Adjustment Web site was developed in January 2006 and has been maintained to inform and engage the public since then. It is updated as new information is developed or published and provides a mechanism for public input. Several hundred comments and questions were received through the Web site or via emails associated with the Web site in the first few months of operation.
- A Weblog regarding the Forest Plan adjustment effort was established in July 2006 and was continually maintained as another method of public communication.
- In response to the above items, a number of letters were received containing comments regarding the issues and alternatives. These included letters from environmental organizations, the timber industry, Southeast Alaska community organizations, and a number of individuals from Southeast Alaska and across the nation.

- Government-to-government consultation has been conducted throughout the process, and is ongoing, with federally recognized Tribes.
- A number of group-specific meetings have also occurred with various organizations (including Alaska Native groups).
- A variety of news releases were issued relative to the Forest Plan adjustment throughout the process.
- A series of ongoing meetings, hosted by the National Forest Foundation and The Nature Conservancy, known as the Tongass Futures Roundtable, have resulted in considerable discussion of Tongass management issues among a broad spectrum of individuals and groups interested in the future of Southeast Alaska since May 2006.
- The input received prior to issuance of the Draft EIS was reviewed and a summary of this synthesis is presented as Appendix A (Issue Identification) to the Final EIS.
- A Draft EIS and Proposed Forest Plan were released on January 12, 2007. This began a 90-day comment period, which was later extended to 108 days. The comment period closed on April 30, 2007.
- During the comment period, open houses and public hearings were held in 24 Alaska communities. In addition to comments on the Draft EIS, the hearings provided opportunity to hear concerns related to subsistence and Alaska Native issues.
- On March 22, 2007, an open house and public hearing was held on the internet, to solicit public comment in an open forum from individuals living anywhere in the world.
- Over 84,000 comment documents were received, including individual letters, form letters, emails, hearing testimony, and comments submitted directly via the Forest Plan Adjustment Web site. Slightly more than 2,000 of these were classified as individual comment documents and the others were classified as form letters and emails. The individual comment documents were subdivided into approximately 5,500 individual comments. Responses were received from all 50 states and 89 foreign countries. A summary of the substantive comments and Forest Service responses to those comments can be found in Appendix H.

The Three Focus Issues

Key Issues

Any alternative that proposes to change the Forest Plan could affect resources and/or outputs relative to the current Forest Plan. Therefore, Chapter 3 of the EIS shows the effects of the various alternatives on all relevant resources and evaluates their effects relative to all of the issues and concerns previously identified during the 1997 plan revision process. However, based on the purpose and need of this EIS and the public input received during the current EIS process, some issues are more likely to influence the comparison among alternatives and represent the major issues to be evaluated. These issues were grouped into three broad issue categories, referred to as the key issues. These key issues are the major issues driving the alternatives and analyses.

Key Issue 1 – Protection of high value roadless areas from road development and timber harvest activity on the Tongass National Forest is of local and national importance, particularly for wildlife and biodiversity, recreation, and tourism.

Many people believe roadless areas should be allowed to evolve naturally through their own dynamic processes and should be afforded protection that ensures this will occur. The Tongass includes very large undeveloped land areas with several portions of the Forest consisting of contiguous roadless areas that exceed 1 million acres and represent large, unfragmented blocks of wildlife habitat. This large scale of roadless lands does not exist on any other National Forest, except the Chugach National Forest in Southcentral Alaska.

Roadless areas are considered important because of their wildlife habitat and recreation values and their importance for tourism. They are also important because of the passive-use and ecosystem services values they provide.

Passive-use values represent values that individuals assign to a resource independent of their use of that resource. Typically this includes existence, option, and bequest values, and represents the value individuals obtain from knowing that expansive roadless areas exist, knowing that they are available to visit in the future should they choose to do so, and knowing that they are available for future generations to inherit. There is interest in preserving large portions of the Tongass because so much of it is in a natural condition, unlike most other national forests, and because the Forest represents a significant portion of the world's remaining temperate rainforests.

Ecosystem services represent the services provided to society by healthy ecosystems. These services and benefits include what some consider to be long-term life support benefits to society as a whole. Examples of ecosystem services include watershed services, soil stabilization and erosion control, improved air quality, climate regulation and carbon sequestration, and biological diversity.

Indicators: Analysis relative to this issue compares the amount and proportion of land protected in non-development Land Use Designations (LUDs); the amount of inventoried roadless areas that would be protected under each alternative; and the amount of productive old-growth forest that would be protected under each alternative. Also, the values of the lands protected are considered. Non-use or passive-use values are discussed qualitatively and with examples provided from other studies.

Key Issue 2 – The Tongass National Forest needs to seek to provide a sufficient timber supply to meet the market demand and help maintain a vibrant economy in Southeast Alaska.

TTRA (Section 101) requires the Forest Service to seek to provide a supply of timber from the Tongass National Forest that meets the annual market demand and the market demand for each planning cycle, consistent with providing for the multiple-use and sustained yield of all renewable resources. With the cancellation of long-term timber contracts and the closure of two Southeast Alaska pulp mills in the 1990s (discussed in detail in Chapter 3 Environment and Effects), current demand for Alaska's National Forest timber depends on markets for sawn wood and the option of exporting manufacturing residues and lower grade logs. Future or planning cycle demand scenarios cover a wide range of issues and depend on rates of economic growth in key markets, conditions faced by competitors, and the rate of investment and innovation in Alaskan manufacturing.

Over the past half a century, the timber industry has been a major component of the economy of Southeast Alaska. However, with the closure of two Southeast Alaska pulp mills and the growth of tourism, timber has played a lesser role. Because the economy of Southeast Alaska is based on relatively few industries, maintaining an active timber industry is important for maintaining a well-diversified economy.

Indicators: Analysis relative to this issue compares the likely demand for timber based on capacity of the local industry and the amount of harvest made available to meet that demand. It also considers the type of wood (sawlogs and utility wood) made available and the usefulness of that wood type to the local industry, as well as the amount of timber that would be available from state and private sources. Finally, it considers the effects on the regional and national economies and the effects on the local communities.

Key Issue 3 – Protection of the wildlife habitat and biodiversity of the Tongass National Forest is of local and national significance and is affected by road development and timber harvest activities.

The Tongass National Forest supports a unique and important assemblage of wildlife including the largest population of brown bears and breeding bald eagles in the world, species of high importance for subsistence (e.g., Sitka black-tailed deer), an extensive array of endemic mammals and other species, and a large number of species that are at least partially dependent on old-growth habitats (e.g., marten and goshawk). Populations of many of these species and the biodiversity of Southeast Alaska are affected by timber harvest and the development of roads.

Although less than 10 percent of the productive old-growth habitat on the Tongass has been converted to young growth, the percentage is much higher for certain types of old growth, such as lowland and large-tree old growth. In addition, a high percentage of non-NFS lands have been harvested at a much higher rate. Therefore, the cumulative effects of harvest and road building on wildlife in Southeast Alaska are greater than the effects for the Tongass by itself.

Indicators: Analysis relative to this issue compares the amount of productive old-growth forest that would be protected under each alternative, as well as the percentages of biogeographic provinces that would be protected in reserves. It also considers the role of the managed lands (development LUDs) in providing wildlife habitat. It rates the alternatives in terms of the expert panel ratings conducted for the 1997 Forest Plan Revision EIS. Habitat changes, as documented by habitat amounts, changes in road densities, and habitat models are also used as indicators. Finally, cumulative harvest and road development on non-NFS lands is quantified and evaluated in conjunction with harvest and road development on NFS lands.

Changes between the Draft EIS and Final EIS

A number of updates and changes were made in the Final EIS in response to new information and to comments received on the Draft EIS. The main areas of change are described below:

1. Refinements were made to base Geographic Information System (GIS) coverages such as ownership, past harvest, roads, and LUDs to reflect updates due to changes in the existing condition and refinement of inventory data.
2. Because of refinements made to the base GIS coverages, the acreages and mileages associated with the existing condition and the alternatives changed, in many cases, and were updated throughout the document. Sometimes analysis methods were also refined, which resulted in changes to the quantification of effects.

3. Expanded discussion and analysis and incorporation of additional scientific references and studies were included in many sections of the Final EIS. This expanded discussion and analysis included elaboration on the risk and scientific uncertainty associated with issues.

4. The *Biodiversity* section of Chapter 3 was expanded to more fully address issues related to disproportionate past harvest, harvest on non-NFS lands and related cumulative effects, and effects on intact watersheds.

5. Alternative 1 was modified in response to comments on the Draft EIS. It now has a significantly smaller timber management land base, and excludes all inventoried roadless areas and many higher value roaded areas from commercial timber management. Examples include areas such as all of Kuiu, Baranof, and Kruzof Islands, much of Chichagof Islands, and all mainland areas.

6. Alternative 7 was modified in response to comments on the Draft EIS. It now deletes the requirement for buffers on Class III streams.

7. Further refinements and changes to the proposed Forest Plan were developed between the Draft EIS and Final EIS.

8. Appendix B was substantially updated and additional information on modeling and analysis techniques was added.

9. Appendix C was substantially revised based on updated and new information on the likelihood of various land adjustments.

10. A new Appendix D was developed, which presents background, rationale, assumptions, and additional analyses related to the old-growth conservation strategy, Wildlife Standards and Guidelines, and wildlife viability analyses as they relate to the Final EIS alternatives.

11. Although extensive mapping, quantification, and analysis of past harvest on non-NFS lands was completed for the Draft EIS, a more extensive analysis of past old-growth harvest, including the past disproportionate harvest of several categories of old growth, and the effects of this harvest, was completed and documented in the Final EIS, primarily in the *Biodiversity* section of Chapter 3;,a catalogue of past harvest is presented in Appendix E.

12. The Biological Assessment for threatened and endangered species that was originally developed for the 1997 Forest Plan Revision was updated and refined and included as Appendix F.

13. Appendix G was developed to summarize new information on timber demand and supply on the Tongass National Forest.

14. A new Appendix H was developed, which summarizes the comments received on the Draft EIS and the Forest Service responses to these comments. Copies of the letters received from agencies and elected officials, including tribal governments, are also included..

Organization of the Document

This Final EIS is organized into several chapters and a number of appendices. Chapter 1, "Purpose and Need," describes the reasons for proposing and completing a plan amendment. Chapter 2, "Alternatives," describes the process used to develop alternatives, explains the components of a Forest Plan, discusses alternatives not considered in detail, and describes the No-Action Alternative and Proposed Action Alternative as well as five other alternatives. Maps of the proposed LUDs under each alternative are also displayed in Chapter 2. Finally, a comparison of these alternatives based on the issues and significant environmental effects is presented.

The discussions of the “Affected Environment” and the “Environmental Consequences” are combined in Chapter 3, “Environment and Effects.” This is done so the environmental consequences (effects) of the alternatives on forest resources, and the background information needed to understand these consequences, are discussed together for each resource. The focus is on significant effects, with the analysis centered on the public issues. Chapter 3 also begins with a general description of the Tongass National Forest.

The Final EIS also includes a list of preparers; a list of agencies, organizations, and persons receiving copies of the document; a bibliography; a glossary; and an index (Chapters 4 through 8). Appendices to the Final EIS are contained in a separate volume (Final EIS Volume II). They provide more background on planning actions, certain resources and analyses, modeling and analysis techniques, a catalogue of past harvest, and a summary of the comments on the Draft EIS with Forest Service responses (Appendix H).

In addition to the two Final EIS volumes, three separate documents are associated with the Final EIS. First, a separate Summary booklet is included within the CD case. Second, the Record of Decision (ROD), which discloses the decision and its rationale, is published along with the Final EIS. Third, the Forest Plan, which includes goals and objectives, the management prescriptions for each LUD, Forest-wide standards and guidelines, plan implementation direction, a monitoring and evaluation plan, and related appendices, accompanies the ROD. In addition, a map packet includes color maps of the LUDs for each alternative and a ROD map that displays the LUDs associated with the decision.

The CD version of the Final EIS, Forest Plan, and ROD includes all of the documents described above, plus additional maps. As noted above, a Summary booklet is included in the CD case. Additional information, maps, and reference documents used in the Tongass Forest Plan Amendment process are contained in the planning record. Many of these documents and records are also available on the Forest Plan Adjustment Web site (http://tongass-fpadjust.net/). These can also be accessed through the main Tongass Web site (www.fs.fed.us/r10/tongass). The planning record in its entirety is incorporated here by reference.

CHAPTER 2
ALTERNATIVES

Alternatives

Introduction

Chapter 2 is divided into four parts:

1. A discussion of how alternatives were developed and of what constitutes an alternative;
2. A discussion of alternatives considered but eliminated from detailed study;
3. A full description of the alternatives that are considered in detail; and
4. A comparison of the alternatives considered in detail.

A color map for each of the seven alternatives considered in detail is included in the *Map Section* of the CD version of the EIS and in the *Map Packet* accompanying the hard copy version. These maps are also available on the EIS Web site at www.tongass-fpadjust.net. Each alternative map shows the locations of the Land Use Designations (LUDs) for that alternative.

Alternative Development Process

What a Forest Plan Includes

Land management planning may be compared to city, county, or borough zoning. Just as areas in a community are zoned as commercial (allowing business uses), industrial (allowing factories), or residential (allowing only homes, schools, etc.), the forest is also zoned to allow, or not allow, various uses and activities. Land management (forest plan) zoning is done through the use of LUDs. This Forest Plan only applies to federal lands within the Tongass National Forest.

Land Use Designations specify ways of managing an area of land and the resources it contains. LUDs may emphasize certain resources (such as remote recreation or old-growth wildlife habitat) or combinations of resources (such as providing for scenic quality in combination with timber harvesting). Each LUD has a detailed management prescription, which includes standards and guidelines.

Prescriptions are specific actions or treatments used in the management of forest resources, such as two-age timber harvest methods. Each management prescription specifies what is allowed to be considered for site-specific project proposals, and under what conditions. *Standards and guidelines* impose limitations on how, where, and when management activities are carried out, usually for specific resource protection purposes. Management prescriptions and standards and guidelines only apply to federal lands.

LUDs are assigned, or allocated, to specified areas of land. Under any one alternative, a given area of land will generally have only one LUD assigned to it; however, the Minerals and Transportation and Utility Systems LUDs are overlay LUDs and can apply to a given piece of ground when and if minerals or transportation/utility systems are to be developed on that piece of ground. In some other cases, two LUDs may apply to the same area, such as a Wild River within a Wilderness. In these cases, the more restrictive direction always applies. Some LUDs, such as Wilderness and LUD II, are congressionally designated and represent permanent allocations.

Forest resource use opportunities, such as timber harvesting or recreation, can be made available in different amounts. What lands to make available for timber harvest or how much of a particular kind of recreation opportunity to provide are questions that land management planning must also address. It is not always possible to provide all resource use opportunities in the amounts desired by everyone. The National Forest Management Act mandates the Forest Service to provide for multiple use and the sustained yield of the products and services obtained from the Forest.

The alternatives themselves are usually designed around a "framework" that establishes how much emphasis is placed on each of the key issues or other issues. The EIS alternatives are directly related to the issues described in Chapter 1. How alternatives were developed to address the issues is discussed below. The *Comparison of Alternatives* section at the end of this chapter also discusses ways in which the alternatives address the issues.

How Alternatives are Described

Each alternative for this EIS is presented in the same format. This includes the following components:

- **Framework.** The basis for alternative design.
- **Desired Condition.** A general description of the ecological, physical, and economic/social conditions that are expected in the future under each alternative framework.
- **Land Use Designations.** The acreages allocated to each Land Use Designation.
- **Standards and Guidelines and Management Prescriptions.** What changes to the existing Forest-wide standards and guidelines and management prescriptions are proposed?
- **Selected Outputs and Measure.** A summary of predicted outputs and measures associated with each alternative.

Land Use Designations

The alternatives are constructed using the LUD allocations defined in the 1997 Tongass Forest Plan as the base. This base represents the current Tongass Forest Plan and consists of Alternative 11 in the 1997 Tongass Forest Plan Revision Final EIS, adjusted by the 1997 Record of Decision (ROD) and subsequent non-significant Forest Plan Amendments made for projects since 1997.

The LUD allocations of the current Tongass Forest Plan define the No-Action Alternative (Alternative 5). The LUD allocations for the Proposed Action alternative (Alternative 6) are very similar to the No Action, but incorporate some adjustments. The other five alternatives differ more substantially from the No Action and Proposed Action in terms of their LUD allocations.

The management prescriptions for each specific LUD under the No Action alternative are the same as under the current Forest Plan (see Chapter 3 of the current Forest Plan, USDA Forest Service 1997b). These management prescriptions are summarized below, following a discussion of current Forest Plan LUDs. The management prescriptions for the other alternatives incorporate very slight modifications; these modifications are fully described in the amended Forest Plan that accompanies this Final EIS, and are summarized in the alternative descriptions, along with the exceptions to the amended Forest Plan.

Wilderness and National Monument

- **Wilderness and Wilderness National Monument** – Manage for the protection and perpetuation of essentially natural biophysical and ecological conditions and provide outstanding opportunities for solitude, primitive recreation, and scientific and educational uses, consistent with ANILCA, the Wilderness Act, and TTRA. Roads are normally not permitted and use of mechanical transport and motorized equipment is limited.
- **Non-wilderness National Monument** – Manage the non-wilderness portions of Admiralty Island and Misty Fiords National Monuments to facilitate development of significant mineral resources and to ensure that mining activities are compatible, to the maximum extent feasible, with the purposes for which the Monuments were established.

Mostly Natural Setting

- **LUD II** – Manage these Congressionally designated areas in a roadless state to retain the wildland character. Wildlife and fish habitat improvement and primitive recreational facility development may be permitted. Timber harvesting is limited to insect and disease control. Roads will not be built except to serve mining and other authorized activities and vital Forest transportation and utility system linkages. (These areas are sometimes referred to as "legislated LUD II.")
- **Research Natural Area** – Manage forest resources for research and education and/or to maintain natural diversity. Current natural conditions are maintained where possible. No timber harvest is allowed.
- **Enacted Municipal Watershed** – Manage enacted municipal watersheds to meet State Water Quality Standards for domestic use. Timber harvest is limited to insect and disease control; however, timber may be removed under conditions that safeguard the quantity and quality of water. Roads are generally limited to those needed to administer the municipal watersheds.
- **Old-growth Habitat** – Maintain a diversity of old-growth conifer habitats in their natural condition to favor old-growth associated fish and wildlife species. No timber harvesting will be scheduled and roads will be located outside the area when possible.
- **Semi-remote Recreation** – Provide motorized and non-motorized recreation opportunities in natural and natural-appearing environments where interaction with others is low and the opportunity for independence and self-reliance is moderate to high. Allow occasional concentrated recreation and tourism facilities in a natural-appearing setting. When present, roads are few and used primarily to expand and improve access to recreation opportunities or to permit access to other parts of the Forest and other ownerships. Timber harvest is limited to salvage of catastrophic events or beach log recovery.
- **Remote Recreation** – Provide recreation opportunities and experiences outside Wilderness in unmodified natural environments where interaction with other visitors is infrequent, and the opportunity for independence and self-reliance is high. Timber harvesting is limited to insect and disease control. Roads are generally absent.
- **Special Interest Area** – Provide for the inventory, maintenance, protection, and interpretation of areas with unique archeological, historical, recreational, scenic, geological, botanical, zoological, or paleontological features. No timber harvest is scheduled. Roads are normally not permitted unless compatible with interpretive objectives.

- **Wild River** – Maintain and enhance the outstandingly remarkable values of river segments that qualify the river to be classified a Wild River and recommended in the 1997 Tongass Forest Plan ROD. Shorelines are primitive and undeveloped. Timber harvesting is limited to insect and disease control. Roads are generally not present. Access is by trail, airplane, or boat.

- **Scenic River** – Maintain and enhance the outstandingly remarkable values of river segments which qualify the river to be classified a Scenic River and recommended in the 1997 Tongass Forest Plan ROD. Shorelines are largely undeveloped but may be accessible in places by roads. Timber harvesting is limited by the ability of the landscape to visually absorb the activity. Roads are designed to be compatible with the landscape.

- **Recreational River** – Maintain and enhance the outstandingly remarkable values of river segments that qualify the river to be classified a Recreational River and recommended in the 1997 Tongass Forest Plan ROD. Shoreline development may occur and the river may be readily accessible by road. Timber harvesting is allowed with priority to maintain existing and proposed recreation sites within the corridor. Roads are permitted.

Moderate Development

- **Experimental Forest** – Manage to provide a variety of long-term opportunities for Forest research and demonstration areas. Timber harvesting will occur only for these purposes. Roads may be developed to facilitate ongoing research.

- **Scenic Viewshed** – Management activities are not visually apparent to the casual observer in the near distance from visual priority travel routes and use areas. In the middle to background distance, activities are subordinate to the landscape character of the area. Timber harvest is allowed and roads are permitted.

- **Modified Landscape** – Manage for a variety of uses. Management activities are subordinate to scenic quality as seen in the near distance. In the middle to background distance, activities may dominate but are designed to be compatible with features found in the characteristic landscape. Timber harvest is allowed and roads are permitted.

Intensive Development

- **Timber Production** – Manage the area to maintain and promote industrial wood production. These lands will be managed to advance conditions favorable for the timber resource and for long-term timber production. Roads are permitted.

Overlay LUDs

- **Minerals** – Encourage the exploration and development of mineral resources in areas having high potential for mineral commodities, including nationally designated strategic and critical minerals. Until mineral activities are initiated, the area will be managed according to the underlying LUD.

- **Transportation and Utility Systems** – Emphasize existing and potential state-identified major public transportation and utility systems. Until transportation or utility systems are constructed, the area will be managed according to the underlying LUD.

Development of Potential Alternatives

As indicated by the Ninth Circuit Court of Appeals, there is a need to evaluate a wide range of alternatives that relate to varying degrees of development of roadless lands, while at the same time providing a supply of timber that corresponds with the full range of timber demand scenarios. Therefore, the array of EIS alternatives was designed to address a full range of roadless development and timber supply/demand levels. Adjustments to the standards and guidelines of the Forest Plan were also incorporated into various alternatives to address clarifications and updates identified as needed in the 5-Year Review and by Forest Service staff.

Basic tools used in the development of the alternatives were the recent timber demand projections (Brackley et al. 2006), the existing inventory of roadless lands, and various sources of information regarding the qualities of the roadless lands. In addition, because of the rigorous level of scientific review that went into designing the current conservation strategy, strong consideration was given to maintaining its elements. Other alternative proposals considered during the 1997 Forest Plan Revision and the 2003 Supplemental EIS processes were given consideration.

A total of 49 alternatives were considered as part of the alternative development process. Of these, 42 alternatives were eliminated from detailed study and are discussed in the following section (*Alternatives Eliminated from Detailed Study*). The remaining seven alternatives are considered in detail in this EIS.

The set of alternatives that are analyzed in detail were designed to fully bracket the range of timber demand scenarios identified by Brackley et al. (2006). Equally important, they were designed to range from very limited development of inventoried roadless areas to more intensive development within roadless areas. This range is captured by the seven alternatives.

Brackley et al. (2006) described four timber demand scenarios: limited lumber production, expanded lumber production, medium integrated industry, and high integrated industry. The following table compares the projected demand for 2022 under these four scenarios with the Allowable Sale Quantity (ASQ) identified for the second decade of each of the alternatives considered in detail (ASQ is discussed in more detail below in the *Alternatives Considered in Detail* section).

Table 2-1
Projected Demand for 2022 under Brackley et al.'s Four Timber Demand Scenarios

Brackley et al. Demand Scenarios & Projected 2022 Demand[1] (MMBF)	Alternatives Considered in Detail & Second-Decade ASQ (MMBF)
	Alternative 1 – 49
Scenario 1 – 68	
	Alternative 2 – 152
Scenario 2 – 187	
	Alternative 3 – 203
Scenario 3 – 204	
	Alternative 5 – 267
	Alternative 6 – 267
Scenario 4 – 342	Alternative 4 – 342
	Alternative 7 – 421

[1] These figures include total volume that would need to be harvested to meet the demand projected by Brackley et al. 2006

Alternatives 1 through 4 were designed to correspond with Scenarios 1 through 4, respectively, while also responding to other concerns. The discrepancies between the second decade ASQs for Alternatives 1 and 2 and projected demand for 2022 under Scenarios 1 and 2 reflect these concerns.

The ASQ for Alternative 1 is 19 MMBF (28 percent) below the projected demand of Scenario 1. There are several reasons for this difference. First, the purpose of Alternative 1 is to depict the current situation, meaning annual timber harvest levels over the last few years of around 50 MMBF. In addition, Alternative 1 responds to the court's direction and public comments by scheduling no timber harvest in roadless areas, as discussed below. This alternative also responds to recommendations from the public to avoid harvest on Kuiu Island. The ASQ of Alternative 2 is 25 MMBF (19 percent) below the projected demand of Scenario 2. The purpose of Alternative 2 is to display an alternative that restricts development activities to lower value roadless areas. Alternative 3 differs from Scenario 3 by only 1 MMBF; Alternative 4 matches Scenario 4 exactly.

Alternatives Eliminated from Detailed Study

The Forest Plan revision process started in 1987 and resulted in the development of dozens of alternatives that were described in the Draft EIS (1990), Supplement to the Draft EIS (1991), Revised Supplement (1996), Final EIS (1997), and Supplemental EIS (2003). In addition, a 1992 draft version of the Final EIS included alternatives that became the basis of some 1996 Revised Supplement and 1997 Final EIS alternatives. Each of these alternatives was considered for detailed study and comparison in this EIS, in their original form or in a modified form. Altogether, 41 alternatives were considered for detailed study prior to the selection of the EIS alternatives—39 of these were based on previous alternatives and 2 were new ones. The 39 previous alternatives are summarized in Table 2-2.

These alternatives were considered in light of the key issues and the purpose and need. They ranged in allowable sale quantity (which is the maximum annual average amount of timber that can be sold from the suitable forest land base) from 0 to almost 700 MMBF per year. Development LUD acres in these alternatives ranged from a few hundred acres to almost 8 million acres and forest lands suitable for timber harvest ranged from 0 to over 2 million acres.

Five alternatives, which were largely based on previously developed alternatives, and two new alternatives were selected for detailed study. Therefore, 34 of the previously developed alternatives were considered, but eliminated from detailed study. The reasons for not selecting them were either that they were similar to and within the range of the selected alternatives, they were outside the range of timber demand estimates, or they would result in substantial changes to the current Forest Plan standards and guidelines that are not warranted based on the purpose and need or the key issues.

In addition to the 41 alternatives discussed above, 8 other alternatives were considered, but not evaluated in detail. Therefore, overall, 49 alternatives were considered and evaluated to varying degrees, with 7 of these being analyzed in detail and 42 being eliminated from further detailed study. The eight additional alternatives that were not analyzed in detail include three alternatives with timber volumes below the volume to be harvested under Alternative 1, one alternative described by The Nature Conservancy and Audubon Alaska, modified versions of Alternatives 4 and 7, an alternative proposed by the Southeast Conference, and a partial alternative proposed by the City and Borough of Yakutat. These eight alternatives are described in the following paragraphs.

Table 2-2
Tongass Forest Plan Alternatives Considered in Detail: 1990 – 2003

Alternative and Source		ASQ (MMBF annual)	Suitable lands (Acres X 1,000)	Non-Development LUDs (Acres X 1,000)	Development LUDs (Acres X 1,000)
1	1997	0	0	16,700	200
1	1996	0	74	16,700	200
6	2003	92	344	15,700	1,200
8	2003	96	351	15,700	1,200
5	1997	122	786	12,100	4,800
4	1997	130	845	11,700	5,200
5	1996	139	1,400	12,100	4,800
4	1996	145	1,507	11,700	5,200
7	2003	174	521	14,300	2,600
A	1990	181	536	13,600	3,300
5	2003	209	589	13,800	3,100
3	2003	236	620	13,500	3,400
3	1997	256	795	12,700	4,200
1	2003	259	664	13,200	3,700
2	2003	259	664	13,200	3,700
4	2003	259	664	13,200	3,700
11	1997	267	676	13,200	3,700
3	1996	278	1,188	12,600	4,300
E	1990	280	717	11,600	5,300
A	1991	298	1,173	13,700	3,200
10	1997	300	924	12,700	4,200
6	1997	309	1,024	12,100	4,800
B	1991	343	1,360	13,000	3,900
B	1990	354	1,101	12,900	4,000
6	1996	362	1,400	12,100	4,800
8	1996	364	1,389	10,500	6,400
F	1990	389	1,111	11,000	5,900
G	1990	390	1,112	11,000	5,900
P	1991	418	1,649	11,700	5,200
C	1990	450	1,200	10,500	6,400
C	1991	451	1,732	11,200	5,700
2	1997	463	1,180	11,700	5,200
D	1991	472	1,818	11,400	5,500
2	1996	489	1,526	11,700	5,200
9	1996	513	1,869	10,800	6,100
9	1997	549	1,390	10,800	6,100
D	1990	640	1,575	9,100	7,800
7	1997	640	1,575	9,100	7,800
7	1996	689	2,044	9,100	7,800

Sources: 1990 Draft EIS, 1991 Supplement to the Draft EIS, 1996 Revised Supplement to the Draft EIS, 1997 Final EIS, and 2003 Supplemental EIS.

Zero to Very Low Volume (ASQ) Alternatives

Consideration was initially given to evaluating zero to very low volume alternatives and recommendations were also made in Draft EIS comments that various zero to very low volume alternatives should be considered for detailed evaluation. As a result, a no-commercial harvest alternative was considered, an alternative with an ASQ at a stable level significantly below Alternative 1 was considered, and a declining volume alternative that started with an ASQ near the Alternative 1 level, but declined over time, was considered. Partially in response to these comments, the development land base of Alternative 1 was significantly reduced and the ASQ was slightly reduced between the Draft EIS and the Final EIS. As a result, even Alternative 1 would produce only 28 MMBF of NIC I sawlogs (the type that could be utilized by the existing sawmills) on an annual basis. This volume is equivalent to less than 15 percent of the estimated mill capacity of the four largest existing sawmills, 11 percent of the estimated active installed processing capacity of all existing Southeast Alaska mills, and only 7 percent of the total processing capacity of existing Southeast Alaska mills. In addition, the recent actual mill output level has been about 35 MMBF. Even Alternative 1 is considered to be a non-sustainable alternative for the existing timber industry because it does not meet these volume levels (see *Economic and Social Environment*, Regional and National Economy, in Chapter 3). Because the three additional alternatives under consideration, by definition, would produce a significantly lower volume than Alternative 1, they would clearly not be sustainable for even a portion of the existing timber industry.

The Tongass Timber Reform Act requires the Forest Service "to seek to meet the market demand." Providing a timber volume that would meet neither the current estimated annual demand nor the recent actual mill output levels, and which would produce only a fraction of estimated existing mill capacities, would clearly not be consistent with TTRA and, therefore, is determined to not be a reasonable alternative. Alternative 1 provides an alternative "sideboard" at the low end of the timber volume range that is already in the "non-sustainable" category.

The Nature Conservancy/Audubon Alaska Alternative

A number of organizations suggested that they might generate a low-harvest alternative for consideration. The only low-harvest alternative that was described was one by The Nature Conservancy and Audubon Alaska in their Conservation Assessment for Southeast Alaska (Albert and Schoen 2007).

This alternative was defined based on modeling of relative ecological values and the ranking of relative suitability for timber production. It includes conservation priority watersheds, other watersheds to be managed for intact conditions, as well as timber production and integrated management watersheds. The EIS team determined that Alternatives 1, 2, and 3 captured the range defined by this alternative and they also represented alternatives that were similar to others that would be developed by other groups (e.g., they avoid the roadless areas and intact watersheds or different combinations of high-value roadless areas or intact watersheds).

Modified Alternatives 4 and 7

A modified version of Alternatives 4 and 7 were evaluated for consideration. The modification involved replacing portions of the development LUDs in these alternatives with the Old-Growth Habitat LUDs from Alternative 6. It was determined that the modified Alternative 4 did not produce significantly more timber volume than Alternatives 5 and 6 and the modified Alternative 7 was not substantially different than Alternative 4. Therefore, these modified alternatives were well within the range of the existing alternatives and it was decided they did not need to be analyzed in detail.

Southeast Conference Alternative

In its comments on the Draft EIS, the Southeast Conference (an association of municipalities, businesses, Native corporations and village councils, civic organizations, and individuals from Southeast Alaska) identified specific lands they believe should be allocated to the Timber Management LUD to allow for reestablishment of an integrated timber industry in Southeast Alaska. These lands were reviewed by the EIS team and it was determined that the vast majority of these lands (plus additional lands) were included as development LUDs in Alternative 7 and most of them were also included in several other alternatives. The lands that were not included were identified as Old-Growth Habitat, Special Interest Area, or Experimental Forest LUDs in most of the alternatives. It was determined that the current range of alternatives captured these lands and there was no need to develop a new alternative based on them.

City and Borough of Yakutat Alternative

In its comments on the Draft EIS, the City and Borough of Yakutat recommended a modification of Alternative 2 for the Yakutat Ranger District. This alternative involved reducing the development LUDs in the ranger district and changing them to Semi-Remote Recreation. Between the Draft EIS and the Final EIS the development LUDs of Alternative 1 in this ranger district were converted to Semi-Remote Recreation. Therefore, it was determined that the City and Borough of Yakutat recommendation was bracketed by the revised Alternative 1 and Alternative 2 in the Final EIS and, therefore, it was not necessary to add an additional alternative for this specific area.

Alternatives Considered in Detail

The following section defines terminology and presents information regarding several aspects of the alternatives. The alternatives considered in detail are presented afterward.

The Allowable Sale Quantity

The amount of timber that could be sold under a Forest Plan is expressed as an Allowable Sale Quantity (ASQ). The ASQ is the maximum amount of timber that may be sold from the area of suitable land contained under the Forest Plan within a given decade (although it is usually expressed in average annual terms). It is neither a targeted amount, nor is it a required amount. It is a ceiling. The amount of timber offered for sale in any year can exceed the annual average as long as the total decade's ASQ is not exceeded, and can also be anywhere below the annual average; the amount offered for sale over a decade can be below the decadal ASQ. Many factors can result in timber sale offerings that are below the average annual ASQ, including lack of program funding, new resource issues that need to be addressed, changes in timber markets, sales delayed by appeals or lawsuits, or other factors that reduce the actual volume.

In some situations, timber can be harvested from unsuitable lands and can contribute to satisfying timber demand, but cannot contribute to the ASQ. An example is the timber produced from thinning of second-growth stands for wildlife habitat enhancement, within LUDs identified as not suitable for timber production.

Non-interchangeable Components

Economics is an important consideration in determining what land can be harvested; however, economic conditions can fluctuate greatly from year to year, shifting specific forest stands from being economic to uneconomic to harvest. As a result, the Tongass National Forest uses the concept of non-interchangeable components

(NIC) to consider economics. NICs allow the separation of ASQ into discrete, individually accountable categories. All seven alternatives have an ASQ for the first decade made up of two NICs:

NIC I. Normal operable volume scheduled from suitable lands that are available for harvest using standard logging systems. This is the most economically operable ground and is typically where the Tongass National Forest has been offering most sales.

NIC II. Non-standard (difficult and isolated) operable volume scheduled from suitable lands that are available for harvest using logging systems not in common use. These lands are currently considered economically and technologically marginal. In the past, this land has rarely been economical to harvest.

Chargeable timber volume from one NIC cannot be substituted for the achievement of the volume limit of another NIC, nor can the limits on the sale of chargeable timber volume associated with each NIC be exceeded.

Standards and Guidelines and Management Prescriptions

The Forest-wide standards and guidelines in Chapter 4, the management prescriptions in Chapter 3, and other chapters of the current Tongass Forest Plan (USDA Forest Service, 1997b) apply to Alternative 5, the No-Action Alternative in this EIS, and are not repeated here. An updated and edited version of the 1997 Forest Plan (as amended) was developed for Alternative 6, the Proposed Action, and for Alternatives 1, 2, and 3. A Proposed Forest Plan was released in January 2007 with the Draft EIS at the beginning of the comment period. This Proposed Forest Plan is modified and updated further for this Final EIS, and is referred to as the Final Proposed Forest Plan (see below). Alternatives 4 and 7 also follow the updated Forest Plan , with the exceptions noted in their alternative descriptions (see below).

Applicable LUD management prescriptions and Forest-wide standards and guidelines are discussed throughout the environmental consequences sections of Chapter 3 because they serve as the basic mitigation measures for individual projects under the Forest Plan. The Forest-wide standards and guidelines, and the LUD-specific standards and guidelines that constitute the management prescriptions, are the full set of mitigation measures for each alternative.

Goals Common to All Alternatives

Air. Maintain the current air resource condition to protect the Forest's ecosystems from on- and off-Forest air emission sources.

Biodiversity. Maintain healthy forest ecosystems; a mix of habitats at different spatial scales (site, watershed, island, province, and forest) capable of supporting the full range of naturally occurring flora, fauna, and ecological processes native to Southeast Alaska.

Ecosystem Services and Non-Use Values. Maintain the broad range and high level of ecosystem services (e.g., watershed, water quality, air quality, biodiversity), and non-use values (e.g., existence, option, and bequest values associated with natural areas) that are provided by the Tongass National Forest.

Fish. Maintain or restore the natural range and frequency of aquatic habitat conditions on the Tongass National Forest to sustain the diversity and production of fish and other freshwater organisms.

Heritage Resources. Identify, evaluate, preserve, and protect heritage resources.

Local and Regional Economies. Provide a diversity of opportunities for resource uses that contribute to the local and regional economies of Southeast Alaska.

Rare Natural Areas. Protect a variety of areas with natural, scenic, or geologic features distinct to the region, including areas set aside specifically for future research needs.

Research. Continue to seek out and promote research opportunities that are consistent with identified information needs.

Soil and Water. Maintain soil productivity Forest-wide, and minimize soil erosion resulting from land-disturbing activities. Minimize sediment transported to streams from land-disturbing activities. Maintain and restore the biological, physical, and chemical integrity of Tongass National Forest waters.

Subsistence. Provide for the continuation of subsistence uses and resources by all rural Alaskan residents.

Wetlands. Minimize the destruction, loss or degradation of wetlands, and preserve and enhance the associated wetland functions and values.

Wilderness. Manage designated Wilderness to maintain an enduring wilderness resource while providing for public access and uses consistent with the Wilderness Act of 1964 and the Alaska National Interest Lands Conservation Act of 1980 (ANILCA).

Descriptions of the Alternatives

Each alternative description includes the following components: 1) a framework; 2) a general description of the desired condition; 3) a table with the acreages allocated to each LUD; 4) a map (included in the *Map Packet* accompanying the EIS hard copy or in the *Map Section* of the CD version) showing the composition of LUDs across the Forest; 5) a map showing the distribution of development, natural setting, and wilderness LUDs; 6) a description of proposed changes to the current Forest-wide standards and guidelines and management prescriptions; and 7) a quantification of outputs and measures associated with each alternative.

The management prescriptions (i.e., LUD-specific standards and guidelines) for each LUD are included in the 1997 Forest Plan, as amended, or in the Final Proposed Forest Plan (see next section), as are the Forest-wide standards and guidelines that apply to each alternative. Details on the modeling of each alternative are included in Appendix B to this EIS (included Volume II).

In the LUD tables for each alternative, the changes from existing acreages represent the differences between the decisions made in the 1997 Tongass Forest Plan Revision ROD, as amended, and the Forest Plan Amendment EIS alternatives.

The goals common to all alternatives are provided below. In addition, the Tongass Timber Reform Act (Section 101) direction for the Tongass to "seek to provide a supply of timber which 1) meets the annual market demand for timber from such forest and 2) meets the market demand from such forest for each planning cycle" will be followed by each alternative "to the extent consistent with providing for the multiple use and sustained yield of all renewable forest resources," as determined by that alternative, and subject to appropriations and applicable law.

Summary of Final Proposed Forest Plan

The 1997 Forest Plan (USDA Forest Service 1997b), as amended, is the plan associated with Alternative 5, the No-Action Alternative. A number of changes to the Forest Plan text are being proposed under the other alternatives, based on the

Forest Plan 5 Year Review and Forest Service staff recommendations. Most changes were incorporated into a Proposed Forest Plan (Land and Resource Management Plan), which accompanied the Draft EIS. These changes were modified and updated for the Final EIS and the major changes being proposed are summarized in this section. The individual alternative descriptions on the following pages only identify items that are not consistent with the Final Proposed Forest Plan, which is defined by the Proposed Forest Plan that accompanied the Draft EIS, as modified in this section. A summary of the main changes that are incorporated into the Final Proposed Forest Plan are provided below.

Management Prescriptions

- Edits and clarifications were made regarding karst management programs, sacred site protection, minerals and geology, off-highway vehicle use, scenery management, and other areas for most LUD prescriptions
- Substantial edits and clarifications were made to the Wilderness and Wilderness National Monument LUD prescriptions

Forest-wide Standards and Guidelines

- Clarifications were made to the standards and guidelines regarding steep slopes and soil stability in the *Soils* and *Water* section.
- Clarifications were made to the standards and guidelines on Class III and IV streams and edits were made to the other standards and guidelines in the Fish section
- The detailed stream process group-specific riparian standards and guidelines are presented in an appendix in the Final Proposed Forest Plan, instead of in the main body of the standards and guidelines, which is the way they were presented in the Proposed Forest Plan that accompanied the Draft EIS.
- A new section was added to Chapter 4 on Invasive Species.
- A new section was added to Chapter 4 on Plants.
- The Threatened, Endangered, and Sensitive Species standards and guidelines are incorporated into subsections under Fish, Wildlife, and Plants (as appropriate) in the Final Proposed Plan, instead of in a separate section as in the Proposed Plan that accompanied the Draft EIS.
- The goshawk foraging habitat and the marten habitat standards and guidelines in the *Wildlife* section were deleted and replaced with a Forest-wide legacy standard and guideline in the Proposed Forest Plan that accompanied the Draft EIS. In addition, the legacy standard and guideline for the Final Proposed Forest Plan is revised further. The revised standard and guideline requires legacy forest structure to be left only in harvest units greater than 20 acres and only in higher risk VCUs, as previously defined (49 VCUs).
- The goshawk nesting habitat standard and guideline in the *Wildlife* section was revised in the Proposed Forest Plan that accompanied the Draft EIS. In addition, the goshawk nesting habitat standard and guideline for the Final Proposed Forest Plan is revised further. The revised standard and guideline permits nesting habitat protection measures to be removed if, after 2 consecutive years of monitoring, evidence of confirmed or probable nesting is no longer observed.
- The requirement to conduct inventories to determine the presence of nesting goshawks for proposed projects that affect goshawk habitat is included in the

Final Proposed Forest Plan (this was inadvertently removed from the Proposed Forest Plan that accompanied the Draft EIS).

- New standards and guidelines on sacred site protection were added in the *Heritage Resources and Sacred Sites* section.
- Extensive edits were made to the Karst and Cave Resources standards and guidelines and the Karst and Cave Resources appendix.
- Substantial edits were made to the Minerals and Geology standards and guidelines.
- Substantial edits were made to the Recreation and Tourism standards and guidelines. The detailed Recreation Opportunity Spectrum-specific standards and guidelines are presented in an appendix in the Final Proposed Forest Plan, instead of in the main body of the standards and guidelines, which is the way they were presented in the Proposed Forest Plan that accompanied the Draft EIS.
- The Scenery standards and guidelines were converted from the Visual Management System to the Scenery Management System.
- Edits were made to off-highway vehicle standards and guidelines in the *Lands* section.
- Edits were made to the road storage and decommissioning standards and guidelines in the *Transportation and Utilities* section.

In addition, there are a number of changes to other Forest Plan sections. These include changes to the Goals and Objectives (Chapter 2 of the Plan) and Monitoring and Evaluation (Chapter 6 of the Plan) chapters and to a number of the Forest Plan appendixes, including Appendix B (Information Needs), Appendix F (Visual Priority Routes and Use Areas), Appendix I (Karst and Caves), Appendix K (Old-Growth Habitat Reserve Criteria), and Appendix L (Resource Schedules).

Finally, the 1982 Planning Regulations implementing NFMA include identification of Wildlife Management Indicator Species (MIS) in Forest Plans. The primary intent of MIS was to monitor populations of selected species to see if longer term trends were indicating they could become threatened or endangered across the national forest. The 1997 Forest Plan identified 13 wildlife and 4 fish MIS species with associated monitoring guidelines. The Tongass National Forest has analyzed MIS monitoring information assembled since 1997. Chapter 3 includes information for each of the species. It has been determined this information is lacking in sufficient detail to help guide management of the selected species on the Forest. The Tongass hosted an interagency review of the Forest Plan Conservation Strategy in April of 2006, which included updated information related to most of the MIS species. Much discussion at the review and in other related venues locally and nationally indicate monitoring should be more focused on wildlife habitats instead of species population trends by themselves. Interagency discussions related to wildlife monitoring and the MIS themselves are ongoing. As a result, the Monitoring and Evaluation chapter in the Final Proposed Plan is revised to be more focused, relative to the version in the Proposed Forest Plan that accompanied the Draft EIS. It is anticipated that the current list of MIS may be revised in the future, but a change in MIS is not part of the Final Proposed Plan.

Proposed LUD Changes Common to Most Alternatives

The LUD allocations for each alternative are described in the following alternative-specific descriptions. The alternatives do not vary in terms of the acreage allocated to congressionally designated areas (i.e., Wilderness, National Monument, and LUD II), nor do they vary in terms of allocations to Research Natural Areas, Enacted Municipal Watersheds, or Wild, Scenic, or Recreational River LUDs. However, they do vary with respect to the other non-development LUDs and all of the development LUDs. The LUDs for each alternative are displayed on alternative LUD maps that accompany this EIS.

Proposed changes to the Special Interest Area and Experimental Forest LUDs are common under all alternatives except Alternative 5, which would follow the 1997 Forest Plan (as amended) for these two LUDs. The proposed changes to Special Interest Area and Experimental Forest LUDs are quantified in the following alternative description sections and shown on the alternative LUD maps, and are described in detail in the *Other Special Land Use Designation* section of Chapter 3.

Proposed changes to the Old-Growth Habitat LUD are common under Alternatives 1, 2, 3, and 6, and are as a result of an interagency process that took place in parallel with this EIS, and was initiated in 2006 and completed in 2007. Under this process, the Tongass worked with the Alaska Department of Fish and Game and the U.S. Fish and Wildlife Service to conduct a comprehensive review and mapping effort for all small old-growth reserves (OGR). The objective of the interagency team review was to develop a consensus biological recommendation on small OGR composition and locations that was consistent with the Forest Plan. This process included the development of a biological recommendation, the refinement of that proposal with Forest Service Ranger District staff, and further refinement by the Forest Supervisor. The refinement process was conducted in order to consider multiple-use objectives in addition to pure biological ones. The final proposal is included in Alternatives 1, 2, 3, and 6 of the Final EIS. Alternative 5 retains the 1997 Plan (as amended) reserve network and the reserves proposed under Alternatives 4 and 7 are not affected by this proposal. Further information on the refinement of small OGRs is included in Appendix D.

Alternative 1

Framework

Under this alternative, forest management would provide a mix of National Forest uses and activities, but would emphasize maintaining inventoried roadless areas, associated fish and wildlife values, and unroaded recreation, tourism, and subsistence opportunities, relative to the current Forest Plan. Timber would be managed within the roaded land base and all inventoried roadless areas would remain in a natural condition. In addition, a number of higher value roaded areas, including all of Kuiu, Baranof, and Kruzof Islands, many portions of Chichagof Island, all mainland areas, and other areas, would be excluded from commercial timber management. A total of 840,000 acres of the Tongass would be in development LUDs and 15.9 million acres would be in non-development LUDs. The majority of the lands changed to non-development LUDs from development LUDs (in the current Plan) would be designated Semi-Remote Recreation. Specific LUD changes under this alternative would include the addition and modification of a number of Geologic Special Interest Areas, recommendations to change the Young Bay Experimental Forest to Semi-Remote Recreation and the Cowee-Davies Creek watersheds from Scenic Viewshed to Experimental Forest, and converting a large area of Remote Recreation LUD north of Juneau to Semi-Remote Recreation. It also would include extensive refinements to the boundaries of the small Old-Growth Reserves, based on a recently completed interagency evaluation.

This alternative would approximately correspond with Scenario 1 (limited lumber production) of the Brackley et al. (2006) timber demand study. It is similar to Alternative 8 of the 2003 SEIS in terms of the areas allocated to non-development LUDs.

Desired Conditions

The vast majority of the currently undisturbed areas of the Forest remain in a natural state and all existing inventoried roadless areas remain roadless. Old-growth conditions prevail on forest lands within these roadless areas. A small, but predictable and sustainable supply of forest products contributes to a very limited Southeast Alaska timber industry, probably based primarily in Ketchikan and Prince of Wales Island. A mixture of old growth, recently harvested areas, and various ages of young growth occurs within roaded areas. Recreation, tourism, and subsistence opportunities emphasize natural setting types, although roaded opportunities expand slightly from current conditions due to construction of additional roads primarily in already roaded areas.

Land Use Designations

If Alternative 1 is selected, the LUD allocation acres shown in Table 2-3 would result. Figure 2-1 shows the distribution of LUDs across the Tongass under Alternative 1 according to three LUD groups (see Table 2-3 for definitions of the LUD groups). A complete LUD map is provided as the Alternative 1 map in the *Map Section* of the CD version of this EIS or in the *Map Packet* accompanying the EIS hard copy.

Management Prescriptions and Standards and Guidelines

Under Alternative 1, the management prescriptions and standards and guidelines identified in the Final Proposed Land and Resource Management Plan would be adopted. These are generally the same as the management prescriptions and standards and guidelines in the 1997 Forest Plan, as amended; however, a number of changes and refinements are proposed. A summary of the main changes to the 1997 Forest Plan, as amended, is provided above in the section titled "Final Proposed Forest Plan."

Selected Outputs

Table 2-4 displays selected outputs and other measures associated with this alternative.

Table 2-3
Land Use Designations for Alternative 1[1]

Land Use Designation	Acres Allocated	Net Change from Current Forest Plan Acres[2]
Wilderness LUD Group		
Wilderness	2,637,292	0
National Monument[3]	3,278,734	0
Total for Wilderness LUD Group	**5,916,026**	**0**
Natural Setting LUD Group		
LUD II	721,002	0
Research Natural Area	26,093	0
Old Growth	1,221,174	38,749
Special Interest Area	221,174	46,712
Enacted Municipal Watershed	45,226	0
Wild, Scenic, and Recreational River	117,319	0
Remote Recreation	2,369,831	238,776
Semi-Remote Recreation	5,296,773	2,442,548
Total for Natural Setting LUD Group	**10,018,592**	**2,766,786**
Development LUD Group		
Experimental Forest	31,405	14,310
Scenic Viewshed	59,296	(417,923)
Modified Landscape	188,357	(413,005)
Timber Production	560,129	(1,950,169)
Total for Development LUD Group	**839,187**	**(2,766,786)**
Total National Forest System Lands	**16,773,804**	**0**

[1] When more than one LUD is applied to the same area, such as a Special Interest Area within Wilderness, only the acreage of the more restrictive LUD is included, except that total Wilderness, Wilderness National Monument, and LUD II acres are always shown. The acreage for the Minerals LUD would be 249,570; these acres are not included in the table because the Minerals LUD is an overlay. No acreages have been calculated for the Transportation and Utility Systems LUD because it is a series of corridors with undefined width and imprecise locations. Totals may not exactly equal the sum of individual entries due to rounding.

[2] These changes from current Forest Plan acres are the differences from the decision made in the 1997 Tongass Forest Plan Revision ROD, as amended, which is represented by Alternative 5.

[3] The majority of the National Monument acres are wilderness; only 166,942 acres are non-wilderness.

[4] Small old-growth reserves and Special Interest Area LUDs increased relative to Alternative 5; however, they overlap extensively, especially on Heceta, Kosciusko, and northeast Chichagof Islands, and the acreages where they overlap were counted with Special Interest Areas.

Figure 2-1
Wilderness, Natural Setting, and Development LUDs on the Tongass National Forest under Alternative 1

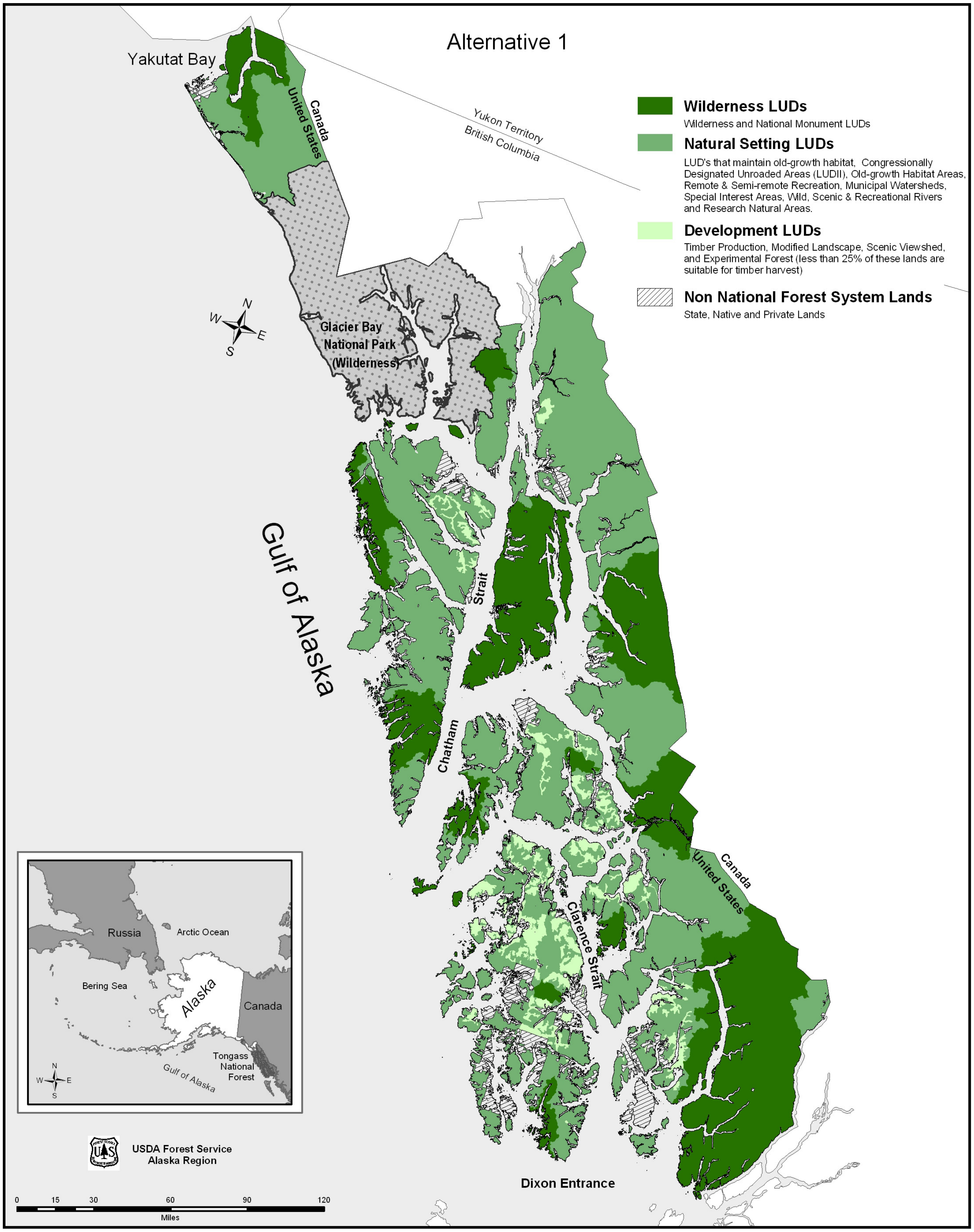


Table 2-4
Selected Outputs and Measures Associated with Alternative 1[1]

Resource/Category	Output/Measure
Percent in Wilderness LUD Group	35%
Percent in Natural Setting LUD Group	60%
Percent in Development LUD Group	5%
Amount of Development LUDs in Inventoried Roadless Areas (millions of acres) [2]	0.0
Percent of Current Productive Old Growth Protected in Reserves (Wilderness/Nat. Mon. and Natural Setting LUDs)	93%
Productive Old Growth after 100+ Years (millions of acres)	4.9
Estimated Forest Land Suitable for Timber Production (acres)[3]	312,000
Scheduled Suitable Forest Land (acres)[3]	144,000
Allowable Sale Quantity or ASQ (millions of board feet)[4]	
1st Decade ASQ	49
2nd Decade ASQ	49
Maximum New Road Construction after 100+ Years (miles)	774
Maximum Average Annual Timber Harvest during 1st Decade, based on the ASQ (acres)	1,774
Potential Short-term Effects on Timber Industry[5]	
Effect on Timber Volume Under Contract	High
Effect on NEPA-cleared Volume	Low
Effect on Timber Volume in Preparation	Low
Percent of Identified Mineral Tracts and Undiscovered Mineral Areas in Open LUDs with Higher Development Costs	
Percent of Identified Mineral Tracts	36%
Percent of Undiscovered Mineral Areas	57%
Recreation Opportunity Spectrum Classes after 150 Years (millions of acres)	
Primitive and Semi-Primitive Non-Motorized	13.2
Semi-Primitive Motorized	1.4
Roaded Natural and Roaded Modified	2.1

1 Totals may not add exactly due to rounding.

2 No lands suitable for timber management and no lands within Timber Production, Modified Landscape, or Scenic Viewshed LUDs are included in inventoried roadless areas under Alternative 1. Approximately 27,000 acres of Experimental Forest are included.

3 Estimated forest land suitable for timber production represents the mapped suitable forest land minus the estimated portion that is unsuitable, but not mapped as such. The scheduled suitable forest land is the portion of the estimated suitable forest land that is scheduled for harvest by ASQ modeling.

4 ASQ volumes expressed as annual averages and include sawlog plus utility.

5 This evaluation provides an indication of potential effects; actual effects would depend on the volume that is under contract when the decision is implemented and whether potentially affected existing sales are cancelled or exempted as part of the decision.

Alternative 2

Framework

Under this alternative, forest management would provide a mix of National Forest uses and activities, but would give additional emphasis to roadless areas, associated fish and wildlife values, and unroaded recreation, tourism, and subsistence opportunities, relative to the current Forest Plan. Timber would be managed within the roaded land base as well as within roadless areas with lower wilderness attribute ratings (primarily those adjacent to developed areas). The vast majority of current roadless areas would remain in a natural condition. A total of 1.9 million acres of the Tongass would be in development LUDs and 14.8 million acres would be in non-development LUDs. The majority of the lands changed to non-development LUDs from development LUDs (in the current Plan) would be designated Semi-Remote Recreation. All areas identified as development LUDs in Alternative 1 would also be development LUDs in this alternative, in addition to other areas. Specific LUD changes under this alternative would include the addition and modification of a number of Geologic Special Interest Areas, recommendations to change the Young Bay Experimental Forest to Semi-Remote Recreation and the Cowee-Davies Creek watersheds from Scenic Viewshed to Experimental Forest, and converting a large area of Remote Recreation LUD north of Juneau to Semi-Remote Recreation. It also would include extensive refinements to the boundaries of the small Old-Growth Reserves, based on a recently completed interagency evaluation.

This alternative would approximately correspond with Scenario 2 (expanded lumber production) of the Brackley et al. (2006) timber demand study.

Desired Conditions

The vast majority of the currently undisturbed areas of the Forest remain in a natural state and most existing roadless areas remain roadless. However, some roadless areas adjacent to existing roaded areas are developed. Old growth conditions prevail on forest lands within roadless areas. A moderate, predictable, and sustainable supply of forest products contributes to a limited Southeast Alaska timber industry, probably based in Ketchikan, Prince of Wales Island, and other communities. A mixture of old growth, recently harvested areas, and various ages of young growth occurs within roaded areas. Recreation, tourism, and subsistence opportunities emphasize natural setting types, although roaded opportunities expand from current conditions.

Land Use Designations

If Alternative 2 is selected, the LUD allocation acres shown in Table 2-5 would result. Figure 2-2 shows the distribution of LUDs across the Tongass under Alternative 2 according to three LUD groups (see Table 2-5 for definitions of the LUD groups). A complete LUD map is provided as the Alternative 2 map in the *Map Section* of the CD version of this EIS or in the *Map Packet* accompanying the EIS hard copy.

Management Prescriptions and Standards and Guidelines

Under Alternative 2, the management prescriptions and standards and guidelines identified in the Final Proposed Forest Plan would be adopted. These are generally the same as the management prescriptions and standards and guidelines in the current Forest Plan; however, a number of changes and refinements are proposed. A summary of the main changes to the current Forest Plan is provided above in the section titled “Final Proposed Forest Plan.”

Selected Outputs

Table 2-6 displays selected outputs and other measures associated with this alternative.

Table 2-5
Land Use Designations for Alternative 2[1]

Land Use Designation	Acres Allocated	Net Change from Current Forest Plan Acres[2]
Wilderness LUD Group		
Wilderness	2,637,292	0
National Monument[3]	3,278,734	0
Total for Wilderness LUD Group	**5,916,026**	**0**
Natural Setting LUD Group		
LUD II	721,002	0
Research Natural Area	26,093	0
Old Growth	1,221,173	38,749
Special Interest Area	221,176	46,713
Enacted Municipal Watershed	45,226	0
Wild, Scenic, and Recreational River	117,319	0
Remote Recreation	2,344,149	213,095
Semi-Remote Recreation	4,232,082	1,377,857
Total for Natural Setting LUD Group	**8,928,220**	**1,676,414**
Development LUD Group		-
Experimental Forest	31,405	14,310
Scenic Viewshed	213,193	(264,026)
Modified Landscape	331,955	(269,407)
Timber Production	1,353,006	(1,157,291)
Total for Development LUD Group	**1,929,559**	**(1,676,414)**
Total National Forest System Lands	**16,773,805**	**0**

[1] When more than one LUD is applied to the same area, such as a Special Interest Area within Wilderness, only the acreage of the more restrictive LUD is included, except that total Wilderness, Wilderness National Monument, and LUD II acres are always shown. The acreage for the Minerals LUD would be 249,570; these acres are not included in the table because the Minerals LUD is an overlay. No acreages have been calculated for the Transportation and Utility Systems LUD because it is a series of corridors with undefined width and imprecise locations. Totals may not exactly equal the sum of individual entries due to rounding.

[2] These changes from current Forest Plan acres are the differences from the decision made in the 1997 Tongass Forest Plan Revision ROD, as amended, which is represented by Alternative 5.

[3] The majority of the National Monument acres are wilderness; only 166,942 acres are non-wilderness.

[4] Small old-growth reserves and Special Interest Area LUDs increased relative to Alternative 5; however, they overlap extensively, especially on Heceta, Kosciusko, and northeast Chichagof Islands, and the acreages where they overlap were counted with Special Interest Areas.

Figure 2-2
Wilderness, Natural Setting, and Development LUDs on the Tongass National Forest under Alternative 2

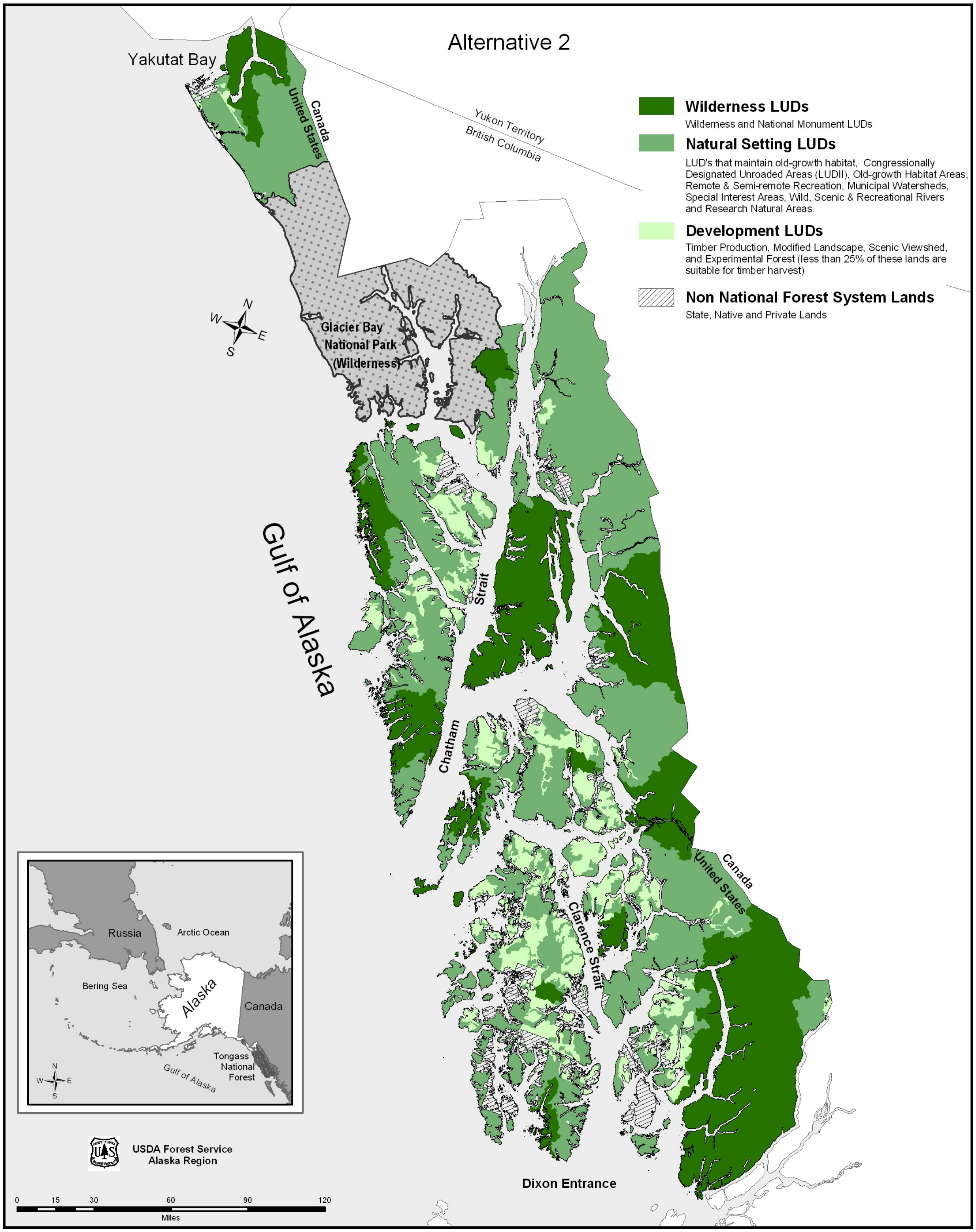


Table 2-6
Selected Outputs and Measures Associated with Alternative 2[1]

Resource/Category	Output/Measure
Percent in Wilderness LUD Group	35%
Percent in Natural Setting LUD Group	53%
Percent in Development LUD Group	12%
Amount of Development LUDs in Inventoried Roadless Areas (millions of acres)	0.8
Percent of Current Productive Old Growth Protected in Reserves (Wilderness/Nat. Mon. and Natural Setting LUDs)	84%
Productive Old Growth after 100+ Years (millions of acres)	4.7
Estimated Forest Land Suitable for Timber Production (acres)[2]	545,000
Scheduled Suitable Forest Land (acres)[2]	403,000
Allowable Sale Quantity or ASQ (millions of board feet)[3]	
1st Decade ASQ	151
2nd Decade ASQ	151
Maximum New Road Construction after 100+ Years (miles)	2,079
Maximum Average Annual Timber Harvest during 1st Decade, based on the ASQ (acres)	5,387
Potential Short-term Effects on Timber Industry[4]	
Effect on Timber Volume Under Contract	None
Effect on NEPA-cleared Volume	Low
Effect on Timber Volume in Preparation	Very Low
Percent of Identified Mineral Tracts and Undiscovered Mineral Areas in Open LUDs with Higher Development Costs	
Percent of Identified Mineral Tracts	29%
Percent of Undiscovered Mineral Areas	51%
Recreation Opportunity Spectrum Classes after 150 Years (millions of acres)	
Primitive and Semi-Primitive Non-Motorized	12.8
Semi-primitive Motorized	1.3
Roaded Natural and Roaded Modified	2.6

[1] Totals may not add exactly due to rounding.
[2] Estimated forest land suitable for timber production represents the mapped suitable forest land minus the estimated portion that is unsuitable, but not mapped as such. The scheduled suitable forest land is the portion of the estimated suitable forest land that is scheduled for harvest by ASQ modeling.
[3] ASQ volumes expressed as annual averages and include sawlog plus utility.
[4] This evaluation provides an indication of potential effects; actual effects would depend on the volume that is under contract when the decision is implemented and whether potentially affected existing sales are cancelled or exempted as part of the decision.

Alternative 3

Framework

Under Alternative 3, forest management would provide a mix of National Forest uses and activities, but would give some additional emphasis to roadless areas, associated fish and wildlife values, and unroaded recreation, tourism, and subsistence opportunities, relative to the current Forest Plan. Timber would be managed within the roaded land base as well as within additional roadless areas; but these additional areas would not include the high value roadless areas identified in the 1999 Record of Decision (USDA Forest Service 1999) as the 18 Areas of Special Interest or the 23 areas proposed for wilderness in H.R. 987. The vast majority of current roadless areas would remain in a natural condition. A total of 2.8 million acres of the Tongass would be in development LUDs and 14.0 million acres would be in non-development LUDs. The majority of the lands changed to non-development LUDs from development LUDs (in the current Plan) would be designated Semi-Remote Recreation. All areas identified as development LUDs in Alternative 2 would also be development LUDs in this alternative, in addition to other areas. Specific LUD changes under this alternative would include the addition and modification of a number of Geologic Special Interest Areas, recommendations to change the Young Bay Experimental Forest to Semi-Remote Recreation and the Cowee-Davies Creek watersheds from Scenic Viewshed to Experimental Forest, and converting a large area of Remote Recreation LUD north of Juneau to Semi-Remote Recreation. It also would include extensive refinements to the boundaries of the small Old-Growth Reserves, based on a recently completed interagency evaluation.

This alternative would approximately correspond with Scenario 3 (medium integrated industry) of the Brackley et al. (2006) timber demand study. It is similar to Alternative 5 of the 2003 SEIS in terms of the areas allocated to non-development LUDs.

Desired Conditions

The vast majority of the currently undisturbed areas of the Forest remain in a natural state and most existing roadless areas remain roadless. However, over half of the roadless areas to be developed under the current Forest Plan are developed. Old growth conditions prevail on forest lands within the roadless areas. A predictable and sustainable supply of forest products contributes to a medium integrated timber industry in Southeast Alaska, probably based in Ketchikan, Prince of Wales Island, Wrangell, and Hoonah. A mixture of old growth, recently harvested areas, and various ages of young growth occurs within roaded areas. Recreation, tourism, and subsistence opportunities occur in natural setting types, but roaded opportunities are considerably expanded from current conditions, although not as much as under the current Plan.

Land Use Designations

If Alternative 3 is selected, the LUD allocation acres shown in Table 2-7 would result. Figure 2-3 shows the distribution of LUDs across the Tongass under Alternative 3 according to three LUD groups (see Table 2-7 for definitions of the LUD groups). A complete LUD map is provided as the Alternative 3 map in the *Map Section* of the CD version of this EIS or in the *Map Packet* accompanying the EIS hard copy.

Management Prescriptions and Standards and Guidelines

Under Alternative 3, the management prescriptions and standards and guidelines identified in the Final Proposed Forest Plan would be adopted. These are generally the same as the management prescriptions and standards and guidelines in the current Forest Plan; however, a number of changes and refinements are proposed. A summary of the main changes to the current Forest Plan is provided above in the section titled "Final Proposed Forest Plan."

Selected Outputs

Table 2-8 displays selected outputs and other measures associated with this alternative.

Table 2-7
Land Use Designations for Alternative 3[1]

Land Use Designation	Acres Allocated	Net Change from Current Forest Plan Acres[2]
Wilderness LUD Group		
Wilderness	2,637,292	0
National Monument[3]	3,278,734	0
Total for Wilderness LUD Group	**5,916,026**	**0**
Natural Setting LUD Group		
LUD II	721,002	0
Research Natural Area	26,093	0
Old Growth	1,221,173	38,749
Special Interest Area	221,176	46,712
Enacted Municipal Watershed	45,226	0
Wild, Scenic, and Recreational River	117,319	0
Remote Recreation	2,182,091	51,036
Semi-Remote Recreation	3,519,753	665,527
Total for Natural Setting LUD Group	**8,053,833**	**802,025**
Development LUD Group		
Experimental Forest	31,405	14,309
Scenic Viewshed	320,457	(156,763)
Modified Landscape	478,541	(122,820)
Timber Production	1,973,542	(536,755)
Total for Development LUD Group	**2,803,945**	**(802,025)**
Total National Forest System Lands	**16,773,803**	**0**

1 When more than one LUD is applied to the same area, such as a Special Interest Area within Wilderness, only the acreage of the more restrictive LUD is included, except that total Wilderness, Wilderness National Monument, and LUD II acres are always shown. The acreage for the Minerals LUD would be 249,570; these acres are not included in the table because the Minerals LUD is an overlay. No acreages have been calculated for the Transportation and Utility Systems LUD because it is a series of corridors with undefined width and imprecise locations. Totals may not exactly equal the sum of individual entries due to rounding.

2 These changes from current Forest Plan acres are the differences from the decision made in the 1997 Tongass Forest Plan Revision ROD, as amended, which is represented by Alternative 5.

3 The majority of the National Monument acres are wilderness; only 166,942 acres are non-wilderness.

4 Small old-growth reserves and Special Interest Area LUDs increased relative to Alternative 5; however, they overlap extensively, especially on Heceta, Kosciusko, and northeast Chichagof Islands, and the acreages where they overlap were counted with Special Interest Areas.

Figure 2-3
Wilderness, Natural Setting, and Development LUDs on the Tongass National Forest under Alternative 3

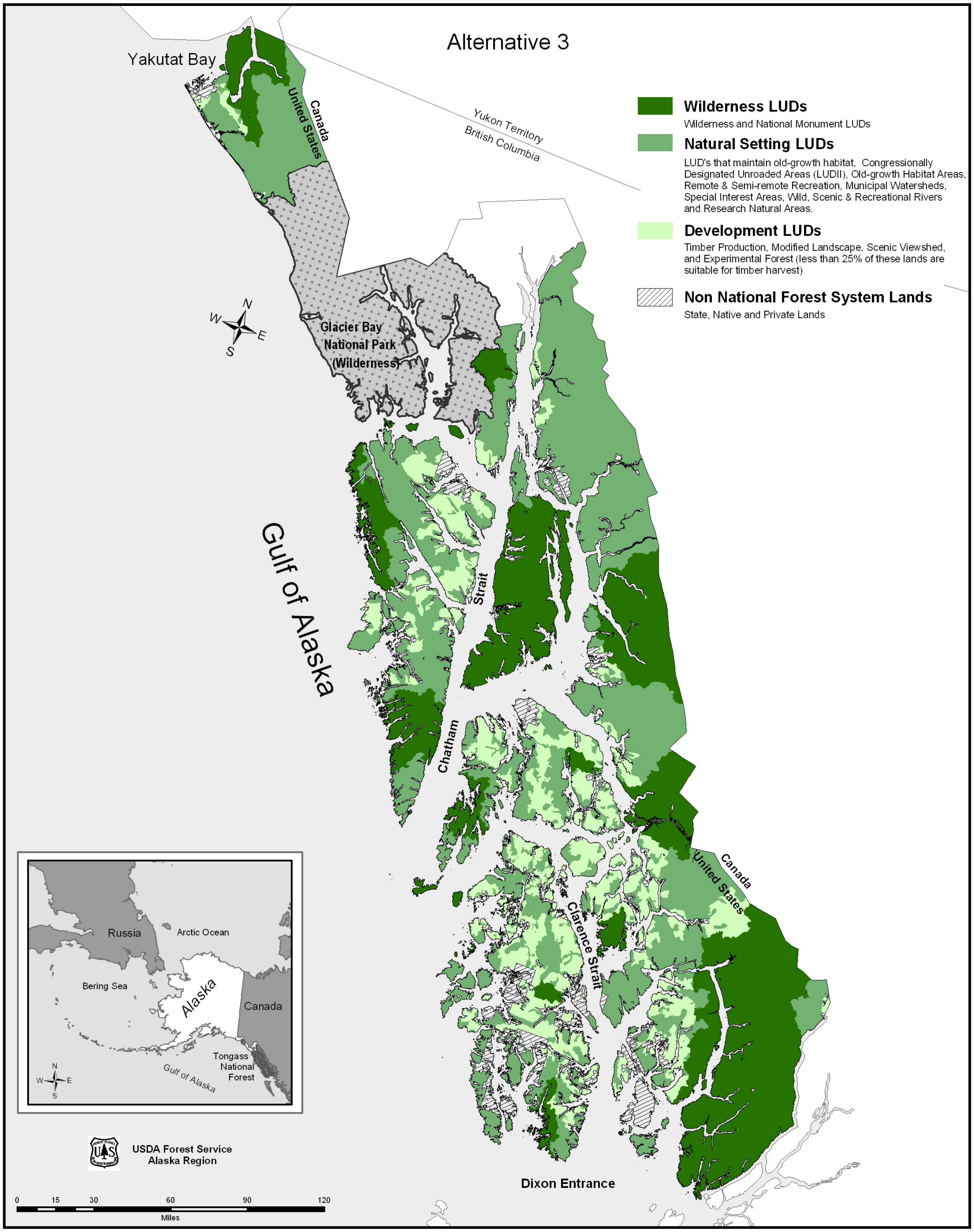


Table 2-8
Selected Outputs and Measures Associated with Alternative 3[1]

Resource/Category	Output/Measure
Percent in Wilderness LUD Group	35%
Percent in Natural Setting LUD Group	48%
Percent in Development LUD Group	17%
Amount of Development LUDs in Inventoried Roadless Areas (millions of acres)	1.7
Percent of Current Productive Old Growth Protected in Reserves (Wilderness/Nat. Mon. and Natural Setting LUDs)	78%
Productive Old Growth after 100+ Years (millions of acres)	4.6
Estimated Forest Land Suitable for Timber Production (acres)[2]	661,000
Scheduled Suitable Forest Land (acres)[2]	526,000
Allowable Sale Quantity or ASQ (millions of board feet)[3]	
1st Decade ASQ	204
2nd Decade ASQ	205
Maximum New Road Construction after 100+ Years (miles)	2,799
Maximum Average Annual Timber Harvest during 1st Decade, based on the ASQ (acres)	6,824
Potential Short-term Effects on Timber Industry[4]	
Effect on Timber Volume Under Contract	None
Effect on NEPA-cleared Volume	None
Effect on Timber Volume in Preparation	Very Low
Percent of Identified Mineral Tracts and Undiscovered Mineral Areas in Open LUDs with Higher Development Costs	
Percent of Identified Mineral Tracts	26%
Percent of Undiscovered Mineral Areas	45%
Recreation Opportunity Spectrum Classes after 150 Years (millions of acres)	
Primitive and Semi-Primitive Non-Motorized	12.4
Semi-Primitive Motorized	1.3
Roaded Natural and Roaded Modified	3.1

[1] Totals may not add exactly due to rounding.

[2] Estimated forest land suitable for timber production represents the mapped suitable forest land minus the estimated portion that is unsuitable, but not mapped as such. The scheduled suitable forest land is the portion of the estimated suitable forest land that is scheduled for harvest by ASQ modeling.

[3] ASQ volumes expressed as annual averages and include sawlog plus utility.

[4] This evaluation provides an indication of potential effects; actual effects would depend on the volume that is under contract when the decision is implemented and whether potentially affected existing sales are cancelled or exempted as part of the decision.

Alternative 4

Framework

Under Alternative 4, forest management would provide a mix of National Forest uses and activities, but would give additional emphasis to timber management and associated economic stability of Southeast Alaska communities, relative to the current Forest Plan. Timber would be managed within an area expanded beyond the current Forest Plan. The vast majority of current roadless areas would remain in a natural condition; however, the majority of roadless areas that contain substantial productive old growth (POG), outside of wilderness, would be developed. A total of 4.7 million acres of the Tongass would be in development LUDs and 12.0 million acres would be in non-development LUDs. Almost all areas identified as development LUDs in Alternative 5 would also be development LUDs in this alternative, in addition to other areas. Specific LUD changes under this alternative would include the addition and modification of a number of Geologic Special Interest Areas, recommendations to change the Young Bay Experimental Forest to Semi-remote Recreation and the Cowee-Davies Creek watersheds from Scenic Viewshed to Experimental Forest, and converting a large area of Remote Recreation LUD north of Juneau to Semi-Remote Recreation.

This alternative would approximately correspond with Scenario 4 (high integrated industry) of the Brackley et al. (2006) timber demand study. It is similar to Alternative 6 of the 1997 FEIS.

Desired Conditions

The vast majority of the currently undisturbed areas of the Forest remain in a natural state and most existing roadless areas remain roadless. However, all of the roadless areas to be developed under the current Forest Plan are developed along with some additional roadless areas. Old growth conditions prevail on forest lands within roadless areas. The Tongass produces a predictable and sustainable supply of forest products that contributes to a high integrated timber industry in Southeast Alaska, probably based in Ketchikan, Prince of Wales Island, Wrangell, Hoonah, and other communities; however, private and state lands also contribute to satisfying the demand for timber. A mixture of old growth, recently harvested areas, and various ages of young growth occurs within roaded areas. Recreation, tourism, and subsistence opportunities occur in natural setting types, but roaded opportunities are substantially expanded from current conditions.

Land Use Designations

If Alternative 4 is selected, the LUD allocation acres shown in Table 2-9 would result. Figure 2-4 shows the distribution of LUDs across the Tongass under Alternative 4 according to three LUD groups (see Table 2-9 for definitions of the LUD groups). A complete LUD map is provided as the Alternative 4 map in the *Map Section* of the CD version of this EIS or in the *Map Packet* accompanying the EIS hard copy.

Management Prescriptions and Standards and Guidelines

Under Alternative 4, the management prescriptions and standards and guidelines identified in the Final Proposed Forest Plan would be adopted, with the exceptions noted below. The Alternative 4 management prescriptions and standards and guidelines are generally the same as those in the current Forest Plan; however, a number of changes and refinements are proposed. The summary, presented above (Final Proposed Forest Plan section), of the main changes to the current Forest Plan, reflects the proposal under Alternative 4, with the following exceptions:

- The Old-Growth Habitat LUD (and the system of large, medium, and small old-growth reserves) is applied only within four biogeographic provinces (Northern Prince of Wales Island, Kupreanof/Mitkof Islands, Dall Island, Northeast Chichagof Island) plus several individual reserves outside of these provinces

- In Value Comparison Units (VCUs) not within the four biogeographic provinces identified above, retain a minimum of 33 percent of the productive forest land in an old-growth forest condition
- The goshawk foraging habitat standard and guideline, the high-value marten habitat standard and guideline, and the proposed Legacy standard and guideline would not be implemented

Selected Outputs

Table 2-10 displays selected outputs and other measures associated with this alternative.

Table 2-9
Land Use Designations for Alternative 4[1]

Land Use Designation	Acres Allocated	Net Change from Current Forest Plan Acres[2]
Wilderness LUD Group		
Wilderness	2,637,292	0
National Monument[3]	3,278,734	0
Total for Wilderness LUD Group	**5,916,026**	**0**
Natural Setting LUD Group		
LUD II	721,002	0
Research Natural Area	26,093	0
Old Growth	393,360	(789,064)
Special Interest Area	221,176	46,712
Enacted Municipal Watershed	45,226	0
Wild, Scenic, and Recreational River	117,319	0
Remote Recreation	2,089,331	(41,724)
Semi-Remote Recreation	2,516,591	(337,634)
Total for Natural Setting LUD Group	**6,130,098**	**(1,121,714)**
Development LUD Group		
Experimental Forest	31,405	14,309
Scenic Viewshed	725,820	248,601
Modified Landscape	745,903	144,541
Timber Production	3,224,559	714,262
Total for Development LUD Group	**4,727,686**	**1,121,714**
Total National Forest System Lands	**16,773,806**	**0**

1 When more than one LUD is applied to the same area, such as a Special Interest Area within Wilderness, only the acreage of the more restrictive LUD is included, except that total Wilderness, Wilderness National Monument, and LUD II acres are always shown. The acreage for the Minerals LUD would be 249,570; these acres are not included in the table because the Minerals LUD is an overlay. No acreages have been calculated for the Transportation and Utility System LUD because it is a series of corridors with undefined width and imprecise locations. Totals may not exactly equal the sum of individual entries due to rounding.

2 These changes from current Forest Plan acres are the differences from the decision made in the 1997 Tongass Forest Plan Revision ROD, as amended, which is represented by Alternative 5.

3 The majority of the National Monument acres are wilderness; only 166,942 acres are non-wilderness.

Figure 2-4
Wilderness, Natural Setting, and Development LUDs on the Tongass National Forest under Alternative 4

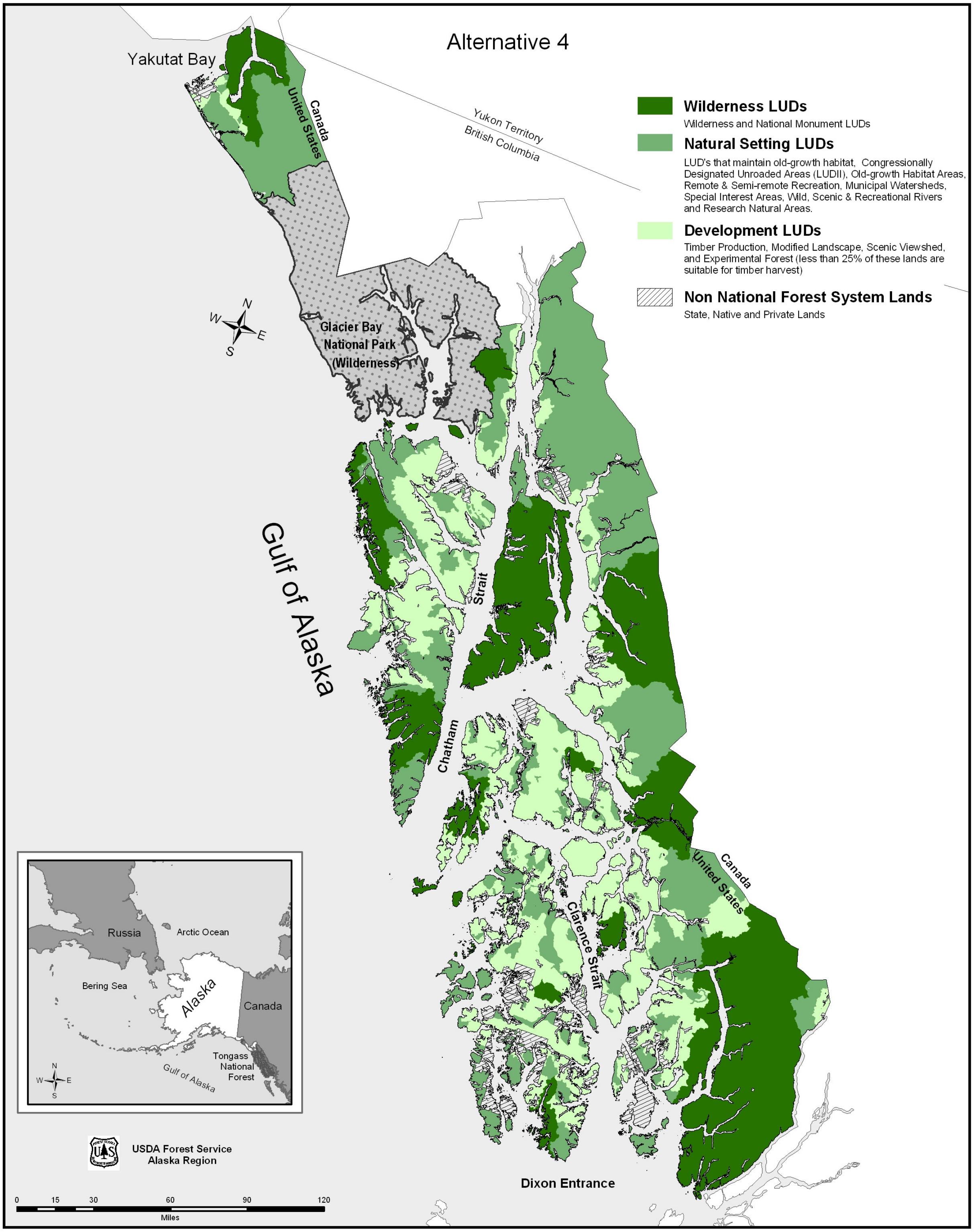


Table 2-10
Selected Outputs and Measures Associated with Alternative 4[1]

Resource/Category	Output/Measure
Percent in Wilderness LUD Group	35%
Percent in Natural Setting LUD Group	37%
Percent in Development LUD Group	28%
Amount of Development LUDs in Inventoried Roadless Areas (millions of acres)	3.4
Percent of Current Productive Old growth Protected in Reserves (Wilderness/Nat. Mon. and Natural Setting LUDs)	60%
Productive Old growth after 100+ Years (millions of acres)	4.3
Estimated Forest Land Suitable for Timber Production (acres)[2]	999,000
Scheduled Suitable Forest Land (acres)[2]	874,000
Allowable Sale Quantity or ASQ (millions of board feet)[3]	
1st Decade ASQ	312
2nd Decade ASQ	360
Maximum New Road Construction after 100+ Years (miles)	4,890
Maximum Average Annual Timber Harvest during 1st Decade, based on the ASQ (acres)	11,647
Potential Short-term Effects on Timber Industry[4]	
Effect on Timber Volume Under Contract	None
Effect on NEPA-cleared Volume	None
Effect on Timber Volume in Preparation	None
Percent of Identified Mineral Tracts and Undiscovered Mineral Areas in Open LUDs with Higher Development Costs	
Percent of Identified Mineral Tracts	20%
Percent of Undiscovered Mineral Areas	35%
Recreation Opportunity Spectrum Classes after 150 Years (millions of acres)	
Primitive and Semi-Primitive Non-Motorized	11.3
Semi-Primitive Motorized	1.2
Roaded Natural and Roaded Modified	4.3

1 Totals may not add exactly due to rounding.
2 Estimated forest land suitable for timber production represents the mapped suitable forest land minus the estimated portion that is unsuitable, but not mapped as such. The scheduled suitable forest land is the portion of the estimated suitable forest land that is scheduled for harvest by ASQ modeling.
3 ASQ volumes expressed as annual averages and include sawlog plus utility.
4 This evaluation provides an indication of potential effects; actual effects would depend on the volume that is under contract when the decision is implemented and whether potentially affected existing sales are cancelled or exempted as part of the decision.

Alternative 5

Framework

This is the No Action alternative. It represents a continuation of the current Forest Plan and would result in a mix of National Forest uses and activities. Timber would be managed in an area more extensive than under Alternative 3, but less extensive than under Alternative 4. The vast majority of current roadless areas would remain in a natural condition; however, the majority of roadless areas that contain substantial POG, outside of wilderness, would be partially developed. A total of 3.6 million acres of the Tongass would be in development LUDs and 13.2 million acres would be in non-development LUDs. This alternative is the same as the current Forest Plan (Alternative 11 from the 1997 FEIS plus amendments).

Desired Conditions

The vast majority of the currently undisturbed areas of the Forest remain in a natural state and most existing roadless areas remain roadless. Old growth conditions prevail on forest lands within roadless areas. A predictable and sustainable supply of forest products contribute to a limited integrated timber industry in Southeast Alaska, probably based in Ketchikan, Prince of Wales Island, Wrangell, and Hoonah. There would be sufficient volume under this alternative to support the existing sawmills. There would also be sufficient volume to support one or more veneer plants or an MDF or other chip-related operation, but probably not both. A mixture of old growth, recently harvested areas, and various ages of young growth occurs within roaded areas. Recreation, tourism, and subsistence opportunities occur in natural setting types, but roaded opportunities are considerably expanded from current conditions.

Land Use Designations

If Alternative 5 is selected, the LUD allocation acres shown in Table 2-11 would result. Figure 2-5 shows the distribution of LUDs across the Tongass under Alternative 5 according to three LUD groups (see Table 2-11 for definitions of the LUD groups). A complete LUD map is provided as the Alternative 5 map in the *Map Section* of the CD version of this EIS or in the *Map Packet* accompanying the EIS hard copy.

Standards and Guidelines

Under Alternative 5, the standards and guidelines identified in the current Forest Plan would be adopted. These represent the 1997 Forest Plan with amendments (USDA Forest Service 1997b).

Selected Outputs

Table 2-12 displays selected outputs and other measures associated with this alternative.

Table 2-11
Land Use Designations for Alternative 5[1]

Land Use Designation	Acres Allocated	Net Change from Current Forest Plan Acres[2]
Wilderness LUD Group		
Wilderness	2,637,292	0
National Monument[3]	3,278,734	0
Total for Wilderness LUD Group	**5,916,026**	**0**
Natural Setting LUD Group		
LUD II	721,002	0
Research Natural Area	26,093	0
Old Growth	1,182,424	0
Special Interest Area	174,463	0
Enacted Municipal Watershed	45,226	0
Wild, Scenic, and Recreational River	117,319	0
Remote Recreation	2,131,055	0
Semi-Remote Recreation	2,854,225	0
Total for Natural Setting LUD Group	**7,251,808**	**0**
Development LUD Group		
Experimental Forest	17,095	0
Scenic Viewshed	477,219	0
Modified Landscape	601,362	0
Timber Production	2,510,298	0
Total for Development LUD Group	**3,605,974**	**0**
Total National Forest System Lands	**16,773,808**	**0**

1 When more than one LUD is applied to the same area, such as a Special Interest Area within Wilderness, only the acreage of the more restrictive LUD is included, except that total Wilderness, Wilderness National Monument, and LUD II acres are always shown. The acreage for the Minerals LUD would be 170,514; these acres are not included in the table because the Minerals LUD is an overlay. No acreages have been calculated for the Transportation and Utility System LUD because it is a series of corridors with undefined width and imprecise locations. Totals may not exactly equal the sum of individual entries due to rounding.

2 These changes from current Forest Plan acres are the differences from the decisions made in the 1997 Tongass Forest Plan Revision ROD, as amended, which is represented by Alternative 5.

3 The majority of the National Monument acres are wilderness; only 166,942 acres are non-wilderness.

Figure 2-5
Wilderness, Natural Setting, and Development LUDs on the Tongass National Forest under Alternative 5

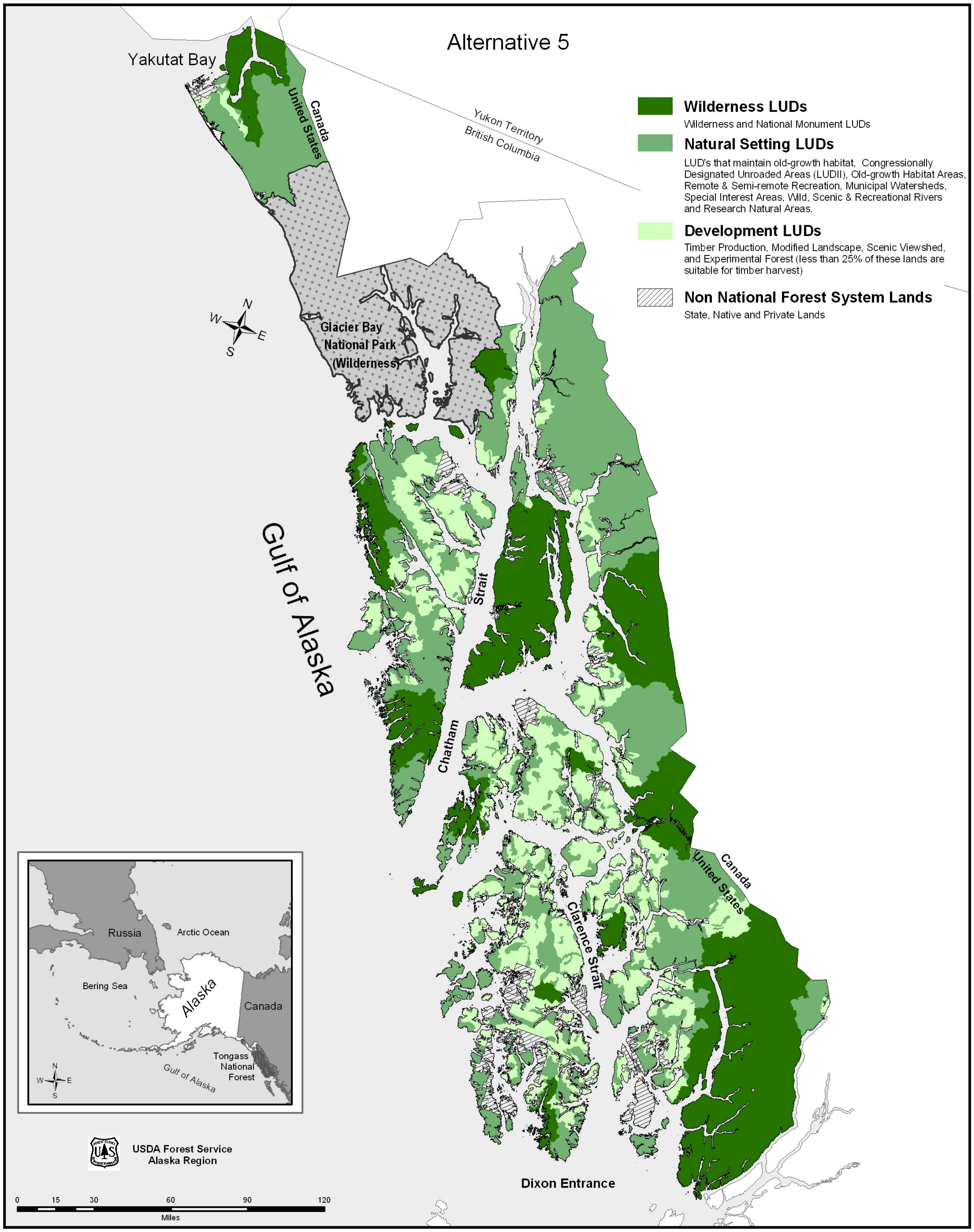


Table 2-12
Selected Outputs and Measures Associated with Alternative 5[1]

Resource/Category	Output/Measure
Percent in Wilderness LUD Group	35%
Percent in Natural Setting LUD Group	43%
Percent in Development LUD Group	21%
Amount of Development LUDs in Inventoried Roadless Areas (millions of acres)	2.4
Percent of Current Productive Old Growth Protected in Reserves (Wilderness/Nat. Mon. and Natural Setting LUDs)	71%
Productive Old Growth after 100+ Years (millions of acres)	4.5
Estimated Forest Land Suitable for Timber Production (acres)[2]	757,000
Scheduled Suitable Forest Land (acres)[2]	702,000
Allowable Sale Quantity or ASQ (millions of board feet)[3]	
1st Decade ASQ	267
2nd Decade ASQ	267
Maximum New Road Construction after 100+ Years (miles)	3,874
Maximum Average Annual Timber Harvest during 1st Decade, based on the ASQ (acres)	10,308
Potential Short-term Effects on Timber Industry[4]	
Effect on Timber Volume Under Contract	None
Effect on NEPA-cleared Volume	None
Effect on Timber Volume in Preparation	None
Percent of Identified Mineral Tracts and Undiscovered Mineral Areas in Open LUDs with Higher Development Costs	
Percent of Identified Mineral Tracts	29%
Percent of Undiscovered Mineral Areas	41%
Recreation Opportunity Spectrum Classes after 150 Years (millions of acres)	
Primitive and Semi-Primitive Non-Motorized	11.9
Semi-Primitive Motorized	1.3
Roaded Natural and Roaded Modified	3.6

1 Totals may not add exactly due to rounding.

2 Estimated forest land suitable for timber production represents the mapped suitable forest land minus the estimated portion that is unsuitable, but not mapped as such. The scheduled suitable forest land is the portion of the estimated suitable forest land that is scheduled for harvest by ASQ modeling. Slight differences in suitable acres between Alternative 5 (shown above) and Alternative 11 of the 1997 Final EIS are caused by: 1) changes in ownership, 2) changes in LUDs, and 3) the use of different estimation methods.

3 ASQ volumes expressed as annual averages and include sawlog plus utility.

4 This evaluation provides an indication of potential effects; actual effects would depend on the volume that is under contract when the decision is implemented and whether potentially affected existing sales are cancelled or exempted as part of the decision.

Alternative 6

Framework

This is the Proposed Action alternative. It is very similar to the Alternative 5 (No Action) alternative in terms of LUD allocations; however, it includes extensive refinements to the boundaries of the small Old-Growth Reserves (based on a recently completed interagency evaluation), new Geologic Special Interest Areas, a new Experimental Forest, the conversion of a large area of Remote Recreation LUD north of Juneau to Semi-Remote Recreation, and other minor LUD refinements. Timber would be managed in an area more extensive than under Alternative 3, but less extensive than under Alternative 4. The vast majority of current roadless areas would remain in a natural condition; however, the majority of roadless areas that contain substantial POG, outside of wilderness, would be partially developed. A total of 3.5 million acres of the Tongass would be in development LUDs and 13.3 million acres would be in non-development LUDs. Specific LUD changes under this alternative would include the addition and modification of a number of Geologic Special Interest Areas, recommendations to change the Young Bay Experimental Forest to Semi-remote Recreation and the Cowee-Davies Creek watersheds from Scenic Viewshed to Experimental Forest, and converting a large area of Remote Recreation LUD north of Juneau to Semi-Remote Recreation. It also would include extensive refinements to the boundaries of the small Old-Growth Reserves, based on a recently completed interagency evaluation.

This alternative is similar to Alternative 11 of the 1997 FEIS.

Desired Conditions

The vast majority of the currently undisturbed areas of the Forest remain in a natural state and most existing roadless areas remain roadless. Old growth conditions prevail on forest lands within roadless areas. A predictable and sustainable supply of forest products contribute to a limited integrated timber industry in Southeast Alaska, probably based in Ketchikan, Prince of Wales Island, Wrangell, and Hoonah. There would be sufficient volume under this alternative to support the existing sawmills. There would also be sufficient volume to support one or more veneer plants or an MDF or other chip-related operation, but probably not both. Populations of wildlife dependent on old-growth and/or unroaded habitats have a moderately high likelihood of being maintained as viable and well-distributed across the Tongass. A mixture of old growth, recently harvested areas, and various ages of young growth occurs within roaded areas. Recreation, tourism, and subsistence opportunities occur in natural setting types, but roaded opportunities are considerably expanded from current conditions.

Land Use Designations

If Alternative 6 is selected, the LUD allocation acres shown in Table 2-13 would result. Figure 2-6 shows the distribution of LUDs across the Tongass under Alternative 6 according to three LUD groups (see Table 2-13 for definitions of the LUD groups). A complete LUD map is provided as the Alternative 6 map in the *Map Section* of the CD version of this EIS or in the *Map Packet* accompanying the EIS hard copy.

Management Prescriptions and Standards and Guidelines

Under Alternative 6, the management prescriptions and standards and guidelines identified in the Final Proposed Forest Plan would be adopted. These are generally the same as the management prescriptions and standards and guidelines in the current Forest Plan; however, a number of changes and refinements are proposed. A summary of the main changes to the current Forest Plan is provided above in the section titled "Final Proposed Forest Plan."

Selected Outputs

Table 2-14 displays selected outputs and other measures associated with this alternative.

Table 2-13
Land Use Designations for Alternative 6[1]

Land Use Designation	Acres Allocated	Net Change from Current Forest Plan Acres[2]
Wilderness LUD Group		
Wilderness	2,637,292	0
National Monument[3]	3,278,734	0
Total for Wilderness LUD Group	**5,916,026**	**0**
Natural Setting LUD Group		
LUD II	721,002	0
Research Natural Area	26,093	0
Old Growth[4]	1,221,173	38,749
Special Interest Area[4]	221,176	46,712
Enacted Municipal Watershed	45,226	0
Wild, Scenic, and Recreational River	117,319	0
Remote Recreation	2,033,665	(97,390)
Semi-Remote Recreation	3,014,704	160,479
Total for Natural Setting LUD Group	**7,400,359**	**148,551**
Development LUD Group		
Experimental Forest	31,405	14,309
Scenic Viewshed	442,101	(35,118)
Modified Landscape	590,338	(11,024)
Timber Production	2,393,576	(116,721)
Total for Development LUD Group	**3,457,420**	**(148,551)**
Total National Forest System Lands	**16,773,806**	**0**

1 When more than one LUD is applied to the same area, such as a Special Interest Area within Wilderness, only the acreage of the more restrictive LUD is included, except that total Wilderness, Wilderness National Monument, and LUD II acres are always shown. The acreage for the Minerals LUD would be 249,570; these acres are not included in the table because the Minerals LUD is an overlay. No acreages have been calculated for the Transportation and Utility System LUD because it is a series of corridors with undefined width and imprecise locations. Totals may not exactly equal the sum of individual entries due to rounding.

2 These changes from current Forest Plan acres are the differences from the decision made in the 1997 Tongass Forest Plan Revision ROD, as amended, which is represented by Alternative 5.

3 The majority of the National Monument acres are wilderness; only 166,942 acres are non-wilderness.

4 Small old-growth reserves and Special Interest Area LUDs increased relative to Alternative 5; however, they overlap extensively, especially on Heceta, Kosciusko, and northeast Chichagof Islands, and the acreages where they overlap were counted with Special Interest Areas.

Figure 2-6
Wilderness, Natural Setting, and Development LUDs on the Tongass National Forest under Alternative 6

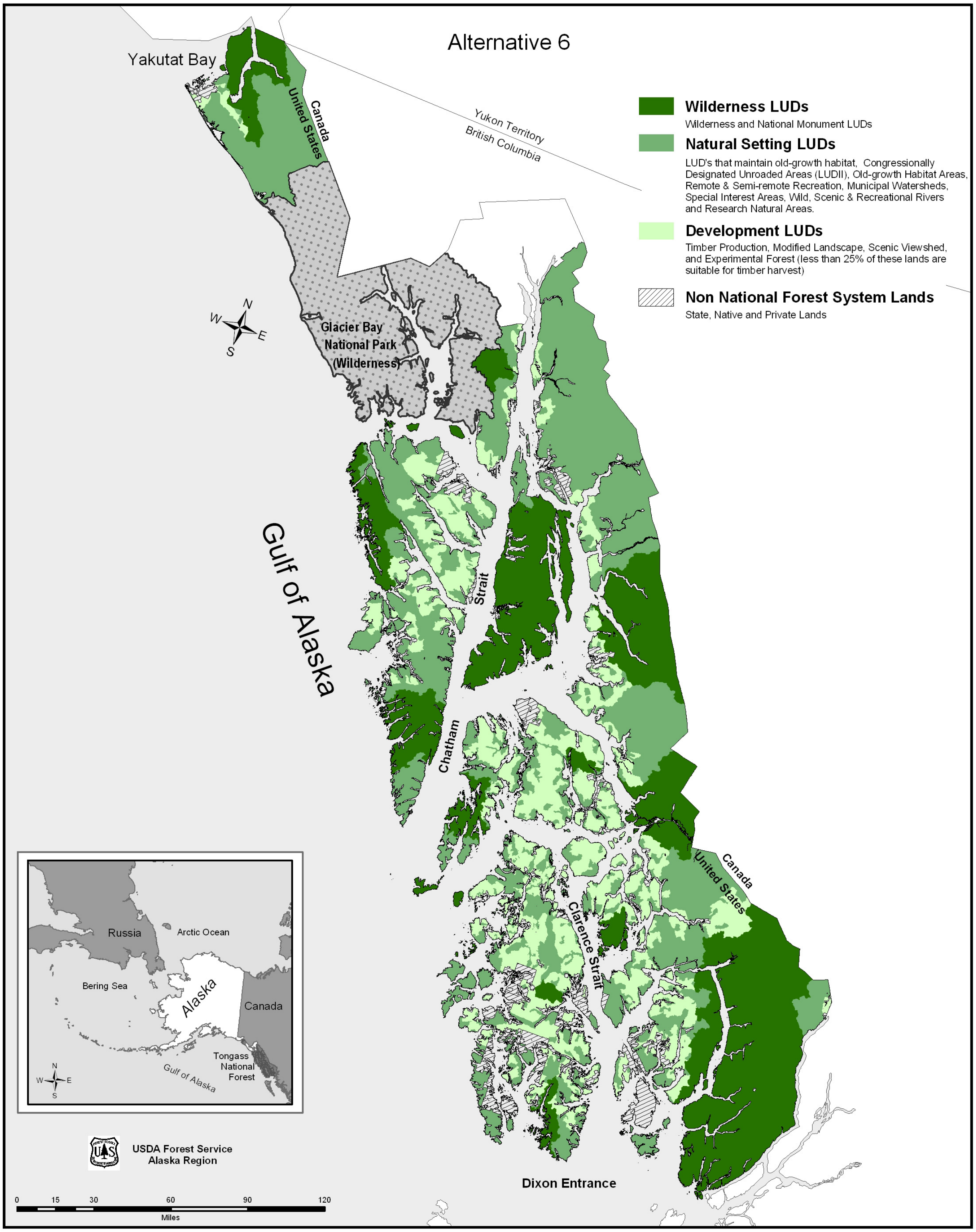


Table 2-14
Selected Outputs and Measures Associated with Alternative 6[1]

Resource/Category	Output/Measure
Percent in Wilderness LUD Group	35%
Percent in Natural Setting LUD Group	44%
Percent in Development LUD Group	21%
Amount of Development LUDs in Inventoried Roadless Areas (millions of acres)	2.3
Percent of Current Productive Old Growth Protected in Reserves (Wilderness/Nat. Mon. and Natural Setting LUDs)	72%
Productive Old Growth after 100+ Years (millions of acres)	4.5
Estimated Forest Land Suitable for Timber Production (acres)[2]	775,000
Scheduled Suitable Forest Land (acres)[2]	689,000
Allowable Sale Quantity or ASQ (millions of board feet)[3]	
1st Decade ASQ	267
2nd Decade ASQ	267
Maximum New Road Construction after 100+ Years (miles)	3,744
Maximum Average Annual Timber Harvest during 1st Decade, based on the ASQ (acres)	9,806
Potential Short-term Effects on Timber Industry[4]	
Effect on Timber Volume Under Contract	None
Effect on NEPA-cleared Volume	None
Effect on Timber Volume in Preparation	None
Percent of Identified Mineral Tracts and Undiscovered Mineral Areas in Open LUDs with Higher Development Costs	
Percent of Identified Mineral Tracts	25%
Percent of Undiscovered Mineral Areas	41%
Recreation Opportunity Spectrum Classes after 150 Years (millions of acres)	
Primitive and Semi-Primitive Non-Motorized	12.0
Semi-Primitive Motorized	1.3
Roaded Natural and Roaded Modified	3.5

1 Totals may not add exactly due to rounding.
2 Estimated forest land suitable for timber production represents the mapped suitable forest land minus the estimated portion that is unsuitable, but not mapped as such. The scheduled suitable forest land is the portion of the estimated suitable forest land that is scheduled for harvest by ASQ modeling.
3 ASQ volumes expressed as annual averages and include sawlog plus utility.
4 This evaluation provides an indication of potential effects; actual effects would depend on the volume that is under contract when the decision is implemented and whether potentially affected existing sales are cancelled or exempted as part of the decision.

Alternative 7

Framework

Under Alternative 7, forest management would provide a mix of National Forest uses and activities, but would give much additional emphasis to timber management, relative to the current Forest Plan. Timber would be managed on a considerably expanded land base compared with the current Forest Plan. The vast majority of current roadless areas would remain in a natural condition; however, the majority of roadless areas that contain substantial POG outside of Wilderness, would be fully developed. A total of 5.0 million acres of the Tongass would be in development LUDs and 11.7 million acres would be in non-development LUDs. Almost all areas identified as development LUDs in Alternative 5 would also be development LUDs in this alternative, in addition to other areas. Specific LUD changes under this alternative would include the addition and modification of a number of Geologic Special Interest Areas and recommendations to change the Young Bay Experimental Forest to Semi-remote Recreation and the Cowee-Davies Creek watersheds from Scenic Viewshed to Experimental Forest.

This alternative is similar to Alternative 2 of the 1997 FEIS.

Desired Conditions

The vast majority of the currently undisturbed areas of the Forest remain in a natural state and most existing roadless areas remain roadless. However, all of the roadless areas to be developed under the current Forest Plan are developed along with additional roadless areas. Old growth conditions prevail on forest lands within roadless areas. The Tongass produces a predictable and sustainable supply of forest products that completely satisfies the demand from a high integrated timber industry in Southeast Alaska, probably based in Ketchikan, Prince of Wales Island, Wrangell, Hoonah, and other communities. Timber from private and state lands is not required to satisfy timber demand. A mixture of old growth, recently harvested areas, and various ages of young growth occurs within roaded areas. Recreation, tourism, and subsistence opportunities occur in natural setting types, but roaded opportunities are substantially expanded from current conditions.

Land Use Designations

If Alternative 7 is selected, the LUD allocation acres shown in Table 2-15 would result. Figure 2-7 shows the distribution of LUDs across the Tongass under Alternative 7 according to three LUD groups (see Table 2-15 for definitions of the LUD groups). A complete LUD map is provided as the Alternative 7 map in the *Map Section* of the CD version of this EIS or in the *Map Packet* accompanying the EIS hard copy.

Management Prescriptions and Standards and Guidelines

Under Alternative 7, the standards and guidelines identified in the current Forest Plan would be adopted, with the exceptions noted below. The current Forest Plan represents the 1997 Forest Plan with amendments (USDA Forest Service 1997b). The exceptions include:

- The Beach and Estuary Fringe buffer is changed to 500 feet. along the beach fringe and 1,000 feet. around estuaries.
- The Riparian Standards and Guidelines are modified so that buffers are not required along Class III streams.
- The Old-Growth Habitat LUD and its management prescription is not used and is deleted.
- The goshawk foraging habitat standard and guideline, the high-value marten habitat standard and guideline, and the proposed Legacy standard and guideline would not be implemented.
- The goshawk nesting standard and guideline would not be implemented.

Selected Outputs

Table 2-16 displays selected outputs and other measures associated with this alternative.

Table 2-15
Land Use Designations for Alternative 7[1]

Land Use Designation	Acres Allocated	Net Change from Current Forest Plan Acres[2]
Wilderness LUD Group		
Wilderness	2,637,292	0
National Monument[3]	3,278,734	0
Total for Wilderness LUD Group	**5,916,026**	**0**
Natural Setting LUD Group		
LUD II	721,002	0
Research Natural Area	26,093	0
Old Growth	0	(1,182,424)
Special Interest Area	221,176	46,712
Enacted Municipal Watershed	45,226	0
Wild, Scenic, and Recreational River	117,319	0
Remote Recreation	2,088,185	(42,870)
Semi-Remote Recreation	2,589,082	(265,143)
Total for Natural Setting LUD Group	**5,808,083**	**(1,433,725)**
Development LUD Group		
Experimental Forest	31,405	14,310
Scenic Viewshed	781,705	304,486
Modified Landscape	840,342	238,980
Timber Production	3,396,243	885,946
Total for Development LUD Group	**5,049,695**	**1,443,725**
Total National Forest System Lands	**16,773,804**	**0**

[1] When more than one LUD is applied to the same area, such as a Special Interest Area within Wilderness, only the acreage of the more restrictive LUD is included, except that total Wilderness, Wilderness National Monument, and LUD II acres are always shown. The acreage for the Minerals LUD would be 249,570; these acres are not included in the table because the Minerals LUD is an overlay. No acreages have been calculated for the Transportation and Utility System LUD because it is a series of corridors with undefined width and imprecise locations. Totals may not exactly equal the sum of individual entries due to rounding.

[2] These changes from current Forest Plan acres are the differences from the decision made in the 1997 Tongass Forest Plan Revision ROD, as amended, which is represented by Alternative 5.

[3] The majority of the National Monument acres are wilderness; only 166,942 acres are non-wilderness.

Figure 2-7
Wilderness, Natural Setting, and Development LUDs on the Tongass National Forest under Alternative 7

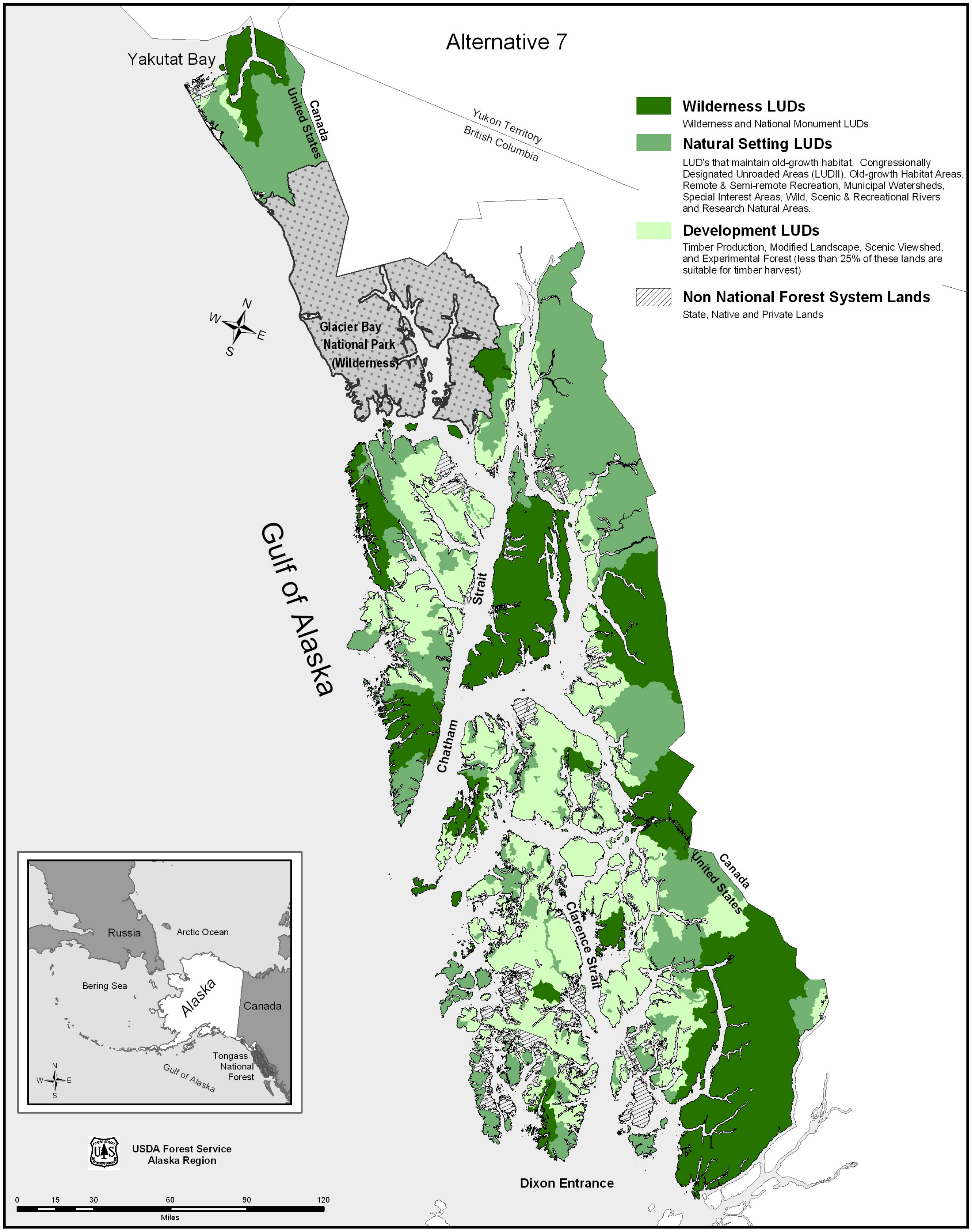


Table 2-16
Selected Outputs and Measures Associated with Alternative 7[1]

Resource/Category	Output/Measure
Percent in Wilderness LUD Group	35%
Percent in Natural Setting LUD Group	35%
Percent in Development LUD Group	30%
Amount of Development LUDs in Inventoried Roadless Areas (millions of acres)	3.7
Percent of Current Productive Old Growth Protected in Reserves (Wilderness/Nat. Mon. and Natural Setting LUDs)	57%
Productive Old Growth after 100+ Years (millions of acres)	4.1
Estimated Forest Land Suitable for Timber Production (acres)[2]	1,174,000
Scheduled Suitable Forest Land (acres)[2]	1,088,000
Allowable Sale Quantity or ASQ (millions of board feet)[3]	
1st Decade ASQ	421
2nd Decade ASQ	421
Maximum New Road Construction after 100+ Years (miles)	5,825
Maximum Average Annual Timber Harvest during 1st Decade, based on the ASQ (acres)	15,827
Potential Short-term Effects on Timber Industry[4]	
Effect on Timber Volume Under Contract	None
Effect on NEPA-cleared Volume	None
Effect on Timber Volume in Preparation	None
Percent of Identified Mineral Tracts and Undiscovered Mineral Areas in Open LUDs with Higher Development Costs	
Percent of Identified Mineral Tracts	18%
Percent of Undiscovered Mineral Areas	33%
Recreation Opportunity Spectrum Classes after 150 Years (millions of acres)	
Primitive and Semi-Primitive Non-Motorized	11.1
Semi-Primitive Motorized	1.2
Roaded Natural and Roaded Modified	4.5

[1] Totals may not add exactly due to rounding.
[2] Estimated forest land suitable for timber production represents the mapped suitable forest land minus the estimated portion that is unsuitable, but not mapped as such. The scheduled suitable forest land is the portion of the estimated suitable forest land that is scheduled for harvest by ASQ modeling.
[3] ASQ volumes expressed as annual averages and include sawlog plus utility.
[4] This evaluation provides an indication of potential effects; actual effects would depend on the volume that is under contract when the decision is implemented and whether potentially affected existing sales are cancelled or exempted as part of the decision.

Comparison of the Alternatives

This section briefly compares the environmental consequences of the seven alternatives with respect to the key issues described in Chapter 1. This comparison is based on the effects analysis presented in Chapter 3.

Prior to presenting the effects comparison, four tables and a figure are displayed to help the reader compare the differences among the alternatives. Table 2-17 and Figure 2-8 summarize the LUD allocations of the alternatives using LUD Group combinations. The four LUD Groups combine the individual LUDs in terms of similarities in management and/or potential effects as described in the *Introduction* to Chapter 3. The other components that help define each alternative beyond LUD allocations are summarized in Table 2-18.

Table 2-19 displays some of the key indicators or measures that are used to quantitatively compare the alternatives relative to the key issues. In addition, Table 2-20, located at the end of this chapter, represents a "Summary of Effects Matrix." This table allows the reader to compare the effects of the alternatives on essentially all resource areas simultaneously, so that a cumulative picture of the net effects can be obtained. This table presents many quantitative measures, but it uses qualitative comparisons where quantitative measures are not feasible. In this regard, it may be used to help consider the net public benefits associated with each alternative.

Key Issue 1 – Protection of high value roadless areas from road development and timber harvest activity on the Tongass National Forest is of local and national importance, particularly for wildlife and biodiversity, recreation, and tourism.

The Tongass includes very large undeveloped land areas, with several portions of the Forest consisting of contiguous roadless areas that exceed one million acres (and are often many times larger than that) and represent large, unfragmented blocks of wildlife habitat. This scale of roadless lands is not available elsewhere in the National Forest System, except on the Chugach National Forest.

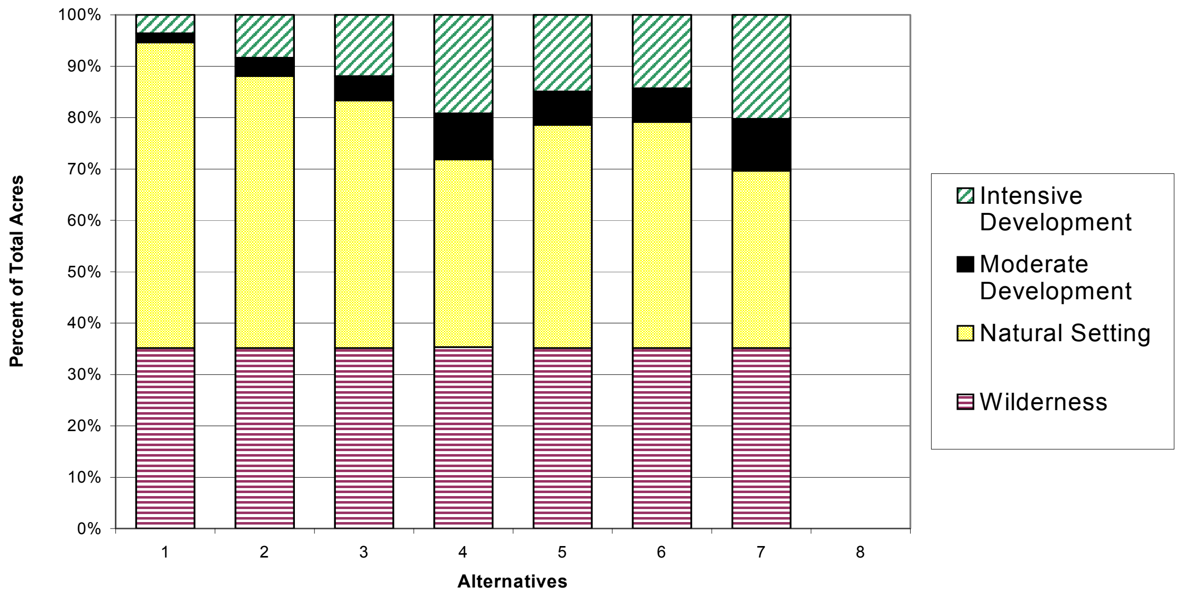
Roadless areas are considered important because of their wildlife habitat and recreation values and their importance for tourism. They are also important because of the passive use values and ecosystem services values they provide. Passive use values represent the value that individuals assign to a resource independent of their use of that resource and typically include existence, option, and bequest values.

Table 2-17
Land Use Designation Group Comparison by Alternative (million acres)[1]

Alternative	Wilderness[2]	Natural Setting	Moderate Development	Intensive Development
1	5.9	10.0	0.3	0.6
2	5.9	8.9	0.6	1.4
3	5.9	8.1	0.8	2.0
4	5.9	6.1	1.5	3.2
5	5.9	7.3	1.1	2.5
6	5.9	7.4	1.1	2.4
7	5.9	5.8	1.7	3.4

[1] LUD Group combinations are described in the *Introduction* to Chapter 3 (Table 3.1-1).
[2] Wilderness LUD group includes 166.942 acres of Nonwilderness National Monument.
Note: Roadless area acreages are correlated with, but not the same as the LUD Group acreages. For example, some roads exist within portions of some Natural Setting LUDs and no roads exist in many areas of development LUDs.

Figure 2-8
Land Use Designation Group Comparison by Alternative (percent)



Direct Effects on Roadless Areas

The Tongass National Forest is about 91 percent roadless, including wilderness. Only small areas where communities are developing, or where road construction and timber harvest have occurred, are "developed" to any noticeable degree. Developed areas and small unroaded areas (not included in inventoried roadless areas) cover about 1.51 million acres, or about 9 percent of the Tongass, wilderness covers about 5.75 million acres, or about 34 percent, and inventoried roadless areas (outside of wilderness) cover about 9.51 million acres, or about 57 percent.

Alternative 1 is designed to avoid inventoried roadless areas. Because of this, after 100 years or more (and full development of these LUD areas) 91 percent of the Tongass and 85 percent of Southeast Alaska (all Alaska lands southeast of Yakutat Bay) would still be in roadless or wilderness.

Alternatives 2 and 3 would progressively enter more roadless areas with 0.8 million acres and 1.7 million acres of development LUDs in roadless areas, respectively. Alternative 2 would ultimately result in 87 percent of the Tongass and 82 percent of Southeast Alaska in roadless or wilderness and Alternative 3 would result in 83 percent and 79 percent.

Next in progression into roadless areas, Alternatives 5 and 6 would include 2.4 and 2.3 million acres of development LUDs in roadless, respectively. Alternative 5 would ultimately result in 80 percent of the Tongass and 76 percent of Southeast Alaska being in roadless or wilderness. These percentages would be 81 and 77 for Alternative 6.

Finally, Alternatives 4 and 7 both enter roadless areas to a higher degree. Alternative 4 would have 3.4 million acres of development LUDs in roadless and Alternative 7 would have 3.7 million. After 100 years or more of implementation, Alternative 4 would result in 76 percent of the Tongass and 73 percent of Southeast Alaska and Alternative 7 would result in 75 percent of the Tongass and 72 percent of Southeast Alaska continuing as roadless or in wilderness.

Distribution of Roadless Areas

Significant acreages of roadless areas would remain in all biogeographic provinces under all alternatives; however, some would maintain a higher percentage than others. Under Alternatives 1 and 2, none of the 21 biogeographic provinces within the Tongass boundary would contain less than 50 percent of their areas in Non-development LUDs. Alternative 1 would have 17 of the 21 provinces containing 90 percent or more acreage in non-development LUDs and Alternative 2 would have 13 provinces.

Table 2-18
Alternative Components

Component	Alternative 1	2	3	4	5	6	7
Alternative Base[1]	2003 – Alt 8	None	2003 – Alt 5	1997 – Alt 6	1997 – Alt 11	1997 – Alt 11	1997 – Alt 2
Old-Growth Reserve Strategy[2]	All, plus refined Small OGRs	All, plus refined Small OGRs	All, plus refined Small OGRs	4 Biogeo. Provinces	All	All, plus refined Small OGRs	None
OG Retention/VCU	None	None	None	33%	None	None	None
Beach & Estuary Fringe Buffer	Beach = 1,000’ Estry.= 1,000’	Beach = 1,000’ Estry.= 1,000’	Beach = 1,000’ Estry.= 1,000’	Beach = 1,000’ Estry.= 1,000’	Beach = 1,000’ Estry.= 1,000’	Beach = 1,000’ Estry.= 1,000’	Beach = 500’ Estry.= 1,000’
Riparian S&Gs	Same as 1997 Forest Plan	Same as 1997 Forest Plan	Same as 1997 Forest Plan	Same as 1997 Forest Plan	Same as 1997 Forest Plan	Same as 1997 Forest Plan	Same as ’97 Plan, but no Class III buffers
1997 Goshawk & Marten S&Gs	No	No	No	No	Yes	No	No
New Forest-wide Legacy S&G	Yes	Yes	Yes	No	No	Yes	No
Goshawk Nest S&Gs	Apply Revised Version	Apply Revised Version	Apply Revised Version	Apply Revised Version	Apply Original Version	Apply Revised Version	Apply General Raptor S&Gs Only
Modified Small Old-Growth Reserve Boundaries	Yes	Yes	Yes	No	No	Yes	No
Experimental Forest Replacement	Yes	Yes	Yes	Yes	No	Yes	Yes
Additional/Modified Geologic Special Interest Areas	Yes	Yes	Yes	Yes	No	Yes	Yes
Other S&G Changes in Proposed Forest Plan	Yes	Yes	Yes	Yes	No	Yes	No

[1] Identifies the previous Forest Plan NEPA document and the specific alternative that the current alternative is largely based on (1997 = the 1997 FEIS; 2003 = 2003 SEIS). However, many changes have been made.
[2] This component refers to the use of the system of old-growth habitat reserves to address wildlife viability. Such a system is in addition to reserves that already exist, such as within Wilderness or Legislated LUD II areas.

Definitions
Reserves:
All = Large, Medium, and Small reserves identified in the current Forest Plan
4 Biogeo. Provinces = N. POW, Kupreanof/Mitkof, Dall Island, NE Chichagof, and individual reserves (Myers Chuck, Lake Eva, Wright Lake).
S&Gs = Standards and Guidelines
VCU = Value Comparison Unit (roughly a watershed)

Table 2-19
Comparison of Alternatives

Resource/Category	Unit of Measure	Alternative 1	2	3	4	5	6	7
Key Issue 1 – Long-term Protection of High-value Roadless Areas								
Inventoried Roadless Areas in development LUDs (acres and percent of all roadless areas)	Millions of Acres	0.0	0.8	1.7	3.4	2.4	2.3	3.7
	Percent	0	9	18	36	26	24	39
Amount of Timber Harvest in current Inventoried Roadless Areas after 100+ years	Thousands of Acres	0	89	186	498	316	307	583
Minimum Percent of Tongass in Inventoried Roadless Areas after 100+ years (assumes 75% of development LUD areas and 0% of non-development LUD areas become roaded)	Percent	57	53	49	41	46	46	40
Percent of Tongass in Wilderness (including Wilderness National Monument)	Percent	34	34	34	34	34	34	34
Percent of Tongass in Wilderness and Inventoried Roadless Areas after 100+ years	Percent	91	87	83	76	80	81	75
Percent of Southeast Alaska in Wilderness and Inventoried Roadless Areas after 100+ years (assumes all non-NFS lands become roaded, except for Glacier Bay NP and 50% of non-NFS lands in the Haines/Skagway area)	Percent	85	82	79	73	76	77	72
Number of the 21 Biogeographic Provinces with Less than 50% of Tongass Lands in Non-development LUDs	Count	0	0	2	5	3	3	5
Key Issue 2—Provision of Sufficient Timber to Meet Market Demand								
Long-Term Effects (Second Decade On)								
Percent Change in Suitable Acres	Percent							
ASQ (average annual)	MMBF	49	151	205	360	267	267	421
NIC I Component of the ASQ	MMBF	49	143	187	314	239	236	370
Ability to Meet the Timber Demand Scenarios in 2022								
Scenario 1—Limited Lumber Industry	Yes/No	No	Yes	Yes	Yes	Yes	Yes	Yes
Scenario 2—Expanded Lumber Industry	Yes/No	No	No	Yes	Yes	Yes	Yes	Yes
Scenario 3—Medium Integrated Industry	Yes/No	No	No	Yes	Yes	Yes	Yes	Yes
Scenario 4—High Integrated Industry	Yes/No	No	No	No	Yes	No	No	Yes
Annual Harvest as a Percent of Processing Capacity								
Active Installed Processing Capacity (261 MMBF)	Percent	9	27	36	60	46	45	71
Total Installed Processing Capacity (361 MMBF)	Percent	7	20	26	43	33	33	51

Table 2-19 (continued)
Comparison of Alternatives

Resource/Category	Unit of Measure	Alternative 1	2	3	4	5	6	7
Key Issue 2—Provision of Sufficient Timber to Meet Market Demand (continued)								
Direct Employment								
Logging	Job-Years	365	583	680	880	803	801	1,098
Sawmills	Job-Years	129	336	428	616	544	542	823
Total	Job-Years	**494**	**919**	**1,108**	**1,496**	**1,346**	**1,343**	**1,922**
Total Net Change from Alternative 5 (No Action)	Percent	-63	-32	-18	11	0	0	43
Direct Income								
Logging	$ million	15.4	24.6	28.7	37.2	33.9	33.8	46.4
Sawmills	$ million	4.1	10.6	13.6	19.5	17.2	17.2	26.1
Total	$ million	**19.5**	**35.3**	**42.3**	**56.7**	**51.1**	**51.0**	**72.5**
Potential Short-Term Effects (2007 to 2009) [1]								
Effect on Timber Volume Under Contract	Percent	High	None	None	None	None	None	None
Effect on NEPA-Cleared Timber Volume	Percent	Low	Low	None	None	None	None	None
Effect on Timber Volume in Preparation	Percent	Low	Very Low	Very Low	None	None	None	None
Key Issue 3 – Protection of Wildlife Habitat and Biodiversity								
Harvest of Productive Old Growth								
Maximum Harvest of Productive Old Growth on NFS Lands after 100+ years	Thousands of Acres	86	215	313	656	463	445	807
Minimum Percent of Original Productive Old Growth Remaining on NFS Lands after 100+ years	Percent	90	88	86	79	83	83	77
Minimum Percent of Original Productive Old Growth Remaining on All Lands in SE Alaska after 100+ years	Percent	82	80	78	73	76	76	71
Road Development								
Maximum New Road Miles Developed on NFS lands after 100+ years (4,942 miles of existing roads)	Miles	774	2,079	2,799	4,890	3,874	3,744	5,825
Percent of WAAs with Total Road Density on NFS Lands greater than 1.0 mile/sq.mile after 100+ years (currently 8% of 188 WAAs)	Percent	11	16	18	23	19	18	25
Number of WAAs with Total Road Density on All Lands (Inside Forest Boundary) greater than 1.0 mile/sq.mile after 100+ years (currently 14% of 191 WAAs)	Percent	20	23	24	28	26	25	31

[1] This evaluation provides an indication of potential effects; actual effects would depend on the volume that is under contract when the decision is implemented and whether potentially affected existing sales are cancelled or exempted as part of the decision.

**Table 2-19 (continued)
Comparison of Alternatives**

Resource/Category	Unit of Measure	Alternative 1	2	3	4	5	6	7
Key Issue 3 – Protection of Wildlife Habitat and Biodiversity (continued)								
Representation of Old Growth Forests								
Number of Biogeographic Provinces with 75% or more of the Original Productive Old Growth Remaining after 100+ years – All Lands in SE Alaska (currently 22 out of 23)*	Count	19	18	16	12	13	13	11
Number of Biogeographic Provinces with less than 50% of the Original Productive Old Growth Remaining after 100+ years – All Lands in SE Alaska (currently 0 out of 23)*	Count	0	0	0	1	0	0	1
Number of Biogeographic Provinces with more than 50% of the Original Large-tree Productive Old Growth Remaining after 100+ years – All Lands in SE Alaska (currently 4 out of 23)	Count	16	16	16	14	16	16	13
Conservation Strategy and Landscape Connectivity								
Landscape connectivity: Number of critical pinch-points with negative effects	Count	0	1	1	3	1	1	4
Abundance and distribution of high quality old-growth forest blocks in OGRs and other Non-development LUDs after 100+ years	Qualitative	Good to Excellent	Good to Excellent	Good to Very Good	Poor to Good	Good to Very Good	Good to Very Good	Poor
Species-Specific Effects								
Goshawks – Likelihood of maintaining viable, well-distributed populations after 100+ years	Rating	Very High	Very High	Very High	Moderately High	High	High	Moderate
Marten – Likelihood of maintaining viable, well-distributed populations after 100+ years	Rating	Very High	High	High	Moderate	Moderate	Moderate	Moderate
Wolf – Likelihood of maintaining viable, well-distributed populations after 100+ years	Rating	Very High	Very High	High	High	High	High	Moderately High
Brown Bear – Likelihood of maintaining viable, well-distributed populations after 100+ years	Rating	Very High	High	High	Moderately High	High	High	Moderately High
Endemic Mammals – Likelihood of maintaining viable, well-distributed populations for all endemics after 100+ years	Rating	Moderate	Moderate	Moderate	Moderately Low	Moderate	Moderate	Very Low
Deer habitat capability on NFS Lands after 100+ years in Terms of Percent of Original (1954) Habitat Capability (88% currently)	Percent	86	84	83	79	81	82	77

* 21 Biogeographic Provinces inside the Forest Boundary plus 2 outside (Chilkat River Complex and Glacier Bay/Fairweather Range)

Alternative 3 would have two biogeographic provinces and Alternatives 5 and 6 would have three provinces with less than 50 percent their acreage in non-development LUDs. The lowest percentage would be for the Etolin Island and Vicinity province with 43 percent under Alternative 3 and for the Kupreanof/Mitkof Island province with 36 percent under Alternative 5 and 39 percent under Alternative 6. Alternative 3 would have 9 of the 21 provinces and Alternative 5 and 6 would have 6 of the 21 provinces with 90 percent or more of their acreage in non-development LUDs.

Alternatives 4 and 7 would each result in five biogeographic provinces with less than 50 percent in non-development LUDs. The lowest percentage would be for the Etolin Island and Vicinity province with 20 percent under Alternative 4 and for the Kupreanof/Mitkof Island province with 18 percent under Alternative 7. Alternatives 4 and 7 would have 6 of the 21 provinces containing 90 percent or more of their acreage in non-development LUDs.

Key Issue 2 – The Tongass National Forest needs to provide a sufficient timber supply to meet the market demand and help maintain a vibrant economy in Southeast Alaska.

Timber from the Tongass National Forest is the main source of raw materials for the region's wood products industry.

Demand may be thought of as the different amounts of a product buyers are willing to purchase at different prices. Demand is not a single number, but instead a series of price-quantity relationships. The same is true of supply. It is the combination of supply and demand that determines the quantity and price of goods produced and consumed.

Accurately projecting future demand is difficult. Market demand for Southeast Alaska timber and wood products depends upon numerous difficult to predict factors, including changes in technology, growth and exchange rates in key markets, changes in consumer tastes and preferences, as well as developments in other producing regions whose products compete with those of Alaska.

The average timber sale on the Tongass includes spruce, hemlock, and cedar and results in a variety of log grades and species. In most forested conditions, the tree species, tree sizes and tree quality are all mixed together. When a timber sale is purchased by a sawmill owner, they are usually required to purchase all of the volume in that sale regardless of the composition. At present, none of the purchasers are set up to efficiently process all grade and species from such sales, nor is the local industry set up to process all of the components of the timber sales. In the absence of a facility to use utility and lower grade logs, a timber sale must be sustained solely on the profits made from the higher grade sawlogs, even though the operator must harvest and pay for the lower grade logs.

It should be noted that the Alaska Regional Forester (Region 10) signed a new policy in March 2007 that approved limited interstate shipments of unprocessed Sitka spruce and western hemlock. This policy is expected to increase the utilization of timber harvested on the Tongass and improve overall timber sale economics by providing a market for smaller diameter and low grade material that cannot be processed profitably by sawmills in Southeast Alaska.

The wood products analysis prepared for this EIS is divided into long- and short-term effects. The long-term effects analysis evaluates the alternatives with respect to a) the projections developed by the Pacific Northwest Research Station of the Forest Service, and b) current production levels, installed capacity, and the minimum volumes required by various processing facilities. These benchmarks are used to evaluate the long-term effects of the alternatives. Long-term effects are assessed based on the ASQ projected under each alternative.

The short-term effects analysis discusses three key components of the "timber pipeline": volume under contract, NEPA-cleared volume (i.e., sales that have approved NEPA documents but have not yet been sold), and timber volume in preparation (i.e., proposed sales that are currently being evaluated under the NEPA process).

Long-Term Effects

PNW Projections. The Forest Service commissioned the Pacific Northwest Research Station to determine the maximum amount of timber product volume that could be sold over time (planning cycle market demand) and to develop a series of demand estimates as the industry grew to meet this output level. This resulted in a "derived demand" analysis that projected various demand figures for four scenarios based upon differing assumptions about future markets and future processing facilities in Southeast Alaska (Brackley et al. 2006). These future visions of the Southeast Alaska wood products industry are hypothetical and presented here to illustrate the type of developments that might take place in cases where different volumes are made available for harvest. The transition from one scenario to the next involves new private investment and market development. A key factor in attracting new investment is whether or not a supply of timber "shelf volume" is available for purchase.

Alternatives 1 through 4 were designed to correspond with Scenarios 1 through 4, respectively, while also responding to other concerns. The discrepancy between the second decade ASQs for Alternatives 1 and 2 and projected demand for 2022 under Scenarios 1 and 2 reflects these other concerns. These scenarios are briefly summarized in the following paragraphs, along with the ability of the alternatives to meet each scenario in 2022.

Scenario 1 – Limited Lumber Production. This scenario approximates the status of the timber industry in Southeast Alaska at the time that the Brackley et al. study was completed. Total derived demand is projected to be 68 MMBF in 2022 under this scenario. It is likely that this volume would be primarily logs from more economical (NIC I) lands.

Alternative 1, with a projected total output of 49 MMBF, could not provide sufficient volume to meet this scenario as currently modeled.

Alternatives 2, 3, 4, 5, 6, and 7 could all provide sufficient volume to meet this scenario in 2022.

Scenario 2 – Expanded Lumber Production. This scenario also projects that only higher value logs are processed, with limited new investments in the existing mills in Southeast Alaska. Total derived demand is projected to be 187 MMBF in 2022 under this scenario. As in Scenario 1, it is likely that this volume would be primarily higher value logs from the more economical (NIC I) lands.

Alternatives 1 and 2, with projected total outputs of 49 MMBF and 151 MMBF, respectively, could not provide sufficient volume to meet this scenario.

Alternatives 3, 4, 5, 6, and 7 could all provide sufficient volume to meet this scenario.

Scenario 3 – Medium Integrated Industry. This scenario builds on Scenario 2 and would establish processing capacity to fully utilize sawlogs and low grade and utility logs from federal and state timber sales. Under this scenario the current sawlog milling capacity would operate efficiently and new processing capacity would be developed to utilize the material that has formerly been left in the woods or exported. Total derived demand is projected to be 204 MMBF in 2022 under this scenario.

> Alternatives 1 and 2 with projected total outputs of 49 MMBF and 151 MMBF, respectively, could not provide sufficient volume to meet this scenario.
>
> Alternatives 3, 4, 5, 6, and 7 could provide sufficient volume to meet this scenario.

Scenario 4 – High Integrated Industry. This scenario builds on Scenario 3 and provides an estimate of the upper market level for the foreseeable future. In order for this situation to be realized, new investments in processing capacity would need to be made and additional market shares established. Total derived demand is projected to be 342 MMBF in 2022 under this scenario.

> Alternatives 1, 2, 3, 5 and 6 with projected total outputs of 49 MMBF, 151 MMBF, 205 MMBF, 267 MMBF, and 267 MMBF respectively, could not provide sufficient volume to meet this scenario.
>
> Alternatives 4 and 7 could provide sufficient volume to meet this scenario.

The ability of the seven alternatives to supply enough timber to satisfy the projected demand for timber under each scenario is summarized in Table S-1.

Current Production Levels, Installed Capacity, and Minimum Volumes Required by Various Processing Facilities. The existing mills in Southeast Alaska had an estimated active installed processing capacity of 261 MMBF in 2006 and a total processing capacity of 361 MMBF. The estimated NIC I components of the harvest volumes projected under each alternative range from 9 percent of the active installed processing capacity under Alternative 1 to 71 percent under Alternative 7. The NIC I volume projected under Alternative 5 (No Action) represents about 46 percent of the existing active processing capacity. The projected NIC I components represent smaller shares of the total installed capacity, ranging from 7 percent under Alternative 1 to 51 percent under Alternative 7.

Two of the future demand scenarios evaluated by Brackley et al. (2006a) involve an integrated industry. These scenarios are based on the assumption that as stable volumes get higher, the industry will develop in an integrated fashion, with operations and production that utilize materials that are inefficient or excess to one another's production. The potential components of an integrated industry could include sawmills, a veneer plant, and a medium density fiberboard (MDF) or bioenergy facility, among others. The different facilities would process different types of log. Sawmills would generally process higher quality material (high grade sawlogs), with the other types of facility processing lower quality material (low grade sawlogs and utility logs).

Based on the projected harvest volumes, only Alternatives 4 and 7 would provide sufficient volume to support an integrated industry that consisted of the existing sawmills, a veneer plant, and an MDF or Bioenergy facility. Under Alternative 5 (No Action), there would be sufficient volume to support the existing sawmills. There would also be sufficient volume to support one or more veneer plants or an MDF or other chip-related operation, but not both.

A number of timber projections were reviewed as part of this analysis. Based on this review, the Forest Service identified a potential upper planning cycle demand of

360 MMBF from all sources. Only Alternative 7 includes sufficient volume to meet this level of demand only from NFS acres.

Direct Employment and Income. Direct sawmill and logging employment estimates are presented in job-years, which represent the equivalent of one year's employment. This potential employment would not necessarily occur all in one year and estimated job totals do not directly translate into estimated numbers of affected workers. These estimates assume a linear relationship between harvest and employment levels, with a one percent change in harvest resulting in a one percent change in employment. In reality, changes in volume will have a lagged response in employment, but the assumed linear relationship is an approximation that can be used to compare alternatives.

Based on projected harvest volumes, average annual direct wood products employment would range from 494 annualized jobs under Alternative 1 to 1,922 jobs under Alternative 7. Approximately 274 of these annualized jobs would be associated with non-Tongass harvest under each alternative. Viewed in relation to Alternative 5 (No Action), projected direct employment would range from a 63 percent decrease under Alternative 1 to an increase of approximately 43 percent under Alternative 7.

Projected annual direct income, which is calculated based on the projected number of jobs, would range from $19.5 million under Alternative 1 to $72.5 million under Alternative 7. These totals also include income that would be generated by non-Tongass harvest.

Short-Term Effects

The following discussion provides an indication of potential short-term effects. Actual effects would depend on the volumes in each pool when the decision is implemented. In the case of the volume under contract, potential impacts would also depend on whether potentially affected sales were cancelled or exempted as part of the decision.

Volume under Contract. Alternative 1 would maintain the majority of the Inventoried Roadless Areas on the Tongass in a natural condition and would not allow timber harvest in those areas. Alternative 1 would affect 52 percent (54 MMBF) of the volume under contract as of August 2006 (104 MMBF). The volume currently under contract would not be affected by any of the other alternatives.

NEPA-Cleared Volume. Alternative 1 would affect 56 percent (255 MMBF) of the current NEPA-cleared volume as of August 2006 (454 MMBF). It should be noted that not all this volume is considered economic under current market conditions. Alternative 2 would affect 44 percent or 198 MMBF of this volume, which represents the volume that has passed through the NEPA process and is scheduled to be available for sale in the near future. None of the other alternatives would affect this volume.

Timber Volume in Preparation. Alternative 1 would affect 56 percent (298 MMBF) of the timber volume in preparation as of September 2006 (536 MMBF). Alternatives 2 and 3 would each affect approximately 7 percent or 40 MMBF of this volume. Alternatives 4, 5, 6, and 7 would not affect this volume.

Key Issue 3 – Protection of the wildlife habitat and biodiversity of the Tongass National Forest is of local and national significance and is affected by road development and timber harvest activities.

The Tongass National Forest supports a unique and important assemblage of wildlife including the largest population of brown bears and breeding bald eagles in the world, species of high importance for subsistence (e.g., Sitka black-tailed deer), an extensive array of endemic mammals and other species, and a large number of species that are at least partially dependent on old-growth habitats (e.g., marten and goshawk). Populations of many of these species and the biodiversity of Southeast Alaska are affected by timber harvest and the development of roads.

Old-Growth Harvest

The amount of harvest of POG is a key indicator of effects on many species, including goshawks, marten, endemic mammals, and deer (to some degree). The range of old-growth harvest is broad among the alternatives. Alternative 1 has the lowest maximum harvest of POG at 86,000 acres, while Alternative 7 has the highest maximum at 807,000 acres. After 100 years or so, a minimum of 90 percent of all POG on NFS lands would remain under Alternative 1 and 77 percent would remain under Alternative 7. Percentages for all of Southeast Alaska, including non-NFS lands, would be 82 percent for Alternative 1 and 71 percent for Alternative 7. The other five alternatives would rank between Alternatives 1 and 7; their order from lowest to highest harvest would have Alternative 2 at the low end progressing to Alternative 3, then 6, then 5, and then 4.

Road Development

The Tongass currently has 4,941 miles of existing roads (including closed and non-system roads). This total includes 2,619 miles of open roads, plus 913 miles of closed roads that are in storage and 1,409 miles of non-system roads. Road construction can negatively affect wildlife by eliminating habitats and by permitting increased access, which can result in increased harvests and human-large predator interactions.

Under Alternative 1, an estimated maximum of 774 new road miles would be developed over 100 years. For Alternatives 2 and 3 the estimated maximum new road construction would be 2,079 and 2,799 miles, respectively. The majority of these road miles would be closed after harvest activities are completed, and reopened at the next entry. The maximum road miles to be constructed under Alternatives 5 and 6 would be 3,874 and 3,744, respectively. Alternative 4 would construct a maximum of 4,890 miles of new road and Alternative 7 would construct a maximum of 5,825 miles of new road.

A better indicator of road effects on wildlife is the road density within Wildlife Analysis Areas (WAA). On Tongass NFS lands, 8 percent of the WAAs that make up the Tongass have a road density greater than 1.0 mile per square mile under existing conditions. Road density would increase in many areas after full implementation of the alternatives. Under Alternative 1, the density would increase so that a maximum of 11 percent of the WAAs would have a density greater than 1.0 mile per square mile. Alternatives 2, 3, and 6 would have a maximum of 16 tp 18 percent, Alternative 5 would have a maximum of 19 percent, and Alternatives 4 and 7 would have 23 to 25 percent. These percentages would increase further when cumulative road development, including future road development on non-NFS lands, is considered. The percentage of WAAs with road density on all lands (including non-NFS lands) greater than 1.0 mile per square mile would be 20 percent for

Alternative 1, 23 to 26 percent for Alternatives 2, 3, 5, and 6, and 28 to 31 percent for Alternatives 4 and 7.

Representation of Old-Growth Forests

The percentage of POG remaining in each biogeographic province and in each ecological subsection is an indication of the degree to which all potentially valuable ecological communities remain fully represented.

After 100 years of Alternative 1 implementation, 19 of the 23 biogeographic provinces covering Southeast Alaska would have 75 percent or more of their POG remaining and none would have less than 50 percent (minimum value = 55 percent). For large-tree POG, 16 out of 23 provinces would have at least 50 percent of the original amount remaining (minimum value = 32%).

At the other end of the spectrum, after 100 years of implementation of Alternatives 4 or 7, 11 to 12 of the 23 biogeographic provinces would have 75 percent or more of their POG remaining and one would have less than 50 percent (minimum value = 44 percent for Alternative 7). Considering large-tree POG, 13 to 14 of the provinces would have at least 50 percent of the original amount remaining (minimum value = 29 percent under Alternative 7).

The other four alternatives (Alternatives 2, 3, 5, and 6) would all have values within these ranges; they would have 13 to 18 of the 23 biogeographic provinces covering Southeast Alaska with 75 percent or more of their POG remaining. None of these alternatives would have any biogeographic provinces with less than 50 percent of their POG. Each of them would also have 16 out of 23 provinces with least 50 percent of the original large-tree POG remaining (minimum value = 31%).

Conservation Strategy and Landscape Connectivity

An adequate amount and distribution of high quality old-growth blocks with good landscape connectivity is fundamental to the “coarse filter” aspect of the Old-Growth Forest Conservation Strategy and is important for the maintenance of viable, well-distributed populations of many species of wildlife. Because of the spacing of old-growth reserves and other non-development LUDs, Alternatives 1 and 2 would result in a good to excellent distribution of high quality old-growth blocks over the long term, and would have little to no effects on landscape “pinch-points.” Alternatives 3, 5, and 6 would have good to very good spacing of old-growth reserves and other non-development LUDs and would similarly effect only one “pinch-point.”

Under Alternative 4, the long-term result would be a good distribution of high quality old-growth blocks in the four biogeographic provinces with old-growth reserves, but a poor to fair distribution in the other provinces over the long term. The old-growth retention requirement would mitigate this to some degree, but would not necessarily result in blocks or large patches of POG being retained. This alternative would also negatively affect three critical landscape “pinch-points.”

Alternative 7 would result in a poor distribution of high quality old-growth blocks over the long term throughout most of the Tongass because of the lack of old-growth reserves, the lack of an old-growth retention requirement, and the high acreage of development LUDs. It would negatively affect four critical landscape “pinch-points” and result in a lower degree of landscape connectivity due to narrower beach buffers.

Species-Specific Effects

Expert panel viability assessments were conducted for key species to rate the alternatives considered in the 1997 Forest Plan Revision EIS. These ratings were transferred to the alternatives in this EIS, based on the four alternatives that are similar between EISs (i.e., 1997-Alternative 6 is similar to 2007-Alternative 4, 1997-Alternative 11 is similar to 2007-Alternatives 5 and 6, and 1997-Alternative 2 is similar to 2007-Alternative 7), and based on harvest acreage similarities. The ratings were also transferred into a relative qualitative description of the likelihood of maintaining viable, well-distributed populations so that the alternatives could more easily be compared.

Under Alternative 1, the likelihood of maintaining viable, well-distributed populations on the Tongass after 100 years is estimated to be very high for the goshawk, marten, wolf, and brown bear, and moderate for endemic mammals. Alternative 2 would rate almost as high. Under Alternative 3, this likelihood is estimated to be very high for the goshawk; high for the marten, wolf, and brown bear; and moderate for endemic mammals.

Alternatives 5 and 6 would have similar ratings. The likelihood of maintaining viable, well-distributed populations on the Tongass after 100 years is estimated to be high for the goshawk, wolf and brown bear; and moderate for the marten and endemic mammals.

Alternatives 4 and 7 rate the lowest among the alternatives. For Alternative 4, the likelihood of maintaining viable, well distributed populations on the Tongass after 100 years is estimated to be high for the wolf; moderately high for the goshawk and brown bear; moderate for the marten; and moderately low for endemic mammals. For Alternative 7, the likelihood is estimated to be moderately high for the wolf and brown bear; moderate for the goshawk and marten; and very low for endemic mammals.

Deer habitat capability expressed in terms of percent of 1954 values can be used to identify the amount of habitat change over time (current habitat capability = 88 percent of 1954 value, based on the deer model). After 100 years of Forest Plan implementation, the percentage for Alternative 1 could drop as low as 86 percent, 84 percent under Alternative 2, 83 percent under Alternative 3, 82 percent under Alternative 6, 81 percent under Alternative 5, 79 percent under Alternative 4, and 77 percent under Alternative 7. These percentages could be increased somewhat with more intensive management of young-growth forests.

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Table 2-20
Summary of Effects Matrix

Value/Resource	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6	Alternative 7
PHYSICAL AND BIOLOGICAL ENVIRONMENT							
Karst							
Karst Resources: Forest Plan S&Gs fully protect high vulnerability karst lands and other karst areas also have S&Gs for protection. However, some effects may occur as a result of timber harvest and road construction. The relative effects on karst resources are proportional to the amount of karst lands in the mapped suitable forest land base.	Maximum harvest after 100+ years on karst lands is 12,000 acres of old growth and 17,000 acres of young growth. Implementation of S&Gs and site-specific mitigation measures will mitigate potential effects.	Maximum harvest after 100+ years on karst lands is 18,000 acres of old growth and 43,000 acres of young growth. Implementation of S&Gs and site-specific mitigation measures will mitigate potential effects.	Maximum harvest after 100+ years on karst lands is 20,000 acres of old growth and 46,000 acres of young growth. Implementation of S&Gs and site-specific mitigation measures will mitigate potential effects.	Maximum harvest after 100+ years on karst lands is 33,000 acres of old growth and 53,000 acres of young growth. Implementation of S&Gs and site-specific mitigation measures will mitigate potential effects.	Maximum harvest after 100+ years on karst lands is 25,000 acres of old growth and 52,000 acres of young growth. Implementation of S&Gs and site-specific mitigation measures will mitigate potential effects.	Maximum harvest after 100+ years on karst lands is 23,000 acres of old growth and 50,000 acres of young growth. Implementation of S&Gs and site-specific mitigation measures will mitigate potential effects.	Maximum harvest after 100+ years on karst lands is 44,000 acres of old growth and 59,000 acres of young growth. Implementation of S&Gs and site-specific mitigation measures will mitigate potential effects.
Soils							
Soil Productivity, Erosion, and Mass Wasting: Changes in soil productivity are proportional to the extent of road development, with road development removing land from productive status. Soil erosion and mass wasting potential is also proportional to the extent of road development, as well as the amount of harvest on steep slopes.	Cumulative acres covered by road surfaces on NFS lands are estimated to increase by a maximum of 2,300 after 100 yrs. Amount of additional harvest on slopes ≥ 67% would be a maximum of 2,400 acres after 100 yrs.	Cumulative acres covered by road surfaces on NFS lands are estimated to increase by a maximum of 6,200 after 100 yrs. Amount of additional harvest on slopes ≥ 67% would be a maximum of 8,200 acres after 100 yrs.	Cumulative acres covered by road surfaces on NFS lands are estimated to increase by a maximum of 8,400 after 100 yrs. Amount of additional harvest on slopes ≥ 67% would be a maximum of 12,400 acres after 100 yrs.	Cumulative acres covered by road surfaces on NFS lands are estimated to increase by a maximum of 14,700 after 100 yrs. Amount of additional harvest on slopes ≥ 67% would be a maximum of 21,600 acres after 100 yrs.	Cumulative acres covered by road surfaces on NFS lands are estimated to increase by a maximum of 11,600 after 100 yrs. Amount of additional harvest on slopes ≥ 67% would be a maximum of 17,400 acres after 100 yrs.	Cumulative acres covered by road surfaces on NFS lands are estimated to increase by a maximum of 11,200 after 100 yrs. Amount of additional harvest on slopes ≥ 67% would be a maximum of 16,600 acres after 100 yrs.	Cumulative acres covered by road surfaces on NFS lands are estimated to increase by a maximum of 17,500 after 100 yrs. Amount of additional harvest on slopes ≥ 67% would be a maximum of 30,000 acres after 100 yrs.
Water and Wetlands							
Stream Flows: Effects on stream flows are expected to vary by watershed and are difficult to predict, but are expected to be small. Any effects that do occur are expected to be proportional to the extent of road development and harvest.	See cumulative acres covered by road surfaces under Soils, road development under Fish, and old-growth forest harvest under Biodiversity and Plants.	See cumulative acres covered by road surfaces under Soils, road development under Fish, and old-growth forest harvest under Biodiversity and Plants.	See cumulative acres covered by road surfaces under Soils, road development under Fish, and old-growth forest harvest under Biodiversity and Plants.	See cumulative acres covered by road surfaces under Soils, road development under Fish, and old-growth forest harvest under Biodiversity and Plants.	See cumulative acres covered by road surfaces under Soils, road development under Fish, and old-growth forest harvest under Biodiversity and Plants.	See cumulative acres covered by road surfaces under Soils, road development under Fish, and old-growth forest harvest under Biodiversity and Plants.	See cumulative acres covered by road surfaces under Soils, road development under Fish, and old-growth forest harvest under Biodiversity and Plants.
Wetlands: Effects of timber harvest and road construction are proportional to the extent of road development and harvest.	See cumulative acres covered by road surfaces under Soils, road development under Fish, and old-growth forest harvest under Biodiversity and Plants.	See cumulative acres covered by road surfaces under Soils, road development under Fish, and old-growth forest harvest under Biodiversity and Plants.	See cumulative acres covered by road surfaces under Soils, road development under Fish, and old-growth forest harvest under Biodiversity and Plants.	See cumulative acres covered by road surfaces under Soils, road development under Fish, and old-growth forest harvest under Biodiversity and Plants.	See cumulative acres covered by road surfaces under Soils, road development under Fish, and old-growth forest harvest under Biodiversity and Plants.	See cumulative acres covered by road surfaces under Soils, road development under Fish, and old-growth forest harvest under Biodiversity and Plants.	See cumulative acres covered by road surfaces under Soils, road development under Fish, and old-growth forest harvest under Biodiversity and Plants.
Public Water Supplies: The supply and quality of water produced by municipal watersheds.	No change in municipal watershed LUD.	No change in municipal watershed LUD.	No change in municipal watershed LUD.	No change in municipal watershed LUD.	No change in municipal watershed LUD.	No change in municipal watershed LUD.	No change in municipal watershed LUD.
Fish							
Fish Passage: Effects of road-stream crossings on fish passage are proportional to the length of roads constructed. However, Forest Plan S&Gs and monitoring are expected to reduce this impact to low levels for all alternatives over the long term.	Cumulative road development on NFS lands is expected to increase by a maximum of 774 miles after 100 yrs. This represents a 16% increase over existing conditions.	Cumulative road development on NFS lands is expected to increase by a maximum of 2,079 miles after 100 yrs. This represents a 42% increase over existing conditions.	Cumulative road development on NFS lands is expected to increase by a maximum of 2,799 miles after 100 yrs. This represents a 57% increase over existing conditions.	Cumulative road development on NFS lands is expected to increase by a maximum of 4,890 miles after 100 yrs. This represents a 99% increase over existing conditions.	Cumulative road development on NFS lands is expected to increase by a maximum of 3,874 miles after 100 yrs. This represents a 78% increase over existing conditions.	Cumulative road development on NFS lands is expected to increase by a maximum of 3,744 miles after 100 yrs. This represents a 76% increase over existing conditions.	Cumulative road development on NFS lands is expected to increase by a maximum of 5,825 miles after 100 yrs. This represents a 118% increase over existing conditions.
Fish Habitat: Effects on fish habitat can be measured by the amount of road development, road density, and timber harvest activity. However, Forest Plan S&Gs associated with riparian areas, wetlands, beach and estuary fringe, etc., are expected to reduce these effects to nonsignificant levels.	After 100 yrs, average road density would be a maximum of 0.22 mi/sq mi with 96% of VCUs having a density < 2 mi/sq mi. on NFS lands. Cumulative average road density on NFS and non-NFS lands combined would be a maximum of 0.42 mi/sq mi with 90% of VCUs having a density < 2 mi/sq mi. Also see road development under Fish Passage and harvest acres under Biodiversity.	After 100 yrs, average road density would be a maximum of 0.27 mi/sq mi with 94% of VCUs having a density < 2 mi/sq mi. on NFS lands. Cumulative average road density on NFS and non-NFS lands combined would be a maximum of 0.47 mi/sq mi with 88% of VCUs having a density < 2 mi/sq mi. Also see road development under Fish Passage and harvest acres under Biodiversity.	After 100 yrs, average road density would be a maximum of 0.30 mi/sq mi with 93% of VCUs having a density < 2 mi/sq mi. on NFS lands. Cumulative average road density on NFS and non-NFS lands combined would be a maximum of 0.49 mi/sq mi with 88% of VCUs having a density < 2 mi/sq mi. Also see road development under Fish Passage and harvest acres under Biodiversity.	After 100 yrs, average road density would be a maximum of 0.38 mi/sq mi with 92% of VCUs having a density < 2 mi/sq mi. on NFS lands. Cumulative average road density on NFS and non-NFS lands combined would be a maximum of 0.57 mi/sq mi with 86% of VCUs having a density < 2 mi/sq mi. Also see road development under Fish Passage and harvest acres under Biodiversity.	After 100 yrs, average road density would be a maximum of 0.34 mi/sq mi with 92% of VCUs having a density < 2 mi/sq mi. on NFS lands. Cumulative average road density on NFS and non-NFS lands combined would be a maximum of 0.53 mi/sq mi with 87% of VCUs having a density < 2 mi/sq mi. Also see road development under Fish Passage and harvest acres under Biodiversity.	After 100 yrs, average road density would be a maximum of 0.33 mi/sq mi with 93% of VCUs having a density < 2 mi/sq mi. on NFS lands. Cumulative average road density on NFS and non-NFS lands combined would be a maximum of 0.52 mi/sq mi with 87% of VCUs having a density < 2 mi/sq mi. Also see road development under Fish Passage and harvest acres under Biodiversity.	After 100 yrs, average road density would be a maximum of 0.41 mi/sq mi with 90% of VCUs having a density < 2 mi/sq mi. on NFS lands. Cumulative average road density on NFS and non-NFS lands combined would be a maximum of 0.60 mi/sq mi with 84% of VCUs having a density < 2 mi/sq mi. Also see road development under Fish Passage and harvest acres under Biodiversity.
Biodiversity and Plants							
Old-Growth Forest Harvest: Because of the importance of old-growth forests to the biodiversity of Southeast Alaska and because it is the habitat that is affected the most on both NFS and non-NFS lands, a measure of effects on biodiversity and plants is the maximum amount of productive old growth (POG) harvest.	A maximum of 86,000 acres of POG would be harvested on NFS lands after 100 yrs. Assuming all of these acres were harvested, approximately 90% of original POG on NFS lands and 82% of original POG on all lands in SE Alaska would remain (past and future harvest on non-NFS lands is included).	A maximum of 215,000 acres of POG would be harvested on NFS lands after 100 yrs. Assuming all of these acres were harvested, approximately 88% of original POG on NFS lands and 80% of original POG on all lands in SE Alaska would remain (past and future harvest on non-NFS lands is included).	A maximum of 313,000 acres of POG would be harvested on NFS lands after 100 yrs. Assuming all of these acres were harvested, approximately 86% of original POG on NFS lands and 78% of original POG on all lands in SE Alaska would remain (past and future harvest on non-NFS lands is included).	A maximum of 656,000 acres of POG would be harvested on NFS lands after 100 yrs. Assuming all of these acres were harvested, approximately 79% of original POG on NFS lands and 73% of original POG on all lands in SE Alaska would remain (past and future harvest on non-NFS lands is included).	A maximum of 463,000 acres of POG would be harvested on NFS lands after 100 yrs. Assuming all of these acres were harvested, approximately 83% of original POG on NFS lands and 76% of original POG on all lands in SE Alaska would remain (past and future harvest on non-NFS lands is included).	A maximum of 445,000 acres of POG would be harvested on NFS lands after 100 yrs. Assuming all of these acres were harvested, approximately 83% of original POG on NFS lands and 76% of original POG on all lands in SE Alaska would remain (past and future harvest on non-NFS lands is included).	A maximum of 807,000 acres of POG would be harvested on NFS lands after 100 yrs. Assuming all of these acres were harvested, approximately 77% of original POG on NFS lands and 71% of original POG on all lands in SE Alaska would remain (past and future harvest on non-NFS lands is included).
Old-Growth Distribution and Representation: The percentage of POG and large-tree POG remaining in each biogeographic province for all of Southeast Alaska (including non-NFS lands) is an indication of the degree to which all potentially valuable ecological communities remain fully represented.	After 100 yrs, 19 of the 23 biogeographic provinces would have 75% or more of their POG remaining and none would have less than 50% (minimum value = 55%). For large-tree POG, 16 of the 23 would have at least 50% remaining and none would have less than 30% (minimum value = 32%).	After 100 yrs, 18 of the 23 biogeographic provinces would have 75% or more of their POG remaining and none would have less than 50% (minimum value = 54%). For large-tree POG, 16 of the 23 would have at least 50% remaining and none would have less than 30% (minimum value = 32%).	After 100 yrs, 16 of the 23 biogeographic provinces would have 75% or more of their POG remaining and none would have less than 50% (minimum value = 52%). For large-tree POG, 16 of the 23 would have at least 50% remaining and none would have less than 30% (minimum value = 32%).	After 100 yrs, 12 of the 23 biogeographic provinces would have 75% or more of their POG remaining and 1 would have less than 50% (minimum value = 49%). For large-tree POG, 14 of the 23 would have at least 50% remaining and none would have less than 30% (minimum value = 31%).	After 100 yrs, 13 of the 23 biogeographic provinces would have 75% or more of their POG remaining and none would have less than 50% (minimum value = 51%). For large-tree POG, 16 of the 23 would have at least 50% remaining and none would have less than 30% (minimum value = 31%).	After 100 yrs, 13 of the 23 biogeographic provinces would have 75% or more of their POG remaining and none would have less than 50% (minimum value = 51%). For large-tree POG, 16 of the 23 would have at least 50% remaining and none would have less than 30% (minimum value = 31%).	After 100 yrs, 11 of the 23 biogeographic provinces would have 75% or more of their POG remaining and 1 would have less than 50% (minimum value = 44%). For large-tree POG, 13 of the 23 would have at least 50% remaining and 1 would have less than 30% (minimum value = 29%).
Wildlife							
Conservation Strategy and Landscape Connectivity: An adequate amount and distribution of high quality old-growth blocks with good landscape connectivity is fundamental to the "coarse filter" aspect of the Old-Growth Forest Conservation Strategy and is important for the maintenance of viable, well-distributed populations of many species of wildlife	This alternative would result in a good to excellent distribution of high quality old-growth blocks over the long term, and would not have a major effect on landscape "pinch-points." In addition to more non-development LUDs, it would improve the protection of high quality old growth due to refinements in small old-growth reserve boundaries, relative to Alternative 5.	This alternative would result in a good to excellent distribution of high quality old-growth blocks over the long term, and would have some effect on one critical landscape "pinch-point." In addition to more non-development LUDs, it would improve the protection of high quality old growth due to refinements in small old-growth reserve boundaries, relative to Alternative 5.	This alternative would result in a good to very good distribution of high quality old-growth blocks over the long term, and would have some effect on one critical landscape "pinch-point." In addition to more non-development LUDs, it would improve the protection of high quality old growth due to refinements in small old-growth reserve boundaries, relative to Alternative 5.	This alternative would result in a good distribution of high quality old-growth blocks in the four biogeographic provinces with old-growth reserves, but a poor to fair distribution in the other provinces over the long term. It would negatively affect three critical landscape "pinch-points."	This alternative would result in a good to very good distribution of high quality old-growth blocks over the long term, and would have some effect on one critical landscape "pinch-point" on Prince of Wales Island.	This alternative would result in a good to very good distribution of high quality old-growth blocks over the long term, with improvements over Alternative 5 due to refinements in the small old-growth reserve boundaries. It would have some effect on one critical landscape "pinch-point" on Prince of Wales Island.	This alternative would result in a poor distribution of high quality old-growth blocks over the long term because of the lack of old-growth reserves, the lack of an old-growth retention requirement, and the high acreage of development LUDs. It would negatively affect 4 critical landscape "pinch-points" and result in a lower degree of landscape connectivity due to narrower beach buffers.
Key Species Distribution and Viability: Expert panel viability assessments were made for key species to rate the alternatives considered in the 1997 Forest Plan Revision EIS. These ratings can be transferred to the alternatives in this EIS, based on the four alternatives that are similar between EISs and harvest acreage similarities.	The likelihood of maintaining viable, well distributed populations on the Tongass after 100 years is estimated to be very high for the goshawk, marten, wolf, and brown bear, and moderate for endemic mammals.	The likelihood of maintaining viable, well distributed populations on the Tongass after 100 years is estimated to be very high for the goshawk and wolf; high for the marten and brown bear; and moderate for endemic mammals.	The likelihood of maintaining viable, well distributed populations on the Tongass after 100 years is estimated to be very high for the goshawk; high for the marten, wolf, and brown bear; and moderate for endemic mammals.	The likelihood of maintaining viable, well distributed populations on the Tongass after 100 years is estimated to be high for the wolf; moderately high for the goshawk and brown bear; moderate for the marten; and moderately low for endemic mammals.	The likelihood of maintaining viable, well distributed populations on the Tongass after 100 years is estimated to be high for the goshawk, wolf, and brown bear; and moderate for the marten and endemic mammals.	The likelihood of maintaining viable, well distributed populations on the Tongass after 100 years is estimated to be high for the goshawk, wolf, and brown bear; and moderate for the marten and endemic mammals.	The likelihood of maintaining viable, well distributed populations on the Tongass after 100 years is estimated to be moderately high for the wolf and brown bear; moderate for the goshawk and marten; and very low for endemic mammals.
Deer Habitat: Deer habitat capability expressed in terms of percent of 1954 values can be used to identify the amount of habitat change over time (current habitat capability = 88% of 1954 value, based on the deer model).	After 100 years, deer habitat capability would be a minimum of 86% of 1954 value on NFS lands. This value has the potential to be increased with young-growth management.	After 100 years, deer habitat capability would be a minimum of 84% of 1954 value on NFS lands. This value has the potential to be increased with young-growth management.	After 100 years, deer habitat capability would be a minimum of 83% of 1954 value on NFS lands. This value has the potential to be increased with young-growth management.	After 100 years, deer habitat capability would be a minimum of 79% of 1954 value on NFS lands. This value has the potential to be increased with young-growth management.	After 100 years, deer habitat capability would be a minimum of 81% of 1954 value on NFS lands. This value has the potential to be increased with young-growth management.	After 100 years, deer habitat capability would be a minimum of 82% of 1954 value on NFS lands. This value has the potential to be increased with young-growth management.	After 100 years, deer habitat capability would be a minimum of 77% of 1954 value on NFS lands. This value has the potential to be increased with young-growth management.

Table 2-20 (continued)
Summary of Effects Matrix

Value/Resource	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6	Alternative 7
HUMAN USES AND LAND MANAGEMENT							
Lands and Other Special Land Use Designations							
Lands: No significant environmental consequences from NFS land ownership administration activities under any alternatives. No land ownership adjustments are proposed under any alternatives. Potential changes to areas designated as Experimental Forest and Special Interest Area. No changes to Research Natural Areas; Wild, Scenic, or Recreational Rivers; or Municipal Watershed LUDs.	Forest Service would conduct land administration under the proposed Forest-wide standards and guidelines, which reflect minimal changes from the current (1997) Forest Plan. Recommended replacement of Young Bay Experimental Forest. Proposed designation of 23 new Special Interest Areas, with net increase of 47,000 acres.	Forest Service would conduct land administration under the proposed Forest-wide standards and guidelines, which reflect minimal changes from the current (1997) Forest Plan. Recommended replacement of Young Bay Experimental Forest. Proposed designation of 23 new Special Interest Areas, with net increase of 47,000 acres.	Forest Service would conduct land administration under the proposed Forest-wide standards and guidelines, which reflect minimal changes from the current (1997) Forest Plan. Recommended replacement of Young Bay Experimental Forest. Proposed designation of 23 new Special Interest Areas, with net increase of 47,000 acres.	Forest Service would conduct land administration under the proposed Forest-wide standards and guidelines, which reflect minimal changes from the current (1997) Forest Plan. Recommended replacement of Young Bay Experimental Forest. Proposed designation of 23 new Special Interest Areas, with net increase of 47,000 acres.	Lands would continue to be managed in accordance with the 1997 Forest Plan standards and guidelines under this alternative.	Forest Service would conduct land administration under the proposed Forest-wide standards and guidelines, which reflect minimal changes from the current (1997) Forest Plan. Recommended replacement of Young Bay Experimental Forest. Proposed designation of 23 new Special Interest Areas, with net increase of 47,000 acres.	Forest Service would conduct land administration under the proposed Forest-wide standards and guidelines, which reflect minimal changes from the current (1997) Forest Plan. Recommended replacement of Young Bay Experimental Forest. Proposed designation of 23 new Special Interest Areas, with net increase of 47,000 acres.
Transportation and Utilities							
National Forest Transportation System Roads: The level of projected timber harvest would affect the road system needed to manage the timber land base.	A maximum of 774 miles would be constructed over 100 yrs, resulting in a cumulative total of 5,716 total miles of open and closed roads at the end of this period.	A maximum of 2,079 miles would be constructed over 100 yrs, resulting in a cumulative total of 7,021 total miles of open and closed roads at the end of this period.	A maximum of 2,799 miles would be constructed over 100 yrs, resulting in a cumulative total of 7,741 total miles of open and closed roads at the end of this period.	A maximum of 4,890 miles would be constructed over 100 yrs, resulting in a cumulative total of 9,832 total miles of open and closed roads at the end of this period.	A maximum of 3,874 miles would be constructed over 100 yrs, resulting in a cumulative total of 8,816 total miles of open and closed roads at the end of this period.	A maximum of 3,744 miles would be constructed over 100 yrs, resulting in a cumulative total of 8,686 total miles of open and closed roads at the end of this period.	A maximum of 5,825 miles would be constructed over 100 yrs, resulting in a cumulative total of 10,767 total miles of open and closed roads at the end of this period.
Southeast Alaska Transportation Plan (SATP): The Forest Service signed a Memorandum of Understanding (MOU) with the State of Alaska in 2006 to provide rights-of-way for the road corridors covered by Public Law 109-59. The MOU also grants easements to the Forest Service for marine access points and LTFs listed on Map 92337.	There would be no effect on the SATP under this alternative.	There would be no effect on the SATP under this alternative.	There would be no effect on the SATP under this alternative.	There would be no effect on the SATP under this alternative.	There would be no effect on the SATP under this alternative.	There would be no effect on the SATP under this alternative.	There would be no effect on the SATP under this alternative.
Timber							
Suitable Forest Lands: Forest lands which are biologically capable of producing commercial wood products without irreversibly harming resources, have a reasonable assurance of adequate reforestation, and for which there is management direction that timber production is appropriate.	312,000 acres are estimated to be suitable; 144,000 acres of these are scheduled suitable lands.	545,000 acres are estimated to be suitable; 394,000 acres of these are scheduled suitable lands.	661,000 acres are estimated to be suitable; 514,000 acres of these are scheduled suitable lands.	999,000 acres are estimated to be suitable; 892,000 acres of these are scheduled suitable lands.	781,000 acres are estimated to be suitable; 687,000 acres of these are scheduled suitable lands.	774,000 acres are estimated to be suitable; 663,000 acres of these are scheduled suitable lands.	1,174,000 acres are estimated to be suitable; 1,070,000 acres of these are scheduled suitable lands.
Allowable Sale Quantity (ASQ): The ASQ is the maximum quantity of timber that may be scheduled from Suitable Forest lands for a 10-year period expressed as an annual average.	The ASQ for the 1st decade and after would be slightly over 49 MMBF.	The ASQ for the 1st decade and after would be 152 MMBF.	The ASQ for the 1st decade would be 185 MMBF. The ASQ for the 2nd decade and after would be 203 MMBF.	The ASQ for the 1st decade would be 312 MMBF. The ASQ for the 2nd decade and after would be 342 MMBF.	The ASQ for the next decade and after would be 267 MMBF.	The ASQ for the next decade and after would be 267 MMBF.	The ASQ for the next decade and after would be 421 MMBF.
Non-Interchangeable Component (NIC)I: NIC I is the portion of the ASQ that may be harvested using existing logging systems.	NIC I for the 1st and 2nd decades is estimated to be slightly less than 49 MMBF.	NIC I for the 1st and 2nd decades is estimated to be 144 MMBF.	NIC I for the 1st and 2nd decades is estimated to be 168 and 186 MMBF, respectively.	NIC I for the 1st and 2nd decades is estimated to be 270 and 294 MMBF, respectively.	NIC I for the 1st and 2nd decades is estimated to be 240 and 242 MMBF, respectively.	NIC I for the 1st and 2nd decades is estimated to be 237 and 236 MMBF, respectively.	NIC I for the 1st and 2nd decades is estimated to be 365 and 370 MMBF, respectively.
Existing Timber Volume Under Contract: Changing suitable land to non-development LUDs could affect timber sales that have been sold.	There is potential for a high effect on timber volume under contract; but this is dependent on the decision.	There would be no effect on the volume under contract under this alternative.	There would be no effect on the volume under contract under this alternative.	There would be no effect on the volume under contract under this alternative.	There would be no effect on the volume under contract under this alternative.	There would be no effect on the volume under contract under this alternative.	There would be no effect on the volume under contract under this alternative.
Minerals							
Mineral Resources: No modification of Forest Service management of mineral activities specific to any alternative. No change in acreage withdrawn from mineral entry, or lands assigned to Minerals LUD. Distribution of other LUD assignments by alternative could affect costs of mineral exploration, development, production or reclamation activities, which could influence level of future mineral activity,	**Identified Mineral Tracts:**	**Identified Mineral Tracts:**	**Identified Mineral Tracts:**	**Identified Mineral Tracts:**	**Identified Mineral Tracts:**	**Identified Mineral Tracts:**	**Identified Mineral Tracts:**
	Withdrawn: 25%	Withdrawn: 25%	Withdrawn: 25%	Withdrawn: 25%	Withdrawn: 25%	Withdrawn: 25%	Withdrawn: 25%
	Higher Cost Open Areas: 36%	Higher Cost Open Areas: 29%	Higher Cost Open Areas: 26%	Higher Cost Open Areas: 20%	Higher Cost Open Areas: 29%	Higher Cost Open Areas: 25%	Higher Cost Open Areas: 18%
	Undiscovered Mineral Areas:	**Undiscovered Mineral Areas:**	**Undiscovered Mineral Areas:**	**Undiscovered Mineral Areas:**	**Undiscovered Mineral Areas:**	**Undiscovered Mineral Areas:**	**Undiscovered Mineral Areas:**
	Withdrawn: 35%	Withdrawn: 35%	Withdrawn: 35%	Withdrawn: 35%	Withdrawn: 35%	Withdrawn: 35%	Withdrawn: 35%
	Higher Cost Open Areas: 57%	Higher Cost Open Areas: 51%	Higher Cost Open Areas: 45%	Higher Cost Open Areas: 35%	Higher Cost Open Areas: 41%	Higher Cost Open Areas: 41%	Higher Cost Open Areas: 33%
Recreation and Tourism							
Recreation Opportunity Spectrum: Current projections suggest that demand currently exceeds supply for Semi-Primitive Motorized settings in inventoried recreation places. The alternatives affect the supply of different recreation settings over time. The percentages shown here are for 150 years after implementation.	Primitive: 61%	Primitive: 61%	Primitive: 59%	Primitive: 55%	Primitive: 57%	Primitive: 57%	Primitive: 54%
	Semi-Primitive Non-Motorized: 18%	Semi-Primitive Non-Motorized: 16%	Semi-Primitive Non-Motorized: 15%	Semi-Primitive Non-Motorized: 13%	Semi-Primitive Non-Motorized: 14%	Semi-Primitive Non-Motorized: 14%	Semi-Primitive Non-Motorized: 12%
	Semi-Primitive Motorized: 8%	Semi-Primitive Motorized: 8%	Semi-Primitive Motorized: 8%	Semi-Primitive Motorized: 7%	Semi-Primitive Motorized: 8%	Semi-Primitive Motorized: 8%	Semi-Primitive Motorized: 7%
	Roaded Natural: 2%	Roaded Natural: 2%	Roaded Natural: 3%	Roaded Natural: 3%	Roaded Natural: 3%	Roaded Natural: 3%	Roaded Natural: 3%
	Roaded Modified: 10%	Roaded Modified: 13%	Roaded Modified: 16%	Roaded Modified: 23%	Roaded Modified: 19%	Roaded Modified: 18%	Roaded Modified: 23%
Home Range Recreation Places: Home range recreation places are those inventoried recreation places within an approximate 20-mile radius from one or more communities. The alternatives affect the LUD groups that these places would be managed under. The percentages shown here are percent of total home range recreation place acres by alternative.	Wilderness: 22%	Wilderness: 22%	Wilderness: 22%	Wilderness: 22%	Wilderness: 22%	Wilderness: 22%	Wilderness: 22%
	Natural Setting: 67%	Natural Setting: 58%	Natural Setting: 53%	Natural Setting: 37%	Natural Setting: 48%	Natural Setting: 49%	Natural Setting: 33%
	Moderate Development: 5%	Moderate Development: 9%	Moderate Development: 12%	Moderate Development: 19%	Moderate Development: 14%	Moderate Development: 13%	Moderate Development: 21%
	Intensive Development: 6%	Intensive Development: 10%	Intensive Development: 13%	Intensive Development: 21%	Intensive Development: 15%	Intensive Development: 15%	Intensive Development: 23%
Recreation Places Important for Tourism: The alternatives affect the LUD groups that recreation places that are important for tourism would be managed under. The percentages shown here are percent of total home range recreation place acres by alternative.	Wilderness: 46%	Wilderness: 46%	Wilderness: 46%	Wilderness: 46%	Wilderness: 46%	Wilderness: 46%	Wilderness: 46%
	Natural Setting: 51%	Natural Setting: 47%	Natural Setting: 43%	Natural Setting: 34%	Natural Setting: 40%	Natural Setting: 40%	Natural Setting: 33%
	Moderate Development: 2%	Moderate Development: 4%	Moderate Development: 5%	Moderate Development: 10%	Moderate Development: 7%	Moderate Development: 6%	Moderate Development: 11%
	Intensive Development: 1%	Intensive Development: 3%	Intensive Development: 6%	Intensive Development: 10%	Intensive Development: 7%	Intensive Development: 7%	Intensive Development: 10%
Scenery							
Scenic Integrity Objectives (SIOs): SIOs define the degree to which the natural landscape can be altered. Visual priority routes and use areas were used to identify seen and seldom seen areas and to map the appropriate SIO.	Visual priority routes and use areas would be protected. Approximately 62% of the Forest would be managed under the High SIO and 4% under Low and Very Low.	Visual priority routes and use areas would be protected. Approximately 62% of the Forest would be managed under the High SIO and 9% under Low and Very Low.	Visual priority routes and use areas would be protected. Approximately 61% of the Forest would be managed under the High SIO and 14% under the Low and Very Low.	Visual priority routes and use areas would be protected. Approximately 56% of the Forest would be managed under the High SIO and 23% under Low and Very Low.	Visual priority routes and use areas would be protected. Approximately 61% of the Forest would be managed under the High SIO and 18% under Low and Very Low.	Visual priority routes and use areas would be protected. Approximately 60% of the Forest would be managed under the High SIO and 17% under Low and Very Low.	Visual priority routes and use areas would be protected. Approximately 54% of the Forest would be managed under the High SIO and 25% under Low and Very Low.

Table 2-20 (continued)
Summary of Effects Matrix

Value/Resource	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6	Alternative 7
Subsistence							
Abundance and Distribution: The majority of subsistence resources (fish and marine invertebrates) would not be affected. However, analysis suggests that deer habitat capabilities in portions of the Tongass may not be adequate to sustain current/future harvest levels under any of the alternatives. The possibility of a significant restriction in harvest resulting from changes in abundance and distribution is assessed in relation to Alternative 5 (No Action).	The possibility of a significant restriction would be lower relative to Alternative 5 (No Action) because of a 77% reduction in development LUD acreage under this alternative.	The possibility of a significant restriction would be lower relative to Alternative 5 (No Action) because of a 46% reduction in development LUD acreage under this alternative.	The possibility of a significant restriction would be slightly lower relative to Alternative 5 (No Action) because of a 22% reduction in development LUD acreage under this alternative.	The possibility of a significant restriction would be higher relative to Alternative 5 (No Action) because of a 31% increase in development LUD acreage under this alternative.	The possibility of a significant restriction, resulting from a change in abundance or distribution, would be the same under this alternative as under Alternative 11 in the 1997 Forest Plan FEIS.	The possibility of a significant restriction, resulting from a change in abundance or distribution, would be the same under this alternative as under Alternative 11 in the 1997 Forest Plan FEIS.	The possibility of a significant restriction would be higher relative to Alternative 5 (No Action) because of a 40% increase in development LUD acreage under this alternative.
Competition: The subsistence analysis concluded that there could be a significant possibility of a significant restriction of subsistence use through increased competition. The possibility of a significant restriction in harvest resulting from a change in competition is assessed in relation to Alternative 5 (No Action).	The possibility of a significant restriction, resulting from a change in competition, would be lower relative to Alternative 5 (No Action) because of a 80% reduction in proposed new road construction under this alternative.	The possibility of a significant restriction, resulting from a change in competition, would be lower relative to Alternative 5 (No Action) because of a 46% reduction in proposed new road construction under this alternative.	The possibility of a significant restriction, resulting from a change in competition, would be lower relative to Alternative 5 (No Action) because of a 28% reduction in proposed new road construction under this alternative.	The possibility of a significant restriction, resulting from a change in competition, would be higher relative to Alternative 5 (No Action) because of a 26% increase in proposed new road construction under this alternative.	The possibility of a significant restriction, resulting from a change in competition, would be the same under this alternative as under Alternative 11 in the 1997 Forest Plan FEIS.	The possibility of a significant restriction, resulting from a change in competition, would be slightly less under this alternative as under Alternative 11 in the 1997 Forest Plan FEIS.	The possibility of a significant restriction, resulting from a change in competition, would be higher relative to Alternative 5 (No Action) because of a 50% increase in proposed new road construction under this alternative.
Heritage Resources and Sacred Sites							
Heritage Resources and Sacred Sites: Potential for effects on these resources is proportional to the amount of harvest and road construction expected to occur. However, because of inventory and tribal consultation that is required, the risk of effects is relatively low.	See road development under Fish and old-growth forest harvest under Biodiversity and Plants as measures of the amount of disturbance. However, because of required inventory and tribal consultation, the risk of effects is relatively low.	See road development under Fish and old-growth forest harvest under Biodiversity and Plants as measures of the amount of disturbance. However, because of required inventory and tribal consultation, the risk of effects is relatively low.	See road development under Fish and old-growth forest harvest under Biodiversity and Plants as measures of the amount of disturbance. However, because of required inventory and tribal consultation, the risk of effects is relatively low.	See road development under Fish and old-growth forest harvest under Biodiversity and Plants as measures of the amount of disturbance. However, because of required inventory and tribal consultation, the risk of effects is relatively low.	See road development under Fish and old-growth forest harvest under Biodiversity and Plants as measures of the amount of disturbance. However, because of required inventory and tribal consultation, the risk of effects is relatively low.	See road development under Fish and old-growth forest harvest under Biodiversity and Plants as measures of the amount of disturbance. However, because of required inventory and tribal consultation, the risk of effects is relatively low.	See road development under Fish and old-growth forest harvest under Biodiversity and Plants as measures of the amount of disturbance. However, because of required inventory and tribal consultation, the risk of effects is relatively low.
Roadless Areas							
Roadless Areas: Roadless areas within moderate and intensive development LUDs would change from roadless to developed status over time.	No acres (0%) of existing roadless areas would be identified as suitable for harvest. The only acres in development LUDs would be Experimental Forests.	0.8 million acres (9%) of the existing roadless areas would be allocated to moderate and intensive development LUDs. Approximately 89,000 acres (0.9%) would be suitable and scheduled for harvest.	1.7 million acres (18%) of the existing roadless areas would be allocated to moderate and intensive development LUDs. Approximately 186,000 acres (2.0%) would be suitable and scheduled for harvest.	3.4 million acres (36%) of the existing roadless areas would be allocated to moderate and intensive development LUDs. Approximately 498,000 acres (5.2%) would be suitable and scheduled for harvest.	2.4 million acres (26%) of the existing roadless areas would be allocated to moderate and intensive development LUDs. Approximately 316,000 acres (3.3%) would be suitable for harvest.	2.3 million acres (24%) of the existing roadless areas would be allocated to moderate and intensive development LUDs. Approximately 307,000 acres (3.2%) would be suitable for harvest.	3.7 million acres (39%) of the existing roadless areas would be allocated to moderate and intensive development LUDs. Approximately 583,000 acres (6.1%) would be suitable for harvest.
Wilderness							
Wilderness: None of the alternatives involve recommending new areas for wilderness or LUD II designation. Roadless areas within the Tongass National Forest were evaluated for recommendations as potential wilderness in the 2003 Forest Plan SEIS (USDA Forest Service 2003).	Wilderness and LUD II areas would be managed under the updated and edited version of the current Forest Plan presented as the Proposed Land and Resource Management Plan.	Same as Alternative 1.	Same as Alternative 1.	Same as Alternative 1.	Wilderness and LUD II areas would be managed under the current Forest Plan.	Same as Alternative 1.	Same as Alternative 1.
ECONOMIC AND SOCIAL ENVIRONMENT							
Economic Impact Analysis							
Long-Term Wood Products Effects: Long-term employment projections are based on the NIC I Component of the ASQ and include a projected non-Tongass harvest of 109 MMBF, which is the same under all the alternatives. Projections are average annual equivalents for the next 10 years and assume full implementation. These totals do not include indirect or induced employment effects.	Projected average annual direct employment would be 365 logging jobs and 129 sawmill jobs under this alternative.	Projected average annual direct employment would be 583 logging jobs and 336 sawmill jobs under this alternative.	Projected average annual direct employment would be 680 logging jobs and 428 sawmill jobs under this alternative.	Projected average annual direct employment would be 880 logging jobs and 616 sawmill jobs under this alternative.	Projected average annual direct employment would be 803 logging jobs and 544 sawmill jobs under this alternative.	Projected average annual direct employment would be 801 logging jobs and 542 sawmill jobs under this alternative.	Projected average annual direct employment would be 1,098 logging jobs and 823 sawmill jobs under this alternative.
Recreation and Tourism: Employment projections are based on a linear projection of demand and projected supply based on changes to ROS settings (see above). Projections are average annual equivalents for the next 10 years, based on the estimated non-resident share of recreation and tourism activity. These totals do not include indirect or induced employment effects.	Projected average annual direct employment would be 4,327 jobs under this alternative.	Projected average annual direct employment would be 4,323 jobs under this alternative.	Projected average annual direct employment would be 4,321 jobs under this alternative.	Projected average annual direct employment would be 4,312 jobs under this alternative.	Projected average annual direct employment would be 4,319 jobs under this alternative.	Projected average annual direct employment would be 4,319 jobs under this alternative.	Projected average annual direct employment would be 4,310 jobs under this alternative.
Salmon Harvesting and Processing: There is not expected to be any significant change to the commercial fishing or fish processing industries over the next decade as a result of National Forest activities.	The Forest Plan Riparian and other S&Gs and monitoring are expected to reduce the effects of potential development activities on fish passage and habitat to low levels over the long-term and are not expected to have significant effects on the commercial fishing and fish processing industries.	Same as Alternative 1.	Same as Alternative 1.	Same as Alternative 1.	Same as Alternative 1.	Same as Alternative 1.	Same as Alternative 1.
Economic Efficiency Analysis							
Present Net Value (PNV): Economic efficiency analysis measures the costs and benefits to society associates with a given alternative. PNV figures are calculated by subtracting discounted costs from discounted benefits to yield a net value. PNV is calculated for those costs and benefits that can be assigned monetary values, in this case timber, recreation and tourism, and program management costs.	The estimated PNV for this alternative is $7,112 million.	The estimated PNV for this alternative is $6,884 million.	The estimated PNV for this alternative is $6,782 million.	The estimated PNV for this alternative is $6,472 million.	The estimated PNV for this alternative is $6,657 million.	The estimated PNV for this alternative is $6,662 million.	The estimated PNV for this alternative is $6,294 million.
Non-Use Values: Non-use values are values that individuals assign to a resource independent of their use of that resource and include existence, option, and bequest values. These types of values are typically associated with undeveloped areas. Impacts to roadless areas are summarized above.	Approximately 1.2 million acres (7%) of the Tongass would be allocated to moderate and intensive development LUDs. Approximately 435,000 acres are estimated to be suitable for harvest.	Approximately 2.0 million acres (12%) of the Tongass would be allocated to moderate and intensive development LUDs. Approximately 563,000 acres are estimated to be suitable for harvest.	Approximately 3.0 million acres (18%) of the Tongass would be allocated to moderate and intensive development LUDs. Approximately 697,000 acres are estimated to be suitable for harvest.	Approximately 4.7 million acres (28%) of the Tongass would be allocated to moderate and intensive development LUDs. Approximately 1.01 million acres are estimated to be suitable for harvest.	Approximately 3.6 million acres (22%) of the Tongass would be allocated to moderate and intensive development LUDs. Approximately 809,000 acres are estimated to be suitable for harvest.	Approximately 3.6 million acres (22%) of the Tongass would be allocated to moderate and intensive development LUDs. Approximately 806,000 acres are estimated to be suitable for harvest.	Approximately 5.0 million acres (30%) of the Tongass would be allocated to moderate and intensive development LUDs. Approximately 1.15 million acres are estimated to be suitable for harvest.

CHAPTER 3

ENVIRONMENT AND EFFECTS

Environment and Effects

Introduction

This chapter combines the affected environment and environmental consequences discussions required by the National Environmental Policy Act (NEPA) implementing regulations (40 Code of Federal Regulations [CFR] 1500-1508). The discussions are combined so that the environmental consequences (effects) of the alternatives on forest resources and the background information needed to understand these consequences are discussed together for each resource. Each resource is first described by its current condition, uses, supply, and demand, or expected use, along with an explanation of how each resource is measured and evaluated. The descriptions are limited to providing the background information necessary for understanding how the Environmental Impact Statement (EIS) alternatives may affect the resource. Methodology and scientific accuracy is discussed for most resources.

Many of the relationships established and discussed in the 1997 Tongass Forest Plan Revision Final EIS and in the 2003 Supplemental EIS (SEIS), in particular, Chapter 3 of these documents, are still valid and, therefore, are incorporated by reference in this EIS. However, this EIS uses updated relevant information to better reflect current conditions and focuses on the potential effects most relevant to the potential changes that could occur from proposed amendment to the current Tongass Forest Plan standards and guidelines and Land Use Designations (LUDs).

Analyzing Effects

Following each resource description is a discussion of the potential effects (environmental consequences) to the resource associated with implementation of each EIS alternative. All significant or potentially significant effects, including direct, indirect, and cumulative effects, are disclosed. Effects are quantified, where possible, although qualitative discussions are also included. The means by which any identified potential adverse effects will be reduced or mitigated are also described.

Environmental consequences are the effects of implementing an alternative on the physical, biological, social, and economic environment. Direct environmental effects are defined as those occurring at the same time and place as the initial cause or action. Indirect effects are those that occur later in time, or are spatially removed from the activity but would be significant in the foreseeable future. Cumulative effects result from the incremental effects of actions, when added to other past, present, and reasonably foreseeable future actions, regardless of what agency (federal or non-federal) or person undertakes such other actions. Cumulative effects can result from individually minor, but collectively significant, actions taking place over a period of time.

Potential adverse environmental effects that cannot be avoided are discussed. Unavoidable adverse effects are those resulting from managing the land for one resource at the expense of the use or condition of other resources. Many adverse effects can be reduced or mitigated by limiting the extent or duration of effects. The current Tongass Forest Plan is designed to mitigate potential adverse effects on forest resources and uses, especially through its mix of management prescriptions and Forest-wide standards and guidelines. Mitigation measures within standards and guidelines are specified for project activities to be implemented under the current Tongass Forest Plan.

Short-term uses, and their effects, are those that occur annually or within the first 10 years of Forest Plan implementation. Long-term productivity refers to the capability of the land and resources to continue producing goods and services for 50 years and beyond. Long-term and cumulative effects may be projected out 100 years or more, as needed, to fully analyze the potential consequences for particular resources.

Irreversible and irretrievable resource commitments are normally not made at the programmatic level of a Forest Plan. Irreversible commitments are decisions affecting nonrenewable resources, such as soils, minerals, plant and animal species, and heritage resources. Such commitments of resources are considered irreversible because the resource has deteriorated to the point that renewal can occur only over a long period of time or at a great expense, or the resource has been destroyed or removed. While the application of LUDs allowing land-altering activities can indicate the potential for such commitments, the actual commitment to develop, use, or affect nonrenewable resources is made at the project level. The gradual decline in old-growth habitat may be considered an irreversible commitment.

Irretrievable commitments represent opportunities foregone for the period during which resource use or production cannot be realized. These decisions are reversible, but the production opportunities foregone are irretrievable. An example of such commitments is the allocation of LUDs that do not allow timber harvest to areas containing suitable and accessible timberlands. For the time over which such allocations are made, the opportunity to obtain timber from those areas is foregone, thus irretrievable. Irreversible and irretrievable commitments are not identified, as such, in the discussions.

For estimating the effects of alternatives at the programmatic Forest Plan level, the assumption is made that the kinds of resource management activities allowed under the LUDs will in fact occur to the extent necessary to achieve the goals and objectives of each alternative. The actual location, design, and extent of such activities are, however, not known at this time because that is a project-by-project decision. In many cases, the discussions refer to the potential for effects to occur, realizing that in many cases these are only estimates.

The effects analysis is useful in comparing and evaluating alternatives, but should not be applied per se to any specific location within the Forest. Land management plans are tools for further agency planning and guide, but do not direct future management activities. The land management plan is a strategic plan that establishes a long-term management framework for the Tongass National Forest. Within that framework, specific projects and activities will be proposed, approved, and implemented depending on specific conditions, budgets, needs, proposals, and circumstances at that time. The plan can only speculate about the projects that may be proposed and budgeted and the events that may occur that will force changes in the projects and the effects of these projects. Thus, the effects presented here are comparative in nature. Specific effects that can be meaningfully measured and evaluated generally occur at the project and activity stage.

A strong effort was made throughout the current Tongass Forest Plan development process to obtain and use the best available information to evaluate and compare the effects of alternatives. NEPA implementing regulations (40 CFR 1502.22) state that when "there is incomplete or unavailable information, the agency shall always make clear that such information is lacking." This was done where appropriate. The NEPA requirement goes on to say that if the incomplete information "is essential to a reasoned choice among alternatives" then considerations, such as the cost of obtaining it, apply. The 1997 Tongass Forest Plan Revision Final EIS, the 2003 SEIS, and this EIS, along with their planning records, will provide the Forest Supervisor and Regional Forester with the "essential" information needed to make a reasoned choice among alternatives.

Cumulative Effects

As noted above, cumulative effects result from the incremental effects of actions, when added to other past, present, and reasonably foreseeable future actions, regardless of what agency (federal or non-federal) or person undertakes such other actions. For this analysis, the region or study area considered for cumulative effects varied according to the resource being assessed.

For most aquatic or watershed-related resources, the area within the proclaimed Forest boundary (approximately 17.87 million acres, including 1.09 million acres of non-National Forest System [NFS] lands) was used, as defined by the Value Comparison Unit (VCU) map (see below for more detail on VCUs and see the VCU map on the CD version of this EIS). VCUs generally correspond with watersheds so basing the analysis of cumulative effects on watershed boundaries is most relevant to aquatic and watershed-related resources.

For wildlife and other terrestrial resources, all of Southeast Alaska from Yakutat Bay southeast to the southeastern end of Alaska (approximately 21.56 million acres, including 4.79 million acres of non-NFS lands) was used as the study area, although some analyses were based on the area within the Forest boundary, depending on the availability and quality of available information. The Southeast Alaska area includes all of Glacier Bay National Park and the State, Bureau of Land Management, and other lands in the vicinity of Haines and Skagway. Often Wildlife Analysis Areas (WAAs) were used to summarize information within these study areas (see below for more detail on WAAs and see the WAA map on the CD version of this EIS). In addition, biogeographic provinces and ecological subsections (see descriptions below) were also used to summarize cumulative effects information for wildlife and other terrestrial resources.

For social and economic, recreation, and related human uses, all of Southeast Alaska and beyond, were given consideration for cumulative effects, especially regarding economic, market, and other factors.

Cumulative effects analyses are presented throughout the effects sections. Many times, direct and indirect effects are presented in the context of past, present and future actions. For example, many of the analyses address past harvest and road construction on NFS lands along with future NFS harvest and road construction. These are cumulative effects analyses because they deal with past, present, and reasonably foreseeable actions on NFS lands. These are typically presented under Direct and Indirect Effects because it is logical to discuss the harvest and road construction plans along with the past harvest and road construction on the lands where the proposed action will take place. However, there are specific cumulative effects sections that reference these analyses and present additional analyses that take into account past, present, and future harvest and road construction on non-NFS lands when added to the NFS land harvest and road construction.

Generally, for the physical and biological resources, the actions considered in assessing cumulative effects included the following:

- Past, present, and future timber harvest and road construction on NFS lands;

- Past, present, and future timber harvest on adjacent private, state, and Native corporation lands. (These usually represent more intensive harvest and road development than for NFS lands; however, consideration was given to the Alaska Forest Resources and Practices Act which is designed primarily to protect fish habitat and water quality and promote rapid reforestation);
- Existing mining at Greens Creek on Admiralty Island and other existing sites, as well as possible future sites, including the proposed Kensington Mine at Berners Bay north of Juneau;
- Electrical intertie and other utility corridor construction, including the Swan Lake-Lake Tyee Transmission Intertie project;
- Regional transportation development as defined by the State Transportation Plan;
- Growth in the cruise ship and guiding industries and general outdoor recreation. Development of fishing and other lodges;
- Human settlements – expansion of cities like Juneau and Ketchikan. Also, recreational cabin development and land auctions by the State; and
- Existing and limited future hydroelectric developments (e.g., Angoon hydroelectric project).

Geographic Information System Database and Quantification for this EIS

The Forest Service developed a computerized geographic information system (GIS) database for the revision of the Tongass Forest Plan, and that system continues to be improved upon and used. This system makes it possible to conduct spatial analysis of alternatives and effects, and to rapidly display resource information in map format. The GIS is a very large database, containing information on many of the resources of the Forest. Much of the data consist of map "layers," each representing a particular resource or attribute (such as forest type, soil type, or recreation places). Numerical data can also be stored, displayed, and analyzed. Computer technology and capability continues to improve and the Forest GIS program, especially at the project level, reflects such growth. Additional information, as well as improved information, is now available for many resource areas. This EIS takes advantage of the new technology capability and information. This EIS validated and updated various GIS layers used in the 1997 Forest Plan Revision Final EIS and the 2003 SEIS. This existing condition information is what has been used as a baseline for the EIS and Alternative 5, No Action.

The baseline numbers used in Alternative 5 do not always match the numbers for Alternative 11 of the 1997 Forest Plan Revision Final EIS, which is the 1997 alternative that is most like the current Forest Plan. This is primarily because of ongoing management of the Tongass National Forest. Examples include changes in land ownership, changes in resource conditions resulting from timber harvest and road construction, and nonsignificant amendments to the 1997 Forest Plan Revision Final EIS. In addition, the use of newer computer mapping and measurement techniques that are more accurate than earlier methods also affects the numbers. In general, the relative differences among the 1997 Forest Plan Revision Final EIS-generated numbers, the 2003 SEIS-generated numbers, and the baseline numbers used in this EIS are small, and do not affect the analysis relationships among these documents.

It should be noted that in some cases where the acreages are measured that depend on overlaying of multiple coverages, the acreage measurements for individual categories sometimes need to be adjusted to account for the fact that coverages do not always line up exactly in places where they should (e.g., along property boundaries, saltwater shorelines, lake edges). Very slight misalignment of the coverages can result in polygon slivers between the coverages, which can produce acreage differences initially. These differences can amount to tens or hundreds of acres or more, especially because we are dealing with such a large area (i.e., 17 million acres). However, on a percentage basis, these slivers and the adjustments that are necessary are insignificant.

It should also be noted that the figures presented are generally rounded to the nearest whole acre, whole mile, or whole percent. No attempt has been made to adjust the numbers to force the sums of rounded numbers to equal the expected totals. Therefore, the sum of rounded individual numbers will often be one digit higher or lower than the expected sum. The sums that are presented are the sums of the unrounded numbers.

Land Use Designation Groupings

For many resources, the effects and the differences in effects among the alternatives are best identified through the LUD allocations. While each LUD has a different purpose and management emphasis, many are similar in the kinds of effects they would potentially create. Based on this concept, and in order to simplify the identification of effects, the LUDs have been grouped into four categories: Wilderness, Natural Setting, Moderate Development, and Intensive Development. For some analyses, the LUDs are grouped into two categories: Wilderness and Natural Setting LUDs make up the non-development LUDs and Moderate and Intensive Development LUDs make up the development LUD category. Note that the Minerals and Transportation and Utility System LUDs are overlay LUDs and are managed according to the underlying LUD until such time that development is approved, if at all. Therefore, acreages in this EIS generally reflect the underlying LUD acreages. Table 3.1-1 displays these LUD groupings.

Land Divisions

The land area of the Tongass National Forest has been divided in several different ways to describe the different resources and how they are affected by Forest Plan alternatives. These divisions vary by resource because the relationship of each resource to geographic conditions and zones also varies. Several of these divisions are described briefly here.

Geographic Provinces

These are seven large land areas that are distinguished by differences in ecological processes. They are defined by a combination of climatic and geographic features. Geographic provinces are used in the evaluation of Research Natural Areas and Wild and Scenic Rivers. See the *Research Natural Areas* section of the 1997 Forest Plan Revision Final EIS for a description of each province.

Biogeographic Provinces

Biogeographic provinces are areas within which certain kinds of plants and animals tend to occur together. They are defined by a combination of similarity in species, patterns of distribution of species, and natural characteristics or barriers. Twenty-one biogeographic provinces occur on the Tongass. They are used in the *Biodiversity* and *Wildlife* sections and described in the *Biodiversity* section of this chapter.

Table 3.1-1
Land Use Designation Groupings Used to Discuss Effects

LUD Group	Land Use Designation
Non-development LUDs	
Wilderness LUD Group	Wilderness Wilderness National Monument Nonwilderness National Monument
Natural Setting LUD Group	LUD II Remote Recreation Semi-Remote Recreation Old-Growth Habitat Enacted Municipal Watershed Research Natural Area[1] Special Interest Area[1] Wild River[1] Scenic River Recreational River
Development LUDs	
Moderate Development LUD Group	Experimental Forest Scenic Viewshed Modified Landscape
Intensive Development LUD Group	Timber production
Overlay LUDs[2]	
Overlay LUD Group	Minerals Transportation and Utility Systems

[1] These three LUDs function as overlay LUDs (see footnote 2) when they occur within Wilderness, Wilderness National Monument, or LUD II areas.
[2] The Minerals and Transportation and Utility Systems (TUS) LUDs are overlay LUDs. Areas allocated to these LUDs are managed according to the underlying LUD until such time that mineral or transportation or utility development is approved, if at all. Generally, acreages in this EIS do not include the Minerals or TUS LUDs, but rather the underlying LUD.

Ecological Sections and Subsections

Ecological sections and subsections are two classification levels within a hierarchical system for subdividing ecosystems according to the National Hierarchical Framework of Ecological Units (see *Biodiversity* section of this chapter).

The framework consists of eight nested mapping levels that serve a variety of purposes. Within the hierarchy, ecological sections characterize medium to large ecosystems (on the order of 1,000 square miles) and ecological subsections characterize mid-sized ecosystems (10 to 1,000 square miles). Fourteen ecological sections and 73 ecological subsections occur on the Tongass.

Value Comparison Units

Value Comparison Units (VCUs) are distinct geographic areas, roughly analogous to watersheds, each encompassing a drainage basin containing one or more large stream systems. The boundaries usually follow watershed divides. VCUs were used for the 1979 Tongass Forest Plan and have since been updated. The Forest currently has about 945 VCUs averaging 18,000 acres in size. They are used to describe the locations of specific resources on the Forest. A map of the VCUs on the Tongass is provided on the CD version of this EIS.

Wildlife Analysis Areas

Wildlife Analysis Areas (WAAs) are land divisions used by the Alaska Department of Fish and Game (ADF&G). Approximately 190 WAAs apply to the Tongass National Forest; they average slightly less than 90,000 acres in size. In general, WAA boundaries correspond with VCU boundaries and they typically include three to eight VCUs (averaging just under five). They are used in the *Subsistence* and *Wildlife* sections. A map of the WAAs on the Tongass is provided on the CD version of this EIS.

General Forest Description

A brief description of the physical, biological, and socioeconomic settings of the Tongass National Forest is presented in this section. Chapter 1 and the alternative maps include a vicinity map.

Physical Setting

The mainland and many of the islands of Southeast Alaska are mountainous, often rising abruptly from sea level to several thousand feet. Elevations of forested areas extend up to approximately 3,000 feet in the southern sections of the Tongass National Forest and up to 2,500 feet further north. The mountain valleys provide reservoirs for huge ice fields and glaciers, located primarily on the mainland.

More than 1 million years ago, all but the highest mountain peaks and some outer coastal areas in Southeast Alaska were covered by ice. The great erosional powers of these vast expanses of ice molded and shaped the landscape as the glaciers moved downhill under their own weight, carving the bedrock below them. When the ice receded and uncovered the land, the more resistant mineral-rich rocks remained, revealing a network of islands dissected by numerous streams, U-shaped valleys, and fiords. This modification by glaciers gives Southeast Alaska's landscape its unique character.

The configuration of the coastline, the warm Japanese ocean current, and the high coastal mountains provide the factors necessary to produce abundant rainfall. The annual precipitation of Southeast Alaska averages more than 100 inches throughout. Precipitation is highest in the southern areas and decreases as one moves north. At higher elevations, more than 200 inches of snow may fall annually, perpetuating the existing ice fields and glaciers. Storms and moderate to heavy precipitation occur year-round, but most commonly from September through November. The abundant moisture feeds numerous streams, rivers, and lakes that dot the landscape.

Southeast Alaska has a maritime climate, resulting from the moderating influence of the Pacific Ocean. In the summer, this provides a cooling influence, while in winter, temperatures are warmer than would be expected for these latitudes. Normal temperatures range from mid-40 degrees Fahrenheit (°F) to mid-60 °F in the summer, and from the high teens to the low-40s in the winter. During the warmer months, temperatures are highest inland and lowest along the coasts, while in the colder months, the reverse is true.

Biological Setting

The coastal forest of Southeast Alaska is part of the cool, temperate rain forest that extends along the Pacific coast from Northern California to Cook Inlet in Alaska. Most of the Forest is composed of old-growth conifers, primarily western hemlock and Sitka spruce, with a scattering of mountain hemlock, western redcedar (in the south), and Alaska yellow-cedar. Red alder is common along streams, beach fringes, and on soils recently disturbed by management activities and landslides. Black cottonwood grows on the floodplains of major rivers and recently deglaciated areas.

Blueberry, huckleberry, Sitka alder, Devil's club, and salal are common shrubs in the Forest. The Forest floor is composed of plants, such as deerheart, dogwood, single delight, and skunk cabbage. Because of the high rainfall and resulting high humidity, mosses grow in great profusion on the ground, on fallen logs, on the lower branches of trees, and in forest openings.

Grass-sedge meadows usually lie at low elevations, often along the coast. Stands of willows border many of the stream channels. Muskeg (bog plant) communities, dominated by sphagnum mosses and sedges, occur throughout the Forest.

The alpine zone usually lies above 2,500 to 3,000 feet. It occupies the area above the coastal forest and is separated from the Forest by a subalpine or transition zone. Resident plants have adapted to snowpack and wind abrasion by evolving low-growth forms. Low, mat-forming vegetation covers most of the area, with cushion-like plants occupying crevices on exposed rock outcrops and talus slopes.

The forests, shorelines, streams, and rivers of Southeast Alaska provide habitat for over 300 species of birds and mammals, including game and non-game animals, such as brown and black bear, Sitka black-tailed deer, moose, wolf, mountain goat, beaver, otter, and marten. The coastline provides ideal habitat for a large population of bald eagles, and wetlands provide nesting habitat for many waterfowl.

A highly productive marine environment includes an abundance of marine mammals, halibut, herring, and hundreds of shellfish. Both resident and anadromous fish are found within and adjacent to the Forest.

Socioeconomic Setting

Southeast Alaska's communities and individuals make up a variety of cultures. The abundant resources of the forests and waters have provided food, shelter, and livelihood for its peoples for thousands of years. The first inhabitants of the area, the Tlingit and Haida, adapted well to the coastal environment and developed a rich culture. The numerous waterways allowed for mobility, which aided in expanding trade and gathering food.

In the 1700s, Russian exploration began in Alaska. The fur trade, primarily sea otter pelts, was the main force driving colonization. When most of the sea otter populations were depleted, the fur industry declined and Russia lost interest in its North American colony. Alaska was sold to the United States in 1867.

Colonization continued under U.S. ownership, and new industries developed. In the late 1800s, commercial fish canning became an important part of the economy of Southeast Alaska. During that same period, the discovery of gold brought thousands of miners to the area, and many were followed by their families. The most important of the early gold discoveries occurred in Juneau. In the early 1900s, the Depression brought a decline in mining employment, and the impact of World War II resulted in the closures of the last remaining mines.

The timber resource was used by the earliest inhabitants in a variety of ways. The Russians harvested timber for building ships and structures, but commercial timber harvest was not developed until the 1900s. In the earlier part of the century, small timber mills operated in a few communities. During the 1950s, two large-scale pulp mills were developed in Ketchikan and Sitka, and the timber industry became a major economic component of Southeast Alaska's economy.

In the 1950s, Alaska focused its attention on statehood, and on January 3, 1959, became the 49th state of the United States. This resulted in an increase in government employment and, coupled with the growth of the timber industry, a gradual shift towards a more diversified economy, with less dependence on nonrenewable resources.

More than 70,000 people live in the towns, communities, and villages of Southeast Alaska. Most of the region's population is concentrated in a few communities, the largest being Juneau, Ketchikan, Sitka, and Petersburg. Services, state and local government, and retail trade were the largest economic sectors by employment in Southeast Alaska in 2005, accounting for 28, 21, and 12 percent of total employment, respectively. Employment in natural resource-based industries remains important in many of the region's communities. Tourism, which has increased in recent years, provides another important source of regional employment and income. Many small, rural communities continue to depend primarily on fishing, timber production, and subsistence uses.

Organization of Chapter 3

The remainder of Chapter 3 is divided into three parts. First, the resources that make up the physical and biological environment are described and the effects of the alternatives are analyzed. This part sets the stage for the next part—the evaluation of human uses and land management. Finally, both of these parts set the stage for the final part—the economic and social environment. The focus is on significant effects, with the analysis centered on the public issues related to the Forest Plan amendment.

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Physical and Biological Environment

Climate and Air

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Affected Environment

Climate

The Tongass National Forest occupies a series of islands and a narrow strip of the mainland between the Pacific Ocean and the crest of the coastal mountains. The configuration of the coastline, the warm Japanese ocean current, and the high coastal mountains combine to produce a cool, wet environment. Precipitation at sea level in Southeast Alaska ranges from 30 inches per year at Skagway to 220 inches per year at Little Port Walter. Precipitation increases with elevation. It is estimated that the average annual precipitation may be as high as 400 inches on the mountains of southern Baranof Island and about 260 inches over the Juneau Icefield. Southeast Alaska has complete cloud cover approximately 85 percent of the year. Snowfall varies according to elevation and distance inland from the coast. October is generally the wettest month. May through July are, on average, the drier months. The Pacific maritime influence holds the daily and seasonal temperatures within a narrow range. Temperatures average 32 degrees Fahrenheit (°F) in the winter and 60°F in the summer. During the warmer months, temperatures are highest inland and lowest along the coasts, while in the colder months, the reverse is true. Storms and moderate to heavy precipitation occur year-round, but most commonly from September through November. The abundant moisture supports an extensive temperate rain forest and feeds numerous streams, rivers, and lakes, which in turn provide valuable fish habitat.

Climate Change

Southeast Alaska has had considerable year-to-year and decade-to-decade variability in its weather, associated with large-scale shifts in ocean temperatures, salinity levels, and ice conditions. Even with these short-term variations in weather, some longer-term trends are evident. Southeast Alaska's climate has shown a strong warming trend since the middle of the 19th century (the end of the little ice age), as has much of the northern hemisphere. This trend accelerated in the late 1970s due to cyclical shift of the Pacific decadal oscillation (Parson et al. 2001). In addition to this natural change, anthropogenic change (human-caused change) has accelerated climate changes during the last several decades (Intergovernment Panel on Climate Change [IPCC] 2007).

Changes to the climate in Southeast Alaska have already resulted in changes to ecosystem processes and services on the Tongass National Forest. The number of days with gale-force winds has more than doubled since 1950 (U.S. Global Change Research Program [USGCRP] 2003). Juday et al. (1998) state that as of their report, the increased frequency of storms had not corresponded to an increase in large-scale blowdowns in Southeast Alaska, although the authors state that they do not know if it resulted in an increase in canopy gap formation. The 2006 Forest Health report noted very little blowdown in aerial and ground surveys (USDA Forest Service and ADNR 2007)

The Muir Glacier has retreated more than 9 miles since 1941, exposing large areas of bare rock that are starting to colonize with alder and willow. Warmer summers have led to longer growing seasons for trees and other vegetation. Warmer winters have meant more insects survive the winter, triggering insect outbreaks that affected trees on over 300,000 acres of forest in Southeast Alaska (including all ownerships) during the 1990s (USGCRP 2003). The warming trend has also reduced snowpack in low-elevation areas, which may contribute to ongoing yellow-cedar decline affecting over 500,000 acres in Southeast Alaska (Hennon and Shaw 1997). Drier summers may have contributed to the number and duration of low stream flow episodes, which can adversely affect salmon, and the increase in the amount of precipitation falling as rain instead of snow since the 1970s has reduced the frequency of low- and moderate-elevation avalanches, allowing mountain hemlock to colonize some alpine areas (Parson et al. 2001).

There are several models that have attempted to predict future trends in Alaska's climate. Most models predict warmer, wetter weather for Alaska and they generally agree that rainfall will increase and snowfall will decrease at lower elevations in Southeast Alaska over the next 50 to 100 years (Bonsal and Prowse 2006). However, these models do not always agree on the extent of climate change in Southeast Alaska. For example, two models were compared in a study by Parson et al. (2001), one from the Canadian Climate Center and the other from the Hadley Center. Both predict rising temperatures and a 10 percent decrease in summer precipitation in some portions of Southeast Alaska, but the models differ in projecting the areas affected. The Canadian scenario predicts that drier summer weather will extend across all of Southeast Alaska, while the Hadley scenario predicts that these effects will be confined to the extreme southeast. Both models predict the expansion of forests into higher elevation areas, as well as increased insect problems and decreased soil moisture, due to increased evaporation during warmer, drier summer weather. These factors may lead to an increase in fire frequency and adversely affect fish. These models are not specific to Southeast Alaska; therefore, the predicted effects may not be relevant for Southeast Alaska. While the 2007 report by the Intergovernmental Panel on Climate Change (IPCC 2007) predicts higher stream runoff at the higher latitudes, as well an increase in heavy precipitation events, a decrease in glacier size, and a slight increase in tree growth, it also concludes that not all areas will be effected the same and limits forecasts to large regions, such as western North America.

A scientific panel on climate change convened by the City and Borough of Juneau (Kelly et al. 2007) has made some site-specific predictions based on a review of several models. They concluded that the Juneau area will see overall warmer and wetter weather, particularly in fall and winter. The Juneau Icefield will continue to retreat. Global sea level will continue to rise as a result of the melting of glaciers and ice sheets and the warming of ocean waters (thermal expansion). Over the next century, global sea level is projected to rise 0.3 foot to 3.0 feet. In the City and Borough of Juneau, however, the land surface is rising as a result of the loss of glacial ice (isostatic rebound), and the rate of uplift is greater than the projected rate of global sea level rise. Over the next century, the relative sea level in the Juneau area likely will decrease between 1.0 and 3.6 feet.

Carbon Sequestration

Carbon, primarily in the form of carbon dioxide, is one of the major greenhouse gases being released into the atmosphere (McPherson and Simpson 1999). The global carbon cycle involves the earth's atmosphere, fossil fuels, the oceans, and the vegetation and soils of the earth's terrestrial ecosystems. Gases that make up the earth's atmosphere, such as carbon dioxide, methane, nitrous oxide, and water molecules, trap the sun's heat, creating a natural "greenhouse effect" that makes life on earth possible (McPherson and Simpson 1999). These gases are released into, and removed from, the atmosphere by a variety of natural sources and sinks.

The Tongass National Forest, like most forests, is considered a carbon sink, storing more carbon in its systems than is released by natural processes. As such, a critical ecosystem service sustained by the forest is *carbon sequestration*, or removal of carbon dioxide from the atmosphere and keeping that carbon inactive by storing it in biomass (live and dead plant structures, primarily) and soil organic matter. D'Amore and Lynn (2002) believed that previous methods may have underestimated the amount of carbon stored in Southeast Alaska. Subsequently, Smith et al. (2004a) estimated that mature hemlock-Sitka spruce forests of the Pacific Northwest store 184.4 tons of carbon per acre. Leighty et al. (2006) estimate that the Tongass contains approximately 2.8 billion metric tons of carbon in both above and below ground living and dead material (an estimated 83,500,000 billion metric tons of carbon are stored world-wide, primarily in the oceans and marine sediment, based on United Nations estimates). Leighty et al. (2006) also estimate that between 6.4 and 17.2 million metric tons (0.2 to 0.6 percent) of stored carbon has been lost on the Tongass since timber harvest began in the early part of the 20th century. For comparison, approximately 4.5 million metric tons of carbon was released every day to produce electric power in the United States in 2005 (DOE 2006).

Generally, the capacity for a system to sequester and store carbon depends on the location, age, and species mix of the forest (Birdsey et al. 1993). Newly established forests accumulate carbon rapidly for many years, slowing as trees mature, growth slows, and decaying material accumulates. However, the cool conditions on the Tongass inhibit decomposition, drastically slowing biomass breakdown and carbon release. Decaying plant matter is incorporated into the system's soil profile, where it accumulates and may reside indefinitely. As a result, old forests generally store considerable amounts of carbon on the forest floor, approximately 70 tons per acre in hemlock-Sitka spruce ecosystems (Smith et al. 2004a). Janisch and Harmon (2002) suggest that it can take more than 200 years following timber harvest for forests to reach equilibrium, the point where carbon released from decay equals carbon stored in the system.

Interest in enhancing ecosystem carbon sequestration and storage has intensified recently, as concerns about how to mitigate climate change have increased. This question of how active ecosystem management may contribute to, or detract from, the mitigation effort is being explored, with varying results. A few studies have shown that management of some forests with certain parameters being met, such as fertilization, may result in heightened capacity for carbon sequestration and storage (Schroeder 1991, Binkley et al. 1997). A study in the eastern United States found that thinning a 50-year-old stand from below (removing the smallest trees) resulted in more stored carbon after 25 years than resulted from thinning stands from the middle or from above (Hoover and Stout 2007). A recent Pacific Northwest study (Perez-Garcia et al. 2005) concluded that the use of wood resulted in "significant atmospheric carbon reductions by displacing more fossil fuel-intensive products in housing construction." They estimate that a rotation of 80 years would sequester the most carbon. Other studies, particularly two with application to Southeast Alaskan ecosystems (Harmon et al. 1990, Leighty et al. 2006), indicate that the

Tongass would generate a net loss of carbon to the atmosphere if active harvest of old growth is pursued. Ultimately, a net loss or gain of carbon in active management situations depends on use of harvested timber, the substitute material available, the amount of carbon emitted in harvesting activities, and the amount of carbon emitted via decomposition of on-site wood waste and soil organic matter losses. If the emissions are less than the carbon stored in utilized wood, and if the system can rapidly replace losses from decomposition through tree growth, the activity may yield a net gain of stored carbon. Whether active management of old-growth forests on the Tongass results in a net gain or loss of carbon is currently unknown.

In addition to the effects of timber management, climate change may also affect carbon sequestration in Southeast Alaska. D'Amore and Lynn (2002) note that numerous studies have shown that carbon stored in soils, including peatlands, may be released to the atmosphere in the form of carbon dioxide or methane as climate warms and that dissolved carbon may be transported to streams and the ocean due to increased rainfall. If warmer, wetter conditions occur, climate change could result in additional carbon losses.

Air Quality

The air quality of Southeast Alaska and the Tongass National Forest is generally good. The prevalent airflow from the Pacific Ocean, the relatively small amount of industrial development in Southeast Alaska, the lack of large population centers, the absence of slash burning following harvest, and environmental regulations all contribute to maintaining clean air. Forest activities have historically had little direct effect on air quality on the Tongass (USDA Forest Service 1997a). However, cruise ship emissions in certain locations and trans-Pacific pollutants such as persistent semi-volatile organic pollutants and greenhouse gases are a growing concern.

Air quality and sources of air pollution on the Tongass are described in Air Quality Monitoring on the Tongass National Forest: Methods and Baselines Using Lichens (Geiser et al. 1994) and Air Quality Biomonitoring with Lichens-Tongass National Forest (Dillman 2007). The Tongass has 127 permanent lichen biomonitoring plots that can be used to detect possible trends in the elemental content of lichen tissue and changes in lichen communities over time. Lichen biomonitoring plots are distributed across the Forest, including all but one Wilderness. Lichens serve as dynamically representative samples of the environmental conditions in which they are growing. Elements and compounds in the air are absorbed by lichens along with moisture from the surrounding environment and become concentrated in the lichen tissue. Roughly 10 percent of the biomonitoring plots on the Tongass were recently re-visited, all in wilderness areas. Little or no change in the elemental content of the lichens was detected between the first monitoring effort (Geiser et al. 1994) and the recent one (a span of about 15 years). Provisional threshold levels were generated from the most pristine areas on the Tongass for 27 elements, including sulfur and nitrogen, in four target lichen species (Dillman 2007). A provisional threshold level is the level of a pollutant of interest per lichen species that can be expected at a clean air site on the Tongass (expressed in parts per million, or ppm). Nearly half of the 127 biomonitoring plots are elevated above the threshold level in one or more elements due to natural or anthropogenic sources. Natural sources include the mineral content of the local rock and soil and salt spray from the ocean (a major factor in sites near the coast). Anthropogenic sources include dust from roads (the most comment human-cause source) as well as wood stoves, fossil fuels (specifically near Juneau), and mining (specifically near the Greens Creek Mine). Monitoring plans call for lichen biomonitoring to be done on a 5 to 10 year interval to better detect pollution trends, especially for trans-Pacific sources of nitrogen.

The Tongass National Forest partnered with the National Park Service Western Airborne Contaminants Assessment Program (WACAP), which quantifies regional and trans-Pacific semi-volatile and persistent organic pollutants in lichens, vascular plants, and other organisms. Results from the WACAP samples collected from the Stikine-LeConte Wilderness are being analyzed by the National Park Service. An aerosol sampler near Petersburg was installed in 2004 as part of the Interagency Monitoring of Protected Visual Environment (IMPROVE) program. This is the only IMPROVE site in Southeast Alaska, with the next nearest station in Tuxedni Wilderness near Anchorage. Data from the IMPROVE site will be collected for 5 years to observe trends and to determine regional, state, and national significance.

Visual inspections of cruise ship emissions by rangers in Tracy Arm/Fords Terror Wilderness occur during the summer tourist season as part of an agreement with the State using U.S. Environmental Protection Agency (EPA)-approved methods. Also, the Tongass is working with the National Park Service in the Southeast Alaska Network and Forest Service Air Resource Program in Region 6 to coordinate a Southeast Alaska cruise ship emissions monitoring effort using passive air samplers in remote locations.

Juneau Air Quality

Juneau's Mendenhall Valley is the only area in Southeast Alaska that is known to have exceeded National Ambient Air Quality Standards. The EPA listed Juneau City and Borough as a non-attainment area for particulate matter less than or equal to 10 micrometers in 1990. The area is classified as Moderate for this component of air quality, with an average daily rating of 110 out of a maximum of 500. Monitoring data indicate that air quality in Juneau has met state and federal ambient air quality standards in recent years. No state or federal ambient air quality standards have been exceeded since 1997. The last time particulate matter standards were exceeded in Juneau was in 1993. The State and EPA are currently considering re-designating the Juneau area as a maintenance area, an area in transition between non-attainment and attainment (Alaska Department of Environmental Conservation [ADEC] 2007). The ADEC has conducted ambient air monitoring in other locations in Southeast Alaska. These studies indicate these areas are within national standards for the pollutants monitored.

Lichen tissues were collected on Mt. Roberts in the downtown Juneau area at five different elevations as part of the Tongass lichen biomonitoring program and in collaboration with the State. The lichen tissues analyzed were elevated above provisional threshold levels in all five plots in three or more elements including sulfur, nitrogen, and heavy metals. Lichens from the plot at 175 feet above sea level had the greatest number of elements above threshold (12), indicating that the sources are probably local and anthropogenic (Dillman 2007).

Sources of Air Pollution

There are 36 stationary sources of air pollution in Southeast Alaska that require air quality control permits. These include diesel power plants, asphalt plants, incinerators, mining facilities, and other facilities. Some of these sources operate intermittently (e.g., back-up power plants may operate during power failures or during peak demand periods, and asphalt plants may operate seasonally), and others may be operating at full capacity (e.g., Greens Creek mine).

Other sources of air pollution in Southeast Alaska include mobile sources (such as cars, trucks, boats, cruise ships, airplanes, and helicopters) and area sources (such as home furnaces, wood stoves, and open burning). Under certain weather conditions, wildfires in Canada can affect air quality and visibility (i.e., regional haze) in parts of Southeast Alaska. The State issued an air quality advisory in July of 2004 due to extensive wildfires in western Canada.

Cruise ship traffic has greatly increased in Southeast Alaska over the last several years. More than 600 cruise ship visits occurred in Juneau during 2006, with an annual average number of visits of 591 ships for the 2003 to 2006 seasons. Cruise ship emission monitoring in Juneau by ADEC indicates that ship emissions are well within federal and state standards. The Mt. Roberts biomonitoring plots contain lichens that were elevated above threshold levels in three or more elements. Possible sources of the elevated elements are urbanization of downtown Juneau, past mining activities, and cruise ship emissions.

Cruise ship traffic in Tracy Arm creates a particular concern for air quality in Wilderness. Tracy Arm/Fords Terror Wilderness received more than 1,000 cruise ship visits between 2003 and 2006. Tracy Arm is less than a mile wide (on average) and is surrounded by high mountains. Cruise ship emissions may linger above the fiord for hours. The emissions are most heavily concentrated in upper Tracy Arm, where vessels stop near the South Sawyer Glacier for 1 to 4 hours (depending on ice conditions). Ship emissions often increase because of rapid changes in engine loading necessary for the ship to maneuver through ice and turn around. The Forest Service has received an increased number of public complaints concerning air quality within the Tracy Arm-Fords Terror Wilderness. In an effort to better address the air quality concerns in the Wilderness, the Forest Service and ADEC enters into a Memorandum of Understanding each year to train Forest Service wilderness rangers to visually monitor cruise ship emissions with EPA approved standards. ADEC annually reviews the visible emission observations and takes action on any that exceed the State Marine Vessel Emission standard (18 AAC 50.070).

Two lichen biomonitoring plots were established in 2003 near the entrance of Tracy Arm, where target lichen species are found. Results indicate no elements were elevated above threshold from this area of Tracy Arm (Dillman 2007). Future efforts to monitor air quality in the wilderness may utilize passive air samplers that measure SO_2, NHO_3, NH_3, and NO_X closer to where the cruise ships linger.

Environmental Consequences

Air Quality

Direct and Indirect Effects

The expected direct effects on air quality from forest management activities are temporary and limited in nature, resulting from dust and vehicular emissions from logging operations, administrative and harvest-related use of Forest roads, mineral development, and smoke from a limited prescribed fire program. None of the alternatives includes broadcast burning of slash following harvest. Alternatives 1, 2, 3, 6, 5, 4, and 7 would result in progressively more harvest, road construction, harvest-related vehicle use, and wood processing, as well as more emissions. No significant adverse effects on air quality are anticipated from these activities under any of the alternatives.

Indirect effects on air quality can result from the use of trees harvested from the Tongass National Forest, such as in the operation of industrial processing sites and firewood burning, as well as emissions from private vehicles using Forest unpaved roads. These indirect effects on air quality can be aesthetically displeasing or have potential health risks to both humans and the Forest. EPA and ADEC have regulatory responsibility, under the Clean Air Act, for air quality related to these kinds of sources. The enforcement of the applicable regulations by these agencies is anticipated to keep any potential adverse effects within the standards for air quality; therefore, no significant indirect effects from the uses of the Tongass National Forest should occur.

Carbon Sequestration

Estimating the effects of the proposed alternatives on carbon sequestration is complex. There are many factors that affect sequestration and storage; some components of an alternative contribute to a net removal of carbon, while some components offset those gains. Further, sequestration and carbon release happen at different time scales; therefore, while an activity may result in an immediate loss of carbon, over time, the net balance may reach zero or result in a net gain of storage.

It is generally assumed that old-growth forests considered for harvest in this analysis are currently in a "steady-state," meaning no net loss or gain of carbon. These systems are simply maintaining their storage capacity. Alternatives that propose less harvest, especially Alternatives 1 and 2, would allow this process to continue throughout most of the Tongass. In addition, much of the wood in harvested areas would be left in the Forest because there is no market for low-quality logs. Much of this wood, and the carbon it contains, would remain on the site as large woody debris for a long period of time under Alternatives 1 and 2.

Alternatives that harvest more old-growth forest have the potential to either increase or decrease the amount of stored carbon, depending on the time scale of consideration, how much of the wood is removed from the Forest for utilization, how the wood is used, and how much carbon is released in cutting, yarding, transporting, and processing the wood and in soil carbon and woody debris decomposition. Alternatives 4 and 7 have the potential to harvest the most wood and would convert both the saw timber and much of the utility wood into lumber and other building materials, such as medium density fiberboard (MDF board), assuming facilities to produce MDF board are built. This material would continue to store the sequestrated carbon for a relatively long period of time (perhaps 75 years), although this storage may be offset by harvest emissions and carbon released by on-site decomposition. If, on the other hand, the low-value logs are used to fuel bio-energy plants, carbon storage would be reduced. New stands would be regenerated and, in time, commercially thinned; these thinning activities may lead to a net gain or a net release of carbon as well, depending on how the thinning is conducted, how the products are used, and how much carbon is released during harvest, transportation, and processing. Alternatives 3, 5, and 6 are expected to be intermediate in their effects relative to Alternatives 4 and 7.

All alternatives include standards and guidelines that protect soils, such as limits on harvest on steep slopes, limits on roads built across steep slopes, and on soil disturbance. These measures would help retain carbon stored as organic material in the soil. Unlike many areas of the country, broadcast burning to reduce slash is not practiced on the Tongass; therefore, much more of carbon stored on the forest floor and in the upper layers of soil is retained compared to sites that are broadcast burned.

Cumulative Effects

Cumulative effects on air quality include harvest-related emissions from state and private land, vehicle and maritime emissions, permitted uses such as community incinerators, industrial operations, cruise ship emissions, and electricity generation. If plans for hydropower production and transmission lines linking communities are implemented, such as the Swan Lake-Lake Tyee project scheduled for completion in 2010, long-term reductions in both air pollution and carbon emissions could result because many communities would no longer rely on diesel generators. The Alaskan Energy Authority estimates that the Swan Lake-Lake Tyee intertie alone would reduce carbon dioxide emissions by approximately 486,000 tons and carbon monoxide by 3,150 tons by 2046 (comment letter submitted April 30, 2007). Most of the logs harvested on private land are expected to be exported; therefore, little additional emissions are expected due to processing wood from state and private land locally. Because of the temporary and limited effects associated with timber harvest on National Forest System (NFS) lands, the alternatives are not expected to contribute significantly to cumulative effects on air quality. Air pollution from wood processing is likely to remain low, but could increase somewhat if more wood is burned to produce energy. Air pollution from forest fires in western Canada could adversely affect air quality in Southeast Alaska, as occurred in 2004.

The cumulative effects from climate change alone and in combination with other stochastic events and with timber harvest are difficult to predict. Warmer temperatures are expected to result in a loss of carbon stored in leaf litter and soil organic matter, due to increased soil respiration (Bachelet et al. 2005). Other changes are more difficult to predict. Species will respond to changing climates individually; some species and some individuals will be more sensitive and vulnerable than others (Millar et al. 2006). Effects on forests could include expansion into alpine areas, increased loss of trees from insects, disease, windthrow, and/or fire, as well as changes in stream flow and vegetation and the animal species these habitats support; however, the degree of change is uncertain. If significant changes do occur over the next several decades, they may affect the range of wildlife, fish, and plant species in Southeast Alaska, as well as human use of these resources.

Cumulative effects on carbon sequestration depend on the amount of forest land harvested, the use to which harvested wood is put, how the non-NFS land is managed, on the amount of carbon released during harvest, processing, and transporting wood products, on-site decomposition, and factors such as the amount of new hydroelectric power (replacing diesel generated power), community expansion, and cruise ship emissions. It is likely that most of the state and private commercial forest land in Southeast Alaska, except for state parks and some other state lands, would be managed for the production of forest products under any of the alternatives considered in this analysis. The maximum amount of suitable land on the Tongass that is likely to be scheduled for harvest over the next 10 years would vary from nearly 18,000 acres under Alternative 1 to nearly 160,000 acres under Alternative 7. Higher levels of harvest would only occur if additional manufacturing facilities and markets are developed and on many other factors, such as funding and staff levels. If the products resulting from harvest are primarily lumber and other building materials, there is a potential that the carbon in these products would be stored for the life of the buildings, longer if the wood is recycled or placed in landfills. If the wood is used for paper products or fuel, carbon storage would be short term. Any temporary storage of carbon in lumber products may be completely off set by carbon released during and after harvest, transportation, and processing. Whether carbon sequestration would actually increase or decrease is unknown.

Additional research and monitoring is needed to effectively manage carbon in the forests of Southeast Alaska. In particular, information is needed on how changes in climate may affect plants, insects, and fungi in Southeast Alaska. Effects may include longer growing seasons due to warmer temperatures or shorter growing seasons due to dryer summer weather. Longer growing seasons and forest expansion into alpine areas may lead to additional carbon sequestration, though this may not always be the case. Carbon incorporated into needles, leaves, twigs, cones, and herbaceous plants that decompose quickly will not sequester much carbon (Millar et al. 2006). Carbon incorporated in the boles and main roots will be sequestered for at least the life of the tree. Climate change may result in changes in fire frequency and/or severity or may speed decomposition of dead material, either of which would release additional stored carbon. As information is gathered, adaptive management strategies can be developed to respond the environmental changes.

One monitoring effort that tracks changes in vegetation is the Forest Inventory and Analysis-Forest Health Monitoring (FIA FHM) program. The existing FIA plots containing lichen and vascular plant data could be combined with Tongass air quality biomonitoring plot data to develop air pollution and climate gradient models that predict changes in lichen communities and other vegetation due to projected climate change scenarios. Annual insect and disease surveys also provide information on how climate change may be affecting forests. Stream gauges, some of which provide long-term data on stream flow, are another tool. The Tongass will work with Pacific Northwest scientists to develop other monitoring measures to alert the Forest Service to trends that may affect the health of the Forest and the species that depend on it.

No significant cumulative effects on global carbon sequestration levels are expected under any of the alternatives considered in this analysis. Leighty et al. (2006) estimate that all the carbon stored in the forests of the Tongass represents approximately one quarter of 1 percent of the stored carbon in forests world wide. Carbon stored in forests, including forest soils, represent a small portion of total global carbon storage (terrestrial, ocean, atmospheric, and fossil carbon pools). For example, the oceans store approximately 20 times as much carbon as all terrestrial systems (IOC 2007). Therefore, it is reasonable to conclude that small changes in carbon sequestration on the Tongass, whether positive or negative, would have a minor effect on atmospheric carbon levels.

While there is general agreement among scientists that the climate is warming, there is considerable uncertainty concerning the exact effects of climate change on the forests of Southeast Alaska and how best to deal with possible changes to the many resources on the Tongass. There is a risk that climate change may result in increased blowdown, increased tree mortality from insects and disease, increased fire frequency and severity, adverse effects on air quality, changes to vegetation, streams, and fish and wildlife habitat, and, therefore, on subsistence and recreation.

The rate of decline and mortality of yellow-cedar in Southeast Alaska may be increased as a result of climate change. The snowpack in low-elevation areas may continue to be reduced as a result of the warming trend, resulting in greater exposure of fine roots to freezing, especially in the southern portion of the region (see *Forest Health* section).

The current warming trend may increase the number of severe windstorms, increasing the risk of catastrophic blowdown events. Juday et al. (1998) state that as of the date of their report, the increased frequency of storms in the last few decades has not corresponded to an increase in large-scale blowdown in Southeast Alaska and the 2006 Forest Health report noted very little blowdown in aerial and ground surveys (USDA Forest Service and ADNR 2007); however, this does not rule out the risk of increased windthrow in the future as additional warming occurs.

As noted above, climate models from both the Canadian Climate Center and the Hadley Center predict rising temperatures and a 10 percent decrease in summer precipitation in portions of Southeast Alaska. Both models also predict decreased soil moisture due to increased evaporation during warmer, drier summer weather. These factors may lead to an increase in fire frequency and severity. Both of these climate models predict an increase in the mean seasonal severity rating for fires in Southeast Alaska by 2060, ranging from 10 to 30 percent, depending on the model (Dale et al. 2001). Currently, fire is not a factor in the ecology of Southeast Alaska, and an increase of 30 percent would still result in very few fires. Given the high rainfall levels in Southeast Alaska (Ketchikan had only 2 days without rain in July 2006), a 10 percent decrease in summer rainfall would still result in wet conditions in most years. However, Southeast Alaska does occasionally experience drier conditions. For example, in July 1971 there were 23 days without rain. If warmer winter weather results in higher insect populations and increased tree defoliation (as discussed above), there is a risk that increased dead material and warmer, drier weather may spawn more fires than are normal for the area. As Berman et al. (1998) state, it is difficult to predict the magnitude of area likely to be burned in a region without an historic fire record, but they estimate that most fires would be small and of low intensity, suggesting a scenario in which 5,000 acres might burn over a period of decades (an average of approximately 100 acres per year). Juday et al. (1998) also suggest that the effects of fires on resources are likely to be low.

In addition to adversely affecting wildlife habitat and releasing additional carbon into the air, fires, either in Southeast Alaska or in neighboring British Columbia, could adversely affect air quality, as fires in western Canada did in 2004. Many scientists (Neilson 2007, Millar et al. 2006) recommend keeping forest density below full stocking to reduce stress on individual trees; this in turn may reduce insect and disease mortality, which may reduce fire risk and severity. Whether this strategy would be useful (or effective) in Southeast Alaska is uncertain.

Forest losses, either from insects, diseases, or fire, could harm wildlife habitat, which in turn could adversely affect subsistence resources. Conversely, Juday et al. (1998) suggest that warmer winters will result in sustained higher populations of Sitka black-tailed deer, one of the most important subsistence resources for residents of Southeast Alaska and a major prey species for wolves. Juday et al. (1998) also postulate that warmer, drier conditions could increase stream temperatures and cause seasonal low flows, both of which could adversely affect salmon. Berman et al. (1998) estimated that a 25 percent decline in salmon stocks would result in a loss of $25 million a year (approximately $31 million in current dollars). However, Oswood et al. 1992 state that melting glaciers would result in more runoff entering streams. This could offset any decrease in summer flows due to reduced summer precipitation, at least in the short run. In time, glacial mass would be reduced and their contribution to stream flow would decrease. Oswood et al. also believe that climate change would result in changes to the nutritional levels of leaf material entering streams, but could not predict whether this would have a positive or negative effect of fish.

In summary, general agreement exists that the climate is warming and indications are that summer precipitation may decline. However, there is considerable uncertainty surrounding specific predictions and even more uncertainty regarding the effect of these changes on the extent of fire, tree mortality, blowdown, air quality, fish and wildlife, subsistence, and recreation.

Geology, Karst, and Caves

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Affected Environment

Geology

The Tongass National Forest is underlain by complex geology. Southeast Alaska is located near the boundary between the Pacific and North American tectonic plates. During the past 170 million years, tectonic movements have brought massive crustal blocks from across the Pacific Ocean and lodged and welded them onto the edge of the North American plate. The resulting southeast-northwest trending rock belts, or accreted terranes, include a wide variety of geologic materials (Nowacki et al. 2001). As the Pacific and North American plates collided, the coastal mountains of Southeast Alaska were uplifted. More recently, fault movements have offset the accreted terranes, adding further geologic complexity to the region. This tectonic plate boundary forms part of the "Ring of Fire," the area around the Pacific Ocean that is high in volcanic, mountain-building, and seismic activities. Evidence of relatively recent volcanic activity exists within the Tongass National Forest. The last certain activity of the Edgecumbe volcanic field occurred between 4 and 6 thousand years ago (Alaska Volcano Observatory 2006). Many volcanic features are also found on southwestern Suemez Island, including several surface flow types, obsidian sources, volcanic vents, and unique geomorphic features.

Together these tectonic, seismic, and volcanic forces have resulted in many different geologic formations in Southeast Alaska. Within the Tongass National Forest, generalized lithologies have been delineated and include granitics, noncarbonated sedimentary, carbonate sedimentary, metasedimentary, complex sedimentary and volcanics, volcanics, and mafics/ultramafics (Nowacki et al. 2001). During the past 12.5 million years, many of these lithologies have been affected by glaciers.

Within the Tongass National Forest, recurrent ice sheets formed and spilled from the St. Elias and Coast Mountains onto adjacent surfaces (Nowacki et al. 2001). Pushing seaward, these continental ice sheets combined with smaller alpine glaciers descended from isolated island peaks. Together, the ice sheets and glaciers reworked the topography of the land by rounding mountains, scouring bedrock, depositing glacial sediments, and carving U-shaped valleys and submarine trenches. In some areas, unconsolidated sediments were left, including glacial till (ice-contact deposits), glacial outwash, and glacial marine sediments. During the last glacial maximum, ice flowed all the way to the continental shelf. As glaciers retreated worldwide, the ice sheet receded first at coastal margins, then north and eastward along major channels and valleys into the mountains. Deglaciation was rapid and largely complete by 13,500 years ago.

The group of islands and fjords that currently make up the Tongass National Forest developed after the last major glacial retreat as seawater flooded the deeply incised valleys and trenches. Since deglaciation, coastlines have shifted dramatically due to tectonic events, worldwide sea level changes, and land rebound in the absence of the glaciers' massive weight. Elevated fossil-bearing marine beaches and deltas along the coastline indicate an uplift of the land relative to the sea since the last glacial maximum.

There are multiple sites with important vertebrate and invertebrate paleontological resources throughout the Tongass, including 220 million year-old sites on Gravina Island and the islands in Keku Strait (Baichtal 2006). Many important paleontological resources have been identified in caves on the Tongass National Forest.

As a result of the geological processes in Southeast Alaska, the region's physiography is topographically complex. Broad physiographic areas in the Tongass National Forest include icefields, recently deglaciated areas, large mainland river systems, angular mountains, rounded mountains, hills, lowlands, and recent volcanic fields. These distinct areas reflect the geomorphic and glacial history of the land. Continental ice sheets flowed, scoured, and deposited materials, tectonics added blocks of distinct geology, and volcanism superimposed younger rocks.

Karst and Caves

The geology and climate of Southeast Alaska are particularly favorable for karst development. Karst is a comprehensive term that applies to the unique topography, surface and subsurface drainage systems, and landforms that develop by the action of water on soluble rock (primarily limestone and marble [carbonates] in Southeast Alaska). The dissolution of the rock results in the development of internal drainage, producing sinking streams (streams that sink into the stream bed or karst features), closed depressions, sinkholes, collapsed channels, and caves.

Karst: A type of topography, drainage system, and landform that develops in areas underlain by soluble rocks, primarily limestone and marble (carbonates). About 3 percent of the land within the Tongass boundary is underlain by karst.

There are approximately 538,000 acres of very pure carbonates within the boundaries of the Tongass National Forest. This area includes carbonate bedrock on federal, state, and private lands. Approximately 458,000 acres of karst are on National Forest System (NFS) lands.

Because of fractures in the carbonates, high annual precipitation, and peatlands adjacent to the carbonate bedrock, karst has developed, to varying extents, within all carbonate blocks. The Tongass National Forest contains the largest known concentration of dissolution caves in Alaska.

In Southeast Alaska, the karst landscape can be characterized as an ecological unit found atop carbonate bedrock in which karst features and drainage systems have developed as a result of differential solution by surface and ground waters. These acidic waters are a direct product of abundant precipitation and passage of these waters through the organic-rich forest soil and adjacent peatlands. Recharge areas may be on carbonate or adjacent noncarbonate substrates. A few characteristics of this ecological unit include mature, well-developed spruce and hemlock forests along valley floors and lower slopes, increased productivity for plant and animal communities, extremely productive aquatic communities, well-developed subsurface drainage, and the underlying unique cave resources (Baichtal and Swanston 1996). The visible karst landscape also contains "epikarst," or surface features, particularly in the alpine and sub-alpine zones. These include deep shafts and fissures, eroded rills, and spires or spikes of limestone.

Karst lands add a vertical, underground dimension to land use planning. Karst subsurface drainage networks generally operate independently of, and with more complexity than, the surface drainage systems above, and the watershed characteristics of the surface may have little or no relationship to the subsurface system. On karst lands, the many solution-widened fissures at the surface become entry points into the subsurface drainage system, where water and sediment from surface sources move vertically downward into the underground lateral systems. Sediment and water from disturbed lands or roads may enter this system at a single point and emerge unexpectedly at one or more distant springs, sometimes crossing surface watershed boundaries. Karst groundwater systems routinely transport water for several thousands of feet to receiving caves, springs, and surface streams.

Most Tongass National Forest caves pre-date the most recent glaciation, as evidenced by the presence of glacial clays, glacial sediments, wood, Pleistocene vertebrate remains, and possibly ancient ice. Speleothems (i.e., secondary mineral deposits such as stalactites, stalagmites, flowstone, and crystal growths) from El Capitan Cave, on Prince of Wales Island, have been radiometrically dated to between 107,000 and 115,000 years old, or during the last interglacial period. Speleothem dates from other caves in the Tongass National Forest range from 53,000 to 185,800 years old. The most recent glaciation modified a pre-existing karst landscape, collapsing some passages and systems, gouging into others, and filling some with sediments. The epikarst (surface karst), which is well developed in higher elevations, has been removed in places at lower elevations by glaciation. Where low-elevation epikarst is present, primarily on the outer coast of islands seaward of Prince of Wales Island, vegetation has been re-established and a forested epikarst created. With the development of forested epikarst and peatlands, and the entrance of associated acidic waters into underground tributaries, a system of enlarged caves and vertical shafts has developed.

There is a definite tie between the karst landscape and the productivity of the spruce and hemlock forests found there. Dense stands of very large diameter spruce and hemlock at lower elevations are characteristic of many karst landscapes. The major contributors are believed to be the nutrient rich soils, well-developed subsurface drainage, and dissected bedrock surface, which allows the tree roots to hold fast and become more windfirm. The old-growth forest on this low-elevation karst provides a well structured, multi-layered canopy resulting in high-quality winter habitat for many wild species. The structure of the forest provides many forbs and shrubs, which provide forage. It is possible that this forage contains, at a minimum, higher calcium levels allowing for better bone, muscle, and antler development. The combination of quality forest structure and abundant nutritional browse make the karst landscape, in general, exceedingly important habitat.

Many wildlife species, including mammals, birds, and invertebrates, find the surface karst features and the stable environment and shelter provided within the caves to be valuable habitat (Baichtal and Swanston 1996). Cave systems provide critical summer and winter roosting and hibernating habitat for bats (Baichtal and Swanston 1996). Preliminary studies suggest that aquatic habitats associated with karst landscapes may be 8 to 10 times more productive than adjacent non-karst aquatic habitats (Baichtal and Swanston 1996). Karst aquatic habitats support a greater abundance, distribution, density, and variety of invertebrate species than non-carbonate habitats, have higher growth rates for smolts and resident fish, have less variable water temperatures and flow regimes, and contain unique habitat affecting species distribution, abundance, and adaptation.

The potential cultural and paleontological significance of the caves and karst landscape is high (Baichtal and Swanston 1996). The Pleistocene paleontology of the area is primarily known from cave and rock shelter deposits, which are often intimately related to archaeological sites. The cool, stable, non-acid environments in the caves result in exceptionally good preservation of bone and organic materials. To date, significant archaeological and paleontological materials have been discovered in over 30 caves and rock shelters within the Tongass National Forest. Evidence of human habitation, the oldest dating to nearly 9,730 years before present (BP), has been discovered in several caves on Prince of Wales and nearby seaward islands. Eighteen black bears (*Ursus americanus*), one dating to approximately 39,000 years BP, and 13 brown bears (*Ursus arctos*) ranging in age from 35,363 to 7,205 years BP and now extinct on Prince of Wales Island, have been found.

Of the 458,000 acres of NFS karst lands, approximately 303,000 acres were originally productive old growth (POG). Based on GIS queries, 95,000 of these POG acres (31 percent) have been harvested, leaving 208,000 acres of existing POG on NFS karst lands. Outside of NFS lands, approximately 77,000 acres of karst have been mapped, and about 26,000 of these acres were originally POG. At least half of these non-NFS POG acres on karst have been harvested.

Aerial and on-the-ground observations are revealing the effects of past resource management on karst systems. Hydrologic evidence suggests that timber harvest increases the amount and changes the timing of peak surface flow, resulting in accelerated sediment and debris transport. Passages have flooded, which had not flooded for centuries, and many cave entrances were infilled and/or blocked by logging slash, sediment, and debris, resulting in surface flows being rerouted into different passages. In the past, runoff generated from road surfaces commonly was diverted into karst features. It is not yet fully known what cumulative effects past timber harvest have had on the epikarst landscape. In some portions of the Tongass National Forest, 70 to 80 percent of the commercial forest land within specific karst blocks has been harvested. Overall, 38 percent of original POG on karst lands below 800 feet in elevation have been harvested on the Tongass. In the North Central Prince of Wales Biogeographic Province (which includes most of Thorne Bay Ranger District and part of the Craig Ranger District), 51 percent of the original POG on karst lands below 800 feet have been harvested.

One of the five additional “emphasis areas” identified during the 1997 Tongass Forest Plan Revision was karst and cave resource management. Responding to the need for a management strategy, standards and guidelines were developed that provided for other land uses while taking into account the function and biological significance of the karst and cave resources within the landscape. This strategy was developed during the 4 years prior to completion of the 1997 Tongass Forest Plan, beginning with the recommendations of a karst and cave resource significance assessment completed by Aley et al. (1993, as cited in USDA Forest Service 1997a) and combining the most current thinking on karst management issues. The Forest began adopting a land management strategy for the karst lands similar to “hazard area mapping” or “risk assessment.” Referred to as “vulnerability mapping” or “karst vulnerability,” this strategy assesses the susceptibility of the karst resources to any land use. Vulnerability mapping utilizes the fact that some parts of a karst landscape are more sensitive than others to planned land uses. The key elements of the strategy focus on the openness of the karst system and its ability to transport water, nutrients, soil and debris, and pollutants into the underlying hydrologic systems. The strategy strives to maintain the capability of the karst landscape to regenerate a forest after harvest, to maintain the quality of the waters issuing from the karst hydrologic systems, and to protect the many resource values within the underlying cave systems as per the requirements of the Federal Cave Resources Protection Act (FCRPA).

On the low to moderate vulnerability karst lands (defined in the Karst and Cave Resources Standards and Guidelines of Chapter 4 in the Forest Plan), where mineral or glacially derived soils fully or partially cover the epikarst, forest regeneration is exceptional. In these areas, even the complete loss of soil and litter from the surface of the limestone will not prohibit the re-establishment of a forest because the displaced surface materials are retained within the epikarst channels (Harding and Ford 1993, as cited in USDA Forest Service 1997a). On highly sensitive karst lands, the epikarst channels are too deep to allow conifer seedlings to establish themselves even if the displaced soil is retained. The bottom of the channels may also be open, directly transporting sediment and debris into the karst groundwater system. Highly sensitive or vulnerable karst areas are generally found at higher elevations, have thin organic soils that are easily displaced, are on steeper slopes, or are in areas of intense karst development. Previous harvest in such areas has increased the percentage of bare rock, resulting in less-than-desirable forest regeneration.

Recent implementation and effectiveness monitoring (USDA Forest Service 2004a) found that the Karst and Cave Standards and Guidelines outlined in Forest Plan were being implemented to the fullest extent practicable. Karst resource input was provided for a number of sales, including those on the Thorne Bay Ranger District, where forested karst lands are most extensive.

Although most caves found to date on the Tongass are not suitable for recreation purposes because of frequent flooding, instability, or presence of fragile structures, the Forest Service is seeking opportunities for surface and subsurface public access and interpretation.

Karst areas in Southeast Alaska are most comparable to those of karst lands found on Vancouver Island and the Queen Charlotte Islands of British Columbia (Canada), portions of Patagonia (Chile), Tasmania, and the west coast of the South Island of New Zealand. All of these areas have very steep surface slopes and subsurface hydraulic gradients, and very high levels of rainfall. These characteristics put them among the most dynamic karst terrains on earth, evolving and changing more rapidly and abruptly than karst in more moderate settings. The Karst Panel Report (Aley et al. 1993, as cited in USDA Forest Service 1997a) found the karst lands of the Tongass National Forest to be of national and international significance for a variety of reasons. The Karst Review Panel in the summer of 2002 confirmed these findings (Griffiths et al. 2002). Both of these panels consisted of world renowned karst experts with a breadth of karst resource backgrounds and a wide variety of international exposure to karst areas and management considerations. Not only is the level of karst development and the karst hydrology and mineralogy globally significant, the paleontological and archaeological discoveries have provided information on the prehistory of Southeastern Alaska and contributed to and challenged theories of the peopling of North America.

The natives and local inhabitants of Southeast Alaska have long known of the presence of caves. The existence of well-developed cave systems was first reported in 1975 and mapping of the caves began in 1987. The existence of vast areas in which karst had developed was fully recognized in 1990. Though noted by early foresters and geologists, the relationship between high site productivity and the presence of karst landscape became apparent at about this same time. With the passing of the FCRPA in 1988, the Forest struggled with methods to protect the many caves throughout the landscape. At first, protection focused on the large, significant karst features and cave entrances. Subsequent measures tended to look at entire karst hydrologic systems.

As of 2006, the Tongass inventory includes 611 caves (plus one state cave). Of these, 290 were listed in 1996 during the initial process of identifying significant cave resources. An additional 87 caves were added in 2003. The Tongass National Forest has received another 57 nominations that are pending. The remaining 177 caves do not have nominations. Intense karst development has been identified on northern, central, and south-central Prince of Wales Island, Kosciusko Island, Dall Island, Heceta Island, Revillagigedo Island, and on the mainland southeast of Wrangell (Baichtal 2006).

Approaches to characterizing karst areas on the Tongass National Forest in recent years have included tracer dye studies to define karst watersheds and water quality parameters, physical monitoring of karst springs, and measurement of rainfall (USDA Forest Service 2004a). These efforts provided preliminary data on how karst groundwater systems and water chemistry relates to precipitation and runoff. These data will be used to establish baseline conditions, and will be compared with karst conditions monitored after implementation of management activities. In addition, Light Distancing and Ranging (LiDAR) technology has been used in ongoing inventories of karst and cave resources.

Environmental Consequences

Geology

Updates to the Forest Plan standards and guidelines would apply under all alternatives except the Alternative 5 (No Action). The standards and guidelines related to geology would be updated under the proposed Forest Plan. The focus of the revisions would be to identify and find solutions to management problems related to geologic resources, and to develop geologic resources on the Tongass National Forest. Geologic inventories would be conducted to cover bedrock geology, surficial geology, stratigraphy, hydrogeology, geomorphic features, geological hazards, karst features, caves, and paleontology, including potential for geologic formations to yield fossil resources of scientific and other values. The focus on geologic resources could result in greater protection of unique features and greater utilization of geological resources. Refer to the *Minerals* section for more information on potential effects related to mining and mineral resources.

Karst and Caves

Karst lands have separate issues and concerns compared with other landforms because karst is a three-dimensional landform with closely integrated surface and subsurface processes. Groundwater flows relatively slowly through porous rock and soil, or via fracture flow, in non-karst terrain. In karst terrain, groundwater may flow relatively quickly through complex underground systems of solution-widened conduits that vary from fissures a few inches wide to cave systems many feet wide. Potential effects to karst systems and caves and associated drainages from timber harvest and road building include changes in hydrology, infiltration rates, sediment production, debris transport, pollutants, and introduction of organics that can lead to oxygen depletion. Issues and concerns related to karst lands primarily revolve around potential changes to groundwater flow in the underground system. Any management activity that causes sediment or organic debris to build up in the subsurface conduits decreases the capacity of these conduits and makes the formation of surface streams more likely. Similarly, any management activity that increases groundwater recharge may also affect the capacity of the conduits in the underground system and make formation of surface streams more likely. Changes in the presence of surface water can produce broad ecosystem changes both above and below ground. Groundwater recharge in karst lands occurs by either discrete or diffuse recharge. Discrete recharge refers to losing or sinking streams that enter the subsurface at specific insurgence points. Diffuse recharge refers to subsurface entry of water through the forest floor and the epikarst. Losing or sinking streams can rapidly deliver sediment into subsurface passageways.

Sediment transport into karst systems also produces concern. This concern is primarily attributed to the size of past harvest blocks and the rate at which the landscape was harvested prior to the early 1990s, when the extensiveness and significance of karst terrain on the Tongass National Forest became more fully recognized. The current standards and guidelines address these concerns to a high degree.

Potential effects on karst lands from planned timber harvesting, associated road construction, and quarry development may occur; however, with careful implementation of the current or proposed standards and guidelines (as modified through ongoing monitoring and adaptive management), and site-specific mitigation measures (designed and implemented at the project level), the Forest expects to mitigate the effects of any proposed activity. Site-specific mitigation measures include protection of the high vulnerability karst areas and features, partial cutting, reduced harvest unit size, use of logging systems that achieve at least partial suspension, reductions in rate of harvest, and other changes in logging practices.

The Karst Review Panel in the summer of 2002 found that implementation of the Karst and Cave Standards and Guidelines from the current Forest Plan had ensured a high level of protection for karst resources overall (Griffiths et al. 2002). The Panel noted high standards in both the philosophy of management and the way that specific management practices were formulated and applied. Implementation of specific policies and procedures was found to be very good and in general compliance with the stated goals and objectives of the karst program. The Panel also noted the extent to which high vulnerability karst had been protected since 1997. In addition, the Panel outlined the action required to more actively manage karst landscapes covered with second-growth stands and recommended a new procedure for assessing the autogenic (precipitation on carbonate rocks) recharge component of karst units.

Implementation and effectiveness monitoring of these karst and cave standards have brought to light a few discrepancies (USDA Forest Service 2004a). Specifically, the definition of low, moderate, and high vulnerability karst lands; the application of appropriate mitigation; the approach to catchment area management; and the resolution of conflicts with riparian management standards have surfaced as topics that need clarification. These have been addressed in the proposed Forest Plan, as discussed below. In addition, continued training and involvement of karst specialists, hydrologists, soil scientists, and other resource specialists has been identified as essential to implementing the standards and guidelines.

Several elements of the Karst and Cave Standards and Guidelines would be updated under the proposed Forest Plan as part of all alternatives except Alternative 5 (No Action). Most importantly, the issues identified as unclear in the current Forest Plan would be clarified, as described with the following explanations. The four-step process to complete a karst landscape assessment would be described in detail, including specific guidance for determining low, moderate, and high vulnerability karst. Depending on level of vulnerability, some management activities would be restricted on karst lands, and mitigation measures would be specified. Catchment areas would be explained, including allogenic (precipitation on non-carbonate rocks) and autogenic (precipitation on carbonate rocks) recharge areas. The potential effects related to second growth management (including commercial thinning), salvage of windthrown timber, and mineral development on karst lands would be addressed, and restrictions detailed based on the level of karst land vulnerability. The proposed standards and guidelines would provide detailed descriptions of factors to evaluate implementing management activities on or near karst lands; however, they also would allow flexibility depending on the professional judgment of karst-trained specialists.

The Karst Review Panel in the summer of 2002 found that implementation of the Karst and Cave Standards and Guidelines from the current Forest Plan had ensured a high level of protection for karst resources overall (Griffiths et al. 2002). The Panel suggested the proposed changes to define appropriate resource management activities in areas of karst management that were unclear in the current version of the Forest Plan. The action alternatives (Alternatives 1, 2, 3, 4, 6, and 7) would incorporate some of these changes in revised standards and guidelines and through proposed designation of new geologic Special Interest Areas. These new Special Interest Areas include all identified high vulnerability karst lands that are not already protected within non-development Land Use Designations (LUDs). Refer to the *Other Special Land Use Designations* section for more information. Significant effects to karst lands and caves have been avoided during implementation of the current Forest Plan. The proposed changes would likely protect karst lands and caves to an even greater extent.

Much of the karst land within development LUDs has been designated as high vulnerability karst land and is protected by standards and guidelines or included within geologic Special Interest Areas. It is estimated that 30 percent of the other karst lands will be determined to be high vulnerability karst with ground verification in the future.

Approximately 457,765 acres of karst underlies NFS lands inside the Tongass National Forest. Under Alternative 5 (No Action), the estimated maximum future harvest on NFS karst lands would be approximately 76,459 acres, including POG and young growth on suitable karst lands (Table 3.2-1). Alternative 6 would involve slightly less area, and Alternatives 1, 2, and 3 would include fewer areas of estimated maximum future harvest on karst lands. Alternatives 4 and 7 would include the most area of karst lands open for timber harvest activities (Table 3.2-1). Based on the current Forest Plan and proposed changes, karst inventories and vulnerability assessments would be required before timber harvest could occur on suitable lands.

Table 3.2-1
Estimated Maximum Future Tongass Harvest on Karst Lands under the Alternatives

Alternative	Old Growth on Karst Lands (acres)	Young Growth on Karst Lands (acres)	Total Area (acres)
Alternative 1	11,941	17,198	29,140
Alternative 2	17,745	42,737	60,482
Alternative 3	19,813	46,358	66,170
Alternative 4	32,512	53,310	85,822
Alternative 5	24,946	51,513	76,459
Alternative 6	22,549	50,079	72,628
Alternative 7	44,121	59,287	103,408

No additional harvest is anticipated in any areas mapped as high vulnerability karst under any of the alternatives. These areas are included in the 42,873 acres of Special Interest Areas under Alternatives 1, 2, 3, 4, 6, and 7, and are not suitable for harvest under Alternative 5. The estimated maximum amount of future POG harvest that could occur on NFS karst lands would vary by alternative, ranging from 11,941 acres under Alternative 1 to 44,121 acres under Alternative 7 (Table 3.2-1).

The maximum amount of construction of new roads on karst lands would also vary by alternative, ranging from 115 miles under Alternative 1 to 329 miles under Alternative 7 (Table 3.2-2). The percentage of new roads that would be constructed on karst lands ranges from 5 or 6 percent under Alternatives 4, 5, 6, and 7 to 15 percent under Alternative 1, where fewer roads would be constructed but a larger percentage of them would be constructed on karst lands. Of these proposed new roads on karst lands, from 1 to 2 miles would occur on slopes greater than 67 percent (Table 3.2-2).

Table 3.2-2
Estimated Maximum New Road Construction on Karst Lands under the Alternatives

New Roads on Karst Lands	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5	Alt. 6	Alt. 7
Length of New Roads on Karst Lands (miles)	115	183	194	259	216	206	329
Percent of New Roads on Karst Lands	15%	9%	7%	5%	6%	5%	6%
Length of New Roads on Slopes >67% on Karst Lands (miles)	1	2	2	2	2	2	2

Cumulative Effects

There are approximately 537,588 acres (840 square miles) of karst lands within the boundaries of the Tongass National Forest. Approximately 457,765 acres (715 square miles) are on NFS lands. Of this, approximately 247,680 acres (387 square miles) are protected in Wilderness, LUD II, or other non-development LUDs under the current Forest Plan. The remaining high vulnerability karst on NFS lands are protected by standards and guidelines that include substantial no-harvest buffers.

Past timber harvest has affected the epikarst landscape on the Tongass National Forest. In some portions of the Tongass, 70 to 80 percent of the commercial forest land within specific karst blocks has been harvested. It is estimated that about 21 percent (95,479 acres) of the karst lands on NFS lands have been harvested (based on the GIS database). Approximately 133 square miles of karst land have been harvested on Prince of Wales Island alone. In addition, 575 miles of authorized or system roads have been mapped on karst lands (out of 3,532 total authorized road miles). These 575 miles include 116 miles at Maintenance Level 1 (closed), 338 miles at Maintenance Level 2 (for high-clearance off-road vehicles), and 112 miles at Maintenance Levels 3, 4, and 5 (the highest maintenance levels, maintained for passenger vehicles). It is likely that a few hundred miles of unauthorized roads also exist on karst terrain. Of the 575 miles of roads mapped on karst lands, 87 percent occur on slopes of less than 35 percent, 13 percent occur on slopes of between 35 and 67 percent, and less than 1 percent occur on slopes of greater than 67 percent.

Baichtal and Swanston (1996) observed sediment deposits and waterline marks in underground systems that suggested that past timber harvesting had increased sediment and debris transport and flooding of underground passages, many of which had not previously flooded for centuries. These timber harvests were conducted prior to the Karst and Cave Resources Standards and Guidelines implemented in the 1997 Forest Plan. As a result, they had more significant effects on karst lands than current and future harvest activities. At that time, many cave entrances were filled or blocked by logging slash, sediment, and debris. Additional runoff generated from road surfaces commonly had been diverted into karst features. They also noted strong evidence of greatly increased surface runoff on karst landscapes and adjacent surfaces after timber harvest, which increased sediment, nutrient, and debris transport capability of associated drainage networks.

Based on information from Prince Wales Island, Baichtal and Swanston (1996) noted few tree regeneration problems in low-elevation stands on karst landscapes. As a consequence, most easily accessible, low-elevation karst areas on the island had been harvested. After the initial timber harvests, harvest activities concentrated on steeper, higher elevation karst landscapes characterized by shallower, excessively well-drained soils. Baichtal and Swanston (1996) suggested that trees were smaller and regeneration problems were greater at these steep, upper elevation sites. This condition possibly resulted from shallow soils with low nutrient availability, excessive drainage of surface and soil waters into subsurface karst systems, removal of much of the shallow soil because of inadequate log suspension, and continued desiccation of the soil once the protective forest canopy was removed. After timber removal, high rainfall rapidly transported fragile soils into the well-developed epikarst.

More recent monitoring of karst lands near harvested areas (USDA Forest Service 2004a) have confirmed that current timber harvest practices have adjusted substantially to accommodate Karst and Cave Standards and Guidelines. For example, karst resource input was provided for timber sales projects throughout the Tongass.

Extensive landscape changes and ground disturbance have occurred and are likely to continue to occur on non-federal lands in Southeast Alaska. These include timber harvest and road construction, mining, recreation and tourism, growth of human settlements, transportation projects, and energy and transmission projects. Forest Service regulations requiring protection of karst resources do not apply to non-federal lands. Approximately 88,000 of the nearly 538,000 acres of karst lands within the Tongass National Forest boundary are on state or private lands. Assuming that none of the karst on state or private lands is protected, an estimated 69 to 74 percent of all the karst lands in Southeast Alaska would be protected in non-development LUD areas under the alternatives.

Transfers of karst lands from NFS lands to other land managers or private owners could also occur under any of the alternatives through land exchanges or other types of land adjustments (see the *Lands* section and Appendix C to the Final EIS). The karst forest lands on Prince of Wales and neighboring islands are among the candidate lands that have been discussed in the past. This type of future action could increase the amount of karst lands in Southeast Alaska that are not in a protected LUD. Any exchange or other type of adjustment (outside of legally required conveyances) would require NEPA analysis, most likely an EIS, which would include public involvement and would disclose any adverse effects to karst and cave resources, as well as to other resources.

Soils

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Affected Environment

Soils in Southeast Alaska develop in parent materials originating from a variety of geological or vegetative sources. Parent material is the inorganic or organic matter in which soils develop, and in the Tongass National Forest includes volcanic ash; glacial deposits; hillslope, stream, and uplifted marine sediments; rock; and deposits of decomposed plant materials. Soils are commonly divided on the basis of their parent material. Both mineral and organic soils occur extensively within the Tongass National Forest, where more than 100 different soils have been identified. Soils cover 84 percent of the inventoried land surface area of the Tongass; the remainder consists of ice, exposed bedrock, and bodies of water.

From a resource management perspective, soil productivity (i.e., a soil's ability to support vegetative growth) and the potential loss of soils or off-site effects from erosion and landslides are the principle concerns. The productivity of soils directly or indirectly affects the productivity of other forest resources. Tree growth, wildlife and fish habitat quality, and recreation uses and potentials depend in part on the quality of soils. In Southeast Alaska, soil productivity, in terms of tree growth, is high on well-drained soils (e.g., on steep slopes and in karst areas) and decreases as latitude and elevation increase and as drainage becomes poorer.

Soil, or site, productivity is generally measured by the rate of biomass accumulation, and site index is commonly used to give a relative indication of this productivity. Site index is determined by the height of dominant trees at a specified age. The site index tables or curves available for use in Southeast Alaska were developed from trees in even-aged stands, not the uneven-aged or old-growth stands that predominate here; consequently, the resulting site index categories are more useful for comparison than as absolute numbers. Soil productivity also can be estimated from the characteristics of individual soil types. The principal characteristics are soil depth, drainage, acidity, and coarse fragment content. Over one-quarter of the total productive forest land in the Tongass National Forest has been mapped in the highest site index category (Category 4), which means that on average these sites will grow trees greater than 80 feet tall in 50 years (Table 3.3-1). Less than 10 percent of the Tongass falls into the lowest site index category (Category 1), which corresponds with trees less than 40 feet high in 50 years. Almost one-quarter of the productive old growth (POG) and two-thirds of the harvested young growth have been mapped as Category 4 (Table 3.3-1).

Table 3.3-1
Estimated Percent of the Productive Forestland on the Tongass by Site Index Category

	Site Index Category					
	1	2	3	4		
Productive Forest Land Category	Avg. Site Index = 0-40	Avg. Site Index = 41-60	Avg. Site Index = 61-80	Avg. Site Index > 80	Unmapped[1]	Total
Productive Old Growth	9%	14%	23%	24%	29%	**100%**
Young Growth – Harvested	4%	6%	21%	66%	2%	**100%**
Young Growth – Natural	13%	6%	16%	39%	26%	**100%**
Total Productive Forest land	9%	13%	23%	28%	26%	**100%**

[1] Unmapped areas are mostly in Wilderness or National Monument.

Soil erosion in the form of gully, sheet, and rill erosion is a minor occurrence under natural, undisturbed conditions in Southeast Alaska, because the thick surface duff layers that cover the mineral soils protect them from surface erosion. Mineral soils can be disturbed and exposed either by natural causes, such as landslides and blowdown, or management activities, such as timber harvest and road construction. Surface erosion can become active once the duff layer is removed and can remain active until revegetation occurs.

Landslides, both naturally occurring and human-caused, dominate soil movement processes on steep forest lands in Southeast Alaska (Swanston 1969, 1974). Although conducted more than 30 years ago, Swanston's papers present excellent characterizations of landslides in Southeast Alaska. Landslides deliver eroded material to streams more quickly, and in greater quantity, than surface erosion. Landslides can seriously retard soil productivity for forest regeneration on slopes by removing the soil mantle down to bedrock or glacial till. It can take 50 to 100 years for soil layers to be rebuilt on exposed bedrock in these landslide areas. Debris deposited on lower slopes and valley bottoms may improve site productivity locally because of incorporation of organic nutrients and improved drainage. Regeneration at such sites is rapid.

In the Tongass National Forest, several factors control soil stability on steep terrain. On steep forested slopes, the dominant failure type is debris avalanche (the failure of a finite mass of water-charged overburden material along a relatively flat surface). These landslides occur primarily at shallow depths (1 to 3 feet) in the soil overburden. The texture of the soil overburden is characteristically gravelly silt or gravelly silty sand; less commonly the texture might be sandy gravel (Swanston 1997). The dominant steep-slope soil types with these textural characteristics in Southeast Alaska have little or no cohesion. Organic content may exceed 30 percent locally because of the downward migration of organic particles into the mineral soil zone, which substantially increases cohesion at some sites. A qualitative system of indexing mass failure provides an indication of the relative frequency of mass failures when vegetation is cleared or the land is disturbed.

Approximately half of the Tongass is made up of lands with slopes less than 35 percent (Table 3.3-2). Approximately one-third of the Tongass ranges in slope from 35 to 67 percent, and the remaining 18 percent exceeds 67 percent slope. Only 13 and 3 percent of POG and harvested young growth exceed 67 percent slope, respectively. In general, these steep slopes pose greater risks for soil erosion through landslides.

Table 3.3-2
Estimated Percent of the Tongass National Forest, POG, and Young Growth by Slope Category

		Percent Slope Category			
	Acres	**0-35%**	**35-67%**	**>67%**	**Total**
Productive Old Growth	4,951,154	49%	38%	13%	**100%**
Young Growth – Harvested	454,725	68%	29%	3%	**100%**
Young Growth – Natural	233,844	81%	14%	4%	**100%**
Other Areas	11,134,085	49%	30%	22%	**100%**
Tongass National Forest	16,773,808	50%	32%	18%	**100%**

Landslides are thought to be an important natural process by which fish habitat structures and stream substrates are replenished (Meehan 1991, Reeves et al.1995, Wing 2000). Sediments and large woody debris, including gravels, are deposited in stream headwater areas. During high flow periods, some of that sediment and wood is transported through the stream system, although much wood may be stored in headwater channels. A recent study by Martin and Benda (2001) in the Game Creek Watershed found that only about 1 percent of the wood (by volume) from landslides reaches mainstem fish habitat. The wood is typically entrained in the upper reaches of fish habitat on alluvial fans and in transition channels. Sediments may more commonly flush through the stream system. Settled gravel can provide fish spawning habitat. Large wood that does reach mainstem aquatic habitat forms structures for hiding and resting. The frequency of delivery and quantity of the material delivered will determine the effect (either positive or negative) landslides will have on stream channels and fish habitat (Meehan 1991, Reeves et al. 1995, Wing 2000). It is generally thought that increased frequency of slides and quantity of material delivered, above the natural range of occurrence, moves the streams out of equilibrium and degrades fish habitat (Meehan 1991, Reeves et al. 1995, Wing 2000).

One inventory of landslides that occurred between 1963 and 1983 in Southeast Alaska (Swanston and Marion 1991) showed that roughly 10 percent (118) of the landslides occurred in clearcut harvest areas or were directly associated with timber harvesting, whereas roughly 90 percent (1,277) occurred in unlogged areas. On a per-acre basis, however, landslides occurred in clearcut areas about three times as frequently as in unlogged areas. Landslides in unlogged areas appear to be larger and longer than those in logged areas. Of the 1,277 landslides that occurred on unlogged areas, 37 affected fish streams (3 percent), while 7 of the 118 landslides on logged areas affected fish streams (6 percent). It is important to note that clearcut timber harvests conducted between 1963 and 1983 did not include the restrictions that were implemented during the past 15 years or would be implemented in the future. These harvests often involved logging large portions of watersheds with very large clearcuts and almost no buffers, slope restrictions, or other restrictions. One would expect to find more landslides after these earlier clearcuts than after the types of clearcuts expected under the current Forest Plan.

The Soil and Water Standards and Guidelines in the current Forest Plan are important for minimizing potential detrimental soil disturbance. According to results of 2004 soil and water implementation and effectiveness monitoring (USDA Forest Service 2004b), the Tongass National Forest is implementing the standards and guidelines for soil disturbance successfully during timber sale administration and road construction. Data collected on Prince of Wales Island and on the Wrangell and Petersburg Ranger Districts indicate that all timber harvest units, including cable, helicopter, and shovel yarding systems, are within the established Region 10 soil quality guideline of less than 15 percent soil disturbance that is considered potentially detrimental (as set forth in Forest Service Manual 2554).

The current Forest Plan takes a relatively conservative approach to avoid potential effects on soil resources. Seven specific items are listed in the proposed Forest Plan to ensure that land use activities avoid irreversible or serious and adverse effects on soil resources. These are based on research on the effects of management activities on soils in Southeast Alaska. For example, at the Forest Plan level, slope gradients of 72 percent or more are removed from the tentatively suitable timber base because of the high risk of soil mass movement and accelerated erosion of Class IV channel systems (see the *Water* section for more information regarding channel classes). At the project planning level, the Forest Supervisor or District Ranger may approve timber harvest on slopes of 72 percent or more on a case-by-case basis, after on-site analysis of slope and Class IV channel stability and an assessment of potential impacts of accelerated erosion on downslope and downstream fish habitat, other beneficial uses of water, and other resources. The threshold of 72 percent comes from the applicable research conducted in Southeast Alaska (Swanston 1997).

As another example, the effectiveness of standards and guidelines related to yarding methods were monitored in Landwehr (1993). This study involved 199 soil disturbance transects in timber harvest units on the Thorne Bay Ranger District. Mineral soil disturbance on individual transects averaged 4.6 percent. Shovel yarding averaged slightly higher levels of disturbance, 5.1 percent, as compared to cable yarding systems that averaged 4.0 percent. In the Coffman Cove area, where operators were less experienced, shovel yarding averaged 7.1 percent mineral soil disturbance. After operators in the Coffman Cove area were directed to reduce soil disturbance, conditions improved and total disturbance was reduced. Standards and guidelines for overall mineral soil disturbance were met in all the units involved in the study.

A Forest-wide inventory to identify, delineate, and digitize all landslides was initiated in 2001. Landslides are being digitized as an independent layer in GIS. As of 2004, landslide inventories have been completed for approximately 2.9 million acres of the Ketchikan, Petersburg, Sitka, and Wrangell Ranger Districts. Additional landslide inventories are being conducted. To date, the density of landslides is greater in managed stands than in unmanaged areas, which is consistent with the results of the Swanston and Marion (1991) inventory. However, the majority of past harvest activities were conducted under substantially lower protections than current-day harvest activities (see the subsection titled *Past Old-Growth Harvest* in the *Affected Environment* portion of the *Biodiversity* section). Continued emphasis is necessary during timber harvests to implement measures that minimize mass failures and landslides.

Environmental Consequences

Direct and Indirect Effects

Forest management activities can cause soil erosion and subsequent loss of site productivity through the exposure of mineral soil, alteration of subsurface drainage, and the concentration of soil and rock material at unstable sites. The management activities that have the greatest potential to affect soil erosion, including sheet, rill, gully, or mass movement erosion, are timber harvest-associated activities, such as road and log-landing construction, rock pit development, and some yarding methods. Forest-wide standards and guidelines protect all areas of the Forest to a high degree, as indicated by 2004 soil and water implementation and effectiveness monitoring (USDA Forest Service 2004b). Monitoring indicates that the Region 10 soil quality standard of less than 15 percent soil disturbance was achieved during timber harvest activities. Soil erosion and loss of productivity would be expected to be even lower if lands are converted from development LUDs to non-development LUDs, which prohibit timber harvest and most road construction.

Due to the substantial amount of vegetative groundcover remaining on harvest units during and following timber harvest, surface erosion from these areas is usually small (Martin and Kirtland 1995, Swanston 1969). The larger effect of harvest activities on soil erosion occurs as landslides. More than 300 landslides and debris flows were triggered by an October 1993 storm on basin-scale clearcuts on Prince of Wales Island (Johnson et al. 2000). Eroded soil from these landslides was transported as sediment in nearby channels. Channel bedload sediment after the 1993 events was 2 to 10 times greater and relatively finer compared with bedload transport in a channel that had last experienced a landslide and debris flow in 1961 (Gomi et al. 2004). Swanston and Marion (1991) mapped landslides in the Tongass National Forest during the 21-year period, 1963 through 1983. They noted an occurrence rate of 118 landslides per 980 square kilometers (242,163 acres) in harvested or roaded areas over 21 years. Based on this count, an average of one landslide occurred per 2,052 acres of harvest over 21 years, or one landslide per 43,092 acres (on average) per year. They found that landslides were 3.5 times more likely on harvested areas. A more recent study (Johnson et al. 2007) compared the effects from 100 percent tree removal to partial cuts (25, 50, and 75 percent removals). They focused on effects to soil saturation (groundwater levels) and found increasing soil saturation with increasing percent tree removal. Increased soil saturation likely correlates with increased potential for soil erosion through landsliding, although they did not model this possibility directly because of uncertainties in estimating loss of cohesion as a result of changes in root strength in partial cuts.

The effects of timber harvest on soil productivity are described in several papers in Slaughter and Gasborro 1988. Regeneration after clearcutting is excellent on all but a few sites in coastal Alaska, and, once established, growth rates of hemlock and spruce are relatively high (Farr and Ford, in Slaughter and Gasborro 1988). New stands contain several thousand stems per acre, and crown closure begins to take place by age 15 to 20 years. Crown closure approaches 100 percent by 25 to 30 years of age and remains so for 100 years or more. Silen (in Slaughter and Gasborro 1988) also states that more than 90 percent of clearcut areas densely restock naturally in Southeast Alaska. Precommercial thinnings aid in achieving desired stocking levels and increased growth (Pawuk, in Slaughter and Gasborro 1988). Klock (in Slaughter and Gasborro 1988) notes that soil compaction, most frequently by ground skidding operations, leads to reduced timber volume growth. The current and proposed Forest Plan includes standards and guidelines to avoid these effects.

Blowdown, or windthrow, can increase along the edges of regeneration harvest units, and this may expose mineral soil. Blowdown increases the potential for soil erosion and may increase the potential for landslides. According to a study by Kramer (2001), watersheds in the Tongass National Forest that experience more intense soil mixing from windthrow have lower levels of strongly humified soil carbon pools (e.g., lower levels of reprecipitated acid) than areas that have not experienced windthrow. The disturbed watersheds include more organic matter in a partially decomposed particulate form, which translates to less acidic carbon forms, higher ion exchange capacity, higher soil pH, and lower bulk density in the soil (Kramer et al. 2004). The disturbed soils are more aerated, better drained, and have higher nutrient status.

Soil productivity decreases from the construction of roads because land is taken "out of production" (i.e., removed, covered over, or compacted). Erosion increases from the construction of roads because of the destabilizing effect of cuts, fills, and drainage alterations, and the lack of protective vegetation cover on road surfaces and other disturbed areas.

The amount of road construction by alternative is used as a measure of both soil productivity losses and erosion potential. In one attempt to quantify road erosion, Kahklen and Hartsog (1999) developed a multiple regression analysis based on road erosion studies in the Tongass National Forest. They found that road erosion was highly variable. The primary variables that correlated with greater sediment yields were heavier traffic volumes, more rainfall, higher road gradients, and lack of road resurfacing. These and other site-specific variables are evaluated more precisely during project planning, based on the specific conditions found at the project site, and will vary based on soil parent materials, rock durability, slope, location within a watershed, mass movement hazard, and other factors. Paustian (1987) measured short-term effects of road building on soil erosion in the Kadashan watershed that resulted in increased suspended sediment yield equivalent to 2 percent of the estimated annual sediment yields. Potential increases in total estimated sediment yield over a 2-year post-road construction period ranged from 20 to 66 percent in three Kadashan study streams. Montgomery (1994) found that drainage concentration from ridgetop roads caused both landsliding and integration of the channel and road networks. Road drainage concentration increased the effective length of the channel network and strongly influenced the distribution of erosional processes in Southeast Alaska.

Standards and guidelines, Best Management Practices (BMPs), and other relevant mitigation measures are applied at the project level to minimize potential adverse effects. At the Forest Plan level, the overall difference in acres disturbed by roads is a good indication of how site-specific effects are likely to vary between alternatives. Refer to the *Water* and *Fish* sections for more detailed analyses of potential effects related due to roads. Table 3.3-3 displays the maximum acres to be covered by road surfaces after the first 15 years of Forest Plan implementation. In addition, it presents the cumulative acres of road surfaces—the total amount of land area covered by all roads after 100+ years - full implementation of the Forest Plan (assuming none of the roads is completely obliterated).

Under all but Alternatives 4 and 7, the cumulative acres of road surfaces would be equal to or less than expected under the current Forest Plan. The cumulative acres of road surfaces would be smallest under Alternatives 1, 2, and 3. Reductions in soil productivity losses and soil erosion would correlate with smaller cumulative roaded acres.

Table 3.3-3
Estimated Cumulative Acreage Covered by Road Surfaces on NFS Lands after the first 15 Years and after Full Implementation of the Forest Plan (100+ Years) by Alternative[1] (currently there are 14,823 acres covered)

Alternative	Estimated Maximum Cumulative Acres Covered by Road Surfaces after First 15 Years of Implementation	Estimated Maximum Cumulative Acres Covered by Road Surfaces after Full Implementation (100+ years)
1	15,239	17,148
2	16,155	21,063
3	16,822	23,223
4	18,050	29,495
5	17,848	26,448
6	17,713	26,058
7	18,903	32,300

[1] Acres covered by road surfaces are calculated based on an average of 3 acres per 1 mile of road.

Soil mass movements (e.g., slumps, earthflows, debris avalanches, and debris flows) constitute the most potentially damaging type of erosion. They are thought to be the major cause of accelerated erosion resulting from resource management activities. Landslides may adversely affect soil quality. They have the potential to affect aquatic habitats both positively and negatively. Landslides have a positive effect by providing new sources of woody debris and gravel. They negatively affect aquatic habitats by destroying viable eggs by smothering and bed load overturn, and by destroying habitat elements for fish (pools, riffles, log discharge, etc.). Resource management activities would be eliminated if lands were switched from development LUDs to Recommended Wilderness or LUD II, reducing the risk of soil mass movements. Under all alternatives, Forest-wide standards and guidelines limit timber harvest on slopes over 72 percent gradient, as well as on soils classified with an extreme mass movement index.

As part of the effects analysis, the average landslide frequency from the Swanston and Marion (1991) study was applied to the estimated harvest levels likely under each alternative over the first 15 years of Forest Plan implementation. The proposed Forest Plan includes standards and guidelines and mitigation measures that were not in effect during the period of the landslide study (e.g., Riparian Standards and Guidelines, the removal of extreme hazard soils from the suitable land base, and BMPs). The Swanston and Marion (1991) landslide study was based primarily on large-scale clearcut logging with almost no buffers. Fewer landslides would be expected, on average, under the current or proposed Forest Plan.

For the purposes of this comparison, the life of the Forest Plan (up to about 15 years) is used because the landslide occurrences reported by Swanston and Marion (1991) reflect long-term averages. Landslides typically are associated with storm events and large amounts of precipitation, which are highly variable from one year to another. For example, widespread landsliding in headwater tributaries following basin wide clear-cut logging on Prince of Wales Island was triggered by intense rainstorms in 1961 and 1993 (Gomi et al. 2004). The numbers in Table 3.3-4 are used to compare the long-term landslide estimates that may result from the individual harvest levels proposed under each alternative. Despite the limitations listed in the footnotes (i.e., landslide frequencies are anticipated to be lower for each alternative than those displayed in the table), Table 3.3-4 provides a means to compare the relative level of effects under each alternative.

Table 3.3-4
Estimated Maximum Increase in Landslide Frequency over the First 15 Years of Forest Plan Implementation[1]

Alternative	Projected Maximum Acres Old Growth Harvested in First 15 Years[2]	Estimated Maximum Increase in Number of Landslides over First 15 Years
1	26,600	7
2	81,610	20
3	108,764	27
4	186,410	46
5	152,329	38
6	148,210	37
7	242,168	60

[1] This table uses the landslide frequency of one landslide per 2,052 acres in harvested and roaded areas cited in Swanston and Marion (1991) and subtracts off an estimated 0.289 landslide per 2,052 acres for unharvested acreas (based on their estimate of landslides being 3.5 times more prevalent in harvested vs. unharvested areas), in order to estimate the increase due to harvest and roading. It should be noted that Swanston and Marion (1991) measured landslide frequency based on large-scale clearcutting of large portions of watersheds that occurred between 1963 and 1983. Almost no harvest buffers were implemented during that time. The standards and guidelines protective of soil resources that are included in the current and proposed Forest Plans were not implemented. As a result, the estimates represent a maximum that likely far exceeds the landslide frequency that would likely occur under current and proposed timber management.

[2] Based on the acres of old growth scheduled for harvest by the Spectrum model over the first 15 years. These numbers assume that the maximum allowable acres would be harvested during this period, an unlikely scenario. Most likely, fewer acres would be harvested, particularly in the first decade. Any harvest would comply with the Forest Plan standards and guidelines, including buffers, unstable slope restrictions, smaller opening sizes, and BMPs.

Alternatives 1, 2, and 3 would have lower landslide potentials, and Alternative 6 would have a slightly lower landslide potential than under the current Forest Plan (Alternative 5). Alternatives 4 and 7 would result in increased potential, with the trend of increasing risk by alternative shown in Table 3.3-4.

Soil conditions could improve with the proposed changes to off-highway vehicle (OHV) management under each action alternative. Reflecting new national policy, the revised Forest Plan would close the Tongass National Forest to OHV use except where designated as open based on resource concerns and other criteria; however, the designation of open roads will need to be consistent with ANILCA. This approach would likely reduce the localized damage caused by OHV routes. In limited parts of the Tongass National Forest, soil degradation from steadily increasing OHV use over the last 15 years has been documented (USDA Forest Service 2006). Recently developed OHVs have enough power and traction to displace several inches of wet soil in a single pass (USDA Forest Service, 2006, unpublished). Avoiding routes that cross saturated soils with low-bearing strength would prevent ruts, soil compaction, and other resource damages (USDA Forest Service 2006, unpublished). OHV routes on the Yakutat Forelands have changed wetlands, created chronic soil disturbance, and caused sedimentation (USDA Forest Service, 2006, unpublished). By limiting OHV users to defined areas, the revised Forest Plan would address these issues before degradation occurred, the preferable option both ecologically and financially (USDA Forest Service 2006).

Cumulative Effects

Cumulative effects to soils would include both the effects discussed above and other potential effects related to activities outside of NFS lands. The total area within the Tongass National Forest boundary, including both NFS and non-NFS lands, is about

17.8 million acres. Of this area, non-NFS lands make up approximately 6 percent (1.06 million acres). A high percentage of the productive old growth on the non-NFS lands has been or can be expected to be harvested over the next 100+ years (see *Biodiversity* section *Cumulative Effects* subsection). Other reasonably foreseeable future activities on these lands include mining, recreation and tourism, growth of human settlements, transportation projects, and energy and transmission projects. Management activities on non-NFS lands are not held to the Region 10 soil standards; however, BMPs are required under the Alaska Forest Resources and Practices Act, including detailed regulations related to providing notification prior to timber harvests and managing riparian areas. The state forester must protect riparian areas from the significant adverse effects of timber harvest activities on fish habitat and water quality. These measures are designed to avoid soil erosion and sedimentation near streams. Martin (1996) compared pre- and post-harvest basins on non-NFS lands and found short-term effectiveness of these BMPs. Martin (1997) evaluated BMP effectiveness, including those designed to reduce soil erosion to mitigate turbidity. He found BMPs minimized sediment delivery and effectively maintained turbidity at comparable non-harvest levels. Arians (2003) includes several studies that compared pre- and post-harvest basins and indicated that logging with the BMPs does not result in significant effects to soils that would result in stream sedimentation and damage to fish. Despite these BMPs, some landslides, soil erosion related to duff removal, and losses in site productivity likely have occurred and will continue to occur on non-NFS lands. However, cumulatively, non-NFS lands represent only 6 percent of all of the soil resources in Southeast Alaska within the Tongass boundary. Potential impacts to the remaining 94 percent of soil resources would be mitigated through implementation of standards and guidelines and BMPs associated with each of the alternatives. The 2005 monitoring (USDA Forest Service 2005b) found that overall soil and water BMPs were implemented and found to be effective in Tongass timber harvest and road construction activities. Based on monitoring results, no changes were recommended to Forest Plan standards and guidelines for attaining State of Alaska water quality standards. Furthermore, effects of harvest on soil resources would ultimately be considered at the project-specific levels, ensuring minimal adverse cumulative effects to soil resources.

Similarly, roads are more prevalent on non-NFS lands than on NFS lands. Projected future road miles and densities under each alternative on both NFS and non-NFS lands are shown in Tables 3.6-8 and 3.6-9 of the *Fish* section of this chapter. In addition to approximately 4,942 total road miles currently on NFS lands, an additional 3,762 miles currently exist on non-NFS lands within the Forest boundary, and most of these roads are associated with timber harvest activities. Road densities are relatively high (2.27 miles per square mile) on non-NFS lands, resulting in commitment of soil resources; however, cumulative future road densities inside the Forest boundary are considerably lower, ranging from 0.39 mile per square mile under Alternative 1 to 0.57 mile per square mile under Alternative 7 (see the *Fish* section for additional information). As described earlier under the discussion of the potential direct and indirect effects to soils from roads, at the Forest Plan level, the overall difference in roaded area is a good indication of how site-specific effects are likely to vary among alternatives. This approach also applies to cumulative effects. Standards and guidelines, BMPs, and other relevant mitigation measures are applied at the project level to minimize potential adverse effects. Under all but Alternatives 4 and 7, the cumulative acres of road surfaces would be equal to or less than under the current Forest Plan. Reductions in soil productivity losses and soil erosion would correlate with lower cumulative road densities.

Overall, the cumulative effects of considered alternative actions combined with other non-NFS lands actions would increase the potential for cumulative effects to soil resources. Potential cumulative effects of harvest, road building, and other actions would be evaluated on a project-specific basis ensuring that any adverse effects to soil resources would be reduced, moderated, mitigated, or eliminated.

Mitigation

Forest-wide standards and guidelines for the soils resource are the same in all alternatives (see the Chapter 4 of the current Forest Plan and the proposed Forest Plan), and will apply to all site-specific projects. Forest-wide standards and guidelines are followed to mitigate the effects of management activities. They are designed to minimize accelerated soil erosion and maintain long-term soil productivity. They include soil conservation practices and incorporate the applicable BMPs (see Soil and Water Handbook). Annual monitoring (described in Forest Service Manual 2554) of BMP implementation and effectiveness helps ensure that water quality goals, and standards and guidelines, are met during project implementation (see Forest Plan, Chapter 6).

Water

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Affected Environment

The Tongass National Forest can be characterized by its abundance of water. The maritime climate brings precipitation nearly year-round, with the heaviest amounts occurring from September through January. Coastal low-elevation rain forests thrive in this maritime climate. Thousands of miles of shoreline and hundreds of bays and inlets characterize the marine environment of the Tongass. An important consideration for all water-related issues is the effect that changes in water flow and quality have on important aquatic resources, especially fish.

The water environment of the Forest can be described in terms of climate, streamflow regimen, water quality, floodplains, wetlands, riparian areas, watershed condition, and water use. There are literally thousands of watersheds within the 26,000 square miles that make up the Tongass National Forest. Climate is described in the *Climate and Air* section; other factors are summarized in the following subsections.

Streams, Lakes, and Flow Regimen

Streams and rivers on the Tongass produce a large volume of water per unit of land. Much of the flow originates or passes through thousands of small to large lakes. Both glacial and non-glacial river and stream systems occur on the Tongass, and runoff varies greatly between the two stream systems. Runoff from glacially fed streams usually starts in June in response to snow and ice melt, reaching peak flows in July and August. Runoff drops rapidly in October and low flows occur from December through April. Runoff from non-glacial streams tends to respond to high precipitation events; therefore, the highest flows tend to be in October and December and the lowest flows between January and March, and mid-May to August. Many factors influence how timber management activities may affect runoff, and most are site-specific. Roads and timber harvest can affect the amount and timing of the runoff. In studies conducted in the Pacific Northwest, factors, especially those relating to roads, affect runoff patterns; although, site-specific conditions including hillslope gradient, topography, soil type, and rainfall all influence the level of effect (Coe 2004).

Stream channels and lakes are categorized by class based on their fish production values. Although there are additional details (see the *Glossary* for full definitions), stream classes are generally defined as follows:

- Class I streams and lakes have anadromous or adfluvial fish or fish habitat: or, high-quality resident fish waters, or habitat above fish migration barriers known to provide reasonable enhancement opportunities for anadromous fish.

- Class II streams and lakes have resident fish or fish habitat and generally steep gradients (6 to 25 percent or higher) where no anadromous fish occur, and otherwise not meeting Class I criteria.
- Class III streams are perennial and intermittent streams that have no fish populations or fish habitat, but have sufficient flow or sediment and debris transport to directly influence downstream water quality or fish habitat capability.
- Class IV streams are intermittent, ephemeral, and small perennial channels with insufficient flow or sediment transport capability to directly influence downstream water quality or fish habitat capability. Class IV streams do not have characteristics of Class I, II, or III streams, and have a bankfull width of at least 0.3 meter (1 foot).

In addition, the Tongass uses a stream channel classification system based on the Alaska Region Channel Type Classification System (Paustian et al. 1992). Streams are categorized into channel types, which are grouped into nine process groups, or combinations of similar channel types based on major differences in landform, gradient, and channel shapes (see Appendix D in the Forest Plan for a full description). These are used to assess watershed conditions, fish habitat production capabilities, and sensitivity to management activities (see the *Fish* section of this chapter for additional information). Approximately 65 percent of the stream channels on the Tongass are classified in the high gradient contained process group (Table 3.4-1).

Approximately 44,000 miles of stream have been mapped on the Forest (Table 3.4-1). There are also streams on the Forest that have not been mapped because they require ground surveys to locate. Many of these are small low-flow, high-gradient Class III and IV headwater streams, but others contain valuable aquatic habitat. Additionally, some 250,000 acres of lakes are present on the Forest lands.

Water Quality

The State of Alaska sets water quality standards for chemical, physical, and biological parameters for waters on National Forest System (NFS) lands. The Alaska Department of Environmental Conservation (ADEC) and the Forest Service have agreed that the USDA Forest Service is the agency responsible for monitoring and protecting water quality on the NFS lands of Alaska for the purpose of meeting the Clean Water Act, as amended. Best Management Practices (BMPs), as described in the Soil and Water Conservation Handbook (Forest Service Handbook 2509.22, Region 10 Amendment, July 2006), the Alaska Nonpoint Source Pollution Control Strategy, and the Alaska Water Quality Standards (18 AAC 70) together form the "Forest Service Alaska Region Water Quality Management Plan," as agreed to in the Memorandum of Agreement dated April 6, 1992 (ADEC and USDA Forest Service 1992). With implementation of this Plan, the State of Alaska recognizes that the Forest Service BMPs are the primary means to protect water quality from nonpoint sources of pollution. In 1997, ADEC determined that the Forest Service BMPs meet or exceed the BMPs contained in the Alaska Forest Resources and Practices Act and Regulations (11 AAC 95) (Brown 1997).

Stream Temperature

Maintaining proper water temperature is critical for the health of aquatic ecosystems. Anadromous fish and other aquatic species are sensitive to water temperature with very low or high temperatures causing adverse conditions. Often in streams with salmon and trout, high water temperature is of greatest concern. Timber harvest and road construction have the potential to reduce stream shade and raise water temperatures. Forest Plan standards and guidelines minimize riparian harvest (see the subsection on Riparian Areas below) in order to maintain stream-side shade.

Table 3.4-1
Mapped Stream Miles by Process Group and Stream Class[1] for each Ranger District Group[2]

Stream Process Group	Class	Northern Ranger Districts	Central Ranger Districts	Southern Ranger Districts	Total
Alluvial Fan	I	236	47	134	**416**
	II	602	90	129	**820**
	III	82	70	101	**253**
	IV	0	1	1	**2**
Estuarine	I	44	11	8	**63**
	II	0	0	0	**0**
	III	0	0	0	**0**
	IV	0	0	0	**0**
Flood Plain	I	2,046	600	1,008	**3,653**
	II	51	119	61	**231**
	III	1	10	9	**20**
	IV	1	0	0	**1**
Glacial Outwash	I	345	212	242	**799**
	II	77	81	7	**165**
	III	61	48	10	**119**
	IV	-	0	-	**0**
High Gradient Contained	I	64	75	131	**270**
	II	2,985	712	2,115	**5,812**
	III	7,707	4,733	8,783	**21,223**
	IV	354	138	291	**783**
Large Contained	I	226	148	234	**607**
	II	15	31	19	**65**
	III	0	0	0	**0**
	IV	-	0	-	**0**
Moderate Gradient Contained	I	576	366	931	**1,873**
	II	339	180	193	**711**
	III	7	35	76	**118**
	IV	1	0	1	**3**
Moderate Gradient Mixed Control	I	755	775	1,147	**2,677**
	II	312	233	223	**768**
	III	6	13	50	**69**
	IV	5	2	5	**11**
Palustrine	I	1,338	374	549	**2,261**
	II	46	71	76	**194**
	III	4	7	31	**41**
	IV	3	1	6	**9**
Unclassified[3]	I	56	1	4	**61**
	II	43	0	0	**43**
	III	17	0	0	**17**
	IV	19	0	-	**19**
Total	**I**	**5,684**	**2,608**	**4,388**	**12,680**
	II	**4,470**	**1,517**	**2,823**	**8,810**
	III	**7,884**	**4,916**	**9,061**	**21,860**
	IV	**382**	**142**	**304**	**828**
Grand Total	**All Streams**	**18,420**	**9,182**	**16,576**	**44,178**

[1] Miles are only those currently mapped and in the GIS database excluding lake channels. Additional unmappable streams are present, but have not been located through on-the-ground surveys, especially Class 3 and 4 streams that are greatly underrepresented in the database. Numbers may not add up precisely because of rounding. See Paustian et al. 1992 for a description of the stream process groups and the glossary for a definition of stream classes.
[2] Northern Districts=Admiralty, Hoonah, Juneau, Sitka, and Yakutat; Central Districts=Petersburg and Wrangell; Southern Districts=Ketchikan-Misty Fiords, Thorne Bay, and Craig
[3] Includes areas such as ice fields, connector streams not field surveyed, braided glacial river channels, culverts, and karst
Source: GIS database, July 2006

An analysis of legacy stream temperature data collected on Prince of Wales Island was completed in 2004. From 1997 to 2002, state water quality criteria for stream temperature were exceeded during warm weather in both harvested and unharvested watersheds (Walters and Prefontaine 2005). In 2004, state water quality criteria were exceeded in all three case study watersheds, two of which are unharvested (USDA Forest Service 2004c). Konopacky Environmental (1996) also did not detect stream temperature increased that could be characterized as differing significantly between logged and unlogged watersheds. High stream temperatures in Southeast Alaska are likely to occur under natural conditions during warm, rainless weather and result in low stream flow periods regardless of watershed harvest levels or extent of past riparian harvest.

Sediment and Other Factors

Sediment is solid materials that were derived from the natural weathering of rock or from erosion of areas modified by man, such as roads, agricultural lands, or urban areas. Sediments are carried and deposited by wind, water, and ice, and may be transported as either suspended load or bedload in streams. Suspended sediment is carried within the water column, while bedload material moves via rolling or bouncing along the bottom of the stream or riverbed. Suspended sediment causes water to have a turbid or murky appearance. Under natural conditions, the great majority of suspended load and bedload transport occurs during storm runoff events.

Soil mass movements (landslides), streams cutting new channels, and bank erosion are the main natural processes creating sediment. Landslides cause large, but temporary, increases in suspended and bedload sediments. Stream and riverbed or bank erosion may contribute to sediment over long periods of time. Steep terrain and large amounts of rainfall make the soil sensitive to erosion if the organic material covering the soil is disturbed. High rainfall also makes soils sensitive to sediment production by road construction and timber harvest activities.

In Southeast Alaska, suspended sediment loads in non-glacial streams in undisturbed watersheds are very low. Concentrations of suspended sediments range from less than 10 parts per million (ppm) in the winter to occasionally over 100 ppm in the fall during storm runoff periods (Schmeige et al. 1974). Suspended sediment in glacial streams is highly dependent on the volume of water flow from snow and ice melt. At high flows, concentrations may reach from 200 to more than 600 ppm; at low flows during winter, suspended sediment concentrations seldom exceed 20 ppm (Schmeige et al. 1974).

ADEC has established numeric criteria for turbidity standards (ADEC 2006a). Turbidity in Alaska correlates with suspended sediment, although the exact relationship varies by region and stream type (Lloyd 1987, Lloyd et al. 1987) and has not been determined in Southeast Alaska. Turbidity data collected during culvert installation or road construction suggests few instances where the state criteria have been exceeded (USDA Forest Service 2004c).

Changes in any of the physical or chemical properties of water can directly affect water use by people, fish, and wildlife. Sediment input to streams and turbidity are the two water quality factors most likely to be affected by alternatives. Other factors, such as temperature and dissolved oxygen, are not expected to change appreciably by alternative and, therefore, they are not discussed further in this section.

Current road construction methods and culvert installation activities have little effects on stream turbidity. The most recent monitoring of turbidity relative to various forestry activities have found few exceedances of the state turbidity standards (USDA Forest Service 2004, Monitoring reports). Of 12 replacement culvert installations monitored in 2004, 10 always met the turbidity standard for drinking water and 11 of the sites met the standard for fish propagation within 48 hours of the construction activity. Typically water returned to less than 5 nephelometric turbidity unit (NTUs) over background shortly after construction.

Recent monitoring was conducted to determine effects of road construction (including a bridge) on meeting turbidity criteria. The study was done on Upper Shaheen Creek in 2004 using the more stringent drinking water criteria. The results are preliminary, but suggest some short-term exceedance of the 5 NTU criteria. Of 50 days of continuous monitoring (when upstream and downstream sites were both monitored) , 11 days had some exceedance; of these, 9 were short term (less than 15 minute spikes in turbidity), while the remaining 2 exceedances were up to 30 minutes. Similar results were found in 2003, when 32 and 51 of 54 monitored culvert installations met drinking water, and fish production turbidity criteria, respectively (Monitoring Report summary for 2003)

Floodplains

Executive Order 11988 directs federal agencies to provide leadership and take action on federal lands to avoid, to the extent practicable, the long- and short-term adverse impacts associated with the occupancy and modification of floodplains. The Forest's floodplains are typically found in broad, flat, alluvial U-shaped valleys, are forested, and usually support plant communities having an overstory of Sitka spruce or Sitka spruce and western hemlock. The shrub understory is variable and may include blueberry, skunk cabbage, devil's club, salmonberry, and alder. Supporting this vegetation are well-, moderately well-, or somewhat poorly-drained, deep mineral soils with thin organic surface layers. Based on channel type characteristics, floodplains are associated with 9 percent of the 42,700 linear miles of the streams mapped on the Forest and are typically protected through identification and designation of riparian management areas and associated Riparian Standards and Guidelines.

Riparian Areas

Riparian areas include the stream channel and any stream-associated vegetation (plants dependent on a continuous source of water), and may include additional stream channel features such as floodplains and alluvial fans. Riparian ecosystems previously harvested for timber are now in various stages of secondary plant succession. With the exception of where the ground is highly disturbed, the species composition on these secondary successional riparian areas is very similar to the riparian vegetation prior to timber harvest, with Sitka spruce, red alder, and western hemlock dominating the tree canopy (USDA Forest Service 1997a). On the more disturbed sites, the vegetation is often similar to primary successional species, such as what occurs following deglaciation, with red alder the most common component.

Current management emphasis under the current Forest Plan is to maintain riparian areas in mostly natural conditions for fish and other riparian-associated resources. Management direction requires no-harvest buffers for Class I, II, and III streams with the widths depending on stream channel process groups. In addition, reasonable assurance of windfirmness must be provided for buffers, which may or may not include additional buffer width depending on site conditions. An evaluation of how well reasonable assurances of wind-firm buffers are working in high-gradient streams on the Tongass was recently conducted (Paustian et al. 2006). Additionally, recent literature was reviewed as part of this study to help assess the need for buffers on these streams (Landwehr 2006). Although field survey information is preliminary, blowdown has averaged about 5 percent in these buffers, which include standard buffers to slope break. The reasonable assurance of wind-firm buffer portion could not be determined at most of the sites. Based on the relative stability of these buffers, and considering recent literature that helps indicate the likely benefit to water and ecology of the systems from these buffers, the recommendation by these authors was to retain these wind-firm buffers as part of the standards and guidelines.

Prior to implementation of the current Forest Plan, approximately 66,000 acres of riparian productive old-growth forest were harvested, including approximately 295 acres that are now within Wilderness (USDA Forest Service 1997a). This represents about 13 percent of the original 490,000 acres of riparian productive old growth (POG) outside wilderness (USDA Forest Service 1997a). Most of this harvest, approximately 63,800 acres, took place between 1950 and 1997. This is approximately 1,329 acres per year. However, following implementation of the current Forest Plan, beginning in 1997, recent harvest in riparian areas has been much lower because it has been limited to road crossings (because no other harvest is allowed in riparian areas).

Watershed Condition

For land within the Tongass National Forest boundary, including all ownerships, 77 percent of the watersheds were classified as healthy in 1992 (i.e., having watershed functions and conditions generally in balance) (USDA Forest Service 1995a). For Tongass NFS land in 1992 (excluding other ownerships), 87 percent of the watersheds were classified as having satisfactory watershed conditions, 10 percent were classified as having declining watershed conditions, and 3 percent were classified as having unsatisfactory watershed conditions (USDA Forest Service 1995b). Watershed evaluation, has continued in recent periods. Assessments have included a GIS database evaluation that identified 25 watersheds of concern (USDA Forest Service 2001a). Follow-up on these evaluations are underway (Paustian 2005). The 1997 Forest Plan included increased protection for headwater streams and their watersheds. Standards and guidelines considered to be important for protection of watersheds by the Alaska Anadromous Fisheries Habitat Assessment (USDA Forest Service 1995a) have been implemented Forest-wide. Also, harvest and road construction have greatly decreased since the early 1990s (refer to the *Timber* section), and 94 miles of roads have been decommissioned between 1997 and 2005 (refer to the *Transportation and Utilities* section); therefore, watershed conditions (e.g., sediment input, stream temperature, fish passage) in many watersheds on the Tongass are likely to have remained stable or improved, although some ongoing impacts remain (e.g., large woody debris input, road and hillslope failures).

There has been about 28,000 acres of harvest in Riparian Management Areas across the Tongass (USDA Forest Service 2006a, Tongass Young-Growth Management Strategy, Exhibit 7). Approximately 15,000 acres of the total contain riparian young-growth stands that will potentially benefit from thinning treatments designed to promote future large wood recruitment. Sustained input of large wood is necessary to maintain stream channel functions and productive fish habitat conditions in Southeast Alaska watersheds. Storing and decommissioning of additional roads would improve habitat quality, fish passage, and water quality as they are treated.

ADEC is responsible for providing a list to the U.S. Environmental Protection Agency (EPA) of the status of water quality within the state. The state makes a determination of which state waters (e.g., streams, rivers, bays) exceed state water quality standards and are limited by point and/or non-point sources of pollution, which may require additional controls to meet state water quality standards. Waters that fit this definition are put on a list as designated under Section 303(d) of the Clean Water Act, which is published by the state and sent to EPA. State waters in this category are known as waters on the 303(d) list. The most recent list for 2004 (ADEC 2006b) includes seven water bodies in Southeast Alaska that are directly or indirectly impaired due to forest management practices. This includes two water bodies (Katlian River and Nakwasina River) listed as impaired for non-attainment of the sediment and turbidity standards due to harvest activities, including road maintenance and riparian harvest. Four locations (Hobart Bay, Schultz Cove, Thorne Bay, and Twelve Mile Arm) have marine nearshore bottom areas impaired from past log transfer facility operations. One location, Ward Cove, is indirectly affected from log processing operations as part of the local pulp mill activity that is no longer occurring. All five exceed state residue standards; Ward Cove also exceeds dissolved gas standards. However, water quality conditions at sites formerly affected by forest practices have been improving because three sites that were included on the previous 303(d) 2 years earlier were removed in the latest report. These include Cube Cove, East Port Frederick, and Klawock Inlet, which are all log transfer facilities. Additionally, part of Ward Cove has been removed due to restoration actions related to pulp mill water quality impacts.

Water Use

Key water uses on the Forest include public water supply, recreation, growth and propagation of fish, and hydroelectric power generation. The Forest supplies domestic water for 23 permanent communities, and about 55 Class A and B public water systems are located in the vicinity of the Tongass National Forest Boundary. Ketchikan, Sitka, and Petersburg have congressionally designated municipal watersheds, and another six communities have non-congressionally designated municipal watersheds. In addition, water is supplied from the Forest to fish hatcheries, industrial sites, and resorts. Hydroelectric generation continues to be used in many places throughout the Forest to provide electricity for mining, sawmills, communities, and other uses. There are six major power installations on the Tongass National Forest: the Snettisham and Gold Creek south of Juneau; Beaver Falls, Ketchikan Lakes, and Swan Lake east of Ketchikan; Lake Tyee near the Bradfield River; and Blue and Green Lakes south and east of Sitka. Additional installations and interties between installations are proposed. The *Lands* and the *Transportation and Utilities* sections of this chapter address planned hydroelectric projects.

Environmental Consequences

Direct and Indirect Effects

This section considers the effects of forest management activities on stream flows, wetlands, public and private water supplies, water quality, and cumulative effects. The effects of timber harvest and roads on fish habitat and riparian resources are discussed in the *Fish* section of this chapter. The effects of sedimentation caused by soil erosion and landslides are discussed in the *Soils* section of this chapter. The effects on potential hydroelectric projects are discussed in the *Lands* section, and the effects of log transfer facilities on the marine environment are discussed in the *Transportation and Utilities* section of this chapter.

Forest management activities affect water quality and quantity, as well as the timing of water flows through alteration of soil and watershed conditions. Most watersheds are in a state of dynamic equilibrium where changes occur naturally because of changes in weather patterns. Because of the overriding influence of climate and basin resiliency, changes in streamflow and sediment delivery resulting from management activities (e.g., timber harvest) are difficult to measure.

Water Quantity

Little is known about the effects of timber harvest and roads on stream flows in Southeast Alaska watersheds. However, many studies in the Pacific Northwest indicate roads and harvest may affect runoff timing and quantity of peak flow depending on many factors, including precipitation, soil depth, lithology, road design, hillslope gradient, and topography (Coe 2004). The potential effects of changes in stream flows within watersheds Forest-wide are expected to vary depending on the noted factors, as well as the relative amount of harvest and roads and the applicable Forest-wide standards and guidelines. The effects from changes in stream flows in a particular watershed can only be estimated during project planning, at which point the rate of entry into watersheds and locations of proposed roads and harvest units would be analyzed. The actual effects on stream flows can only be determined by site-specific monitoring.

Water Use

The Municipal Watershed Land Use Designation (LUD) is applied to 45,236 acres in 11 watersheds serving 9 incorporated cities and boroughs (Ketchikan, Petersburg, Sitka, Juneau, Wrangell, Kake, Klowock, Craig, and Hydaburg [see the amended Forest Plan, Chapter 3, Municipal Watershed under all Alternatives]). All of the alternatives would include the same protections to these watersheds. Watersheds serving unincorporated communities and other non-municipal water systems would be managed under Forest-wide standards and guidelines (see the amended Forest Plan, Chapter 4, Soil and Water). These stream locations are designated by ADEC as drinking water streams Class A or B, which include municipal and non-municipal water intakes. Other than the municipal sites, other streams could be affected by Forest Service actions that include harvest and road building in the watersheds where these streams are located. While most of the current sites have LUD designations that do not allow timber harvest under any alternative, many of the watersheds where these sites occur (Class A and B drinking water designations) have LUD designations of timber harvest. Among sites with timber harvest LUD designation in watersheds with these Class A or B designations, Alternative 1 has the least and Alternative 7 has the most. Prior to actions in any of these watersheds, the Forest Plan (Chapter 4, Soils and Water Standards) requires the Forest Service to conduct a watershed analysis and consult with ADEC as well as with owners and operators of public water systems prior to authorizing management activities that may cause pollution.

Water Quality

Riparian areas, as a component of aquatic and riparian ecosystems, would continue to be protected through use of the Riparian Standards and Guidelines under all alternatives, which protects water quality parameters such as stream turbidity, temperature, and nutrients. Protection for riparian areas would be the same under all alternatives at site levels. In addition, the application of BMPs would minimize or prevent adverse effects on water quality from the limited amount of riparian area within yarding corridors and stream road crossings, and from any non-commercial timber harvest that may occur. See the *Soils* section for further discussion on potential affects to water quality.

Cumulative Effects

One of the main cumulative factors affecting water quantity, use, and quality, in addition to actions taken on NFS lands, is ongoing and additional regional land development actions on non-NFS lands. These actions, in addition to the various effects of the considered alternatives, may have compounding effects on water conditions. While BMPs applied on NFS lands would moderate these effects, some effects on water may remain, and with the addition of other actions, may increase risk to water resources. One of the factors associated with potentially adverse effects to water are roads and associated actions such as timber harvest, culvert and bridge installation, and potential hazardous substance spills. While the effects would vary with location and type of activity, the amount of road miles is a partial indicator of cumulative effects region-wide. Table 3.4-2 shows the change in road miles on a regional basis, including non-NFS roads. Currently, there are about 4,941 total road miles (including all authorized and non-system roads) on NFS lands and an additional 3,756 miles on non-NFS lands within the Forest boundary. Many of these roads are associated with non-NFS timber harvest activities. In general, timber harvest activities on non-NFS areas are not as protective of stream riparian areas. Reduced protection of these areas has a greater risk of increasing impacts to water quality. Therefore, roads constructed on non-NFS lands may be associated with greater water quality and quantity impacts per mile of road than on NFS lands. Generally, however, the amount of roads may be an indicator of cumulative effects on water resources of the Tongass National Forest and adjacent areas; therefore, the cumulative effects to water resources would generally be proportional to overall changes in road miles. NFS road development under Alternative 1 would have the lowest contribution to cumulative effects by increasing total NFS road miles by about 16 percent over existing conditions; however, road construction on both NFS and non-NFS lands together would result in a total increase in road miles of 34 percent because non-NFS road development would likely increase substantially. Alternatives 4 and 7 would have the largest cumulative effect when including all roads, resulting in an increase in road miles equal to about 82 and 92 percent over existing conditions, respectively. The other alternatives (2, 3, 5, and 6) would result in a cumulative increase in road miles between 49 and 70 percent over existing conditions, when both NFS and non-NFS roads are included.

Table 3.4-2
Estimated Number of Road Miles on All Lands within the Tongass Forest Boundary for Each Alternative after Full Implementation of the Forest Plan (approximately 100+ years)[1]

		Alternative						
Road Categories	**Existing**	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Total New Miles on NFS Lands		774	2,079	2,799	4,890	3,874	3,744	5,825
Total Miles on NFS Lands	4,941	5,715	7,020	7,740	9,831	8,815	8,685	10,766
Total Miles on Non-NFS Lands[2]	3,756	5,970	5,970	5,970	5,970	5,970	5,970	5,970
Total Miles on All Lands	**8,697**	**11,685**	**12,990**	**13,710**	**15,801**	**14,785**	**14,655**	**16,736**

[1] Assumes full implementation of Forest Plan at ASQ levels plus future non-NFS harvest. Roads on NFS lands adjusted for fall down.
[2] Assumes an increase of 2,214 road miles on non-NFS lands over 100+ years. Annette Island is included because it is surrounded by areas within the Forest boundary.

While less directly tied to water quality and quantity conditions, the amount of timber harvest may also be an indicator of cumulative effects to water conditions because of potential effects on sediment input, water temperature, stream detritus input, and flow patterns. Tree harvest areas in the Tongass National Forest are primarily characterized as POG vegetation regions. POG in 1954 accounted for about 34 percent of the land area within the Tongass National Forest boundary, which includes NFS lands as well as state and private lands. Therefore, land disturbance related to harvest is primarily limited to a small portion of the total land area. Non-POG areas include areas with small trees, muskeg, or wetlands; all regions where streams may be common; and ice fields and rocky mountainous areas where few streams may be present.

Table 3.4-3 indicates the cumulative portion of POG area that would be harvested within the Forest boundary (including all non-NFS lands) under each alternative, and the portion of all lands inside the Forest boundary that would potentially be disturbed by timber harvest. (This latter analysis represents an index of overall watershed disturbance associated with vegetation removal by timber harvest and does not consider roads outside of harvest units, urban areas, etc., which are a minor portion of the total disturbance area.) Currently, most (87 percent) of the POG acreage within the Forest boundary has not been harvested. Considering all lands inside the Forest boundary, 95 percent of the total land base has not been subjected to vegetation removal by timber harvest (Table 3.4-3). Alternative 1, including non-NFS harvest, would result in a reduction in POG area to 82 percent of the original acreage; 94 percent of all lands inside the Forest boundary would remain undisturbed by direct timber harvest. Alternatives 2, 3, 5, and 6 would result in 76 to 80 percent of the POG remaining; 92 to 93 percent of all lands would remain undisturbed by direct timber harvest after over 100 years of projected harvest. Alternatives 4 and 7 would have the greatest effect; POG would be reduced to 70 to 72 percent of the original area; 90 to 91 percent of the total land base would remain undisturbed by direct harvest. It is likely some local effects on water quality and, possibly, quantity, from all alternatives. On a Forest-wide basis, however, the overall effects would be very minor for all alternatives. As noted above for roads, lesser riparian protections on state and private lands would have a greater likelihood of causing adverse effects to water quality and quantity in watersheds on non-NFS lands, which could be compounded if NFS lands are harvested in the same watersheds. Potential cumulative effects of harvest, road building, and other actions would be evaluated at the project-specific level in order to ensure that any adverse effects to water resources would be reduced, moderated, mitigated, or eliminated.

Table 3.4-3.
Percent of Original POG Remaining on All Lands within the Tongass Forest Boundary and Percent of All Lands inside the Boundary that are Not Directly Disturbed by Timber Harvest after Full Implementation of the Forest Plan (approximately 100+ years)[1]

Alternative	Percent of All Original POG Remaining [2]	Approximate Percent of All Lands Not Disturbed by Timber Harvest [3]
Existing	87%	95%
1	82%	94%
2	80%	93%
3	78%	92%
4	72%	91%
5	76%	92%
6	76%	92%
7	70%	90%

[1] Assumes full implementation of Forest Plan at ASQ levels plus future non-NFS harvest.
[2] Original POG equals about 34 percent of all land area (17,869,000 acres) of this region.
[3] Value represents the percent of all 17,869,000 acres inside the Tongass boundary (plus Annette Island) that would be disturbed by timber harvest and is used as an index of overall watershed disturbance associated with timber harvest. It does not include the acreage of other forms of ground disturbance (e.g., roads, towns) beyond the harvest of POG.

The potential for future climate change is a factor that could affect water quality and quantity conditions on the Tongass. Some of the models developed for the region predict both changes in precipitaion and air temperature. The details of recent climate models (see the *Cumulative Effects* subsection in the *Fish* section) project slight decreases in summer rainfall (about 10 percent) and increased temperature.

Southeast Alaska is characterized by high rainfall, so small reductions have limited potential to significantly reduce stream flows. Streams, both in harvested and unharvested watersheds, have occasionally been documented with brief periods of temperature standard exceedances. Theoretically, if air temperature changes were large enough, these exceedances could become more frequent. Currently there are no 303(d) streams listed for temperature exceedance. Whether temperature changes would be large enough to cause changes to this level are unknown. However, in the short term that the amended Forest Plan will be in place before being modified again (likely 10 to 15 years), large magnitude changes in both stream flow and stream temperature are hightly unlikely. In summary, there is general agreement that the climate is warming and that summer precipitation is likely to decline. However, there is considerable uncertainty surrounding specific predictions of when and the magnitude, and even more uncertainty regarding the effect of these changes on water quantity and quality.

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Wetlands

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Affected Environment

Definition and Regulatory Aspects

The U.S. Environmental Protection Agency (EPA) and the U.S. Army Corps of Engineers (Corps) jointly define wetlands as "those areas that are inundated or saturated by surface or groundwater with a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas." Wetlands are considered to be ecologically important for the physical, biological, and chemical functions they provide. The functions include flood flow moderation, groundwater recharge and discharge, wildlife and fish habitat, and water quality protection.

The Corps' Wetlands Delineation Manual (Experimental Laboratory 1987) provides the standards for determining areas of wetlands and deepwater habitats. Land areas are defined as wetlands when soil, hydrology, and vegetation all meet the technical criteria for establishing wetlands.

For federal regulatory purposes, wetlands are considered a subclass of Special Aquatic Sites (40 Code of Federal Regulations [CFR] Section 230.3) and have been deemed Waters of the United States (33 CFR 328.3). All waters of the United States are subject to regulation through the Clean Water Act by the Corps and EPA. Sections 404 and 401 of the Clean Water Act were created specifically with the intent "to restore and maintain the chemical, physical, and biological integrity of our Nation's waters." Executive Order 11990, as amended (42 U.S.C. 4321 et. seq.), requires federal agencies "to avoid...adverse impacts associated with the destruction or modification of wetlands...wherever there is a practicable alternative" and to "include all practicable measures to minimize harm to wetlands." Further, the agencies are required to preserve and enhance the natural and beneficial values of wetlands in carrying out their responsibilities.

Wetland Classification

The classification system, as described below, is based on U.S. Fisn and Wildlife Service's (USFWS's) classification of wetlands and deepwater habitats of the United States, developed by Cowardin et al. (1979).

Palustrine wetlands include the vegetated wetlands traditionally referred to as marshes, swamps, bogs, fens, and prairies. They include all nontidal wetlands dominated by trees, shrubs, persistent emergent plants, mosses or lichens, and all such wetlands that occur in tidal areas where salinity due to ocean-derived salts is below 0.5 percent. Palustrine wetland classes on the Tongass include emergent wetlands (including peatlands), scrub-shrub wetlands, and forested wetlands. Classes are described in the following paragraphs.

Forested class. Over half (53 percent) of the National Wetland Inventory (NWI)-mapped wetland acres on the Tongass are forested wetlands. Vegetation ranges from scrubby mixed conifer forests (greater than 20 feet high) to moderately productive mixed conifer, western, or mountain hemlock stands. Shrubs and forbs dominate the understory.

Emergent class. Approximately 25 percent of the NWI-mapped wetland acres are emergent. The emergent class is characterized by erect, rooted herbaceous plants, and mosses and lichens. Peatlands (muskegs) are included in the emergent class of wetland area on the Forest. In Southeast Alaska, all relatively open bogs that have a groundcover high in sphagnum mosses and/or sedges are called "muskegs," and are a type of peatland.

Scrub-Shrub class. Approximately 13 percent of the NWI-mapped wetland acres are scrub-shrub. This class is the most vegetatively varied wetland class in Southeast Alaska. Plant species may include true shrubs, young trees, and tree and/or shrubs that are small or stunted because of environmental conditions. Scrub-shrub wetlands are associated with three broad wetland plant communities: scrub-shrub alder/willow, scrub-shrub evergreen/emergent, and forested scrub-shrub evergreen/emergent.

Lacustrine wetlands include all permanently flooded lakes, reservoirs, and tidal lakes with ocean-derived salinities below 0.5 parts per thousand. Approximately 5 percent of the NWI-mapped wetland acres are lacustrine.

Estuarine wetland system. Estuarine wetlands are those areas that are predominantly intertidal, and are those parts of the rivers or streams or other bodies of water having an unimpaired connection with the open sea, where the sea water is diluted with freshwater derived from land drainage. Less than 2 percent of the NWI-mapped wetland acres are estuarine.

Riverine wetland system. The riverine wetland system includes all channel-contained streams and rivers. These areas are bounded by uplands, channel banks, or palustrine wetlands dominated by trees, shrubs, emergent mosses or lichens. In braided streams, the riverine wetland system is bounded by the banks forming the outer limits of the depression within which the braiding occurs. Less than 2 percent of the NWI-mapped wetland acres are riverine.

Wetland Mapping and Distribution

On the Tongass, wetlands may be found from sea level to alpine elevations, and may include estuaries and riparian areas. Wetland acreage shown in Table 3.5-1 is from the NWI, which is available through USFWS. The NWI database wetland identification map is based on geography, visible hydrology, and vegetation as seen in high altitude imagery (USFWS 2006).

Table 3.5-1
Mapped Acres of Wetlands on the Tongass National Forest by Wetland System and Class

Wetland Systems	Wetland Classes	Acres
Palustrine	Forested	2,123,440
	Emergent (including peatlands/muskegs)	1,009,777
	Scrub-shrub	535,325
	Palustrine - undistinguished	51,675
Lacustrine		181,746
Estuarine		64,792
Riverine		46,427
Marine		9,092
Total Wetlands		**4,022,272**

Source: National Wetland Inventory database, USFWS 2006.

Environmental Consequences

Direct and Indirect Effects

The physical, biological, and chemical integrity of wetlands in the Tongass is affected mainly through timber harvest operations, which include the construction and maintenance of roads, landings, stream crossing structures, marine access points, and log transfer facilities (LTFs). The magnitude of timber harvest-related effects to wetlands depends, in part, on the intensity, location, and duration of the timber harvest activity or road construction.

Limited research studies have been conducted on the effects of timber harvest or road building on wetlands in Southeast Alaska. The research on the effects of harvest on wetland systems have been primarily focused on regeneration of trees (Julin and D'Amore 2003, Duncan 2002). Studies on road construction on wetland sites have been focused on the effects to hydrology, and only a few wetland sites were studied (Glaser 1999, Kahklen and Moll 1999, McGee 2000). Wetlands are complex natural systems and these few studies may not represent the breadth of the potential effects to wetland functioning that could occur across the Tongass National Forest. Additionally, processes in a complex natural system, such as regrowth of a forest after harvest, contain random components and are not predictable at every scale or for every location.

Silvicultural operations, such as harvesting trees, are generally exempted from Corps permitting requirements. The construction or maintenance of forest roads in support of silvicultural practices, and temporary roads for moving mining equipment, are also generally covered under this exemption for the discharge of dredged or fill material into waters of the United States. This exemption is contingent on the construction and maintenance being conducted in accordance with the Corps' Best Management Practices (BMPs) as stated in 33 CFR 323.4(a)(6). These practices have been incorporated into BMP 12.5 of the Alaska Region's BMP Handbook (Forest Service Handbook 2509.22).

In each of the seven alternatives, the Forest-wide standards and guidelines (including BMPs) would be applied to activities in and around wetlands. The standards and guidelines that apply to wetlands are the same for all alternatives. They provide direction to avoid development activities in wetlands to the extent feasible, minimize effects on wetlands, and locate and design roads to minimize effects on wetlands. Project-level analysis and planning would be used to avoid construction in wetlands, and would provide site-specific plans to minimize effects.

Tree harvesting on wetland sites would have direct effects on the sites themselves and indirect effects on adjacent or nearby wetlands. The effects would include potentially altering hydrology, changing nutrient pathways, delivering sediment (which can diminish water quality), changing plant species composition and growth, and reducing shading. Harvesting trees in wetlands is not expected to convert wetlands to uplands. However, harvest would result in a short-term reduction in hydrologic and biogeochemical wetland functions that begin to return as soon as there is tree revegetation. The habitat functions provided by forest areas may require more time and forest regrowth to return. Habitat values for many species using forested habitat are discussed in the *Wildlife* section of this chapter.

In Southeast Alaska, forested wetlands have been found to successfully regenerate and grow into dense, differentiated stands after clearcutting (Julin and D'Amore 2003, Duncan 2002). Some of the habitat functions are dependant on, or related to, characteristics of the old-growth ecosystem, which would not develop over the life of the Forest Plan (10 to 15 years).

According to a study on regeneration of forested wetlands, tree growth was slow in Histosols (wet, organic soils), but it proceeded regularly and exceeded the minimum USDA Forest Service volume-production standard for commercial timberland (Julin and D'Amore 2003). Revegetation of forested wetland sites is expected to occur in the same timeframe as other forested sites, usually within 3 to 5 years. Site quality on wetland soils, however, may be lower than on sites with better drainage, and may require additional time for trees to reach merchantable size on wetlands compared to drier sites.

Construction of roads within wetlands permanently removes the wetland area and its functions under the roadbed itself. Additionally, crossing wetlands with roads without adequate provision for cross-drainage could lead to sedimentation from road construction or changes in hydrologic patterns.

There are approximately 1,079 existing road miles on wetlands on the Tongass, including non-system roads and closed roads. This represents 22 percent of the 4,941 total road miles. Table 3.5-2 shows the road miles by wetland classification that exist on the Tongass. The majority of these roads were constructed as part of forestry activities. There have been limited research studies done on the effects of forestry roads constructed in the past on wetlands or uplands in the Tongass National Forest. The results of the wetland and upland studies on the Tongass suggest that the hydrologic effects of roads remain within a few meters of the road (Glaser 1999, Kahklen and Moll 1999, McGee 2000). The results are similar to studies done in other areas with similar climates (cool, moist, and year-round precipitation). Researchers have studied the effects of ditching on peatlands in northern climates. In northern England, they found that the measurable effects of ditches on peatland hydrology were limited to less than 3 meters from the ditches (Stewart and Lance 1991, Coulson et al. 1990).

Table 3.5-2
Existing Roads and Maximum Miles of New Roads in Wetlands by Alternative after 100+ Years[1]

	Palustrine Wetlands						
Alternatives	Forested	Scrub-Shrub	Emergent (including peatlands/ muskegs)	Lacustrine Wetlands	Estuarine Wetlands	Riverine Wetlands	Total Wetlands
1	192	5	29	0	0	0	226
2	492	29	86	0	0	0	608
3	683	45	121	0	0	0	849
4	1,363	97	212	0	33	0	1,680
5	1,001	72	166	0	2	0	1,240
6	972	68	163	0	0	0	1,204
7	1,674	116	238	0	61	0	2,048
Existing Roads	807	56	201	1	10	4	**1,079**

[1] Totals may not appear to sum correctly due to rounding.
Source: NWI database (USFWS 2006) and Tongass National Forest GIS database.

Reconstruction of a road for timber harvest maintains the original investment and makes it suitable and safe for the intended use. Reconstruction involves rehabilitation of the original roadbed. It can include cleaning ditches, replacing drainage structures, reinstalling bridges, and grading and shaping. Generally, reconstruction of existing roadbeds for timber harvest would not add impermeable surface to wetlands. However, some reconstruction can include upgrading a road and widening the roadbed. In the Forest-Level Roads Analysis, a few roads, specifically on Prince of Wales Island, have been recommended for upgrading and widening the roadbed (USDA Forest Service 2003c). Widening an existing roadbed in wetlands would add to the impermeable surface and increase the total effects to wetlands. The recommendations in the Forest-Level Roads Analysis would be the same for all alternatives. The estimated road miles to be reconstructed would vary by alternative, however, ranging from 925 total miles under Alternative 1 to 2,371 miles under Alternative 7. Alternatives 2 through 6 would reconstruct an estimated 1,784 to 2,100 total road miles (see Table 3.12-2 in the *Transportation and Utilities* section).

Some activities in road reconstruction have potential to affect wetland hydrology, such as replacing drainage structures or cleaning road ditches. This may have a positive or negative effect on wetland hydrology, depending on the condition of the existing road in the wetland. Road maintenance can include reconditioning the original road template, grading the road surface, cleaning roadside ditches, and removing vegetation that may encroach upon the road or block vision. In general, this would have no effect, or it could improve wetland hydrology in areas where drainage has become blocked.

The difference between alternatives in effects to wetlands generally falls within two categories: 1) short-term or long-term effects due to timber harvest, and 2) loss of wetland acres and function due to road construction. Acres of harvest and miles of roads proposed in wetlands can be used to provide comparisons between alternatives. However, actual acres of harvest in wetlands are likely to be lower, particularly in scrub-shrub and emergent wetlands, when acres are dropped in units with poor volume. Miles of road would likely be less than shown in this analysis because road layout for individual projects would avoid wetlands to the extent feasible, as required in the Forest-wide standards and guidelines. Also, there are standards and guidelines to protect beach and estuarine, riverine, and lacustrine areas. The beach and estuary fringe, an area of 1,000 feet slope distance around all identified estuaries and from all saltwater shorelines, is classified as unsuitable for timber activities and roads are discouraged. Riparian area protection varies depending on the classification of the stream. The Forest-wide standards and guidelines include a restriction on programmed timber harvest in riparian management zones and within 100 feet of Class I fish-bearing streams as well as Class II streams that flow into Class I streams. These standards and guidelines would provide further protection for wetlands that occur in estuarine, riparian, and lacustrine areas.

Tables 3.5-2 and 3.5-3 show the proposed maximum miles of road and acres for harvest under the alternatives. Alternative 5, the No-Action Alternative, would conduct harvest activities on a maximum of 123,000 acres and construct a maximum of 1,240 new miles of roads in wetlands. Alternatives 1 and 2 would maintain the most acres of undisturbed forest with less risk of adverse effects to wetlands due to harvest. Alternatives 1 and 2 include harvesting on approximately 18 and 52 percent of the wetland acreage proposed in Alternative 5, respectively. Alternatives 1 and 2 also propose constructing approximately 18 and 50 percent of the road miles in wetland proposed by Alternative 5, respectively. Alternative 3 is in the middle of the alternatives in terms of harvest acres and road construction in wetlands. It would include harvest activity on 71 percent of the acres in wetlands shown in Alternative 5 and construct 68 percent of the road miles. Alternative 6 proposes slightly less harvesting and road construction (97 percent of Alternative 5 for both). Alternatives 4 and 7 propose the highest level of harvest and road construction in wetlands. They would include approximately 36 and 65 percent more acres of harvest in wetlands than in Alternative 5, respectively, and 35 and 65 percent more miles of roads in wetlands to achieve that harvest, respectively.

Therefore, over time, Alternatives 7 and 4 would have a higher risk of direct and indirect effects to wetlands due to harvest and road work than Alternative 5, the current Forest Plan. Alternatives 1 and 2 would have the least risk of effects to wetlands. The acres of harvest and miles of road construction for Alternative 3 would be intermediate and its potential to affect wetlands would be somewhat lower than Alternative 5, while Alternative 6 would have slightly lower effects.

Table 3.5-3
Maximum Harvest Area in Mapped Wetlands by Alternative before after 100+ Years of Full Implementation[1]

Alternative	Palustrine Wetlands: Forested	Palustrine Wetlands: Scrub-Shrub	Palustrine Wetlands: Emergent (including peatlands and muskegs)	Lacustrine Wetlands	Estuarine/ Marine[2] Wetlands	Riverine Wetlands	Total Wetlands
1	19,604	399	1,921	4	0	8	**21,936**
2	55,605	2,096	5,975	15	0	47	**63,737**
3	76,066	3,397	8,452	23	2	51	**87,991**
4	144,981	7,237	14,269	60	238	86	**166,871**
5	106,507	5,333	11,179	35	11	77	**123,142**
6	103,423	5,076	10,976	37	2	68	**119,583**
7	178,142	8,644	16,048	67	448	91	**203,440**

[1] Totals may not appear to sum correctly due to rounding.
[2] Less than 50 acres mapped as marine wetlands occur in Alternatives 4 and 7 only.
Source: NWI database, USFWS 2006; Tongass National Forest GIS database.

Cumulative Effects

When considering effects to wetlands, it is important to look at both the land outside the National Forest System (NFS) lands and the cumulative effects of past, present, and reasonably foreseeable future activities. Individual wetlands provide important physical, biological, and chemical functions, and are not isolated from other resources when viewed on a larger scale. Surface and subsurface water, along with many organisms, move through the landscape. As discussed in the direct and indirect effects section, changes to or loss of functions in an individual wetland can have effects that extend beyond individual wetlands as they contribute to the overall functioning within a watershed and landscape.

Each landscape area or watershed has different physical, chemical, and biological characteristics and vegetation patterns. The significance of an addition to cumulative effects from a change in an individual wetland would depend on the amount and type of disturbance in the analysis area, wetland locations and distribution in the watersheds, the distance to other wetlands and waterbodies, and connectivity of hydrology and habitat between them. Assessing cumulative effects to wetlands will be done for individual projects for the relevant analysis area as part of the National Environmental Policy Act process in all alternatives. However, past plus expected harvest and road construction for forestry and other uses on all land ownerships can be used to compare the risk of the alternatives adding to cumulative effects.

Non-NFS lands comprise approximately 6 percent of the lands within the Tongass National Forest boundary and 22 percent of Southeast Alaska. Silviculture on non-NFS lands are generally exempt from the Corps' permitting requirements contingent on the construction and maintenance of roads being conducted in accordance with the general Corps' BMPs as stated in 33 CFR 323.4(a)(6). Timber harvesting on state, municipal, and private land is also governed by the Alaska Forest Resources and Practices Act of 1979 (AS 41.17). Alaska Forest Resources and Practices Regulations (Alaska Department of Natural Resources [ADNR] 2004) includes regulations designed to prevent adverse impacts to fish habitat and water quality from timber operations. The regulations are less extensive than the standards and guidelines that direct activities on the Forest. The state regulations provide direction to avoid and minimize road building, sedimentation, establishment of landings, and damage to vegetative cover when yarding across marshes and non-forested muskegs. The regulations also provide buffers for forested wetlands if classified as anadromous water bodies or tributaries to anadromous water bodies. Harvest and associated activities are not specifically regulated on forested wetlands that are otherwise classified.

Timber harvest can alter wetland function and type but is not expected to convert wetlands to uplands. The hydrologic and biogeochemical functions begin to return as soon as there is tree revegetation, but the habitat functions provided by forested areas may take longer and more forest regrowth to return. Some of the habitat functions are dependent on, or related to, characteristics of the old-growth ecosystem, which will not develop during the life of the Forest Plan (10 to 15 years). Therefore, the effects of a project may add to cumulative effects to wetlands or their functions, particularly habitat functions in an area. Habitat and habitat changes are discussed in greater depth in the *Biodiversity* section.

To compare the potential for cumulative effects due to harvest on wetlands, harvest was analyzed on lands of all ownerships within the Tongass Forest Boundary (plus Annette Island, which is surrounded by the Forest). There are approximately 17.87 million acres of land inside the Forest boundary. Approximately 30 percent of that land is currently in productive old growth (POG). Approximately 13 percent of the original POG on all ownerships in this area has been harvested through 2006. Thus, approximately 87 percent of POG on all ownerships is remaining. The percent of POG remaining on NFS lands is higher than for non-NFS lands (92 and 66 percent, respectively) due to the concentrated timber harvest areas on non-NFS lands. Looking at all land ownerships within the Forest boundary, the POG remaining in 100 years under full implementation of the Forest Plan would be greatest for Alternative 1, followed by Alternatives 2, 3, 6, 5, 4, and 7 in that order (Table 3.5-4). Therefore, the risk of cumulative effects to wetlands due to harvest would follow that same order.

Alteration of water flow in wetlands through increases in impervious surfaces reduces the time that water resides in wetlands or streams in a watershed and can lead to more severe flooding or more dry spells in streams. The effect of a road on an individual wetland, when added to other alterations to the hydrology in an area, could result in water flow alterations. In the Tongass, the impervious surfaces are generally forestry roads. These can be used to examine cumulative effects.

Table 3.5-4
Cumulative Percent of Original POG Remaining on All Ownerships in 2006 and Estimated Minimum Percent Remaining after 100+ Years[1] for All Lands within the Tongass Forest Boundary[2]

Remaining POG on All Ownerships in 2006 as a Percent of all Original POG	Remaining POG after 100+ Years as a Percent of Original POG						
	Alternative						
	1	2	3	4	5	6	7
87%	82%	80%	78%	72%	76%	76%	70%

[1] Assumes full implementation of Forest Plan at ASQ levels plus future non-NFS harvest.
[2] Annette Island is included because it is surrounded by areas within the Forest boundary.
Source: Tongass National Forest GIS database.

Road density is greater on the non-NFS lands within the Forest boundary than on the Tongass NFS lands due to concentrated harvest and more populated areas. Road density averages 0.19 mile per square mile on the Tongass NFS and 2.19 miles per square mile for non-NFS lands. The average for land of all ownerships is 0.31 mile per square mile; however, those are averages over a very large area and there is considerable variability. Table 3.6-9 in the *Fish* section of this chapter (percent frequency of Value Comparison Units [VCUs]) by road density categories for the Tongass and land of all ownerships) shows the large variability in road density across the Tongass. VCUs are roughly equal to a watershed.

No documentation was found regarding a threshold at which impervious surfaces interact to an extent to have a qualitatively or quantitatively different effect for wetlands in Southeast Alaska. In Washington State, a literature search to determine the best available science with which to evaluate cumulative effects of activities in wetlands revealed that there is disagreement about a specific threshold. The opinions in one report about the threshold to use, range from 10 to 20 percent impervious surfaces within a watershed. There were also scientists whose opinion was that specific thresholds were not accurate and that deterioration began immediately (Sheldon et al. 2005). The most conservative idea is that there is no accurate threshold, and that deterioration begins immediately. While cumulative effects will be analyzed during project analysis, comparisons can be made about the risk of adding to cumulative effects on wetlands associated with each alternative.

Table 3.5-5 shows the average future road density for each alternative for all ownerships. It includes forestry and other roads proposed for construction on NFS land and reasonably foreseeable roads on non-NFS lands. Alternatives 7 and 4 would result in the highest average road density. Therefore, in those alternatives, there is a greater risk of management actions adding to cumulative effects to wetlands. The average road densities for Alternatives 3, 5, and 6 are intermediate and their risk of cumulative effects would fall in the mid-range when compared to the other alternatives. Alternatives 1 and 2 would have the lowest risk of cumulative effects due to an individual project.

Table 3.5-5
Existing and Estimated Future Maximum Road Density (miles per square mile) for NFS Lands and for All Ownerships within the Forest Boundary by Alternative after 100+ Years[1]

		Alternative						
	Existing	**1**	**2**	**3**	**4**	**5**	**6**	**7**
National Forest Land	**0.19**	0.22	0.27	0.30	0.38	0.34	0.33	0.41
All Ownerships	**0.31**	0.42	0.47	0.49	0.57	0.53	0.52	0.60

[1] Assumes full implementation of Forest Plan at ASQ levels plus future non-NFS harvest. Annette Island is included because it is surrounded by areas within the Forest boundary.
Source: Tongass National Forest GIS database

Other activities also need to be considered when determining cumulative effects for past, present, and foreseeable future effects to wetlands. They include mineral extraction, transmission line projects, hydroelectric projects, transportation developments, expansion of cities, and recreational site development. Existing mining is at Greens Creek on Admiralty Island, Berner's Bay north of Juneau, and other locations. Given the level of world pricing, an increase in exploration is expected. There are also several regional transportation projects and regional energy and transmission projects planned for construction. Each of these activities can include clearing vegetation and disturbing wetlands with construction and maintenance. Therefore, the activities have the potential to affect wetlands and their functions and would be considered during individual project analysis. The effects of these projects would be the same for each alternative.

Changes in Southeast Alaska's climate (discussed in the *Climate and Air* section) could affect the size, type, and functions of wetlands and, therefore, could add to cumulative effects. While the models do not fully agree on the climate change predictions for Southeast Alaska, they generally predict warmer weather, with more winter rainfall, less snowfall, and a decrease in summer rain in some areas. That would likely result in lower soil moisture due to increased evaporation during warmer, dryer summer months. Also, a precipitation shift from snow to rain could lead to more water running off the landscape rather than being stored as snow. Snowmelt is an important water source for wetlands in the spring and summer.

Thus, increased evaporation and less water storage could lead to drier meadows or bogs and, possibly, fewer wetlands.

Changes in temperature could favor some plants and stress others. Longer growing seasons with warmer temperatures would likely result in faster growth. Those conditions would also favor more decomposition that could lead to changes in the organic matter in soils and bogs. Changes in climate could shift wetlands from being carbon sinks to sources of aerial and aquatic carbon due to more rapid decomposition during warmer summers. All of these factors could lead to changes in wetland types, such as shifts in vegetation from herbaceous to shrub, from shrubs to trees, or from bogs to more productive forests. However, as discussed in the *Climate and Air* section, the models do not always agree and the predictions for total precipitation in portions of Southeast Alaska differ.

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Fish

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Affected Environment

Fish and the aquatic resources on the Tongass National Forest provide major subsistence, commercial, and sport fisheries, as well as support traditional and cultural values. Abundant rainfall, streams with glacial origins, and watersheds with high stream densities provide an unusual number and diversity of freshwater fish habitats. These abundant aquatic systems of the Tongass provide spawning and rearing habitats for the majority of fish produced in Southeast Alaska. Maintenance of this habitat, and associated high-quality water, is a focal point of public, state, and federal natural resource agencies, as well as user groups, Native organizations, and individuals.

Approximately 12,700 stream miles and 4,100 lakes and ponds are mapped as Class I water bodies (based on Tongass GIS data); these water bodies are considered to be anadromous or high-value resident fish habitat. Another 8,800 stream miles and 4,700 lakes and ponds are mapped as resident fish habitat. Most of the Forest's streams and rivers empty into bays or estuaries, which are important during some life stages of anadromous species, as well as for many saltwater fish species. Marine invertebrates, such as clams and crabs, are commonly found in the estuaries and nearshore marine environment of Southeast Alaska. Some marine animals, including, Dungeness (*Cancer magister*), butter clams (*Saxidomes giganteus*), and other benthic and epibenthic organisms may be affected by upland management activities, such as timber harvest, road construction, and related log transfer and storage facilities.

Subsistence, commercial, and sport fisheries are all important to the way of life for Southeast Alaskan residents. Sport fishing is a favorite activity of residents and visitors. Hatcheries, and the enhancement of wild fish, among other aquaculture projects, contribute to resource availability and abundance. The primary fish species harvested in these fisheries are shown in Table 3.6-1.

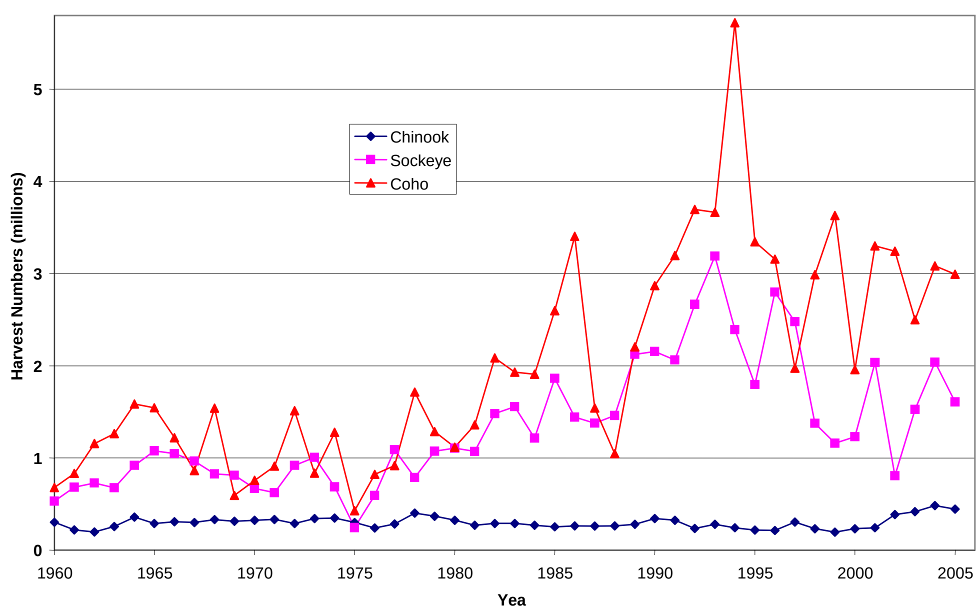
Table 3.6-1
Commonly Harvested Sport, Subsistence, and Commercial Fish

Species[1]	Sport	Subsistence	Commercial
Pink salmon (*Oncorhynchus gorbuscha*)	X	X	X
Chum salmon (*Oncorhynchus keta*)	X	X	X
Coho salmon (*Oncorhynchus kisutch*)	X	X	X
Sockeye salmon (*Oncorhynchus nerka*)	X	X	X
Chinook salmon (*Oncorhynchus tshawytscha*)	X	X	X
Cutthroat trout (*Oncorhynchus clarki*)	X	X	
Rainbow trout and steelhead (*Oncorhynchus mykiss*)	X	X	
Dolly Varden char (*Salvelinus malma*)	X	X	
Eulachon smelt (*Thaleichthys pacificus*)		X	

[1] Alternate names commonly used for the same species include pink or humpback; chum or dog; coho or silver; sockeye or red; Chinook or king; and eulachon, hooligan, or candlefish.

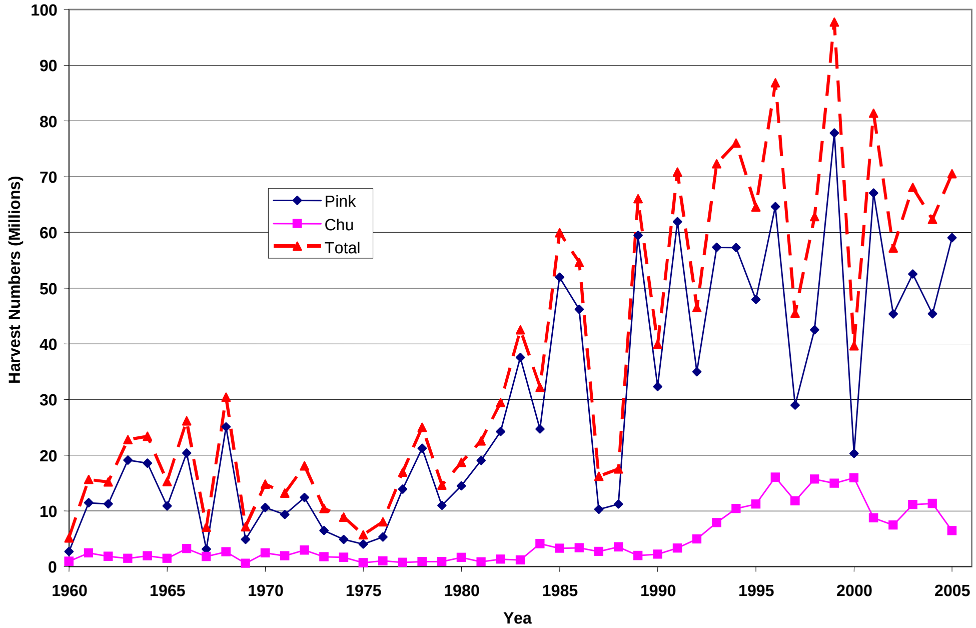
Commercial fish harvest in the waters of Southeast Alaska can fluctuate widely from year to year. For example, salmon harvest in Southeast Alaska averaged approximately 50 million fish between 1935 and 1940. It then declined steadily to less than 20 million fish in 1950. From 1950 to 1975, harvests were generally low, falling below 6 million fish in 1975 (Figures 3.6-1 and 3.6-2). Since 1975, harvest has been increasing in Southeast Alaska. Recent years where record harvest occurred for each of the main species were: Chinook (2004), sockeye (1993), coho (1994), pink (1999), and chum salmon (1996) (Bachman et al. 2005). Overall record harvest of total salmon occurred in 1999, when 98 million salmon were captured (Bachman et al. 2005). Overall, recent commercial salmon harvest (since early to mid-1990s) has remained high (Figures 3.6-1 and 3.6-2).

Figure 3.6-1
Commercial Harvest of Chinook, Sockeye and Coho Salmon in Southeast Alaska 1960 to 2005



Source: Bachman et al. 2005

Figure 3.6-2
Commercial Harvest of Pink, Chum and Total Salmon in Southeast Alaska 1960-2005



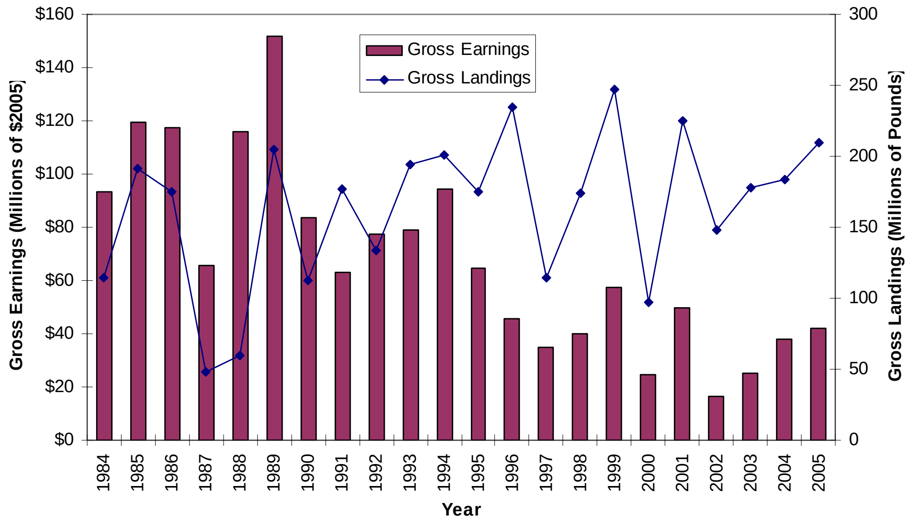
Source: Bachman et al. 2005

Based on estimated portions of each species originating from the Tongass National Forest, over 70 percent of the total harvested fish began their life in streams and lakes within the Forest boundaries. Fluctuations in commercial harvest trends are partly attributable to changes in ocean productivity. The productivity of marine waters in the Gulf of Alaska, and the survival of salmon and steelhead trout, is both highly variable and cyclic. From the mid-1970s into the mid-1990s, favorable ocean currents have resulted in high productivity and, consequently, high marine survival of salmon (USDA Forest Service 1995a). These favorable conditions have been more variable in more recent years and may not be following past cyclic patterns (Kruse 1998).

Based on the estimate of salmon produced from streams originating in the Tongass National Forest, estimated annual commercial salmon harvest (1984 to 2005) averaged over 164 million pounds, with a wholesale value (ex-vessel value) over $68 million (adjusted to 2005 dollars). The harvesting and processing of these salmon provided a substantial number of direct and indirect jobs in Southeast Alaska. In the most recent year reported, 2005, more than 210 million pounds of salmon were harvested worth more than $41 million in Southeast Alaska (Figure 3.6-3)

Hatchery production has also contributed substantially in overall fish production regionally. Hatchery production state-wide has greatly increased since 1977 with releases of more than 1 billion fish occurring annually since 1988, peaking in 2003 with more than 1.6 billion juvenile fish released state-wide (White 2006). These hatchery-released fish have contributing substantially to harvest statewide, with the number of returning fish increasing from less than 5 million in 1980 to more than 80 million statewide in both 2003 and 2005. A substantial portion of hatchery

Figure 3.6-3
Commercial Harvest and Wholesale (Exvessel) CPI Adjusted Value of Salmon Produced from the Tongass National Forest, Southeast Alaska (1984-2005)



Data Sources: Don Martin, Personal Communication, July 2006: Backman et al. 2005,http://w w w .cf.adfg.state.ak.us/geninfo/finfish/salmon/catchval/blusheet/94exvesl.php;http://w w w .cf.adfg.state.ak.us/geninfo/finfish/salmon/catchval/history/1970-2004s.php, Duffy (2004) http://w w w .cf.adfg.state.ak.us/geninfo/pubs/csepseak/csepseak.pdf

production and harvest occurs in Southeast Alaska with juvenile salmon releases equaling about one-third of total state release in 2005 (White 2006). Harvest of hatchery fish is a substantial portion of total salmon harvest in the Southeast Alaska region, averaging about 13 percent of the total number of commercially harvest fish (including cost recovery harvest) in recent years (1994 to 2005), or about 12 million fish annually (Alaska Department of Fish and Game [ADF&G] 2004a, White 2006). In some recent years, over 90 percent of the total commercial harvest of chum salmon, and a lesser percentage other salmon species, have resulted from enhancement projects in Southeast Alaska (ADF&G 2004a).

Approximately 85 percent of Southeast Alaska's sport fishing occurs in the vicinity of the Tongass National Forest. Sport fishing use has increased over the last four decades. For example, sport harvest of salmon in Southeast Alaska more than doubled in the last decade (from 1995 to 2004) (ADF&G 2004b). The economics of commercial and sport fishing is discussed in detail in the 1997 Tongass Forest Plan Revision Final EIS (USDA Forest Service 1997a) and updated in the *Economics and Social Environment* section of this chapter.

Fish Habitat

With more than 42,700 miles of streams and 250,000 acres of ponds and lakes (based on GIS measurements), the Forest provides abundant fish habitat. The habitat has been inventoried and classified, and estimates have been made of fish production. This section begins with a description of key habitat components, then presents a review of information on the effects of past harvest in Southeast Alaska on salmonid stocks, and finishes with a description of how fish habitat is mapped and classified on the Tongass.

Important Components of Fish Habitat

Stream Temperature and Dissolved Oxygen

Salmon and trout have optimum temperature ranges for rearing, spawning, and adult migration. Generally salmonid require cool stream temperature to thrive in most stream conditions (Bjornn and Reiser 1991). While very cool water conditions can be a limiting factor to salmon and trout survival and production, warmer temperatures are most often the more limiting condition within most of the range of Pacific salmon. However, in much of Southeast Alaska, increased summer temperature is much less of a concern than for more southerly regions due to the normal cool climatic conditions (Murphy and Milner 1997). Heating of streams also affects the amount of dissolved oxygen in the water, another important component for salmonid production and survival.

Stream temperatures are affected by solar radiation, evaporation, advection, conduction, and convection (Adams and Sullivan 1989, Brown 1983). Streams have a general tendency to warm as flow moves from upstream to downstream. The natural heating from solar radiation, increased air temperatures, and natural decreased stream flow tend to result in higher temperatures in the summer (Zwieniecki and Newton 1999). Timber harvest can have its greatest effect on stream temperature by removal of shade trees that reduce direct solar heating. Increased temperature results in reduced oxygen, but other factors such as decaying organic matter or abundance of salmon in a stream can also have large effects on dissolved oxygen concentrations (Pentec Environmental 1991, Welch et al. 1998, Spence et al. 1996).

Lack of stream shading buffers has been found to cause increases in stream temperature over 10 degrees Celcius (°C) in some small streams of the Pacific Northwest (Everest and Reeves 2007). Additionally lack of buffers can result in elevated microclimate temperatures that contribute to this heating (Spence et al. 1996, Chen 1991, Chen et al. 1992, Sullivan et al. 1990). However, effects in Southeast Alaska on stream temperature from past and resent harvest have not been of this magnitude and are often not significantly different than similar unaffected streams.

Murphy and Milner (1997) summarized the results of many of the studies on effects on stream temperature, of earlier past harvest in Southeast Alaska, when streams were typically not buffered. They noted a wide range of results. Some very small streams with timber harvest approached lethal levels (over 25°C). But most studies found no effect or only modest (e.g., 2°C) increases with stream temperatures not approaching lethal levels. These studies were all on streams that were harvested under old rules that did not require buffers. Effects on winter temperature also showed varied results in Southeast Alaska, some ranging from a slight increase, to no change, to a slight decrease in temperature in streams traversing clearcuts (Meehan et al. 1969 and Thedinga et al. 1989). Recent watershed monitoring on the Tongass (1997 to 2002) found that state water temperature standards were exceeded at similar rates in both harvested and unharvested watersheds (Walters and Prefontaine 2005). This suggests that elevated summer stream temperature is affected more by other environmental conditions than past timber and riparian harvest.

Situations where elevated temperature and low dissolved oxygen have been found to occur, and associated with fish die-offs, have been related mostly to the characteristics of stream morphology, hydrology, season, and number of fish present, not past timber harvest (Pentec 1991, Murphy 1985, Murphy and Milner 1997). Generally small basins of low elevation, low stream flow, confined intertidal conditions, with high numbers of adult fish, during warm weather periods were areas that occasionally had die-offs of adult salmon due to low oxygen (Murphy and Milner 1997).

Sediment

Sediment, includes both the coarse (gravel, cobble, bolder, bedrock) and fine (sand, silt) substrate composition in the stream channel. The relative composition affects many factors in stream production, including spawning areas and spawning success for salmon and trout, and benthic organism composition, which is an important food resource for fish. The amount of coarse sediment affects available spawning habitat and influences pool filling and bank stability (Spence et al. 1996). High levels of fines also affect pool filling, but also greatly influence survival of eggs and fry in spawning nests of salmon and trout (Chapman and McLeod 1987, Chapman 1988, Iwamoto et al. 1978, Gregory and Bisson 1997, McNeil 1964). Generally, the greater the portion of fines in spawning areas, the lower the survival of eggs and fry (McNeil 1964, Koski 1972, Chapman 1988). Increased fines in streams also reduce interstitial spaces in large substrate that are important habitat for many common cool water mountain stream aquatic insects.

Sources of sediment include input from banks, downstream movement from tributaries, and slumping and slides that enter or are near streams. The stream bed composition is a function of stream slope, roughness elements (e.g., amount and size of large woody debris [LWD]), and local adjacent geomorphic composition.

Several timber harvest related activities may affect stream substrate composition, including road construction, road drainage structures, level of use and maintenance of roads, number of stream crossings by roads, density of roads in the watershed, erosion and slumping of hill slopes following harvest, bank erosion where trees have been removed, and hydrology changes (Swanson et al. 1987, Furniss et al. 1991, Spence et al. 1996, Everest et al. 1987).

Past timber harvest practices have affected sediment levels in Southeast Alaska streams in some situations (Pentec 1990, Murphy and Milner 1997). Timber harvest in other regions have produced substantial increases in sediment and changes in composition; these are generally related to intensive timber harvest activities (Holtby and Scrivener, 1989, Cederholm et al. 1981). However, many studies of the effects of timber harvest and amount of sediment in Southeast Alaska streams have been inconclusive (Murphy and Milner 1997, Sheridan et al. 1984). Nevertheless, models developed by the Forest Service suggest that timber harvest activities, especially related to road construction, would increase fine sediment inputs to streams potentially affecting spawning success (Murphy and Milner 1997).

Large Woody Debris

LWD in stream channels includes entire trees, rootwads, and larger branches. LWD is an important component of fish habitat for good trout and salmon habitat, especially in heavily wooded regions (Swanson et al. 1976, Bisson et al. 1987, Naiman et al. 1992, Beechie and Sibley 1997, Spence et al. 1996, Murphy et al. 1986). LWD provides channel complexity, cover, and is especially important in the formation of pools (Bisson et al. 1987, Sullivan et al 1987, Benda et al. 2003). LWD has been found to form over 70 percent of all pools in a typical Alaskan valley bottom stream (Heifetz et al. 1986). The benefits of LWD in streams include critical sediment retention (Keller and Swanson 1979, Sedell et al. 1988), structural diversity (Ralph et al. 1994), gradient modification (Bilby 1979), nutrient production (Cummins 1974), and protective cover from predators. Its presence is often critical for overwinter habitat for various salmon and trout (Murphy and Milner 1997, Murphy et al. 1985, Koski et al.1984). Wood controls sediment movement downstream, minimizing the risk of debris flows in small headwater streams. In large streams, coarse sediment accumulated behind LWD often provides spawning gravels (Bilby and Bisson 1998, Montgomery et al. 2003). Newly entered LWD plays an important role in stream by providing inputs of leaf litter and needles and as it ages enhances nutrient dynamics.

Sources of LWD to streams include a variety of processes such as windthrow, wildfires, stream bank erosion, tree natural mortality, and debris slides, deep-seated mass soil movement, and input from upstream areas (Swanson and Lienkamper 1978, Benda et al 2003). Small headwater streams can provide wood to larger channels downstream (Potts and Anderson 1990, Prichard et al. 1998, Coho and Burges 1991, Benda et al 2003, Reeves et al. 2003).

Debris flows and dam-break floods during high flow occurrences can cause the transport of wood from upstream to downstream regions (Swanson and Lienkaemper, 1978). Because of the large size of much of the wood that enters streams, its ability to float during this type of event is limited to larger third- to fifth-order streams (Swanson and Lienkaemper 1978). While much less frequent than high flow events, large amounts of LWD can be added by debris torrents (Lamberti et al. 1991). The entry of LWD and coarse sediment at tributary junctions by debris torrents can form complex habitat, including pools and cover, and add spawning gravel to the main channel (Benda et al. 2003).

In streams of the Tongass, Murphy and Koski (1986) found that 40 percent of LWD in streams originated within 3 feet of the bank and 99 percent within 100 feet of stream channel. Martin et al. (1998) found similar results estimating that 94 percent of LWD entered streams in unharvested Southeast Alaska areas originated within 98 feet of the stream channel. There may be exceptions to this in certain streams. Reeves et al. (2003) found that about 65 percent of the LWD pieces in Oregon coastal streams originated in upslope areas, primarily from steep intersecting stream channel. Reeves et al. (2003) noted that similar conditions were observed in California and Washington states. The width of the stream valley and the slope of intersecting tributaires were the main factors determining the portion of wood entering from side streams.

The primary timber-related actions that may affect LWD supply to streams include buffer width along streams, stream class and channel characteristics that buffers are placed on, size of trees remaining in the buffer area, and effects on windthrow from adjacent harvest.

Murphy and Koski (1989) used a model to estimate that for moderate-sized valley bottom streams in Southeast Alaska with no buffers, LWD would decrease to about 30 percent of pre-harvest levels in about 90 years. Some studies have documented reduced LWD in Alaska clearcut streams relative to old-growth stream channels over time (Heifetz et al. 1986, Johnson et al. 1986, Murphy et al. 1986, Murphy and Milner 1997). But in the short term, LWD may be higher in clearcut areas (Lisle 1986). Limited long-term monitoring has occurred on Southeast Alaska streams to document changes. However, it was found that Maybeso Creek had a decrease in number and size of LWD, 30 years after harvest (Bryant 1980) with similar changes in Harris River (Bryant 1985, cited in Murphy and Milner 1997). However, these watersheds were intensively logged under conditions that had no buffer strips on streams; buffers were almost completely absent during timber harvest until the late 1980s. Buffer strips have greatly increased in frequency and size since then.

Buffer strip blowdown affects timing of LWD entry to streams. Several studies have shown that blowdown in buffers increases after harvest, primarily in the short term

(Pentec 1996, Martin 1996). Effects were short term, however, with rate of blowdown decreasing over time and the effects on total LWD loading to streams slight. There has been some documentation of a large increase in rootwads in a stream due to blowdown, which was considered beneficial to fish habitat (Murphy and Milner 1997). Recent monitoring of harvest areas since 2000 have found highly variable rates and amounts of windthrow adjacent to harvest units, but effects on stream LWD supply was not assessed (USDA Forest Service 2007). However, Martin and Grotefendt (2007) found that windthrow on non-NFS lands with 20-meter buffers would, on average, reduce the long-term LWD supply in Southeast Alaska forest streams by about 5 percent relative to unharvested areas (an additional 5 percent would be lost due to harvest).

Food Sources

Food sources for stream fish can originate directly within the stream or enter from the adjacent terrestrial environment or upstream aquatic environment. The main sources are from leaf and litter deposits from the adjacent riparian vegetation, algae growth and production on the stream bottom, and from returning salmon carcasses. This is ultimately the food base for smaller aquatic organisms (e.g., aquatic insects) that become food sources for stream fish. Detrital input is the main source from heavily shaded small- and medium-sized streams (Richardson 1992, Gregory et al. 1991). Larger streams in contrast derive much more of their food sources from algae production. Nutrient and organic input from returning salmon are also important (Wipfli et al. 1998). Small streams, many of which are not fish-bearing, supply nutrients that contribute substantially to larger streams (Independent Multidisciplinary Science Team 1999). When riparian trees are removed, the primary source of food is initially shifted to algae production within the stream and is derived less from leaf and needle organic matter (Murphy and Milner 1997). Overall production along many streams with canopy removal in Southeast Alaska actually increased (those where light was limiting), while in some there was no change (Murphy and Milner 1997). When second-growth areas regrow, however, production may be reduced due to shade greater than was produced by the original old growth. Small streams in Alaska have been found to also contribute substantially to larger streams through downstream transport of terrestrial and aquatic prey directly and detritus resources indirectly for fish (Wipfli 1996, Wipfli and Gregovich, Piccolo and Wipfli 2002). The type of riparian forest along these small streams affects both the amount and type of resources passed down stream. In some cases, the regrowth of alder trees along streams following harvest has resulted in higher amount of resources to downstream fish streams (Piccolo and Wipfli 2002). While changes to riparian areas will change the composition of the downstream transported food sources, the final overall effect of total removal, or complete retention of riparian vegetation on fishless streams on downstream fish streams over the long term is not clear, as actions near these small stream may have additional effects (e.g. sedimentation) on stream production (Wipfli and Gregovich 2002).

Effects of Past Forest Management Practices on Salmonid Fish Stocks

Past timber harvest practices and related actions in many regions of native Pacific salmon distribution range have been associated with declines of fish stocks (Everest and Reeves 2007). Similar reductions in stocks, however, have not been observed in Alaska (Byrant and Everest 1998). This may be partly because other human-induced disturbances (e.g. agriculture, dams, urban development), which are common in other regions, are rare in Southeast Alaska. As noted above, older forest practices (mostly prior to 1980) in the Tongass National Forest have had documented adverse effects to anadromous fish habitat conditions, including spawning habitat, rearing habitat, and migration conditions (Murphy and Milner 1997). Harvest during this timeframe accounts for about 60 percent of all timber harvest on the Tongass National Forest (see Tables 3.9-8 and 3.9-9 in the *Biodiversity* section). In one study of multiple streams in Southeast Alaska, summer fry numbers of coho salmon increased in clearcut areas, but had reduced or similar numbers of fall and winter stages of juveniles relative to old-growth systems (Murphy et al 1986). In another study, increased summer abundance of coho juveniles in clearcut areas had reduced the number of outmigrating coho smolts relative to old-growth areas (Thedinga et al. 1989). Similarly, juvenile steelhead abundance, while high in unbuffered clearcut streams in the summer, became very low in the winter as these fish moved to buffered and old-growth habitats where cover was higher (Johnson et al. 1986).

However, studies addressing potential long-term effects of timber harvest and related actions on actual numbers of fish produced are rare within the range of Pacific salmon, including Alaska (Brant and Wright in press). Brant and Wright (in press) compiled and analyzed the data from multiple juvenile fish studies in 26 streams in Southeast Alaska in an attempt to determine what long-term effects past harvest management actions have had on fish production by comparing fish abundance in managed and old-growth watershed streams. The managed watershed all had timber harvest activity prior to 1980, which generally included clearcutting of riparian trees. Partly because most studies examined were not specifically designed to address long-term effects, overall results of this analysis were limited. They examined population densities of juvenile fish from studies conducted from 1978 to 2000, including data on coho salmon, Dolly Varden char, steelhead, and cutthroat trout. Even with the variability of data, they found statistically significant differences between the managed and old-growth watersheds. Coho salmon and Dolly Varden densities were significantly lower in harvested areas, while steelhead density was greater in harvested areas. Where long-term trends were significant, they were downward in harvested areas. There were many differences in overall production among regions, differences between seasons, and morphological differences among streams that contributed to much overlap in abundance between treatment groups and the lack of clear results. Overall, this study suggests some negative effects on some populations from older harvest practices (prior to 1980). New forest practices in the Tongass National Forest are intended to prevent the habitat degradation in riparian areas and headwater streams that have contributed to these adverse effects on populations (Bryant and Wright in press).

Recent monitoring of stream fish populations, based on specific sampling designs intended to assess effects of recent timber harvest practices, is not at the stage where determinations can be made about effects of these newer practices on fish populations (USDA Forest Service 2007), but, as shown earlier (Figures 3.6-1, and 3.6-2), overall trends in Southeast Alaska commercial harvests from 1960 to 2005, including coho, pink, chum, and sockeye salmon, do not indicate specific downward trends in these populations, or specific trends that could be correlated with amounts of timber harvest activity. While many factors outside of forest management practices in Southeast Alaska (e.g., ocean conditions, weather, hatchery releases, harvest management, watershed conditions in other areas) influence these numbers, no obvious effects can be discerned from harvest data. However, the effects of these moderating factors may be too great to permit harvest data to demonstrate any effects on fish populations resulting from timber harvest in specific Southeast Alaska watersheds, particularly if they are relatively small (Bryant and Wright in press, Bryant and Everest 1998).

Stream Classification on the Tongass

Fish habitat on the Tongass is classified, for management purposes, using two classification systems (see the *Water* section of this chapter). The first is stream class, which relates primarily to presence or absence of fish, type of fish, and water quality. The second category is stream process group, which characterizes streams based on channel and drainage basin morphological conditions.

Stream Class Inventory

Streams are categorized by stream class, a classification primarily associated with fish use. Stream classes describe stream values, such as whether anadromous or resident fish inhabit a particular stream. Class I streams are anadromous and high-value resident fish streams, Class II streams are other resident fish streams, Class III streams are managed for water quality and, where appropriate, downstream aquatic resources, and Class IV are small streams that do not influence downstream water quality or fish habitat. Refer to the *Water* section for more detailed descriptions (also see the *Glossary* in the Proposed Forest Plan volume for more complete definitions.)

Channel Type Inventory

Perennial and many intermittent streams on the Forest have been inventoried for channel-type. The channel types provide a system to estimate the amount and quality of fish habitat, and can be used to predict their physical response and sensitivity to different management activities. Channel types have been categorized into distinct groups, called “stream process groups.” Process groups describe the interrelationship between watershed runoff, landform relief, geology, and glacial or tidal influences on fluvial erosion or depositional processes. They are described in Channel Type User Guide Tongass National Forest Southeast Alaska (Paustian et al. 1992). Process groups, in conjunction with stream class, are used for assigning the Riparian Standards and Guidelines. The estimated miles of stream by process group and class within the Tongass National Forest are shown in Table 3.4-1 in the *Water* section of this chapter.

Fish Habitat Enhancement

Much emphasis has been placed on the enhancement of fish habitat on the Tongass National Forest. From 1980 to 1995, the Forest Service implemented 176 fisheries habitat enhancement projects on the Tongass (USDA Forest Service 1997a).

Many of the fish habitat enhancement projects implemented on the Tongass National Forest are cooperative projects involving multiple agencies and organizations, including the Forest Service, ADF&G, Regional Aquaculture Associations, timber companies, and other non-profit hatcheries.

Types of enhancement projects have included:

- Fishways
- Falls Modification
- Spawning Channels
- Debris Removal
- Lake Fertilization

- Lake Stocking
- Stream Stocking
- Rearing Ponds
- Incubation Boxes
- Large Woody Debris (LWD) Management

In more recent years, emphasis has included a reduced array of projects across the Forest. Specific ongoing projects include the following:

- Fishways: Currently one is actively being developed at Snow Pass Creek;
- Falls Modification: One site is being evaluated at Kanalku Creek;
- Spawning Channels: One new site is being evaluated at Fish Creek;
- Lake Fertilization: Currently one lake (Redoubt) is being fertilized annually;
- Lake Fish Stocking: One pen-rearing/lake stocking site is planned for implementation in 2007 at Bakewell Lake; and
- LWD: Several LWD projects are being implemented associated with watershed restoration.

Additionally, habitat access to streams has been improved through replacement of culverts that did not meet current juvenile fish passage design criteria. About 88 percent of all stream crossings (about 80 percent of the crossings are culverts or similar structures) have been assessed as to suitability to ensure juvenile fish passage. Among the crossings assessed, about 1,200 crossings, or 37 percent of all crossings (mostly culverts), did not meet current juvenile fish passage standards (USDA Forest Service 2006b). Of those not meeting standards, more than 75 percent were on Class II streams. Habitat above the crossings with potential passage problems was estimated to equal about 0.5 percent and 3.2 percent of all Class I and Class II stream miles on the Tongass, respectively. Based on the restrictive criteria used to determine whether a culvert is suitable for juvenile fish passage, the known distribution of fish above culverts designated as not meeting passage criteria (about 85 percent of those reaches have fish populations), and the small size of most of these streams, the habitat area affected would actually be much less than the percentages imply (USDA Forest Service 2006b). However, even though the habitat area may be small, the effect on an individual stock may be important. Most of these culverts were installed prior to implementation of the 1997 Forest Plan standards and guidelines for culvert installation. A recent survey of 29 culverts installed since the 1997 standards and guidelines began to be implemented found that two (7 percent) did not meet current juvenile fish passage criteria (Dick Aho, USDA Forest Service Biologist, Personal Communications August 23, 2007). To reduce these effects, culverts are being replaced, removed, or bypassed.

Approximately 240 culverts have been replaced through 2006 to improve fish passage. The Tongass National Forest estimated that it spent $1.5 to $2.0 million a year for culvert replacement for approximately 50 sites per year through 2005 (USDA Forest Service 2006b). The culvert replacement program declined in 2006 due to funding reductions, and is projected to continue to decline in future years. However, the intention is to continue this program of culvert replacement when funding supply is reinstated as part of road maintenance funding.

Fisheries Habitat Enhancement Opportunities

The anticipated salmon production from fish habitat enhancement projects on the Tongass National Forest is calculated based on site-specific habitat conditions and an analysis of limiting factors for salmon production. The test for these habitat production estimates consists of monitoring conducted on individual projects and the subsequent feedback of the monitoring results into the project planning process.

The 1997 Tongass Land Management Plan Revision Final EIS identified 158 potential projects for initiation during the first 10 years of implementation of the Forest Plan (USDA Forest Service 1997a). The extent of implementation of these projects has been considerably less. The public continues to expect the maintenance or improvement of fish habitat values. Public interest for subsistence, commercial, and sport-harvested fish remains high.

Demand for subsistence fish is discussed in the *Subsistence* section of this chapter, while commercial and sport fish demand are reviewed in this section. Commercial fish demand is calculated based on goals set by Regional Salmon Planning Teams for annual fish production for several species. Some of the “year 2000” goals were set in 1981 in the Comprehensive Salmon Plan for Southeast Alaska, Phase I, and have not been updated. Annual common property commercial harvest usually achieved these goals for pink salmon (92 percent), coho salmon (61 percent), and sockeye salmon (58 percent), but infrequently for chum salmon (31 percent) for the period of 1991 through 2003 (ADF&G 2004a). Harvest has been highly variable during this period. National Forest habitats were estimated to contribute approximately 80 percent of the fisheries in Southeast Alaska (USDA Forest Service 1997a), although the relative contribution has decreased in more recent years due to increased hatchery production.

There has been a tenfold increase in state-wide angler participation from 1961 through 2004, with total license sales in Alaska increasing from 55,564 to 503,422 during this period (Jennings et al. 2007). Overall, the number of anglers increased in Southeast Alaska by about 40 percent between 1991 and 2004 (from about 93,000 to 130,000 angler licenses) (Howe et al. 1995, Howe et al. 2001, Jennings et al. 2006, 2007). This equates to about a 4.5 percent increase in total licenses sales in Southeast Alaska annually. However, the number of Southeast Alaska resident anglers declined slightly since 1991 (about 10 percent), while the number of non-resident anglers increased from about 58,000 to 98,000 between 1991 and 2004; a 70 percent increase. The rate of increase exceeds that for sport fishing participation in all of Alaska for this same period (1991 to 2004) with total state fishing license sales increasing about 29 percent (from about 391,000 to over 503,000) (Jennings et al. 2007).

Fish Management Indicator Species

National Forest Management Act (NFMA) regulations direct the use of Management Indicator Species (MIS) in forest planning to help display the effects of forest management. MIS are species whose population changes are believed to indicate the effects of land management activities. For the 1997 Forest Plan, pink salmon, coho salmon, Dolly Varden char, and cutthroat trout were selected as MIS. Pink salmon were selected to represent anadromous fish that are limited in their freshwater life period by spawning gravel quality and quantity; coho salmon to represent anadromous fish that are generally limited in their freshwater life period by stream and lake rearing area; Dolly Varden char because of their ubiquitous distribution in freshwater habitats; and cutthroat trout because of their dependency on small freshwater stream systems, which are most susceptible to effects from management activities. These MIS fish species, and their habitats, are described in the 1997 Forest Plan Revision Final EIS.

Threatened and Endangered Fish Species

Federally listed threatened and endangered species are those plant and animal species formally listed by the U.S. Fish and Wildlife Service (USFWS) or the National Marine Fisheries Service (NMFS), under authority of the Endangered Species Act (ESA) of 1973, as amended. An endangered species is defined as one that is in danger of extinction throughout all or a significant portion of its range. A threatened species is defined as one that is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.

No federally listed fish species or stocks originate from Alaska streams. However, some federally listed fish stocks may occur in marine waters within the boundary of the Tongass National Forest. These fish include the following:

Endangered species:

- Snake River sockeye salmon
- Upper Columbia River spring-run Chinook salmon
- Upper Columbia River steelhead

Threatened species:

- Snake River spring/summer Chinook salmon
- Snake River fall Chinook salmon
- Puget Sound Chinook salmon
- Lower Columbia River Chinook salmon
- Upper Willamette River Chinook salmon
- Columbia River chum salmon
- Snake River Basin steelhead
- Lower Columbia River steelhead
- Upper Willamette River steelhead
- Middle Columbia River steelhead
- Puget Sound steelhead

These listed stocks of salmon and steelhead do not spawn in Alaska, but are known to seasonally inhabit marine waters on the outside coast to the west and occasionally in inside waters of the Tongass National Forest. They may feed on fish that are dependent on coastal marine waters of the Tongass National Forest at some stages of their lives.

Pursuant to Section 7 of the ESA, a biological assessment was prepared to assess the effects of the 1997 Forest Plan revision on the endangered Snake River sockeye salmon and the threatened Snake River spring/summer Chinook salmon and Snake River fall Chinook salmon, and submitted to NMFS for review and concurrence in the Tongass Forest Plan process (Appendix J of the 1997 Tongass Forest Plan Revision EIS). This assessment has been updated to address the currently listed fish species relative to the alternatives considered in the Forest Plan amendment (Appendix F).

Essential Fish Habitat

The *Magnuson–Stevens Fishery Conservation and Management Act* mandates that agencies initiate consultation with NMFS for any activities that could affect essential fish habitat (EFH). EFH has been broadly defined by Congress for federally managed species to be "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity".

NMFS (2005) clarified what the specific definition is for EFH in Alaskan waters. EFH is the general distribution of a species described by life stage. It is generally the habitat area that includes 95 percent of that life stage, where it is known, to occur. Where distribution data is unknown, surrogate species may be assumed. Maps were presented in NMFS (2005) defining EFH for species and life stages; other than for salmon species, little EFH is present in the inside waters of Southeast Alaska. Those groundfish species that are present include some sole species life stages only. Several other species, however, have some life stages located in the marine waters offshore of Southeast Alaska and some enter outer nearshore waters. In general, EFH for marine groundfish species (e.g., rockfish, sablefish, sole, plaice, cod, pollock), are extremely limited near Tongass waters.

Salmon EFH covers freshwater, estuarine, and marine waters from the high tide level to 200 meters deep and out to the 200 nautical mile U.S. exclusion zone, depending on life stage. The freshwater EFH is defined primarily by what is present in the ADF&G's Catalogue of Waters Important for Spawning, Rearing, or Migrations of Anadromous Fishes (ADF&G 1998). Freshwater EFH for salmon in the Tongass would include all streams, lakes, ponds, and wetlands currently or historically accessible to salmon. The shallow marine waters adjacent to forest lands are considered EFH for salmon, but little of this area is EFH for most groundfish species.

Sensitive Fish Species

Sensitive species are those plant and animal species identified by the Regional Forester for which population viability is a concern on National Forest Service (NFS) lands within the region. The goal of the Forest Service Sensitive Species Program (Forest Service Manual 2670) is to ensure that species numbers and population distribution are adequate so that no federal listing will be required and no extirpation will occur on NFS lands.

The Alaska Region Sensitive Species List was updated in June 2002. There are three fish species currently designated as sensitive species in the Alaska Region.

Northern Pike

Northern pike are found in five lakes, referred to as Pike Lakes, approximately 23 miles east of Yakutat in Roadless Area 341 (Browning 1986). These lakes are shallow, with high concentrations of humic acid and peat-filled margins. The northern pike in Pike Lakes are the only naturally occurring pike in Southeast Alaska and are probably remnant populations that survived only because the most recent glacial advance missed the Pike Lakes area. Relatively little information is available on the life history and population dynamics of these pike populations. Their presence in any other regional waters would be considered as an invasive species (see the *Invasive Aquatic Species* subsection below).

Large Chum Salmon

Near Hyder on the Portland Canal, Fish Creek produces very large chum salmon, probably the largest chum salmon in North America. Several fish over 38 pounds have been weighed by biologists; fish weighing 25 pounds are common. The average size of large chum salmon is close to 20 pounds (the average chum salmon from other areas weighs around 10 pounds). A high percentage of the returning fish have spent 4 and 5 years in the ocean, accounting for the large average size. Normally, chum salmon stay at sea for 2 to 5 years (Salo 1991). Fish Creek is a low-gradient stream, dominated by high-quality spawning gravels and extensive areas of groundwater upwelling. The predominant upwelling and high-quality spawning gravels appear to be the reasons for the remarkable production levels. Populations have been stable or increasing, with a reported escapement of more than 60,000 in 1993.

Island Run King Salmon

King Salmon River and Wheeler Creek populations of king salmon are island genetic stocks. No other naturally occurring runs of island king salmon stocks are known to exist in Southeast Alaska. King Salmon River and Wheeler Creek are both within Kootznoowoo Wilderness. Information on these populations is limited, although recent escapement counts suggest the population is stable or slightly decreasing. The King Salmon River stock serves as an important king salmon transplant source for other streams and rivers.

Invasive Aquatic Species

Species are considered invasive if they are not native to an ecosystem, and if they are likely to cause harm to human health, the economy, or the environment (Executive Order 13112). Due to its remote landscape, northern climate, small human population, and few concentrated disturbed habitat areas, Alaska has relatively few invasive species compared to the rest of the United States, according to ADF&G's Alaska Aquatic Nuisance Species Management Plan (Fay 2002). However, factors such as altered disturbance patterns, constant flow of marine-based shipping and cruise ships, fishing and recreational boating traffic, and climate change may increase the prevalence of invasive aquatic species. Global climate change may create conditions suitable for new invasives, as well as range expansions, by altering geographic range limits and making habitats no longer as suitable for existing native species.

Invasive aquatic species can affect native species by eating them, competing with them, hybridizing with them, disrupting or destroying their habitat, or introducing pathogens or parasites that sicken or kill them (Schrader and Hennon 2005). In addition to natural range extension, several potential pathways exist for introduction of invasive aquatic species. These pathways included fish farms, international and local movement of bait and game fish, trade in live seafood, aquaculture, and contaminated sport angle gear brought into Alaska, as well as ballast discharge from international vessels (Fay 2002, Schrader and Hennon 2005). Several aquatic species have been noted as potential threats to Alaska, including fish (northern pike, Atlantic salmon, yellow perch, ornamental aquarium fish), invertebrates (green crab, New Zealand mudsnail, Chinese mitten crab, zebra mussel, signal crayfish, spiny water flea), plant (cordgrass), and several additional miscellaneous taxa (Fay 2002, Schrader and Hennon 2005). Additionally, eastern brook trout (non-native) and non-endemic rainbow trout have been stocked in many areas where they were not native and compete or hybridize with native trout (Schrader and Hennon 2005). Of these fish, transplanted northern pike and Atlantic salmon are the two fish species of greatest concern (Fay 2002). The invertebrates Chinese mitten crab, green crab, and New Zealand mudsnail, even though they have not been found in Alaska, are of major concern because of their potential to do serious damage to the Alaskan ecosystems (Hines et al. 2004, Schrader and Hennon 2005). Atlantic salmon that have escaped from fish farms pose a threat to native salmon by competing for habitat and introducing diseases and parasites. This species has been observed in Southeast Alaska marine waters and, rarely, in streams (Fay 2002). Also, northern pike, which has not appeared in Southeast Alaska (with the exception of a native stock in Yakutat), have caused widespread damage to resident trout where they have been introduced, and could potentially affect coho salmon through predation. Northern pike have the potential to cause serious environmental and economic damage to highly productive salmon streams in Southeast Alaska (Fay 2002). In the Tongass, there is a risk that these and possibly other non-native sport fish may be introduced into lakes and rivers by individuals seeking to increase sport fishing opportunities. As the road network is extended into more areas of Southeast Alaska, this risk increases. Refer to the ADF&G aquatic species management plan for additional details.

Environmental Consequences

Direct and Indirect Effects

Many of the standards and guidelines in the current Forest Plan were based, to a large extent, on the recommendations of the Anadromous Fisheries Habitat Assessment (AFHA) (USDA Forest Service 1995a). AFHA is considered the most comprehensive scientific review available for the Tongass. The 1997 ROD notes that the standards and guidelines and other direction included in the current Forest Plan meet or exceed all of the recommendations by AFHA. The AFHA evaluation is still relevant for the current EIS.

Additionally, two separate panels assessed effects of alternatives on fish-related issues (Dunlap 1996, 1997). The two panel assessments were completed, one in 1996, which was used for the 1997 EIS assessment, and a more limited assessment completed in 1997 that added additional panel assessments for a subset of the alternatives included in the 1997 EIS. While the current alternatives being evaluated have differences from the alternatives evaluated by these panels, four of them are based on the 1997 alternatives and differ only in specific ways. Where the similarities are comparable, the results of the assessments can be used to help evaluate relative effects of the considered alternatives.

The panel assessments were based on activities that are part of timber management among the alternatives. The main activities included roads and harvest. The location and amount of road miles have historically affected slope stability and runoff to steams having major effects on water quality and fish passage, which are both factors that affect fish habitat and abundance. Additionally, the location and amount of timber harvest can affect riparian vegetation and slope stability, especially on unstable soils, which also have substantial influence fish habitat. These two items, as well as aquatic habitat enhancement, will be discussed first under General Effects. They will set the stage for the discussion of how the alternatives compare to the past panel assessments. The Fish/Riparian Assessment Panel summary reports (Dunlap 1996, 1997) serve as the basis for the second part of the following discussion of environmental consequences.

In general, with the exception of Alternatives 4 and 7, the effects of all alternatives on fish resources are expected to be at or below those predicted for the selected alternative in the 1997 Tongass FEIS, which represents the current Forest Plan. The Forest Plan is very similar to Alternatives 5 and 6.

General Effects

Roads

Roads pose the greatest risk to fish resources on the Tongass (Dunlap 1996, USDA Forest Service and U.S. Department of the Interior (USDI), Bureau of Land Management 1995), partly because they pose the largest risk of management-caused sediment input to streams (Reid and Dunne 1984, Furniss et al. 1991, Gomi et al. 2005, Hassan et al. 2005). Roads can potentially create areas of hillslope instability resulting in landslide generation, contribute fine sediment from surface erosion, and alter surface and subsurface water flow patterns. Landslide debris (sediment, large wood) that enters streams may block or shift channels, fill pools, and increase fines in spawning areas. Increased sediment yield, including yields during road construction, road use during timber harvest activities, and lack of sufficient maintenance or proper closure following timber harvest activities, are all viewed as potential areas of risk for maintaining fish resources. Roads may also increase risk to fish movement due to improper construction relative to fish passage (Gibson et al 2005) and blocked culverts. Stream-rearing fish, particularly cutthroat trout and Dolly Varden, that occupy the smaller headwater streams during some parts of their lives are at the greatest risk. Juveniles of stream-rearing fish are often highly mobile during their freshwater stage, moving seasonally between stream reaches.

While riparian protection (e.g., buffers) can greatly reduce sediment delivery to streams (Belt et al. 1992, Chamberlin et al. 1991), they provide little reduction in the risks to fish or stream channels caused by roads during construction. Road construction practices require additional attention to ensure that risks to fish and stream channels are not excessively high. Roads also increase the risk that improved access would contribute to over-harvest of fish by anglers. These potential effects are best addressed at the site-specific level during project design.

USDA Forest Service and USDI, Bureau of Land Management (1995) concluded that watersheds with fewer roads generally have healthier fish populations. NMFS, as part of their working guidance document for comprehensive salmon restoration initiatives on the Pacific coast, developed a matrix of key habitat indicators of watershed conditions to determine where adverse effects may occur, and identify factors that limit salmonid production (NMFS 1996). NMFS indicted that these factors are appropriate for use at watershed, reach, and site scales. One of these habitat indicators was road density. NMFS noted the following: 1) a watershed with road density of less than 2 miles per square mile and no valley bottom roads would be considered “properly functioning,” 2) watersheds with road density of 2 to 3 miles per square mile and some valley bottom roads were “at risk,” and 3) watersheds with road density greater than 3 miles per square mile and many valley bottom roads were rated as “not properly functioning.” Based on this information, the frequency of occurrence of road densities exceeding the “properly functioning” value of 2 miles of road per square miles, not considering road location, was used as a general index of relative effects of roads on aquatic resources.

Total road miles and road density would increase under all alternatives and follow a similar pattern (Table 3.6-2). The increase in road miles over existing conditions could range from 16 to 118 percent for the alternatives over the next 100+ years. This percentage increase would be 16 to 57 percent for Alternatives 1, 2, and 3; 76 to 78 percent for Alternatives 5 and 6; and 99 to 118 percent for Alternatives 4 and 7. Currently, the Value Comparison Units (VCUs) containing at least some harvest account for about 41 percent of all VCUs on the Tongass; however, total harvest in each VCU is highly variable ranging from just a few acres to several thousand. Currently, the average road density on NFS lands on all VCUs is 0.19 mile per square mile, while the average road density in only VCUs with some past harvest is approximately 0.46 mile per square mile. After more than 100 years of Forest Plan implementation, the estimated overall road density on NFS lands would range from 0.22 mile per square mile under Alternative 1 to 0.41 mile per square mile under Alternative 7. On average, all of these densities are within the range of what NMFS (1996) characterized as “properly functioning” watershed road densities for west coast salmon. Currently, about 98 percent of all VCUs have road densities in the “properly functioning” range (less than 2 miles of road per square mile) for NFS lands. The alternatives would reduce the portion of VCUs with this road density on NFS lands to about 96 percent (Alternative 1) to 90 percent (Alternative 7) (Table 3.6-2). Alternatives 1 and 2 would have the lowest frequency of VCUs with road density over 2 miles per square mile. The largest relative increase in the percentage of VCUs with high road density would occur between existing conditions and Alternative 7. Additionally, the number of VCUs that have no roads on NFS lands is currently about 68 percent; this percentage would remain about the same under Alternative 1 and decrease to 60 to 66 percent under Alternatives 2, 3, and 6, and to 51 to 59 percent under Alternatives 4, 5, and 7. Increases in road densities are primarily in watersheds that already have roads. Potential effects that additional road construction and increases in density would have on any specific VCU and related watershed condition would ultimately be addressed on a project-specific level.

Table 3.6-2
Estimated Road Miles and Percent of VCUs in Road Density Categories on NFS Lands under Existing Conditions and after 100+ years of Full Implementation[1]

	Alternative							
Road Type	**Existing**	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Existing Roads	4,941	4,941	4,941	4,941	4,941	4,941	4,941	4,941
New Road Construction	-	774	2,079	2,799	4,890	3,874	3,744	5,825
Road Reconstruction[2]	-	925	1,784	1,932	2,182	2,100	2,046	2,371
Total Roads	4,941	5,716	7,021	7,741	9,832	8,816	8,686	10,767
Percent Increase	-	16%	42%	57%	99%	78%	76%	118%
Road Density Categories (Mi /Sq. Mi.)[3]								
0	68.0%	67.8%	66.0%	63.6%	52.1%	58.9%	60.0%	51.4%
>0 - 1.0	21.5%	20.4%	19.4%	20.2%	26.1%	22.4%	21.1%	24.9%
>1.0 - 2.0	8.0%	7.3%	8.7%	9.3%	13.5%	11.0%	11.4%	13.5%
>2.0 - 3.0	2.0%	3.5%	4.8%	5.5%	6.6%	6.3%	6.1%	7.6%
>3.0 - 4.0	0.4%	1.0%	1.2%	1.4%	1.7%	1.4%	1.4%	2.5%
>4.0	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%
Percent of VCUs with Average Road Density less than 2 miles/mi^2	98%	96%	94%	93%	92%	92%	93%	90%
Average Road Density (miles /mi^2) for all NFS Lands	0.19	0.22	0.27	0.30	0.38	0.34	0.33	0.41

[1] Assumes full implementation of Forest Plan at ASQ levels plus future non-NFS harvest. Includes adjusted road miles estimated to be needed to harvest all suitable timber in the alternative allowing for approximation of fall down (the reduction between the planned and the actual roads needed due to discovering additional streams, soils issues, etc, during timber sale layout). See Appendix B for details of estimating methods.
[2] Estimated existing road miles that would need to be reconstructed.
[3] Percentages are based on 935 VCUs that contain at least 100 acres of NFS lands.

It should be noted that these projected road densities are based on harvesting at the ASQ level, including both non-interchangeable components (NIC) I and II, over the next 100 years or so. Some adjustment has been made to the harvest acres to account for normal "fall down" that would result from actual on-the-ground surveys during layout when more streams, unsuitable soils, and other factors greatly reduce the actual amount of road and harvest that would occur on these lands. However, based on past harvest practices, even these adjustments may overestimate the future amount of harvest area, these road densities represent maximums and are not likely to be achieved.

Soils of high risk for landslide or mass wasting failure are those indicated as a mass movement index of 3 (MMI 3) (generally gradient of 55 to 72 percent). The upper ranges of these soils (65 to 72 percent) generally have the higher risk of slope failure. Those soils with slopes greater than 72 percent mass movement index of 4 (MMI 4) are removed from the suitable timber base, but may have small inclusions within the MMI 3 layer. Also, current standards and guidelines, in consideration of these concerns, recommend avoiding building roads on slopes greater than 67 percent. Therefore, roads built on soils with slopes greater than about 67 percent are considered at greater risk of slumping or mass failure, increasing the chance of large amounts of sediment entering streams. The miles of road likely to be constructed on soils of this type are shown in Table 3.6-3. While the area is small among all alternatives, due to standards and guidelines that restrict construction of roads in regions of this slope category, there are differences among the alternatives. Overall, Alternative 1 has the lowest portion of new roads in this category.

Table 3.6-3
Estimated Maximum Road Miles on Potentially Unstable Soils Based on Slopes Greater Than 67 Percent over the Length of the Project (approximately 100+ years)[1]

Road Type	Alternative						
	1	2	3	4	5	6	7
Road mile > 67% Slope	9	30	41	66	53	51	80

[1] Includes adjusted roads miles estimated to be needed to harvest all suitable timber in the alternative allowing for approximation of fall down (the reduction between the planned and the actual roads needed due to discovering additional streams, soils issues, etc, during timber sale layout).

Alternative 2 and 3 areas are also moderately low, while Alternatives 5 and 6 are intermediate and Alternatives 4 and 7 are the highest.

The number of road crossings of streams increases the risk of both adding sediment to streams and impeding fish passage (Class I and II streams). While the BMP for construction methods of culverts and bridges reduce these risk for sediment and turbidity, monitoring of some streams, which have mostly compliance with water quality standards, have found occasional increases in turbidity at least in the short term as described in the USDA Forest Service Tongass Monitoring Reports (USDA Forest Service 2004c). Also, new fish passage guidelines (Forest Service Handbook 2090.21 Aquatic Habitat Management Handbook as USDA Forest Service 2001a) for culvert design greatly reduce risk of new culvert installation impeding fish passage on Class I and II streams. But some risks still remain. An index of these risks to both added sediment from road crossings and impedance of fish passage is shown in Table 3.6-4. Currently about 3,600 fish stream crossings exist on the Tongass. The various alternatives would add moderately to this number increasing risk. Alternative 1 would have the least risk, while Alternatives 4 and 7 would have the most risk. Alternatives 5 and 6 would be similar, and intermediate. In general the trend follows that of road miles constructed.

Table 3.6-4
Estimated Number of Existing and Maximum New Stream Crossings for New Roads by Alternative over the Length of the Project (approximately 100+ years)[1]

Stream Class	Alternative							
	Existing[2]	1	2	3	4	5	6	7
I	1,300	47	137	193	377	296	293	472
II	2,300	121	293	389	769	621	603	958
III	-	650	1,783	2,371	3,917	3,186	3,093	4,899
Total	**3,600**	**817**	**2,213**	**2,952**	**5,064**	**4,103**	**3,989**	**6,328**

[1] Based on adjusted roads estimated to be needed to harvest all suitable timber in the alternative allowing for approximation of fall down (the reduction between the planned and the actual roads needed due to discovering additional streams, soils issues, etc, during timber sale layout). See Appendix B for details of estimation methods.
[2] Approximate estimate based on USDA Forest Service 2006 data. Values expanded based on portion of road miles assessed and known portion of Class I and II crossing in the Tongass. Class III stream crossing not assessed.

Timber Harvest

Timber harvest activities can increase risk to fish resources. Protection of riparian areas, including floodplains, areas of riparian vegetation, and certain wetlands associated with riparian systems are of particular concern. As discussed earlier, riparian vegetation serves many important functions for stream fish habitat, including supplying LWD, food input, and stream shade to name a few. Also of concern is the amount of protection afforded steeper channels (often not fish-bearing) in the headwaters areas and protection of steep hillslope areas. These streams (e.g. class III streams) also require LWD to properly function (Paustian et al. 2006), as well as contributing nutrients, food resources, and, in some situation, LWD to downstream fish streams. Protection of estuaries is also important when locating roads and timber harvest units. Although Forest Plan standards and guidelines associated with riparian areas, wetlands, and beach and estuary fringe are expected to protect fish resources from significant impacts associated with timber harvest, there is still some level of risk. The risk is related to the level of harvest, portion of streams in the harvest area, and quantity of potentially unstable slopes in the harvest area associated with each alternative.

Timber harvest activities on the Forest could potentially affect as many as 144,000 (Alternative 1) to 1,070,000 total acres (Alternative 7) after full implementation of the Forest Plan (100+ years) (Table 3.6-5). Alternatives 1, 2, and 3 would harvest the least acreage and Alternatives 4 and 7 the most, while Alternative 5 (No Action) and Alternative 6 (Proposed Action) would be in the higher portion of the intermediate range of alternatives. Projected acreages are based on harvesting at the Allowable Sale Quantity (ASQ) level, but with adjustment for probable fall down rates to account for reductions from on the ground surveys during project examination during specific project National Environmental Policy Act (NEPA) evaluation and final project layout. Therefore, the values are expected to reasonably approximate Forest-wide harvest (see the *Timber* section).

As harvested forest areas mature, young growth is predicted to become an increasingly larger portion of the harvest. When this occurs, the alternatives with lowest overall harvest have the highest portion of second-growth harvest reducing areas of new ground disturbance related to harvest. Alternatives 1, 2, and 3 would have at least 39 percent as young-growth harvest, while Alternatives 5 and 6 would have 33 percent. Altenatives 4 and 7 would have only 25 to 26 percent of the harvest as young growth. Actual acres of young growth would range from about 58,000 under Alternative 1 to 262,000 under Alternative 7.

Table 3.6-5
Estimated Maximum Acres of Timber Harvest after 100+ Years of Full Forest Plan Implementation[1]

Alternative	Maximum Acres Likely to be Harvested Over the Life of the Forest Plan[2]	Percent of Likely Harvest that is Young Growth
Alternative 1	144,265	40%
Alternative 2	393,937	46%
Alternative 3	513,676	39%
Alternative 4	891,986	26%
Alternative 5	686,583	33%
Alternative 6	663,471	33%
Alternative 7	1,069,624	25%

[1] Based on the ASQ. Incorporates adjustments for falldown.
[2] Includes productive old growth and young-growth harvest.

The number of stream miles within development LUDs can be used as an index to risk for fish resources from harvest-related actions. As shown in Table 3.6-6, the stream habitat at risk closely follows the quantity of harvest. The total stream miles in development LUDs ranges from a low of 4,300 miles for Alternative 1 to 19,900 miles for Alternative 7 (Table 3.6-6). Class I streams are considered most important because these are anadromous and high-quality resident fish streams. Class I stream miles range from about 1,300 miles under Alternative 1 to 5,300 miles under Alternative 7. Total fish stream miles (Class I and II) range from 2,300 under Alternative 1 to 9,500 under Alternative 7. Streams receive substantial protection from riparian buffers and the beach fringe under all of the alternatives. In general, the riparian protections would greatly reduce direct effects to fish resources. However, the greater the miles of streams in development LUDs, the greater the risk to fish resources. The lower reaches of all streams under Alternatives 1, 2, 3, 4, 5, and 6 would be protected within a 1,000-foot beach fringe and Class I, II, and III streams would all receive buffers. Alternative 7 would fully protect a smaller portion of lower stream reaches because of only a 500-foot beach fringe. Alterntive 7 would not require buffers on Class III streams, which may affect downstream fish-bearing streams through a reduction in LWD contributions in certain situations (Paustian et al. 2006).

Table 3.6-6
Mapped Stream Miles[1] within Development LUDs by Alternative

Stream Class	Alternative 1	2	3	4	5	6	7
I	1,341	2,364	3,037	4,841	3,752	3,628	5,274
II	951	1,772	2,321	3,912	3,117	2,983	4,216
III	2,004	4,582	6,318	9,657	7,618	7,344	10,425
Total	4,295	8,718	11,676	18,411	14,487	13,954	19,915

[1] Note: Streams have been inventoried more completely in areas that were proposed as Development LUDs compared with areas in Non-development LUDs. Development LUDs include Timber Management, Modified Landscape, Scenic Viewshed, and Experimental Forest.

As noted under the road section, disturbance to hillslope regions with potentially unstable soils could cause slumping and mass wasting. While most of the soil types of highest risk potential would be excluded from the timber base, some areas may still be harvested. Regions greater than 67 percent slope are areas with higher potential for slumping (see the *Roads* discussion in this section). The old-growth acreage of these areas that may be harvested is shown in Table 3.6-7. Because of very limited harvest, Alternative 1 has the least area of potential harvest on steep slopes and Alternative 2 is also relatively low. The larger area of harvest on steep slopes would be under Alternatives 4 and 7, while Alternatives 3, 5, and 6 are intermediate.

Table 3.6-7
Estimated Maximum Acres of Old-Growth Harvest on Potentially Unstable Soils (Slopes > 67%) after Full Implementation of the Forest Plan (approximately 100+ years)[1]

	Alternative						
Hill Slope	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Harvest Acres on Slopes > 67%	2,414	8,176	12,391	21,592	17,445	16,626	30,036

[1] Includes adjusted harvest acres estimated in the alternatives allowing for approximation of fall down (the reduction between the planned and the actual harvest area due to discovering additional streams, soils issues, etc, during timber sale layout). See Appendix B for details of estimating methods.

Fish Habitat Enhancement and Log Tranfer Facilities

Fish enhancement projects, such as fish passage, stream and lake stocking, and lake fertilization would not be affected by any of the considered alternatives. Project enhancement funding and selection of projects is primarily independent of amount or location of timber harvest; therefore, all alternatives would have similar effects on enhancement activities.

Effects of LTFs on marine aquatic species are addressed in the *Transportation and Utilities* section of this chapter. Generally, effects would be somewhat proportional to the amount of harvest and include slight coverage of shallow (less than 60 feet deep) regions of nearshore habitat with wood debris (primarily bark), affecting primarily benthic marine organisms in very small areas of tidal and subtidal habitat.

Fish/Riparian Panel Assessment Elements

The panel process is described in the *Introduction* to this chapter. The 1995 Fish/Riparian Assessment panel included four fisheries scientists and two physical scientists (hydrology and geomorphology). The 1997 assessment meeting included just the original four fisheries scientists. The first panel assessed both effects to fish and stream physical attributes (relating to riparian conditions), while the second panel only assessed effects to fish of a subset of the alternatives included in the 1997 EIS.

The detailed results of the first assessment panel analysis is presented in the 1997 FEIS (USDA Forest Service 1997a) and will only be summarized here because many of the factors among current and past alternatives differ. At the time of the first panel meeting, the 1997 Alternative 11 (Alternative 5 [No Action] in this analysis) was not available to the panels. The second panel, however, included this alternative in its assessment. The 2007 alternatives that are based on a corresponding 1997 alternative are as follows:

- 2007 Alternative 4 was based on 1997 Alternative 6
- 2007 Alternative 5 was based on 1997 Alternative 11
- 2007 Alternative 6 was based on 1997 Alternative 11
- 2007 Alternative 7 was based on 1997 Alternative 2

The extension of the panel assessments from the 1997 alternatives to the corresponding 2007 alternatives are primarily based on similarities in acres and locations of potential harvest, miles of proposed roads, and the level of riparian protection and beach/estuary protection between the alternative pairs. In general, the acres and locations of harvest and the miles of proposed roads are very similar for each alternative pair. Similarly, the beach/estuary protection level is the same within each pair. The level of riparian protection is also the same between the 2007 Alternatives 5 and 6 and the 1997 Alternative 11. However, the 2007 Alternative 4 has slightly greater riparian protection than the 1997 Alternative 6, and the 2007 Alternative 7 has the same riparian protection as the 1997 Alternative 2. The extension of panel assessment conclusions is qualified below, where appropriate.

The fisheries and physical scientists rated five possible outcomes for each of eight species of fish, including both resident and anadromous life strategies for two of the species. The fish considered included all five salmon species, cutthroat trout, steelhead, and Dolly Varden char. The physical scientist rated the effects of each alternative on natural stream conditions based on stream attributes, including amount of large woody debris, percent pool area, and stream width-to-depth ratio; residual pool depth; and stream bed grain size for a similar five possible outcomes.

The panels for fish and riparian estimated the effect of each alternative in one of five outcomes (categories) of effects to fish and riparian conditions. Alternatives rated in the first two outcomes (Outcome I and II) generally had mostly no or minimal adverse effects to fish or riparian conditions. Alternatives that had greater portion of ratings in Outcomes III, IV, and V had moderate to severe rated adverse effects to fish or riparian conditions (Dunlap 1996, 1997).

Generally, adverse effects of any alternative in the 1997 EIS were lower and varied less among alternatives on Chinook and sockeye salmon than other species. This is because most Chinook salmon in the Tongass region are present in large river systems (mostly flowing out of Canada) or on Admiralty Island, and most of these systems would have little management activity that could affect them. Sockeye salmon primarily spawn and rear in lakes (although some stream spawning does occur), and lake areas are well protected under all alternatives. Other species, including coho, pink and chum salmon, cutthroat trout, steelhead, and Dolly Varden char are more at risk from management activities because of their greater reliance on stream habitats for spawning, rearing (fry, juvenile), and immigration. The outcome rating for these species was more varied among alternatives and varied among species, mostly based on the amount time and number of life stages spent within streams of the Tongass. Generally, the panel assessments concluded that the level of road construction and timber harvest was positively related to the level of risk to fish and fish habitats. This same trend would hold for the 2007 alternatives.

The scientists in the panels noted several factors they considered important in their evaluation of risks for these alternatives (Dunlap 1996, 1997). These parameters are relevant for evaluation of the current alternatives. Generally, roads were considered the greatest risk to fish resources. Amount, location, and type of timber harvest, especially relative to steep slopes, soil type, stream type, and estuaries were also considered very important in affecting risk. Watershed analysis was important where guidelines would be modified. Also, high levels of riparian protection were a major item considered important for protection of fish resources and their habitat. Firm standards, guidelines, and adequate monitoring were all considered important. Most of the panel's concerns and recommendation were considered and adopted into the final alternative selected for 1997 and are incorporated into Alternatives 1, 2, 3, 5, and 6, to a slightly lesser extent into Alternative 4, and even less into Alternative 7.

The panels described the significant characteristics of each of the alternatives that affected their evaluation. Below is a summary of the 2007 alternatives presented with reference to the panel assessments.

Alternative 1: This alternative would have future harvest and road construction concentrated in a relatively small part of the Forest, which would reduce additional degradation and facilitate recovery of degraded habitat in some watersheds. Riparian and beach/estuary protection would be high because the Alternative's Riparian and Beach/Estuary Standards and Guidelines are essentially the same as the current Forest Plan standards and guidelines. These are the same as the 1997 Alternative 11 standards and guidelines, which were highly rated by the expert panel. Overall, harvest and road construction levels would be the lowest among the alternatives. Because of the low level of harvest and road construction as well as the level of riparian protection, if this alternative were to be evaluated by the panel today, it would likely rank as the lowest risk alternative among the alternatives considered in this EIS, and would generally rank between the two lowest risk alternatives of the 1997 alternatives.

Alternative 2: This alternative is similar to Alternative 1, but with moderately greater distribution of harvest area and increase in roads. Riparian and beach/estuary protection would remain high for the same reasons as for Alternative 1. Harvest and road construction would be increased moderately over Alternative 1 expanding into some new area, but still remain relatively low. It would rank second lowest risk among alternatives evaluated in this EIS and would likely have been between the second and third lowest risk alternative evaluated by the panel in the 1997 EIS.

Alternative 3: This alternative increases harvest considerably over Alternative 1 by expanding into many more watershed areas. However, riparian and beach/estuary protection would remain high for the same reasons as Alternative 1. The moderate network of roads and harvest would increase likelihood of areas of habitat degradation and reduce likelihood of habitat recovery. This alternative, based on riparian protections and moderate harvest, would be ranked third lowest for risk among this EIS alternatives and likely would have been ranked between the third and fourth among alternatives for the 1997 EIS by the panel.

Alternative 4: This alternative is based on the 1997 Alternative 6. The panel assessments concluded that the relatively large area harvested and moderate road network in this alternative would increase the chance of gaps in fish distribution and fish habitat recovery (Dunlap 1996). The old-growth reserves and retention proposed in this alternative may offset some of the harvest and road effects. However, if this alternative were evaluated by the panel today, it would likely rank as the second highest risk alternative among the alternatives considered in this EIS; it ranked in the middle of the 1997 alternatives evaluated (Dunlap 1996).

Alternative 5 (No Action): This alternative is the 1997 Forest Plan (Alternative 11) as amended. The panel assessment concluded that the relatively few miles of roads and moderate levels of timber harvest over the next 100 years in this alternative would reduce risk to fish habitat (Dunlap 1997). Further, the panel noted that the Forest-wide relatively high riparian protections would have relatively low risks to fish habitat (Dunlap 1997). If this alternative were evaluated by the panel today, it would likely rank as the third highest risk alternative among the alternatives considered in this EIS; it ranked in the lower risk group of alternatives in 1997 (Dunlap 1997).

Alternative 6 (Proposed Action): This alternative was based on the 1997 Alternative 11. This alternative would have very slightly lower harvest and roads than the current Alternative 5. The panel assessment concluded that the relatively few miles of roads and moderate levels of timber harvest over the next 100 years in this alternative would have relatively low risk to fish habitat (Dunlap 1997). Further, the panel noted that the Forest-wide relatively high riparian protections would reduce the risks to fish habitat (Dunlap 1997). If this alternative were evaluated by the panel today, it would likely rank as the fourth highest risk alternative among the alternatives considered in this EIS; it would have ranked in the lower risk group of alternatives in 1997 (Dunlap 1997).

Alternative 7: This alternative was based on the 1997 Alternative 2. The panel assessment concluded that the road network and area harvested would increase the likelihood of areas of future habitat degradation and reduce the likelihood of habitat recovery (Dunlap 1996). Of particular concern was harvest on MMI 3 soils, which has greater potential to increase stream habitat degradation and increase risks to stream channels and fish habitat due to lower riparian protection along Class III streams (Dunlap 1996, 1997). In addition, the 1997 panel assessment concluded that management of slopes around steep-gradient Class III streams could change the rate of wood and sediment delivery and affect downstream fish habitat over the long term (Dunlap 1997). This alternative was thought to result in degradation of fish habitat and increase gaps in fish distribution in the next 100 years (Dunlap 1997). Estuary protection would be high because of the essential continuation of current Forest Plan standards and guidelines for estuaries, which were highly rated by the panel (Dunlap 1997). Although beach protections are reduced for this alternative relative to others. Overall, harvest and road development would be the highest, and riparian protections the lowest, of all alternatives. If the panel were to assess this alternative it would likely rate it as the highest risk to fish resources of any in this EIS. The comparable 1997 alternative was rated second highest for risk among all alternatives evaluated in 1997.

Species Assessments

Threatened and Endangered Species

Consultation requirements for the Forest Plan Revision under Section 7 of the ESA, as amended, were completed with the USFWS and NMFS for the 1997 Forest Plan EIS. Both USFWS and NMFS reviewed the biological assessments for threatened and endangered species under their regulatory jurisdiction and concluded that the Tongass Forest Plan Revision was “not likely to adversely effect” threatened or endangered species occurring on the Tongass for the 1997 Plan. These findings were made subject to the programmatic scope of the Forest Plan Revision and following the associated Forest-wide standards and guidelines (see Chapter 4 of the 1997 Forest Plan).

Formal and informal consultation procedures (as directed by the ESA, as amended in 50 CFR 17.7, and Forest Service Manual 2670) are used with NMFS and USFWS on all projects that implement the 1997 Forest Plan. Forest-wide standards and guidelines (see Chapter 4 of the amended Forest Plan) for threatened, endangered, and sensitive species direct that all projects would comply with requirements of the ESA, as amended, and Forest Service policy (Forest Service Manual 2670).

Because Alternative 11 of the 1997 Forest Plan Revision Final EIS was deemed not likely to adversely affect threatened or endangered species occurring on the Tongass, the alternatives being examined in this EIS would also likely fall in this category because they have the same or similar protective measures as Alternative 11 from the 1997 Final EIS, with the exception of greater acreage harvested under Alternatives 4 and 7.

Most of the currently ESA-listed salmon and steelhead are unlikely to be in marine waters near the Tongass Forest because their migration routes and rearing areas mostly to the west of the forest boundaries, although a small number may be present in the inner waters. Because of this very limited distribution relative to the project and lack of affects to the marine environment, it is not anticipated that adverse effects would occur to listed fish species from any of the alternatives. The Biological Assessment for the considered actions is presented in Appendix F. The conclusion of this Biological Assessment is that the considered actions for the Tongass Land and Resource Management Plan are “not likely to adversely effect” any endangered or threatened salmon or steelhead ESU/DPS.

Essential Fish Habitat Assessment

Section 305(b)(2) of the Magnuson-Stevens Act requires all federal agencies to consult with the Secretary on all actions or proposed actions authorized, funded, or undertaken by the agency that may adversely affect EFH. This consultation is done for site-specific projects with ground-disturbing activity. The application of Forest-wide standards and guidelines and BMPs developed to meet soil protection, water quality standards, and fish habitat protection will help protect EFH on the Tongass National Forest and adjacent estuarine and marine waters. Because adoption of the Forest Plan does not specifically result in any actions that could affect EFH, and any action that would be taken following adoption of the Plan that could affect EFH would have a formal EFH developed, no formal EFH was developed for the considered actions in this EIS.

Sensitive Species

Northern Pike

Northern Pike are found in five lakes east of Yakutat. Forest-wide standards and guidelines for wetlands and riparian management generally cover these areas. Although road access exists within 0.5 mile of Pike Lakes, there is no land suitable for timber harvest immediately around the lakes. Natural habitat conditions associated with the lakes are expected to be maintained under all alternatives; therefore, no effects are anticipated.

Fish Creek Chum Salmon

The habitat for the Fish Creek chum salmon, near Hyder on the Portland Canal, would be managed in accordance with the Forest-wide standards and guidelines for wetlands and riparian management (see Chapter 4 of the amended Forest Plan) under all alternatives; one exception is the elimination of Class III stream buffers under Alternative 7. Additional standards and guidelines for chum salmon that apply to the Fish Creek chum salmon include coordination with appropriate agencies to protect, maintain, and preserve this run of chum salmon, and to provide for habitat improvement as necessary to maintain the viability of the run. Alternative 1 is expected to have no effect on the Fish Creek chum salmon. Alternatives 2, 3, 4, 5, and 6 would have a slight risk of effects, but if effects occur, they are not expected to be significant. Alternative 7 would have a larger risk of effects because of the elimination of Class III stream buffers under this alternative; but the potential for significant effects is still small.

There have been improvement projects to increase spawning habitat for this population. With these improvement projects, the habitat for these chum salmon is expected to be improved in the future. Alternatives 2, 3, 4, 5, 6, and 7 would maintain the current LUD as Scenic Viewshed, which would allow continued habitat improvements. Alternative 1 would convert this area to Remote Recreation, which may limit continued enhancement activities and/or the ability to conduct stream habitat improvement projects.

Island Run King Salmon

King Salmon River and Wheeler Creek habitats for island run king salmon are both within Kootznoowoo Wilderness. Natural habitat conditions are to be maintained, and specific Forest-wide standards and guidelines also apply (see Chapter 4 of the amended Forest Plan). None of the alternatives would change how this area would be managed. Application of the wilderness prescription and Forest-wide standards and guidelines to sustain habitat conditions would not result in any affects on these island run king salmon.

Invasive Aquatic Species

ADF&G lists four species of fish that are non-native to Alaska found in Alaskan waters (Fay 2002). Only two, the Eastern Brook trout and Atlantic salmon, have been found in the aquatic habitats of the Tongass National Forest. Additionally, northern pike, which has only been found in apparently native waters in the Yakutat area in the Tongass, is of greatest concern because of its potential to directly impact native salmon species. Other aquatic species, including the Chinese mitten crab and New Zealand mudsnail, both of which can inhabit freshwater, are a major concern for impacts they would cause if they invaded these aquatic habitats (Schrader and Hennon 2005, Fay 2002). While no alternative would have substantial effects on invasion or establishment of non-native aquatic species, some actions could have potential indirect effects. One of the biggest concerns for invasive fish is active stocking of waters primarily with species often considered game fish in other areas. This would apply primarily to northern pike, which can inhabit lakes and rivers. In general then, alternatives that increase human access to fresh waters within the Forest would have the greatest risk of increasing invasive aquatic species in aquatic habitat of the Forest. The major form of increased access to aquatic habitats of the Forest would be through increased roads where people may travel with invasive species either intentionally, such as northern pike, or by accident, such as in the case of some aquatic species, like the New Zealand mudsnail. Based on this criterion, the relative risk would be proportional to road miles (Table 3.6-2) with Alternative 1 having the least and Alternative 7 having the most risk.

Some negative effects, or more appropriately, increased risk to, the natural range of variation in stream processes and fish habitat would likely occur by management activities over the long term for all alternatives. The extent of harvest activity and associated road development are likely to result in decreases of some fish populations in managed watersheds. Measures taken to mitigate, or moderate, the negative effects have been incorporated into the alternatives in ways to reduce levels of risk to the fisheries resource. All alternatives have the same or substantially similar standards and guidelines that influence fish habitat as were adopted following the 1997 EIS. While the standards and guidelines do supply substantial protection of fisheries resources, some risk of impacts would remain, and these are generally proportional primarily to the amount of road miles and to a lesser degree on acres harvested. Therefore, the major difference between the alternative is the relative risk from the construction of roads and harvest, which are directly proportional to the quantity of these two parameters by alternative. In general, Alternatives 1, 2, and 3 would have the lowest risk because of low harvest and road miles, 5 and 6 would be intermediate and similar because harvest is very similar, and Alternative 4 and especially 7 would have most risk to fish resources due to the relatively high portion of harvest and road building.

Conclusions – Direct and Indirect Effects

Much of this EIS evaluation has been based on the conclusions, derived from scientific literature, monitoring reports, and expert evaluations, that current Forest Plan standards and guidelines, practices, and related BMPs are adequate to ensure minimal or no harm to fish resources, at least for most of the alternatives considered. However, there is a degree of scientific uncertainty associated with these conclusions. The current Plan has only been in place for 10 years, although many of the practices have been in place longer. The active monitoring that has been occurring does not suggest marked problems with water quality or fish resources as a result of these actions (USDA Forest Service 2004c, 2006b). While active monitoring has been occurring, the full effect of these types of actions has not had an extensive period of evaluation. Even though relevant information indicates protections would be adequate under most of the alternatives, there is some risk to fisheries resources in implementing any of the considered alternatives.

Based on best available science, it can be concluded that there is a relatively low long-term risk to fish habitat from Alternatives 1, 2, 3, 5, and 6 because of low to moderate levels of timber harvest and road construction, and the relatively high riparian protections offered by Forest Plan standards and guidelines. Under Alternative 4, the risks are higher because of an increase in harvest and road development, and the risks are higher yet under Alternative 7 because of further increases in harvest and road development, and a decrease in riparian protections for Class III streams.

Cumulative Effects

General

The effects of the alternatives on fish resources may be influenced by other actions occurring in the project area. The main cumulative factors affecting fish are related to land development actions that occur regionally. This includes primarily other timber harvest-related actions on non-NFS lands, especially associated roads. The total lands within the Tongass National Forest boundary, which includes all NFS lands and other non-NFS lands, equals about 17.8 million acres. Of this, only about 6 percent (1.1 million acres) are non-NFS lands. However, development actions on these non-NFS lands, which include most cities and towns in Southeast Alaska, are moderately intense.

As discussed previously, one of the main factors affecting fish resources in the Tongass is the level of road development. Generally, the greater the density of roads in the watershed, the greater risk there is to fish resources. Among several indicators used by NMFS (1996) to characterize status of watershed conditions, they recommended a maximum road density threshold levels for maintaining “properly functioning” watersheds for coastal salmon as 2 miles per square mile, with increased risk to salmon as road densities increase beyond this value. There are 947 VCUs inside the Tongass boundary, including both NFS and non-NFS lands. VCUs approximate watershed sizes, so road densities by VCU would be comparable for evaluating conditions relative to NMFS threshold road densities.

The average road densities by alternative and for the region are shown in Table 3.6-8. For this assessment, we have assumed an increase in road miles on non-NFS lands for the life of the project (100+ years). The average road density on non-NFS lands is much higher than on NFS lands. This high average density is partly the result of the high number of road miles in city areas, as well as concentrated timber harvest areas. Even though the amount of non-NFS land area is relatively low, high density on these lands results in the overall average densities increasing sharply relative to NFS lands. However, even with these increases, overall averages remain relatively low for any alternative, ranging from 0.42 (Alternative 1) to 0.60 (Alternative 7).

Table 3.6-8
Estimated Average Total Road Density on Tongass NFS Lands and Non-NFS Lands within the Tongass National Forest Boundary by Alternative over 100+ years[1]

Alternative	Road Density as Miles/Square Mile: Road Density on NFS Lands	Road Density on Non-NFS Lands[2]	Total Road Density All Lands
Existing	0.19	2.19	0.31
Alternative 1	0.22	3.49	0.42
Alternative 2	0.29	3.49	0.47
Alternative 3	0.32	3.49	0.49
Alternative 4	0.40	3.49	0.57
Alternative 5	0.35	3.49	0.53
Alternative 6	0.35	3.49	0.52
Alternative 7	0.43	3.49	0.60

[1] Assumes full implementation of Forest Plan at ASQ levels plus future non-NFS harvest. Includes adjusted roads miles estimated to be needed to harvest all suitable timber in the alternative allowing for approximation of fall down (the reduction between the planned and the actual roads needed due to discovering additional streams, soils issues, etc, during timber sale layout). Annette Island is included because it is surrounded by areas within the Forest boundary.
[2] Assumes an estimated the increase in non-NFS road miles within the Forest boundary from 3,756 miles at present to 5,970 after 100+ years.

However, there are VCUs that have higher road densities that are increased by the addition of roads from the alternatives (Table 3.6-9). Currently, most (68 percent) of the VCUs on NFS lands have no roads and only just over 2 percent have road densities exceeding 2 miles per square mile. The inclusion of non-NFS lands reduces the percentage of VCUs with no roads to 61 percent and pushes the portion of VCUs exceeding 2 miles per square mile to almost 6 percent under existing conditions. Under Alternatives 1 and 2 for all lands combined, the percentage of VCUs exceeding 2 miles per square mile would increase to a maximum of 10 to 12 percent after 100+ years. The largest increase in the percentage of VCUs with high density would occur under Alternative 7, which would have a maximum of 16 percent of VCUs exceeding the 2 miles per square mile threshold.

After 100+ years, Alternatives 3 through 6 would have a maximum of 12 to 14 percent of VCUs with density greater than 2 miles per square mile when roads on non-NFS lands are included. When roads on all lands are included, a minimum of about 37 to 46 percent of the VCUs would still have no roads after 100+ years (Table 3.6-9).

The effect on fish resources are less directly tied to amount of harvest than to roads, but harvest may influence them through effects on water quality, riparian management, and regions where harvest is allowed, as discussed under direct effects. The cumulative effects of timber harvest were discussed in the *Water* section on water quality for all lands (including non-NFS lands) within the Forest boundary and relate to potential effect to fish resources. Existing conditions include retention of 87 percent of the original productive old-growth forest inside the Forest boundary and with 95 percent of the land area remaining undisturbed from direct timber harvest (Table 3.4-3 of the *Water* section). Overall the cumulative effects to fish relating directly to quantity of timber harvest would be least for Alternative 1 as 82 percent of the original productive old growth on all lands within the Forest boundary would be retained and greatest for Alternative 7 as productive old growth would be reduced to 70 percent, in addition to reduced riparian protections for Alternative 7. Even with highest harvest alternative, the majority of productive old

Table 3.6-9
Estimated Road Miles and Percent of VCUs in Road Density Categories on NFS Lands and on All Lands Combined within the Tongass National Forest Boundary by Alternative after 100+ years of Full Implementation[1]

Road Density Categories[2]	Alternative							
	Existing	1	2	3	4	5	6	7
Road Miles Per Sq. Mi.	NFS Lands	NFS Lands	NFS Lands	NFS Lands	NFS Lands	NFS Lands	NFS Lands	NFS Lands
0	68.0%	67.8%	66.0%	63.6%	52.1%	58.9%	60.0%	51.4%
>0 - 1.0	21.5%	20.4%	19.4%	20.2%	26.1%	22.4%	21.1%	24.9%
>1.0 - 2.0	8.0%	7.3%	8.7%	9.3%	13.5%	11.0%	11.4%	13.5%
>2.0 - 3.0	2.0%	3.5%	4.8%	5.5%	6.6%	6.3%	6.1%	7.6%
>3.0 - 4.0	0.4%	1.0%	1.2%	1.4%	1.7%	1.4%	1.4%	2.5%
>4.0	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%
New Miles	**-**	**774**	**2,079**	**2,799**	**4,890**	**3,874**	**3,744**	**5,825**
Total Miles	**4,941**	**5,715**	**7,020**	**7,740**	**9,831**	**8,815**	**8,685**	**10,766**
Road Miles Per Sq. Mi.	All Lands	All Lands	All Lands	All Lands	All Lands	All Lands	All Lands	All Lands
0	60.8%	45.1%	44.6%	43.3%	37.2%	41.0%	41.6%	36.9%
>0 - 1.0	22.4%	35.2%	33.2%	32.9%	34.1%	32.7%	32.0%	32.5%
>1.0 - 2.0	11.4%	9.7%	10.7%	11.4%	14.9%	12.9%	13.3%	15.1%
>2.0 - 3.0	4.4%	6.5%	7.5%	7.9%	9.1%	8.9%	8.6%	9.9%
>3.0 - 4.0	1.0%	2.3%	3.0%	3.3%	3.6%	3.4%	3.4%	4.2%
>4.0	0.0%	1.2%	1.2%	1.2%	1.2%	1.2%	1.2%	1.4%
New Miles	**-**	**2,988**	**4,293**	**5,013**	**7,104**	**6,088**	**5,958**	**8,039**
Total Miles	**8,697**	**11,685**	**12,990**	**13,710**	**15,801**	**14,785**	**14,655**	**16,736**

[1] Assumes full implementation of Forest Plan at ASQ levels plus future non-NFS harvest. Roads on NFS lands adjusted for fall down. Estimated the increase in non-NFS road miles within the Forest boundary from 3,756 miles at present to 5,970 after 100+ years. Annette Island is included as a VCU because it is surrounded by areas within the Forest boundary.
[2] For NFS lands, percentages are based on 935 VCUs that contain at least 100 acres of NFS lands. For all lands, percentages are based on all 947 VCUs inside the Forest boundary, including Annette Island.

growth would remain unaffected for the full implementations of the Forest Plan over more than a 100-year period (Table 3.4-3 of the *Water* section). Total cumulative effects to fish resources, based on relative amount of area disturbed, would be relatively low as 90 to 94 percent of the land base would remain undisturbed by direct timber harvest for all alternatives. However, some local regions may have fish resources affected where watershed harvest levels and road density are high. Additionally, with less protections for riparian areas on state and private land (e.g., no required buffers on non-fish bearing streams, and some fish bearing streams), a greater risk to fish resources would occur in watersheds that have a high portion of non-NFS harvest occurring. Again, effects of harvest activities on fish resources would ultimately be considered at the project-specific levels, ensuring minimal adverse cumulative effects.

Climate Change

Climate change is one factor that has some unquantifiable potential to affect fishery resources on the Tongass. While the models do not fully agree on the climate change predictions for Southeast Alaska, they generally predict warmer weather, with more winter rainfall, less snowfall, and a decrease in summer rain in some areas. Both factors, if large enough, have the potential to affect fish resources. Climate models from both the Canadian Climate Center and the Hadley Center predict rising temperatures and a 10 percent decrease in summer precipitation in portions of Southeast Alaska (though they differ on the areas affected). Given the high summer rainfall levels in Southeast Alaska (Ketchikan averages over 7 inches of rain per month in the summer), a 10 percent decrease in summer rainfall would still result in wet conditions in most years. However, Southeast Alaska does occasionally experience dryer conditions. For example, in July 1971 there were 23 days without rain. Juday et al. (1998) postulate that warmer, dryer conditions could increase stream temperatures and cause reduced seasonal low flows, both of which could adversely affect salmon. Reduced stream flow in summer months and high water temperatures during this same period have been a common concern for salmonid populations in much of their native range. These types of concerns are less prominent in the cool wet environment common in Southeast Alaska, although some conditions of low flow and higher stream temperature resulting in adverse effects have been observed. Specific concerns, for example, include changes in the timing of emerging pink and chum salmon and the potential for not being properly timed with early marine planktons supplies (Heard and Salo 1991), and elevated temperatures and lower summer flows reducing holding pool survival of adults because of dissolved oxygen depletion.

In the case of coho salmon, sidechannels may have lower flows and increased temperatures, which could reduce their usability. However, increased temperature could reduce rearing time in freshwater for coho salmon from 2 years to 1, which may have advantages (less overwinter mortality) and disadvantages (smaller size on marine water entry, reducing marine survival). Sea-level rise could inundate estuarine rearing areas. However, the Southeast Alaska land mass is rising in many areas, and the potential change in water level over the next century is 0.3 to 3 feet, while some areas, particularly in northern Southeast Alaska, may rise several feet 1 to 4 feet (Kelly et al 2007). Changes in the next decade or two, will obviously be much less. So overall effects on estuarine areas and fish stocks will vary considerably and, within the timeframe covered by this Forest Plan amendment (i.e., 10 to 15 years) changes are difficult to predict and may even be difficult to detect.

In summary, there is general agreement that the climate is warming and that summer precipitation is may decline. However, there is considerable uncertainty surrounding specific predictions and even more uncertainty regarding the effect of these changes on resources including fish.

Conclusions – Cumulative Effects

Overall, the cumulative effects of considered alternative actions in conjunction with other non-NFS lands and actions associated with timber harvest would increase the regions of greatest risk for fish resources. While all alternatives would increase high road density areas, overall the number of VCUs of increased risks to fish remains relatively small, at 16 percent for the entire region, even for Alternative 7, which has the highest average density and the highest frequency of high road density areas. Other alternatives would have less risk with high road density areas ranging from about 10 to 14 percent for all lands combined. Cumulative effects of actual timber harvest would follow a similar trend among the alternatives; however, the potential cumulative effects of harvest, road building, and other actions would be evaluated on a project-specific basis so that the potential for adverse cumulative effects to fish resources within a given watershed could be reduced or eliminated.

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Plants

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Affected Environment

This section describes the affected environment for plants on the Tongass National Forest. It is divided into three areas of focus: Plant Communities, Threatened, Endangered, and Sensitive (TES) Species, and Invasive Plants. The *Plant Communities* subsection below provides an overview of vegetation and describes the process and status of vegetation classification and vegetation mapping on the Tongass. The *Threatened, Endangered, Sensitive, and Rare Plant* and *Invasive Plant Species* subsections below include an overview of current conditions.

Plant Communities

The composition, age, and structure of the plant communities present today on the Tongass are the result of interactions between biological and physical environments, natural disturbances, and land use history. This subsection introduces the ecological context for the occurrence of common forested and non-forested plant communities.

The coastal forest of Southeast Alaska is part of the cool, temperate rain forest that extends along the Pacific coast from Northern California to Cook Inlet in Alaska. Most of the Forest is composed of old-growth conifers, primarily western hemlock *(Tsuga heterophylla)* and Sitka spruce *(Picea sitchensis)*, with a scattering of mountain hemlock *(Tsuga mertensiana)*, Alaska yellow-cedar *(Chamaecyparis nootkatensis)*, and western redcedar *(Thuja plicata)* in the south. Red alder *(Alnus rubra)* is common along streams, beach fringes, and on soils recently disturbed by management activities and landslides. Black cottonwood *(Populus balsamifera* ssp*. trichocarpa)* grows on the floodplains of major rivers and recently deglaciated areas.

Blueberry and huckleberry *(Vaccinium* spp.), Sitka alder *(Alnus viridis* spp. *sinuata)*, devil's club *(Oplopanax horridus)*, and salal *(Gaultheria shallon)* are common shrubs in forested communities. The Forest floor is habitat for a variety plants, such as false lily-of-the-valley *(Maianthemum dilitatum)*, bunchberry *(Cornus canadensis)*, five-leaf bramble *(Rubus pedatus)*, and skunk cabbage *(Lysichiton americanum)*. Because of the high rainfall and resulting high humidity, a large variety of mosses grow in great profusion on the ground, fallen logs, the lower trunks and branches of trees, as well as in forest openings. Hundreds of epiphytic lichen species can also be found on tree trunks and branches, especially in old-growth forests, riparian areas, and maritime beach fringe forests.

Grass and sedge meadows usually lie at low elevations, often along the coast and toeslopes of hills and mountains. Stands of willows *(Salix* spp.) border many of the stream channels. Muskeg (peatland) communities, dominated by shore pine *(Pinus contorta* var. *contorta),* peat moss *(Spaghnum* spp.), and sedges *(Carex* spp.), occur throughout the Forest. These non-forest vegetation types are also described in the *Wetlands* and *Biodiversity* sections of this chapter.

Alpine and sub-alpine vegetation usually occurs above 2,500 feet elevation. The sub-alpine zone is often dominated by mountain hemlock (*Tsuga mertensiana*) where the coastal forest treeline begins to decline into low-lying and krumholtz vegetation between 2,500 and 2,800 feet elevation. Resident plants have adapted to persistent snow cover and wind desiccation by evolving low-growth forms. Mat-forming heaths, such as mountain heather (*Cassiope* spp. and *Phyllodoce* spp.), cover much of the area, with cushion-like flowering plants and non-vascular plants (lichens, mosses, and liverworts) occupying exposed rock outcrops, crevices, and talus slopes.

The detailed description and effects analysis to vegetation on a habitat/landscape scale can be found in the *Biodiversity* section of this chapter.

Vegetation Classification

Integrating vegetation information in analysis, planning, and decisionmaking includes the development of vegetation classifications, the use of the classifications to map vegetation with remotely sensed imagery, and ecological models. Classification of vegetation types is an effective tool for studying, understanding, and communicating habitat information. Vegetation classifications at appropriate scales have been widely used in wildlife management, forest planning, project planning, and silviculture in the National Forests. Vegetation classifications can be used to identify realistic objectives and management opportunities, determine capability and suitability, and evaluate forest health. They can be used to streamline monitoring design and facilitate extrapolation of monitoring interpretations; assess risks for the introduction of invasive species, fire, insects, and disease; and describe current habitats for plant and animal species based on current vegetation composition, structure, and function. Function refers to the interactions and influences between plant and animal species within an area and their environment, including natural processes of change or disturbance (wind, aging, etc.).

On the Tongass National Forest, fine-scale vegetation communities known as plant associations have historically been used for project-level planning and analysis of silvicultural treatments. Work on describing forested plant communities on the Tongass began in the early 1980s. Three guides, one each for the former Ketchikan, Stikine, and the Chatham Areas, were developed to identify and describe forested plant associations (DeMeo et al. 1992, Pawuk and Kissinger 1989, Martin et al. 1995). They provide a key for identifying the plant associations based on dominant and diagnostic species in the tree, shrub, and herb layers of the Forest. Plant association names consist of the dominant tree species that occurs in the overstory canopy, along with dominant or diagnostic species found in the shrub and/or herb strata (layers). Plant association descriptions include species cover and constancy (how often a species occurs in a particular association), productivity estimates, and management considerations to guide the interpretation of effects of actions on an area with a specific plant association.

In the Tongass plant association guides, forested plant associations are grouped into the following series based on the dominant tree species in the overstory canopy:

- Mixed-Conifer Series
- Mountain Hemlock Series
- Shore Pine (Lodgepole Pine) Series
- Sitka Spruce Series

- Western Hemlock Series
- Western Hemlock-Western Red Cedar Series
- Western Hemlock-Yellow Cedar Series

The Federal Geographic Data Committee established the National Vegetation Classification Standards (NVCS), which is a hierarchical existing vegetation classification with nine levels (Federal Geographic Data Committee 1997). The seven upper levels are primarily based on physiognomy. The two lowest levels, alliance and association, are based on floristic attributes. This hierarchy has been incorporated into the recently published Forest Service Existing Vegetation Classification and Mapping Technical Guide (Brohman and Bryant 2005). All of the forested plant associations of Southeast Alaska have been crosswalked to the NVCS. A list of the crosswalked forested plant associations can be found on the Alaska Natural Heritage Program (ANHP) Web site at: http://aknhp.uaa.alaska.edu/ecology/Ecology_Plant_Association_Tracking_List.htm.

Development of a non-forested vegetation classification for the Tongass is currently in progress. The Yakutat Forelands plant community classification (Shephard 1995) included a classification of non-forested vegetation types. In order to produce a consistent product for the rest of the Tongass that is compatible with the NVCS and meets the needs of the Forest Service, the protocols in the Forest Service Existing Vegetation Classification and Mapping Technical Guide are being followed. Once the non-forested classification is complete, a guide containing descriptions of plant associations will be developed.

Vegetation Mapping

The only Forest-wide vegetation map currently available is the Tongass Existing Veg map, a GIS-based data set that was derived from the former TimberType database. In Existing Veg, forested stands are identified by broad forest canopy cover types. Information for forested stands includes dominant overstory species, type for low productivity stands, size class (e.g., seedling, sapling, young growth, or old growth), and volume class for productive stands. Generic non-forested types are also mapped (e.g., ice, shrub, muskeg, beach, alpine, and sand).

A new, interim model for classifying productive forests of the Tongass has been developed that organizes forested stands in the Existing Veg map into seven size-density categories (Caouette and DeGayner 2005). This system, referred to as the Size-Density Model (SD7), is described in the *Biodiversity* section of this chapter, and may be useful for describing forest structural diversity and wildlife habitats.

Mapping vegetation communities at the plant-association level has not occurred on the Forest. Producing plant-association maps requires large amounts of field data and high-resolution imagery combined with modeling; therefore, plant-association maps will most likely need to be developed on a project-specific basis, while still meeting Forest-wide standards for vegetation mapping. New and updated mid-level (alliance and/or dominance type) maps of vegetation types sufficient for Forest- or watershed-scale analysis may be developed in the near future.

Threatened, Endangered, Sensitive, and Rare Plants

There are no federally listed or proposed Threatened or Endangered plants that are known to occur or are likely to occur on the Tongass National Forest. The only federally listed or proposed plant in Alaska is the Aleutian hollyfern (*Polystichum aleuticum)*, which is listed as endangered; however, it is only known to occur on Adak Island and is not expected to occur on the Tongass National Forest.

Sensitive plant species are those plant species identified by the Regional Forester for which population viability is a concern on National Forest System (NFS) lands within the region. A viability concern is identified by either a significant current or predicted downward trend in population numbers or density, or a significant current or predicted downward trend in habitat capability that would reduce a species' existing distribution. The goal of the Forest Service Sensitive Species Program (Forest Service Manual 2670) is to ensure that species numbers and population distribution are adequate so that no federal listing will be required and no extirpation will occur on NFS lands.

ANHP's Rare Species Global Rankings Criteria is the primary source of information used to rank rare plant species in Alaska. The Regional Sensitive Plant Species List identifies certain rare plants on the ANHP list as sensitive and are known or suspected to occur on the Tongass. There are currently 17 plant species listed as sensitive on the Tongass National Forest. Revisions to the Regional Sensitive Plant Species list are periodically recommended based on new information derived from recent publications, field work, and laboratory analysis concerning rare plants.

The sensitive plants known or suspected to occur in the Tongass National Forest are listed in Table 3.7-1. This table includes a general range and habitat description for each species. In addition, it includes a preliminary estimate of the potential number of acres of habitat for each species. These estimates are likely to be overestimates of available habitat, because the habitat requirements of sensitive plant species are often not well known and, even when they are well known, the habitat requirements are generally tied to micro-habitat characteristics. These estimates are based on available Tongass Forest GIS mapping and, as a result, are tied to macro-habitat information that is currently available. Nevertheless, they provide a means or an index of measuring the effects of the alternatives by assessing the percentage of each habitat affected.

Sensitive plant surveys are conducted as part of project planning to identify populations or habitats of sensitive species within planning areas. An understanding of the distributions of sensitive and rare plants on the Tongass is limited because most botanical surveys are focused on project areas. As a result, very few Forest-wide inventories have been conducted.

ANHP maintains a list of plants that are considered rare within Alaska. This list currently contains 86 plants (including those with sensitive or rare designations, or with significant range extensions on the Tongass) documented to occur on the Tongass National Forest. Rare plant species are those that are inherently rare or not naturally well distributed on the Forest; however, rare plants do not have the same protection in the Forest-wide standards and guidelines or the same determination language as sensitive plants. The State of Alaska list of rare plants, with global and state rankings, is used as guidance for determining which rare plants may be addressed in the project-level analysis. The State list with state and global rankings is available online at: http://aknhp.uaa.alaska.edu/botany/Botany_tracking_page.htm. Generally, plants with a state ranking of S1 (critically imperiled in state) or S2 (imperiled in state) are given consideration during project analysis.

Table 3.7-1
Regional Forester Sensitive Plant Species that are Known or Suspected to Occur on the Tongass National Forest[1]

Common Name (*Scientific Name*)	Range and Habitat[2]
Eschscholtz's little nightmare (*Aphragmus eschscholtzianus*)	This plant is confined to southern Alaska and adjacent areas in Canada in a band extending from the Aleutians through the southwest Yukon. The plant is known from about 30 sites throughout its range. It is suspected to occur in mountainous areas on the northern mainland of the Tongass. It grows in moist mossy areas, seeps, heaths, and scree slopes in the subalpine and alpine. Because the plant is so small, it is easily overlooked. This plant has not been documented on the Tongass. The Tongass contains a high estimate[2] of approximately 1,424,000 acres of habitat that is potentially suitable for Eschscholtz's little nightmare.
Norberg arnica (*Arnica lessingii* ssp. *Norbergii*)	This plant has been found in less than 20 sites in a range extending from Prince William Sound through the northern panhandle. The plant grows from sea level to subalpine in meadows, shrublands, dry meadows, and open forest. This plant has been identified in five locations on the Yakutat Ranger District. The Tongass contains a high estimate[2] of approximately 502,000 acres of habitat that is potentially suitable for Norberg arnica.
Moonwort fern, no common name (*Botrychium tunux*)	This fern has a specific habitat found on well-drained open areas on maritime beaches or upper beach meadows. Six populations have been found on the Yakutat Ranger District. The Tongass contains a high estimate[2] of approximately 16,000 acres of habitat that is potentially suitable for *Botrychium tunux.*
Moonwort fern, no common name (*Botrychium yaaxudakeit*)	This plant is found on well-drained open areas on maritime beaches or upper beach meadows. Five populations are known on the Yakutat Ranger District. The Tongass contains a high estimate[2] of approximately 16,000 acres of habitat that is potentially suitable for *Botrychium yaaxudakeit.*
Goose-grass sedge (*Carex lenticularis* var. *dolia*)	The sedge ranges from the Aleutians east to the Alaska-Canada Coast Range, through the Rockies south to Glacier National Park. It grows in wet meadows, along lakeshores and snowbeds, generally at high elevations. There are seven known locations on the Juneau, Ketchikan, and Sitka Ranger Districts. Recent research has recognized *Carex enanderi* as the same species as *Carex lenticularis* var. *dolia*. Consequently, goose-grass sedge is more common than thought, although still rare. It is proposed to remove this plant from the sensitive species list. The Tongass contains a high estimate[2] of approximately 526,000 acres of habitat that is potentially suitable for goose-grass sedge.
Edible thistle (*Cirsium edule*)	This plant ranges from southern Southeast Alaska, through western Washington, to extreme northwestern Oregon. It grows in open meadows, scree slopes, and along glacial streams and lakeshores. There are three documented locations in the Misty Fiords National Monument. This plant is expected to occur elsewhere in the southeast portion of the Tongass National Forest. The Tongass contains a high estimate[2] of approximately 695,000 acres of habitat that is potentially suitable for edible thistle.
Davy mannagrass (*Glyceria leptostachya*)	This plant has a range from central Southeast Alaska, disjunctly south through central California. It grows in shallow freshwater and along stream and lake margins. In Alaska, it has been identified at five sites in Ketchikan, Wrangell, and Sitka areas. The Tongass contains a high estimate[2] of approximately 1,314,000 acres of habitat that is potentially suitable for Davy mannagrass.
Wright filmy fern (*Hymenophyllum wrightii*)	This fern's range is disjunct from Russian Far East, Korea, and Japan to the Petersburg and Sitka areas in the Tongass National Forest, south to about four sites in British Columbia coastal areas and the Queen Charlotte Islands. Only the gametophyte stage has been recorded in Alaska, while the sporophyte stage has been documented on the Queen Charlotte Islands. It grows on shaded cliff faces; bases of trees; decaying wood and rootwads; and in the dense, humid coastal forests near saltwater and low elevation areas. It has been found on Biorka, Baranof, Chichagof, Mitkof, Etolin, and Kupreanof Islands The Tongass contains a high estimate[2] of approximately 8,845,000 acres of habitat that is potentially suitable for Wright filmy fern.
Truncate quillwort (*Isoetes truncata*)	This plant grows immersed in shallow fresh water pools or ponds. It is known from Kodiak and Vancouver Islands, with a disjunct population at Pyramid Lake, Alberta. It is suspected to occur from Prince William Sound through the Tongass National Forest. There are three documented locations on the Sitka Ranger District. The plant on the Tongass is thought to be a hybrid of more common species: *Isoetes occidentalis, I. maritima* and possibly *I. echinospora.* Therefore, it is proposed that this plant be removed from the sensitive species list. The Tongass contains a high estimate[2] of approximately 31,000 acres of habitat potentially suitable for wright filmy fern within the Tongass.

Table 3.7-1 (continued)
Regional Forester Sensitive Plant Species that are Known or Suspected to Occur on the Tongass National Forest[1]

Common Name (*Scientific Name*)	Range and Habitat[2]
Calder lovage (*Ligusticum calderi*)	This plant is known from Vancouver Island north through the southern part of the Tongass National Forest (Dall and Prince of Wales Islands) and disjunct to Kodiak Island. It occurs in alpine and subalpine meadows, boggy slopes, and rocky areas. It has been identified in 10 locations in the Craig Ranger District. The Tongass contains a high estimate[2] of approximately 681,000 acres of habitat that is potentially suitable for Calder lovage.
Pale poppy (*Papaver alboroseum*)	A rather spectacular poppy, this species has been identified in three disjunct areas: Kamchatka and northern Kurile Islands; Cook Inlet, Kenai Peninsula, Portage Glacier; and northern British Columbia and southern Yukon. The plant grows in open areas, recently deglaciated areas, rock outcrops, sand, gravel, and on well-drained soils. In the Tongass National Forest, it is suspected on the mainland in the Skagway and Juneau areas. It has been identified in seven locations on the Sitka Ranger District. The Tongass contains a high estimate[2] of approximately 1,598,000 acres of habitat that is potentially suitable for the pale poppy.
Bog orchid (*Platanthera gracilis*)	This orchid is known from a limited range in the southernmost part of the Tongass and adjacent British Columbia. It has been identified at four sites in wet meadows and is expected in peat bogs. Little is known about this plant. Distributions, population size, population trends, existence of historical populations, and habitat requirements have not yet been determined. This plant has been synonimized with the common *Platanthera stricta* and is proposed to be removed from the sensitive list. The Tongass contains a high estimate[2] of approximately 84,000 acres of habitat that is potentially suitable for the bog orchid.
Loose-flowered bluegrass (*Poa laxiflora*)	This grass ranges from the Hoonah area south to Oregon. The plant grows in upper beach meadows, open areas, open forests, and along riparian areas. It is suspected to occur throughout the Tongass National Forest from the Juneau Ranger District south. There are over 20 populations on the Juneau, Craig, Petersburg, and Ketchikan Districts, and Admiralty Island National Monument. The Tongass contains a high estimate[2] of approximately 7,287,000 acres of habitat that is potentially suitable for loose-flowered bluegrass.
Kamchatka alkali grass (*Puccinellia kamtschatica*)	This grass ranges from the Aleutians through the central Tongass National Forest. It grows on tidal flats, salt marshes, and sea beaches. The status of this species is in question. Some authors recognize it as a distinct species; others do not. Current research on *Puccinellia* may conclude that this species is the same as the much more common *Puccinellia nutkaensis*. The Tongass contains a high estimate[2] of approximately 26,000 acres of habitat that is potentially suitable for Kamchatka alkali grass.
Unalaska mist-maid (*Romanzoffia unalaschcensis*)	This plant ranges from the Aleutian Islands through Prince William Sound, disjunct to the Tongass National Forest. The plant grows in cracks in rock outcrops; along stream banks; beach terraces; open rocky areas; and on grassy, mossy rock cliffs along shores. There are two documented occurrences on Thorne Bay and Sitka Ranger Districts. At a very broad scale, the Tongass contains a high estimate[2] of approximately 3,158,000 acres of habitat that is potentially suitable for Unalaska mist-maid.
Queen Charlotte butterweed (*Senecio moresbiensis*)	This plant has been found in the southern half of the Tongass National Forest, Queen Charlotte Islands, and northern Vancouver Island. It grows in alpine and subalpine meadows, boggy or rocky slopes, open rocky heaths, or grassy areas. It has been found adjacent to a road on Prince of Wales Island. Less than 15 populations have been documented on the Thorne Bay and Craig Ranger Districts. The Tongass contains a high estimate[2] of approximately 681,000 acres of habitat that is potentially suitable for Queen Charlotte butterweed.
Circumpolar starwort (*Stellaria ruscifolia ssp. aleutica*)	This plant ranges from the eastern Aleutians east across southern coastal Alaska to the northern Tongass. This plant is inconspicuous and difficult to identify. It grows in open gravely sites and along creeks in the mountains. It has been identified in one location on the Yakutat Ranger District. The Tongass contains a high estimate[2] of approximately 176,000 acres of habitat that is potentially suitable for circumpolar starwort.

[1] Sensitive Plant list updated June 2002.
[2] Habitat acreage estimates for each species are approximate and tend to overestimate the potential habitat because they are based on macro-habitat information currently available in GIS. Nevertheless, they provide a means of measuring the effects of the alternatives by assessing the percentage of each habitat affected.

Invasive Plant Species

In the past, Alaska's remoteness and relatively low disturbance level has protected it from infestations of non-native plants. Compared to the lower 48 states, Alaska has a low level of invasive plants, but it is growing. As inventories have increased, more non-native species have been documented in Southeast Alaska on NFS lands (Schrader and Hennon 2005). Not all non-natives are invasive. Executive Order 13112 (1999) defines an "invasive species" as a species that is 1) non-native (or alien) to the habitat under consideration, and 2) whose purposeful or accidental introduction causes or is likely to cause economic or environmental harm or harm to human health. Executive Order 13112 directs all federal agencies to address invasive species concerns and refrain from actions likely to increase invasive species problems.

Many existing laws and directives provide management direction for "noxious" plants. Noxious is a political designation used by state or federal governments and, in the past, has primarily been driven by threats to agriculture or rangelands. Laws pertaining to only "listed noxious species" are inadequate in addressing threats to NFS lands in Alaska. The Forest Service recognizes this and refers to species of concern as "invasive." Invasive species terminology, in this document, includes noxious and invasive alien plant species.

There are two programs in Alaska that were created to track occurrences of non-native plants and rank the invasiveness of non-native species. The first program is Alaska Exotic Plants Information Clearinghouse (AKEPIC), a database administered and coordinated by ANHP. AKEPIC is a cooperative project between the USDA Forest Service, State and Private Forestry, the National Park Service, U.S. Geological Survey, University of Alaska, and other federal, state, and local agencies in support of the Alaska Committee for Noxious and Invasive Plants Management and the Strategic Plan for Noxious and Invasive Plants Management in Alaska. The Tongass National Forest maintains an inventory of occurrences of non-native plants in the AKEPIC database to track and monitor occurrences. The database is available online at: http://akweeds.uaa.alaska.edu/.

The second statewide program is the Weed Ranking Project that was created to better assess what species could be most problematic in the Alaska system. The Weed Ranking Project assesses the potential invasiveness of non-natives that have been found in Alaska and non-natives that have been invasive in other locations and for which there is appropriate habitat in Alaska. The invasiveness rankings are available online through ANHP at: http://akweeds.uaa.alaska.edu/akweeds_ranking_page.htm.

During the past several years, surveys along some roads, trails, trailheads, and other sites of recent human activity in Southeast Alaska have been conducted. Recently, systematic surveys of all non-native species have been initiated in areas of heavier use that are more susceptible to non-native plant invasion. The areas of greatest non-native plant diversity and extent of invasion have been found around towns and the most heavily traveled areas. The areas with the lowest number of species were further from population centers or paved roads (Arhangelsky 2005). Schrader and Hennon (2005) cited references that suggest that highest invasive plant occurrences are in areas of human activity, such as roads, recreational areas, industrial, commercial, and industrial development.

Survey results of all non-natives found on the Tongass are documented in the AKEPIC inventory. The data do not provide the extent of infestation, but do include the location of species found. While the database includes some entries for the Tongass starting in 2000, the majority of the entries are from 2002 and later. Table 3.7-2 shows the number of non-native species found on the Tongass during

Table 3.7-2
Number of Non-Native Species Recorded by District

Ranger District	Number of Non-Native Species Recorded[1]
Admiralty National Monument	17
Craig Ranger District	56
Hoonah Ranger District	10
Juneau Ranger District	17
Ketchikan-Misty Fiords Ranger District	26
Petersburg Ranger District	21
Sitka Ranger District	24
Thorne Bay Ranger District	59
Wrangell Ranger District	28
Yakutat Ranger District	14
Total	**88**

[1] Sites may be very close to each other and done on the same day (e.g., the survey of Prince of Wales Is included recording non-native species every 0.25 mile of road)
Source: AKEPIC 2006 and Tongass GIS

surveys. The number of species is notably larger on the Craig and Thorne Bay Ranger Districts due to the systematic survey of roads completed on Prince of Wales Island in 2005.

The 2005 systematic survey of Prince of Wales Island also provided information that many more species exist than had previously been recorded on the island. The 2005 survey of Prince of Wales Island recorded 33 new species of non-native plants on NFS lands (Arhangelsky 2005).

Table 3.7-3 shows a list of all non-native plant species recorded on the Tongass National Forest and invasiveness rankings from the Alaska Weed Ranking Program. The rankings are for the South Coastal zone of Alaska and range from 1 to 100 (100 representing the highest invasiveness rating) for the species that have an invasiveness ranking.

Of the 88 species of non-natives on the Tongass, 46 have an invasiveness ranking. The invasiveness ranking is based on analysis of four parameters for each species, including:

- Ecological impact: impact on processes, community structure and composition, and other trophic levels.
- Biological characteristics: mode of reproduction, methods of dispersal, competitive abilities, and habitat.
- Ecological amplitude and distribution: United States and global distribution, and level of impact in other locations.
- Feasibility of control: seed bank viability, other methods of reproduction, and effort known to be required for control.

Table 3.7-3
Non-Native Plants on the Tongass: Number of Occurrences and Invasiveness Ranking

Common Name	Scientific Name	No. of Locations on the Tongass[1]	Invasiveness Ranking [2]
alfalfa	*Medicago sativa*	2	
alsike clover	*Trifolium hybridum*	417	57
annual bluegrass	*Poa annua*	460	51
annual hawksbeard	*Crepis tectorum*	25	43
bird's foot trefoil	*Lotus corniculatus*	6	
bitter dock	*Rumex obtusifolius*	2	
black bindweed, wild buckwheat	*Polygonum convolvulus*	7	51
black medic, hop clover	*Medicago lupulina*	57	48
bladder campion	*Silene latifolia*	1	45
bluegrass	*Poa pratensis*	654	57
brittlestem hempnettle	*Galeopsis tetrahit*	67	
bull thistle	*Cirsium vulgare*	92	61
burr medic	*Medicago minima*	4	
butter and eggs	*Linaria vulgaris*	21	
Canada bluegrass	*Poa compressa*	83	35
Canada thistle	*Cirsium arvense*	72	76
Canary grass	*Phalaris canariensis*	1	
cat's-ears	*Hypochoeris radicata*	161	
chicory	*Cichorium intybus*	1	
colonial bentgrass	*Agrostis tenuis.*	56	
common chickweed	*Stellaria media.*	22	57
common comfrey	*Symphytum officinale*	6	
common dandelion	*Taraxacum officinale*	1,681	62
common dogmustard	*Erucastrum gallicum*	6	
common groundsel	*Senecio vulgaris*	31	
common hawkweed	*Hieracium lachenalii*	12	
common plantain	*Plantago major* var. *major*	2,264	44
common St. Johnswort	*Hypericum perforatum*	15	52
common tansy	*Tanacetum vulgare*	39	57
common velvetgrass	*Holcus lanatus*	238	
common yarrow	*Achillea millefolium*	120	48
creeping bentgrass, red top	*Agrostis gigantea*	463	
	Agrostis stolonifera	126	
creeping buttercup	*Ranunculus repens*	526	54
crested wheatgrass	*Agropyron cristatum*	1	
curled dock	*Rumex crispus*	24	48
European mountain ash	*Sorbus aucuparia*	1	
fall dandelion	*Leontodon autumnalis*	2	
field bindweed	*Convolvulus arvensis*	2	
field mustard	*Brassica rapa*	66	
fowl bluegrass	*Poa palustris*	830	
foxtail barley	*Hordeum jubatum*	8	63
garden dock	*Rumex longifolius*	4	
garlic mustard	*Alliaria petiolata*	12	70
golden clover	*Trifolium aureum*	1	
hedge false bindweed	*Calystegia sepium* ssp. *sepium*	1	
Himalayan blackberry	*Rubus armeniacus (R. discolor)*	1	
Italian rye grass	*Lolium multiflorum*	5	41
Japanese knotweed	*Polygonum cuspidatum*	254	87
lamb's quarters	*Chenopodium album*	7	
large-leaf lupine	*Lupinus polyphyllus*	77	
larger mouse-eared chickweed	*Cerastium fontanum Baumg*. ssp. *triviale*	1,262	39
maltesecross	*Lychnis chalcedonica*	2	
marsh cudweed	*Gnaphalium palustre*	11	
mayweed, stinking chamomile	*Anthemis cotula*	3	41

Table 3.7-3 (continued)
Non-Native Plants on the Tongass: Number of Occurrences and Invasiveness Ranking

Common Name	Scientific Name	No. of Locations on the Tongass[1]	Invasiveness Ranking [2]
meadow foxtail	*Alopecurus pratensis*	15	
meadow hawkweed	*Hieracium caespitosum*	8	
mouseear hawkweed	*Hieracium pilosella*	1	
Narrow-leaf Hawkweed	*Hieracium umbellatum*	60	35
night-flowering catchfly	*Melandrium noctiflorum*	1	
Norwegian cinquefoil	*Potentilla norvegica*	2	
orange hawkweed	*Hieracium aurantiacum*	325	71
orchard grass	*Dactylis glomerata*	610	
ornamental jewelweed	*Impatiens glandulifera*	2	
ox-eye daisy	*Leucanthemum vulgare*	610	
perennial rye grass	*Lolium perenne*	162	
perennial sowthistle	*Sonchus arvensis*	8	59
pineappleweed	*Matricaria discoidea*	140	34
prickly lettuce	*Lactuca serriola*	8	
purple foxglove, foxglove	*Digitalis purpurea*	73	51
purple-topped turnip	*Brassica rapa* var. *rapa*	6	
quackgrass	*Elymus repens*	5	
Queen Anne's lace	*Daucus carota*	1	
red clover	*Trifolium pratense*	206	
reed canary grass	*Phalaris arundinacea*	3,120	83
ribgrass, buckhorn, English plantain	*Plantago lanceolata*	2	
rough bluegrass	*Poa trivialis*	34	
rough hawkbit	*Leontodon hirtus*	3	
scentless mayweed	*Tripleurospermum inodorum*	1	48
scotch broom	*Cytisis scoparius*	22	69
sheep sorel	*Rumex acetosella* ssp. *acetosella*	86	45
	Rumex acetosella ssp. *angiocarpus*	2	
shepherd's purse	*Capsella bursa-pastoris*	6	40
	Capsella rubella	1	
silverweed	*Potentilla anserina*	3	
slender hairgrass	*Deschampsia elongata*	304	
smooth brome	*Bromus inermis*	9	62
sneezeweed	*Achillea ptarmica*	1	46
spearmint	*Mentha spicata*	1	
spiny sowthistle	*Sonchus asper*	35	
splitlip hempnettle	*Galeopsis bifida.*	5	43
spotted knapweed	*Centaurea biebersteinii*	6	88
spurry	*Spergula arvensis*	1	
stick chickweed	*Cerastium glomeratum*	1	
tall buttercup	*Ranunculus acris*	1	
tall fescue	*Festuca arundinacea*	20	
tansy ragwort, stinky willie	*Senecio jacobea*	9	63
thyme-leaf speedwell	*Veronica serpyllifolia subsp. serpyllifolia*	228	
timothy	*Phleum pratense*	1,373	56
true forget-me-not	*Myosotis scorpioides*	25	
wall lettuce	*Mycelis muralis*	39	32
western pearly everlasting	*Anaphalis margaritacea*	46	
wheat	*Triticum aestivum*	2	
white clover	*Trifolium repens*	2,269	59
white mustard	*Sinapis alba*	1	
white sweet clover	*Melilotus alba*	54	80
willow weed	*Polygonum lapathifolium*	6	
wormseed mustard	*Erysimum cheiranthoides subsp. cheiranthoides*	2	
yellow salsify, goatsbeard	*Tragopogon dubius*	1	48
yellow sweet clover	*Melilotus officinalis*	9	65

[1] AKEPIC 2006 http://akweeds.uaa.alaska.edu/
[2] Alaska Weed Ranking Proogram. http://akweeds.uaa.alaska.edu/akweeds_ranking_page.htm

Environmental Consequences

Direct and Indirect Effects

This section compares effects of the seven alternatives on sensitive and rare plant species and on the introduction or spread of invasive species. There would be no effects to Threatened or Endangered plant species because there are none found on the Tongass.

Threatened, Endangered, Sensitive, and Rare Plants

Direct effects of the proposed alternatives on sensitive or rare plants would include physical damage to sensitive plants by cutting, trampling, or crushing them with vehicles, other machinery, foot traffic, or felled trees. Severe impacts may cause mortality, or inhibit the vigor and reproductive capability of the plants.

Indirect effects involve alteration of habitat, such as changes in sunlight and moisture availability, herbivore or pollinator behavior, soil structure and fertility, vegetation structure, and competition from other native species as well as invasive and other non-native species. Some indirect effects, such as changes in sunlight or moisture, can be beneficial or harmful depending on the effect and the specie's life history. For example, if a plant has habitat requirements of partial sun, then increasing the size of a forest opening may benefit that species; however, that same opening may be harmful to a plant that requires shade. Activities likely to cause indirect effects to sensitive and rare plants include removal or reduction of tree canopy, road construction, changes in hydrology associated with road construction, increased competition by invasive plants, construction of other facilities, increased off-road vehicle use, increased access, and increased use and associated trampling by recreationists.

The alternatives described in Chapter 2 differ primarily by the proposed amount of timber that is likely to be harvested and the miles of road construction and reconstruction. Alternative 5, the No-Action Alternative, would follow the 1997 Forest Plan standards and guidelines. The other six alternatives would mostly follow the proposed standards and guidelines, which provide additional protection for sensitive and rare plants. There are three exceptions that could affect sensitive and rare plants: the area of non-development LUDs, beach buffer requirements, and Class III stream protection. Table 2-16 in Chapter 2 provides a comparison of the components of the alternatives.

Alternatives 1, 2, 3, and 6 would have more acreage in old-growth reserves and other non-development LUDs than Alternative 5 (current Forest Plan) or Alternatives 4 and 7. This increased area in reserves would provide more area in large blocks of intact habitats, which would be beneficial to sensitive and rare plants. Alternative 4 utilizes a reduced old-growth strategy and Alternative 7 would reduce non-development LUDs even further (including the elimination of the Old-Growth Habitat LUD). This could contribute to the risk of direct or indirect effects to sensitive or rare plant species that generally occur in old-growth habitats. Both Alternatives 4 and 7 could result in the loss of local viability for some sensitive species due to the creation of large gaps within old-growth habitat. Species listed as sensitive on the Tongass that include forest or forest openings as a potential habitat are Norberg arnica, Wright filmy fern, and loose-flowered bluegrass.

In Alternative 7, the beach buffer would be reduced to 500 feet for timber harvest, compared to 1,000 feet in the other alternatives. This would increase the risk of direct or indirect effects to species that inhabit areas close to shore or in low elevations. The species listed as sensitive on the Tongass that may inhabit areas close to shore are moonwort fern, Wright filmy fern, loose-flowered bluegrass, Kamchatka alkali grass, Unalaska mist-maid, Queen Charlotte butterweed, and circumpolar starwort.

Finally, Alternative 7 is different from the other alternatives in that it would not require timber harvest buffers along Class III streams. As a result, plant species that occupy riparian areas along steep, rocky and mountainous streams would not receive the same degree of protection under Alternative 7.

Construction of roads would involve removal of vegetation within the path of the road. This could affect rare and sensitive plants that inhabit the specific habitat found within the location of the new road. Roads can be constructed in many types of habitat, depending on the need for access for forestry activities.

Reconstruction of a road for timber harvest maintains the original investment and makes the road suitable and safe for the intended use. Reconstruction for forestry activities involves the rehabilitation of the original roadbed. It can include cleaning ditches, replacing drainage structures, re-installing bridges, and grading and shaping. The roadbed had been created and used (compacted) in the past and, in general, no longer supports sensitive or rare plants; however, newly exposed bedrock in unique geological areas can create new habitat for rare and sensitive plants. Road maintenance can include reconditioning the original road template, grading the road surface, cleaning roadside ditches, and removing vegetation that may encroach upon the road or block vision. Because the maintenance activities remain in the road prism, this would be unlikely to have an effect on sensitive or rare plants.

In general, alternatives with low amounts of timber harvest and road construction would have less risk of direct and indirect effects. Alternatives with more acres proposed for harvest and road construction would have more risk of effects. Other activities related to timber harvest, such as log transfer facility (LTF) construction, would increase with elevated timber harvests. Effects to sensitive and rare plants would, therefore, also be related to the amount of timber harvest allowed.

Alternative 5, the No-Action Alternative, proposes harvesting up to approximately 463,000 acres of old growth and constructing up to 3,874 miles of new roads over the next 100+ years (Table 3.7-4). Alternatives 1 and 2 would maintain the most acres of undisturbed forest and have less risk of adverse effects due to harvest and related activities. Alternatives 1 and 2 propose harvesting approximately 86,000 and 215,000 old-growth acres, respectively, or 19 to 46 percent of the acreage proposed in Alternative 5 (No Action). Alternatives 1 and 2 also propose constructing approximately 20 and 54 percent of the road miles proposed by Alternative 5. Alternatives 3 and 6 are in the middle of the alternatives in terms of acres for harvest and road construction. They include harvesting 335,000 and 445,000 acres, respectively, or 72 and 96 percent of the maximum acres of old growth proposed under Alternative 5. They propose to construct up to 2,799 and 3,744 miles of new road, respectively. Alternatives 4 and 7 propose the highest level of harvest and road construction and would have the highest risk of adverse effects due to harvest and related activities. They would harvest a maximum of 656,000 to 807,000 acres of old growth, respectively, and would build more miles of roads to achieve that harvest than any other alternative. Following Table 3.7-4 is a discussion of the likely effects to sensitive and rare plants, taking into account the Forest management direction for activities proposed by the alternatives.

Table 3.7-4
Maximum Acres of Harvest and Maximum Miles of Road Construction by Alternative

	Alternative						
	1	**2**	**3**	**4**	**5**	**6**	**7**
Maximum Acres Likely to be Harvested after Full Implementation of the Forest Plan (thousands of acres after 100+ years)							
Productive Old Growth	86.0	214.5	313.4	656.5	462.6	445.1	807.4
Young Growth	58.3	179.4	200.2	235.5	224.0	218.4	262.2
Total Acres	**144.3**	**393.9**	**513.7**	**892.0**	**686.6**	**663.5**	**1,069.6**
Maximum Miles of Road Likely to be Constructed							
New Road Construction	774	2,079	2,799	4,890	3,874	3,744	5,825
Road Reconstruction	925	1,784	1,932	2,182	2,100	2,046	2,371
Total Road Work (includes reconstruction)	**1,948**	**4,344**	**5,252**	**7,660**	**6,541**	**6,342**	**8,836**

Source: Tongass National Forest GIS database

Sensitive Plants

Within all alternatives, a biological evaluation, including a sensitive plant review, is prepared for individual project proposals as part of the site-specific environmental analysis. The sensitive plant review is required to include sufficient detail to determine how a proposed action may affect each sensitive species. The intensity and scope of inventories selected to provide information for effects analysis is required to be commensurate with the potential risk of a proposed project to sensitive plant species. The review is used to evaluate project-level impacts to sensitive plants in order to ensure that proposed project activities do not contribute to population or habitat declines that could lead to federal listing or loss of viability. In addition, appropriate Forest-wide standards and guidelines (TES species) will be applied to sustain those plants and their habitat that are listed as sensitive.

The proposed standards and guidelines for Alternatives 1, 2, 3, 4, 6, and 7 include an additional provision for reviewing the implementation and effectiveness of conservation actions for sensitive plants. This review would provide information to improve conservation efforts and reduce the likelihood of negative effects due to management actions.

The risk of adverse effects to sensitive plants would increase with increasing land disturbance; therefore, over time, Alternatives 4 and 7 would have a higher risk of direct and indirect effects due to harvest and road work, when compared to other alternatives. Alternatives 5 and 6 would have the next highest risk. The acres of harvest and miles of road construction for Alternative 3 is intermediate and its risk to affect sensitive plants would likely fall in the mid-range when compared to the other alternatives. Alternatives 1 and 2 would have the least risk of effects. It should be noted that through project-level evaluation and application of Forest-wide standard and guideline protection measures, it is unlikely the alternatives under consideration would have substantial adverse effects.

A species distribution is limited to areas that can meet the species-specific physical and biological needs. Due to the limited scope of surveys conducted within the Tongass, exact species distributions are unknown; however, by utilizing existing GIS data and available habitat information, areas that contain the necessary biological and physical requirements of each species on a macro-scale can be approximated. Although this analysis can not predict the exact distribution of each species, it can aid in assessing the location and total acreage of potentially suitable habitat for each sensitive species. For the sake of this discussion, potentially suitable habitat is defined as an area where the biological and physical requirements of a sensitive species are met, at least on a macro-scale, based on available GIS data. Although this technique overestimates the actual available habitat, it is likely that it also overestimates the acreage affected and, therefore, it is useful to be able to compare the percent of habitat affected by each alternative. Only 3 of the 17 sensitive species found on the Tongass would experience an impact on more than 0.1 percent of their potentially suitable habitat due to road construction and harvest activities. These include Norberg arnica, Wright filmy fern, and loose-flowered bluegrass. In general, the magnitude of effects for these species declines in order from Alternative 7 to 4, 5, 6, 3, 2, and 1. The effects on each of the sensitive species and their potentially suitable habitat are addressed below and in Table 3.7-5.

Eschscholtz's little nightmare (*Aphragmus eschscholtzianus*):
There is a high estimate of approximately 1,424,000 acres of potentially suitable habitat for Eschscholtz's little nightmare within the Tongass. This species grows within moist mossy areas, seeps, heaths, and scree slopes in subalpine and alpine areas, where harvest would not occur. Very little access to timber through alpine or subalpine areas would be needed. Each of the alternatives considered would impact less than 0.1 percent of potentially suitable habitat (Table 3.7-5). Because of the protection from the Forest-wide standards and guidelines, and the very low chance of impacting this habitat, there is essentially no risk that any alternative would result in loss of this specie's viability, or create significant trends towards federal listing.

Norberg arnica (*Arnica lessingii ssp. Norbergii*):
There is a high estimate of approximately 502,000 acres of potentially suitable habitat for Norberg arnica within the Tongass. This plant grows in various habitats, including open forests where it could be affected by silvicultural practices or associated road construction. The largest effect would result from Alternatives 4 and 7, which could impact approximately 0.3 percent of potentially suitable habitat for Norberg arnica (Table 3.7-5). The magnitude of effect declines in order from Alternative 7 to 4, 5, 6, 3, 2, and 1. Alternative 1 would result in an impact to less than 0.1 percent of potentially suitable habitat. Through project-level evaluation and application of Forest-wide standard and guideline protection measures, and based on the low proportion of habitat potentially affected, there would be a very low risk that effects would result in loss of this specie's viability, or create significant trends towards federal listing.

Moonwort fern, no common name (*Botrychium tunux* and *Botrychium yaaxudakeit*):
There is a high estimate of approximately 16,000 acres of potentially suitable habitat for *Botrychium tunux* and *Botrychium yaaxudakeit* within the Tongass. These plants grow in open areas on maritime beaches or upper beach meadows where harvesting activities would not occur. While access to timber through beaches may be needed if new LTFs are required, it would be infrequent. Each of the Alternatives considered would impact less than 0.1 percent of potentially suitable habitat (Table 3.7-5). Because of the protection from the Forest-wide standards and guidelines, and the very low chance of impacting this habitat, there is essentially no risk that any alternative would result in loss of this specie's viability, or create significant trends towards federal listing.

Goose-grass sedge (*Carex lenticularis* var. *dolia*):
There is a high estimate of approximately 526,000 acres of potentially suitable habitat for goose-grass sedge within the Tongass. This plant grows in moist mossy areas, seeps, heaths, and scree slopes in the subalpine and alpine where harvest would not occur. While access to timber through alpine or subalpine areas may be

needed, it is not likely. Each of the alternatives considered would impact less than 0.1 percent of potentially suitable habitat (Table 3.7-5). Additionally, goose grass sedge is more common than originally thought, although still rare. It has been proposed to be removed from the sensitive species list. With the very low chance of impacting potential habitat and the protection of Forest-wide standards and guidelines, there would be essentially no risk that effects would result in loss of this specie's viability or create significant trends towards federal listing.

Edible thistle (*Cirsium edule*):
There is a high estimate of approximately 695,000 acres of potentially suitable habitat for edible thistle within the Tongass. The likelihood of adverse effects is low because this plant grows in open meadows, scree slopes, and along glacial streams and lakeshores where harvest would not occur; however, access to timber through this type of habitat may be needed. Each of the alternatives considered would impact less than 0.1 percent of potentially suitable habitat (Table 3.7-5). Because of the protection from the Forest-wide standards and guidelines, and the very low chance of impacting this habitat, there is essentially no risk that any alternative would result in loss of this specie's viability, or create significant trends towards federal listing.

Davy mannagrass (*Glyceria leptostachya*):
There is a high estimate of approximately 1,314,000 acres of potentially suitable habitat for davy mannagrass within the Tongass. This plant grows in shallow freshwater and along stream and lake margins where harvest would not occur. While these areas are generally protected by Riparian Standards and Guidelines, it is possible that access to timber through this type of habitat may be needed. Under Alternative 7, road construction would impact approximately 0.1 percent of potentially suitable habitat for davy mannagrass. Road construction and harvest activities under all other alternatives considered would impact less than 0.1 percent of potentially suitable habitat (Table 3.7-5). The magnitude of effect declines in order from Alternative 7 to 4, 5, 6, 3, 2, and 1. With the protection of Forest-wide standards and guidelines along with the Riparian Standards and Guidelines, there is a very low risk that effects would result in loss of this specie's viability, or create significant trends towards federal listing.

Wright filmy fern (*Hymenophyllum wrightii*):
There is a high estimate of approximately 8,845,000 acres of potentially suitable habitat for wright filmy fern within the Tongass. This plant grows in various habitats, including near the bases of trees, on decaying wood and rootwads, and in the dense, humid coastal forests near saltwater and low elevation areas. These areas could be affected by silviculture or associated road construction, indicating that all alternatives considered may affect this sensitive plant. Alternative 7 would impact up to approximately 9 percent of potentially suitable habitat; 0.2 percent of this would be as a result of road construction (Table 3.7-5). The magnitude of effect declines in order from Alternative 7 to 4, 5, 6, 3, 2, and 1. Alternative 1 would impact up to approximately 1 percent of potentially suitable habitat. Through project-level evaluation and application of Forest-wide standard and guideline protection measures, there is a low risk that effects would result in loss of this specie's viability, or create significant trends towards federal listing.

Truncate quillwort (*Isoetes x truncata*):
There is a high estimate of approximately 31,000 acres of potentially suitable habitat for truncate quillwort within the Tongass. This plant grows immersed in shallow fresh water pools or ponds where harvest would not occur. While these areas are protected by riparian standards and guidelines, it is possible that access to timber through this type of habitat may be needed. Each of the alternatives considered would impact less than 0.1 percent of potentially suitable habitat (Table 3.7-5). This

species is more common than previously thought and it has been proposed to be removed from the sensitive species list. With the extremely low chance of impacting this habitat and the protection of Forest-wide standards and guidelines, there is essentially no low risk that effects would result in loss of specie's viability, or create significant trends towards federal listing.

Calder lovage (*Ligusticum calderi*):
There is a high estimate of approximately 681,000 acres of potentially suitable habitat for calder lovage within the Tongass. This plant occurs in alpine and subalpine meadows, boggy slopes, and rocky areas where harvest would not occur. While access to timber through alpine and subalpine areas may be needed, it is not likely. Each of the alternatives considered would impact less than 0.1 percent of potentially suitable habitat (Table 3.7-5). Because of the protection from the Forest-wide standards and guidelines, and the very low chance of impacting this habitat, there is essentially no risk that any alternative would result in loss of this specie's viability, or create significant trends towards federal listing.

Pale poppy (*Papaver alboroseum*):
There is a high estimate of approximately 1,598,000 acres of potentially suitable habitat for pale poppy within the Tongass. This plant occurs in open areas, recently deglaciated areas, rock outcrops, sand, gravel, and on well-drained soils where harvest would not occur. While access to timber through this type of habitat may be needed, it is not likely. Each of the alternatives considered would impact less than 0.1 percent of potentially suitable habitat (Table 3.7-5). Because of the protection from the Forest-wide standards and guidelines, and the very low chance of impacting this habitat, there is essentially no risk that any alternative would result in loss of this specie's viability, or create significant trends towards federal listing.

Bog orchid (*Platanthera gracilis*):
There is a high estimate of approximately 84,000 acres of potentially suitable habitat for bog orchid within the Tongass. This plant grows in wet meadows and peat bogs where harvest would not occur. While standards and guidelines provide protection to wetlands, it is possible that access to timber through this type of habitat may be needed. Each of the alternatives considered would impact less than 0.1 percent of potentially suitable habitat (Table 3.7-5). In addition, this plant has been synonymized with the common *Platanthera stricta* and is proposed to be removed from the sensitive list. With the extremely low chance of impacting this habitat and the protection of Forest-wide standards and guidelines, there is essentially no risk that effects would result in loss of this specie's viability, or create significant trends towards federal listing.

Loose-flowered bluegrass (Poa laxiflora):
There is a high estimate of approximately 7,287,000 acres of potentially suitable habitat for loose-flowered bluegrass within the Tongass. This plant grows in various habitats including along riparian areas and in open forests where it could be affected by silvicutlure or associated road construction. Alternative 7 would impact up to approximately 6 percent of potentially suitable habitat; 0.2 percent of this would be as a result of road construction (Table 3.7-5). The magnitude of effect declines in order from Alternative 7 to 4, 5, 6, 3, 2, and 1. Alternative 1 would impact 0.6 percent of potentially suitable habitat. Through project-level evaluation and application of Forest-wide standard and guideline protection measures, there is a low risk that effects would result in loss of this specie's viability, or create significant trends towards federal listing.

Kamchatka alkali grass (*Puccinellia kamtschatica*):
There is a high estimate of approximately 26,000 acres of potentially suitable habitat for Kamchatka alkali grass within the Tongass. This plant occurs in tidal flats, salt

marshes, and sea beaches where harvest would not occur. While access to timber through beach areas may be needed if new LTFs are required, it would be infrequent. Each of the alternatives considered would impact less than 0.1 percent of potentially suitable habitat (Table 3.7-5). Because of the protection from the Forest-wide standards and guidelines, and the very low chance of impacting this habitat, there is essentially no risk that any alternative would result in loss of this specie's viability, or create significant trends towards federal listing.

Unalaska mist-maid (*Romanzoffia unalaschcensis*):
There is a high estimate of approximately 3,158,000 acres of potentially suitable habitat for Unalaska mist-maid within the Tongass. The plant grows in cracks within rock outcrops, along stream banks, beach terraces, open rocky areas, and on grassy/mossy rock cliffs along shores where harvest would not occur; however, access to timber through these habitats may be needed. Each of the alternatives considered would impact less than 0.1 percent of potentially suitable habitat (Table 3.7-5). Because of the protection from the Forest-wide standards and guidelines, and the very low chance of impacting this habitat, there is essentially no risk that any alternative would result in loss of this specie's viability, or create significant trends towards federal listing.

Queen Charlotte butterweed (*Senecio moresbiensis*):
There is a high estimate of approximately 681,000 acres of potentially suitable habitat for Queen Charlotte butterweed within the Tongass. This plant grows in meadows, boggy or rocky slopes, open rocky heaths, or grassy areas where harvest would not occur. While access to timber through these areas may be needed, it is not likely. Each of the alternatives considered would impact less than 0.1 percent of potentially suitable habitat (Table 3.7-5). With the very low chance of impacting this habitat and the protection of Forest-wide standards and guidelines, there is essentially no risk that effects would result in loss of this specie's viability, or create significant trends towards federal listing.

Circumpolar starwort (*Stellaria ruscifolia* ssp. *aleutica*):
There is a high estimate of approximately 176,000 acres of potentially suitable habitat for circumpolar starwort within the Tongass. This plant grows in open gravely sites and along creeks in the mountains where harvest would not occur; however, access to timber through this type of habitat may be needed. Each of the alternatives considered would impact less than 0.1 percent of potentially suitable habitat (Table 3.7-5). Because of the protection from the Forest-wide standards and guidelines, and the very low chance of impacting this habitat, there is essentially no risk that any alternative would result in loss of this specie's viability, or create significant trends towards federal listing.

Rare Plants
The proposed standards and guidelines for all alternatives, except Alternative 5 (No Action), include additional protection for rare plants. Alternatives 1, 2, 3, 4, 6, and 7 include the proposed standards and guidelines that provide specific direction to avoid, minimize, or mitigate adverse effects to rare plants and populations during project planning. The additional protection provided by the proposed standards and guidelines would reduce the risk of adverse effects on rare plants.

Table 3.7-5.
Maximum Effects on Potential Suitable Habitat for Sensitive Plant Species by Alternative (contributing effect of roads shown in parentheses)

Common Name (*Scientific Name*)	Total Potential Suitable Habitat (acres)	Percent of Total Potential Suitable Habitat Affected by Alternative						
		1	2	3	4	5	6	7
Eschscholtz's little nightmare (*Aphragmus eschscholtzianus*)	1,424,000	< 0.1%	< 0.1%	< 0.1%	< 0.1%	< 0.1%	< 0.1%	< 0.1%
Norberg arnica (*Arnica lessingii* ssp. *Norbergii*)	502,000	< 0.1%	0.1%	0.2%	0.3%	0.2%	0.2%	0.3%
Moonwort fern, no common name (*Botrychium tunux*)	16,000	< 0.1%	< 0.1%	< 0.1%	< 0.1%	< 0.1%	< 0.1%	< 0.1%
Moonwort fern, no common name (*Botrychium yaaxudakeit*)	16,000	< 0.1%	< 0.1%	< 0.1%	< 0.1%	< 0.1%	< 0.1%	< 0.1%
Goose-grass sedge (*Carex lenticularis* var. *dolia*)	526,000	< 0.1%	< 0.1%	< 0.1%	< 0.1%	< 0.1%	< 0.1%	< 0.1%
Edible thistle (*Cirsium edule)*	695,00	< 0.1%	< 0.1%	< 0.1%	< 0.1%	< 0.1%	< 0.1%	< 0.1%
Davy mannagrass (*Glyceria leptostachya*)	1,314,000	< 0.1%	< 0.1%	< 0.1%	< 0.1%	< 0.1%	< 0.1%	0.1% *(0.1%)*
Wright filmy fern (*Hymenophyllum wrightii*)	8,845,000	1.0%	2.5% *(0.1%)*	3.7% *(0.1%)*	7.3% *(0.2%)*	5.5% *(0.1%)*	5.4% *(0.1%)*	9.4% *(0.2%)*
Truncate quillwort (*Isoetes x truncata*)	31,000	< 0.1%	< 0.1%	< 0.1%	< 0.1%	< 0.1%	< 0.1%	< 0.1%
Calder lovage (*Ligusticum calderi*)	681,000	< 0.1%	< 0.1%	< 0.1%	< 0.1%	< 0.1%	< 0.1%	< 0.1%
Pale poppy (*Papaver alboroseum*)	1,598,000	< 0.1%	< 0.1%	< 0.1%	< 0.1%	< 0.1%	< 0.1%	< 0.1%
Bog orchid (*Platanthera gracilis*)	84,000	< 0.1%	< 0.1%	< 0.1%	< 0.1%	< 0.1%	< 0.1%	< 0.1%
Loose-flowered bluegrass (*Poa laxiflora*)	7,287,000	0.6%	1.5%	2.3% *(0.1%)*	4.6% *(0.1%)*	3.4% *(0.1%)*	3.4% *(0.1%)*	6.0% *(0.2%)*
Kamchatka alkali grass (*Puccinellia kamtschatica*)	26,000	< 0.1%	< 0.1%	< 0.1%	< 0.1%	< 0.1%	< 0.1%	< 0.1%
Unalaska mist-maid (*Romanzoffia unalaschcensis*)	3,158,000	< 0.1%	< 0.1%	< 0.1%	< 0.1%	< 0.1%	< 0.1%	< 0.1%
Queen Charlotte butterweed (*Senecio moresbiensis*)	681,000	< 0.1%	< 0.1%	< 0.1%	< 0.1%	< 0.1%	< 0.1%	< 0.1%
Circumpolar starwort (*Stellaria ruscifolia* ssp. *aleutica*)	176,000	< 0.1%	< 0.1%	< 0.1%	< 0.1%	< 0.1%	< 0.1%	< 0.1%

Source: Tongass National Forest GIS database
Percent of total potential suitable habitat affected is calculated by estimating potential suitable macro-habitat using available GIS descriptors of habitat and then intersecting these habitat areas with areas to be affected by the alternatives.
Values in parentheses *( )* represent the contributing effect of roads to the total percent of habitat affected.

Alternative 5 is covered by the 1997 Forest Plan standards and guidelines, which did not include specific protection for rare plants; however, protection of rare plant populations and their habitats in a proposed project area is generally accomplished through project analysis and planning. Effects of a proposed action on rare plant species and their habitats are generally addressed in plant resource reports.

The effects of the alternatives on rare plants would be more heavily influenced by the area of timber harvest and road construction. Therefore, the likelihood of adverse effects to rare plants would be highest for Alternative 7, followed by Alternatives 4, 5, 6, 3, 2, and 1.

Invasive Plant Species

Invasive plants can adversely affect an area either when invasive plants become established or when an existing species spreads to occupy a larger area. Invasive plants can negatively affect habitat by competing for resources such as water and light, establishing and changing the community composition, eliminating or reducing native plants, or by changing the vegetation structure. The changes in community composition or vegetation structure can reduce native plant populations as well as negatively affect habitat for wildlife. Highly invasive plant species often have aggressive reproductive methods and can successfully compete for resources (Schrader and Hennon 2005).

Ground disturbance associated with management activities on the Forest can provide an opportunity for invasive plant introduction or expansion. This would be a direct effect of timber harvest or road construction because the activities disturb soil and/or remove existing vegetation, providing openings for invasive plants to establish or spread. Movement of equipment can also provide opportunities for seed transport into new areas. Indirect effects can include the establishment or spread of invasive plants through the use of roads after harvest for recreation or during road maintenance. In general, land disturbance effects to invasive plants can be wider than the effects in the specific area of disturbance due to the interconnectedness of land.

The Tongass National Forest Invasive Plant Management Plan (Lerum and Krosse 2005) provides guidance for prevention, early detection, control, management, and rehabilitation or restoration of areas with established invasive plants. It incorporates policy and emphasis direction from federal and regional documents, including the Alaska Region Invasive Plant Strategy (USDA Forest Service 2005a).

The proposed standards and guidelines address invasive plants for all alternatives except Alternative 5 (No Action). The proposed standards and guidelines for invasive plants are new and include direction to review proposed projects to determine the risk of introduction or spread of invasive plants and implement appropriate mitigation measures. They also include direction to control existing invasions and rehabilitate habitats impacted by invasive species. The proposed standards and guidelines for Alternatives 1, 2, 3, 4, 6, and 7 would reduce the likelihood of negative effects that would result from the introduction or spread of invasive plant species.

Alternative 5 (No Action) includes the use of the 1997 Forest Plan that does not include specific standards and guidelines for controlling invasive plants. However, when followed, the guidance in the Tongass National Forest Invasive Plant Management Plan (Lerum and Krosse 2005) would provide some protection from invasive plants.

All of the alternatives include timber harvest and new road construction that could directly and indirectly increase invasive plants. Increased disturbance increases the risk of establishment or spread of invasive plants. The effects would vary between alternatives depending on the level of disturbance due to timber harvest and new roads construction.

The acres of harvest and miles of road included in each alternative are shown in Table 3.7-4. Over time, Alternatives 4 and 7 and, to a lesser extent, Alternatives 5 and 6 would have a higher risk of direct and indirect effects due to harvest and road work. In addition, Alternative 5 does not include the revised standards and guidelines; therefore, there is a greater risk of adverse effects for each acre disturbed. The acres of harvest and miles of road construction for Alternative 3 is intermediate; its risk would likely fall in the mid-range when compared to the other alternatives. Alternatives 1 and 2 propose the least amount of disturbance from timber harvest, and roads would have the lowest risk of adverse effects.

Cumulative Effects

Threatened, Endangered, Sensitive, and Rare Plants

When considering effects to sensitive and rare plants, it is important to look at land both inside and outside NFS lands and the cumulative effects of past, present, and reasonably foreseeable future activities. Each landscape area has different physical, chemical, and biological characteristics, as well as different vegetation patterns. The significance of an addition to cumulative effects from management activities would depend on factors such as the amount and type of disturbance in an analysis area, type of vegetation in the area, habitat availability for each sensitive or rare species, known locations of each species, and amount of disturbance in the potential habitat area for each species. Assessing cumulative effects to sensitive and rare plant species will be done for individual projects as part of the National Environmental Policy Act (NEPA) process for the relevant analysis area; however, past plus expected harvest and road construction for forestry and other uses on all land ownerships can be used to compare the risk that each alternative would add to cumulative effects on sensitive and rare plants.

As discussed above, Table 3.7-5 summarizes the amount of each sensitive species potentially suitable habitat on NFS lands affected for each alternative. These values create a baseline set of conditions as well as a prediction of future conditions during the life of the Forest Plan under all alternatives. These data can be used when future project-specific analyses are conducted as part of the NEPA process.

Timber harvesting on state, municipal, and private land is governed by the Alaska Forest Resources and Practices Act (AS 41.17). Alaska Forest Resources and Practices Regulations (ADNR 2004) do not address threatened, endangered, or rare plants; however, they do limit disturbance in marshes and non-forested muskegs, which would provide some protection for those plant species.

To compare the potential cumulative effects of harvest under the seven alternatives on sensitive or rare plants, harvest on lands of all ownerships in Southeast Alaska was analyzed. There are approximately 21.6 million acres of land in Southeast Alaska. Non-NFS lands comprise about 4.8 million acres or 22 percent of the 21.6 million acres in Southeast Alaska; Glacier Bay National Park consists of about 2.5 million acres. Approximately 30 percent of the lands in Southeast Alaska were originally productive old growth (POG). Approximately 13 percent of the POG on all ownerships had been harvested by 2006. Thus, approximately 87 percent of the original POG on all ownerships was remaining in 2006. The percent of POG remaining on NFS lands is higher than for non-NFS lands that lie within the Tongass National Forest boundary (92 and 70 percent, respectively) due to the concentrated timber harvest areas in the non-NFS lands that are within the Tongass boundaries.

Looking at all ownerships of land in the Forest, the POG forest remaining in 100 years under full implementation of the Forest Plan would be greatest for Alternative 1, followed by Alternatives 2, 3, 6, 5, 4, and 7 (Table 3.7-6). Therefore, the risk of cumulative effects to sensitive or rare plants due to harvest would be lowest for Alternative 1, followed by 2, 3, 5, 6, 4, and 7. Table 3.9-17 in the *Biodiversity* section shows a similar relative risk among the alternatives for cumulative effects by Biogeographic Province.

Table 3.7-6
Cumulative Percent of the Original (1954) POG Remaining on All Ownerships in 2006 and after 100+ Years under Full Implementation of the Forest Plan for Each Alternative with Estimated Future Harvest on State, Private, and Other Lands

Remaining POG on All Ownerships in 2006 as a Percent of all Original POG	Remaining POG after 100+ Years as a Percent of 1954 POG						
	Alternative						
	1	2	3	4	5	6	7
87%	82%	80%	78%	73%	76%	76%	71%

Source: Tongass National Forest GIS database

Existing road density is greater on the non-NFS lands within the Tongass National Forest boundaries than on the NFS lands due to concentrated harvest and more populated areas. It averages 0.19 mile per square mile on NFS lands and 2.19 miles per square mile for the non-NFS lands. The average for lands of all ownerships is 0.31 mile per square mile; however, those are averages over a very large area and there is great variability. The range of road density by VCU shows large variabilityacross the Tongass as seen in Table 3.6-9 in the *Fish* section (percentage of VCUs by road density category for the Tongass and lands of all ownerships). All VCUs have road densities of less than 4 miles per square mile under existing condition.

Table 3.7-7 shows the average future road density for each alternative. It includes existing roads and forestry as well as other roads proposed for construction on NFS lands and reasonably foreseeable on non-NFS lands. Alternatives 7 and 4, and to a lesser extent Alternatives 5 and 6, would have the highest average road density. Therefore, in those alternatives, there is higher risk that management actions would add to cumulative effects to sensitive or rare plants. The average road density for Alternative 3 is intermediate and its risk of cumulative effects would fall in the mid-range when compared to the other alternatives. Alternatives 1 and 2 would have the least risk of cumulative effects. Table 3.6-9 in the *Fish* section shows a similar relative risk among the alternatives of cumulative effects by VCU.

Table 3.7-7
Future Average Road Density by Alternative (miles per square mile)

	Existing	Alternative						
		1	2	3	4	5	6	7
National Forest Service Land	0.19	0.22	0.27	0.30	0.38	0.34	0.33	0.41
All Ownerships	0.31	0.42	0.47	0.49	0.57	0.53	0.52	0.60

Source: Tongass National Forest GIS database

There are other activities that have occurred in the past and are reasonably foreseeable to occur in the future that have the potential to add to cumulative effects to rare and sensitive plants in regional and local areas. They include mineral extraction, transmission line projects, hydroelectric projects, transportation developments, expansion of cities, and recreational site development. Existing mining is at Greens Creek on Admiralty Island, Berner's Bay north of Juneau, and other locations. Given the level of world pricing, an increase in exploration is expected. There are also several regional transportation projects and regional energy and transmission projects planned for construction. Each of these activities can include clearing vegetation and disturbing habitat for construction and maintenance; therefore, they have the potential to affect sensitive and rare plants and their habitat and would be considered in project analysis.

Changes in Alaska's climate (discussed in the *Climate and Air* section of this chapter) could affect the hydrology and other habitat conditions where the sensitive and rare plants occur. While the models do not fully agree on the climate change predictions for Southeast Alaska, they generally agree on warmer weather with more winter rainfall and less snowfall and a decrease in summer rain in some areas. That would likely result in lower soil moisture due to increased evaporation during warmer, drier summer months. Also, a precipitation shift from snow to rain could lead to more water running off the landscape rather than being stored to feed streams and wetlands in the late spring and summer; thus, increasing evaporation and reducing water storage. These factors could lead to drier streams, meadows, and wetlands.

Changes in temperature and hydrologic conditions would likely favor some plant species and stress others. There has been little research into the effects of changes in environmental conditions for each of the sensitive and rare species; consequently, there is uncertainty as to the effect of changes in the climate on these plant species known or suspected to occur on the Tongass.

Invasive Plant Species

When considering effects to invasive plants, it is important to look at both NFS and non-NFS lands and the cumulative effects of past, present, and reasonably foreseeable future activities. Invasive plants on any land ownership in Southeast Alaska can affect invasive establishment or spread on NFS lands and vice versa. Also, activities on land of any ownership can establish or spread plants that affect other lands. As mentioned in the direct and indirect effects, activities can have wider affects on invasive plants than the specific area of land disturbance due to the interconnectedness of land.

As discussed for rare plants, each landscape area has different characteristics and vegetation patterns. The significance of an addition to cumulative effects of forestry activities would depend on factors such as the amount and type of disturbance in the analysis area, the existence of invasive plants at the time of project implementation, type of vegetation in the area, amount of harvest and road building for a specific project, and the project plans to contain invasive plants. Assessing cumulative effects needs to be done for individual projects in the context of the effects in the relevant analysis area.

Past, present, and future harvest and road construction for harvest and other purposes on lands of all ownerships can be used to compare the risk of Alternative 6 (Proposed Alternative), to cumulative effects due to invasive plant introduction or spread. Table 3.7-7 shows the average existing road density and future road density for each alternative for all land ownerships and for NFS lands. Alternatives 7 and 4 and, to a lesser extent, Alternatives 5 and 6 would have the highest average road density and, therefore, a higher risk of adding to cumulative effects of invasive plants. The average road density for Alternative 3 is intermediate; its risk of cumulative effects would fall in the mid-range when compared to the other alternatives. Alternatives 1 and 2 would have the least risk of cumulative effects due to an individual project.

As discussed under cumulative effects for sensitive and rare plants, there are fewer restrictions on timber activities on non-NFS lands than on NFS lands. Timber activities on non-NFS lands that can contribute to the introduction or spread of invasive plants are not specifically regulated by the State of Alaska. To compare the risk of effects of harvest in the seven alternatives on invasive plants, POG remaining on land of all ownerships was analyzed. Looking at all ownerships of land in the Forest, the POG (unharvested) forest remaining in 100 years under full implementation of the Forest Plan would be greatest for Alternative 1, followed by Alternatives 2, 3, 6, 5, 4, and 7 (Table 3.7-6). Therefore, the risk of cumulative effects to be substantial for invasive plants due to harvest would be highest for Alternative 7, followed by 4, 5, 6, 3, 2, and 1.

There are other activities that have occurred and are reasonably foreseeable to occur in the future that have the potential to add to cumulative effects of invasive plants. They include mineral extraction, transmission line projects, hydroelectric projects, transportation developments, expansion of cities, and recreational site development. Each of these activities can include clearing vegetation, construction, transportation for construction and ongoing activities, and maintenance. Therefore, they have the potential to introduce or spread invasive plants in an area and would need to be considered in the project analysis.

Changes in Southeast Alaska's climate (discussed in the *Climate and Air* section of this chapter) could also create the conditions that encourage the spread of invasive plants by altering opportunities for invasive plants to colonize new areas, where could be compounded by climate change. Changing climate may also result in range extensions for some species that are native at more southerly latitudes, and they may become established or become more widespread on the Tongass, as a result. Changes in growing conditions would likely favor some plant species and stress others. There is uncertainty in the effect of changes in the climate to the invasive plants on the Tongass.

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Forest Health

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Affected Environment

Current Situation

Insects, diseases, related decay processes and windthrow are an integral and natural part of forest ecosystems. Many of these appear to play key roles in gap-level disturbance (see discussion of old-growth forests in the *Biodiversity* section of this chapter) and in providing wildlife habitat. The majority of the forests on the Tongass are old-growth forests. Losses to the timber resource caused by heart rot in live trees are considerable in old-growth forests. Approximately one-third of the volume of the old-growth hemlock-spruce forests in Southeast Alaska is decayed by heart rot fungi (USDA Forest Service and ADNR 2007).

In addition to heart rot, some of the more common destructive insects, diseases, and conditions within Southeast Alaska are listed below.

Black-Headed Budworm, *Acleris gloverana* (Walsingham), is one of the more destructive forest insects in coastal Southeast Alaska. In 1993, a peak year for budworm, approximately 258,000 acres of spruce-hemlock forests were affected. This was the largest outbreak in decades. In the 1950s, almost one-third of the net timber volume was lost on many hemlock sites due to budworm defoliation (USDA Forest Service and ADNR 2000). Black-headed budworm populations are currently at endemic levels, with less than 1,000 acres of mapped defoliation in the last 3 years (USDA Forest Service and ADNR 2007). Larval feeding strips hemlock foliage and can cause growth reduction, top-kill, and, at times, tree mortality (USDA Forest Service and ADNR 2000). Juday et al. (1998) rated many potential impacts on the coastal forests of Southeast Alaska due to climate change. They concluded that there was a high risk of increased damage from black-headed budworm outbreaks.

Hemlock Sawfly, *Neodiprion tsugae* (Middleton), is a serious defoliator of western hemlock throughout Southeast Alaska. Outbreaks tend to be of longer duration in southern Southeast Alaska where widespread damage is usually confined to the area south of Frederick Sound, especially along Clarence Strait. Larvae feed on mature (older) needles rather than current year (new) foliage. Most sawfly outbreaks do not cause tree mortality, but the tops are killed in some trees and tree growth may be reduced. Heavy defoliation by hemlock sawflies is known to reduce radial growth and cause top kill. No hemlock sawfly defoliation was mapped in 2006 (USDA Forest Service and ADNR 2007).

Spruce Beetle, *Dendroctonus rufipennis* (Kirby), is the most destructive forest insect Alaska-wide, although outbreaks in Southeast Alaska are typically smaller and of shorter duration than those in south/central and interior Alaska. Most outbreaks originate in blowdown or in cull logs left in harvest units and spread to adjacent standing timber. Mortality in unmanaged Sitka spruce stands varies and can be as high as 75 percent. Weather conditions appear to play a role in the expansion or contraction of beetle populations. Spruce beetle activity has been noted across the Tongass National Forest and adjacent lands from Yakutat Forelands to Dall Island (USDA Forest Service and ADNR 2000). Spruce beetle activity in 2006 centered on a 4,000-acre area between Haines and Skagway (USDA Forest Service and ADNR 2007).

Spruce Needle Aphid, *Elatobium abietinum* (Walker), is an introduced species that feeds on the needles of Sitka spruce, often causing reduced growth and increasing susceptibility to other mortality agents such as spruce beetle. As with other insect pests, populations have cycles, generally increasing following mild winters. More than 25,000 acres of spruce forest were defoliated in the winter of 1991 to 1992 (USDA Forest Service and ADNR 2000). The current outbreak began in 1998, with the worst defoliation occurring in 2003 when more than 30,000 acres were affected. Defoliation by spruce aphids affected approximately 9,120 acres in 2006, mostly in small pockets within the beach fringe from Lynn Canal in the north to Dall Island in the south (USDA Forest Service and ADNR 2007).

Hemlock Dwarf Mistletoe, *Arceuthobium tsugense* (Rosendhal, G. N. Jones), is a parasitic flowering plant that infects western hemlock throughout Southeast Alaska as far north as Haines. Infestation levels vary—dwarf mistletoe is absent in some stands, while almost every hemlock is infected in other stands. The upper elevational limit for Hemlock dwarf mistletoe in approximately 500 feet (Shaw and Hennon 1991). Volume growth in western hemlock trees heavily infected with dwarf mistletoe can be reduced by 39 percent or more (Thomson et al. 1985). In addition to reduced stem growth, infestations cause increased growth and retention of lower branches and distortation and weakening of wood strength at and near swellings. The spread of dwarf-mistletoe in young hemlock stands can result from leaving standing infected hemlock in harvest units (Laurent 1974). Dwarf mistletoe responds to light with increased seed production. Rates of spread to adjacent and lower canopy trees may increase in partial cuts where infected hemlocks remain. Trummer et al. (1998) developed a model for dwarf mistletoe infections in uneven-aged forests of Southeast Alaska that suggests infection rates are significantly correlated with levels of dwarf mistletoe infection in the residual trees. Deal (2001) reports partial cutting resulted in maintaining mistletoe levels at generally undamaging levels, with a trend towards less mistletoe in stands with higher harvest levels. A recent study of partial cut stands in British Columbia found that most young trees infected with mistletoe were advanced regeneration established before logging (Muir 2006).

Alaska Yellow-Cedar. Decline and mortality of yellow-cedar continues to be one of the most widespread and important forest problems in Southeast Alaska. Aerial surveys have mapped approximately 500,000 acres of decline in a wide band from western Chichagof and Baranof Islands to the Ketchikan area (USDA Forest Service and ADNR 2007). This decline is associated with wet, poorly drained sites, and recent research has demonstrated that no organism is the primary cause of the decline (Hennon and Shaw 1997). Hennon and Shaw suggest that reduced snow pack in low-elevation areas associated with a warming trend that started in the 1800s has exposed fine surface roots to freezing, which in turn kills trees. As the climate continues to warm, cedar decline is likely to continue to spread, especially in the south and east. Conversely, yellow-cedar appears to be spreading northward as climate warms, into areas that retain snow longer into the spring.

Hemlock Fluting. Hemlocks with fluting have deeply incised grooves and ridges extending vertically along their trunks, a condition that reduces the value of hemlock logs because they yield less sawlog volume and some of the milled wood contains bark. Fluting is a common problem in Southeast Alaska, especially on mid- to high-quality sites at low elevations, on gradual slopes, and with western exposure (Julin et al. 1993). It is rarely found away from the coast. The cause of fluting is not completely understood, but it may be associated with increased wind firmness, especially on shallow soils, due to growth increases triggered by silvicultural treatments or natural disturbance (USDA Forest Service and ADNR 2007). Julin et al (1993) found that the larger buttresses were generally aligned with the direction of the tree lean. They also concluded that western hemlock trees in Southeast Alaska may be genetically predisposed to form fluted trunks. Silvicultural treatments that favor other species and reduce branch size and retention period would greatly reduce fluting (Julin et al. 1993). However, because fluting primarily occurs in the beach buffer, the effect on timber resources is limited.

Decays. Stem decays cause substantial loss in all tree species in unmanaged stands. Tree death and stem breakage resulting from decay contribute to the structural diversity in stands and may be a major factor in small-scale disturbance in Southeast Alaska (Hennon and McClellan 2003). Many decay fungi enter through tree wounds. The accidental wounding of trees during partial cuts and commercial thinnings can increase the impact from decay organisms in managed stands (USDA Forest Service 1997a, Appendix G). However, Christensen et al. (2002) found very low levels of disease-caused defects in both thinned and unthinned 90-year-old hemlock-Sitka spruce stands on the Tongass compared to old-growth forests. Juday et al. (1998) rated many potential impacts on the coastal forests of Southeast Alaska due to climate change. They concluded that there is a risk that new fungal tree diseases will appear in Southeast Alaska as the climate warms.

Animal Damage. Significant animal damage to trees is apparent at various locations across the Tongass National Forest. Porcupine feeding on hemlock and spruce is common on Mitkof Island and many mainland areas. Young trees in managed and unmanaged stands are often top-killed or killed outright as porcupine feeding girdles the main bole. Bark beetles have been found infesting damaged trees. This damage becomes significant when groups of trees are killed or deformed. As trees grow larger (age 40 to 50 years), porcupine damage shifts from top kill to basal wounds, which serve as entry points for decay fungi. Brown bears cause basal wounds on Alaska yellow-cedar each spring on Baranof and Chichagof Islands. Bears rip off the bark in the spring to lick the sweet cambium. The majority of yellow-cedar in some stands have basal wounds from bear feeding (ADNR 2000).

Fire. Fire has played a minor role in the forests of Southeast Alaska because of the abundant year-round precipitation. The average size of fires on the Forest between 1958 and 1988 was less than 7 acres (USDA Forest Service 2003b). More recently, approximately 400 to 500 acres have burned annually on the Tongass. The average fire has been approximately 10 acres (pers. com. Dexter Duehn, Fire Management Officer, Tongass National Forest). Juday et al. (1998) rated many potential impacts on the coastal forests of Southeast Alaska due to climate change. They concluded that there would be an increased risk of forest fires, though they anticipated the effects on resources would be low.

Windthrow. Windthrow is the dominant disturbance agent in Southeast Alaska. Two forms occur: small-scale events (gap disturbance) and large-scale events (catastrophic disturbance). Most of the Forest is subject to small-scale windthrow events. Individual trees or small groups of trees blow over during storm events, opening gaps in the canopy that allow young trees to grow to fill the openings. This results in complex, mixed-aged stands. Disease and decay agents also play a role in this process. Nowacki and Kramer (1998) state that diseased trees are more at risk to windthrow and stem-snap, while Hennon and McClellan (2003) report that many of the uprooted or broken-stemmed trees had died before falling. Small-scale events occur on a regular basis and result in openings from 6 to 13 percent on the canopy (Nowacki and Kramer 1998). Areas not protected by topographic barriers from the severe effects of infrequent, major storms are subject to large-scale windthrow events that cause catastrophic damage. Entire stands have been blown down in the past, resulting in the regeneration of more even-aged stands with more uniform canopies (Nowacki and Kramer 1998). Both forms of windthrow are a part of the natural forest generation, growth, and development. Juday et al. (1998) rated many potential impacts on the coastal forests of Southeast Alaska due to climate change. They concluded that there was a high risk of increased large-scale blowdown across Southeast Alaska as well as increased windthrow around harvest units.

Monitoring and Pest Management

Forest pest activity on the Tongass National Forest is typically detected during on-the-ground activities, or during annual aerial surveys conducted by the region's Forest Pest Management group. The timing of surveys coincides with foliage and pest development. Pest activity noted during surveys is documented and reported to the appropriate land manager. In cooperation with land managers, Forest Pest Management people conduct on-site investigations to verify the pest, evaluate the pest and its host(s), and formulate future management alternatives. Often, pest and host monitoring is required to fully understand potential impacts prior to development of management alternatives.

Populations of historically significant defoliating insects are monitored through a sampling system that occurs in conjunction with the annual aerial survey. Defoliating larvae are collected, identified, and counted at designated sites. Gypsy moth pheromone traps have been placed throughout Southeast Alaska to provide an early warning that these insects are present. Data from larvae counts and pheromone traps, in conjunction with the collection of host and weather information, enhances forest pest managers' ability to predict defoliator damage.

The impact of hemlock dwarf-mistletoe and methods of reducing damage from the disease in managed stands have been established by several research studies. In addition, Forest Pest Management has surveyed numerous even-aged stands from 10 to 100 years old to determine the incidence and impact of hemlock dwarf-mistletoe in managed stands.

Research studies have yielded information on the pathology and epidemiology of decline of yellow-cedar (cited above). In addition, information on the distribution of decline and acreage affected has been determined by mapping during aerial surveys. Porcupine damage in managed stands is currently being assessed. As more young-growth stands reach commercial thinning age, forest pest research is beginning to focus on pest activity within these stands.

The Forest develops site-specific prescriptions, based on monitoring information, scientific information, and pest management projections, to prevent or limit insect and disease damage. The objective is to limit infestations of natural insects, disease-causing organisms, and parasites to normal background levels, and to prevent or reduce infestations of non-native organisms to the extent feasible. Similarly, the Forest objective is to limit windthrow to levels that would occur naturally through silvicultural prescriptions prepared for each timber sale.

Environmental Consequences

Direct and Indirect Effects

In general, alternatives that favor low amounts of timber harvest will tend to perpetuate current disease levels in old-growth forests. Ecological processes and wildlife habitat for old-growth associated species would be maximized, but so would the continued loss of timber, primarily due to high levels of heart rot. Higher amounts of timber harvest would generally yield young stands with lower levels of insect and disease activity. However, two-aged and uneven-aged management, primarily used in the Scenic Viewshed LUD, could maintain or even increase levels of hemlock dwarf mistletoe. Two-aged and uneven-aged management may also result in higher levels of stem and root disease caused by injuring residual trees during harvest operations; however, the degree of increase, if any, is uncertain. Two-aged treatments that clump leave trees are less likely to cause damage to residual trees. Similarly, thinning young, even-aged stands may also lead to stem and root disease due to wounding of leave trees during thinning, although a retrospective study did not find that thinning had increased defect levels in thinned stands on the Tongass compared to unmanaged stands (Deal et al. 2002), and Christensen et al. (2002) did not find higher levels of decay in two 90-year old stands that had been commercially thinned 25 years earlier compared to unthinned stands.

Alternative 7 proposes approximately three times the suitable acres as Alternative 1, and Alternatives 4, 5, and 6 propose approximately twice the number of suitable acres as Alternative 1 and substantially more than Alternatives 2 and 3. Most suitable acres would be harvested at some time during the next 100 years (refer to the *Timber* section for a discussion of likely harvest under each alternative). Therefore, over time, Alternatives 7 and 4 and, to a lesser extent, Alternatives 5 and 6, are likely to result in more acres with a lower risk of insect activity and somewhat less forest with high levels of heart rot and other disease organisms than the other alternatives. Conversely, Alternatives 1 and 2 would retain more acres of old-growth forest, which would likely result in somewhat higher levels of insect and disease across the Tongass. The acres of suitable land proposed for Alternative 3 is intermediate between Alternatives 2 and 5, and its effects on insect and disease would likely fall in the mid-range, compared to the other alternatives.

Alternatives 4, 5, 6, and 7 could result in approximately four to ten times as many acres of two-aged and uneven-aged harvest over time as Alternatives 1 and two to four times as many acres as Alternative 2 in the first decade (Table 3.8-1). There is some concern that two-aged and uneven-aged harvest could lead to higher levels of windthrow, dwarf mistletoe, and stem decay compared to even-aged harvest methods. Dean et al. (2002) report that the number of uprooted trees was somewhat higher in partially harvested stands, but overall tree mortality rates were similar. Bole wounds were common on trees in partially harvested stands, but “natural tree injuries from falling trees and animal feeding were far more abundant at several sites” (USDA Forest Service and ADNR 2002). Alternatives with more two-aged and uneven-aged management may favor shade-tolerant species (western hemlock, mountain hemlock, and yellow-cedar), while even-aged may result in stands with a higher proportion of Sitka spruce. However, retrospective studies indicate that Sitka spruce can be maintained in mixed hemlock-Sitka spruce stands over a wide range of cutting intensities if enough Sitka spruce trees are present in the stand after harvest (Dean 2002).

Table 3.8-1
Approximate Projected Annual Harvest During First Decade (acres)

	Alternative						
	1	2	3	4	5	6	7
Even-aged	1,180	3,674	5,181	7,308	6,872	6,769	10,030
Two-aged and Uneven-aged	602	1,586	2,193	3,957	3,028	2,859	5,902

Source: SPECTRUM Model (Forest-wide Activity and Output Results)

In general, endemic levels of insect and disease activity in mature and overmature forests would be allowed to run their course under all alternatives. Harvesting flexibility would be maintained to take advantage of timber salvage opportunities, particularly for dead and dying yellow-cedar stands. Insect and disease suppression may be justified in high-quality, mature to overmature stands that cannot be salvaged immediately, or that lie near recreation areas and communities where scenic values are high.

Animal damage, such as that from porcupines, is expected to continue and would likely be increasingly evident in precommercially thinned stands where porcupines are present. Winter feeding by porcupines is known to damage and sometimes kill young trees. The Forest has been alternating precommercial thinning prescriptions to reduce porcupine damage by favoring cedar and deferring thinning in some areas. Bear also damage young trees by removing bark to reach the sweet cambium tissue below the bark. Alternatives that result in creating more young stands (Alternatives 4, 5, 6, and 7) would lead to more acres of forest that would be vulnerable to animal damage.

Damage from wind would continue to occur; some increase is likely to occur along the edges of harvest units and along stream buffers and other legacy trees. Riparian buffers would be protected under Alternatives 1 to 6 by leaving sufficient additional trees along the outer edge of the stream buffer to provide a reasonable assurance of a windfirm (RAW) buffer. Riparian buffers on Class I and II streams would be protected by RAW buffers under Alternative 7. Alternatives with more harvest and road building (Alternatives 4, 5, 6, and especially 7) would tend to increase the risk of harvest- and road-related windthrow compared to those with less harvest and road building (Alternatives 1 and 2). If the current climate trend continues and more gale-force wind storms occur, blowdown may increase for all alternatives in proportion to the amount of harvest (refer to the *Timber* section of this chapter).

There may be a short-term increase in fire risk during harvest operations if activities are conducted during dry periods. Alternatives with higher levels of timber harvest (Alternatives 4, 5, 6, and 7) may have a small increase in fire risk compared to alternatives with less harvest. If climate change results in warmer, dryer summer conditions, fire risk may increase for all alternatives compared to the last several decades. Warmer winters are likely to increase insect damage because more insects will survive the winter. This, in turn, could lead to larger and more frequent fires (refer to the *Climate and Air* section of this chapter).

Cumulative Effects

The greatest potential forest insect and disease problems are likely to be in mature and overmature stands where disease levels are high. Tree vigor tends to decrease with maturity, causing an increase in susceptibility to insects and diseases. Heart rot levels are directly proportional to both tree and stand ages. The spruce beetle has the potential to significantly alter the desired condition of stands in certain locations near the mainland where the insect has periodically become active. The spruce aphid was introduced approximately 80 years ago and appears to be causing more damage to spruce as the climate warms (Shrader and Hennon 2005). The recent assessment of invasive pathogens in Alaska and its national forests states that Alaskan forests are particularly vulnerable to invasive pathogens because of the relatively small number of native tree species and the narrow genetic base (Shrader and Hennon 2005), although damage in 2006 was down 60 percent from the peak in 2003 (USDA Forest Service and ADNR 2007). The Shrader and Hennon report concluded that the European scolytid bark beetle poses the greatest threat to the spruce forests throughout Alaska if introduced.

Stem and root decay, and the incidence of hemlock dwarf-mistletoe, have historically increased with intensified land management activities, particularly under harvesting systems other than clearcutting (Trummer et al. 1998). If the current warming trend continues, cedar decline and damage from insects are likely to increase, both from species currently present in Southeast Alaska and from entering the area from other parts of North America or elsewhere. Hotter, dryer summers could also lead to increased fire frequency, size, and damage, which could have fundamental changes in age class and species composition. This, in turn, could result in changes in wildlife habitat. Invasive plants may also adversely affect forest health. Refer to the *Plant* section of this chapter for a discussion of invasive plant species.

There have been approximately 767,000 acres of harvest in Southeast Alaska, approximately 41 percent of this has been on non-National Forest System (NFS) lands. There are over 330,000 acres of old-growth forest on state and Native corporation lands. It is likely that most of this would be harvested over the next few decades and replaced with young stands that would be managed on relatively short rotations. Shorter rotations and even-aged silvicultural prescriptions implemented on non-NFS lands are likely to contribute to decreasing mistletoe, insect, and disease levels in the forests of Southeast Alaska, especially the loss due to heart rot. Alternatives with more even-aged management, especially Alternatives 4 and 7, would add to these changes. Conversely, increased use of commercial thinning in the outer decades may damage leave trees, increasing decay rates. Also, the younger stands established after harvest on all lands are likely to add to the loss of growth and tree mortality caused by animal damage in the region. Harvest-related windthrow may increase on NFS lands and adjacent areas that are harvested using even-aged silvicultural systems whether on NFS or non-NFS lands.

Maintaining biotic and structural diversity provides an opportunity for limiting some insect and disease problems. Some insects and diseases are host-specific, depend upon plants that are under stress, or flourish under homogeneous conditions. In other cases, and particularly for heart rot, favoring younger-aged stands through even-aged management may be the most effective way of limiting insect and disease problems. Maintaining healthy young-growth stands through stand density control (thinning) may reduce insect damage (Neilson 2007).

The careful use of alternatives to even-aged harvest methods can be a tool for maintaining natural but not excessive levels of diseases, such as heart rot and dwarf mistletoe, which have important ecological consequences. Integrated Pest Management provides the opportunity to evaluate these and more traditional clearcut practices. Through prescription processes, stands with unacceptable insect and disease-related losses, as well as those of high risk for future losses, would be identified for treatment. Detection methods such as aerial surveys, currently in use, would continue to be used for the early identification of epidemics.

The current warming trend increases the risk of increased insect and disease outbreaks, catastrophic blowdown events, and fires. Juday et al. (1998) rated many potential impacts on the coastal forests of Southeast Alaska due to climate change. They concluded that there was a high risk of increased large-scale blowdown across Southeast Alaska and increased windthrow around harvest units; although, they also state that as of the date of their report, the increased frequency of storms in the last few decades has not corresponded to an increase in large-scale blowdown in Southeast Alaska. Also, the 2006 Forest Health report noted very little blowdown in aerial and ground surveys (USDA Forest Service and ADNR 2007); however, this does not rule out the risk of increased windthrow in the future as additional warming occurs.

Warmer, dryer weather may result in increased levels of insect and disease levels. For example, Juday et al. (1998) concluded that there was a high risk of increased damage from black-headed budworm outbreaks, and there is a risk that new fungal tree diseases will appear in Southeast Alaska as the climate warms.

As discussed under the *Climate and Air* section, some climate models for Southeast Alaska predict rising temperatures, a 10 percent decrease in summer precipitation in portions of the region, and decreased soil moisture due to increased evaporation during warmer, dryer summer weather. These factors may lead to an increase in fire frequency and severity by 2060, ranging from 10 to 30 percent, depending on the model (Dale 2003). Currently, fire is not a factor in the ecology of Southeast Alaska, and an increase of 30 percent in acres burned would still result in very little fire damage. Given the high rainfall levels in Southeast Alaska (Ketchikan had only 2 days without rain in July 2007, receiving a total of 10 inches of rain that month), a 10 percent decrease in summer rainfall would still result in wet conditions in most years. However, Southeast Alaska does occasionally experience dryer conditions. For example, in July 1971 there were 23 days without rain. If warmer winter weather results in higher insect populations and increased tree defoliation, there is a risk that increased dead material and warmer, dryer weather may spawn more fires than are normal for the area. Berman et al. (1998) state that it is difficult to predict the magnitude of area likely to be burned in a region with no historic fire record, but they believe that most fires would be small and of low intensity. Berman et al. (1998) suggest a scenario in which 5,000 acres might burn over a period of decades. Juday et al. (1998) also suggest that the effects of fires on resources are likely to be low.

Biodiversity

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Affected Environment

The conservation of biological diversity, or biodiversity, is of national and global concern. Biodiversity may be defined as “The variety of and variability within and among living organisms and the ecological complexes of which they are part; this includes diversity within species, between species, and of ecosystems.” (United Nations Environment Programme 1991). Biological diversity encompasses the variety of genetic stocks, plant and animal species and subspecies, ecosystems, and the ecological processes through which individual organisms interact with one another and their environments. Under the National Forest Management Act (NFMA), the Forest must provide for diversity of plant and animal communities based on the suitability and capability of specific land areas.

The conservation of biological diversity commonly requires a dual strategy addressing both individual species, as well as entire ecosystems (Marcot et al. 1994). Many discussions of biodiversity revolve around the maintenance of species; however, it must be emphasized that conserving biodiversity is about maintaining genetic, species, community or ecosystem, and landscape levels of biological organization. The traditional species-by-species approach is important for featured or management indicator species, sensitive or rare species, and for the recovery of federally designated threatened or endangered species. A more comprehensive strategy focused on higher levels of biological organization, and ecosystems may be necessary to conserve rare or declining habitats, as well as the entire complement of associated biota and ecological processes (Noss 1991, Scott et al. 1991, Franklin 1993). For a conservation strategy targeting biodiversity to be truly effective, it should have the following characteristics or expected outcomes:

- It should include the conservation of all levels or scales of biodiversity in the planning area (Schwartz 1999, Poiani et al. 2000),
- It should be comprehensive in its inclusion of all elements (Lambeck and Hobbs 2002, Groves 2003),
- It should address the concept of adequacy (Lambeck and Hobbs 2000, Tear et al. 2005),
- It should provide a framework for monitoring (Haufler et al. 2002, Tear et al. 2005), and
- It should anticipate change (Tear et al. 2005).

Maintaining and/or enhancing habitats to sustain viable populations of individual species are addressed by guidelines for specific species or species groups. This "fine filter" approach to biological conservation is discussed in the Wildlife, Fish, and Plant sections of this chapter. The most practical way to address conservation of these species and other elements of biodiversity is by using a broader "coarse filter," or ecosystem/landscape-based strategy for conserving biological diversity (Noss 1991, Scott et al. 1991, Wilcove 1993). While many conservation planning efforts blend the two strategies, it is important to note that there are fundamental differences between these conservation strategies. Fine filter strategies focus on providing for the needs of individual or multiple species within a landscape while coarse filter strategies focus on providing an appropriate mix of ecosystems or ecological communities across a planning landscape (The Nature Conservancy 1982, Marcot et al. 1994, Haufler 1999, Schwartz 1999).

Biological diversity on an ecosystem or landscape scale can be described in terms of three components: composition, structure, and function (Noss 1990). These three components refer to the following:

- Composition refers to the numbers and types of species, plant communities, and smaller ecosystems within an area.
- Structure refers to the spatial arrangement of these communities or ecosystems across a landscape, their vertical stratification into dominant life forms (tree, shrub, herbaceous), the horizontal spacing of communities across the landscape, and how they are connected to variations in tree heights and diameters within a stand or between stands.
- Function refers to the interactions and influences between plant and animal species within an area—how each species uses its environment—and to natural processes of change or disturbance (wind, aging, etc.).

For additional discussion on composition, structure, and function components of biological diversity, see the 1997 Forest Plan Final EIS (pages 3-12 to 3-26).

Assessing biodiversity and the conservation strategy to provide viable, well distributed populations across the Tongass National Forest has been conducted at several scales from broad biogeographic provinces down to finer scales of ecological subsections, watersheds, and Value Comparison Units (VCUs). Assessing biodiversity at smaller scales such as at watershed and VCU level is done at the project-level scale. The biogeographic province and ecological section/subsection are discussed in more detail below, with the focus on maintaining biodiversity across the entire Tongass.

Ecosystem Classification

Utilizing both biogeographic provinces and ecological subsection classifications allows for some additional insight into how various communities are represented at different landscape scales. Both classification systems were developed using different processes, but complement each other in terms of addressing biodiversity. The development of biogeographic provinces is weighted more heavily toward wildlife species distributions, including barriers and linkages, while the ecological section/subsection system is more heavily weighted toward surface geology and geomorphic processes, both of which affect soils and vegetation patterns. Both of these broad-based “coarse filter” classification systems are described in more detail below.

Biogeographic Provinces

The Tongass can be subdivided on an ecosystem basis. A broad division that has been used on the Tongass for a number of years is that of the biogeographic province (USDA Forest Service 1997a). These large-scale landscape delineations are characterized by 1) similarities in terrestrial wildlife species composition, 2) similarities in distributional patterns for many of these species, 3) geologic and water barriers stemming from past events, such as glaciation, and 4) generally similar climatic conditions and physiographic characteristics. By subdividing on this scale, biogeographic provinces can assist land managers in broad-level assessment and planning.

Twenty-one biogeographic provinces were identified within the Tongass National Forest boundary. Only one of these provinces (Yakutat Forelands) extends partially outside the boundary. Two additional provinces (Chilkat River Complex and Glacier Bay/Fairweather Range) are defined completely outside the Forest boundary but within Southeast Alaska (Table 3.9-1). Figure 3.9-1 shows the location of the biogeographic provinces in Southeast Alaska with their corresponding map numbers.

Ecological Sections and Subsections

In addition to the biogeographic province approach, another way to address conservation of species and other elements of biodiversity with a “coarse filter” or ecosystem/landscape-based strategy, is to use the National Hierarchical Framework of Ecological Units, which describes and defines the process for delinating landscapes at various spatial scales. This process consists of eight nested mapping levels that serve a variety of purposes (Cleland et al. 1997). Within the hierarchy, ecological sections characterize medium to large ecosystems (on the order of 1,000 square miles) and ecological subsections characterize mid-sized ecosystems of 10 to 1,000 squares miles. Nowacki et al. (2001) used this framework to subdivide the Alaska Region into 19 ecological sections and 96 ecological subsections; 14 of the ecological sections and 73 of the ecological subsections occur on the Tongass.

Nowacki et al. (2001) provide additional detail on the ecological sections and subsections of the Tongass. Physiography, lithology, and surface geology were the primary factors for subsection delineation in Southeast Alaska, along with geomorphic processes, soil groups, subregional climate, and potential natural communities (climax vegetation). They are delineated in Figure 3.9-2 and listed later in this section under Table 3.9-6.

Table 3.9-1
Biogeographic Provinces Identified within the Tongass National Forest

No.	Province	Description
1.	Yakutat Forelands	A very young, nearly flat landscape with extensive flooding and active isostatic rebound (uplifting of the ground after glaciers recede). Most surfaces vary from 200 to 1,500 years old. Dune formation and succession are ongoing processes due to glacial rebound and wave action. Plant community patterns reflect a diverse mosaic of naturally occurring older and young forests, shrublands, bogs, and meadows. Sitka spruce, alder, and cottonwood are abundant on well drained, recently deglaciated, and active fluvial surfaces. Most of the province is inside the Tongass Forest boundary, but the southern lobe that extends into Glacier Bay National Park is not.
2.	Yakutat/ Glacier Bay Upland	The climate varies from very wet hypermaritime along the coast to very wet maritime inland. Mountains abruptly rising more than 10,000 feet from sea level, extensive active glaciers, and fiords dominate this landscape. Sitka spruce, alder, and cottonwood are abundant at lower elevations; alpine and lichen over rock plant communities dominate the land from 2,000 to over 10,000 feet elevation.
3.	East Chichagof Island	This province is drier and colder than the outer coast of Chichagof Island; the winter snow pack is generally greater. Chichagof Island is deeply dissected into three peninsulas, which may be functioning biologically more like separate islands. Vegetation in this province represents a modal condition similar to the Admiralty Island Province.
4.	West Chichagof Island	This province is dominated by a very wet hypermaritime climate and exposure to outer coastal storms. Hundreds of small islands dot the coast. Topography is gentle when compared to the mountains of Baranof Island and the coastline is highly irregular. The Sitka spruce/Pacific reedgrass plant association is abundant along the outermost coastal fringe; otherwise, vegetation is similar to the other northern islands.
5.	East Baranof Island	This province is colder than West Baranof or East Chichagof Island. Mountain glaciers occur along the divide between east and west Baranof. Topography is rugged and steep to saltwater, with little flat land. Plant associations on East Baranof are similar to much of the mainland due to the steep topography and cold environment. Spruce, devil's club, salmonberry forest associations are common on avalanche and steep erosional slopes; alpine and rock/lichen plant communities are abundant.
6.	West Baranof Island	This province is similar to the West Chichagof Island Province with the exception of southern Baranof, where precipitation exceeds 250 inches per year. Topographically, Baranof Island is the most rugged of all the islands in Southeast Alaska. The southern half of this province is highly dissected by steep-sided fiords; the outer coast is dotted with hundreds of small islands. All forest plant associations except those in the Western redcedar series and those found around large mainland rivers occur in this province. Kruzof Island has some unique vegetation communities, which have not been classified.
7.	Admiralty Island	This province is represented by relatively gentle topography and moderate rainfall. Winter conditions are moderated by the surrounding marine environment. Winds from Chatham and Icy Straits, Lynn Canal, and off the mainland are often severe. All forest plant associations except those in the Western redcedar series, those found around large mainland rivers, and those occurring only on outer coastal areas occur in this province. Forest productivity is high. Fresh and saltwater marshes in the numerous bays and inlets, and alpine and bog communities, are abundant.
8.	Lynn Canal	Rain shadows and the dominating influence of the continental climate make this the driest and seasonally warmest province in Southeast Alaska. Precipitation is generally less than 60 inches per year. The topography is rugged and glaciated. The southern portion of the Chilkat Peninsula is more similar to the East Chichagof Island Province. Western and mountain hemlock and Sitka spruce plant associations are common. Alpine tundra and extensive rock/lichen communities dominate much of the land from 2,000 to over 8,000 feet elevation.
9.	Northern Coast Range	This province has little maritime influence. Topography is rugged and glaciated. The Taku and Whiting Rivers extend into Canada. Yellow-cedar plant associations occur in this province.
10.	Kupreanof/ Mitkof Islands	The climate is cooler and the winter snow pack greater than on the islands to the south. The eastern edge of this province is strongly influenced by wind-born loess (silt) coming from the Stikine River and the mainland. All forest plant associations except those in the Western redcedar series and those occurring only on outer coastal areas occur in this province. This province contains the highest percentage of muskeg wetlands within the Tongass.
11.	Kuiu Island	Kuiu Island is deeply dissected, creating several prominent peninsulas. The topography is gentle compared to neighboring Baranof Island or the mainland. The climate is cooler and winter snow pack greater than on islands to the south, yet milder than the mainland or islands nearer the mainland. The western portion of Kuiu Island is subject to severe windstorms from both the ocean and Chatham Strait. Most forested plant associations occur here, but those found in outer coastal environments dominate.

Table 3.9-1 (continued)
Biogeographic Provinces Identified within the Tongass National Forest

No.	Province	Description
12.	Central Coast Range	This province is warmer than the Northern Coast Range Province. The topography is similar, but overall less precipitous. The Stikine River system is located in the center of this province and has a major continental influence, providing a migration corridor for plant and animal species. Plant associations found along saltwater are similar to those occurring elsewhere in northern Southeast Alaska except for those near the mouth of the Stikine River. Here, unique plant associations subject to high loess-carrying winds can be found.
13.	Etolin Island and Vicinity	Similar to the Kupreanof/Mitkof Islands Province, this province is also subject to continental influence from the mainland and the Stikine River. Glacial flour (very finely ground particles of rock, silt, or clay created by a glacier when its rock-filled ice scrapes over bedrock and which flow out from beneath a glacier in the meltwater) is present in the marine environment in the northern part of this province nearly year-round. All forest plant associations except those occurring only on outer coast areas are present.
14.	North Central Prince of Wales Island	Topography is relatively gentle, limestone is common, and precipitation is relatively low due to interception by lands to the south and southwest. All forest plant associations except those found around the mainland river systems occur in this province. Overall forest productivity is high. Karst topography and numerous caves are present.
15.	Revilla Island/ Cleveland Peninsula	Climate is variable with warm and wet conditions predominating on land nearest the outer coast; much colder conditions occur near the mainland. Revilla, Gravina, and Annette Islands are influenced by human activities and populations, whereas the Cleveland Peninsula and Duke Island are generally in a natural condition. Revilla Island has many exceptional estuaries. Muskeg ponds are common on Duke Island, attracting many wintering and migratory birds.
16.	Southern Outer Islands	These islands are isolated and are subject to strong oceanic influences. Temperatures are moderate year-round. The topography is low-lying and gentle. These islands are relatively rich in endemic vertebrate species, including dusky shrew, long-tailed vole, and ermine. Major coastal seabird colonies are present.
17.	Dall Island and Vicinity	These islands are subject to strong oceanic influences. Temperatures are moderate year-around. The topography is rugged and dissected, with abundant limestone outcrops. Dall Island appears to be a glacial refugia but inventories of plants and animals are limited. Major coastal seabird colonies are present on Dall Island.
18.	South Prince of Wales Island	The climate is warm and wet, and deep snow is rare or highly transient. The topography is steep and rugged and the coastline is highly dissected. The vegetation in this province is strongly influenced by southeasterly storms; mixed conifer and western hemlock-redcedar plant associations dominate.
19.	North Misty Fiords	Compared to South Misty Fiords, this province has considerable topographic relief and characterized as having a colder, mainland-type climate with many glaciers. Vegetation occurs in long, narrow strips along the valleys and lower slopes of fiords. Much of the vegetation is muskeg, with cottonwoods in some of the river bottoms and subalpine fir along the Canadian border.
20.	South Misty Fiords	South Misty Fiords is typical of the other mainland provinces and is the warmest. Topographic relief is lower in comparison with North Misty. Forest plant associations are more diverse than the other coastal provinces, and the vegetation is less fragmented by rock and ice than in North Misty Fiords. The southwestern portion of this province is rolling, nearly continuous muskeg with conifer forests in the bottoms and flats. This province is the northern limit of Pacific silver fir, yew, and honeysuckle.
21.	Ice Fields	Permanent ice fields, active glaciers (some advancing and some receding), and nunataks (mountain peaks between glaciers) dominate this province.
22.	Chilkat River Complex	The Chilkat River Complex lies at the northern end of the Inside Pasage and is outside the Tongass Forest boundary. It consists of tall ridge systems, large glacial rivers, and includes glaciers and snowfields. Many of the rivers and drainage basins extend across the international boundary into Canada. Because of the overlap of coastal and interior floras and faunas, the province contains Alaska's highest vascular plant species richness and the highest mammalian diversity in Southeast Alaska (Carstensen et al. 2007).
23.	Glacier Bay/Fairweather Range	This is the largest province in Southeast Alaska (2.5 million acres) and is located outside the Tongass Forest boundary. The vast majority is high mountains and glaciers and the majority is non-vegetated. The highest peaks are in the Fairweather Range along the western edge of the province, with Mt. Fairweather at over 15,000 feet. A large flat, foreland, the Gustavus Foreland, occurs in the area around Gustavus and to the north in the Bartlett River valley. Lowlands are also fairly extensive along the Dundee River and other smaller drainages on the southwest side of Glacier Bay. Glacier Bay National Park protects virtually the entire province (97 percent), except for about 75,000 acres in the vicinity of Gustavus.

Figure 3.9-1
Map of Biogeographic Provinces of Southeast Alaska

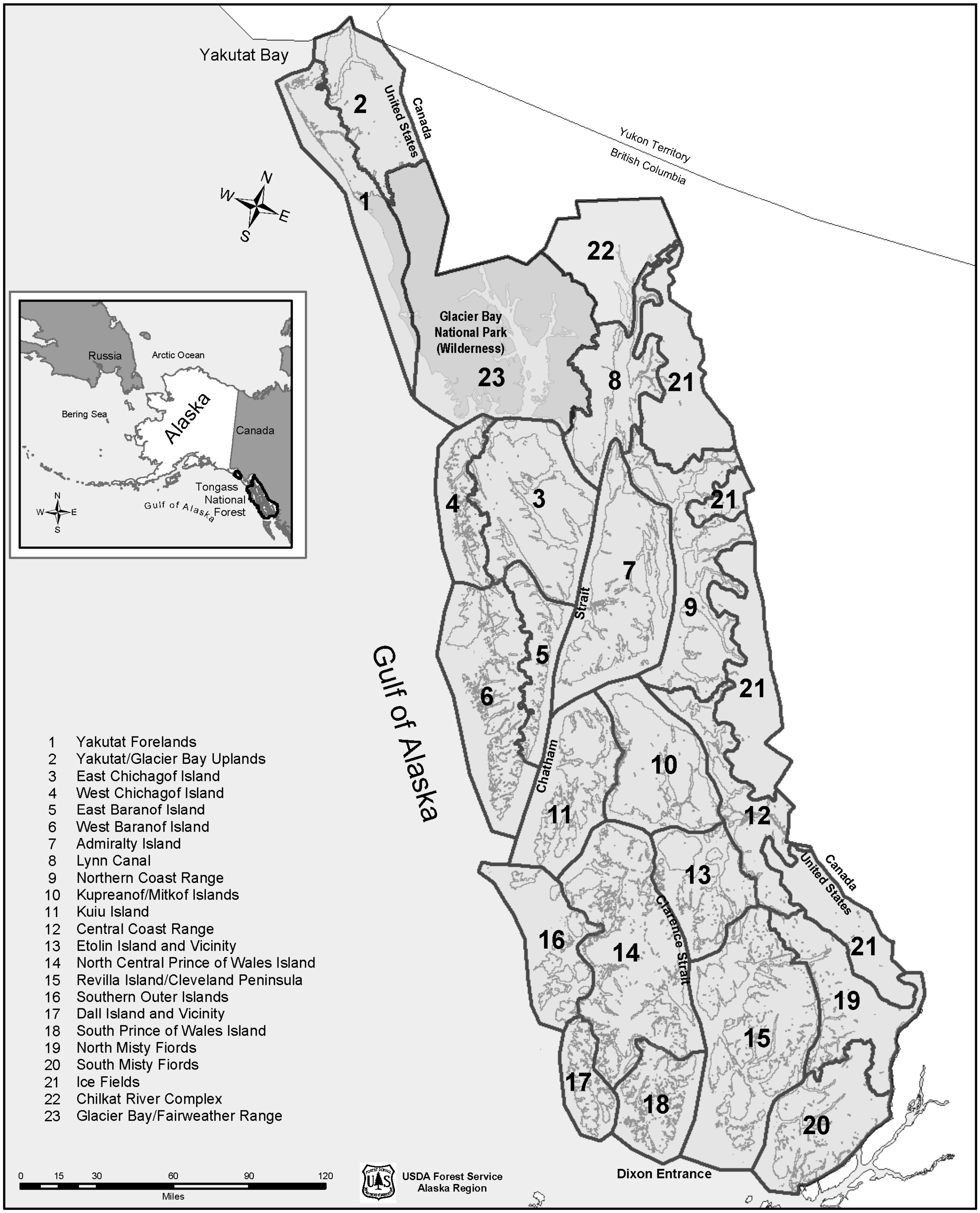
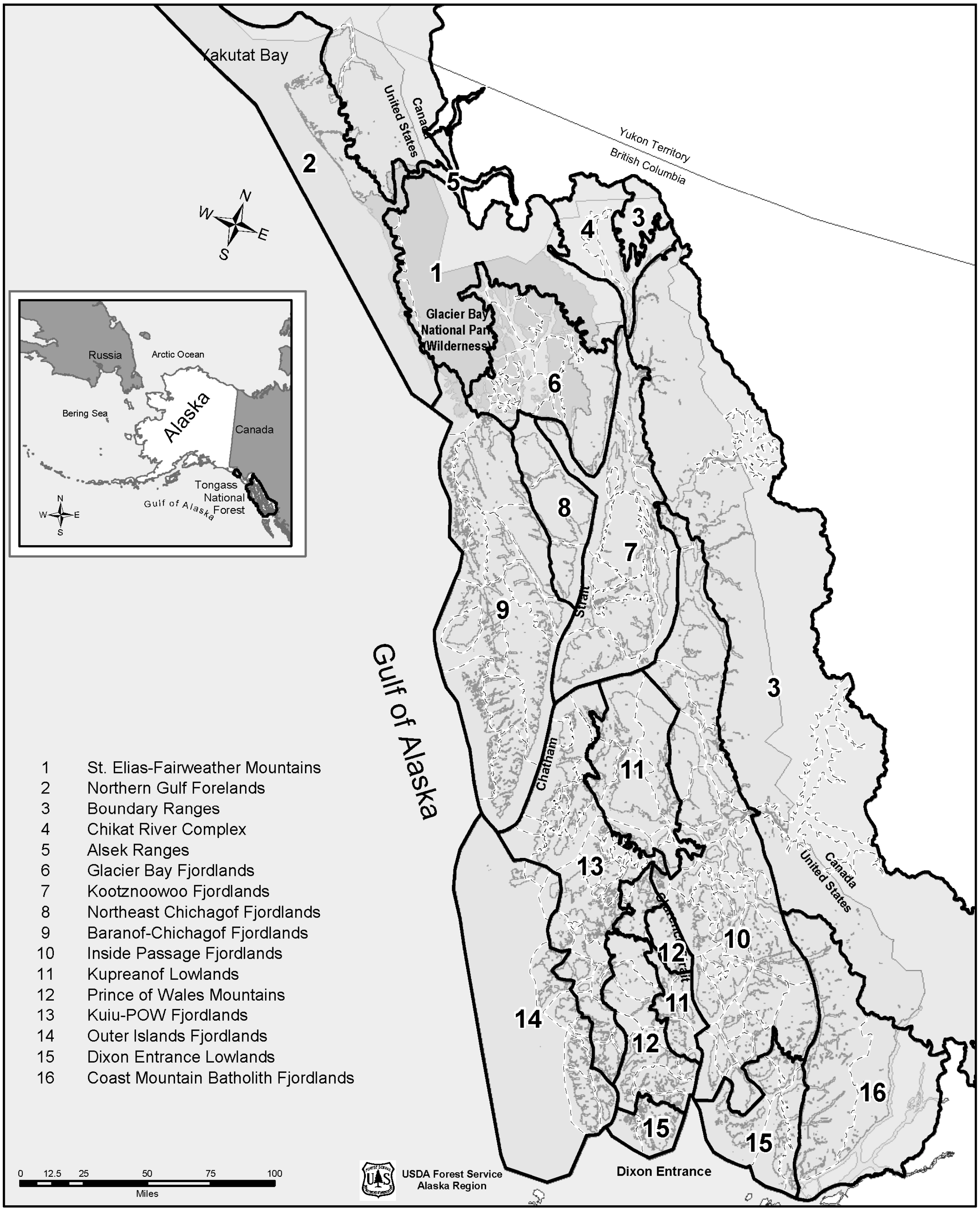


Figure 3.9-2
Ecological Sections (numbered areas) and Subsections (dashed lines) of Southeast Alaska



Cover Types

The vegetation of Southeast Alaska and the Tongass National Forest is dominated by temperate coastal rain forests at lower elevations (less than about 2,000 feet.). Interspersed within the forest are muskegs, other wetlands, and other nonforest types. At higher elevations, alpine vegetation, rock, glaciers, and snowfields dominate. Figure 3.9.3 displays a general breakdown of the broad cover types on the Tongass. Table 3.9-2 provides a summary of this breakdown by biogeographic province.

The Tongass contains approximately 9.9 million acres of forest lands (approximately 59 percent of the total land area of the Tongass National Forest). These forest lands are divided into productive and unproductive forest lands. Productive and unproductive forest lands are distinguished in terms of their ability to produce wood. The distinction is primarily used in timber management; however, it is useful for describing forest cover types for biodiversity and wildlife habitats as well. Productive forest land (5.64 million acres of the Tongass) is defined as land capable of producing at least 20 cubic feet of wood fiber per acre per year or having greater than 8,000 board feet per acre of standing volume. Unproductive forest land (4.22 million acres of the Tongass) is forest land that does not meet these thresholds. Timber harvest occurs only within the productive forest land base.

Of the 5.64 million acres of productive forest land on the Tongass, 4.95 million acres or 88 percent are old growth and are referred to as productive old growth (POG). The remaining 0.69 million acres are young-growth forest; about 0.45 million acres of the young growth is a result of timber harvest. The remainder of the young growth is a result of natural processes (e.g., wind, fire, glacial retreat).

The remaining 6.91 million acres of the Tongass National Forest (41 percent) is classified as non-forest and includes shrub and herbaceous habitats (e.g., muskeg, alpine, estuaries), sparsely vegetated and non-vegetated areas (e.g., snow, rock, ice), and aquatic habitats (e.g., streams, ponds, and lakes). These general cover types are further broken down and discussed in more detail below beginning with non-forested habitats and followed by unproductive old-growth and POG cover types.

Figure 3.9-3
General Cover Types on the Tongass National Forest

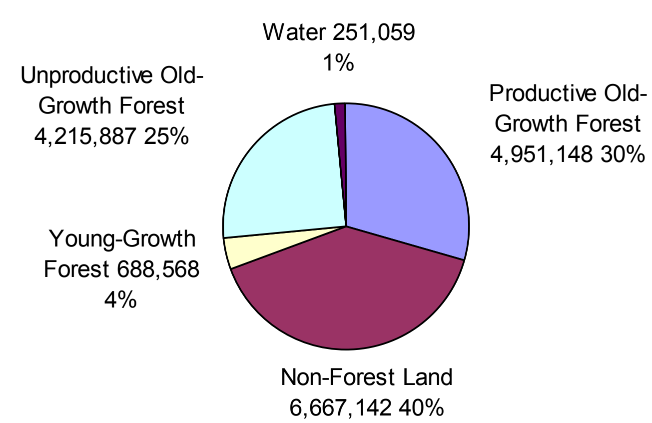


Table 3.9-2
General Cover Types on the Tongass by Biogeographic Province (in thousands of acres)

	Forest Lands						Non-Forest		
	Productive Forest Land			Unproductive Forest Land					
Biogeo. Province	POG	Young Growth[1]	Total Productive Forest Land	Forested Muskeg	Other Unprod. Forest	Total Unprod. Forest	Land	Water	Total Non-Forest
1	47,770	88,844	136,615	30,068	26,297	56,365	99,335	19,632	118,968
2	23,399	34,554	57,953	3,856	14,875	18,732	822,741	17,423	840,164
3	395,100	52,788	447,888	64,529	205,804	270,333	319,361	5,877	325,238
4	72,038	889	72,927	32,300	83,249	115,549	85,698	8,785	94,482
5	88,311	16,334	104,645	10,670	90,499	101,169	179,273	5,859	185,132
6	215,021	19,429	234,450	48,782	194,892	243,674	265,738	22,688	288,426
7	589,823	22,585	612,408	79,852	191,457	271,308	154,516	12,700	167,216
8	153,160	12,993	166,153	19,707	100,438	120,145	339,303	7,774	347,077
9	317,677	10,328	328,005	15,718	160,472	176,190	476,234	11,892	488,126
10	305,846	41,714	347,560	137,220	212,855	350,075	55,250	3,708	58,958
11	294,075	35,684	329,758	42,158	90,856	133,014	22,204	4,759	26,963
12	245,701	10,755	256,456	23,464	153,153	176,617	269,774	9,038	278,812
13	218,715	43,854	262,569	70,258	131,592	201,850	25,302	4,861	30,162
14	514,269	193,916	708,185	132,501	275,162	407,663	65,171	25,633	90,804
15	503,091	51,216	554,306	167,122	310,485	477,607	101,272	29,409	130,681
16	113,451	18,096	131,547	25,607	44,653	70,260	6,564	1,677	8,241
17	67,987	1,740	69,727	4,979	26,817	31,796	10,996	3,582	14,578
18	162,097	5,673	167,770	46,126	109,495	155,621	27,991	11,138	39,129
19	198,559	7,921	206,480	20,210	265,362	285,572	458,110	18,244	476,354
20	309,900	2,445	312,345	79,770	293,279	373,049	204,634	15,301	219,936
21	115,160	16,810	131,970	7,277	172,021	179,298	2,677,676	11,079	2,688,754
Totals	4,951,148	688,568	5,639,716	1,062,173	3,153,714	4,215,887	6,667,142	251,059	6,918,202

[1] Includes 454,724 acres of harvested young growth and 233,843 acres of natural young growth.
(Source: Tongass National Forest GIS databases)
Note: Totals may not appear to sum correctly due to rounding.

Non-Forest Lands

Non-forest ecosystems provide unique and valuable habitat types that include wetland and other areas of shrub and herbaceous types (e.g., muskegs, alpine, estuaries), non-vegetated areas (e.g., snow, rock, ice), and aquatic sites (e.g., streams, ponds, and lakes). These habitats contribute greatly to the species diversity on the Tongass National Forest by providing unique microsites and openings that contain shrub and herbaceous vegetation that is often uncommon elsewhere.

Approximately 41 percent of the Tongass is non-forested. Of the non-forest land area, over half (55 percent) comprises rock and ice/snow, followed by brush and alder brush (20 percent), alpine (8 percent), recurrent slide areas (6 percent), and wetland-meadow (4 percent) (Table 3.9-3). Approximately 0.5 million of the remaining non-forest acres (7 percent) include small amounts of mass wasting areas, uplifted beach, river fill, willow, sand dunes, urban/agriculture, and other types.

Unproductive Forest

Approximately 25 percent or 4.2 million acres of the Tongass are classified as unproductive forest. Approximately 25 percent of this habitat type is forested

Table 3.9-3
Non-Forest Cover Types on the Tongass by Biogeographic Province (thousands of acres)

		Non-Forest Lands									
No.	Biogeographic Unit	Alder Brush	Brush	Alpine	Ice & Snow Field	Muskeg-Meadow	Rock	Recurrent Slide	Fresh Water	Other[1]	Total
1	Yakutat Forelands	4	8	<0.5	<0.5	72	<0.5	<0.5	19	13	**119**
2	Yakutat Uplands	46	419	3	190	2	143	12	17	7	**840**
3	East Chichagof Island	42	<0.5	82	1	43	85	59	6	7	**325**
4	West Chichagof Island	6	<0.5	18	<0.5	13	36	12	7	2	**94**
5	East Baranof Island	5	15	25	16	2	89	25	6	3	**185**
6	West Baranof Island	3	51	54	5	22	103	24	22	5	**288**
7	Admiralty Island	3	14	37	2	6	28	60	13	4	**167**
8	Lynn Canal	9	65	45	46	1	140	24	8	9	**347**
9	North Coast Range	20	124	20	60	4	199	40	11	9	**488**
10	Kupreanof/Mitkof Island	<0.5	3	4	0	40	1	5	3	4	**59**
11	Kuiu Island	1	2	4	<0.5	1	6	4	5	4	**27**
12	Central Coast Range	15	38	23	23	4	125	25	9	16	**279**
13	Etolin Island	1	2	8	0	2	7	2	3	5	**30**
14	North Central Prince of Wales	<0.5	4	14	<0.5	22	16	6	26	4	**91**
15	Revilla Isl./Cleveland Pen.	6	12	37	<0.5	10	26	4	29	8	**131**
16	Southern Outer Islands	<0.5	<0.5	3	0	2	1	<0.5	2	<0.5	**8**
17	Dall Island and Vicinity	0	3	3	0	2	3	<0.5	4	<0.5	**15**
18	South Prince of Wales	0	5	2	0	1	15	5	11	1	**39**
19	North Misty Fiords	23	90	67	41	1	205	23	19	8	**477**
20	South Misty Fiords	14	57	49	11	1	50	15	15	7	**220**
21	Ice Fields	40	159	42	1,284	1	738	33	11	381	**2,689**
	Totals	**238**	**1,070**	**540**	**1,680**	**252**	**2,020**	**379**	**245**	**495**	**6,918**

[1] Other includes small amounts of (in descending order of available acres) Natural Grassland, Mass Wasting areas, Uplifted Beach, Uncensused Freshwater, River Fill, Willow, Urban/Agriculture, and Sand Dunes.
Source: Tongass National Forest GIS databases

muskeg (Table 3.9-2). Although some of these lands are relatively sparsely forested, they have at least 10 percent tree cover. Many unproductive forest stands are consistent with old-growth definitions, but the trees are typically small and stunted (under 40 feet in height) and the canopy is open (10 to 40 percent canopy closure). Hemlock, cedar, and lodgepole pine are the most common trees; blueberry and rusty menzesia are the most common shrubs. Near wet bogs or muskegs, heath family plants and grasses assume increasing dominance. Timber harvest has had little direct effect on unproductive forest. Past disturbance to this habitat type has occurred in the primarily as a result of road construction, which has resulted in some permanent reduction in total wetland acres. This disturbance is discussed further in the *Wetlands* section. Unproductive forests are also addressed in the *Old-Growth Forest* subsection below.

Productive Forest

As noted above, the 5.64 million acres of productive forest land on the Tongass consists of both old growth and young growth. Approximately 88 percent of the productive forest land consists of old growth and approximately 12 percent is young growth, which includes both natural young growth and harvested areas.

Old-Growth Forest

POG forests are ecosystems distinguished by old and typically larger diameter trees, with most old-growth stands greater than 150 years old. At the landscape scale, old-growth forests on the Tongass include heterogeneous stands of productive forests within a mosaic of unproductive forests and non-forested areas comprised of shrub and herbaceous plant communities. These areas have been affected by various levels of natural and human-caused disturbances.

The biological diversity associated with old-growth forests has long been recognized as important within the Tongass National Forest, and the old-growth forest is the ecosystem most affected by timber management activities on the Tongass. Franklin (1993) estimated that invertebrate biota, creatures essential to ecosystem function through such processes as nitrogen fixation and decomposition, may represent more than 90 percent of the species diversity of old-growth forests in the Pacific Northwest. Because other habitat types (e.g., non-forested habitats) are fully represented across the Tongass and have not likely changed appreciably from original conditions, the old-growth ecosystem is the primary focus for the analysis of biological diversity in this document.

As described above, old-growth forests are divided into two major categories: POG and unproductive old growth. These are further divided on the basis of their productivity, defined in terms of their ability to produce a minimum volume of wood. The relative productivity of a stand is based on site quality. Site quality is defined as the ability of a forest site to grow trees (Carmean 1975), and is based on the physiography, climate, soil, and other factors of the environment that are not easily altered. Site productivity is the capacity of a tree species to thrive and successfully compete on a particular site and is influenced by the physiological makeup of the tree species and environmental factors (Pritchett 1979). Productivity measurements are most commonly based on site index values. Site index is expressed as the height of dominant and co-dominant trees at a given age, normally 50 or 100 years. Site index values for Southeast Alaska were determined by Farr (1984) by measuring the height and age of sample trees in a stand from standard site index curves projecting the height at the index age.

A higher site quality generally translates into taller trees and higher volume per acre. Higher site quality results in faster changes in tree characteristics and stand structure. Height to diameter ratios increase faster on high sites and live crown ratios will tend to decrease faster due to the affects of heavier stocking. Species composition is influenced by site quality. For example, Sitka spruce and western hemlock tend to have a greater competitive advantage on the high site quality areas while cedars are generally better represented on mid to lower site quality areas. Site productivity, a function of site quality, is highly correlated with soil drainage, effective soil depth, soil development (parent material), and landscape position (landform and slope position) (Cullen 1987). Site variation within stands can be significant. Typically, site productivity is highest in the valley bottoms decreasing with increased elevation.

The oldest harvests on the Tongass tended to be on the higher productivity sites at lower elevations, adjacent to the beach and within floodplain riparian areas where large Sitka spruce were available and abundant. These oldest young-growth stands are generally dominated by Sitka spruce and western hemlock regeneration. Road construction, started during the pulp mill era, allowed for harvest to be located farther away from the beach and riparian areas, although harvest during the early years was still concentrated at lower elevations. Old growth on limestone soils (which includes karst terrain) was also more heavily targeted. As a result of targeting highly productive and economical sites in the early years of timber harvest, larger-tree stands were often disproportionately harvested. Due to more extensive road development and restrictions brought about by development of a Forest Plan in 1979, stands harvested in the 1980s and especially in the late 1990s to the present tend to be located across a much more diverse range of sites.

Maintaining a full representation of ecosystem types is an accepted strategy for conserving biodiversity in landscapes managed for forestry (Franklin 1993), and is part of the overall conservation strategy implemented under the 1997 Forest Plan which includes small, medium, and large old-growth reserves and forest-wide Standard and Guideline protection measures. Most species, especially those for which knowledge is sparse or absent, are best sustained by ensuring that an adequate portion of each ecosystem type is represented in a relatively unmanaged state (Wells et al. 2003). Some specific types of old-growth forest ecosystems are at greater risk than others, such as forests associated with alluvial/colluvial surfaces or karst geology (USDA Forest Service 1999a, Baichtal and Swanston 1996). POG forest stands, particularly low elevation stands, have been affected the most by human modification through timber harvest.

Young-Growth Forest

As shown in Figure 3.9-3, there are approximately 689,000 acres of young-growth forest on the Tongass. Approximately 455,000 acres of POG have been harvested on the Tongass, nearly half of this amount is on land that is currently suitable for timber harvest. (See the *Timber* section for additional discussion on young-growth and suitability.) There are opportunities to manage these stands to increase biodiversity. Young-growth stands can be treated through release, pre-commercial thinning, and commercial thinning to concentrate growth in fewer, larger trees. Since 1979, over 100,000 acres have been pre-commercially thinned on the Tongass. These treatment methods have averaged about 5,600 acres per year in recent years and can be used to extend the period that understory forage is available for species such as deer, increase habitat for certain prey species, or promote conditions that mimic old-growth stand characteristics at a faster rate than would occur without treatment (USDA Forest Service 2000a, Carey 2003). Approximately 45 percent of the areas harvested on the Tongass are no longer suitable for commercial timber harvest because of their current land use designations, which include Wilderness, LUD II, 1,000-foot wide beach fringe, riparian areas, and old-growth habitat reserves. While these stands are not managed for timber production, they can still be thinned to improve wildlife habitat using the same treatments described above.

Old Growth Classification

For the 1997 Forest Plan, the Tongass classified POG on the basis of three volume strata (low, medium, and high volume). These were refined based on using the existing TIMTYP inventory, soils, and slopes. Since the issuance of the 1997 Forest Plan, several landscape and timber-sale analyses have effectively used the three broad timber-type categories delineating non-forest, unproductive old-growth forest, and POG forest lands, which were divided further into high-, medium-, and low-volume strata forest stands (see the Timber section in this chapter for additional discussion on timber volume class and volume strata).

Size-Density Model

While the three-volume strata approach for POG is useful for estimating timber volume for forest planning purposes, it is not as useful for describing other important forest elements, including forest structure, ecosystem diversity, and wildlife habitat. Forest structure is defined as the spatial arrangement of the components of vegetation, and is a function of tree size and height, vertical stratification into layers, and horizontal spacing of trees. It is important because it reflects the complex spatial and temporal interactions between plant growth (e.g., dispersal and competition), physiographic factors (e.g., geology, soils, slope, aspect, elevation), climate, and disturbance (e.g., wind, landslides, and human activities). Areas of high-structure habitat are typically located in areas of well-drained soils on unconsolidated sediments associated with alluvial fans, floodplains, or toe slopes.

Differences in forest structure are more useful because timber volume may be misleading when describing wildlife habitat or other attributes of the stand. For example, two stands may have the same volume but one may be a dense stand of medium-sized trees with a single canopy layer while the other stand may be a combination of widely-spaced large overstory trees and two or three lower canopy layers containing small and medium sized trees (Caouette et al. 2000, Caouette and DeGayner 2001).

To move beyond the limitations of timber volume, Forest Service managers and planners have begun to revise and refine forest mapping on the Tongass by creating a tree size and density mapping model for POG forests. Such information is more applicable for assessing conservation of biodiversity, estimating timber values, and developing wildlife habitat models.

One alternative to using volume estimates is using a combination of two common forest measurements: tree sizes and tree densities (Caouette et al. 2000). These two measures provide a more comprehensive forest measuring system than timber volume (Spies and Franklin 1991, Franklin 1995). The Forest Service recently published National Guidance on vegetation classification and mapping that specifically requires tree sizes (expressed as quadratic mean diameter of all live dominant/co-dominant trees) and tree densities (expressed as canopy closure) for the mapping of forest structure (USDA Forest Service 2004d). The Tongass National Forest recently developed an approach that uses these two measurements to model structural diversity in order to better define and describe forest structural attributes (Caouette and DeGayner 2005). The size-density model (SDM) uses a combination of two common forest measurements: tree sizes and tree densities (Caouette et al. 2000). This model has proven to be the best tool for representing these other forest elements.

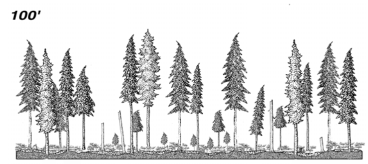
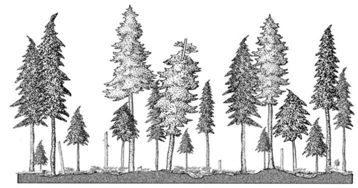
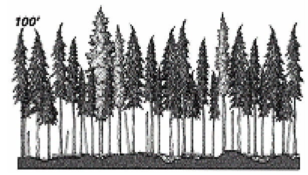
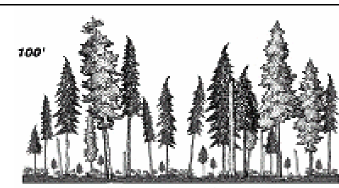
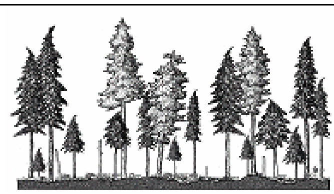
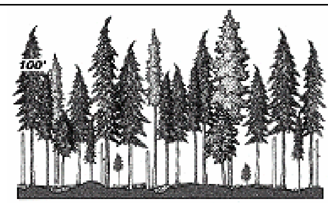
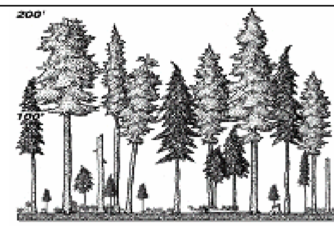
SDM uses timber volume class, hydric soil class, and aspect to characterize forest structure. These attributes were correlated with the stand density index and mean quadratic diameter to derive the various SDM categories. The following seven stand types have been defined and delineated using the Tongass Timber Inventory as the source for the analysis:

- SD4H: Volume class 4 on hydric soils
- SD4N: Volume class 4 on non-hydric soils, north aspect or flat
- SD4S: Volume class 4 on non-hydric soils, not north aspect or flat
- SD5H: Volume class 5 on hydric soils
- SD5N: Volume class 5 on non-hydric soils, north aspect or flat
- SD5S: Volume class 5 on non-hydric soils, not north aspect or flat
- SD67: Volume classes 6 and 7

These categories were used to develop a hierarchical mapping model for predicting tree sizes and densities on the Tongass National Forest. Figure 3.9-4 presents a description of each of the categories and illustrates the most probable forest type based on land form and forest condition. Figure 3.9-5 shows how the above SDM categories compare to the low-, medium-, and high-volume strata approach used for the 1997 Forest Plan. Based on their analysis, the authors suggest that the model is appropriate for use in forest or landscape planning on the Tongass (Caouette and DeGayner 2005). For example, the SDM is more useful in its ability to better define forest structure, both forest-wide and within stand, than the three-volume strata approach. Some components of the SDM have helped identify frequently used wildlife habitats in parts of the Tongass National Forest (Doerr et al. 2005, DeGayner et al. 2005). Other potential applications may include 1) broad-scale forest inventories; 2) stratification for reducing the amount or intensity of project-level field inventories; 3) developing forest structure value ranking systems for project-level analyses; 4) modeling diversity across landscapes or watersheds; and 5) setting and implementing conservation targets (DeGayner et al. 2005).

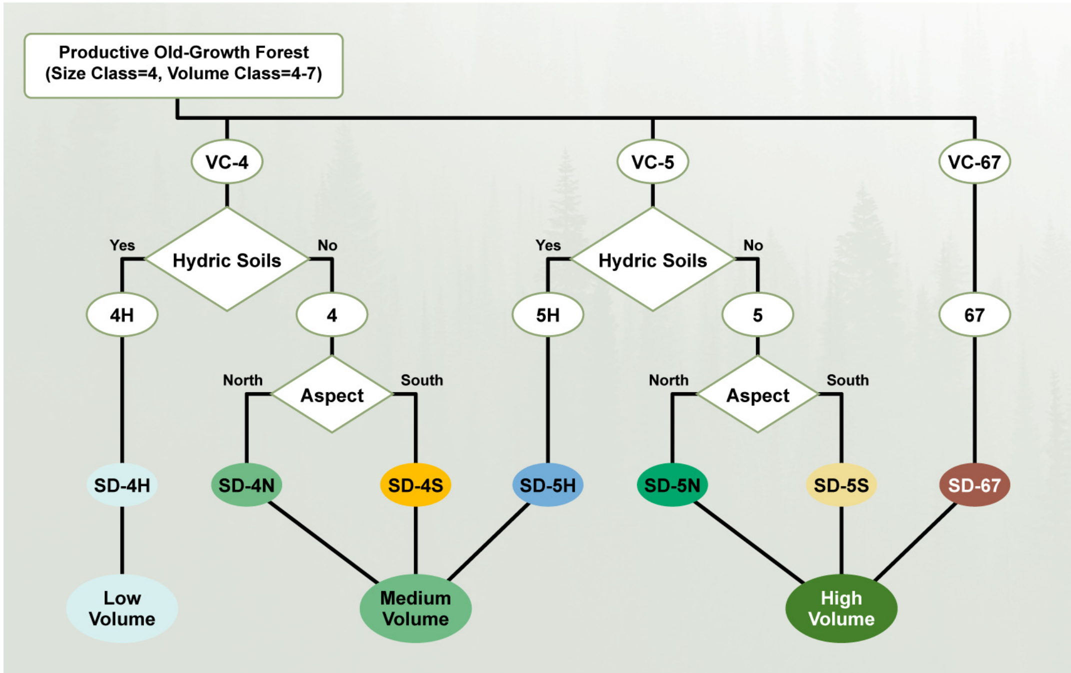
The disproportionate harvest of the larger POG types is an issue of concern relative to forest management on the Tongass. In the analysis that follows, we define the larger POG types in two ways. First, large-tree POG is defined as the SD67 POG type (Figure 3.9-4). This type represents the most productive of the POG types and typically contains the highest density of large trees. The second category is referred to as high-volume POG and is defined as the grouping of the three types that represent the highest volume stratum -- SD67, SD5N, and SD5s (Figures 3.9-4 and 3.9-5). This grouping represents the types with the largest trees on the Tongass.

Figure 3.9-4
Tree Size and Density Model used to Describe Forested Conditions across the Tongass National Forest

SD	*Land and Forest Condition* Most Probable Forest Type	*Tree Sizes and Densities* Most Probable Forest Type [1]	*Illustration* Most Probable Forest Type
4H	Low productive older forests associated with wet, poorly drained land types (e.g., muskegs, fens, rolling hills, broken mountain slopes, plateaus, glacial outwash zones). Canopy closure is variable. Trees are small, old, and defective. Stand volume is low.	Low densities **(SDI < 280)** of small-diameter trees **(QMD < 17 inches)**. Tree size distribution and spacing is variable and patchy. Tree diameters greater than 40 inches are generally not present.	
4N	Low to moderately productive older upland forests. Canopy characteristics are variable and patchy, with moderate canopy closure and relatively coarse canopy texture. Stand volume is low to moderate.	Low densities **(SDI < 280)** of medium diameter trees **(17 < QMD < 21 inches)**. Tree size distribution and spacing is variable and patchy. Tree diameters greater than 40 inches are rare.	
4S	Highly productive younger upland forests. Stand volume is moderate, but increasing rapidly. Crown competition is high. Canopy characteristics tend to be uniform, with high canopy closure and fine canopy texture.	High densities **(SDI > 280)** of medium-diameter trees **(17 < QMD < 21 inches)**. Tree size distribution and spacing tends to be more uniform. Tree diameters greater than 40 inches are rare.	
5H	Moderately productive older forests associated with wet, poorly drained land types (see 4H above). Canopy closure, texture, and structure tend to be variable and patchy. Stand volume and annual growth is also variable and patchy.	Low densities **(SDI < 280)** of medium-diameter trees **(17 < QMD < 21 inches)**. Tree diameters greater than 40 inches are somewhat common, but not uniformly distributed throughout the stand.	
5N	Moderately productive older upland forests. Stand volume is moderate to high. Canopy characteristics tend to be variable, with moderate canopy closure and coarse canopy texture.	Low densities **(SDI < 280)** of medium-to-large diameter trees **(17< QMD < 21 inches)**. Tree size distribution and spacing is variable and patchy. Tree diameters greater than 40 inches are common, but not uniformly distributed throughout the stand.	
5S	Highly productive upland forests. Stand volume is high. Canopy characteristics tend to be uniform, with moderate to high canopy closures.	High densities **(SDI > 280)** of medium-diameter trees **(17 < QMD < 21 inches)**. Tree size distribution and spacing tends to be uniform. Tree diameters greater than 40 inches are somewhat common, but not uniformly distributed throughout the stand.	
67	Highly productive forests associated with riparian areas, alluvial fans, colluvial toe slopes, karst geology, and wind-protected uplands. Stand volume is high. Stand age can vary. Canopy closure is low to moderate and canopy texture is coarse.	Low densities **(SDI < 280)** of large-diameter trees **(QMD > 21 inches)**. Tree diameters greater than 40 inches are common and uniformly distributed throughout the stand.	

[1] SDI=Stand Density Index; QMD=Quadratic Mean Diameter; >=greater than; <=less than
Source: Caouette 2006

Figure 3.9-5
Comparison of SDM Categories, the Four Volume Classes from the 1979 Forest Plan, and the Three Volume Strata Approach Used for the 1997 Forest Plan



Source: Caouette 2006

Forest-Wide Distribution of Old-Growth Forest

The distribution and condition of the old-growth ecosystem across the Tongass can be examined by comparing the representation of various types of old growth by elevation and across the biogeographic provinces and ecological subsections, with regard to the original representation. As stated earlier, because other habitat types (e.g., non-forested and unproductive forest habitats) are fully represented across the Tongass and have not changed appreciably from original levels, the old-growth ecosystem is the primary focus for the analysis of biological diversity in this document.

Old Growth Distribution by Elevation

Elevation is considered one of the most significant landscape variables influencing old-growth forest habitat values. Three elevation zones are described in Table 3.9-4 and the acreages for these components are divided between the productive and unproductive old growth. The different elevation zones displayed (less than 800 feet, 800 to 1,500 feet, and greater than 1,500 feet) are important for many wildlife species during certain times of the year. For example, old-growth forest, particularly SD5S, SD5N, and SD67, provide suitable winter habitat for Sitka black-tailed deer through increased snow-intercept capabilities (see the *Wildlife* section in this chapter for species-specific discussion).

Table 3.9-4
Conifer Old-Growth Acres of the Tongass within Three Elevation Zones

Elevation Zone	Description	Productive Old Growth	Unproductive Old Growth	Total Old Growth
Less than 800 feet	All upland old growth below 800 feet in elevation	2,961,192	1,812,165	4,773,357
800 to 1,500 feet	All upland old growth between 800 and 1,500 feet in elevation	1,409,322	1,022,014	2,431,335
Greater than 1,500 feet	All upland old growth more than 1,500 feet in elevation	580,635	1,381,708	1,962,343
Total		**4,951,148**	**4,215,887**	**9,167,035**

POG forest (all SDM categories described in Figure 3.9-4 and outlined in Figure 3.9-5) found at lower elevations accounts for approximately 60 percent of the old-growth forest on the Forest. It should be noted that POG at lower elevations (at or below 800 feet in elevation) has been harvested disproportionately in some biogeographic provinces. Forest-wide, 60 percent of all POG is found at or below 800 feet in elevation (Table 3.9-4); however, approximately 80 percent of all old-growth forest harvested since 1954 occurred below this elevation zone.

Old Growth Distribution by Biogeographic Province and SDM Category

Sixteen of the 21 biogeographic provinces covering the Tongass currently have more than 100,000 acres of POG and 11 provinces have more than 200,000 acres. Three provinces – Admiralty, North Central Prince of Wales, and Revilla/Cleveland – include more than 500,000 acres of POG each. The current POG acreage in each SDM category is displayed by biogeographic province in Table 3.9-5. These acres by SDM category can serve as a baseline for the amounts of existing structural classes at the landscape level.

The same three provinces that contain more than 500,000 acres of POG, contain more than 200,000 acres of high-volume POG, with Admiralty containing over 300,000 acres. Seven provinces contain more than 100,000 acres of high-volume POG and 14 provinces contain more than 50,000 acres. Large-tree POG (SD67), however, is not as uniformly distributed. Forty percent of the large-tree POG on the Tongass is within two provinces: North Central Prince of Wales and Admiralty. Other provinces, in which large-tree POG comprises over 10 percent of the POG include Yakutat Forelands, Kuiu Island, Southern Outer Islands, and South Prince of Wales.

Forest-wide, the Tongass consists of 20 percent low-volume, 39 percent medium-volume, and 41 percent high-volume POG types. The province with the highest percentage of low-volume POG (SD4H) is the Kupreanof/Mitkof province, which has a high percentage of low-lying wetland areas. Portions of adjacent North Central Prince of Wales and Etolin Island and Vicinity provinces also contain large areas of the low-volume type.

Old Growth Distribution by Ecological Subsection and SDM Category

Examining the distribution of old growth by ecological subsection allows comparison at a smaller scale than the biogeographic province scale. The ecological subsections better define and describe habitats with similar overall vegetative patterns. Table 3.9-6 displays the POG forest acres within each of the 73 ecological subsections on the Tongass by SDM category. Ecological subsections vary dramatically in their ability to support POG, even within similar landforms, elevation,

Table 3.9-5
Distribution of Existing POG Acres by SDM Category across the 21 Biogeographic Provinces on the Tongass National Forest

Biogeographic Province	Low Volume	Medium Volume			High Volume			TOTAL
	SD4H	SD4N	SD4S	SD5H	SD5N	SD5S	SD67	
1	6,948	2,759	2,610	6,759	2,063	1,501	25,130	47,770
2	1,829	1,657	8,148	1,054	2,005	6,707	1,999	23,399
3	83,913	44,368	85,560	31,428	42,357	72,959	34,515	395,100
4	16,714	11,994	22,963	3,144	5,333	9,878	2,012	72,038
5	15,270	13,291	25,180	6,157	11,590	14,852	1,970	88,311
6	45,715	34,958	71,142	10,072	18,262	30,760	4,113	215,021
7	87,253	55,535	101,188	43,735	67,356	136,494	98,262	589,823
8	20,710	19,585	43,837	9,102	12,384	35,748	11,796	153,160
9	43,024	35,686	79,235	27,219	41,582	68,458	22,472	317,677
10	102,873	25,362	49,867	29,484	27,240	51,465	19,554	305,846
11	54,018	16,443	32,329	34,529	43,449	76,626	36,682	294,075
12	44,458	23,603	55,247	18,750	25,559	58,108	19,975	245,701
13	63,121	20,091	43,580	15,813	23,807	39,915	12,387	218,714
14	132,698	18,722	47,170	89,807	37,119	70,773	117,979	514,269
15	109,381	32,378	73,788	74,881	62,216	118,593	31,854	503,090
16	27,750	6,911	20,161	15,643	13,408	16,767	12,810	113,451
17	9,324	5,513	15,509	4,616	10,851	14,262	7,911	67,987
18	31,743	10,788	29,621	13,682	10,819	22,115	43,328	162,097
19	16,008	34,433	77,411	4,454	18,889	34,597	12,767	198,559
20	56,978	39,468	102,131	13,814	28,691	54,676	14,142	309,900
21	8,873	19,348	47,494	2,995	9,720	20,938	5,793	115,160
Total	978,603	472,889	1,034,172	457,139	514,702	956,193	537,451	4,951,148
Percent of Total POG by SDM Category	20%	10%	21%	9%	10%	19%	11%	100%

and soil conditions. For example, the Gulf of Esquibel Till Lowlands and the Rowan Sediments vary from 32 percent to 72 percent covered by POG, respectively.

Sixty of the 73 ecological subsections currently have more than 20,000 acres of POG on National Forest System (NFS) land and 65 of the ecological subsections have more than 10,000 acres. The 13 subsections that currently have less than 20,000 acres, also had less than 20,000 acres of POG originally. Similarly, the 8 subsections with less than 10,000 acres had less than 10,000 acres originally. Fifteen ecological subsections currently have more than 100,000 acres of POG and only 2 subsections have less than 1,000 acres. The ecological sections containing the largest amounts of POG include the Inside Passage Fiordlands (1,208,000 acres), Kootznoowoo Fiordlands (653,000 acres), Baranof-Chichagof Fiordlands (573,000 acres), Kuiu-Prince of Wales Fiordlands (481,000 acres), Kupreanof Lowlands (388,000 acres), and the Coast Mountain Batholith Fiordlands (387,000 acres).

Table 3.9-6
Distribution of POG Acres by SDM Category across the 73 Ecological Subsections on the Tongass National Forest

Ecological Section (Bold) and Subsection Names	Low Volume	Medium Volume			High Volume			TOTAL
	SD4H	SD4N	SD4S	SD5H	SD5N	SD5S	SD67	
St. Elias-Fairweather Mountains								
St. Elias-Fairweather Icefields	299	849	3,453	106	409	1,880	1,530	8,526
Puget Peninsula Metasediments	359	431	2,894	129	255	2,260	961	7,290
Northern Gulf Forelands								
Yakutat-Lituya Forelands	8,196	3,305	5,271	7,657	3,755	5,212	25,512	58,908
Chilkat River Complex								
Chilkat Complex	41	711	574		111	127	197	1,759
Boundary Ranges								
Boundary Ranges Icefields	18,532	40,237	104,352	5,833	17,555	45,982	11,503	243,994
Stikine-Taku River Valleys	8,795	4,329	5,562	4,031	4,915	4,085	1,894	33,612
Glacier Bay Fiordlands								
Wachusett-Adams Hills		183	2		35	9		229
Berg Bay Complex	1,706			1,882			1,636	5,223
Chilkat Peninsula Carbonates	12,458	9,562	16,726	5,137	6,884	19,379	7,074	77,221
Baranof-Chichagof Fiordlands								
North Chichagof Granitics	18,954	12,584	20,940	10,251	11,161	16,339	6,213	96,442
Outer Coast Wave-cut Terraces	16,503	5,245	7,776	2,537	1,898	3,157	520	37,636
West Chichagof Complex	3,951	5,839	12,510	605	1,869	3,816	1,297	29,885
Ushk-Patterson Bay Granitics	8,588	6,115	11,611	1,846	5,139	5,575	3,017	41,891
Peril Strait Granitics	24,267	12,521	27,806	6,708	6,761	17,857	5,128	101,048
North Baranof Complex	7,658	8,027	13,811	3,403	8,987	10,237	1,470	53,593
Sitka Sound Complex	13,253	13,369	24,712	3,409	8,008	10,602	1,153	74,506
Mount Edgecumbe Volcanics	9,104	2,775	4,777	1,749	1,361	3,464	358	23,587
Central Baranof Metasediments	5,393	7,007	15,056	1,604	2,553	5,512	638	37,764
Necker Bay Granitics	4,772	7,287	17,705	808	3,249	5,625	1,121	40,568
South Baranof Sediments	6,990	5,285	12,303	1,557	3,157	6,326	702	36,320
Northeast Chichagof Fiordlands								
Point Adolphus Carbonates	5,795	2,371	4,291	5,009	5,878	10,189	8,256	41,789
Freshwater Bay Carbonates	24,930	10,465	21,713	6,361	9,758	18,152	6,636	98,016
Kook Lake Carbonates	7,339	5,647	9,308	2,927	7,708	11,250	4,465	48,644
Kootznoowoo Fiordlands								
Stephens Passage Glaciomarine Terraces	29,237	14,792	27,359	11,854	11,620	22,812	11,482	129,157
North Admiralty Complex	8,185	12,478	25,696	6,213	17,144	35,680	21,370	126,767
Stephens Passage Volcanics	5,438	4,544	10,810	2,951	4,551	12,531	7,110	47,934
Thayer Lake Granitics	7,257	3,231	7,099	3,518	4,505	12,624	7,337	45,571
Mitchell-Hasselborg Till Lowlands	15,796	6,337	9,383	7,803	7,037	10,228	6,028	62,613
Hood-Gambier Bay Carbonates	17,558	12,920	23,352	7,494	16,977	34,493	30,787	143,582
South Admiratly Volcanics	14,815	6,746	15,113	7,962	10,769	23,072	19,067	97,544
Inside Passage Fiordlands								
Holkham Bay Complex	38,205	23,686	56,501	25,641	35,865	60,405	18,060	258,363
Cape Fanshaw Complex	12,630	1,805	4,206	6,477	3,730	7,298	7,089	43,235
Thomas Bay Outwash Plains	3,584	796	1,522	621	787	1,089	1,718	10,117
Wrangell Narrows Metasediments	23,849	14,914	29,699	7,897	17,142	29,659	11,455	134,615
Eastern Passage Complex	14,925	11,611	23,600	6,583	15,496	31,932	7,555	111,702
Stikine River Delta	2,047	2,372	4,398	1,558	3,012	4,875	2,554	20,816

Table 3.9-6 (continued)
Distribution of POG Acres by SDM Category across the 73 Ecological Subsections on the Tongass National Forest

Ecological Section (Bold) and Subsection Names	Low Volume	Medium Volume			High Volume			TOTAL
	SD4H	SD4N	SD4S	SD5H	SD5N	SD5S	SD67	
Bell Island Granitics	27,649	14,696	30,882	9,943	14,785	32,133	4,639	134,728
Stikine Strait Complex	8,059	2,769	6,194	2,055	3,520	5,015	1,180	28,793
Etolin Granitics	5,354	3,364	7,527	1,411	3,813	7,769	1,229	30,467
Zimovia Strait Complex	26,709	9,998	17,501	8,214	10,164	15,439	4,831	92,857
Clarence Strait Volcanics	25,544	5,380	16,072	9,671	7,748	15,987	4,720	85,122
Ketchikan Mafics/Ultramafics	4,918	1,351	2,966	2,794	2,926	4,060	2,253	21,268
Vixen Inlet Till Lowlands	5,448	398	510	1,718	466	727	788	10,055
Traitors Cove Metasediments	25,264	6,307	17,610	21,641	19,070	36,149	13,364	139,405
Behm Canal Complex	10,428	5,368	8,679	12,918	13,848	29,211	6,328	86,781
Kuiu-Prince of Wales Fiordlands								
Kuiu-POW Granitics	11,577	7,314	13,410	7,190	10,666	19,532	10,683	80,372
Rowan Sediments	11,803	2,780	5,736	11,593	14,262	27,328	20,013	93,515
North POW-Kuiu Carbonates	14,398	2,847	8,219	14,703	9,314	18,754	41,545	109,779
Alvin Bay Sediments	10,604	2,418	5,212	8,513	10,055	15,997	3,558	56,357
Affleck Canal Till Lowlands	11,880	1,179	2,311	4,018	2,814	4,062	1,033	27,296
North POW Complex	11,885	593	1,577	10,837	2,660	5,434	9,704	42,689
Elevenmile Till Lowlands	5,412	269	872	3,676	525	2,702	1,112	14,567
Gulf of Esquibel Till Lowlands	5,789	1,115	2,844	2,002	993	1,457	627	14,828
Klawock Inlet Till Lowlands	144	99	129	151	84	58		665
Soda Bay Till Lowlands	13,048	2,721	7,560	5,551	3,528	4,912	3,131	40,451
Kupreanof Lowlands								
Kake Volcanics	16,523	1,316	2,485	6,075	1,775	2,690	2,365	33,229
Duncan Canal Till Lowlands	32,046	6,065	10,841	7,279	5,722	10,184	3,766	75,903
Sumner Strait Volcanics	59,191	9,633	21,131	17,840	12,904	25,254	8,863	154,815
Central POW Till Lowlands	39,785	1,263	2,946	26,001	3,982	6,432	19,322	99,730
Kasaan Peninsula Volcanics	1,316	358	601	474	544	388	515	4,197
Skowl Arm Till Lowlands	6,159	2,202	3,392	2,034	1,240	2,022	3,167	20,215
Outer Islands Fiordlands								
Outer Islands Complex	7,382	384	1,028	6,415	959	1,462	1,383	19,013
Dall-Outside Complex	19,494	10,250	29,453	8,030	20,460	23,329	13,223	124,239
Prince of Wales Mountains								
Central POW Volcanics	38,491	7,238	19,645	26,452	15,377	30,390	38,341	175,934
Hetta Inlet Metasediments	10,731	3,157	10,982	5,710	4,538	9,603	27,293	72,015
Moira Sound Complex	11,087	3,818	11,548	4,683	4,212	9,652	12,684	57,684
Dixon Entrance Lowlands								
South POW Granitics	12,121	5,151	10,997	3,837	3,365	5,427	8,211	49,109
Duke Island Till Lowlands	3,684	389	352	1,740	450	576	114	7,306
Thorne Arm Granitics	7,810	1,713	4,971	4,334	3,105	3,832	1,271	27,035
Princess Bay Volcanics	6,658	471	1,982	10,176	1,546	4,520	361	25,715
Foggy Bay Till Lowlands	10,848	1,259	3,410	2,035	963	1,734	391	20,641
Boca De Quadra Complex	12,468	8,408	19,394	2,813	5,482	7,277	912	56,754
Coast Mountain Batholith Fiordlands								
Misty Fiords Granitics	45,483	58,470	141,313	12,490	36,799	70,963	21,632	387,149
Total	**978,603**	**472,889**	**1,034,172**	**457,139**	**514,702**	**956,193**	**537,451**	**4,951,148**
Percent of Total POG by SDM Category	20%	10%	21%	9%	10%	19%	11%	100%

High-volume and large-tree POG occur throughout Southeast Alaska; however, their relative abundance varies across ecological subsections. High-volume POG represents more than 50 percent of all POG in 12 subsections. It occurs at the highest relative abundance in subsections within the Northern Gulf Forelands, Kuiu-Prince of Wales Fiordlands, and the Prince of Wales Mountains ecological sections. Similarly, large-tree POG makes up more than 20 percent of all POG in 9 subsections. It occurs in the highest relative abundance in the Northern Gulf Forelands, Kuiu-Prince of Wales Fiordlands, and the Prince of Wales Mountains ecological sections.

Past Old-Growth Harvest

Overview of Past Harvest on National Forest System Lands

Originally, 5.4 million acres of POG occupied the Tongass and 8 percent of this POG has been harvested. At least 10 percent harvest has occurred in six provinces—East Chichagof Island, East Baranof Island, Kupreanof/Mitkof Islands, Etolin Island, North Central Prince of Wales Island, and Southern Outer Islands (Table 3.9-7). With 26 percent POG harvest, North Central Prince of Wales has had

Table 3.9-7
Total POG, High-Volume POG (SD5S, SD5N, SD67), Large-Tree POG (SD67), and Low-Elevation High-Volume and Large-Tree POG: Original Acres and Percent Remaining by Biogeographic Province on National Forest System Lands

		Acres of Original POG[1]					Percent of Original POG Remaining				
No.	Geographic Unit	Total POG	High-Volume POG[2]	High-Volume[2] POG ≤800 ft	SD67 POG	SD67 POG ≤800 ft	Total POG	High-Vol. POG[2]	High-Vol.[2] POG ≤800 ft	SD67 POG	SD67 POG ≤800 ft
1	Yakutat Forelands	51,398	31,015	30,799	26,181	26,095	93%	93%	93%	96%	96%
2	Yakutat Uplands	24,811	11,614	11,103	2,408	2,192	94%	92%	92%	83%	81%
3	East Chichagof Island	439,307	178,124	114,262	47,335	36,883	90%	84%	80%	73%	71%
4	West Chichagof Isld	72,038	17,223	13,795	2,012	1,918	100%	100%	100%	100%	100%
5	East Baranof Island	101,840	37,072	29,024	5,894	5,397	87%	77%	74%	33%	34%
6	West Baranof Island	231,999	64,001	49,692	9,036	8,488	93%	83%	80%	46%	44%
7	Admiralty Island	598,419	307,613	184,803	100,755	68,011	99%	98%	97%	98%	96%
8	Lynn Canal	158,538	63,368	37,892	13,355	9,417	97%	95%	93%	88%	86%
9	North Coast Range	317,898	132,654	65,270	22,536	13,773	100%	100%	100%	100%	100%
10	Kupreanof/Mitkof Isld	341,588	121,135	73,158	29,920	22,505	90%	81%	76%	65%	64%
11	Kuiu Island	322,569	174,993	121,702	44,945	28,952	91%	90%	87%	82%	75%
12	Central Coast Range	252,179	107,789	66,361	21,854	16,777	97%	96%	94%	91%	89%
13	Etolin Island	254,781	99,193	61,367	22,847	15,739	86%	77%	72%	54%	48%
14	North Central POW	698,394	343,711	231,880	171,375	128,734	74%	66%	62%	69%	68%
15	Revilla Isl/Cleveld Pen	548,748	241,884	123,115	45,095	26,869	92%	88%	84%	71%	65%
16	Southern Outer Islds	128,589	52,674	38,826	17,200	12,957	88%	82%	79%	74%	71%
17	Dall Island and Vicin.	68,355	33,260	23,189	8,018	5,937	99%	99%	99%	99%	98%
18	South POW	165,389	78,369	55,383	44,283	34,589	98%	97%	97%	98%	98%
19	North Misty Fiords	199,929	67,130	38,864	13,164	9,693	99%	99%	98%	97%	96%
20	South Misty Fiords	309,900	97,509	61,530	14,142	11,210	100%	100%	100%	100%	100%
21	Ice Fields	119,204	39,039	18,296	6,965	4,764	97%	93%	89%	83%	80%
	Forest-wide	5,405,872	2,299,369	1,450,310	669,321	490,903	92%	87%	84%	80%	78%

[1] Original POG is defined in this EIS as the POG that existed, outside of towns, prior to all mapped timber harvest. About 300 acres were mapped as harvested in the 1700s and 1800s and about 16,000 acres are from the first half of the 1900s. The vast majority (about 438,000 acres) has occurred since 1950. To estimate original high volume and SD67 POG, an estimate was made of the percentage of past harvest in these categories using timber type mapping from the mid-1980s. Based on this analysis, prior harvest on NFS lands was estimated to have been 29% SD67 and 64% high volume (see Appendix B).

[2] High-volume POG contains the largest tree types (SD5S, SD5N, SD67).

the highest rate of past harvest. Ten provinces have had less than 5 percent harvest and six provinces have had 1 percent or less. Significant among these is Admiralty, which had nearly 600,000 acres of original POG and only about 1 percent harvest on NFS lands.

Approximately 454,724 acres of old growth have been harvested on the Tongass National Forest, with 96 percent (435,039 acres) having been harvested since 1954, when industrial-scale logging began. The two decades with the greatest amount of harvest were the 1960s and the 1970s; these two decades account for 50 percent of all Tongass old-growth harvest (Table 3.9-8).

Harvest practices and regulations on the Tongass have varied substantially over the years. The amount of harvest is categorized in Table 3.9-9 according to specific periods of relatively consistent land management.

Table 3.9-8
Past Harvest by Decade on the Tongass National Forest

Decade	Harvest Acres	Percent of All Harvest
2000-2006	15,507	3%
1990-1999	80,846	18%
1980-1989	87,946	19%
1970-1979	117,645	26%
1960-1969	109,544	24%
1950-1959	26,994	6%
1940-1949	6,456	1%
1930-1939	1,502	0%
1920-1929	5,064	1%
1910-1919	2,669	1%
<1910	550	0%
Total	**454,724**	**100%**

Table 3.9-9
Past Harvest Relative to Management Practices on the Tongass National Forest

Period	Harvest Acres	Period Description
1997-2006	29,218	Represents the current period under the 1997 Forest Plan (as amended); high level of resource protection
1991-1996	52,266	TTRA had passed and Forest Plan was under revision; proportional harvest for long-term contracts and stream buffers required
1979-1990	115,401	1979 Forest Plan was in effect, but prior to TTRA amendment
1954-1978	237,154	Prior to the first Forest Plan – initial period of industrial-scale logging; relatively few restrictions
1750-1953	20,685	Prior to the first Forest Plan and before industrial-scale logging began
Total	**454,724**	

In general, the more recent the harvest the more protections were in place. Approximately 57 percent of the harvest on the Tongass occurred prior to the protections adopted by the first Forest Plan in 1979. Another 25 percent was harvested after the first Forest Plan, but before the additional riparian protections and proportionality requirements of TTRA (see below). An additional 12 percent of the harvest took place after TTRA, but before the current Forest Plan was adopted, which implemented extensive harvest restrictions. Thus, only 6 percent of the old-growth harvest on the Tongass has taken place under the current Forest Plan, which offers the greatest protections.

Past harvest on the Tongass has disproportionately targeted the larger POG types. Early logging in particular, especially prior to the 1990s, extensively harvested the larger tree types. These types were not only the highest timber volume types, but they also often grew at lower elevations in the easiest areas to access (e.g., valley bottoms and lower slopes). When TTRA was passed, the harvest of the largest tree categories was limited as a proportion of total harvest. This applied only to the long-term contracts, which were in effect at the time and extended into the late 1990s.

In this discussion, larger POG types are defined by two categories: 1) large tree POG, also referred to as SD67, is the type with the largest average diameter tree diameter sizes and 2) high-volume POG, which includes the three largest types (SD67, SD5N, and SD5S), and represents the types with the highest average timber volume. Both of these categories are of high value for wildlife and aesthetics, but the large-tree POG is considered of highest value.

The proportion of harvest in these larger POG types was estimated based on timber type mapping conducted in the mid-1980s. As a result, we estimate that 31 percent of all harvest on NFS lands conducted prior to 1992 (when the proportionality requirement of TTRA began to be implemented) consisted of large-tree POG and 66 percent consisted of high-volume POG. From 1992 to the present, these percentages dropped to approximately 17 percent for large-tree POG and 52 percent for high-volume POG. The original composition of POG on the Tongass National Forest is estimated to have included 12 percent large-tree POG and 43 percent high-volume POG. Averaging all past harvest together, the weighted average harvest of large-tree and high-volume POG was 29 and 64 percent of the harvest. As a result of the cumulative disproportionate harvest on NFS lands over the years, the overall proportion of larger tree types on the Tongass have been reduced to 11 percent for large-tree POG and 41 percent for high-volume POG.

The composition of recent past harvest (under the current Forest Plan) by SDM category is summarized in the Tongass 2006 Annual Monitoring Report (USDA Forest Service 2007h). Of the 17,202 acres harvested during the period, 1998 through 2003, approximately 14 percent was from the large tree type (SD67) and 48 percent occurred in high-volume POG (SD5S, SD5N, and SD67), indicating that harvest has been slightly disproportionate during this period as well. However, this has been a period of relatively poor economics and only a small percentage of the total harvest allowed under the Forest Plan has been implemented.

Table 3.9-7 displays the original amount of POG and the percent remaining in different categories by biogeographic province. This table also provides an indication of the rate of past harvest for different types. For example, 87 percent of the original high-volume POG and 80 percent of the original large-tree POG are remaining Forest-wide. As noted above, the larger tree types were targeted for logging, especially at lower elevations. As a result, 84 percent of the original high-volume POG and 78 percent of the large-tree POG below 800 feet are remaining today.

Three provinces – East Baranof, Etolin, and North Central Prince of Wales – have had more than 20 percent of their high-volume POG harvested. Conversely, 13 provinces have had 10 percent or less of their high-volume POG harvested. Five provinces – East Baranof, West Baranof, Kupreanof/Mitkor, Etolin, North Central

Prince of Wales have had more than 30 percent of their large-tree POG harvested and 9 provinces have had 10 percent or less removed.

At low to intermediate elevations, the same limestone soils that produce karst topography and caves are very productive and produce some of the largest tree forests on the Tongass. As a result, POG forests on karst terrain have been harvested at a very high rate. Overall, 31 percent of all POG growing on karst soils of the Tongass has been harvested (95,000 acres harvested out of 303,000 original acres). Approximately 38 percent of the low elevation (less than 800 feet) POG growing on karst soils of the Tongass has been harvested (81,000 out of 216,000 acres). Over half of this harvest has occurred in the North Central Prince of Wales province where karst terrain is most well developed.

Overview of Past Harvest on Non-National Forest System Lands

Many of the non-NFS lands in Southeast Alaska are also available for timber harvest and much harvest has occurred on these lands, which cumulatively affects old-growth forest resources (see the *Timber* section in this chapter). The non-NFS landowners include the Alaska native corporations, the State of Alaska, and other private landowners and local governments within the Tongass boundary. Areas within Southeast Alaska, but outside the Forest boundary are managed by the National Park Service (Glacier Bay National Park), the Bureau of Land Management, the State of Alaska, and private landowners and local governments.

The major landowners that harvest timber on non-NFS lands within the Tongass boundary are the Alaska native corporations, including Sealaska, the regional corporation, and 12 village corporations. Together, the native corporations own and manage approximately 579,000 acres within the Tongass boundary (see Table 3.11-1 in the *Lands* section). In addition, the State of Alaska owns and manages 454,000 acres of lands within the Tongass boundary, and an additional 513,000 acres of lands north and west of Haines in and adjacent to the Haines State Forest. A portion of these state lands are managed for timber harvest. Other private landowners and local governments own and manage another 227,000 acres of lands within the Tongass boundary and a limited acreage outside the boundary; some of these acres are managed for timber.

Past old-growth harvest on non-NFS lands within the Tongass boundary consists of approximately 301,000 acres on native corporation lands (some of which is partial harvest), 35,000 acres on state lands, and 14,000 acres on other lands. Outside the Forest boundary, primarily in the Haines area, an additional 21,000 acres have been harvested. Thus, the total non-NFS harvest of old growth within the Tongass Forest boundary is approximately 351,000 acres and an estimated total of 371,000 acres have been harvested on non-NFS lands throughout Southeast Alaska.

Intensive harvest on non-NFS lands started later than on NFS lands, beginning in earnest in the late 1970s. High rates of harvest began in the early 1980s, peaking in the early 1990s, and decreasing to a lower level at present. The decades with the highest harvest were the 1980s and 1990s.

As a result of the timing of past harvest, a large majority (about 94 percent) of the second growth on non-NFS lands is less than 25 years old and is currently in the stand initiation stage. Only about 6 percent is currently in the early stages of the stem exclusion stage.

The Alaska Forest Resources and Practices Act (FRPA) (Alaska Statute 41.17) governs how timber harvesting, reforestation, and timber access can occur on state, private, and municipal land. The FRPA was originally adopted in 1978. Major revisions were adopted in 1990 to address riparian management on private land and other issues. Additional changes to the stream classification system and riparian management standards for coastal forests were adopted in 1999. Approximately 48 percent of the harvest on non-NFS lands in Southeast Alaska occurred prior to the major protective revisions to the FRPA in 1990. However, the majority of the harvest (52 percent) occurred after the FRPA revisions were adopted.

Disproportionate past harvest has occurred at a higher rate for large-tree POG and at approximately the same rate for high-volume POG on non-NFS lands compared with NFS lands. Overall, 37 percent of the non-NFS harvest acres consisted of large-tree POG and 62 percent consisted of high-volume POG. As a result of past harvest on non-NFS lands within the Forest boundary, the proportion of larger tree types has been reduced to 6 percent for large-tree POG and 37 percent for high-volume POG. Counting all non-NFS lands within Southeast Alaska, the percentages are 7 percent for large-tree POG and 56 percent for high-volume POG. The higher percentages for high-volume POG are because of the prevalence of these types and the low rate of harvest in the Glacier Bay and Chilkat River complex biogeographic provinces.

Cumulative Past Harvest

<u>Overview</u>

Cumulatively, of the 6.13 million acres of POG that originally existed on all lands within the Tongass Forest boundary (outside of that occupied by towns), approximately 805,000 acres or 13 percent has been harvested. When considering all of Southeast Alaska, including Glacier Bay National Park and the lands around Haines and Skagway, approximately 826,000 acres, or 13 percent, have been harvested out of 6.5 million acres of original POG. Approximately 92 percent of the original POG is present on the Tongass and 66 percent is estimated to remain on non-NFS lands. The percent of total POG remaining for all of Southeast Alaska is estimated to be 87 percent.

Timber harvest has occurred in a spatially clumped fashion within Southeast Alaska, with activity concentrated on islands, such as Prince of Wales, northeast Chichagof, northern Kuiu, and Zarembo. Very little activity has occurred on some other islands and much of the mainland (e.g., within the 19 designated Wilderness Areas and National Monuments and 12 legislated LUD II areas). Table 3.9-10 displays the land area, acreage of remaining POG and POG harvested, and percentage of POG remaining by land category for all lands in Southeast Alaska by biogeographic province. The percentage of the original POG forest no longer in an old-growth condition can serve as a general indicator of the potential effect on several biodiversity aspects, including structural (within-stand) diversity, connectivity (unfragmented, continuous old-growth blocks), and age and species composition (including understory species).

Some harvest has occurred in 20 of the 23 biogeographic provinces in Southeast Alaska; however, 13 provinces have over 90 percent of their original POG remaining (Table 3.9-10). Over 30,000 acres have been harvested in 6 biogeographic provinces (Table 3.9-10); the harvest in these 6 provinces accounts for about 75 percent of all harvest in Southeast Alaska. Only 2 provinces, North Central Prince of Wales and Dall Island and Vicinity, have had 20 percent or more of their original POG harvested.

<u>Disproportionate Past Harvest</u>

Across the Tongass and Southeast Alaska in general, timber harvest has been concentrated in the larger tree types and the higher timber volume classes. While approximately 87 percent of all POG remains across Southeast Alaska, about 82 percent of high-volume POG remains unharvested, and about 68 percent of large-tree POG remains. To a lesser extent, timber harvest has also been concentrated at the lower elevations (e.g., approximately 84 percent of the high-volume, low-elevation old growth remains unharvested on NFS lands compared with 87 percent of high-volume POG on NFS lands in general) (Table 3.9-7).

Large-tree stands found in alluvial river bottoms and karst areas were the target of early clearcut logging throughout Southeast Alaska (especially in the 1950s through the 1970s); some clearcuts were extensive and in many cases trees were harvested to the stream banks. With growing concerns over fisheries protection and proportionality, buffer restrictions were instituted in the 1990s.

As timber harvest moved away from streams and further inland, large-tree karst forests began to receive more logging pressure than did the riparian and alluvial fan forests due to their excellent drainage and the ease of road-building on these low, rolling landscapes (Albert and Schoen 2007, Chapter 2).

Most harvested POG was high-volume POG and a high proportion of this harvest was the largest tree category (SD67). Approximately 10 percent of the remaining POG in Southeast Alaska is mapped as the largest tree category (SD67); 42 percent of the remaining POG is mapped as high volume. The greatest concentrations of POG in the largest tree categories are in the North Central Prince of Wales and the Admiralty Island Biogeographic Provinces. These two biogeographic provinces account for 40 percent of the remaining large-tree POG inside the Forest boundary and 38 percent of the remaining large-tree POG in Southeast Alaska (Tables 3.9-7 and 3.9-10). These values serve as baselines for comparison with potential changes under the alternatives considered in this analysis.

Albert and Schoen (2007) estimate that, although approximately 10 percent of all POG is represented by large-tree forests, it has been harvested at a rate of nearly three times its availability on the landscape. Furthermore, harvest of these large-tree stands has primarily occurred at low elevations, particularly within valley floor (flood plain) areas and on karst lands. Albert and Schoen (2007) estimate that low elevation karstland forests make up only 2.7 percent of the region's POG, but these types have also been the focus of timber harvest in Southeast Alaska, accounting for approximately 15 percent of all timber harvest in Southeast Alaska (Chapter 2, Table 4).

Harvest of POG growing on karst terrain may be the most disproportionate example of the types of past harvest. Karst mapping covers 458,000 acres of the Tongass, 303,000 acres (66 percent) of which was originally covered by POG. Although limited amounts of karst POG occur in almost all provinces of Southeast Alaska, the majority is found in five provinces: North Central Prince of Wales, Southern Outer Islands, Dall Island and Vicinity, East Chichagof, and Admiralty Island.

Today, 208,000 acres (69 percent) of the original POG on karst terrain remains. Therefore, 31 percent of the original POG on NFS karst terrain has been harvested, compared with 8 percent of POG in general. Karst POG at low elevations were targeted by early harvest activity at an even higher rate. Of the 216,000 acres of karst POG originally found at low elevations (less than 800 feet) on NFS lands, 81,000 acres or 38 percent have been harvested.

Table 3.9-10
Existing POG, Past Harvest, and Percent of Original POG Remaining for NFS, Non-NFS and All Lands by Biogeographic Province for Southeast Alaska

		Existing POG			Part Harvest of POG			% of Original POG Remaining			% of Original High Volume POG Remaining			% of Original SD67 POG Remaining		
No.	Biogeographic Unit	NFS	Non-NFS	All Lands	NFS	Non-NFS	All Lands	NFS	Non-NFS	All Lands	NFS	Non-NFS	All Lands	NFS	Non-NFS	All Lands
1	Yakutat Forelands	47,770	41,456	89,226	3,627	13,991	17,618	93%	75%	84%	93%	66%	81%	96%	16%	81%
2	Yakutat Uplands	23,399	0	23,400	1,411	0	1,411	94%	--	94%	92%	--	92%	83%	--	83%
3	East Chichagof Island	395,100	34,935	430,035	44,208	37,503	81,711	90%	48%	84%	84%	34%	76%	73%	16%	58%
4	West Chichagof Island	72,038	331	72,369	0	0	0	100%	100%	100%	100%	100%	100%	100%	--	100%
5	East Baranof Island	88,311	1,027	89,338	13,530	2	13,531	87%	100%	87%	77%	99%	77%	33%	0%	33%
6	West Baranof Island	215,021	12,731	227,753	16,978	2,354	19,332	93%	84%	92%	83%	69%	82%	46%	38%	44%
7	Admiralty Island	589,823	7,800	597,623	8,595	20,135	28,730	99%	28%	95%	98%	21%	94%	98%	15%	91%
8	Lynn Canal	153,160	16,254	169,414	5,378	549	5,927	97%	97%	97%	95%	95%	95%	88%	88%	88%
9	North Coast Range	317,677	38,786	356,463	221	20,561	20,782	100%	65%	94%	100%	57%	92%	100%	33%	77%
10	Kupreanof/Mitkof Island	305,846	29,258	335,104	35,742	35,026	70,768	90%	46%	83%	81%	28%	71%	65%	8%	47%
11	Kuiu Island	294,075	1,855	295,929	28,494	144	28,639	91%	93%	91%	90%	84%	90%	82%	58%	82%
12	Central Coast Range	245,701	5,258	250,959	6,479	1,433	7,912	97%	79%	97%	96%	69%	95%	91%	24%	89%
13	Etolin Island	218,714	13,390	232,104	36,066	4,476	40,543	86%	75%	85%	77%	61%	76%	54%	20%	51%
14	North Central Prince of Wales	514,268	84,377	598,645	184,125	135,406	319,532	74%	38%	65%	66%	24%	56%	69%	12%	55%
15	Revilla Isl./Cleveland Pen.	503,091	70,123	573,213	45,658	24,906	70,563	92%	74%	89%	88%	62%	84%	71%	9%	59%
16	Southern Outer Islands	113,451	4,887	118,338	15,138	5,827	20,964	88%	46%	85%	82%	33%	77%	74%	16%	67%
17	Dall Island and Vicinity	67,986	31,635	99,621	369	32,916	33,285	99%	49%	75%	99%	33%	68%	99%	8%	42%
18	South Prince of Wales	162,097	11,077	173,174	3,292	14,536	17,828	98%	43%	91%	97%	43%	88%	98%	48%	88%
19	North Misty Fiords	198,559	2,261	200,820	1,370	841	2,211	99%	73%	99%	99%	58%	98%	97%	18%	95%
20	South Misty Fiords	309,900	276	310,176	0	0	0	100%	100%	100%	100%	100%	100%	100%	100%	100%
21	Ice Fields	115,160	113	115,273	4,044	0	4,044	97%	100%	97%	93%	100%	93%	83%	100%	83%
	Total within Forest Boundary[1]	**4,951,148**	**407,829**	**5,358,976**	**454,724**	**350,606**	**805,331**	**92%**	**54%**	**87%**	**87%**	**40%**	**81%**	**80%**	**17%**	**68%**
	Chilkat River Complex	0	145,104	145,104	0	20,637	20,637	--	88%	88%	--	89%	89%	--	73%	73%
	Glacier Bay/Fairweather Range	0	170,840	170,840	0	200	200	--	100%	100%	--	100%	100%	--	--	--
	Total Southeast Alaska	**4,951,148**	**723,773**	**5,674,921**	**454,724**	**371,443**	**826,168**	**92%**	**66%**	**87%**	**87%**	**64%**	**82%**	**80%**	**26%**	**68%**

[1] Includes Annette Island and all of the Ice Fields province, although they are not entirely within the Forest boundary.

Although only 26,000 acres of mapped karst POG originally occurred on non-NFS lands, harvest rates are higher if non-NFS lands are considered as well. Assuming that 50 percent of all non-NFS karst POG and 75 percent of all non-NFS low elevation karst POG have been harvested, the overall harvest rate for karst POG in Southeast Alaska was estimated at 33 percent overall, and 41 percent for low elevation karst.

Current Conditions by Biogeographic Province

This section summarizes the affected environment in each biogeographic province, with respect to past harvest and other past developments on NFS and non-NFS lands. The primary sources for this information include the Tongass GIS layers, GIS layers provided by the State of Alaska, GIS layers provided by Sealaska Corporation, interpretation of aerial photographs and orthophotography to create new GIS layers, GIS layers developed by The Nature Conservancy based on satellite imagery (Albert and Schoen 2007), and the State's FRPA detailed plan of operation database of harvest activities on non-NFS lands. A tabular summary of past harvest information is presented as a catalogue of past harvest in Appendix E.

A description of the climate, topography, vegetation, and other factors related to biodiversity is provided for the 23 biogeographic provinces in Southeast Alaska in Table 3.9-1. In addition, a description of the natural history for 22 biogeographic provinces (some of these provinces follow different boundaries) in Southeast Alaska is presented by Carstensen et al. (2007). Some of the key relevant information from both of these sources is also summarized here.

In addition, these sections summarize the effects of past harvest on the biodiversity and old-growth habitats of Southeast Alaska. The effects of past harvest are differentially discussed for NFS and non-NFS lands, as well as cumulatively. A similar analysis of the current condition of old-growth integrity and biodiversity within the biogeographic provinces of Southeast Alaska is presented by Carstensen et al. (2007).

Yakutat Forelands

The Yakutat Forelands biogeographic province is a very young and nearly flat landscape at the northern end of Southeast Alaska that supports a complex mosaic of forest and wetlands. Approximately 65 percent of the province is in congressionally protected land designations (mostly in the Yakutat Forelands LUD II and Glacier Bay National Park). Private and State of Alaska lands comprise about 5 percent of the province and consist primarily of Yak-Tat Kwaan Village Corporation lands (4 percent of the province). State of Alaska lands also comprise a significant percentage (1 percent of the province).

A relatively low percentage of NFS POG has been harvested (about 4,000 acres). As a result, approximately 93 percent of the original POG on NFS land remains today. The native corporation and state lands in the province (mostly near Yakutat), have experienced relatively high harvest (about 14,000 acres); however, essentially no harvest has occurred in Glacier Bay National Park within the province. As a result, about 75 percent of the original POG remains on non-NFS lands. Most of the harvest took place in the mid-1980s or earlier, so the young growth that resulted is primarily at the end of the stand initiation stage or the beginning of the stem exclusion stage (Appendix E). Overall, 84 percent of the original POG on all lands within the province remains today. Harvest of larger tree types has occurred at a rate slightly higher than the overall rate and it is estimated that the percentage of high-volume and large-tree POG remaining today is 81 percent for both categories.

One very large block of large-tree POG exists in the upper Situk River and adjacent small watersheds, near the northeastern edge of the province. As a result of this large block and other patches, 51 percent of the existing POG in the province is mapped as high volume and 29 percent is mapped as large-tree POG. These percentages are among the highest of the provinces in Southeast Alaska, although the province includes only 89,000 acres of existing POG. However, this province is prone to extensive windthrow events, and the extensive large-tree POG in this area is susceptible to blowdown as well as future harvesting.

Past harvest has not significantly affected the biodiversity of the province or the integrity of the old-growth ecosystem, except on native corporation lands in a relatively confined area east of Yakutat where extensive harvest has taken place. Although POG has been locally harvested intensively, the overharvest of large-tree or high-volume POG has not been a significant factor in this province. Past blowdown events have also reduced the extent of old growth within the province. However, because the landscape of the Yakutat Forelands is so geologically young, this natural reduction of old growth by wind is compensated somewhat, by the natural succession of large acreages of younger forest that have colonized fresh substrates.

Yakutat Uplands

This rugged and mountainous province includes extensive active glaciers, fiords, and mountains rising from sea level to more than 10,000 feet. Approximately 38 percent of the province is in congressionally protected land designations (primarily the Russell Fiord Wilderness). Aside from a few acres of private lands (less than 0.1 percent), the province is virtually 100 percent within the Tongass National Forest.

Slightly over 1,000 of the 25,000 original acres of POG in the province have been harvested; therefore, 94 percent of the original POG remains today. Harvest of larger tree types has occurred at a higher rate so it is estimated that the percentage of high-volume and large-tree POG remaining today is 92 and 83 percent, respectively.

High-volume POG makes up almost half of the POG in the province (46 percent). However, large-tree POG comprises only 9 percent because of the lack of highly productive sites. The province contains only about 23,000 acres of existing POG. Portions of the province are prone to extensive windthrow events, as is the case for the Yakutat Forelands province.

Because past harvest has been so low in this province, little effect on the biodiversity or old-growth ecosystem integrity of the province has occurred. As is the case for the Yakutat Forelands province, wind may play the role of diminishing existing old growth, while primary succession of natural young-growth forests will contribute to the extent of POG over time.

East Chichagof Island

This rugged province is characterized by steep, U-shaped valleys and rounded mountains and is deeply dissected into three peninsulas. Karst terrain occupies high elevations and steep sideslopes, mostly above the POG, but the U-shaped valleys contain a substantial amount of valley floor POG, including large-tree types. Approximately 31 percent of the province is in congressionally protected land designations (25 percent in four LUD II areas and 6 percent in the West Chichagof-Yakobi Wilderness). Non-NFS lands comprise about 8 percent of the province, and consist primarily of Sealaska lands (5 percent of the province) and Huna Totem

Village Corporation lands (2 percent of the province). It includes the town of Hoonah and several smaller settlements including Tenakee Springs and Pelican.

Approximately 10 percent of the original POG on NFS lands has been harvested (about 44,000 acres). Most of this harvest took place in the 1970s, 1980s, and 1990s (Appendix E). On native corporation lands and other non-NFS lands in the province, approximately 38,000 additional acres or 52 percent have been harvested, primarily in the past 25 years. As a result, about 90 percent of the original POG on NFS lands, about 48 percent of the original POG on non-NFS lands, and about 84 percent of the original POG on all lands remains today. The vast majority of all harvest has taken place within the last 25 years and, therefore, the resulting young growth is in the stand initiation stage of succession. Harvest of the larger tree types (especially large-tree POG) occurred at a high rate relative to other POG types in this province, and it is estimated that 76 percent of the high-volume types and 58 percent of the large-tree types remain today.

Most high-volume and large-tree POG occurred along the shoreline and within valley bottoms in the province, and this POG was targeted by past harvest. Although only about 16 percent of all POG has been harvested in the province, approximately 42 percent of all large-tree POG and 24 percent of all high-volume POG has been harvested. This province also originally contained about 46,000 acres of POG on karst terrain. About 17 percent of this karst POG has been harvested.

Past harvest has had a substantial effect on old-growth ecosystems in some watersheds of this province. This has occurred in many of the watersheds on NFS lands of northeast and southeast Chichagof, and on native corporation lands to the south, southeast, and west of Hoonah. As noted above, overharvest of high-volume POG, and especially large-tree POG, has occurred and floodplain/valley bottom large-tree POG was targeted in the past in many of these watersheds. Because of the rugged topography of this province, the largest tree forests and the easiest access for logging were concentrated in these valley bottom areas. The rate of disproportionate harvest on NFS lands was substantially reduced with the passage of the Tongass Timber Reform Act in 1990 (which had a proportionality requirement for high vs. low volume Forest-wide) and with the adoption of the 1997 Forest Plan, which incorporates large portions of the floodplain areas on Chichagof Island within riparian buffers; however, most past harvest was conducted prior to the 1990s (Appendix E).

One area of particular concern is the narrow neck of land that connects northeast Chichagof to the main body of the island. This “pinch-point” or “bottleneck” may constrain wildlife movements and genetic interchange for other plants and animals because of the relatively narrow corridors of habitat between saltwater areas. This area has experienced some past harvest and could be significantly affected if substantial future harvest in this area were to occur. A second area of concern is the pinch-point connecting Lisianski Inlet with the North Arm of Peril Strait in the western portion of the province. However, this area lies completely within congressionally protected land designations. See the *Wildlife* section for a description of pinch-points and an analysis of the effects of additional development in these areas on wildlife movements.

West Chichagof Island

This province has a very wet climate and is exposed to outer coastal storms. It has a highly irregular shoreline with hundreds of small islands. Topography is gentler than the mountains of Baranof Island. Approximately 87 percent of the province is within congressionally protected land designations, mostly within the West

Chichagof – Yakobi Wilderness. Non-NFS lands comprise less than 0.5 percent of the province.

As a result of the high proportion of congressionally protected areas and the relatively low productivity of the province, no known harvest has taken place, either on NFS lands or on non-NFS lands. Therefore, the original percentage of high-volume and large-tree POG remain today. Approximately 24 percent of the POG in the province is high volume and 3 percent is large-tree POG. The province includes about 72,000 total acres of POG.

East Baranof Island

The East Baranof Island province is rugged and steep to saltwater, with relatively few flat lands. It includes among the highest and most rugged topography found on the islands of Southeast Alaska. Approximately 23 percent of its land area lies within the South Baranof Wilderness. Less than 1 percent of the province is comprised of non-NFS lands (the majority of which is state-owned).

Approximately 13 percent of the original POG on all lands has been harvested (about 14,000 acres), resulting in 87 percent of the original POG remaining. The majority of the harvest in this province was conducted in the 1960s (Appendix E), when relatively few restrictions on harvesting were in place. About 77 percent of the original high-volume POG and about 33 percent of the original large-tree POG remains today, indicating a high disproportionate harvest, particularly of large-tree POG.

The remaining large-tree POG is relatively scattered in small patches, often occurring in valley bottoms. However, high-volume POG occurs in many areas and along shorelines and within river valleys.

As is the case for East Chichagof, past harvest in the East Baranof Island province has had a substantial effect on old-growth ecosystems of several watersheds in the northern portion of the province. As noted for East Chichagof, overharvest of high-volume POG, and especially large-tree POG, occurred in floodplain/valley bottom areas, which were targeted because of the presence of large trees and the rugged topography elsewhere. Also as noted for East Chichagof, the rate of disproportionate harvest on NFS lands was substantially reduced with the passage of the Tongass Timber Reform Act in 1990, and with the adoption of the 1997 Forest Plan; however, most past harvest was conducted prior to the 1990s (Appendix E).

West Baranof Island

This province is similar to the West Chichagof Island Province with the exception of southern Baranof, which has exceptionally high precipitation. Baranof Island is the most rugged of all the islands in Southeast Alaska. Approximately 31 percent of the province is protected within the South Baranof Wilderness or the Enacted Municipal Watershed of Sitka. Non-NFS lands comprise about 4 percent of the province and consist of lands owned by the city and borough of Sitka, the State of Alaska, Shee Atika Village Corporation, and a variety of other private owners.

Approximately 7 percent of the original POG on NFS lands has been harvested (about 17,000 acres). On the State of Alaska and other non-NFS lands, 16 percent (2,000 acres) has been harvested. Overall, this results in 92 percent of the original POG on all lands remaining today. The vast majority of these acres were harvested 30 to 40 years ago and they are now in the stem exclusion stage of succession (Appendix E). High-volume POG was harvested at a rate higher than the overall harvest rate; 82 percent of all high-volume POG remains. Large-tree POG has been harvested at a much higher rate; an estimated 44 percent of all large-tree POG remains today.

Most remaining high-volume and large-tree POG is distributed along the shoreline and in river valleys. On all land ownerships combined, 25 percent of all POG is high volume, but only 2 percent is large-tree POG.

Although the overall rate of past harvest within the province is relatively low, the rate for the northern portion of the province is relatively high and the effects of past harvest on some watersheds in this area has also been relatively high. As noted for East Chichagof and East Baranof, overharvest of large-tree POG has occurred in floodplain/valley bottom areas, which were targeted because of the presence of large trees and the rugged topography elsewhere. As a result, less than half of the original large-tree POG in the province remains today.

Admiralty Island

The Admiralty Island Province has relatively gentle topography and moderate rainfall. Forest productivity is high. Approximately 90 percent of the province is protected within the Admiralty National Monument (Kootznoowoo Wilderness). Non-NFS lands in the province represent 4 percent of the land area and primarily consist of Shee Atika Village Corporation lands near Cube Cove, as well as lesser amounts of Sealaska Regional Corporation and State of Alaska lands and other ownerships. The village of Angoon occurs on the west side of the island and the Greens Creek mine at the north end of the island. The Greens Creek mine is the largest operating mine on the Tongass; however, it only occupies about 320 acres for facility development (see *Minerals* section).

Admiralty Island province ranks second in POG acreage relative to all other provinces in Southeast Alaska (598,000 acres). Before commercial timber harvest was initiated, it ranked third in POG acreage. Although 99 percent of the original POG on NFS lands remains today, about 72 percent (20,000 acres) of the POG on non-NFS lands has been harvested and only 28 percent is remaining. Because of the dominance of NFS lands in the province, 95 percent of the original POG remains on all lands combined. High-volume and large-tree POG have been harvested at a rate slightly higher than the overall POG harvest rate; 94 percent of all high-volume POG and 91 percent of all large-tree POG remain today.

High-volume and large-tree POG are abundant throughout the province. On all lands combined, approximately 51 percent of POG is high volume and 17 percent consists of large-tree POG. This province also originally contained about 38,000 acres of POG on karst terrain. Only about 3 percent of this karst POG has been harvested.

Although most of the province has experienced little to no past harvest, the area on native corporation lands near Cube Cove in the northwest portion of the province has been extensively harvested. Because the majority of all POG in three major adjacent drainages and adjacent areas near Cube Cove has been harvested, effects on the biodiversity and old-growth integrity in this local area have been substantial. However, the vast majority of Admiralty Island remains intact and, as a result of the abundance of POG in this province, including high-volume and large-tree POG, it represents a massive reserve and reservoir for biological diversity in Southeast Alaska.

Lynn Canal

The Lynn Canal province is characterized by rugged and glaciated topography and relatively low precipitation. The southern portion of the Chilkat Peninsula is more similar to the East Chichagof Island Province than to the rest of the province. Approximately 22 percent of the province is included within congressionally protected land designations (15 percent wilderness and 6 percent LUD II). Non-

NFS lands comprise about 4 percent of the province; the State of Alaska manages the majority of this land. The cities of Juneau and Douglas occur on the east side of Lynn Canal within the province.

Approximately 169,000 acres of POG currently exists in the province and 6,000 acres have been harvested. As a result, approximately 97 percent of the original POG remains today. High-volume POG and large-tree POG have both been harvested at a higher rate than other POG; 95 percent of high-volume POG remains, but only 88 percent of large-tree POG remains today.

The overall effects of past harvest on the biodiversity and old-growth ecosystem integrity within the province have been relatively low, because of the relatively low harvest rates. However, localized pockets of high harvest have occurred on the west side of Lynn Canal.

Northern Coast Range

The Northern Coast Range covers the rugged and glaciated coastal mountains of the northern mainland. It is characterized by deep fiords, tidewater glaciers, and active glacial rivers, including the Taku and Whiting Rivers, which extend into Canada. It also includes some less rugged topography on Douglas Island, Cape Fanshaw, and other locations. Approximately 23 percent of the province is in a congressionally protected land designation (wilderness) and an additional 1 percent is in a research natural area. Approximately 10 percent of the province (103,000 acres) is non-NFS lands, with the largest landowners being Goldbelt Village Corporation (35,000 acres), the State of Alaska (19,000 acres), and the city and borough of Juneau (19,000 acres)

Approximately 356,000 acres of POG currently exists in the province and about 21,000 acres have been harvested. Overall, 94 percent of the POG, 77 percent of the large-tree POG, and 92 percent of the high-volume POG remains today. However, almost all of the past harvest in the province is from non-NFS lands owned by Goldbelt in the vicinity of Hobart Bay. As a result, 65 percent of all POG on non-NFS lands remains and only 33 percent and 57 percent of the large-tree and high-volume POG types remains today on these lands, respectively.

On all lands combined, 7 percent of all POG is large-tree POG and 42 percent is high volume. Remaining larger tree types are well distributed at lower elevations throughout the province, except in the vicinity of Hobart Bay.

Although only about 6 percent of the original POG in the province has been harvested, as noted above, it is concentrated in the vicinity of Hobart Bay. Approximately two-thirds of the POG and a higher percentage of the larger tree types have been removed in this area on non-NFS lands. Thus, the effects of past harvest in the watersheds of this area have been relatively high.

Kupreanof/Mitkof Island

This province covers Kupreanof and Mitkof Islands in the center of Southeast Alaska and represents the province with the greatest extent of low-lying, muskeg wetlands. Because of the less rugged relief in the province, it is not as topographically fragmented as most other provinces; however, natural fragmentation of old growth does occur, due to the extensive wetlands. Approximately 6 percent of the lands of the Kupreanof/Mitkof Island province are in congressionally protected land designations; this is one of the lowest percentages in Southeast Alaska. Another 1 percent is protected in municipal watershed status. Non-NFS lands cover 90,000 acres, or 11 percent of the province. The State of Alaska is the largest individual landowner (31,000 acres), followed by Sealaska Regional Corporation (27,000 acres) and Kake Village Corporation (24,000 acres). Petersburg, Kake, and a few smaller settlements occur within this province.

POG currently exists on 335,000 acres and there has been about 71,000 acres of harvest in the province. Overall, 83 percent of the original POG remains today; however, 90 percent of NFS POG and 46 percent of non-NFS POG remains. Disproportionate harvest of larger tree types has occurred on NFS lands; about 65 percent of the original large-tree POG and 81 percent of the original high-volume POG remains. Disproportionate harvest has occurred even more intensively on non-NFS lands; only 8 percent of the original large-tree POG and 28 percent of the original high-volume POG remains. As a result of past disproportionate harvest and the relatively low original proportion of larger tree types in this province, large-tree POG and high-volume POG make up only about 6 percent and 32 percent of existing POG, respectively.

Harvest has occurred in many areas throughout the province and the remaining POG is also distributed throughout. However, the northwest corner of Kupreanof Island, near Kake, has been the most extensively harvested. The heavy POG harvest, especially of the larger tree types, has likely negatively affected biodiversity in this area.

One area of particular concern in this province is the narrow area between Lindenburg Peninsula and the remainder of Kupreanof Island. This pinch-point may constrain wildlife movements and genetic interchange for other plants and animals because of the relatively narrow corridors of habitat between saltwater areas. These areas have experienced some past harvest and could be significantly affected if substantial future harvest were to occur in this area. However, this area is largely protected by the Petersburg Creek-Duncan Salt Chuck Wilderness. See the *Wildlife* section for a description of pinch-points and an analysis of the effects of additional development in these areas on wildlife movements.

<u>Kuiu Island</u>

The Kuiu Island province has gentle topography relative to adjacent Baranof Island or the mainland. Kuiu Island is deeply dissected, creating several prominent peninsulas and obstacles to wildlife movements. Approximately 27 percent of the province is in congressionally protected land designations (mostly wilderness). The province is 99 percent NFS lands; only a few thousand acres are owned by others.

Approximately 296,000 acres of POG, containing about 12 percent large-tree POG and 53 percent high-volume POG, remains in the province. This compares with an estimated 325,000 original acres of POG, containing about 14 percent large-tree POG and 54 percent high-volume POG, indicating a slightly higher rate of past harvest of the larger tree types for all lands combined. Overall, 91 percent of all POG, 90 percent of high-volume POG, and 82 percent of large-tree POG remains today.

Most past harvest occurred in this province during the 1970s and 1980s (Appendix E). Although logging has occurred in many portions of the province, the southern two-thirds of the province has experienced relatively low rates of harvest. In contrast, the northern one-third of the island has undergone fairly extensive harvest, which began relatively intensively in the late 1960s. Because much of this logging occurred in the early years, prior to the implementation of many Forest Plan protections, some fairly extensive tracts are now in the stem exclusion stage of succession. Some of these watersheds with extensive early harvest have experienced relatively high old-growth fragmentation and effects on biodiversity.

One area of particular concern in this province is the narrow neck of land between the Bay of Pillars and Port Camden and the portage between Port Camden and

Threemile Arm, which connect the northern and eastern parts of the island to the rest of Kuiu Island. These pinch-points may constrain wildlife movements and genetic interchange for other plants and animals because of the relatively narrow corridors of habitat between saltwater areas. These areas have experienced some past harvest and could be significantly affected by substantial future harvest, if it were to occur. See the *Wildlife* section for a description of pinch-points and an analysis of the effects of additional development in these areas on wildlife movements.

Central Coast Range

The Central Coast Range covers the rugged and glaciated coastal mountains of the central mainland. It is similar to the Northern Coast Range, although it is less precipitous and warmer. The Stikine River system traverses the center of this province and has a major continental influence on it. Approximately 37 percent of the province is protected within the large Stikine-LeConte Wilderness. NFS lands comprise 97 percent of the province, State of Alaska lands cover 2 percent, and there are no other landowners with more than a few hundred acres.

POG currently exists on 251,000 acres and there has been about 8,000 acres of past harvest. Overall, 97 percent of the original POG remains today. Disproportionate harvest of larger tree types has occurred to some degree; about 95 percent of high-volume POG and 89 percent of large-tree POG remains today. High-volume and large-tree POG represent about 42 percent and 8 percent of the remaining POG, respectively.

The majority of the watersheds in the province have experienced no past harvest to very minor effects from past timber harvest. Exceptions are watersheds in the Thomas Bay area and the Bradfield River drainage. Relatively high rates of past harvest, including large-tree harvest, have had some negative effects on old-growth integrity and biodiversity in these watersheds.

Etolin Island and Vicinity

The Etolin Island and Vicinity province includes Etolin, Wrangell, Zarembo, and smaller islands. It is similar to the Kupreanof/Mitkof province and is subject to continental influence from the mainland and the Stikine River. Congressionally protected land designations (South Etolin Wilderness) cover 16 percent of the province and 95 percent of the province is under national forest management. The State of Alaska manages almost 5 percent of the province and the city of Wrangell owns almost 1 percent.

Approximately 232,000 acres of POG, containing about 35 percent high-volume POG and 6 percent large-tree POG, remains in the province. This compares with an estimated 273,000 original acres of POG, containing 39 percent high-volume POG and 9 percent large-tree POG, indicating a higher rate of past harvest of the larger tree types. Overall, 85 percent of all POG, 76 percent of high-volume POG, and 51 percent of large-tree POG remains today. Although disproportionate harvest has occurred on all ownerships, non-NFS lands have had the highest rate of disproportionate harvest; the 4,000 acres of past harvest on non-NFS lands included 39 percent of the high-volume and 80 percent of the large-tee POG.

Most harvest in this province occurred in the 1970s and 1980s (Appendix E). Harvest has occurred throughout the province, but especially on northern Etolin and Zarembo Islands, central Wrangell Island, and many of the smaller islands in the province. Watersheds containing the highest rates of past harvest include those on northwest Zarembo Island and the majority of Vank and Sokolof Islands. Past harvest in these areas and on some state lands has had negative effects on local biodiversity.

North Central Prince of Wales Island

The North Central Prince of Wales Island province covers the northern and central portions of Prince of Wales Island and some adjacent islands. It has relatively gentle topography and extensive areas of karst and limestone soils. Approximately 8 percent of the province is protected in congressional land designations (wilderness and LUD II) and approximately 79 percent of the province is under national forest management. Other major landowners include: Sealaska Regional Corporation (11 percent), State of Alaska (5 percent), Kavilco Village Corporation (2 percent), Klawock-Heenya Village Corporation (2 percent); Shan-Seet Village Corporation (1 percent); and Haida Village Corporation (1 percent). A number of small towns and settlements occur within the province including Craig, Klawock, Thorne Bay, Hydaburg, Coffman Cove, Hollis, and others.

The North Central Prince of Wales Island province originally contained more POG than any other province in Southeast Alaska and, after half a century of commercial timber harvest, it still does. The province currently contains 599,000 acres of POG; about 320,000 acres or 35 percent of the original POG have been harvested. Approximately 74 percent of the original POG remains on NFS lands and 38 percent remains on non-NFS lands. For high-volume POG, an estimated 66 percent remains on NFS lands and 24 percent remains on non-NFS lands. Similarly, for large-tree POG, an estimated 69 percent remains on NFS lands and only 12 percent remains on non-NFS lands.

Almost all of the past harvest on NFS lands took place in the 1960s through the 1990s, with the majority occurring in the 1960s and 1970s. On non-NFS lands, most of the harvest took place in the 1980s and 1990s, with substantial acreage harvested in the current decade as well (Appendix E). Therefore, a mixture of age groups occurs and the young growth in this province is split between the stand initiation and stem exclusion stages of plant succession.

This province originally contained about 152,000 acres of karst POG, or almost half of the karst POG within the Forest boundary in Southeast Alaska. About 72,000 acres, or 47 percent, has been harvested. This percentage climbs to about 52 percent if only karst POG at low elevations (less than 800 feet) is considered.

On NFS lands, 44 percent of the existing POG is high volume and 23 percent is large tree POG. On non-NFS lands, 31 percent of existing POG is high volume and 8 percent is large tree POG. Overall, 42 percent of the remaining POG on all lands is high volume and 20 percent is large tree POG. Because of its abundance, POG is still well distributed within the province; however, there are many areas of past intensive harvest where negative effects on biodiversity have likely occurred. These areas include parts of northern Prince of Wales Island; the Staney Creek, Thorne Bay, Big Salt, Craig/Klawock, and Hollis areas of central Prince of Wales Island; and much of Kosciusko and Tuxekan Islands.

One area of particular concern in this province is the Neck Lake area, which is a relatively narrow piece of land between Whale Passage and El Capitan Passage connecting the extreme northern Prince of Wales to the remainder of the island. This pinch-point could constrain wildlife movements and genetic interchange for other plants and animals because of the relatively narrow corridors of habitat between saltwater areas. In addition, this area has experienced relatively high past harvest and could be significantly affected by substantial future harvest, if it were to occur. See the *Wildlife* section for a description of pinch-points and an analysis of the effects of additional development in these areas on wildlife movements.

In addition, Sulzer Portage, a relatively narrow neck of land on Prince of Wales Island connecting West Arm Cholmondeley Sound and Portage Bay at the head of Hetta Inlet. It joins the North Central Prince of Wales and the South Prince of Wales Island provinces and has had considerable past timber harvest. Due to recent land selections, the immediate portage is entirely on non-NFS lands. Substantial future harvest, if it were to occur, could substantially affect ecological connectivity. See the *Wildlife* section for a description of pinch-points and an analysis of the effects of additional development in these areas on wildlife movements.

Revilla Island/Cleveland Peninsula

This province includes Revillagedo (Revilla), Gravina, Annette, Duke, and smaller islands, as well as the Cleveland Peninsula portion of the mainland. Approximately 23 percent of the province is in congressionally protected land designations (wilderness national monument and LUD II) and an additional 1 percent is in a municipal watershed status. About 85 percent of the province is under national forest management. The Annette Island Indian Reservation is the second largest ownership with 7 percent of the province, the State of Alaska is the third largest landowner with 5 percent, followed by Cape Fox Village Corporation at 2 percent, and Sealaska Regional Corporation at 1 percent. The cities of Ketchikan, Saxman, and Metlakatla occur within the province.

This province has the third largest number of acres of POG among all Southeast Alaska provinces. Approximately 573,000 acres of POG currently exist in the province, and 70,000 acres have been harvested. The remaining POG consists of 41 percent high-volume POG and 6 percent large-tree POG. Originally, 44 percent of the POG was high volume and 9 percent was large-tree POG, indicating a higher rate of past harvest of larger tree types. Overall, 89 percent of all POG, 84 percent of high-volume POG, and 59 percent of large-tree POG remains today. Although disproportionate harvest occurred on all ownerships, non-NFS lands had the highest rate of disproportionate harvest: the 25,000 acres of past harvest on non-NFS lands included 38 percent of the high-volume and 91 percent of the large-tree POG.

Harvest on NFS lands in this province has been relatively evenly distributed over time beginning in the 1950s, with the highest decadal harvest in the 1990s (Appendix E). Harvest on non-NFS lands has generally occurred in the more recent decades. Relatively high concentrations of past harvest have occurred at a number of areas along Behm Canal, George Inlet, Carroll Inlet, and near Ketchikan on Revilla Island and on northern Annette Island. In many of these areas, biodiversity has been affected due to the intensity of past harvest and the higher reductions in larger tree POG types.

Southern Outer Islands

The Southern Outer Islands is a small, isolated province subject to strong oceanic influences. Topography is low-lying and gentle and the islands are relatively rich in endemic vertebrate species. Almost half (49 percent) of the province is in congressionally protected land designations (wilderness and LUD II) and 94 percent of the province consists of NFS lands. Other major landowners include: Shaan-Seet Village Corporation (3 percent); State of Alaska (2 percent); and Sealaska Regional Corporation (1 percent).

The province contains a high proportion of POG relative to its size. It contains about 118,000 acres of existing POG and 21,000 acres of harvest have occurred; thus, the remaining POG represents 85 percent of the original POG acreage. The majority of the islands in the province have had little or no past harvest; harvest has been concentrated on Heceta Island, and to a lesser extent on San Juan Batista and Suemez Islands. Most NFS harvest was conducted in the 1960s through the 1980s

(Appendix C). Heceta Island is mostly covered with karst terrain and limestone soils and originally contained fairly extensive stands of large-tree karst POG; most of these stands have been cut. Today, about 38 percent of the existing POG within the province is high-volume and 11 percent is large-tree POG. On NFS lands, 88 percent of the original POG remains, while on non-NFS lands only 46 percent remains. About 82 percent of the original NFS high-volume POG remains compared with only 33 percent of the original high-volume POG on non-NFS lands. Similarly, 74 percent of the original large-tree POG exists today on NFS lands, while only 16 percent of original large-tree POG remains on non-NFS lands. This province originally contained about 39,000 acres of POG on karst terrain. To date, about 36 percent of this karst POG has been harvested.

Effects of past harvest have been slight to non-existent on most portions of most of the islands in the province. However, extensive past harvesting on Heceta Island, on both NFS and non-NFS lands, have affected the biodiversity in a number of the watersheds.

Dall Island and Vicinity

This province is located at the extreme southwestern corner of Southeast Alaska and, like the Southern Outer Islands province, is subject to strong oceanic influences. Unlike the Southern Outer Islands province, the topography of the Dall Island and Vicinity province is rugged and dissected with abundant limestone outcrops. The province includes Dall Island and Long Island along with numerous small islands. Approximately 3 percent of the province is in congressionally protected land designations and only 56 percent of the province consists of Tongass National Forest lands. This province has the lowest proportion of NFS lands of any province within the Tongass Forest boundary. Other major landowners include: Sealaska Regional Corporation (29 percent); Klukwan Village Corporation (11 percent); Haida Village Corporation (1 percent); and the State of Alaska (1 percent).

The Dall Island and Vicinity province contains approximately 100,000 acres of POG and has experienced 33,000 acres of harvest, almost all of which is on non-NFS lands. Almost all of this harvest was conducted either in the 1980s or in the last 10 years (Appendix E), so the majority of the young growth is still in the stand initiation successional stage. Approximately 99 percent of the original POG remains on NFS lands, along with 99 percent of the original high-volume POG and 99 percent of the original large-tree POG. On non-NFS lands, 49 percent of the original POG is remaining, while 33 percent of the original high-volume POG and 8 percent of the original large-tree POG remains today, indicating substantial disproportionate harvest of large-tree POG. This province originally contained about 12,000 acres of POG on karst terrain. To date, at least 10 percent of this karst POG has been harvested.

Much of the past harvest took place on private lands on Long Island, where extensive stands of large-tree POG originally existed. The province is believed to have originally contained the best representation of large-tree karst forest in Southeast Alaska (Carstensen et al. 2007). The biodiversity of watersheds on much of northern Long Island has been substantially modified due to expansive harvesting in this area. This level of modification has also occurred in some watersheds on eastern Dall Island.

South Prince of Wales Island

The South Prince of Wales Island biogeographic province covers the southern quarter of Prince of Wales Island and is characterized by steep and rugged topography and a highly dissected coastline. It is relatively warm and wet and provides habitat for plant species that do not grow further north. Approximately 28 percent of the province is in congressionally protected land designations (South Prince of Wales Wilderness and Nutkwa LUD II) and the majority of the province is roadless. Non-NFS lands comprise about 8 percent of the land area, about two-thirds of which is owned and managed by Kootznoowoo Village Corporation. Haida Village Corporation, the State of Alaska, and other parties comprise the remaining owners.

The province currently contains about 173,000 acres of POG and has had about 18,000 acres of past harvest. With the exception of the Chasina Peninsula in the northeast, relatively little past harvest has occurred on NFS lands in the province (about 3,000 acres). As a result, approximately 98 percent of the original POG on NFS land remains. Non-NFS lands have been relatively heavily harvested (approximately 14,000 acres) with approximately 43 percent of the original POG remaining. Counting all ownerships, 91 percent of the original POG remains. Harvest is concentrated in the northern portion of the province on the Chasina Peninsula and along Cholmondeley Sound. Although high-volume and large-tree POG have been harvested at higher rates than smaller tree types, it is estimated that 88 percent of both high-volume and large-tree POG remains in the province on all lands combined. However, the percent of these types remaining is much lower in local areas with the highest rates of harvest (e.g., Chasina Peninsula and Cholmondeley Sound).

Extensive tracts of high-volume POG, including large-tree forests, occur within the northwestern portion of the province and are mostly protected within the Nutkwa LUD II area. Because of these tracts and other areas of high-volume and large-tree POG, these types make up high percentages of the existing POG relative to other Southeast Alaska provinces (51 and 29 percent, respectively).

One area of particular concern on the edge of this province is the Sulzer Portage, a relatively narrow neck of land on Prince of Wales Island connecting West Arm Cholmondeley Sound and Portage Bay at the head of Hetta Inlet. It joins the North Central Prince of Wales and the South Prince of Wales Island provinces and has had considerable past timber harvest. Due to recent land selections, the immediate portage is entirely on non-NFS lands. Substantial future harvest, if it were to occur, could substantially affect ecological connectivity. See the *Wildlife* section for a description of pinch-points and an analysis of the effects of additional development in these areas on wildlife movements.

North Misty Fiords

The North Misty Fiords province has considerable topographic relief and a cold, mainland-type climate with many glaciers. Vegetation occurs in long, narrow strips along river valleys and lower slopes of fiords. The province is 99 percent NFS lands and 82 percent of the province is protected within the Misty Fiords National Monument, which is in wilderness status. The State of Alaska is the only other major landowner with 1 percent of the province.

The province contains 201,000 acres of existing POG and only 2,000 acres of past harvest. Thus, 99 percent of the original POG, 98 percent of the original high-volume POG, and 95 percent of the original large-tree POG remains today. High-volume and large-tree POG represent 33 percent and 6 percent of the existing POG, respectively. Because of the low degree of past harvest, their effects are relatively minor throughout the province.

South Misty Fiords

The South Misty Fiords province has lower topographic relief and is warmer than the North Misty Fiords province, but otherwise it is typical of the other mainland provinces. Forest vegetation is more diverse than the other coastal provinces, and vegetation is less fragmented by rock and ice than the North Misty Fiords province. The southwestern portion of the province is rolling, nearly continuous muskeg with conifer forests in the bottoms and flats. Approximately 99 percent of the province is in congressionally protected land designations (Misty Fiords National Monument) and nearly 100 percent is on NFS lands. The State of Alaska is the only other major landowner with less than 1 percent of the province.

The province contains 310,000 acres of existing POG and no measurable past harvest. Thus, 100 percent of the original POG, 100 percent of the original high-volume POG, and 100 percent of the original large-tree POG remains today. High-volume and large-tree POG represent 31 percent and 5 percent of the existing POG, respectively. Because of the lack of past harvest, no effects from past timber harvest have occurred within the province.

Ice Fields

The Ice Fields province covers the highest mountains along the eastern boundary of Southeast Alaska with Canada. It is dominated by permanent ice fields, active glaciers, and nunataks (mountain peaks between glaciers). Approximately 33 percent of the province is in congressionally protected land designations (wilderness or national monument) and nearly 100 percent is on NFS lands. The State of Alaska is the only other major landowner with less than 1 percent of the province.

The province contains 115,000 acres of existing POG in narrow bands along mountain valleys, and 4,000 acres of past harvest. Thus, 97 percent of the original POG, 93 percent of the original high-volume POG, and 83 percent of the original large-tree POG remains today. High-volume and large-tree POG represent 32 percent and 5 percent of the existing POG, respectively. Because of the low level of past harvest in this province, the effects of past harvest are localized and relatively minor throughout the province.

Chilkat River Complex

The Chilkat River Complex lies at the northern end of the Inside Pasage and is outside the Tongass Forest boundary. It consists of tall ridge systems, large glacial rivers, and includes glaciers and snowfields. Many of the rivers and drainage basins extend across the international boundary into Canada. Because of the overlap of coastal and interior floras and faunas, the province contains Alaska's highest vascular plant species richness and the highest mammalian diversity in Southeast Alaska (Carstensen et al. 2007). The province is located outside the Tongass Forest boundary and has 2 percent of its lands in a congressionally protected status. Although an additional 10 percent is administratively protected, the province has the lowest overall percentage of lands in a status that restricts development of all Southeast Alaska provinces. Approximately 59 percent of the province consists of state lands, including the 286,000-acre Haines State Forest, the 45,000-acre Chilkat Bald Eagle Preserve, and 242,000 acres of other state lands. The Bureau of Land Management manages about 39 percent of the province, small edges of Glacier Bay National Park represent about 1 percent, and other landowners, including the cities and boroughs of Haines and Skagway, comprise the remaining 1 percent.

The province contains about 145,000 acres of POG and about 21,000 acres have been harvested. The result is that approximately 88 percent of the original POG in the province remains today. Large-tree POG has been harvested at a higher rate; about 73 percent remains. However, about 89 percent of the original high-volume POG is estimated to remain, indicating a non-disproportionate harvest for the high-volume POG types as a group.

Although only about 13 percent of the original POG in the province has been harvested, about 27 percent of the large-tree POG has been logged and harvest has been concentrated within the Haines State Forest near the confluences of the Chilkat River with the Klehini and Kelsall Rivers. Thus, the effects of past harvest in these local areas have been relatively high.

Glacier Bay/Fairweather Range

The Glacier Bay/Fairweather Range province is the largest province in Southeast Alaska (2.5 million acres), but the vast majority of it is high mountains and glaciers and the majority is non-vegetated. The highest peaks are in the Fairweather Range along the western edge of the province, with Mt. Fairweather at over 15,000 feet. A large flat, foreland, the Gustavus Foreland, occurs in the area around Gustavus and to the north in the Bartlett River valley. Lowlands are also fairly extensive along the Dundee River and other smaller drainages on the southwest side of Glacier Bay. Glacier Bay National Park protects virtually the entire province (97 percent), except for about 75,000 acres in the vicinity of Gustavus. There are no NFS lands in the province.

Although approximately 171,000 acres of POG exist in the lowlands of the province, only a small fraction (< 0.5 percent) has been harvested. High-volume POG makes up the vast majority of the POG in the province (an estimated 92 percent), but large-tree POG is relatively rare (< 1 percent).

The effects of past harvest on the biodiversity and old-growth ecosystem integrity of the province has been insignificant because of the insignificant amount of past harvest. Primary succession of natural young-growth forests will contribute to the extent of POG over time.

Fragmentation

The Tongass National Forest is characterized by fragmentation on many scales and this fragmentation is the result of different processes. Fragmentation occurs when large blocks of habitat are broken into smaller parcels by natural (e.g., wind throw, landslides, soil slumping, erosion, insects and diseases, and avalanches) or human induced (e.g., roads or timber harvest operations) forces. From a regional perspective, the Tongass National Forest is highly fragmented due to numerous islands and dramatic topographic relief. At a landscape level across the project area, the natural distribution of POG forest is quite patchy and is linear in many areas, with fragmentation created by muskeg, forested wetlands, and alpine areas.

On a small scale, single-tree gaps within a 400-year-old Sitka spruce stand provide habitat for forest interior birds such as the hairy woodpecker. On a broader scale, large patches of wind disturbance of 10 acres or more may create nesting habitat for migratory songbirds, or increase the growth of understory forage for some species such as deer.

Timber harvest operations, including road-building, add to the level of fragmentation or edge that occurs naturally. The effect of timber-harvest varies with the placement of units and their proximity to large existing forest blocks. Simulation studies have indicated that when 50 percent of a watershed is harvested with a staggered setting design, little if any interior forest remains. As habitat becomes fragmented, residual habitat patches become smaller and more isolated from each other. Whether a particular patch pattern and degree of fragmentation is beneficial or deleterious depends largely on the characteristics of the species using the landscape (Morrison et al. 1992). Some species, particularly those with limited mobility such as small mammals may view open spaces (natural or human-induced) as travel barriers. Fragmentation may increase the risk of predation by avian, and mammalian carnivores, or increase isolation between other subpopulations which in turn may increase the risk of local extirpation.

Timber harvest tends to increase forest fragmentation and the amount of forest edge. The edges between different forest types, and between forested and non-forested areas, can affect the environment close to the edge. For example, forest edges tend to be warmer in the summer and cooler in the winter than interior forests (Franklin 1993). Some species increase in abundance close to an edge while others decrease in abundance. Species associated with interior forests but not with forest edges are of concern since timber harvest tends to decrease the amount of interior forest. Concannon (1995) noted that the edge effect or depth-of-edge influence distance varied by such factors as forest type, tree density, site aspect, slope, solar insolation, aspect, slope, latitude, season, and edge type (e.g., peatland, shoreline). Edge effects ranged from 30 to over 200 meters (from approximately 100 feet to over 660 feet) from an edge. Edge effects change as forest grows; however, there is little information on how that may reduce overall effects over time.

Patches of old-growth forest sometimes serve as the only habitat in a landscape for many lichens, fungi, bryophytes, plants, and small-bodied animals, all of which contribute to the biodiversity and productivity of the forest ecosystem. These patches may be critical for species that are locally endemic, occur only in very specific conditions of forest structure or soil, or have limited dispersal capabilities. These issues are typically assessed in detail during project-level analysis.

The framework of the old-growth forest conservation strategy in the current Forest Plan consists of a network of small, medium, and large old-growth reserves (OGRs), specifically designed to conserve habitats of the species that have the most viability concerns. It was designed, in part, to recognize and account for current conditions within each biogeographic province, and to better maintain future old-growth forest in provinces where past harvest has been high. A second component of the old-growth forest conservation strategy in the 1997 Forest Plan is the set of standards and guidelines that protect specific areas (e.g., 1,000-foot-wide beach fringe) and provide habitat connectivity in those areas with LUD allocations that permit commercial timber harvest.

To preserve the integrity of the old-growth ecosystem on the Tongass National Forest, project-level analyses are conducted at the landscape scale to identify blocks of contiguous old-growth forest within already identified large and medium reserves and other natural setting LUDs. Landscape connectivity among these blocks is evaluated during this analysis (see Chapter 4 of the Forest Plan, Landscape Connectivity Standard and Guideline).

Intact Watersheds

Another way of evaluating fragmentation and biodiversity in general is through considering the degree to which areas have been modified or developed by humans on a large watershed scale and then assessing effects on the watersheds that have undergone little if any previous modification. For this analysis, the VCU is used to define large watersheds. VCUs are Tongass land divisions with boundaries that typically follow watershed divides and encompass one or more stream systems. There are about 945 VCUs on the Tongass and they average about 18,000 acres in size.

Intact watersheds are defined here as those having less than 5 percent of their POG harvested, which is consistent with a similar analysis conducted by Audubon Alaska and The Nature Conservancy (Albert and Schoen 2007). This measure provides land managers with a means to assess the extent to which the Tongass consists of intact, undeveloped, and fully functional landscapes (a measure of conservation representation), and provides a means of assessing future changes expected under various management alternatives. Fully functional landscapes are defined as areas that maintain focal species, communities, and/or systems, and their supporting ecological processes within their natural ranges of variability (Poiani et al. 2000). Thus, functional landscapes are an important element in the conservation of biodiversity and can be used as a means to identify areas of biological importance. The use of a 5 percent POG harvest criterion for this classification is not meant to imply that a watershed must exceed this threshold to be fully functional. It is highly likely that many watersheds remain fully functional at harvest levels significantly above this level. It is used simply to provide an index or a measure of the proportion of watersheds that are intact and in relatively pristine condition.

Table 3.9-11 summarizes the number and acreage of intact large watersheds within each biogeographic province inside the Tongass Forest boundary. Overall, approximately 67 percent of the large watersheds and 72 percent of the acreage are estimated to be intact. Biogeographic provinces with the highest acreages of intact watersheds include the six biogeographic provinces along the mainland south of Skagway and the Admiralty Island province. Others that contain at least 0.5 million acres in intact watersheds include the East Chichagof, West Baranof, and Lynn Canal provinces. Those provinces with less than 50 percent of their large watersheds considered to be intact include Kupreanof/Mitkof, Etolin Island and Vicinity, and North Central Prince of Wales. Audubon Alaska and The Nature Conservancy (Albert and Schoen 2007) conducted a similar comparison of watersheds with greater than 95 percent of POG intact for all of Southeast Alaska. They found that approximately 71 percent of the landbase in Southeast Alaska still exists within these intact landscapes, and that much of this area was concentrated along the rugged mainland coast and Glacier Bay.

Table 3.9-11
Number and Acreage of Existing Intact* Large Watersheds (VCUs) by Biogeographic Province within the Tongass Forest Boundary

	Biogeographic Province	Total Number of Large Watersheds (VCUs) [1/]	Percent of Intact Large Watersheds (VCUs) [1/]	Approximate Total Acreage in Large Watersheds	Percent of Acreage in Intact Large Watersheds
1	Yakutat Forelands	24	83%	344,231	80%
2	Yakutat Uplands	26	96%	916,929	99%
3	East Chichagof Island	87	53%	1,129,840	49%
4	West Chichagof Island	31	100%	287,518	100%
5	East Baranof Island	22	55%	394,381	60%
6	West Baranof Island	43	65%	797,901	69%
7	Admiralty Island	60	88%	1,085,689	85%
8	Lynn Canal	50	76%	671,845	80%
9	North Coast Range	49	90%	1,111,396	94%
10	Kupreanof/Mitkof Island	35	37%	842,334	39%
11	Kuiu Island	30	73%	493,252	60%
12	Central Coast Range	29	79%	729,163	85%
13	Etolin Island	27	33%	518,932	30%
14	North Central Prince of Wales	116	24%	1,488,826	17%
15	Revilla Island/Cleveland Peninsula	84	68%	1,347,381	71%
16	Southern Outer Islands	20	50%	223,986	64%
17	Dall Island and Vicinity	35	71%	200,222	53%
18	South Prince of Wales	36	78%	395,076	75%
19	North Misty Fiords	32	94%	975,904	96%
20	South Misty Fiords	54	100%	906,047	100%
21	Ice Fields	57	93%	3,006,309	94%
	Total	**947**	**69%**	**17,867,163**	**74%**

[1] Intact is defined here as those watersheds having less than 5 percent of their POG harvested and not containing other major disturbances (e.g., large mines, communities, major roads).

Endemism

Endemic species are species that are isolated to islands or specific geography that potentially have an increased risk of adverse effects associated with management or natural disturbance. For example, these species may not be able to travel between islands or may be adapted to living in a very specific habitat that has a limited distribution. Species tied to island archipelagos are more sensitive to the effects of introduced non-natives, including pathogens and disease, and natural events, such as climate change, than other managed landscapes due to their limited mobility and isolation from other subpopulations (Cook et al. 2006). Therefore, there is a higher probability of extinction on islands. Risk assessment panels, convened prior to the 1997 Forest Plan, determined that endemic mammals were the most sensitive of all wildlife species to future landscape disturbances, such as that resulting from timber harvesting (Swanston et al. 1996). Such disturbances affect the likelihood of maintaining viable, well-distributed populations of endemic mammals across the Forest.

Southeast Alaska has been found to be a region with an especially high degree of endemism in its small mammal fauna, principally because of its archipelago geography combined with highly dynamic glacial history and resulting natural “pinch points” or "bottle-necks" where natural features (e.g., mountains or water bodies) or human caused features (e.g., roads and harvest units) constrain potential movement by wildlife to narrow bands of habitat. For example, some islands do not support particular species even though suitable habitat exists (e.g., there are no brown bears on Prince of Wales Island or wolves on Admiralty, Baranof, or Chichagof islands). Other species have restricted habitat requirements. Small mammals appear to be most diverse in scrub and herbaceous habitat associations and were least abundant and diverse in closed-canopy, even-aged (young growth) coniferous forest types and pine muskegs (MacDonald and Cook 2000). Between 1990 and 2005, 111 islands on the Tongass were surveyed for mammals, though much of this effort occurred prior to 2000 (Tongass Conservation Strategy Review Workshop 2006). This has resulted in the documentation of new distributions, new species, and distinct populations that also suggest a high level of endemism on the Tongass (see the *Wildlife* section for additional discussion). There continue to be gaps in knowledge about the natural history, ecology, and distribution of wildlife subspecies indigenous to Southeast Alaska (Hanley et al. 2005), and continued research will help to fill current gaps for some species. Additional species-specific discussion can be found in this chapter under the *Wildlife*, *Plant*, and *Fish* sections.

Invasive Species

Alaska has, until recently, been relatively isolated from invasive species, due to climatic conditions, large undeveloped areas, limited transportation routes, and sparse human population centers (Fay 2002). Schrader and Hennon (2005) assessed the current status of invasive species in Alaska's ecosystems, which include non-native plants, fish, wildlife, and other species, emphasizing the Chugach and Tongass National Forests. More than 130 non-native plant species have been recorded in Alaska through 2005 (AKEPIC 2006). Eighty-eight species of non-natives have been recorded on the Tongass, 46 have an invasiveness ranking according to their invasive characteristics and threat to Alaska, with 29 of those species identified as having a greater potential threat to Alaska. Fifteen of the species found on the Tongass are among the species that pose a greater potential threat (see the *Plant* section in this chapter for additional discussion on non-native plants).

Although many non-native wildlife species have been introduced or transplanted in Alaska, with the exception of rats in coastal ecosystems and possibly slugs in estuaries, none is considered invasive at the present. Additional discussion on terrestrial wildlife invasives are discussed in the *Wildlife* section of this chapter.

Schrader and Hennon (2005) identified 11 aquatic species in their assessment. Six species have already established breeding populations in National Forest lands and other areas in Alaska and include northern pike (*Esox lucius* Linnaeus), yellow perch (*Perca flavescens*), redlegged frog (*Rana aurora*), Pacific chorus frog (*Pseudacris regilla*), rainbow trout (*Oncorhynchus mykiss* Walbaum), and brook trout (*Salvelinus fontinalis*). The other five species are not established in Alaska yet, but cause widespread problems in the lower 48 states and could become problematic in Alaska. These species of concern are the Atlantic salmon (*Salmo salar)*, Chinese mitten crab (*Eriocheir sinesis*), New Zealand mudsnail (*Potamopyrgus antipodarum* Gray), goldfish (*Carassius auratus*), and the signal crayfish (*Pacifacstacus leniusculus*). In Alaska, established populations of northern pike (with the exception of Pike Lakes on the Yakutat Ranger District) pose the greatest immediate concern, while the Atlantic salmon, Chinese mitten crab, and New Zealand mudsnail species are likely to invade Alaska in coming years (Fay 2002). Invasive tree pathogens are not currently damaging Alaskan ecosystems, but there are numerous species that could cause widespread tree mortality if introduced.

Four introduced insects are currently established in Alaska: the larch sawfly, alder woolly aphid, spruce aphid, and amber-marked birch leafminer. These insects can cause widespread tree defoliation and mortality. A number of exotic insects pose a potential threat and are related primarily to transport of infested plant and wood products.

Managing invasive species on the Tongass National Forest will likely be challenging in the future. Increased public awareness at all levels coupled with interagency cooperation and development of cooperative management partnerships is needed to limit invasive species populations at current levels in Alaska.

The Forest Service is addressing invasive plant management through the Alaska Region Invasive Plant Strategy (USDA Forest Service 2005a) and the Tongass National Forest Invasive Plant Management Guides (Lerum and Krosse 2005). Within the Forest Service, various approaches are in place to address four action elements (prevention, early detection and rapid response, control, and restoration) in the National Strategy and Implementation Plan for Invasive Species Management (USDA Forest Service 2004f). See the *Plants* section in this chapter for more information on management of non-native plant species.

Environmental Consequences

Old-growth forests, which cover more than half of the 16.8 million acres of the Tongass, provide the primary habitat for the majority of terrestrial plant and animal species. They also represent ecosystems with uniquely defined characteristics and are the habitat types most affected by timber management activities; therefore, they are the most affected ecosystems on the Tongass, and the following discussion focuses on general effects on old-growth forest ecosystems.

Direct and Indirect Effects

This analysis of effects on biodiversity is subdivided into a number of sections. The first section focuses on effects associated with anticipated changes to old-growth forest representation over time, related to timber harvest. Associated with the evaluation of the effects on representation, are the effects on the elements of the old-growth forest conservation strategy for each alternative, including the coarse-filter (forest-wide system of old growth reserves) and fine-filter (standards and guidelines) components. Smaller sections address the effects on fragmentation and intact watersheds, endemics, and invasive species. The final section of this analysis evaluates the cumulative effects on biodiversity of the proposed Forest Plan adjustment in conjunction with past, present, and reasonably foreseeable activities on both NFS) and non-NFS lands (including private, state, and other ownerships).

Measurement of Effects

To quantify potential effects on biodiversity, the alternatives can be compared in terms of their ability to maintain a functional and interconnected old-growth ecosystem. Functional refers to the ability of an ecosystem to maintain or contribute to the maintenance of populations that use it, and to contribute to the diversity and productivity of other ecosystems. Examples of ecosystem functions include providing habitat for organisms, climatic buffering, soil development, and the maintenance of soil productivity through inputs of coarse woody debris, nitrogen fixation, spread of biotic and abiotic disturbance through landscapes, and nutrient cycles.

The interconnectedness of an ecosystem is a measure of the extent to which the landscape pattern of the old-growth ecosystem provides for biological and ecological flows to sustain old-growth associated animal and plant species across the Tongass and Southeast Alaska. Connectivity does not necessarily mean that old-growth areas need to be physically joined in space, because most associated species can disperse across areas that are not in old-growth ecosystem conditions. Landscape features affecting connectivity of old-growth ecosystems include the distances between old-growth reserve areas and forest conditions in the areas between the reserve areas (matrix lands).

Given that Southeast Alaska consists of many islands, connectivity issues should include landscape level connections between individual islands as well as between islands and the mainland portion of Southeast Alaska; however, current and future forest management activities are expected to have a greater influence on within-island conditions than between islands. Forest management areas require measures that ensure wildlife movement patterns and habitat diversity are protected over time. This is an important consideration when analyzing functional landscape connectivity and the maintenance of well-distributed, viable populations. Several “pinch-points“ or "bottle-necks" where natural features or human-caused features (e.g., roads and clearcuts) constrain potential movement by wildlife to narrow bands of habitat have been identified on the Tongass and are discussed in greater detail in other places within this section and under the *Wildlife* section of this chapter.

Fragmentation associated with habitat loss results in smaller sizes of habitat patches available to a species, increased distances among habitat patches, increased amounts of matrix conditions in which habitat patches are embedded, and altered spatial distribution of habitat types (Haufler 2006). These factors are strongly tied to the structural and functional connectivity of the landscape, and thus the ability of the landscape to support well-distributed and viable wildlife populations.

By maintaining a functional and interconnected old-growth ecosystem, it can be assumed that various components of biodiversity, including structural diversity (within-stand and landscape level), connectivity (unfragmented, contiguous blocks of old growth), stand age and species composition (including understory species), and ecological processes (e.g., tree establishment, disturbance, and nitrogen fixation) will also be maintained. The amount and distribution of POG after 100 years of Forest Plan implementation can serve as a relative indicator of the functioning and interconnectedness of the old-growth ecosystem and the potential effects on biodiversity under each alternative.

In addition, effects on biodiversity can be measured by the degree of change expected to occur in the composition and distribution of the old-growth ecosystem relative to its historic composition and distribution. It can be assumed that the more an alternatives change the natural distribution and composition of old-growth ecosystems, the greater are its effects on biodiversity. Therefore, the effects of the alternatives on the distribution and composition of old-growth forests can be evaluated by examining the representation of POG and specific types of POG across the Tongass, with reference to historical representation. At the same time the analysis examines the old-growth conservation strategy of each alternative and the degree to which it maintains old-growth function, interconnectedness, and representation.

Another measure of the effects of the alternatives on landscape fragmentation can be obtained by evaluating the degree to which the alternatives would result in converting large, relatively pristine watersheds to a modified state (see *Intact Watersheds* in the *Affected Environment* part of this section). For this analysis, VCUs are used to define large watersheds and intact large watersheds are defined as those having less than 5 percent of their POG harvested and not containing other major disturbances. The use of VCUs and a 5-percent threshold are not based on specific criteria for defining intact large watersheds. Therefore, this measure should be viewed as one measure or an index of ecosystem fragmentation.

Finally, one additional tool is used in the comparison of the alternatives. The 1997 Forest Plan Revision Final EIS biodiversity analysis (U.S. Forest Service 1997a) relied in part upon expert panel evaluations of alternatives in terms of the estimated relative risks to the old-growth ecosystem (DeGayner 1996). This old-growth panel assessment is referred to below, where appropriate. Although the alternatives evaluated by the panel evaluations do not exactly correspond to the alternatives evaluated here (the old-growth reserve system and many new standards and guidelines were being developed and evaluated during the 1997 Forest Plan Revision), useful inference about the relative risks of the current alternatives can be made. Panel assessments were also conducted for wildlife and fish species and these are discussed in the *Wildlife* and *Fish* environmental effects sections.

Conservation Strategy Overview

An integrated old-growth conservation strategy was developed and incorporated into the 1997 Forest Plan (Appendix D). This strategy has two basic components. The first is a forest-wide reserve network that protects the integrity of the old-growth forest by retaining blocks of intact, largely undisturbed habitat. The old-growth reserves include a system of large, medium, and small Habitat Conservation Areas allocated to the Old-growth Habitat Land Use Designation (LUD), and full protection of all islands less than 1,000 acres in size. The reserve network also includes all other non-development LUDs. These include Wilderness, National Monument, Legislated LUD II, Wild River, Remote and Semi-remote Recreation, Research Natural Area, Municipal Watershed, and all other LUDs that essentially maintain the integrity of the old-growth ecosystem. The old-growth reserves were specifically designed to conserve habitats of the species that have the greatest viability concerns. They were designed, in part, to recognize and account for current conditions within each biogeographic province, and to better maintain future old-growth forest in provinces where past harvest has been high. The second component of the old-growth habitat conservation strategy is management of the matrix, e.g., the lands with LUD allocations where commercial timber harvest may occur. Within the matrix, components of the old-growth ecosystem are maintained by standards and guidelines to protect important areas and provide old-growth forest habitat connectivity. This component includes the beach and estuary fringe, riparian buffers, and a variety of other categories where timber harvest is not permitted. Matrix lands play a vital role in providing functional connectivity across fragmented landscapes (Szacki 1999). A detailed description of the rationale and components of the strategy is provided in Appendix D.

Research since 1997 has provided much new information on plant and wildlife populations and habitat relationships in Southeast Alaska; however, there continue to be gaps in knowledge about the ecology and distribution of many species making direct correlations between land management activities and their habitats and/or population impacts difficult. The conservation strategy itself is a step toward addressing this uncertainty by maintaining an extensive network of reserves and landscape connectivity on the Tongass; however, the effectiveness of the reserves and buffers in relation to their size, landscape pattern, and geographic distribution has yet to be scientifically tested (Powell et al. 1997). Smith (2005) noted that for many species, it is unknown whether the current reserve design is capable of supporting well-distributed, viable populations or providing sufficient connectivity to enable the flow of individuals between reserves. In addition to the unknowns related to the reserve network, there is also a need to explicitly define future desired conditions of matrix lands which provide life requisites for many species and to determine the optimal way to manage young-growth to benefit wildlife (*Workshop Integration Session*, Tongass Conservation Strategy Review Workshop 2006); new approaches to stand management that offer alternatives to clearcutting are also being evaluated.

The conservation strategy developed for the 1997 Forest Plan Revision is incorporated directly in Alternative 5, which represents the current Forest Plan. Each alternative incorporates a variation of the current old-growth conservation strategy by maintaining some level of old-growth reserves and providing additional old-growth protection within the matrix. These variations in the strategy are evaluated below.

General Overview of Effects

An overview of the degree to which old-growth forest protection is afforded by the old-growth strategy of each alternative is provided by examining the amount and percent of POG that occurs in reserves (areas where old-growth harvest is generally not permitted) versus the amount and percent in the matrix (areas where forests are actively managed). Table 3.9-12 presents a detailed summary of this information for each alternative. This table also identifies the composition of POG in various categories by summarizing all POG, high-volume POG, and large-tree POG.

Table 3.9-12
Estimated Acreage and Percentage of All Existing POG, High-Volume POG, and SD67 POG in Reserves[1] and Matrix[2] Lands (minimum protected vs. maximum harvested) by Alternative[3]

Alt.	POG Category	Amount in Reserves[1]		Amount in Matrix[2]: Minimum Protected		Amount in Matrix[2]: Maximum Harvested[4]		Total Existing POG	
		Acres	Percent	Acres	Percent	Acres	Percent	Acres	Percent
1	All POG	4,615,995	93%	249,182	5%	85,972	2%	4,951,148	100%
	High-Volume POG	1,862,441	93%	104,444	5%	41,460	2%	2,008,345	100%
	SD67 POG	477,813	89%	43,253	8%	16,385	3%	537,451	100%
2	All POG	4,167,367	84%	569,270	11%	214,511	4%	4,951,149	100%
	High-Volume POG	1,674,500	83%	232,318	12%	101,529	5%	2,008,346	100%
	SD67 POG	425,744	79%	77,417	14%	34,291	6%	537,451	100%
3	All POG	3,866,467	78%	771,255	16%	313,426	6%	4,951,148	100%
	High-Volume POG	1,572,277	78%	294,628	15%	141,440	7%	2,008,345	100%
	SD67 POG	401,011	75%	90,844	17%	45,596	8%	537,451	100%
4	All POG	2,965,670	60%	1,329,005	27%	656,473	13%	4,951,148	100%
	High-Volume POG	1,203,702	60%	511,928	25%	292,714	15%	2,008,345	100%
	SD67 POG	307,863	57%	145,418	27%	84,169	16%	537,451	100%
5	All POG	3,518,425	71%	970,176	20%	462,556	9%	4,951,156	100%
	High-Volume POG	1,431,634	71%	378,068	19%	198,647	10%	2,008,349	100%
	SD67 POG	364,183	68%	113,501	21%	59,767	11%	537,451	100%
6	All POG	3,563,600	72%	942,445	19%	445,103	9%	4,951,148	100%
	High-Volume POG	1,458,202	73%	352,379	18%	197,760	10%	2,008,342	100%
	SD67 POG	375,671	70%	103,085	19%	58,696	11%	537,451	100%
7	All POG	2,807,478	57%	1,336,275	27%	807,396	16%	4,951,148	100%
	High-Volume POG	1,143,122	57%	502,283	25%	362,940	18%	2,008,345	100%
	SD67 POG	287,295	53%	144,188	27%	105,968	20%	537,451	100%

[1] Reserves include all Non-Development LUDs (e.g., Old-Growth Habitat, Semi-Remote Recreation, Remote Recreation, Wilderness, National Monument, etc.).
[2] Matrix includes all Development LUDs (Timber Production, Modified Landscape, Scenic Viewshed, and Experimental Forest).
[3] Numbers may not appear to sum correctly due to rounding.
[4] Maximum harvested assumes the maximum allowed by the Allowable Sale Quantity is harvested each decade. The estimate assumes all scheduled suitable POG is harvested [calculated by subtracting alternative-specific reduction factors for the Model Implementation Reduction Factor (MIRF) and scheduling from the mapped suitable acreage under each alternative (see the *Timber* section)].

The alternatives cover a wide range of old-growth effects from minimal effects associated with Alternative 1, which has a maximum old-growth harvest of 86,000 acres, to substantially greater effects associated with Alternative 7, which has a maximum old-growth harvest of 807,000 acres. This broad range results in from 57 to 93 percent of the existing POG on the Tongass being maintained within reserves, with an additional amount of POG being protected from harvest by standards and guidelines in the matrix. Maximum POG harvest would range from 2 percent to 16 percent of existing POG. Harvest of high-volume and large-tree POG would range from 2 to 18 percent and from 3 to 20 percent, respectively. Placing the alternatives in order from lowest to highest maximum POG harvest results in the following ranking: Alternatives 1, 2, 3, 6, 5, 4, and 7.

Table 3.9-13
Estimated Acreage and Percentage of Young Growth[1] in Reserves[2] and in Matrix[3] Lands (minimum protected vs. maximum harvested) by Alternative[4]

Alternative	Amount in Reserves[2]		Amount in Matrix[3] Minimum Protected		Amount in Matrix[3] Maximum Harvested[5]		Total Existing Young Growth	
	Acres	Percent	Acres	Percent	Acres	Percent	Acres	Percent
1	189,528	42%	208,624	46%	56,573	12%	454,724	100%
2	96,452	21%	189,840	42%	168,432	37%	454,724	100%
3	88,097	19%	182,289	40%	184,339	41%	454,724	100%
4	55,024	12%	187,627	41%	212,073	47%	454,724	100%
5	72,930	16%	176,753	39%	205,037	35%	454,724	100%
6	83,045	18%	171,601	38%	200,075	44%	454,724	100%
7	35,426	8%	183,700	40%	235,599	52%	454,724	100%

1 Young growth in this table includes only young growth originating from past timber harvest. It does not include natural young growth (e.g., from blowdown), which is assumed to either be harvested or converted back to young growth naturally.
2 Reserves include all non-development LUDs (e.g., Old-Growth Habitat, Semi-Remote Recreation, Remote Recreation, Wilderness, National Monument, etc.).
3 Matrix includes all development LUDs (Timber Production, Modified Landscape, Scenic Viewshed, and Experimental Forest).
4 Numbers may not appear to sum correctly due to rounding.
5 Maximum harvested assumes the maximum allowed by the Allowable Sale Quantity is harvested each decade. The estimate assumes all scheduled suitable young growth is harvested [calculated by subtracting alternative-specific reduction factors for the Model Implementation Reduction Factor (MIRF) and scheduling from the mapped suitable acreage under each alternative (see the *Timber* section)].

In addition, to the harvest of POG, each alternative designates a portion of the existing young growth to be set aside and not harvested. Table 3.9-13 summarizes these areas and the amounts to be included in reserves, in the matrix, and the amount potentially harvested. There would be a range of approximately 219,000 to 398,000 acres of existing productive young growth that would not be harvested and that would eventually develop into mature forest and then POG. Based on the fact that most of this young growth is currently 20 to 40 years old (see Table 3.9-8), after about 70 years when the majority of the POG harvest has taken place, this young growth will be maturing and potentially beginning to take on some older forest characteristics, particularly if subjected to thinning or other types of stand management. Based on the historical overharvest of high-volume and large-tree POG (see *Affected Environment* part of this section), a high proportion of this young growth will be on high-site index lands, indicating faster than average growth rates.

The future and historical distribution of POG harvest by biogeographic province is represented in Table 3.9-14, which shows the percent of existing POG relative to the original POG, and the percent of original POG remaining after 100+ years of implementation for each alternative. In addition, Table 3.9-14 shows the percent of original POG that would be remaining, after 100+ years, inside reserves designated by the Forest Plan for each alternative. POG harvest would occur in 18 of the 21 provinces in at least one alternative. The range of the alternatives is 9 provinces containing some harvest under Alternative 1 to 18 provinces containing harvest under Alternative 7. Most of harvest in all alternatives would come from four biogeographic provinces in the south-central portion of the Tongass (North Central Prince of Wales Island, Kupreanof/Mitkof Island, Revilla Island/Cleveland Peninsula, and Etolin Island).

Table 3.9-14
Estimated Percent of Original POG Remaining Forest-wide (1st number) and in Reserves (2nd number) in 100+ Years Assuming Maximum POG Harvest[1] under Each Alternative by Biogeographic Province

No.	Biogeographic Province	POG Original Acres	POG % Remaining in 2006	% of Original POG Remaining After 100+ Years (Forest-wide/In Reserves) by Alternative: 1	2	3	4	5	6	7
1	Yakutat Forelands	51,398	93	93/93	89/82	84/70	81/59	83/70	83/70	81/59
2	Yakutat Uplands	24,811	94	94/94	94/93	94/92	93/91	94/92	94/92	93/91
3	East Chichagof Island	439,307	90	88/81	85/66	83/60	76/34	80/49	81/52	72/27
4	West Chichagof Island	72,038	100	100/100	100/100	100/100	100/100	100/100	100/100	100/100
5	East Baranof Island	101,840	87	87/87	81/60	80/57	72/31	77/50	78/53	71/31
6	West Baranof Island	231,999	93	93/93	91/83	89/79	83/57	89/78	89/79	82/56
7	Admiralty Island	598,419	99	99/99	99/99	99/99	99/99	99/98	99/99	99/99
8	Lynn Canal	158,538	97	96/93	94/82	92/77	83/50	88/67	89/68	82/50
9	North Coast Range	317,898	100	100/100	100/100	99/95	87/51	91/65	91/67	85/51
10	Kupreanof/Mitkof Island	341,588	90	85/74	80/61	75/48	64/25	69/35	70/36	60/19
11	Kuiu Island	322,569	91	91/91	85/76	84/77	72/42	79/62	79/63	69/42
12	Central Coast Range	252,179	97	97/97	97/94	91/76	83/49	86/67	87/68	81/60
13	Etolin Island & Vicinity	254,781	86	81/70	74/45	71/40	60/18	69/40	69/40	56/17
14	North Central Prince of Wales	698,394	74	69/53	67/47	65/41	60/33	63/38	63/39	53/21
15	Revilla Island/ Cleveland Pen.	548,748	92	90/84	86/73	85/68	75/47	81/62	81/62	71/43
16	Southern Outer Islands	128,589	88	85/78	83/73	82/71	80/64	81/70	81/70	76/62
17	Dall Island and Vicinity	68,355	99	99/99	99/99	98/96	93/82	95/85	95/86	90/80
18	South Prince of Wales	165,389	98	98/97	96/87	91/73	80/48	87/63	87/65	77/48
19	North Misty Fiords	199,929	99	99/99	98/97	98/93	97/88	98/93	98/93	96/88
20	South Misty Fiords	309,900	100	100/100	100/100	100/100	100/100	100/100	100/100	100/100
21	Ice Fields	119,204	97	97/94	96/89	95/81	93/76	93/82	94/81	93/76
Forest-wide		**5,405,872**	**92**	**90/85**	**88/77**	**86/72**	**79/55**	**83/65**	**83/66**	**77/52**
Additional Mature or Older Second Growth (110-160 yrs), Protected Forest-wide[3]			**0**	**7/4**	**5/2**	**5/2**	**4/1**	**5/1**	**5/2**	**4/1**

[1] The estimated suitable POG incorporates a reduction factor for the Model Implementation Reduction Factor (MIRF) and scheduling, which reduces mapped suitable acres to the estimated scheduled acres for each biogeographic province (see the *Timber* section).
[2] Percentage of original POG. Harvest of suitable old growth is estimated to occur until approximately until the year 2105
[3] Expressed as a percent of original POG

Effects on the largest tree categories of old growth and on old-growth growing on karstlands are of particular concern because past timber harvest has concentrated in these stands. In the following discussion the largest tree categories are represented in two ways: high-volume and large-tree POG. High-volume POG includes the three (out of seven) SDM classes that generally represent the most productive sites, produce the highest timber volumes, and contain the largest trees (SD5N, SD5S, and SD67). Large-tree POG is defined as the SD67 class (typically the type with the highest density of large trees) by itself. Tables 3.9-15 and 3.9-16 present information similar to Table 3.9-14, but for high-volume POG and large-tree POG relative to the original amounts of each of these POG categories by biogeographic province. Harvest of karstlands is summarized in Table 3.9-17, which shows the percent of existing karst POG relative to the original karst POG acres, and the percent of original karst POG remaining after 100+ years of implementation for each alternative. Impacts on biodiversity could be expected to be greatest in those areas that have the highest cumulative harvest percentages of the various POG categories, because they are more susceptible to greater losses of biodiversity components associated with POG forests.

Under all alternatives, long-term POG representation by ecological subsection would be maintained by protecting at least 41 percent of original POG in all 73 subsections (Table 3.9-18). At least 90 percent of original POG would be maintained in 25 (Alternative 7) to 51 (Alternative 1) of the 73 subsections and at least 75 percent would be maintained in 45 (Alternative 7) to 69 (Alternative 1) out of the 73 subsections.

The effects of the alternatives on the number, acreage, and percentage of intact large watersheds are summarized in Table 3.9-19. An intact watershed is defined, for the purpose of this ananlysis as one in which less than 5 percent of the original POG has been harvested. Currently, 69 percent of the large watersheds on the Tongass, which converts to 74 percent of the acreage, are considered intact. After 100+ years of implementation of the alternatives, giving consideration to additional harvest on non-NFS lands, these percentages would range from 60 percent of the watersheds (68 percent of the acreage) under Alternative 1 to 47 percent of the watersheds (57 percent of the acreage) under Alternative 7. Approximately 8 percent of the drop in percentage of intact watersheds and 5 percent of the drop in acreage would be due to additional development on non-NFS lands.

Table 3.9-15
Estimated Percent of Original High-Volume POG Remaining Forest-wide (1st number) and in Reserves (2nd number) in 100+ Years Assuming Maximum POG Harvest[1] under Each Alternative by Biogeographic Province

		POG		% of Original POG Remaining After 100+ Years (Forest-wide/In Reserves) by Alternative						
No.	Biogeographic Province	Original Acres	% Remaining in 2006	1	2	3	4	5	6	7
1	Yakutat Forelands	31,015	93	93/93	87/78	79/61	75/56	78/61	78/61	74/56
2	Yakutat Uplands	11,614	92	92/92	92/90	91/89	90/87	91/89	91/89	90/87
3	East Chichagof Island	178,124	84	83/75	79/61	78/56	70/31	75/47	76/50	67/25
4	West Chichagof Island	17,223	100	100/100	100/100	100/100	100/100	100/100	100/100	100/100
5	East Baranof Island	37,072	77	77/77	70/49	69/46	63/24	66/39	67/42	60/24
6	West Baranof Island	64,001	83	83/83	81/75	80/71	74/49	79/71	79/71	72/49
7	Admiralty Island	307,613	98	98/98	98/98	98/98	98/98	98/97	98/98	98/98
8	Lynn Canal	63,368	95	94/92	91/78	89/74	78/42	85/64	86/66	77/42
9	North Coast Range	132,654	100	100/100	100/100	99/95	85/49	90/66	91/68	84/48
10	Kupreanof/Mitkof Island	121,135	81	76/66	71/53	67/45	56/25	61/35	61/36	51/19
11	Kuiu Island	174,993	90	90/90	82/72	80/68	69/43	75/59	75/59	66/43
12	Central Coast Range	107,789	96	96/96	95/92	89/74	82/58	86/66	86/68	81/59
13	Etolin Island & Vicinity	99,193	77	72/62	65/40	63/36	53/17	61/36	61/36	48/16
14	North Central Prince of Wales	343,711	66	60/46	58/40	56/37	51/29	55/34	54/35	44/20
15	Revilla Island/ Cleveland Pen.	241,884	88	86/80	83/70	81/67	71/45	79/61	79/62	67/42
16	Southern Outer Islands	52,674	82	78/69	75/62	74/61	71/52	73/59	73/60	67/50
17	Dall Island and Vicinity	33,260	99	99/99	99/99	99/97	95/86	96/89	96/89	92/83
18	South Prince of Wales	78,369	97	97/96	95/85	91/73	78/44	86/62	86/63	74/44
19	North Misty Fiords	67,130	99	99/99	97/95	97/91	95/85	97/91	97/91	94/85
20	South Misty Fiords	97,509	100	100/100	100/100	100/100	100/100	100/100	100/100	100/100
21	Ice Fields	39,039	93	93/91	93/87	92/81	90/76	90/80	91/81	90/76
Forest-wide		**2,299,369**	**87**	**86/81**	**83/73**	**81/68**	**75/52**	**79/62**	**79/63**	**72/50**
Additional Mature or Older Second Growth (110-160 yrs) on High-Volume Sites, Protected Forest-wide[3]			**0**	**11/5**	**8/3**	**8/2**	**7/2**	**7/2**	**7/2**	**6/1**

[1] The estimated suitable POG incorporates a reduction factor for the Model Implementation Reduction Factor (MIRF) and scheduling, which reduces mapped suitable acres to the estimated scheduled acres for each biogeographic province (see the *Timber* section).
[2] Percentage of original POG. Harvest of suitable old growth is estimated to occur until approximately until the year 2105
[3] Expressed as a percent of original High-Volume POG

Table 3.9-16
Estimated Percent of Original Large-Tree POG (SD67) Remaining Forest-wide (1st number) and in Reserves (2nd number) in 100+ Years Assuming Maximum POG Harvest[1] under Each Alternative by Biogeographic Province

		POG		% of Original POG Remaining After 100+ Years (Forest-wide/In Reserves) by Alternative						
No.	Biogeographic Province	Original Acres	% Remaining in 2006	1	2	3	4	5	6	7
1	Yakutat Forelands	26,181	96	96/96	90/80	82/61	78/59	80/61	80/61	78/59
2	Yakutat Uplands	2,408	83	83/83	80/74	80/73	75/65	79/73	79/73	74/65
3	East Chichagof Island	47,335	73	72/65	71/55	70/52	64/31	69/47	70/49	62/26
4	West Chichagof Island	2,012	100	100/100	100/100	100/100	100/100	100/100	100/100	100/100
5	East Baranof Island	5,894	33	33/33	32/24	32/21	31/15	31/18	31/20	31/15
6	West Baranof Island	9,036	46	46/46	45/42	44/40	43/29	44/40	44/40	43/29
7	Admiralty Island	100,755	98	98/98	98/98	98/98	98/98	98/96	98/98	98/98
8	Lynn Canal	13,355	88	88/86	86/75	84/71	74/33	80/58	81/61	72/33
9	North Coast Range	22,536	100	100/100	100/100	99/96	81/33	88/61	91/65	78/33
10	Kupreanof/Mitkof Island	29,920	65	62/54	58/45	55/39	47/21	51/28	51/30	43/15
11	Kuiu Island	44,945	82	82/82	67/49	65/47	56/26	61/40	62/41	52/26
12	Central Coast Range	21,854	91	91/91	90/85	84/71	76/50	81/62	80/60	75/52
13	Etolin Island & Vicinity	22,847	54	50/41	46/29	44/27	36/12	42/26	43/27	33/11
14	North Central Prince of Wales	171,375	69	62/45	60/40	59/38	54/30	57/34	57/37	47/21
15	Revilla Island/ Cleveland Pen.	45,095	71	68/62	65/52	64/51	57/34	61/45	62/47	54/32
16	Southern Outer Islands	17,200	74	69/57	67/52	65/51	61/40	64/48	64/51	57/39
17	Dall Island and Vicinity	8,018	99	99/99	99/99	97/95	96/93	97/94	97/94	95/91
18	South Prince of Wales	44,283	98	98/96	94/83	91/74	78/41	87/62	87/64	73/41
19	North Misty Fiords	13,164	97	97/97	95/89	95/89	93/84	94/88	94/88	93/84
20	South Misty Fiords	14,142	100	100/100	100/100	100/100	100/100	100/100	100/100	100/100
21	Ice Fields	6,965	83	83/81	83/80	83/78	82/73	81/74	83/78	81/73
Forest-wide		669,321	80	78/71	75/64	73/60	68/46	71/54	72/56	64/43
Additional Mature or Older Second Growth (110-160 yrs) on SD67 Sites, Protected Forest-wide[3]			**0**	**17/8**	**12/4**	**12/4**	**11/2**	**11/3**	**11/4**	**9/2**

[1] The estimated suitable POG incorporates a reduction factor for the Model Implementation Reduction Factor (MIRF) and scheduling, which reduces mapped suitable acres to the estimated scheduled acres for each biogeographic province (see the *Timber* section).
[2] Percentage of original POG. Harvest of suitable old growth is estimated to occur until approximately until the year 2105
[3] Expressed as a percent of original SD67 POG

Table 3.9-17
Estimated Percent of Original Karst POG Remaining Currently and in 100+ Years Assuming Maximum POG Harvest[1] under Each Alternative

	Karst POG		% of Original Karst POG Remaining After 100+ Years by Alternative						
	Original Acres	**% Remaining in 2006**	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Low Elevation (<800 feet)	215,708	62%	58%	56%	55%	52%	54%	55%	47%
Moderate-High Elevation (>800 feet)	87,791	84%	82%	79%	78%	73%	76%	77%	70%
Total	**303,499**	**69%**	**65%**	**63%**	**62%**	**58%**	**60%**	**61%**	**54%**
Additional Mature or Older Second Growth (110-160 yrs) on Karst, Protected from Future Harvest[3]		0%	26%	17%	16%	14%	14%	15%	12%

[1] The estimated suitable POG incorporates a reduction factor for the Model Implementation Reduction Factor (MIRF) and scheduling, which reduces mapped suitable acres to the estimated scheduled acres (see the *Timber* section).
[2] Percentage of original POG. Harvest of suitable old growth is estimated to occur until approximately until the year 2105
[3] Expressed as a percent of original SD67 POG

Effects by Alternative

The following subsections summarize the biodiversity effects associated with each alternative with reference to the data presented in Tables 3.9-12, 3.9-13, 3.9-14, 3.9-15, 3.9-16, 3.9-17, 3.9-18, and 3.9-19.

Alternative 1

Alternative 1 would have the lowest effect on biodiversity among the alternatives, primarily because it would result in the lowest harvest and the highest POG acreage in reserves. Although this alternative was not specifically evaluated in the 1996 panel assessment, based on its level of harvest and other factors considered in the assessment, it is clear that the assessment would have confirmed this ranking.

Alternative 1 would maintain 93 percent of the existing POG within reserves and an additional 5 percent would be protected in the matrix by standards and guidelines or not scheduled for harvest. As a result, only 2 percent or 86,000 acres would be subject to harvest (Table 3.9-12). Long-term maximum harvest of high-volume and large-tree POG are also projected to be in the 2 to 3 percent range. In addition, there would be about 398,000 acres of existing productive young growth that would not be harvested and that would eventually develop into mature forest and then POG (Table 3.9-13). This represents about four times as much as the maximum POG harvest.

Assuming maximum harvest over 100+ years, approximately 90 percent of the original POG would remain Forest-wide; 85 percent of the original POG would be in reserves (Table 3.9-14). Harvest would be conducted in 9 out of 21 provinces occupied by the Tongass, but only 5 provinces would have potential harvest exceeding 5,000 acres. At least 15 of the 21 provinces would have more than 90 percent of their original POG remaining after 100+ years, and only 1 province, North Central Prince of Wales, would have less than 75 percent remaining (Table 3.9-14).

Table 3.9-18
Estimated Percentage of Original POG Remaining Forest-wide in 100+ Years Assuming Maximum POG Harvest[1] under Each Alternative by Ecological Subsection

Ecological Section (Bold) and Subsection Names	Original POG Acres	Remaining POG in 2006 as a Percent of Original POG	Alternative 1	2	3	4	5	6	7
St. Elias-Fairweather Icefields									
St. Elias-Fairweather Icefields	9,147	93%	93%	93%	93%	83%	85%	87%	80%
Puget Peninsula Metasediments	7,290	100%	100%	100%	100%	100%	100%	100%	100%
Northern Gulf Forelands									
Yakutat-Lituya Forelands	63,945	92%	92%	89%	85%	82%	83%	83%	81%
Chilkat River Complex									
Chilkat Complex	1,759	100%	100%	100%	100%	100%	100%	100%	100%
Boundary Ranges									
Boundary Ranges Icefields	247,947	98%	98%	97%	97%	94%	96%	96%	93%
Stikine-Taku River Valleys	33,612	100%	100%	100%	100%	100%	100%	100%	100%
Glacier Bay Fiordlands									
Wachusett-Adams Hills	229	100%	100%	100%	100%	100%	100%	100%	100%
Berg Bay Complex	5,223	100%	100%	100%	100%	100%	100%	100%	100%
Chilkat Peninsula Carbonates	81,944	94%	94%	89%	89%	75%	83%	83%	73%
Baranof-Chichagof Fiordlands									
North Chichagof Granitics	99,381	97%	97%	96%	95%	91%	94%	94%	90%
Outer Coast Wave-cut Terraces	37,756	100%	100%	100%	100%	99%	100%	100%	99%
West Chichagof Complex	29,885	100%	100%	100%	100%	100%	100%	100%	100%
Ushk-Patterson Bay Granitics	44,015	96%	95%	95%	95%	87%	88%	89%	86%
Peril Strait Granitics	112,526	90%	90%	86%	83%	72%	77%	78%	70%
North Baranof Complex	65,323	82%	82%	75%	74%	63%	69%	70%	61%
Sitka Sound Complex	82,921	91%	90%	87%	85%	70%	84%	84%	67%
Mount Edgecumbe Volcanics	27,352	86%	86%	82%	79%	76%	78%	78%	74%
Central Baranof Metasediments	42,324	89%	89%	88%	86%	82%	85%	85%	82%
Necker Bay Granitics	40,686	100%	100%	100%	100%	100%	100%	100%	100%
South Baranof Sediments	36,320	100%	100%	100%	100%	100%	100%	100%	100%
Northeast Chichagof Fiordlands									
Point Adolphus Carbonates	43,858	95%	95%	90%	89%	76%	88%	88%	75%
Freshwater Bay Carbonates	114,959	86%	81%	75%	75%	69%	72%	73%	60%
Kook Lake Carbonates	59,098	82%	80%	76%	73%	65%	70%	71%	64%
Kootznoowoo Fiordlands									
Stephens Passage Glaciomarine Terraces	129,536	100%	100%	99%	98%	96%	95%	97%	95%
North Admiralty Complex	126,913	100%	100%	100%	100%	100%	100%	100%	100%
Stephens Passage Volcanics	49,914	97%	96%	96%	96%	93%	96%	96%	96%
Thayer Lake Granitics	45,630	100%	100%	100%	100%	100%	100%	100%	100%
Mitchell-Hasselborg Till Lowlands	62,653	100%	100%	100%	100%	100%	100%	100%	100%
Hood-Gambier Bay Carbonates	144,261	100%	100%	100%	100%	100%	100%	100%	100%
South Admiralty Volcanics	102,890	97%	95%	95%	95%	95%	95%	95%	95%

Table 3.9-18 (continued)
Estimated Percentage of Original POG Remaining Forest-wide in 100+ Years Assuming Maximum POG Harvest[1] under Each Alternative by Ecological Subsection

Ecological Section (Bold) and Subsection Names	Original POG Acres	Remaining POG in 2006 as a Percent of Original POG	Alternative 1	2	3	4	5	6	7
Inside Passage Fiordlands									
Holkham Bay Complex	258,587	100%	100%	100%	98%	86%	90%	90%	84%
Cape Fanshaw Complex	43,579	100%	99%	99%	97%	61%	71%	75%	57%
Thomas Bay Outwash Plains	14,538	70%	70%	62%	56%	47%	54%	55%	44%
Wrangell Narrows Metasediments	160,511	85%	76%	67%	64%	56%	62%	62%	51%
Eastern Passage Complex	114,036	98%	98%	96%	85%	78%	83%	83%	76%
Stikine River Delta	25,010	89%	83%	82%	82%	82%	82%	82%	81%
Bell Island Granitics	139,862	97%	96%	94%	91%	89%	91%	91%	87%
Stikine Strait Complex	32,029	90%	86%	75%	73%	56%	72%	72%	49%
Etolin Granitics	32,088	95%	92%	84%	81%	72%	78%	80%	68%
Zimovia Strait Complex	103,961	90%	85%	79%	71%	58%	68%	69%	53%
Clarence Strait Volcanics	86,738	99%	98%	95%	94%	79%	94%	94%	75%
Ketchikan Mafics/Ultramafics	21,499	99%	98%	96%	96%	95%	84%	84%	72%
Vixen Inlet Till Lowlands	10,068	100%	100%	100%	100%	82%	84%	83%	66%
Traitors Cove Metasediments	162,948	86%	81%	77%	76%	62%	70%	70%	58%
Behm Canal Complex	92,329	94%	92%	90%	90%	85%	89%	89%	84%
Kuiu-Prince of Wales Fiordlands									
Kuiu-POW Granitics	85,962	95%	93%	92%	90%	83%	89%	89%	80%
Rowan Sediments	109,770	85%	85%	72%	71%	66%	69%	69%	64%
North POW-Kuiu Carbonates	190,444	58%	52%	50%	49%	45%	48%	48%	41%
Alvin Bay Sediments	57,548	99%	98%	98%	98%	79%	88%	88%	74%
Affleck Canal Till Lowlands	27,386	100%	100%	100%	100%	82%	100%	100%	77%
North POW Complex	50,227	85%	82%	81%	80%	78%	77%	77%	72%
Elevenmile Till Lowlands	14,899	98%	97%	88%	88%	75%	87%	86%	69%
Gulf of Esquibel Till Lowlands	14,828	100%	100%	100%	100%	100%	100%	100%	100%
Klawock Inlet Till Lowlands	755	88%	88%	88%	88%	88%	88%	88%	88%
Soda Bay Till Lowlands	40,933	99%	99%	99%	94%	90%	88%	89%	80%
Kupreanof Lowlands									
Kake Volcanics	40,175	83%	77%	71%	69%	62%	65%	67%	59%
Duncan Canal Till Lowlands	83,581	91%	86%	80%	76%	65%	69%	70%	58%
Sumner Strait Volcanics	167,966	93%	90%	88%	81%	64%	71%	71%	60%
Central POW Till Lowlands	133,163	75%	69%	69%	68%	66%	67%	67%	59%
Kasaan Peninsula Volcanics	4,197	100%	93%	93%	92%	91%	92%	91%	59%
Skowl Arm Till Lowlands	21,442	94%	92%	87%	79%	73%	79%	77%	67%
Outer Islands Fiordlands									
Outer Islands Complex	19,013	100%	100%	100%	100%	100%	100%	100%	100%
Dall-Outside Complex	125,992	99%	97%	97%	95%	91%	93%	92%	89%
Prince of Wales Mountains									
Central POW Volcanics	244,092	72%	66%	64%	61%	56%	60%	60%	48%
Hetta Inlet Metasediments	85,030	85%	82%	77%	76%	64%	71%	71%	59%
Moira Sound Complex	57,828	100%	100%	99%	91%	81%	88%	87%	77%

Table 3.9-18 (continued)
Estimated Percentage of Original POG Remaining Forest-wide in 100+ Years Assuming Maximum POG Harvest[1] under Each Alternative by Ecological Subsection

Ecological Section (Bold) and Subsection Names	Original POG Acres	Remaining POG in 2006 as a Percent of Original POG	Alternative 1	2	3	4	5	6	7
Dixon Entrance Lowlands									
South POW Granitics	244,092	100%	100%	100%	97%	92%	96%	97%	91%
Duke Island Till Lowlands	85,030	100%	97%	97%	97%	97%	97%	97%	97%
Thorne Arm Granitics	57,828	91%	88%	81%	81%	80%	80%	80%	78%
Princess Bay Volcanics	244,092	83%	79%	76%	75%	73%	76%	75%	71%
Foggy Bay Till Lowlands	85,030	100%	100%	100%	100%	100%	100%	100%	100%
Boca De Quadra Complex	57,828	100%	100%	100%	100%	100%	100%	100%	100%
Coast Mountain Batholith Fiordlands									
Misty Fiords Granitics	388,315	100%	100%	100%	100%	100%	100%	100%	100%
Totals	**5,405,873**	**92%**	**90%**	**88%**	**86%**	**79%**	**83%**	**83%**	**77%**

[1] The estimated suitable POG incorporates a reduction factor for the Model Implementation Reduction Factor (MIRF) and scheduling, which reduces mapped suitable acres to the estimated scheduled acres for each ecological subsection (see the *Timber* section).

Relative to the largest tree categories, after 100+ years of maximum implementation of Alternative 1, 86 percent of the original high-volume POG and 78 percent of the original large-tree POG would remain, with the vast majority of these acres in reserves (Tables 3.9-15 and 3.9-16). At least 13 of the provinces would maintain 90 percent or more of their original high-volume POG and 2 provinces would maintain less than 75 percent (minimum = 60 percent for North Central Prince of Wales) (Table 3.9-15). Relative to large-tree POG, at least 9 provinces would maintain 90 percent or more of their original acres and 8 provinces would have less than 75 percent (minimum = 33 percent for East Baranof) (Table 3.9-16).

Implementation of Alternative 1 would result in a maximum reduction of the karst POG on the Tongass from 69 percent of the original karst POG at present, to 65 percent after 100+ years. Low elevation karst POG would be reduced from 62 percent currently, to 58 percent (Table 3.9-17).

Long-term POG representation by ecological subsection would be maintained under Alternative 1 by protecting at least 52 percent of the original POG on NFS lands in all 73 subsections (Table 3.9-18). At least 90 percent of original POG would be maintained in 51 of the 73 subsections and at least 75 percent would be maintained in 69 out of the 73 subsections.

If one considers the regrowth of current young growth that would be protected under this alternative (Table 3.9-13), after 100+ years the equivalent of an additional 7 percent of the original POG acres would be in mature forest stands and some stands would be at the beginning stages of exhibiting older forest characteristics (Table 3.9-14). Similarly, an additional 11 percent of the original high-volume POG, 17 percent of the original large-tree POG, and 26 percent of the original karst POG would be in mature forest stages (Tables 3.9-15, 3.9-16, and 3.9-17, respectively). In summary, after 100+ years of implementation under Alternative 1, 97 percent of the original POG would be remaining as POG or in mature forest stages. Likewise, 97 percent of the original high-volume POG would still be in high-volume POG or in mature forest stages, 95 percent of the original large-tree POG would be remaining as large-tree POG or in mature forest stages, and 91 percent of the original karst POG would be remaining as POG or in mature forest stages.

Alternative 1 would result in the additional conversion of intact large watersheds to a modified condition. After 100+ years of implementation under maximum harvest, the percentage of intact watersheds would be reduced from 69 percent to 60 percent of the Tongass. Similarly, the percentage of the land area of the Tongass in intact watersheds would be reduced from 74 percent to 68 percent (Table 3.9-19).

However, the majority of this reduction would occur as a result of additional development on non-NFS lands, even if no additional Tongass harvest occurred. Approximately 8 percentage points of the drop in percentage of intact watersheds and 5 percentage points of the drop in acreage are due to additional development on non-NFS lands.

Table 3.9-19
Estimated Percent of All Large Watersheds[1] in each Biogeographic Province Defined as Intact[2] After 100+ Years[3] of Forest Plan Implementation under Each Alternative

No.	Biogeographic Province	Number and Acreage of All Large Watersheds		% of All Large Watersheds Defined as Intact Under Existing Conditions and After 100+ Years by Alternative (% of number of watersheds/% of acreage)								
		No.	Acres	Existing	1	2	3	4	5	6	7
1	Yakutat Forelands	24	344,231	83/80	67/73	63/72	58/71	58/71	58/71	58/71	58/71
2	Yakutat Uplands	26	916,929	96/99	96/99	96/99	96/99	96/99	96/99	96/99	96/99
3	East Chichagof Island	87	1,129,840	53/49	52/47	51/45	48/43	33/27	37/29	41/34	31/26
4	West Chichagof Island	31	287,518	100/100	97/99	97/99	97/99	97/99	97/99	97/99	97/99
5	East Baranof Island	22	394,381	55/60	45/49	45/49	45/49	45/49	45/49	45/49	45/49
6	West Baranof Island	43	797,901	65/69	58/65	58/65	56/64	47/54	53/57	53/57	47/54
7	Admiralty Island	60	1,085,689	88/85	82/80	82/80	82/80	82/80	82/80	82/80	82/80
8	Lynn Canal	50	671,845	76/80	56/64	56/64	50/59	32/45	42/51	44/53	32/45
9	North Coast Range	49	1,111,396	90/94	67/80	67/80	67/80	31/54	39/59	39/59	31/54
10	Kupreanof/Mitkof Island	35	842,334	37/39	31/30	29/29	20/20	9/8	11/11	11/11	9/8
11	Kuiu Island	30	493,252	73/60	73/60	73/60	73/60	47/34	67/55	67/55	47/34
12	Central Coast Range	29	729,163	79/85	72/77	66/73	52/57	38/53	38/51	38/51	38/51
13	Etolin Island & Vicinity	27	518,932	33/30	26/23	22/19	19/17	11/12	19/17	19/17	11/12
14	North Central Prince of Wales	116	1,488,826	24/17	20/13	19/13	16/10	12/8	12/9	12/10	10/6
15	Revilla Island/ Cleveland Pen.	84	1,347,381	68/71	55/60	51/58	49/57	37/44	39/47	39/47	33/43
16	Southern Outer Islands	20	223,986	50/64	50/64	45/60	45/60	45/59	45/60	45/60	45/59
17	Dall Island and Vicinity	35	200,222	71/53	34/19	34/19	31/16	29/15	29/15	29/15	29/15
18	South Prince of Wales	36	395,076	78/75	72/69	69/65	56/51	47/45	50/46	50/46	47/45
19	North Misty Fiords	32	975,904	94/96	94/96	91/93	88/91	88/91	88/91	88/91	88/91
20	South Misty Fiords	54	906,047	100/100	100/100	100/100	100/100	100/100	100/100	100/100	100/100
21	Ice Fields	57	3,006,309	93/94	88/92	86/91	84/90	84/89	82/89	84/90	82/88
Forest-wide		947	17,867,163	69/74	60/68	59/67	56/65	48/58	50/60	51/60	47/57

[1] Large watersheds are defined here as VCUs.
[2] Intact is defined here as having less than 5 percent of original POG harvested and not containing other major disturbances.
[3] Considers past and future harvest on private and other non-NFS lands.

Alternative 2

Alternative 2 would rank second lowest in terms of effects on biodiversity primarily because it would result in the second lowest POG harvest and the second highest POG acreage in reserves. Although this alternative was not specifically evaluated in the 1996 panel assessment, based on its level of harvest and other factors considered in the assessment, it is clear that the assessment would have confirmed this ranking.

Under Alternative 2, approximately 84 percent of all existing POG would be maintained within reserves. Standards and guidelines would protect an additional 11 percent of the existing POG from harvest and the maximum POG potentially harvested would be approximately 215,000 acres or 4 percent (Table 3.9-12). Long-term maximum harvest of high-volume and large-tree POG are projected to be in the 4 to 5 percent range. In addition, there would be about 286,000 acres of existing productive young growth that would not be harvested and that would eventually develop into mature forest and then POG (Table 3.9-13). This represents a long-term replacement for over 100 percent of the future maximum POG harvest.

Assuming maximum harvest over 100+ years, approximately 88 percent of the original POG would remain Forest-wide; 77 percent of the original POG would be in reserves (Table 3.9-14). Harvest would be spread over 18 out of 21 provinces occupied by the Tongass, but only 8 provinces would have potential harvest exceeding 5,000 acres. At least 12 of the 21 provinces would have 90 percent or more of their original POG remaining after 100+ years, and only 2 provinces (North Central Prince of Wales and Etolin & Vicinity) would have less than 75 percent remaining (Table 3.9-14).

Relative to the largest tree categories, after 100+ years of maximum implementation of Alternative 2, 83 percent of the original high-volume POG and 75 percent of the original large-tree POG would remain, with the vast majority of these acres in reserves (Tables 3.9-15 and 3.9-16). At least 11 of the provinces would maintain 90 percent or more of their original high-volume POG and 4 provinces would maintain less than 75 percent (minimum = 58 percent for North Central Prince of Wales) (Table 3.9-15). Relative to large-tree POG, at least 9 provinces would maintain 90 percent or more of their original acres and 9 provinces would have less than 75 percent (minimum = 32 percent for East Baranof) (Table 3.9-16).

Implementation of Alternative 2 would result in a maximum reduction of the karst POG on the Tongass from 69 percent of the original karst POG at present, to 63 percent after 100+ years. Low elevation karst POG would be reduced from 62 percent currently, to 56 percent (Table 3.9-17).

Long-term POG representation by ecological subsection would be maintained under Alternative 2 by protecting at least 50 percent of original POG in all 73 subsections (Table 3.9-18). At least 90 percent of original POG would be maintained in 43 of the 73 subsections and at least 75 percent would be maintained in 66 out of the 73 subsections.

If one considers the regrowth of current young growth that would be protected under this alternative (Table 3.9-13), after 100+ years the equivalent of an additional 5 percent of the original POG acres would be in mature forest stands and some stands would be at the beginning stages of exhibiting older forest characteristics (Table 3.9-14). Similarly, an additional 8 percent of the original high-volume POG, 12 percent of the original large-tree POG, and 17 percent of the original karst POG would be in mature forest stages (Tables 3.9-15, 3.9-16, and 3.9-17, respectively). In summary, after 100+ years of implementation under Alternative 2, 93 percent of the original POG would be remaining as POG or in mature forest stages. Likewise, 91 percent of the original high-volume POG would still be in high-volume POG or in mature forest stages, 87 percent of the original large-tree POG would be remaining as large-tree POG or in mature forest stages, and 80 percent of the original karst POG would be remaining as POG or in mature forest stages.

Alternative 2 would result in the additional conversion of intact large watersheds to a modified condition. After 100+ years of implementation under maximum harvest, the percentage of intact watersheds would be reduced from 69 percent to 59 percent of the Tongass. Similarly, the percentage of the land area of the Tongass in intact watersheds would be reduced from 74 percent to 67 percent (Table 3.9-19). However, the majority of this reduction would occur as a result of additional development on non-NFS lands, even if no additional Tongass harvest occurred. Approximately 8 percentage points of the drop in percentage of intact watersheds and 5 percentage points of the drop in acreage are due to additional development on non-NFS lands.

Alternative 3

Alternative 3 would rank third lowest in terms of effects on biodiversity primarily because it would result in the third lowest POG harvest and the third highest POG acreage in reserves. Although this alternative was not specifically evaluated in the 1996 panel assessment, based on its level of harvest and other factors considered in the assessment, it is clear that the assessment would have confirmed this ranking.

Alternative 3 would maintain approximately 78 percent of all existing POG would be maintained within reserves. Standards and guidelines would protect an additional 16 percent of the existing POG from harvest and the maximum POG potentially harvested would be approximately 313,000 acres or 6 percent (Table 3.9-12). Long-term maximum harvest of high-volume and large-tree POG are projected to be in the 7 to 8 percent range. In addition, there would be about 270,000 acres of existing productive young growth that would not be harvested and that would eventually develop into mature forest and then POG (Table 3.9-13). This represents a long-term replacement for over 86 percent of the future maximum POG harvest.

Assuming maximum harvest over 100+ years, approximately 86 percent of the original POG would remain Forest-wide; 72 percent of the original POG would be in reserves (Table 3.9-14). Harvest would be spread over 18 out of 21 provinces occupied by the Tongass, but only 12 provinces would have potential harvest exceeding 5,000 acres. At least 11 of the 21 provinces would have 90 percent or more of their original POG remaining after 100+ years, and only 2 provinces (North Central Prince of Wales and Etolin & Vicinity) would have less than 75 percent remaining (Table 3.9-14).

Relative to the largest tree categories, after 100+ years of maximum implementation of Alternative 3, 81 percent of the original high-volume POG and 73 percent of the original large-tree POG would remain, with the vast majority of these acres in reserves (Tables 3.9-15 and 3.9-16). At least 9 of the provinces would maintain 90 percent or more of their original high-volume POG and 5 provinces would maintain less than 75 percent (minimum = 56 percent for North Central Prince of Wales) (Table 3.9-15). Relative to large-tree POG, at least 7 provinces would maintain 90 percent or more of their original acres and 9 provinces would have less than 75 percent (minimum = 32 percent for East Baranof) (Table 3.9-16).

Implementation of Alternative 3 would result in a maximum reduction of the karst POG on the Tongass from 69 percent of the original karst POG at present, to 62 percent after 100+ years. Low elevation karst POG would be reduced from 62 percent currently, to 55 percent (Table 3.9-17).

Long-term POG representation by ecological subsection would be maintained under Alternative 3 by protecting at least 49 percent of original POG in all 73 subsections (Table 3.9-18). At least 90 percent of original POG would be maintained in 41 of the 73 subsections and at least 75 percent would be maintained in 62 out of the 73 subsections. The one subsection with less than 50 percent of its original POG, North POW-Kuiu Carbonates, would still maintain about 94,000 acres of POG.

If one considers the regrowth of current young growth that would be protected under this alternative (Table 3.9-13), after 100+ years the equivalent of an additional 5 percent of the original POG acres would be in mature forest stands and some stands would be at the beginning stages of exhibiting older forest characteristics (Table 3.9-14). Similarly, an additional 8 percent of the original high-volume POG, 12 percent of the original large-tree POG, and 16 percent of the original karst POG would be in mature forest stages (Tables 3.9-15, 3.9-16, and 3.9-17, respectively). In summary, after 100+ years of implementation under Alternative 2, 91 percent of the original POG would be remaining as POG or in mature forest stages. Likewise, 89 percent of the original high-volume POG would still be in high-volume POG or in mature forest stages, 85 percent of the original large-tree POG would be remaining as large-tree POG or in mature forest stages, and 78 percent of the original karst POG would be remaining as POG or in mature forest stages.

Alternative 3 would result in the additional conversion of intact large watersheds to a modified condition. After 100+ years of implementation under maximum harvest, the percentage of intact watersheds would be reduced from 69 percent to 56 percent of the Tongass. Similarly, the percentage of the land area of the Tongass in intact watersheds would be reduced from 74 percent to 65 percent (Table 3.9-19). However, the majority of this reduction would occur as a result of additional development on non-NFS lands, even if no additional Tongass harvest occurred. Approximately 8 percentage points of the drop in percentage of intact watersheds and 5 percentage points of the drop in acreage are due to additional development on non-NFS lands.

Alternative 4

With several important exceptions, Alternative 4 is similar to most aspects of the current Forest Plan (Alternative 5). Most importantly, however, it would have fewer old-growth reserves. The Old-Growth Habitat LUD is used in only four provinces (plus a few individual reserves), but other non-development LUDs provide some reserves in all provinces. It also includes additional requirements of maintaining 33 percent of the old growth in each VCU and not harvesting more than 50 percent of the POG within a 50-year period. However, there is no requirement to consider spacing, location, size, shape, or composition in the design of the retained acres; as a result, Alternative 4 would not provide as much protection to the conservation of biodiversity if the retained acres are widely distributed, in small parcels, linear in shape, or do not protect important habitat features (e.g., important deer winter range, under-represented forest plant associations, or suspected goshawk nesting habitat). Alternative 4 would have the same beach and estuary fringe and riparian buffers as Alternative 5 that would enhance connectivity within the matrix, but would not include the goshawk and marten or the legacy forest structure standards and guidelines that require retention trees in harvest units within specific VCUs.

Alternative 4 is based on, and is similar to, the 1997 Alternative 6, which was evaluated in the 1997 Forest Plan Revision FEIS (see Chapter 2); therefore, the conclusions of the 1997 old-growth panel assessment can be extended to the current Alternative 4. The panel assessment concluded that this alternative was ranked in the middle group of the alternatives evaluated by the panel. As such, it ranked better than our 2007 Alternative 7 but, through comparisons with acreage harvested and other alternative components, it would have ranked worse than all of the other 2007 alternatives in terms of effects on biodiversity. In addition to the acres of harvest, the primary factor associated with this ranking is the absence of reserves over relatively large areas of the Tongass. The old-growth network was specifically designed to ensure the maintenance of well-distributed viable populations of all old-growth associated wildlife species across the Tongass. The 1996 panel assessment concluded that alternatives that did not emphasize the old-growth reserve network had the highest potentials to create biodiversity concerns within biogeographic provinces over the long term.

Moreover, the old-growth network was specifically designed to ensure the maintenance of well-distributed viable populations of all old-growth associated wildlife species across the Tongass. The 1997 FEIS panel assessment concluded that alternatives that did not include the OGR system have the highest potentials to create biodiversity concerns within biogeographic provinces over the long term. Therefore, by default, the reduction of this component of the conservation strategy under Alternative 4 would be expected to result in a greater loss of biodiversity relative to the current Forest Plan. This is particularly relevant in the Etolin and Revilla Island/Cleveland Peninsula biogeographic provinces where a substantial amount of timber harvest is proposed but where no reserve system or a very limited reserve system would be in place, respectively.

Alternative 4 would include 60 percent of the existing POG within reserves and an additional 27 percent would be protected within the matrix by standards and guidelines or not scheduled for harvest. As a result, about 13 percent, or 656,000 acres, would be subject to harvest (Table 3.9-12). Long-term maximum harvest of existing high-volume and large-tree POG are projected to be in the 15 to 16 percent range. In addition, there would be about 243,000 acres of existing productive young growth that would not be harvested and that would eventually develop into mature forest and then POG (Table 3.9-13). This represents a long-term replacement for about 37 percent of the future maximum POG harvest.

Assuming maximum harvest over 100+ years, approximately 79 percent of the original POG would remain Forest-wide; 55 percent of the original POG would be in reserves (Table 3.9-14). Harvest would be spread over 20 out of the 21 provinces, and 15 provinces would have potential harvest exceeding 5,000 acres. At least 7 of the 21 provinces would have more than 90 percent of their original POG remaining after 100+ years, and 5 provinces (North Central Prince of Wales, Kupreanof/Mitkof, Etolin & Vicinity, Kuiu, and East Baranof) would have less than 75 percent remaining (Table 3.9-14).

Relative to the largest tree categories, after 100+ years of maximum implementation of Alternative 4, 75 percent of the original high-volume POG and 68 percent of the original large-tree POG would remain, with the majority of these acres in reserves (Tables 3.9-15 and 3.9-16). At least 7 provinces would maintain 90 percent or more of their original high-volume POG and 9 provinces would maintain less than 75 percent (minimum = 51 percent for North Central Prince of Wales) (Table 3.9-15). Relative to large-tree POG, at least 5 provinces would maintain 90 percent or more of their original acres and 10 provinces would have less than 75 percent (minimum = 31 percent for East Baranof) (Table 3.9-16).

Implementation of Alternative 4 would result in a maximum reduction of the karst POG on the Tongass from 69 percent of the original karst POG at present, to 58 percent after 100+ years. Low elevation karst POG would be reduced from 62 percent currently, to 52 percent (Table 3.9-17).

Long-term POG representation by ecological subsection would be maintained under Alternative 4 by protecting at least 45 percent of original POG in all 73 subsections

(Table 3.9-18). At least 90 percent of original POG would be maintained in 29 of the 73 subsections and at least 75 percent would be maintained in 51 out of the 73 subsections. Two subsections, North POW-Kuiu Carbonates and Thomas Bay Outwash Plains, would have with less than 50 percent of their original POG remaining after 100+ years. North POW-Kuiu Carbonates would maintain about 86,000 acres of POG and Thomas Bay Outwash Plains would maintain about 7,000 acres of POG.

If one considers the regrowth of current young growth that would be protected under this alternative (Table 3.9-13), after 100+ years the equivalent of an additional 4 percent of the original POG acres would be in mature forest stands and some stands would be at the beginning stages of exhibiting older forest characteristics (Table 3.9-14). Similarly, an additional 7 percent of the original high-volume POG, 11 percent of the original large-tree POG, and 14 percent of the original karst POG would be in mature forest stages (Tables 3.9-15, 3.9-16, and 3.9-17, respectively). In summary, after 100+ years of implementation under Alternative 4, 83 percent of the original POG would be remaining as POG or in mature forest stages. Likewise, 82 percent of the original high-volume POG would still be in high-volume POG or in mature forest stages, 79 percent of the original large-tree POG would be remaining as large-tree POG or in mature forest stages, and 72 percent of the original karst POG would be remaining as POG or in mature forest stages.

Alternative 4 would result in the additional conversion of intact large watersheds to a modified condition. After 100+ years of implementation under maximum harvest, the percentage of intact watersheds would be reduced from 69 percent to 48 percent of the Tongass. Similarly, the percentage of the land area of the Tongass in intact watersheds would be reduced from 74 percent to 58 percent (Table 3.9-19). However, a portion of this reduction would occur as a result of additional development on non-NFS lands, even if no additional Tongass harvest occurred. Approximately 8 percentage points of the drop in percentage of intact watersheds and 5 percentage points of the drop in acreage are due to additional development on non-NFS lands.

Alternative 5

Alternative 5 represents the current Forest Plan. Although this alternative was not specifically evaluated in the 1996 panel assessment, based on its level of harvest and other factors considered in the assessment, it is clear that it would rate as having a lower effect on biodiversity than Alternatives 4 and 7 and a higher effect than Alternatives 1, 2, 3, or 6.

Alternative 5 would maintain 71 percent of the existing POG within reserves and an additional 20 percent would be protected within the matrix by standards and guidelines or not scheduled for harvest. As a result, about 9 percent, or 463,000 acres, would be subject to harvest (Table 3.9-12). Long-term maximum harvest of high-volume and large-tree POG are projected to be in the 10 to 11 percent range. In addition, there would be about 250,000 acres of existing productive young growth that would not be harvested and that would eventually develop into mature forest and then POG (Table 3.9-13). This represents a long-term replacement for about 54 percent of the future maximum POG harvest.

Assuming maximum harvest over 100+ years, approximately 83 percent of the original POG would remain Forest-wide; 65 percent of the original POG would be in reserves (Table 3.9-14). Harvest would be spread over 19 out of the 21 provinces, but only 14 provinces would have potential harvest exceeding 5,000 acres. At least 8 of the 21 provinces would have more than 90 percent of their original POG remaining after 100+ years, and 3 provinces (North Central Prince of Wales, Kupreanof/Mitkof, and Etolin & Vicinity) would have less than 75 percent remaining (Table 3.9-14).

Relative to the largest tree categories, after 100+ years of maximum implementation of Alternative 5, 79 percent of the original high-volume POG and 71 percent of the original large-tree POG would remain, with the majority of these acres in reserves (Tables 3.9-15 and 3.9-16). At least 8 provinces would maintain 90 percent or more of their original high-volume POG and 5 provinces would maintain less than 75 percent (minimum = 55 percent for North Central Prince of Wales) (Table 3.9-15). Relative to large-tree POG, at least 5 provinces would maintain 90 percent or more of their original acres and 9 provinces would have less than 75 percent (minimum = 31 percent for East Baranof) (Table 3.9-16).

Implementation of Alternative 5 would result in a maximum reduction of the karst POG on the Tongass from 69 percent of the original karst POG at present, to 60 percent after 100+ years. Low elevation karst POG would be reduced from 62 percent currently, to 54 percent (Table 3.9-17).

Long-term POG representation by ecological subsection would be maintained under Alternative 5 by protecting at least 48 percent of original POG in all 73 subsections (Table 3.9-18). At least 90 percent of original POG would be maintained in 31 of the 73 subsections and at least 75 percent would be maintained in 56 out of the 73 subsections. One subsection, North POW-Kuiu Carbonates, would have with less than 50 percent of its original POG remaining after 100+ years, but would still maintain about 91,000 acres.

If one considers the regrowth of current young growth that would be protected under this alternative (Table 3.9-13), after 100+ years the equivalent of an additional 5 percent of the original POG acres would be in mature forest stands and some stands would be at the beginning stages of exhibiting older forest characteristics (Table 3.9-14). Similarly, an additional 7 percent of the original high-volume POG, 11 percent of the original large-tree POG, and 14 percent of the original karst POG would be in mature forest stages (Tables 3.9-15, 3.9-16, and 3.9-17, respectively). In summary, after 100+ years of implementation under Alternative 5, 88 percent of the original POG would be remaining as POG or in mature forest stages. Likewise, 86 percent of the original high-volume POG would still be in high-volume POG or in mature forest stages, 82 percent of the original large-tree POG would be remaining as large-tree POG or in mature forest stages, and 74 percent of the original karst POG would be remaining as POG or in mature forest stages.

Alternative 5 would result in the additional conversion of intact large watersheds to a modified condition. After 100+ years of implementation under maximum harvest, the percentage of intact watersheds would be reduced from 69 percent to 50 percent of the Tongass. Similarly, the percentage of the land area of the Tongass in intact watersheds would be reduced from 74 percent to 60 percent (Table 3.9-19). However, over on-third of this reduction would occur as a result of additional development on non-NFS lands, even if no additional Tongass harvest occurred. Approximately 8 percent of the drop in percentage of intact watersheds and 5 percent of the drop in acreage is due to additional development on non-NFS lands. Approximately 8 percentage points of the drop in percentage of intact watersheds and 5 percentage points of the drop in acreage are due to additional development on non-NFS lands.

Alternative 6

Alternative 6 represents the proposed action and represents a modification of the current Forest Plan. It would result in slightly less POG retained within the matrix, but would expand the reserve system relative to the current Forest Plan

(Alternative 5). On balance, it would protect more POG than Alternative 5, particularly the POG in reserves and large-tree POG. Therefore, it would have a lower overall effect on biodiversity than Alternative 5. Although this alternative was not specifically evaluated in the 1996 panel assessment, based on its level of harvest and other factors considered in the assessment, it is clear that it would have a lower effect on biodiversity than Alternatives 4, 5, and 7 and a higher effect than Alternatives 1, 2, or 3.

Under Alternative 6, 72 percent of the existing POG would be included within reserves and an additional 19 percent would be protected within the matrix by standards and guidelines or not scheduled for harvest. As a result, about 9 percent, or 445,000 acres, would be subject to harvest (Table 3.9-12). Although Alternative 6 would protect 28,000 fewer acres of POG in the matrix than Alternative 5 (partly because the matrix land area would be smaller under Alternative 6), it would have 45,000 more acres of POG in reserves. Long-term maximum harvest of high-volume and large-tree POG are projected to be in the 10 to 11 percent range. Again in comparison with Alternative 5, although Alternative 6 would protect 1,000 fewer acres of large-tree POG in the matrix, it would maintain about 11,000 more acres within reserves. Alternative 6 includes a refinement of small old-growth reserve boundaries relative to Alternative 5; one of the factors this refinement emphasized was the incorporation of more large-tree POG.

In addition to the POG that would not be harvested, there would be about 255,000 acres of existing productive young growth that would not be harvested under Alternative 6 and that would eventually develop into mature forest and then POG (Table 3.9-13). This represents a long-term replacement for about 57 percent of the future maximum POG harvest.

Assuming maximum harvest over 100+ years, approximately 83 percent of the original POG would remain Forest-wide; 66 percent of the original POG would be in reserves (Table 3.9-14). Harvest would be spread over 19 out of the 21 provinces, but only 13 provinces would have potential harvest exceeding 5,000 acres. At least 8 of the 21 provinces would have more than 90 percent of their original POG remaining after 100+ years, and 3 provinces (North Central Prince of Wales, Kupreanof/Mitkof, and Etolin & Vicinity) would have less than 75 percent remaining (Table 3.9-14).

Relative to the largest tree categories, after 100+ years of maximum implementation of Alternative 6, 79 percent of the original high-volume POG and 72 percent of the original large-tree POG would remain, with the majority of these acres in reserves (Tables 3.9-15 and 3.9-16). At least 8 provinces would maintain 90 percent or more of their original high-volume POG and 5 provinces would maintain less than 75 percent (minimum = 54 percent for North Central Prince of Wales) (Table 3.9-15). Relative to large-tree POG, at least 6 provinces would maintain 90 percent or more of their original acres and 9 provinces would have less than 75 percent (minimum = 31 percent for East Baranof) (Table 3.9-16).

Implementation of Alternative 6 would result in a maximum reduction of the karst POG on the Tongass from 69 percent of the original karst POG at present, to 61 percent after 100+ years. Low elevation karst POG would be reduced from 62 percent currently, to 55 percent (Table 3.9-17).

Long-term POG representation by ecological subsection would be maintained under Alternative 6 by protecting at least 48 percent of original POG in all 73 subsections (Table 3.9-18). At least 90 percent of original POG would be maintained in 31 of the 73 subsections and at least 75 percent would be maintained in 57 out of the 73 subsections. One subsection, North POW-Kuiu Carbonates, would have with less than 50 percent of its original POG remaining after 100+ years, but would still maintain about 92,000 acres.

If one considers the regrowth of current young growth that would be protected under this alternative (Table 3.9-13), after 100+ years the equivalent of an additional 5 percent of the original POG acres would be in mature forest stands and some stands would be at the beginning stages of exhibiting older forest characteristics (Table 3.9-14). Similarly, an additional 7 percent of the original high-volume POG, 11 percent of the original large-tree POG, and 15 percent of the original karst POG would be in mature forest stages (Tables 3.9-15, 3.9-16, and 3.9-17, respectively). In summary, after 100+ years of implementation under Alternative 6, 88 percent of the original POG would be remaining as POG or in mature forest stages. Likewise, 86 percent of the original high-volume POG would still be in high-volume POG or in mature forest stages, 83 percent of the original large-tree POG would be remaining as large-tree POG or in mature forest stages, and 76 percent of the original karst POG would be remaining as POG or in mature forest stages.

Alternative 6 would result in the additional conversion of intact large watersheds to a modified condition. After 100+ years of implementation under maximum harvest, the percentage of intact watersheds would be reduced from 69 percent to 51 percent of the Tongass. Similarly, the percentage of the land area of the Tongass in intact watersheds would be reduced from 74 percent to 60 percent (Table 3.9-19). However, over on-third of this reduction would occur as a result of additional development on non-NFS lands, even if no additional Tongass harvest occurred. Approximately 8 percentage points of the drop in percentage of intact watersheds and 5 percentage points of the drop in acreage are due to additional development on non-NFS lands.

Alternative 7

Alternative 7 represents the alternative with the highest POG harvest level. It also differs from the other alternatives in that it does not designate Old-Growth Habitat LUDs, although it does include reserves associated with other non-development LUDs. In addition to the elimination of Old-Growth Habitat LUDs, Alternative 7 also proposes to reduce the beach buffer from 1,000 feet to 500 feet. This would likely reduce the effectiveness of these shoreline corridors in providing landscape linkages between habitat reserves and thus, potentially reduce the interconnectedness of the old-growth forest ecosystem. Further, it differs from all other alternatives by not requiring riparian buffers along Class III streams, which would also have some negative effect on old-growth connectivity (although Class I and II riparian buffers are most important in this regard). Finally, as in the case for Alternative 4, it would not include the goshawk and marten or the legacy forest structure standards and guidelines that require retention trees in harvest units within specific VCUs.

Alternative 7 is based on and is similar to the 1997 Alternative 2, which was evaluated in the 1997 Forest Plan Revision FEIS (see Chapter 2); therefore, the conclusions of the 1997 old-growth panel assessment can be extended to the current Alternative 7. The panel assessment concluded that this alternative was ranked in the highest risk group in terms of effects on biodiversity among the alternatives evaluated by the panel. As such, it ranked worse than our 2007 Alternative 4 and, through comparisons with acreage harvested and other alternative components, it would have ranked worse than all of the other 2007 alternatives as well. In addition to the acres of harvest, the primary factor associated with this ranking is the absence of reserves over many relatively large areas of the Tongass. Of particular concern are the North Central Prince of Wales Island, Etolin Island & Vicinity, Kupreanof/Mitkof Island, and Revilla Island/Cleveland

Peninsula biogeographic provinces, which have already been heavily affected by timber harvest. The old-growth network was specifically designed to ensure the maintenance of well-distributed viable populations of all old-growth associated wildlife species across the Tongass. The 1996 panel assessment concluded that alternatives that did not emphasize the old-growth reserve network had the highest potentials to create biodiversity concerns within biogeographic provinces over the long term.

Alternative 7 would include 57 percent of the existing POG within reserves and an additional 27 percent would be protected within the matrix by standards and guidelines or not scheduled for harvest. As a result, about 16 percent, or 807,000 acres, would be subject to harvest (Table 3.9-12). Long-term maximum harvest of existing high-volume and large-tree POG are projected to be in the 18 to 20 percent range. In addition, there would be about 219,000 acres of existing productive young growth that would not be harvested and that would eventually develop into mature forest and then POG (Table 3.9-13). This represents a long-term replacement for about 27 percent of the future maximum POG harvest.

Assuming maximum harvest over 100+ years, approximately 77 percent of the original POG would remain Forest-wide; 52 percent of the original POG would be in reserves (Table 3.9-14). Harvest would be spread over 20 out of the 21 provinces, and 16 provinces would have potential harvest exceeding 5,000 acres. At least 7 of the 21 provinces would have at least 90 percent of their original POG remaining after 100+ years, and 7 provinces (North Central Prince of Wales, Kupreanof/Mitkof, Etolin & Vicinity, Revilla/Cleveland, Kuiu, East Chichagof, and East Baranof) would have less than 75 percent remaining (Table 3.9-14).

Relative to the largest tree categories, after 100+ years of maximum implementation of Alternative 7, 72 percent of the original high-volume POG and 64 percent of the original large-tree POG would remain, with the majority of these acres in reserves (Tables 3.9-15 and 3.9-16). At least 7 provinces would maintain 90 percent or more of their original high-volume POG and 11 provinces would maintain less than 75 percent (minimum = 44 percent for North Central Prince of Wales) (Table 3.9-15). Relative to large-tree POG, at least 5 provinces would maintain 90 percent or more of their original acres and 12 provinces would have less than 75 percent (minimum = 31 percent for East Baranof) (Table 3.9-16).

Implementation of Alternative 7 would result in a maximum reduction of the karst POG on the Tongass from 69 percent of the original karst POG at present, to 54 percent after 100+ years. Low elevation karst POG would be reduced from 62 percent currently, to 47 percent (Table 3.9-17).

Long-term POG representation by ecological subsection would be maintained under Alternative 7 by protecting at least 41 percent of original POG in all 73 subsections (Table 3.9-18). At least 90 percent of original POG would be maintained in 25 of the 73 subsections and at least 75 percent would be maintained in 45 out of the 73 subsections. Four subsections, North POW-Kuiu Carbonates, Central POW Volcanics, Stikine Strait Complex, and Thomas Bay Outwash Plains, would have with less than 50 percent of their original POG remaining after 100+ years. These subsections would have 78,000, 79,000, 16,000, and 6,000 acres of POG, respectively.

If one considers the regrowth of current young growth that would be protected under this alternative (Table 3.9-13), after 100+ years the equivalent of an additional 4 percent of the original POG acres would be in mature forest stands and some stands would be at the beginning stages of exhibiting older forest characteristics (Table 3.9-14). Similarly, an additional 6 percent of the original high-volume POG, 9 percent of the original large-tree POG, and 12 percent of the original karst POG would be in mature forest stages (Tables 3.9-15, 3.9-16, and 3.9-17, respectively). In summary, after 100+ years of implementation under Alternative 7, 81 percent of the original POG would be remaining as POG or in mature forest stages. Likewise, 78 percent of the original high-volume POG would still be in high-volume POG or in mature forest stages, 71 percent of the original large-tree POG would be remaining as large-tree POG or in mature forest stages, and 66 percent of the original karst POG would be remaining as POG or in mature forest stages.

Alternative 7 would result in the additional conversion of intact large watersheds to a modified condition. After 100+ years of implementation under maximum harvest, the percentage of intact watersheds would be reduced from 69 percent to 47 percent of the Tongass. Similarly, the percentage of the land area of the Tongass in intact watersheds would be reduced from 74 percent to 57 percent (Table 3.9-19). However, a portion of this reduction would occur as a result of additional development on non-NFS lands, even if no additional Tongass harvest occurred. Approximately 8 percentage points of the drop in percentage of intact watersheds and 5 percentage points of the drop in acreage are due to additional development on non-NFS lands.

Endemics

As noted in the Endemism subsection of the Affected Environment part of this section, Southeast Alaska is rich in endemics, and endemic mammals and other groups are sensitive to future landscape disturbances. Because unproductive forest and non-forested ecosystems have not changed appreciably since original levels, nor are they anticipated to change under the full implementation of the Forest Plan under any of the alternatives, concerns focus on the loss of POG habitat, which is most influenced by management activities. Those species most closely associated with old growth are assumed to be at greatest risk.

The 1997 Forest Plan FEIS panel assessment for endemics evaluated 14 species or subspecies endemic to Southeast Alaska (see the *Wildlife* section of the 1997 Forest Plan Revision FEIS and the *Wildlife* section in this chapter for additional information). Each of the above species occupies restricted ranges (i.e., currently known to be limited to one or a few isolated islands). Under all alternatives, the Prince of Wales flying squirrel is currently assumed to have the greatest viability concern over time.

The panel concluded that the 1997 Alternative 11 (equivalent to the current Forest Plan or the 2007 Alternative 5) ranked among the alternatives with the highest likelihood of sustaining habitat to support viable populations of endemic mammals. Under the current Forest Plan, all islands less than 1,000 acres were removed from the timber base to eliminate risk to these species associated with habitat loss or alteration from timber harvest. The 1,000-foot beach buffer, riparian corridors, and the old-growth reserve system are also features of the current Forest Plan that provide functional habitat for species with relatively small home ranges. These protective provisions would be maintained under all the action alternatives, with the exception of Alternative 7 under which the beach fringe buffer would be reduced to 500 feet, the system of old-growth reserves would be significantly contracted, and Class III stream buffers would be eliminated. Alternative 4 would also significantly reduce the old-growth reserve system in some provinces. Alternatives 1, 2, 3, and 6, which propose to harvest less timber than under the current Forest Plan, would likely continue to maintain habitat and connectivity to support viable populations of endemic mammals.

Based on the number of acres converted from the matrix to reserves, as described above, the ability to maintain viable populations of endemic mammals would be greatest under Alternative 1, followed by Alternatives 2, 3, 6, 5, 4, and 7. See the *Wildlife* section in this chapter for additional species-specific discussion.

Invasive Species

As discussed in the Affected Environment section, numerous non-native species have been introduced or transplanted in Alaska, including plants, wildlife, fish, other aquatic organisms, and insects. Managing invasive species on the Tongass National Forest must include increased public awareness at all levels coupled with interagency cooperation and development of cooperative management partnerships to monitor and limit invasive species populations at current levels in Alaska.

Currently, non-native or invasive plant species make up the vast majority of species listed as threats in Alaska. Fifteen of the species found on the Tongass are among the species that pose a greater potential threat. The areas of greatest non-native plant diversity and extent of invasion have been found around towns and the most heavily traveled areas. The areas with the lowest number of species were further from population centers or paved roads (Arhangelsky 2005). Schrader and Hennon (2005) cited several references that suggest that the highest invasive plant occurrences are in areas of disturbance such as roads, recreational areas, commercial, and industrial development. As more surveys are conducted, it is anticipated that more invasive plant species will be documented (see the Plant section in this chapter for additional discussion of effects from non-native plants).

Non-native wildlife species have been transplanted for sport hunting or other consumption opportunities such as trapping or, in some cases, accidentally introduced in Southeast Alaska; however, only the Norway rat is considered invasive at this time. Concern regarding potential range expansion of this species exists; however, measures to reduce the potential of introducing this species elsewhere on the Tongass is limited because the Forest does not have jurisdiction regarding shipping throughout Southeast Alaska waters. Because of the growing number of elk in Southeast Alaska, this species may be considered as a possible invasive species outside of Etolin and Zarembo islands, due to their effects on Sitka black-tailed deer, which have similar habitat needs (see the *Wildlife* section in this chapter).

Invasive fish and other aquatic organisms identified as threats for Alaska are discussed in more detail under the *Fish* section in this chapter. Established populations (throughout the Susitna River drainage, parts of the Kenai system) of northern pike (with the exception of Pike Lakes on the Yakutat Ranger District) pose the greatest immediate concern, while the Atlantic salmon, Chinese mitten crab, and New Zealand mudsnail are species likely to invade Alaska in coming years (Schrader and Hennon 2005). Effects of these species on native populations are currently unknown; however, based on documented impacts in other areas, species such as the Chinese mitten crab and New Zealand mudsnail quickly colonize environments and dominate the invertebrate community in aquatic ecosystems by consuming large portions of the food resources, outcompeting and physically crowding native species. This could lead to local extirpation in some areas over time.

Schrader and Hennon (2005) noted that invasive tree pathogens are not currently damaging Alaskan ecosystems, but there are numerous species that could cause widespread tree mortality if introduced. Introduced insects currently established in Alaska include the larch sawfly, alder woolly aphid, spruce aphid, and amber-marked birch leafminer, and could cause widespread tree defoliation and mortality (see the *Forest Health* section in this chapter for additional discussion of effects).

With the exception of certain fish and aquatic organisms that would not be expected to increase independent of any of the alternatives, most of the other invasive or potentially invasive species listed above would be influenced by management activities that would increase harvest and other associated management activities, such as the building of new roads. Alternatives 1, 2, and 3 designate more reserve areas than the other alternatives. Under Alternatives 4 and 7, there would be an increase in the amount of harvest and roading, relative to the current Forest Plan; more lands would be available for timber harvest activities under Alternatives 4 and 7. Although any management activity has the potential to increase the risk of introducing invasive species to a system, it is reasonable to assume that increases in harvest and roading from current levels would contribute additional source areas for invasive establishment and persistence.

None of the alternatives proposes changes to the management framework of the Tongass in relation to invasives. Most of the species identified above are not specifically addressed under the Forest Plan Monitoring section or standards and guidelines; however, the Alaska Region of the Forest Service is currently developing an invasive species strategy that will apply the principles of prevention, early detection, control, and rehabilitation in cooperation with various agencies and partners to reduce or eliminate invasive species establishment.

Cumulative Effects

When considering biodiversity and the distribution of old growth across the Tongass, it is important to consider non-NFS lands (which include private, city, state, and other federal lands. As noted in the subsections titled *Cumulative Past Harvest* and *Current Conditions by Biogeographic Province* in the *Affected Environment* portion of this section, past harvest has been more extensive on non-NFS lands than on NFS lands. The area used to assess cumulative effects on biodiversity encompasses all lands in Southeast Alaska, including all lands within the Tongass National Forest boundary, from the Yakutat area southeast to the south of Ketchikan. In addition, it includes the area of Glacier Bay National Park, and the areas around Haines and Skagway. Some resource areas may require larger or smaller areas to address cumulative effects. For example, for some resources, the extent of analysis needs only include the area within the Tongass boundary (i.e., without the Glacier Bay National Park and Haines/Skagway areas). In particular, cumulative effects are sometimes addressed within a VCU (e.g., water, fish, wetlands), or a WAA (e.g., wolves, deer), or a Biogeographic Province or an Ecological Subsection (e.g., species viability).

Under the current Forest Plan, with few exceptions (e.g., minerals production and utility corridors), only lands classified as suitable for timber production are scheduled for harvest in the future. However, other reasonably foreseeable activities that have the potential to cumulatively affect biodiversity locally and regionally include:

- Minerals extraction (e.g., Green's Creek on Admiralty Island and Kensington Gold Mine near Berners Bay north of Juneau),
- Transmission line intertie projects (e.g., Swan Lake-Lake Tyee Intertie northeast of Ketchikan),
- Hydroelectric projects (e.g., Four Dam Pool projects, other limited small hydroelectric projects such as Angoon),
- Regional transportation developments (e.g., Juneau Access Road),
- Growth in the cruise ship, guiding services, fishing/destination type lodging, and
- Human settlements (e.g., expansion of cities like Juneau and Ketchikan, recreational cabin development, and land auctions by the State of Alaska).

Because plant and wildlife populations exist across all land ownerships, addressing potential adverse effects of management activities on overall biodiversity requires agencies and other landowners to work together. A species population viability and its distribution within Southeast Alaska is influenced in part by geologic processes (e.g., island archipelago), habitat and connectivity between patches (e.g., fragmentation), and by state and federal regulatory mechanisms such as harvest limits, season length, subsistence needs, and timber harvest practices on all lands. Overall, biodiversity on the Tongass remains in good condition and are mostly dominated by old-growth forest. As development continues through timber harvest, associated activities such as road building, and community expansion, particularly in areas where extensive development has already occurred (i.e., Prince of Wales Island), maintaining connectivity and roadless refugia will become increasingly important, particularly for wide-ranging species whose distribution depends on some level of connectivity across the landscape. In addition, the management of human resources will continue to play a role in the viability and distribution of biodiversity across the Forest.

Cumulative Effects on Productive Old Growth in General

The focus of the analysis remains on changes to the old-growth ecosystem as this habitat is most affected under each of the alternatives. This section displays future projected harvest on both NFS lands and non-NFS lands by biogeographic province and ecological subsection. For assessing overall effects to biodiversity across all ownerships for Southeast Alaska, both biogeographic province and ecological subsection are appropriate scales. As stated in the *Affected Environment* section, using both biogeographic provinces and ecological subsection classifications allows additional insight into how various communities are represented at different landscape scales. Both classification systems were developed using different processes, but complement each other in terms of addressing biodiversity.

To estimate the future harvest of POG on non-NFS lands, it was assumed that 75 percent of the remaining old-growth would be harvested on Native corporation lands and 50 percent of the remaining old growth would be harvested on state lands, other private lands, and lands owned by municipalities, over the life of the Forest Plan (100+ years). The total percent harvest of POG on all lands within Southeast Alaska by biogeographic province and each ecological subsection could then be calculated.

On NFS lands, approximately 455,000 acres have been harvested. As a result, 92 percent of the original POG remains today. Additional POG harvest on NFS lands under the alternatives would range from an estimated maximum of 86,000 acres under Alternative 1 to 807,000 acres under Alternative 7, over the next 100+ years. The result would be that an estimated 90 to 77 percent of the original POG on these lands would remain indefinitely.

Approximately 371,000 acres of POG (including a small portion of helicopter partial harvest acres) have been harvested on non-NFS lands, with the majority of the harvest occurring in the last 25 years. With this harvest, 51 percent of the original POG is estimated to remain on these lands. Future harvest on non-NFS lands over the next 100+ years is estimated to be as high as 295,000 additional acres. Therefore, after the total cumulative harvest on non-NFS lands an estimated 19 percent is expected to remain (considered to be a conservatively high estimate).

Considering NFS and non-NFS lands combined, 87 percent of the area originally occupied by POG remains unharvested today. The percent of original POG that would remain after full implementation of the Forest Plan and future non-NFS harvest (after 100+ years) would range from 82 percent under Alternative 1 to 71 percent under Alternative 7 (Table 3.9-20). This does not include approximately 3 to

6 percent additional that would be represented by mature second growth that is protected from harvest, some of which would be beginning to take on older forest characteristics.

Past harvest activities have concentrated, and future harvest will continue to concentrate under most alternatives, primarily in three biogeographic provinces: the North Central Prince of Wales, Kupreanof/Mitkof, and Revilla/Cleveland provinces. These three provinces account for about 56 percent of the past harvest and will account for 44 to 74 percent of future harvest, depending on the alternative.

North Central Prince of Wales is the province with the most extensive past and future harvest and development. Currently, 65 percent of the original POG remains in the province (Table 3.9-20). After 100+ years, the minimum amount remaining would range from 44 to 55 percent, depending on the alternative.

In addition to the three provinces mentioned above, relatively high rates of POG removal have occurred, or are planned to occur, within the Etolin Island & Vicinity, East Chichagof, Southern Outer Island, Dall Island & Vicinity, and Yakutat Forelands biogeographic provinces (however, POG removal in the Yakutat Forelands province is partially due to windthrow rather than timber harvest). Under all alternatives, harvest will continue to be concentrated in matrix NFS lands and on private and state lands, and reserves will continue to exist on NFS, other federal, and some state lands. More specific descriptions of effects are presented under the *Cumulative Effects by Biogeographic Province* subsection below.

Theoretical and empirical studies suggest that the likelihood of a population persisting over time is related to some threshold level of habitat loss across the landscape (Fahrig 1997, 1999, 2003; Flather et al. 2002; Andren 1994). Reported threshold levels for the percentage of habitat maintained at which the rate of landscape extinction increases range from 20 percent (Fahrig 1997) to 50 percent (Soule and Sanjayan 1998), depending in part on the dispersal capability of the species under consideration (see the Cumulative Effects subsection of the *Wildlife* section for further information on this topic). It is important to note that, although many plant and animal species make higher use of the larger forest types defined by high-volume and large-tree POG, few are totally restricted to these habitats. In fact, almost all species make at least some use of types other than mapped POG (e.g., unproductive old growth and older young growth forests). The thresholds of importance to an individual species depend on specific habitat requirements as well as dispersal capabilities. Existing natural fragmentation of habitats can also affect the level of additional fragmentation that can be supported. Therefore, the percentages of POG and larger tree types presented in these cumulative effects discussions represent indices of risk, which can be generally compared with theoretical and empirical thresholds, recognizing the high degree of variability among species habitat requirements, dispersal capabilities, and the natural level of fragmentation within the landscape.

Within the Tongass National Forest boundary, the Conservation Strategy was designed to address the more extensive harvest on non-NFS lands through the old-growth reserve system network and Forest-wide standards and guidelines, both of which were intended to maintain habitat components important to a variety of species and maintain connectivity across the landscape, with or without much contribution from non-NFS lands. In other words, benefits from non-NFS lands were assumed to be minimal in the design of the strategy. Therefore, the cumulative effects associated with the combination of NFS and non-NFS harvest, for those alternatives that incorporate the complete conservation strategy (i.e., Alternatives 1, 2, 3, 5, and 6), are not expected to be appreciably different than the direct and indirect effects.

Table 3.9-20
Cumulative Percent of Original POG Remaining on All Ownerships after 100+ Years of Maximum[1] Forest Plan Implementation under Each Alternative, incorporating Future Harvest on Non-NFS Lands[2] by Biogeographic Province

	Biogeographic Province	Estimated Original POG on All Ownerships (Acres)	Percent Remaining POG on All Ownerships	Percent Remaining POG after 100+ Years as a Percent of Original POG — Alternative 1	2	3	4	5	6	7
1	Yakutat Forelands	89,226	84%	77%	75%	73%	72%	72%	73%	71%
2	Yakutat Uplands	23,400	94%	94%	94%	94%	93%	94%	94%	93%
3	East Chichagof Island	430,035	84%	78%	75%	74%	67%	71%	72%	64%
4	West Chichagof Island	72,369	100%	100%	100%	100%	100%	100%	100%	100%
5	East Baranof Island	89,338	87%	86%	81%	80%	72%	76%	78%	70%
6	West Baranof Island	227,753	92%	90%	88%	86%	81%	86%	86%	80%
7	Admiralty Island	597,623	95%	95%	95%	95%	95%	95%	95%	95%
8	Lynn Canal	169,414	97%	92%	89%	88%	80%	84%	85%	79%
9	North Coast Range	356,463	94%	89%	89%	88%	77%	81%	81%	76%
10	Kupreanof/Mitkof Island	335,104	83%	74%	70%	66%	57%	61%	61%	53%
11	Kuiu Island	295,929	91%	91%	85%	83%	72%	79%	79%	69%
12	Central Coast Range	250,959	97%	96%	95%	89%	82%	85%	86%	80%
13	Etolin Island	232,104	85%	78%	71%	69%	59%	67%	67%	55%
14	North Central Prince of Wales	598,645	65%	55%	54%	52%	49%	51%	51%	44%
15	Revilla Island/ Cleveland Peninsula	573,213	89%	81%	79%	77%	69%	74%	74%	66%
16	Southern Outer Islands	118,338	85%	80%	78%	77%	75%	76%	76%	72%
17	Dall Island and Vicinity	99,621	75%	58%	58%	57%	55%	55%	55%	53%
18	South Prince of Wales	173,174	91%	87%	85%	81%	71%	77%	77%	68%
19	North Misty Fiords	200,820	99%	98%	98%	97%	96%	97%	97%	95%
20	South Misty Fiords	310,176	100%	100%	100%	100%	100%	100%	100%	100%
21	Ice Fields	115,273	97%	97%	96%	95%	93%	93%	94%	93%
22	Chilkat River Complex	145,104	88%	56%	56%	56%	56%	56%	56%	56%
23	Glacier Bay/ Fairweather Range	170,840	100%	100%	100%	100%	100%	100%	100%	100%
Total for Southeast Alaska		**5,674,921**	**87%**	**82%**	**80%**	**78%**	**73%**	**76%**	**76%**	**71%**

[1] Maximum Forest Plan implementation is defined as the maximum harvest allowed by the Allowable Sale Quantity each decade. The estimate assumes all scheduled suitable POG is harvested [calculated by subtracting alternative-specific reduction factors for the Model Implementation Reduction Factor (MIRF) and scheduling from the mapped suitable acreage under each alternative (see the Timber section)].

[2] Based on an inventory of existing harvest on non-NFS lands and the estimation of future harvest by major landowner category.

Table 3.9-21
Cumulative Percent of Original High-Volume POG Remaining on All Ownerships after 100+ Years of Maximum[1] Forest Plan Implementation under Each Alternative, incorporating Future Harvest on Non-NFS Lands[2] by Biogeographic Province

Biogeographic Province		Estimated Original High-Volume POG on All Ownerships (Acres)	Percent Remaining High-Volume POG on All Ownerships	Remaining High-Volume POG after 100+ Years as a Percent of Original POG — Alternative 1	2	3	4	5	6	7
1	Yakutat Forelands	56,525	81%	73%	70%	66%	64%	65%	65%	63%
2	Yakutat Uplands	11,614	92%	92%	92%	91%	90%	91%	91%	90%
3	East Chichagof Island	213,321	76%	69%	66%	65%	59%	63%	63%	56%
4	West Chichagof Island	17,275	100%	100%	100%	100%	100%	100%	100%	100%
5	East Baranof Island	37,246	77%	76%	70%	69%	62%	66%	67%	60%
6	West Baranof Island	68,682	82%	77%	76%	74%	69%	74%	74%	68%
7	Admiralty Island	323,390	94%	93%	93%	93%	93%	93%	93%	93%
8	Lynn Canal	69,994	95%	87%	84%	83%	73%	78%	79%	71%
9	North Coast Range	162,093	92%	83%	83%	82%	71%	76%	76%	70%
10	Kupreanof/Mitkof Island	151,400	71%	61%	57%	53%	44%	49%	49%	41%
11	Kuiu Island	175,546	90%	89%	82%	80%	69%	75%	75%	66%
12	Central Coast Range	110,637	95%	94%	93%	87%	80%	84%	84%	79%
13	Etolin Island	106,381	76%	67%	61%	59%	50%	57%	57%	45%
14	North Central Prince of Wales	453,890	56%	45%	44%	42%	39%	41%	41%	33%
15	Revilla Island/ Cleveland Peninsula	282,301	84%	74%	71%	70%	62%	68%	68%	58%
16	Southern Outer Islands	58,072	77%	70%	68%	67%	64%	66%	66%	61%
17	Dall Island and Vicinity	63,691	68%	52%	52%	51%	50%	50%	50%	48%
18	South Prince of Wales	94,158	88%	83%	81%	77%	67%	74%	73%	64%
19	North Misty Fiords	68,370	98%	97%	96%	95%	93%	95%	95%	93%
20	South Misty Fiords	97,581	100%	100%	100%	100%	100%	100%	100%	100%
21	Ice Fields	39,093	93%	93%	93%	92%	90%	90%	91%	90%
22	Chilkat River Complex	112,625	89%	60%	60%	60%	60%	60%	60%	60%
23	Glacier Bay/ Fairweather Range	157,413	100%	100%	100%	100%	100%	100%	100%	100%
Total for Southeast Alaska		**2,931,297**	**82%**	**75%**	**73%**	**72%**	**67%**	**70%**	**70%**	**65%**

[1] Maximum Forest Plan implementation is defined as the maximum harvest allowed by the Allowable Sale Quantity each decade. The estimate assumes all scheduled suitable POG is harvested [calculated by subtracting alternative-specific reduction factors for the Model Implementation Reduction Factor (MIRF) and scheduling from the mapped suitable acreage under each alternative (see the Timber section)].
[2] Based on an inventory of existing harvest on non-NFS lands and the estimation of future harvest by major landowner category.

Cumulative Effects on Specific Productive Old-Growth Types

Historically, as discussed in the *Past Old-Growth Harvest* subsection, some of the more productive forest types have been harvested at a higher rate than POG in general. These forest types have included both high-volume and large-tree POG (SD67), POG on karstlands, and low elevation POG (Albert and Schoen 2007). Tables 3.9-21 and 3.9-22 present the acreage of original high-volume and large-tree POG along with the percent currently remaining and the percent remaining after 100+ years by biogeographic province for all of Southeast Alaska.

For all ownerships across Southeast Alaska, an estimated 82 percent of high-volume POG remains today, although the percentage found in individual provinces ranges from a low of 56 percent to a high of 100 percent. After 100+ years, it is estimated that the overall amount remaining would range from a high of 75 percent under Alternative 1 to a low of 65 percent under Alternative 7 (Table 3.9-21). This does not include approximately 5 to 9 percent additional that would be represented by mature second growth growing on high-volume sites and is protected from harvest. The percent of POG remaining would range from 45 to 100 percent in individual provinces under Alternative 1 and from 33 to 100 percent under Alternative 7.

Approximately 68 percent of large-tree POG remains on all ownerships combined in Southeast Alaska. The percent remaining in individual provinces ranges from a low of 33 percent to a high of 100 percent. After 100+ years, the amount remaining would range from a high of 62 percent under Alternative 1 to a low of 52 percent under Alternative 7 (Table 3.9-22). This does not include approximately 7 to 14 percent additional that would be represented by mature second growth growing on large-tree POG sites and is protected from harvest. The percent of POG remaining would range from 32 to 100 percent in individual provinces under Alternative 1 and from 30 to 100 percent under Alternative 7.

Cumulative harvest on karst lands has affected about 34 percent of all karst POG and resulted in approximately 66 percent of all karst POG remaining unharvested. This represents about 84 percent of all karst POG at moderate to higher elevations (> 800 ft.), but only about 60 percent of all karst POG at low elevations (< 800 ft.). After 100+ years and assuming that all karst POG on non-NFS lands is harvested, the overall percent remaining would range from a high of 60 percent under Alternative 1 to a low of 50 percent under Alternative 7. In addition, from 11 to 24 percent of the original karst POG would be in mature second growth, some of which would be beginning to take on older forest characteristics.

Cumulative Effects and Climate Change

In addition to the approach and direction of management on the Tongass, there is uncertainty with regards to the cumulative effects on biodiversity associated with climate change. Warmer temperatures and decreased precipitation are anticipated to result in changes to vegetation and thus the suitability of wildlife habitat, among other impacts (see *Climate and Air* section). Although some species may benefit (e.g., greater overwinter survival of deer, and thus a greater prey base for wolves, resulting from warmer winter temperatures during normal years), habitat losses could also result from wind, increased risk of fires, insect infestations, disease, and from changes to microclimate conditions for many plant and animal species, especially those species already found in unique habitat conditions.

Table 3.9-22
Cumulative Percent of Original SD67 POG Remaining on All Ownerships after 100+ Years of Maximum[1] Forest Plan Implementation under Each Alternative, incorporating Future Harvest on Non-NFS Lands[2] by Biogeographic Province

Biogeographic Province		Estimated Original SD67 POG on All Ownerships (Acres)	Percent Remaining SD67 POG on All Ownerships	Remaining SD67 POG after 100+ Years as a Percent of Original POG — Alternative 1	2	3	4	5	6	7
1	Yakutat Forelands	32,356	81%	78%	73%	66%	63%	65%	65%	63%
2	Yakutat Uplands	2,408	83%	83%	80%	80%	75%	79%	79%	74%
3	East Chichagof Island	63,769	58%	54%	53%	52%	47%	51%	52%	46%
4	West Chichagof Island	2,012	100%	100%	100%	100%	100%	100%	100%	100%
5	East Baranof Island	5,894	33%	33%	32%	32%	31%	31%	31%	31%
6	West Baranof Island	10,434	44%	39%	39%	39%	37%	38%	38%	37%
7	Admiralty Island	109,477	91%	90%	90%	90%	90%	90%	90%	90%
8	Lynn Canal	15,109	88%	78%	76%	75%	65%	70%	71%	64%
9	North Coast Range	33,870	77%	66%	66%	66%	54%	59%	60%	52%
10	Kupreanof/Mitkof Island	43,968	47%	42%	40%	38%	32%	34%	35%	29%
11	Kuiu Island	45,073	82%	81%	67%	65%	56%	61%	61%	52%
12	Central Coast Range	22,550	89%	89%	87%	82%	73%	79%	78%	72%
13	Etolin Island	24,912	51%	46%	42%	40%	33%	39%	39%	30%
14	North Central Prince of Wales	228,477	55%	47%	45%	44%	40%	43%	43%	35%
15	Revilla Island/ Cleveland Peninsula	55,209	59%	55%	53%	52%	46%	50%	50%	44%
16	Southern Outer Islands	19,760	67%	60%	58%	57%	53%	56%	56%	49%
17	Dall Island and Vicinity	21,202	42%	37%	37%	37%	36%	37%	37%	36%
18	South Prince of Wales	54,556	88%	85%	82%	80%	69%	76%	76%	65%
19	North Misty Fiords	13,545	95%	94%	92%	92%	90%	92%	92%	90%
20	South Misty Fiords	14,147	100%	100%	100%	100%	100%	100%	100%	100%
21	Ice Fields	6,978	83%	83%	83%	83%	81%	81%	83%	81%
22	Chilkat River Complex	28,676	73%	32%	32%	32%	32%	32%	32%	32%
23	Glacier Bay/ Fairweather Range	0	--	--	--	--	--	--	--	--
Total for Southeast Alaska		**854,457**	**68%**	**62%**	**60%**	**59%**	**54%**	**57%**	**57%**	**52%**

[1] Maximum Forest Plan implementation is defined as the maximum harvest allowed by the Allowable Sale Quantity each decade. The estimate assumes all scheduled suitable POG is harvested [calculated by subtracting alternative-specific reduction factors for the Model Implementation Reduction Factor (MIRF) and scheduling from the mapped suitable acreage under each alternative (see the Timber section)].
[2] Based on an inventory of existing harvest on non-NFS lands and the estimation of future harvest by major landowner category.

The greatest concerns for plant and wildlife populations in relation to climate change, however, are the weather extremes that can be expected to occur periodically (CGC-ASR 1998). Periodic severe winter snowfalls are anticipated

(Juday et al. 1998). These events would be of greatest concern for populations that are limited in number or distribution. The predator-prey dynamic of wolves and deer provide an example of one system where these effects may be realized. Additional discussion on predator-prey dynamics can be found under the Wildlife section.

However, despite these uncertainties, the risks associated with implementation of the Forest Plan are very low. The life of this amendment is expected to be 10 to 15 years at most, by which time, much more research and monitoring information will be available and another comprehensive evaluation will be undertaken. The current levels of harvest activity are at a 5-decade low and even if timber sales are made available and the timber industry responds rapidly, there will be a period of preparation prior to the implementation of any sale. Therefore, it is estimated that a maximum of 30,000 to 150,000 acres of old-growth could be harvested over the life of this amended plan (e.g., the next 10 to 15 years). This harvest level would represent from less than 1 percent to 3 percent of the existing POG. Even when added to past harvest, cumulative harvest on NFS lands would be only 9 to 11 percent of the original POG.

Many of the gaps in information will be addressed through monitoring (See Chapter 6 in the Forest Plan). Additional studies stemming from adaptive management and known informational needs are discussed in Appendix B of the Forest Plan should assist land managers in the decision-making process to limit the degree of uncertainty and measure risk inherent in any decision into the future.

Cumulative Effects by Biogeographic Province

In the *Current Conditions by Biogeographic Province* subsection of *Affected Environment*, each biogeographic province is described with regard to past harvest and developments on both NFS and non-NFS lands of Southeast Alaska, and their effects on biodiversity. The following subsection builds on the previous subsection and discusses the cumulative effects associated with the past harvest and developments, when combined with the present and reasonably foreseeable harvest and developments on both NFS and non-NFS lands.

Yakutat Forelands

Past cumulative harvest in this biogeographic province removed 16 percent of the POG on all lands combined, resulting in 84 percent of the original POG remaining. Future harvest is expected to remove an additional 7 to 13 percent, resulting in approximately 71 to 77 percent of the original POG remaining after 100+ years (Table 3.9-20). High-volume POG is currently estimated to represent 81 percent of its original acreage. Future representation of high-volume POG is expected to be a minimum of 63 to 73 percent (Table 3.9-21). Similarly, large-tree POG is expected to decline from about 81 percent of original acreage at present, to a minimum of 63 to 78 percent after 100+ years (Table 3.9-22).

Currently, 83 percent of the large watersheds (representing 80 percent of the acreage) in the portion of the province within the Tongass Forest boundary are considered to be in an intact condition. After 100+ years, this percentage is expected to be reduced to a minimum of 58 to 67 percent (representing 71 to 73 percent of the acreage), depending on the alternative (Table 3.9-19). If the portion of the province that extends south into Glacier Bay National Park is included, the percentage of intact watersheds existing and remaining in the province after 100+ years would be substantially greater.

Cumulative effects on biodiversity associated with Alternatives 1 and 2 are expected to be slightly higher than existing conditions and concentrated in the area around Yakutat. Under these alternatives, future harvest would be mostly associated with non-NFS lands (there would be no NFS harvest under Alternative 1). Harvest on non-NFS lands would also be higher than harvest on NFS lands under all other alternatives. However, future NFS harvest associated with the other alternatives would approach the non-NFS harvest level. The extensive area of reserves in this province, under all alternatives, would limit effects on biodiversity. This is particularly true for Alternatives 1, 2, 3, 5, and 6, which include some acreage in the Old-Growth Habitat LUD designations, in addition to the large areas in Semi-Remote Recreation and LUD II and in Glacier Bay National Park that are associated with all the alternatives (65 percent of the province is in congressionally protected land designations). Further, Alternatives 1, 2, 3, and 6 would provide additional matrix retention as a result of the application of the legacy forest structure standard and guideline in two VCUs within the province.

Yakutat Uplands

The Yakutat Uplands province has experienced only limited past harvest equivalent to 6 percent of the original POG. Future cumulative harvest under all alternatives would also be limited to no more than several hundred additional acres. Therefore, approximately 93 to 94 percent of the original POG would be remaining after 100+ years (Table 3.9-20). In addition, future development would not change the percentage of large watersheds in an intact condition; they would remain at 96 percent of the watersheds or 99 percent of the acreage (Table 3.9-19). As a result of the limited extent of future development, cumulative effects on biodiversity are expected to be insignificant under any of the alternatives.

East Chichagof Island

Approximately 16 percent of the original POG in this province has been harvested, resulting in 84 percent of the original POG remaining. Following maximum future harvest after 100+ years, the percentage of original POG remaining would range from 64 percent (Alternative 7) to 78 percent (Alternative 1) (Table 3.9-20). High-volume POG is currently estimated to represent 76 percent of its original acreage. Future representation of high-volume POG is expected to be a minimum of 56 to 69 percent (Table 3.9-21). Similarly, large-tree POG is expected to decline from about 58 percent of original acreage at present, to a minimum of 46 to 54 percent after 100+ years (Table 3.9-22).

Currently, 53 percent of the large watersheds (representing 49 percent of the acreage) of the province are considered to be in an intact condition. After 100+ years, this percentage is expected to be reduced to a minimum of 31 to 52 percent (representing 26 to 47 percent of the acreage), depending on the alternative (Table 3.9-19). In addition to timber harvest, additional development associated with Hoonah and other communities in the province would contribute to cumulative effects.

Although specific watersheds would undergo a high cumulative percent harvest, Alternatives 1, 2, 3, 5, and 6 would result in the long-term retention of at least 71 percent of the original POG, 63 percent of the original high-volume POG, and 51 percent of the original large-tree POG. In addition, the conservation strategy in each of these alternatives would result in the spatial distribution of POG within reserves across the province. Further, Alternatives 1, 2, 3, and 6 would fully protect both pinch-points within the province by including them within reserves; Alternative 5 would fully protect one pinch-point and provide substantial protection to the second. Alternative 5 would not provide as much POG in reserves, but would provide more POG within the matrix because of the marten standards and guidelines. Alternatives 4 and 7, on the other hand, would not protect the pinch-point between northeast Chichagof and the main island. Further, because of a relatively low abundance and non-uniform distribution of reserves within the province, Alternative 7 and, to a lesser extent, Alternative 4, would likely result in gaps in the distribution of some organisms within the province and lower biodiversity.

West Chichagof Island

No past harvest has been mapped within the West Chichagof Island province and less than 200 acres (mostly on non-NFS lands) are projected to be harvested in the future. Therefore, the percentage of original POG remaining in the province after 100+ years would be almost 100 percent (Table 3.9-20). Future development is not expected to change the percentage of large watersheds in an intact condition either; currently this percentage is 100 percent. As a result, because of the very limited extent of future development, cumulative effects on biodiversity are expected to be virtually non-existent under any of the alternatives.

East Baranof Island

Past cumulative harvest in this biogeographic province has removed 13 percent of the POG on all lands combined, resulting in 87 percent of the original POG remaining. Future harvest is expected to remove an additional 1 to 17 percent, resulting in approximately 70 to 86 percent of the original POG remaining after 100+ years (Table 3.9-20). High-volume POG is currently estimated to represent 77 percent of its original acreage. Future representation of high-volume POG is expected to be a minimum of 60 to 76 percent (Table 3.9-21). Similarly, large-tree POG is expected to decline from about 33 percent of original acreage at present, to a minimum of 31 to 33 percent after 100+ years (Table 3.9-22). Therefore, although past large-tree POG harvest has been disproportionately high, the vast majority of remaining large-tree POG is in reserves and less than 10 percent of this remaining large-tree POG would be harvested under any of the alternatives.

Currently, 55 percent of the large watersheds (representing 60 percent of the acreage) are considered to be in an intact condition. After 100+ years, this percent age is expected to be reduced to a minimum of 45 percent (representing 49 percent of the acreage), depending on the alternative (Table 3.9-19).

Cumulative effects on biodiversity associated with Alternative 1 would be similar to those associated with existing conditions, because less than 1,000 additional acres of harvest would occur (on non-NFS lands). Alternatives 2, 3, 5, and 6 would result in a maximum of 6,000 to 11,000 additional acres of POG harvest. As is the case for East Chichagof Island province, specific watersheds would undergo high cumulative harvest under these alternatives; however, the conservation strategy would provide for extensive areas in reserves, distributed across the province, resulting in the retention of a minimum of 76 percent of original POG. Alternatives 4 and 7 would result in 15,000 to 17,000 additional acres of harvest and, although the southern half of the province would substantially be in reserves, the northern half would have large areas with no reserves, resulting in higher cumulative effects on biodiversity.

West Baranof Island

Approximately 8 percent of the original POG in this province has been harvested, resulting in 92 percent of the original POG remaining. Following maximum future harvest after 100+ years, the percentage of original POG remaining would range from 80 percent (Alternative 7) to 88 percent (Alternative 1) (Table 3.9-20). High-volume POG is currently estimated to represent 82 percent of its original acreage. Future representation of high-volume POG is expected to be a minimum of 68 to 77 percent (Table 3.9-21). Similarly, large-tree POG is expected to decline from about 44 percent of original acreage at present, to a minimum of 37 to 39 percent after

100+ years (Table 3.9-22). Therefore, as is the case for East Baranof Island province, although past large-tree POG harvest has been disproportionately high, the vast majority of remaining large-tree POG is in reserves and less than 10 percent of this remaining large-tree POG would be harvested under any of the alternatives.

Currently, 65 percent of the large watersheds (representing 69 percent of the acreage) of the province are considered to be in an intact condition. After 100+ years, this percentage is expected to be reduced to a minimum of 47 to 58 percent (representing 54 to 65 percent of the acreage), depending on the alternative (Table 3.9-19). In addition to timber harvest, additional development associated with Sitka and possible road and transmission line extensions within the province would contribute to cumulative effects.

Cumulative effects on biodiversity associated with Alternative 1 would only be associated with past harvest and non-NFS harvest because no NFS harvest would occur. Alternatives 2, 3, 5, and 6 would result in a maximum of 11,000 to 16,000 additional acres of POG harvest. As is the case for East Baranof Island province, specific watersheds would undergo high cumulative harvest under these alternatives; however, the conservation strategy would provide for extensive areas in reserves, distributed across the province, resulting in the retention of a minimum of 86 percent of original POG under these alternatives. In addition, Alternatives 1, 2, 3, and 6 would provide additional matrix retention as a result of the application of the legacy forest structure standard and guideline in four VCUs within the province. Under Alternatives 4 and 7, 28,000 to 31,000 additional acres of harvest (including non-NFS harvest) would occur and, although the southern half of the province would substantially be in reserves, the northern half would have large areas with no reserves, resulting in higher cumulative effects on biodiversity.

Admiralty Island

The Admiralty Island province has experienced 29,000 acres of past harvest; this represents only 5 percent of the original POG because of the size of the province and its extensive amount of POG. No NFS harvest would occur in the future and, although several thousand additional acres of harvest on non-NFS lands is expected to occur, the remaining POG would still be close to 95 percent of the original POG after 100+ years (Table 3.9-20). Similarly, high-volume POG is expected to change from about 94 to 93 percent and large-tree POG is expected to decrease from about 91 to 90 percent, purely as a result of non-NFS harvest.

Currently, 88 percent of the large watersheds (representing 85 percent of the acreage) of the portion of the province within the Tongass Forest boundary are considered to be in an intact condition. After 100+ years, this percentage is expected to be reduced to a minimum of 82 percent (representing 80 percent of the acreage) (Table 3.9-19). In addition to timber harvest, a proposed hydroelectric project and transmission line north of Angoon and continued operation and potential expansion of mining activity at Greens Creek would contribute to cumulative effects.

Although past and future harvest and development are concentrated in a few watersheds, which would experience relatively high effects on biodiversity, the cumulative effect on the overall biodiversity of the province is not expected to be high because of the expansive size and dominantly undeveloped nature of the province. Further, none of the future effects would be associated with NFS harvest. The vast majority of Admiralty Island would continue to remain intact under all alternatives and, as a result of the abundance of POG in this province, including high-volume and large-tree POG, it would continue to represent a massive reserve and reservoir for biological diversity in Southeast Alaska.

Lynn Canal

Past cumulative harvest in this biogeographic province has removed only 3 percent of the POG on all lands combined, resulting in 97 percent of the original POG remaining. Future harvest is expected to remove an additional 5 to 18 percent, resulting in approximately 79 to 92 percent of the original POG remaining after 100+ years (Table 3.9-20). High-volume POG is currently estimated to represent 95 percent of its original acreage. Future representation of high-volume POG is expected to be a minimum of 71 to 87 percent (Table 3.9-21). Similarly, large-tree POG is expected to decline from about 88 percent of original acreage at present, to a minimum of 64 to 78 percent after 100+ years (Table 3.9-22).

Currently, 76 percent of the large watersheds (representing 80 percent of the acreage) are considered to be in an intact condition. After 100+ years, this percent age is expected to be reduced to a minimum of 32 to 56 percent (representing 45 to 64 percent of the acreage), depending on the alternative (Table 3.9-19). In addition to timber harvest, continued development of areas around Juneau, Skagway, and Haines, the potential development of the Kensington Mine near Berners Bay, and the proposed development of the Juneau Access Road, would contribute to cumulative effects in this province.

Alternatives 1, 2, and 3 would result in a maximum of 5,000 to 12,000 acres of additional harvest resulting in the retention of at least 88 percent of original POG. Alternatives 5 and 6 would result in a maximum of 20,000 to 23,000 additional acres of POG harvest, resulting in the retention of a minimum of 84 percent of original POG. In addition, these five alternatives would incorporate a conservation strategy that would result in the spatial distribution of reserves, which would limit effects on biodiversity. Alternatives 4 and 7 would result in a maximum of 29,000 to 31,000 additional cumulative acres of harvest, which would produce a retention of at least 79 percent of the original POG. Even though there would be large areas with no reserves, the province would have extensive reserves even under Alternatives 4 and 7, which would limit effects on biodiversity.

Northern Coast Range

Approximately 6 percent of the original POG in this province has been harvested, resulting in 94 percent of the original POG remaining. Following maximum future harvest after 100+ years, the percentage of original POG remaining would range from 76 percent (Alternative 7) to 89 percent (Alternative 1) (Table 3.9-20). High-volume POG is currently estimated to represent 92 percent of its original acreage. Future representation of high-volume POG is expected to be a minimum of 70 to 83 percent (Table 3.9-21). Similarly, large-tree POG is expected to decline from about 77 percent of original acreage at present, to a minimum of 52 to 66 percent after 100+ years (Table 3.9-22).

Currently, 90 percent of the large watersheds (representing 94 percent of the acreage) of the province are considered to be in an intact condition. After 100+ years, this percentage is expected to be reduced to a minimum of 31 to 67 percent (representing 54 to 80 percent of the acreage), depending on the alternative (Table 3.9-19).

Harvest on NFS lands would not contribute to cumulative effects under Alternatives 1 and 2, and would contribute only in a minor way under Alternative 3. Almost all future harvest would be on non-NFS lands under these alternatives; long-term retention of POG would be about 88 to 89 percent. Under Alternatives 5 and 6, cumulative harvest would be a maximum of 48,000 to 52,000 acres; however, the conservation strategy under these two alternatives would provide for extensive areas in reserves, distributed across the province, resulting in the retention of a minimum of 81 percent of original POG. Under Alternatives 4 and 7, 65,000 to

68,000 additional acres of harvest (including non-NFS harvest) would occur and there would be large areas with no reserves, resulting in higher cumulative effects on biodiversity.

Kupreanof/Mitkof Islands

The Kupreanof/Mitkof Islands province has experienced 71,000 acres of past harvest, which represents 17 percent of the original POG; as a result, 83 percent of the original POG remains today. Following maximum future harvest after 100+ years, the percentage of original POG remaining would range from 53 percent (Alternative 7) to 74 percent (Alternative 1) (Table 3.9-20). High-volume POG is currently estimated to represent 71 percent of its original acreage. Future representation of high-volume POG is expected to be a minimum of 41 to 61 percent (Table 3.9-21). Similarly, large-tree POG is expected to decline from about 47 percent of original acreage at present, to a minimum of 29 to 42 percent after 100+ years (Table 3.9-22).

Currently, 37 percent of the large watersheds (representing 39 percent of the acreage) of the portion of the province within the Tongass Forest boundary are considered to be in an intact condition. After 100+ years, this percentage is expected to be reduced to a minimum of 8 to 31 percent (representing 9 to 30 percent of the acreage) (Table 3.9-19). In addition to timber harvest, additional development in the Petersburg and Kake areas and proposed additional road and transmission line development (especially between Petersburg and Kake) would contribute to cumulative effects.

Projected future cumulative harvest could be as high as 35,000 (Alternative 1) to 87,000 acres (Alternative 5) under Alternatives 1, 2, 3, 5, or 6. These harvest levels would result in the retention of 61 to 74 percent of the original POG, 49 to 61 percent of the original high-volume POG, and 34 to 42 percent of the original large-tree POG. These cumulative harvest levels would result in a reduction in habitat for species that prefer older forest stages (particularly larger tree types) and increases in habitat for species that prefer younger forest stages. However, the conservation strategy employed in each of these alternatives would result in POG being distributed in reserves and within the matrix across the province so that, although local reductions in biodiversity would be expected, habitat representation across the province would be maintained. Alternative 5 would not provide as much POG in reserves as Alternatives 1, 2, 3, and 6; however, it would provide more POG within the matrix because of the marten standards and guidelines. Under Alternatives 4 and 7, harvest could be as high as 104,000 to 119,000 additional acres, resulting in the retention of 53 to 57 percent of original POG, 41 to 44 percent of original high-volume POG, and 29 to 32 percent of large-tree POG. These cumulative harvest levels would result in greater reductions in habitat for species that prefer older forest stages, but more importantly, these alternatives would result in large expanses of habitat areas without POG in reserves, particularly under Alternative 7.

Kuiu Island

Past cumulative harvest in this biogeographic province has removed 9 percent of the POG on all lands combined, resulting in 91 percent of the original POG remaining. Future cumulative harvest is expected to remove from less than 1 percent (Alternative 1) to 22 percent of additional POG acreage, resulting in approximately 69 to 91 percent of the original POG remaining after 100+ years (Table 3.9-20). High-volume POG is currently estimated to represent 90 percent of its original acreage. Future representation of high-volume POG is expected to be a minimum of 66 to 89 percent (Table 3.9-21). Similarly, large-tree POG is expected to decline from about 82 percent of original acreage at present, to a maximum of 52 to 81 percent after 100+ years (Table 3.9-22).

Currently, 73 percent of the large watersheds (representing 60 percent of the acreage) are considered to be in an intact condition. After 100+ years, this percentage is expected to be reduced to a minimum of 47 to 73 percent (representing 34 to 60 percent of the acreage), depending on the alternative (Table 3.9-19).

Cumulative effects on biodiversity associated with Alternative 1 would only be associated with past harvest and non-NFS harvest because no NFS harvest would occur. Alternatives 2, 3, 5, and 6 would result in a cumulative maximum of 20,000 to 41,000 acres of additional harvest, resulting in the long-term retention of at least 79 to 85 percent of original POG, 75 to 82 percent of original high-volume POG, and 61 to 67 percent of original large-tree POG. In addition, these four alternatives would incorporate a conservation strategy that would result in the spatial distribution of reserves, which would limit effects on biodiversity. Alternatives 4 and 7 would result in a maximum of 62,000 to 72,000 additional cumulative acres of harvest, which would result in the retention of at least 69 to 72 percent of the original POG, 66 to 69 percent of high-volume POG, and 52 to 56 percent of large-tree POG. These two alternatives would result in large expanses of habitat areas without POG in reserves, which would increase their effects on biodiversity.

Central Coast Range

Approximately 3 percent of the original POG in this province has been harvested, resulting in 97 percent of the original POG remaining. Following maximum future harvest after 100+ years, the percentage of original POG remaining would range from 80 percent (Alternative 7) to 96 percent (Alternative 1) (Table 3.9-20). High-volume POG is currently estimated to represent 95 percent of its original acreage. Future representation of high-volume POG is expected to be a minimum of 79 to 94 percent (Table 3.9-21). Similarly, large-tree POG is expected to decline from about 89 percent of original acreage at present, to a minimum of 72 to 89 percent after 100+ years (Table 3.9-22).

Currently, 79 percent of the large watersheds (representing 85 percent of the acreage) of the province are considered to be in an intact condition. After 100+ years, this percentage is expected to be reduced to a minimum of 38 to 72 percent (representing 51 to 77 percent of the acreage), depending on the alternative (Table 3.9-19).

Additional harvest on NFS lands would not contribute to cumulative effects under Alternative 1 and only in a limited way under Alternative 2. Under Alternatives 3, 5, and 6, additional cumulative harvest would range from 20,000 acres to 31,000 acres, resulting in long-term POG retention of 85 to 89 percent, long-term high-volume POG retention of 84 to 87 percent, and long-term large-tree POG retention of 78 to 82 percent. The conservation strategy under these alternatives would provide for extensive areas in reserves, distributed across the province. Under Alternatives 4 and 7, 39,000 to 43,000 additional acres of harvest (including non-NFS harvest) would occur, resulting in long-term POG retention of 80 to 82 percent, long-term high-volume POG retention of 79 to 80 percent, and long-term large-tree POG retention of 72 to 73 percent. There would be some large areas with no reserves, under these two alternatives, resulting in higher cumulative effects on biodiversity.

Etolin Island and Vicinity

The Etolin Island and Vicinity province has experienced 41,000 cumulative acres of past harvest representing 15 percent of the original POG; as a result, 85 percent of the original POG remains today. Following maximum future harvest after 100+ years, the percentage of original POG remaining would range from 55 percent (Alternative 7) to 78 percent (Alternative 1) (Table 3.9-20). High-volume POG is currently estimated to represent 76 percent of its original acreage. Future representation of high-volume POG is expected to be a minimum of 45 to 67 percent (Table 3.9-21). Similarly, large-tree POG is expected to decline from about 51 percent of original acreage at present, to a minimum of 30 to 46 percent after 100+ years (Table 3.9-22).

Currently, 33 percent of the large watersheds (representing 30 percent of the acreage) of the portion of the province within the Tongass Forest boundary are considered to be in an intact condition. After 100+ years, this percentage is expected to be reduced to a minimum of 11 to 26 percent (representing 12 to 23 percent of the acreage) (Table 3.9-19). In addition to timber harvest, additional development in the Wrangell area would contribute to cumulative effects.

Projected future cumulative maximum harvest would be 19,000 acres under Alternative 1, resulting in 78 percent long-term POG retention. Under Alternatives 2, 3, 5, and 6 the cumulative maximum harvest would be 38,000 (Alternative 2) to 50,000 acres (Alternative 5). These harvest levels would result in the retention of 67 to 71 percent of the original POG, 57 to 61 percent of the original high-volume POG, and 39 to 42 percent of the original large-tree POG. These cumulative harvest levels would result in a reduction in habitat for species that prefer older forest stages (particularly larger tree types) and increases in habitat for species that prefer younger forest stages. However, the conservation strategy employed in each of these alternatives would result in POG being distributed in reserves and within the matrix across the province so that, although local reductions in biodiversity would be expected, habitat representation across the province would be maintained. The legacy forest structure standard and guideline would provide for additional POG in the matrix under Alternatives 1, 2, 3, and 6, and the marten standard and guideline would provide this for Alternative 5. Under Alternatives 4 and 7, harvest could be as high as 72,000 to 83,000 additional acres, resulting in the retention of 55 to 59 percent of original POG, 45 to 50 percent of original high-volume POG, and 30 to 33 percent of large-tree POG. These cumulative harvest levels would result in greater reductions in habitat for species that prefer older forest stages, but more importantly, these two alternatives would result in large expanses of habitat areas without POG in reserves. In addition, POG in the matrix would not be supplemented by either the legacy or the marten standard and guideline. As a result, these two alternatives would have a relatively high effect on province biodiversity.

North Central Prince of Wales Island

Approximately 35 percent of the original POG in this province has been harvested, resulting in 65 percent of the original POG remaining. Following maximum future harvest after 100+ years, the percentage of original POG remaining would range from 44 percent (Alternative 7) to 59 percent (Alternative 1) (Table 3.9-20). High-volume POG is currently estimated to represent 56 percent of its original acreage. Future representation of high-volume POG is expected to be a minimum of 33 to 45 percent (Table 3.9-21). Similarly, large-tree POG is expected to decline from about 55 percent of original acreage at present, to a minimum of 35 to 47 percent after 100+ years (Table 3.9-22).

Currently, 24 percent of the large watersheds (representing 17 percent of the acreage) of the province are considered to be in an intact condition. After 100+

years, this percentage is expected to be reduced to a minimum of 10 to 20 percent (representing 6 to 13 percent of the acreage), depending on the alternative (Table 3.9-19). In addition to timber harvest, additional development associated with Klawock, Craig, Thorne Bay, and the many other small communities in the province would contribute to cumulative effects.

Under Alternatives 1 and 2, additional cumulative harvest would range from 89,000 acres to 104,000 acres, resulting in long-term POG retention of 54 to 55 percent, long-term high-volume POG retention of 44 to 45 percent, and long-term large-tree POG retention of 45 to 47 percent. Projected future cumulative maximum harvest would be 118,000 to 131,000 acres under Alternatives 3, 5, and 6, resulting in 51 to 52 percent long-term POG retention, 41 to 42 percent long-term high-volume POG retention, and 43 to 44 percent long-term large-tree POG retention. The conservation strategy under Alternatives 1, 2, 3, 5, and 6 would provide for extensive areas in reserves, distributed across the province. In addition, the legacy forest structure standard and guideline would provide for additional POG in the matrix under Alternatives 1, 2, 3, and 6, and the goshawk and marten standards and guidelines would provide this for Alternative 5. Alternatives 1, 2, 3, and 6 would provide reserves to maintain connectivity for the Neck Lake pinch-point, while Alternative 5 would provide for some connectivity. These alternatives also would provide a number of reserves in the Sulzer Portage pinch-point area to enhance connectivity. Under Alternatives 4 and 7, 150,000 to 198,000 additional acres of harvest (including non-NFS harvest) would occur, resulting in long-term POG retention of 44 to 49 percent, long-term high-volume POG retention of 33 to 39 percent, and long-term large-tree POG retention of 35 to 40 percent. Alternative 4 would supplement the pool of non-development LUDs in this province with an array of Old-Growth Habitat LUD areas, although the extent of reserves would be less than under Alternatives 1, 2, 3, 5, or 6. Alternative 7, on the other hand, would not include Old-Growth Habitat LUDs and would have large areas with no reserves. In addition, POG in the matrix would not be supplemented by either the legacy or the marten standard and guideline. Alternative 4 would provide for some connectivity at the Neck Lake pinch-point, but would not provide much in the way of reserves near the Sulzer Portage pinch-point. Alternative 7 would provide not provide very few acres of reserves in the vicinity of either pinch-point. As a result, Alternative 4 would have a relatively high effect on province biodiversity and Alternative 7 would have a very high effect. Alternative 7 and, to a lesser extent, Alternative 4, would likely result in gaps in the distribution of some organisms within the province and lower biodiversity.

Revilla Island/Cleveland Peninsula

The Revilla Island/Cleveland Peninsula province has had 71,000 cumulative acres of past harvest representing 11 percent of the original POG; as a result, 89 percent of the original POG remains today. Following maximum future harvest after 100+ years, the percentage of original POG remaining would range from 66 percent (Alternative 7) to 81 percent (Alternative 1) (Table 3.9-20). High-volume POG is currently estimated to represent 84 percent of its original acreage. Future representation of high-volume POG is expected to be a minimum of 58 to 74 percent (Table 3.9-21). Similarly, large-tree POG is expected to decline from about 59 percent of original acreage at present, to 44 to 55 percent after 100+ years (Table 3.9-22).

Currently, 68 percent of the large watersheds (representing 71 percent of the acreage) of the portion of the province within the Tongass Forest boundary are considered to be in an intact condition. After 100+ years, this percentage is expected to be reduced to a minimum of 33 to 55 percent (representing 43 to 60 percent of the acreage) (Table 3.9-19). In addition to timber harvest, additional development in the Ketchikan, Saxman, and Metlakatla areas, including the Swan-Tyee transmission line (under construction), would contribute to cumulative effects.

Projected future cumulative maximum harvest would be 49,000 acres to 77,000 acres under Alternatives 1, 2, and 3, resulting in 77 to 81 percent long-term POG retention, 70 to 74 percent of the original high-volume POG retention, and 52 to 55 percent of the original large-tree POG retention. Under Alternatives 5 and 6 the cumulative maximum harvest would be 94,000 acres. These harvest levels for Alternatives 5 and 6 would result in the retention of 74 percent of the original POG, 68 percent of the original high-volume POG, and 50 percent of the original large-tree POG. These cumulative harvest levels would result in a reduction in habitat for species that prefer older forest stages (particularly larger tree types) and increases in habitat for species that prefer younger forest stages. However, the conservation strategy employed in each of these alternatives would result in POG being distributed in reserves and within the matrix across the province so that, although local reductions in biodiversity would be expected, habitat representation across the province would be maintained. The legacy forest structure standard and guideline would provide for additional POG in the matrix under Alternatives 1, 2, 3, and 6, and the marten standard and guideline would provide this for Alternative 5. Under Alternatives 4 and 7, harvest could be as high as 128,000 to 151,000 additional acres, resulting in the retention of 66 to 69 percent of original POG, 58 to 62 percent of original high-volume POG, and 44 to 46 percent of large-tree POG. These cumulative harvest levels would result in greater reductions in habitat for species that prefer older forest stages, but more importantly, these two alternatives (especially Alternative 7) would result in large expanses of habitat areas without POG in reserves. In addition, POG in the matrix would not be supplemented by either the legacy or the marten standard and guideline. As a result, these two alternatives would have a relatively high effect on province biodiversity.

Southern Outer Islands

Approximately 15 percent of the original POG in this province has been harvested, resulting in 85 percent of the original POG remaining. Following maximum future harvest after 100+ years, the percentage of original POG remaining would range from 72 percent (Alternative 7) to 80 percent (Alternative 1) (Table 3.9-20). High-volume POG is currently estimated to represent 77 percent of its original acreage. Future representation of high-volume POG is expected to be a minimum of 61 to 70 percent (Table 3.9-21). Similarly, large-tree POG is expected to decline from about 67 percent of original acreage at present, to a minimum of 49 to 60 percent after 100+ years (Table 3.9-22).

Currently, 50 percent of the large watersheds (representing 64 percent of the acreage) of the province are considered to be in an intact condition. After 100+ years, this percentage is expected to be reduced to a minimum of 45 to 50 percent (representing 59 to 64 percent of the acreage), depending on the alternative (Table 3.9-19).

Most of the islands that make up this province are entirely in reserves under all alternatives. Harvest would be limited to Heceta and Suemez in all alternatives, as well as San Juan Bautista Islands in Alternatives 3, 5, and 6. Alternatives 1, 2, 3, 5, and 6 would result in the maximum future cumulative harvest of 7,000 to 12,000 acres, producing a long-term retention of 76 to 80 percent of the original POG, 66 to 70 percent of the original high-volume POG, and 56 to 60 percent of the original large-tree POG. The conservation strategy in each of these alternatives would result in the spatial distribution of POG within reserves across the province. Under Alternatives 4 and 7, harvest could be as high as 14,000 to 19,000 additional acres, resulting in the retention of 72 to 75 percent of original POG, 61 to 64 percent of original high-volume POG, and 49 to 53 percent of large-tree POG. These latter two alternatives would result larger habitat areas without POG in reserves.

Dall Island and Vicinity

Past cumulative harvest in this biogeographic province has removed 25 percent of the POG on all lands combined, resulting in 75 percent of the original POG remaining. Future cumulative harvest is expected to remove from less than 17 percent (Alternative 1) to 22 percent of additional POG acreage, resulting in approximately 53 to 58 percent of the original POG remaining after 100+ years (Table 3.9-20). The vast majority of this future harvest is on non-NFS lands under all alternatives. High-volume POG is currently estimated to represent 77 percent of its original acreage. Future representation of high-volume POG is expected to be a minimum of 61 to 70 percent (Table 3.9-21). Similarly, large-tree POG is expected to decline from about 42 percent of original acreage at present, to a minimum of 36 to 37 percent after 100+ years (Table 3.9-22). The great majority of this retention would be in reserves.

Currently, 71 percent of the large watersheds (representing 53 percent of the acreage) are considered to be in an intact condition. After 100+ years, this percentage is expected to be reduced to a minimum of 29 to 34 percent (representing 15 to 19 percent of the acreage), depending on the alternative (Table 3.9-19).

The maximum cumulative future harvest would be 23,000 to 29,000 acres under all of the alternatives, with 23,000 acres of harvest on non-NFS lands and from 0 to 6,000 acres on NFS lands. At least 80 percent of the original POG on NFS lands would be in reserves under all alternatives. The only area on NFS harvest would be at the extreme northwestern corner of Dall Island with no harvest planned on Long Island. The reserves on Dall Island stretch the entire length of the island on the west side. Therefore, although a substantial portion of the non-NFS POG is expected to be harvested, the contribution by NFS harvest would be relatively small.

South Prince of Wales

The South Prince of Wales Island province has had 18,000 cumulative acres of past harvest representing 9 percent of the original POG; as a result, 91 percent of the original POG remains today. Following maximum future harvest after 100+ years, the percentage of original POG remaining would range from 68 percent (Alternative 7) to 87 percent (Alternative 1) (Table 3.9-20). High-volume POG is currently estimated to represent 88 percent of its original acreage. Future representation of high-volume POG is expected to be a minimum of 64 to 83 percent (Table 3.9-21). Similarly, large-tree POG is expected to decline from about 88 percent of original acreage at present, to a minimum of 65 to 85 percent after 100+ years (Table 3.9-22).

Currently, 78 percent of the large watersheds (representing 75 percent of the acreage) of the portion of the province within the Tongass Forest boundary are considered to be in an intact condition. After 100+ years, this percentage is expected to be reduced to a minimum of 47 to 72 percent (representing 45 to 69 percent of the acreage) (Table 3.9-19).

Projected future cumulative maximum harvest would be 8,000 acres to 26,000 acres under Alternatives 1, 2, 3, 5, and 6, resulting in 77 to 87 percent long-term POG retention, 73 to 83 percent of the original high-volume POG retention, and 76 to 85 percent of the original large-tree POG retention. The conservation strategy employed in each of these alternatives would result in POG being distributed in reserves and within the matrix across the province so that, although local reductions in biodiversity would be expected, habitat representation across the province would be maintained. The goshawk and marten standards and guidelines would provide additional POG in the matrix in this province under Alternative 5. Under Alternatives 4 and 7, harvest could be as high as 37,000 to 43,000 additional acres, resulting in the retention of 68 to 71 percent of original POG, 64 to 67 percent of original high-volume POG, and 65 to 69 percent of large-tree POG. In all alternatives, large reserves exist in the southern and western portions of the province. However, Alternatives 4 and 7 do not include reserves over large areas in the north and east parts of the province, as well as portions of the west. As a result, these two alternatives would have a higher effect on province biodiversity.

North Misty Fiords

Only 2,000 acres of past harvest has occurred in the North Misty Fiords province, and up to 7,000 acres is projected for the future. As a result, a minimum of 95 percent of the POG originally found in the province is expected to be retained long term, relative to the 99 percent at present (Table 3.9-20). Similarly, neither high-volume nor large-tree POG are expected to drop below 90 percent of their original acreages. Also, future development is not expected to reduce the percentage of large watersheds in intact condition to less than 88 percent by number or 91 percent by acreage, under any of the alternatives (Table 3.9-19). Therefore, because of the very limited extent of future development, cumulative effects on biodiversity are expected to be very low under any of the alternatives.

South Misty Fiords

No past harvest has been mapped within the South Misty Fiords province and less than 200 acres (on non-NFS lands) are projected to be harvested in the future. Therefore, the percentage of original POG remaining in the province after 100+ years would be almost 100 percent (Table 3.9-20). Future development is not expected to change the percentage of large watersheds in an intact condition either; currently this percentage is 100 percent. As a result, because of the very limited extent of future development, cumulative effects on biodiversity are expected to be virtually non-existent under any of the alternatives.

Ice Fields

Approximately 3 percent of the original POG in this province has been harvested, resulting in 97 percent of the original POG remaining. Following maximum future harvest after 100+ years, the percentage of original POG remaining would range from 93 percent (Alternative 7) to 97 percent (Alternative 1) (Table 3.9-20). High-volume POG is currently estimated to represent 93 percent of its original acreage. Future representation of high-volume POG is expected to be a minimum of 90 to 93 percent (Table 3.9-21). Similarly, large-tree POG is expected to decline from about 83 percent of original acreage at present, to a minimum of 81 to 83 percent after 100+ years (Table 3.9-22).

Currently, 93 percent of the large watersheds (representing 94 percent of the acreage) of the province are considered to be in an intact condition. After 100+ years, this percentage is expected to be reduced to a minimum of 82 to 88 percent (representing 88 to 94 percent of the acreage), depending on the alternative (Table 3.9-19).

Cumulative effects on biodiversity associated with Alternative 1 would only be associated with past harvest because no NFS harvest and only a few acres of non-NFS harvest would occur. Alternatives 2, 3, 4, 5, 6 and 7 would result in a cumulative maximum of 1,000 to 4,000 acres of additional harvest, resulting in the long-term retention of at least 93 percent of original POG, 90 percent of high-volume

POG, and 81 percent of large-tree POG. The vast majority of this POG is in reserves (Table 3.9-14). Therefore, although local watershed effects are expected, cumulative effects on biodiversity at the province level are expected to be minor.

Chilkat River Complex

The Chilkat River Complex province has had about 21,000 acres of past harvest, representing 12 percent of the original POG; therefore, 88 percent of the original POG remains today. The province lies entirely outside the Forest boundary, so there would be no future harvest on NFS lands associated with any of the alternatives. Approximately 32 percent of the existing POG, 26 percent of existing high-volume POG, and 11 percent of existing large-tree POG stands are located in reserves.

Future cumulative harvest associated with state and private lands in the province, could result in up to 52,000 additional acres of POG harvest after 100+ years (Table 3.9-20). With this additional harvest, the POG retention would amount to a minimum of 56 percent, with a minimum of 60 percent retention for high-volume POG and 32 percent retention for large-tree POG. In addition, future development associated with Haines and Skagway could contribute to cumulative effects within the province.

Tongass management would not contribute to cumulative effects within the province and would only contribute to a regional effect, relative to multiple adjacent provinces. The three provinces that are adjacent to the Chilkat River Complex are the Glacier Bay/Fairweather Range, the Ice Fields, and the Lynn Canal provinces. Among these three, the Lynn Canal province would be managed with the highest intensity. However, even in the Lynn Canal province, the long-term retention of POG would be 79 to 92 percent, depending on the alternative. The Ice Fields and Glacier Bay/Fairweather Range provinces would retain 93 to 100 percent of their POG under any alternative (Table 3.9-20).

Glacier Bay/Fairweather Range

Past harvest within the Glacier Bay/Fairweather Range province has been limited to a few hundred acres. Similarly, negligible future cumulative harvest is projected under all alternatives. As a result, the percentage of original POG remaining in the province after 100+ years would be almost 100 percent (Table 3.9-20). Future development is not expected to change the percentage of large watersheds in an intact condition either; currently this percentage is also close to 100 percent because of Glacier National Park. Therefore, because of the very limited extent of future development, cumulative effects on biodiversity are expected to be negligible under any of the alternatives.

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Wildlife

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Affected Environment

The Tongass National Forest supports a rich array of wildlife species, providing habitat for approximately 54 species of mammals, 231 species of birds, and 5 species of amphibians and reptiles. There are an additional 18 species of marine mammals found in Southeast Alaska that depend entirely on the ocean environment, as well as 45 bird and 3 amphibian or reptile species considered casual or accidental visitors to Southeast Alaska. Some species that are relatively abundant on the Forest (e.g., bald eagles and brown bears) are listed as threatened or endangered in other parts of their range, and others are endemic to the Tongass (essentially found nowhere else in the world) and may occupy ranges limited to single islands. Other species have wide geographic ranges and are found elsewhere in Alaska, Canada, and the lower 48 states. The diversity of wildlife on the Forest provides many opportunities for consumptive and non-consumptive uses including commercial, general, and subsistence hunting; and photographic and viewing activities.

This section provides an overview of wildlife habitats on the Tongass, describes current management regimes related to wildlife habitat and relevant policies, and provides information on key species and their habitats. The consumptive uses of wildlife are also briefly discussed. This section also addresses issues related to invasive species and endemism. Updated information presented at an interagency review of the Forest Plan Conservation Strategy, held in Ketchikan, Alaska, in April 2006, is incorporated and referenced where appropriate. This workshop took into account new literature published since 1997 as well as ongoing research and included the presentation of preliminary results.

Approximately 55 percent of the 16.8 million acres of the Tongass National Forest consists of temperate rainforest (see Figure 3.9-3 of the *Biodiversity* section). This includes both productive and non-productive old growth (POG), a classification that relates to the ability of a stand to grow trees of a certain size or volume per acre. Ninety-eight percent of the POG on the Tongass is dominated by Sitka spruce and western hemlock, both of which occur throughout Southeast Alaska. Approximately

4 percent of the Tongass is young-growth forest (both natural and harvested), primarily distributed among four biogeographic provinces (North Central Prince of Wales, Etolin Island, Kupreanof/Mitkof, andRevillagigedo Island/Cleveland Peninsula). The remaining 41 percent of the Tongass consists non-forested habitat that includes sparsely vegetated areas of shrub and herbaceous (e.g., muskegs, alpine, estuaries), non-vegetated areas (e.g., snow, rock, ice), and aquatic sites (e.g., streams, ponds, and lakes). Tables 3.9-2 and 3.9-3 in the *Biodiversity* section show the distribution of forested and non-forested cover types on the Tongass.

Old-Growth Habitat and the Conservation Strategy

Although many wildlife species on the Tongass are associated with more than one habitat type, most inhabit old-growth forests or prey on species that inhabit old-growth forests. Old growth is characterized by a patchy, multi-layered canopy; trees that represent many age classes; large trees that dominate the overstory, standing dead (snags) or decadent trees; and higher accumulations of down woody material. The structure and function of an old-growth ecosystem will be influenced by stand size, landscape position, and juxtaposition with other elements of the landscape. POG can be broken down further in terms of seven categories based on tree size and density. See the Old-Growth Forest subsection in the Affected Environment portion of the *Biodiversity* section of this document, including Figures 3.9-4 and 3.9-5, for a detailed discussion of old growth on the Tongass and the size-density model (SDM).

The 1997 Forest Plan established a comprehensive, science-based old-growth conservation strategy to address wildlife sustainability and viability. This strategy was based on careful analysis and integration of the best scientific information available at that time and is comprised of two key components.

The first is a Forest-wide reserve network that is designed to protect the integrity of the existing old-growth ecosystem. It incorporates a network of small, medium, and large old-growth reserves (OGRs) and other non-development Land Use Designations (LUDs), which protect 71 percent of the existing POG on the Tongass National Forest (Appendix D).

The second component of the conservation strategy is a set of standards and guidelines that apply in the development LUDs where commercial timber harvesting is permitted (referred to as the matrix). In these areas, the standards and guidelines sustain key components of the landscape that the available scientific information indicates is important for wildlife. These include a 1,000-foot buffer along the entire marine shoreline and riparian buffer corridors. Standards and guidelines established for other reasons, also contribute protected old growth. Finally, assuming the maximum level of timber harvest permitted by the Forest Plan, there are additional areas that are not scheduled for harvest due to economic considerations. Collectively, these standards and guidelines and unscheduled areas would maintain at least 66 percent of the POG within the matrix or over 19 percent of all POG on the Tongass (Appendix D).

Overall, the conservation strategy in the 1997 Forest Plan protects slightly more than 90 percent of all existing POG forests on the Tongass. It is important to note that this percentage assumes that old-growth forest is harvested at the maximum allowable rate in each future decade before sufficient second-growth forest has reached harvestable size and can replace old growth in the harvest. If this maximum rate does not occur, then the percentage of POG retained will be higher. A more detailed description of the Tongass conservation strategy, and the basis for its development, is provided below under effects, in the *Biodiversity* section, and in Appendix D.

Landscape Connectivity and Fragmentation

Landscape connectivity is defined as the degree to which the structure of a landscape helps or hinders the movement of wildlife species (Taylor et al. 1993). A "well-connected" landscape enables organisms to readily move among habitat patches over the long term. Fragmentation is the loss of connectivity across the landscape and is a substantial threat to many species, especially those that are smaller or less mobile. Fragmentation occurs when large blocks of habitat are broken into smaller parcels by natural (e.g., wind throw) or human induced (e.g., roads or timber operations) forces. As habitat is lost or fragmented, residual habitat patches become smaller and more isolated from each other. This limits the movement of species and, through their increased isolation, puts them at greater risk of extirpation. Open spaces left by fragmentation can act as travel barriers for some species, or increase the risk of predation for other species that venture across them (see the *Biodiversity* section for additional discussion on fragmentation).

There are two types of landscape connectivity that can be considered: structural and functional connectivity (Brooks et al. 2003). Structural connectivity describes the physical relationships among habitat patches, generally ignoring the behavioral response of organisms to landscape structure. Landscape corridors, or areas of continuous habitat that link similar habitat patches in a landscape and thus facilitate the movement of species among isolated habitat patches, are representative of structural connectivity. On the Tongass, intact riparian buffers and the beach fringe function as corridors that facilitate dispersal and allow movement between small, isolated subpopulations of species. Advances in the fields of landscape ecology, habitat fragmentation, and population genetics have led to a broader view of connectivity, with less of a structured focus on corridors, and more of a perspective on the functional connectivity provided by landscape linkages or "linkage zones" (Bennett 1999 as cited in Haufler 2007). Functional connectivity relates to the degree of movement or flow of organisms through the landscape. Linkage zones are not necessarily discrete features of the landscape, but may occur where the juxtaposition of particular habitats or land uses act to funnel dispersers between habitat patches. The concept of functional connectivity addresses movement capabilities of individual species, habitat patches, landscape configurations, matrix conditions, barriers, and their relationships in maintaining continuous populations (Haufler 2007). On the Tongass, matrix lands play a vital role as landscape linkages because they provide functional connectivity between OGRs and other non-development land use areas.

The National Forest Management Act (NFMA) regulations provide that habitat must be "well distributed" so that "individuals can interact with others in the planning area." The continued existence of a population within which interaction between individuals becomes difficult (significantly less frequent) or impossible may no longer be well distributed, as segments of the population become isolated. The fragmentation of habitats, which isolates and creates small insular populations, contributes to decreased population distribution and increased likelihood of local extirpation (Wilcove et al. 1986). Because the Tongass is an island archipelago, relatively isolated populations may already exist with naturally higher risks to local extirpation (see discussion of endemism below).

The idea of maintaining well-distributed habitats brings up the issue of scale, which is a fundamental difficulty underlying the assessment of functional landscape connectivity. For example, because species differ in their dispersal abilities and, therefore, the way they perceive patches as functionally connected, the scale of the interaction between the species and the landscape should be taken into account when assessing the connectedness of the landscape. That is, there are likely features within the matrix that are not conducive to crossing by some species that are most appropriately identified at the project level, rather than on a Forest-wide basis. As such, the following discussion takes a broader view of connectivity by focusing on areas where natural or human-caused features (e.g., roads and clearcuts) constrain potential movement by wildlife to narrow bands of habitat, often referred to as “pinch-points” or “bottlenecks.”

These points often function as movement corridors and need special planning and design to ensure that wildlife migration patterns and habitat diversity are protected over the long term and are thus an important aspect in considering functional landscape connectivity. Additionally, determining if management activities are likely to create barriers that could affect species distribution on a landscape scale (e.g., within biogeographic provinces) is a useful means of identifying potential adverse short-term effects on maintaining well distributed, viable populations.

“Pinch-points” can be geographic or ecologically based. For example, areas have been identified on the Tongass where geographic “pinch-points” connect major landscapes within islands. These are all relatively narrow areas between larger land units where future alterations in habitat could significantly reduce natural connectivity and limit the ability of land-based species to disperse or migrate. The following is a description of six key areas, identified by the Interdisciplinary Team (IDT) during the development of the 1997 Forest Plan, where a high amount of development has occurred; there are a number of additional pinch-points (e.g., the Cleveland peninsula between Santa Ana and Yes Bay and between Neets and Shrimp Bay) where concentrated harvest is less likely to occur during the life of the Forest Plan, which should be analyzed at the project level:

1. The portage between Tenakee Inlet and West Port Frederick on Chichagof Island, a narrow neck of land connecting northeast Chichagof Island to the main body of the rest of the island. This is in the East Chichagof biogeographic province.
2. The area connecting Lisianski Inlet with the North Arm of Peril Strait is a narrow region that connects two major portions of Chichagof Island.
3. The area between Port Camden, Bay of Pillars, and 3-Mile Arm on Kuiu Island (Kuiu Island biogeographic province), a narrow neck of land connecting the northern and eastern part of the island to the rest of Kuiu Island.
4. The narrow area between Lindenburg Peninsula and the remainder of Kupreanof Island.
5. The Neck Lake area between Whale Passage and El Capitan Passage on Prince of Wales Island (North Central Prince of Wales biogeographic province) has experienced high levels of past and ongoing forest management activities. It also is a relatively narrow piece of land connecting the extreme northern end of Prince of Wales Island to the remainder of the island.
6. Sulzer Portage, between the West Arm Cholmondeley Sound and Portage Bay at the head of Hetta Inlet, on Prince of Wales Island. This area has had considerable timber harvesting on both National Forest and adjacent private lands, and due to a recent transfer of land ownership the pinch-point itself is now all private land. This relatively narrow neck of land joins the southeast part of Prince of Wales Island to the remainder of the island, connecting North Central and South Prince of Wales biogeographic provinces.

Ecological “pinch-points” are areas where habitat conditions within a landscape facilitate movement between habitat patches. These areas may be peninsulas of forested habitat surrounded by nonforested habitat that receive concentrated wildlife use and can best be identified by conducting a landscape connectivity analysis. Some species are very mobile through a variety of habitat conditions and some need relatively intact mature forest to successfully travel. Some conditions, such as large water crossings, present a barrier to movement to some species and not to others. For most species, however, connectivity is not an either/or function. Pyare and Smith (2005, 2006) conducted a preliminary evaluation of functional connectivity on the Tongass by experimentally evaluating the movement potential of flying squirrels through various landscape elements in an intensively managed area on Prince of Wales Island to derive a spatial model to evaluate movement potential at a larger scale. Experiments revealed that flying squirrels moved with the least resistence across large expanses of old-growth and old-growth fragments, followed by second-growth up to 100 meters wide, with the most resistence in regenerating clearcuts and young second growth greater than 100 meters wide. Noteably, while males appeared to have a high movement potential in fragmented landscapes, females and juveniles did not. This detailed level of pinch-point analysis is necessarily done at a finer scale during project planning or landscape analyses (Smith and Pyare 2005, 2006).

Species Accounts

The following species accounts are divided into five sections: Threatened and Endangered Species, Candidate Species, Forest Service Sensitive Species, Management Indicator Species, and Other Species of Concern. Species on "sensitive lists" compiled by other entities (e.g., Boreal Partners in Flight, Alaska Natural Heritage Program, and Alaska Department of Fish and Game (ADF&G) Nongame) are addressed through the Regional Forester's sensitive species list. This list is in the process of being updated. Table 3.10-1 lists all species considered for this section.

Threatened and Endangered Species

Federally listed threatened and endangered species are those plant and animal species formally listed by the U.S. Fish and Wildlife Service (USFWS) or National Marine Fisheries Service (NMFS) under authority of the Endangered Species Act (ESA) of 1973, as amended. An endangered species is defined as one that is in danger of extinction throughout all or a significant portion of its range. A threatened species is defined as one that is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.

The federally listed wildlife species within the boundary of the Tongass National Forest include humpback whale (*Megaptera novaeangliae*) and Steller sea lion (*Eumetopias jubata*). Recovery plans have been prepared for the humpback whale and Steller sea lion. The ESA for the State of Alaska authorizes the Commissioner of the ADF&G to list Alaska endangered species. Species listed as endangered by the State of Alaska include the short-tailed albatross (*Diomedea albatrus*), humpback whale, right whale (*Eubalaena glacialis*), and blue whale (*Balaenoptera musculus*). With the exception of the humpback whale, none of these species occur in Southeast Alaska and therefore are not considered further here.

Pursuant to Section 7 of the ESA, a Biological Assessment was prepared to assess the effects of the 1997 Forest Plan revision on endangered or threatened species and ensure that proposed actions would not jeopardize the continue existence of listed species (specifically, humpback whale and the eastern population of the Steller sea lion) and was submitted to NMFS for review and concurrence. The Biological Assessments and agency concurrences for the Forest Plan revision can be found in Appendix J of the 1997 Forest Plan Revision Final EIS. Humpback whales and Steller sea lions will not be addressed further in this document, but are evaluated in an updated Biological Assessment prepared for the current Forest Plan amendment (Appendix F).

The Queen Charlotte goshawk and the Alexander Archipelago wolf were both the subject of listing petitions under the ESA in the 1990s; the petitions were reviewed and formally accepted by USFWS in 1994. USFWS concluded in 1995 that listing was not warranted for either subspecies, but concerns remained for their long-term viability. The goshawk finding was challenged in U.S. District Court, which remanded the finding to USFWS with instructions to base the finding on the existing management plan for the Tongass (the 1997 Forest Plan), rather than the one in

Table 3.10-1
Wildlife Species in Southeast Alaska that are Federally Listed Species or Candidate for Listing under the ESA (NMFS or USFWS), Management Indicator Species (USDA Forest Service), or Sensitive Listed Species (USDA Forest Service)

Species Common Name (*Scientific Names*)[2/]	Federal T&E Listed Species	Federal Candidate Species	Management Indicator Species[1]	Forest Service Sensitive Listed Species [2]	Other Species of Concern
MAMMALS					
Alexander Archipelago Wolf (*Canis lupus ligoni*)			X		
American Marten (*Martes americana*			X		
Black Bear (*Ursus americanus)*			X		
Brown Bear (*Ursus arctos*)			X		
Northern Flying Squirrel (*Glaucomys sabrinus*)					X
Humpback Whale (*Megaptera novaeangliae*)	X				
Mountain Goat (*Oreamnus americana*)			X		
Red Squirrel (*Tamiasciurus hudsonicus*)			X		
River Otter (*Lutra canadensis*)			X		
Sitka Black-tailed Deer (*Odocoileus hemionus sitkensis*)			X		
Steller sea lion (*Eumetopias jubata*)	X				
BIRDS					
Bald Eagle (*Haliaeetus leucocephalus*)			X		
Brown Creeper (*Certhia americana*)			X		
Hairy Woodpecker (*Picoides villosus*)			X		
Kittlitz's Murrelet (*Brachyramphus brevirostris*)		X			
Marbled Murrelet (*Brachyramphus marmoratus*)					X
Queen Charlotte Goshawk (*Accipiter gentilis laingi*)				X	
Osprey (*Pandion haliaetus*)				X	
Peale's Peregrine Falcon (*Falco peregrinus anatum*)				X	
Red-breasted Sapsucker (*Sphyrapicus ruber)*			X		
Spruce Grouse (*Falcipennis Canadensis*)					
Trumpeter Swan (*Cygnus buccinator*)				X	
Vancouver Canada Goose (*Branta canadensis fulva*)			X		

[1] This document addresses all Management Indicator Species listed in the 1997 Forest Plan.
[2] Listed plant and fish species are addressed in their respective sections.

development at the time. USFWS released a new finding in August 1997, which also concluded that listing was not warranted. Several more legal challenges occurred in the intervening years and, most recently, the court instructed the USFWS to evaluate whether Vancouver Island is a "significant portion of the subspecies' range and, if so, to determine whether the bird should be listed. A new Finding, released in November 2007 concluded that that Vancouver Island is a significant portion of the Queen Charlotte goshawk's range and that listing the subspecies on Vancouver Island is warranted. The review also indicated that the subspecies' populations in British Columbia and Alaska are distinct population segments (DPS) and that the best available information on biological vulnerability and threats to the goshawk does not support listing the Alaska DPS as threatened or endangered at this time.

The Kittlitz's murrelet is a candidate species for listing. Species accounts for the Kittlitz's murrelet, Queen Charlotte goshawk, and Alexander Archipelago wolf are provided below under the Candidate Species subsection, Forest Service Sensitive Species subsection, and Management Indicator Species subsection, respectively.

Candidate Species

Kittlitz's Murrelet

On May 9, 2001, the Secretary of the Interior was petitioned to list the Kittlitz's murrelet (*Brachyramphus brevirostris*) as endangered with concurrent designation of critical habitat under the ESA. Petitioners cited dramatic reductions in population size over the past decade and declining habitat quality as reasons for the requested listing. The species was officially designated a candidate species (warranted, but precluded) on May 4, 2004.

The Kittlitz's murrelet is closely associated with glacial habitats along the Alaska mainland coast. Breeding sites are usually chosen in the vicinity of glaciers and cirques in high-elevation alpine areas with little or no vegetative cover (van Vliet 1993). When present, vegetation is primarily composed of lichens and mosses (Day et al. 1983). The species nests a short distance below the peak or ridge on coastal cliffs, barren ground, rock ledges, and talus above timberline in coastal mountains, generally near glaciers 0.2 to 47 miles inland (Day et al. 1983). The remote and solitary nesting habits lead to extreme difficulty in finding nests. Non-breeding or off-duty breeders spend the summer in inshore areas, especially along glaciated coasts.

The Kittlitz's murrelet is one of the rarest seabirds in North America. The only American population occurs in Alaskan waters from Point Lay south to northern Southeast Alaska (Endicott and Tracey Arm). The largest breeding populations are believed to be in Glacier Bay National Park and Preserve, Prince William Sound, Kenai Fjords, and Icy Bay (Kendall and Agler 1998 as cited in Day et al. 2000). According to the petition, the southern boundary of the breeding range is LeConte Bay on the Tongass National Forest. Latest worldwide population estimates range from 9,500 to 26,500 birds. The best information available from USFWS indicates that Prince William Sound populations have declined by 84 percent since 1984, Kenai Fjords area by 83 percent since 1976, Malaspina Forelands by 38 percent and perhaps as much as 75 percent between 1992 and 2002, and Glacier Bay by 60 percent between 1990 and 1999. Speculated causes for decline include oil pollution, glacial recession, gillnet mortality, and availability of preferred forage fish (Kuletz et al. 2003, Piatt and Anderson 1996, van Vliet and McAllister 1994). Effects of these factors include increased adult and juvenile mortality and low recruitment. Human-caused mortality includes gillnet fisheries and oil spills like that from the Exxon Valdez or smaller tourism and fishing boats. Increased disturbance from helicopter tours and cruise ships may also be a factor.

Forest Service Sensitive Listed Species

Sensitive species are those plant and animal species identified by the Regional Forester for which population viability is a concern on National Forest System (NFS) lands within the region. Either a significant current or predicted downward trend in population numbers or density, or a significant current or predicted downward trend in habitat capability that would reduce a species' existing distribution indicates a viability concern. The goal of the Forest Service Sensitive Species Program (Forest Service Manual 2670) is to ensure that species numbers and population distribution are adequate so that no federal listing will be required and no extirpation will occur on NFS land. The Alaska Region Sensitive Species List was last updated in June 2002 and an update is currently in progress.

Plants and fish species identified as Sensitive are discussed in their respective sections. The Queen Charlotte goshawk is described in greater detail because this species has additional management concerns. The Regional Sensitive Species List continues to be revised as new information dictates.

Queen Charlotte Goshawk

The northern goshawk inhabits forested lands throughout North America, favoring dense stands of conifer or deciduous mature and/or old growth for nesting habitat. The Queen Charlotte goshawk is recognized as a distinct subspecies, and is endemic to coastal rainforests from Vancouver Island to northern Southeast Alaska (Taverner 1940, Iverson et al. 1996, Squires and Reynolds 1997). Recent genetic analysis indicates that this population may be genetically distinct from goshawks found elsewhere (Talbot et al. 2005 as cited in USFWS 2007). During the last decade, conservation designations of the goshawk in Southeast Alaska have varied; however, its status in Southeast Alaska remains a concern (Cotter 2007b). In addition to being considered a species of special management concern on the Tongass, the Queen Charlotte goshawk is of special concern to the State of Alaska and has been included by Stenhouse and Senner (2005) on Audubon's Alaska WatchList because of its limited distribution and the potential threats posed by commercial timber harvesting in breeding and nonbreeding seasons. In 2000, the Canadian government listed the Queen Charlotte subspecies as threatened because of continued logging of low-elevation, old-growth coniferous forests within its range and likely population declines (Environment Canada 2006).

Within Southeast Alaska and on the Tongass, the goshawk is a year-round resident and may occupy different, or overlapping, winter and breeding territories. Prior to studies during the past decade, very little was known about goshawks on the Tongass. Goshawks occur in low densities across the Forest and are difficult to study in the dense temperate rainforests of Southeast Alaska (Schempf et al. 1996 as cited in USFWS 2007). A recent interagency study of goshawks in the Tongass found 61 nesting areas within approximately 30,000 mi^2 (77,000 km^2); though this number is not reflective of a density estimate *per se* (Flatten et al. 2001). Goshawk nests can be found in all LUDs, and the number of known nest sites has not significantly increased in recent years; however, this is probably related to reduced survey efforts and the fact that goshawks are frequenty missed during surveys due to their secretive nature, low density, and use of old-growth habitats where they are difficult to detect (Flatten et al. 2001, Boyce et al. 2005, *Northern Goshawks on the Tongass National Forest* presented at the Tongass Conservation Strategy Review Workshop 2006). The interagency research project has also ceased, and follow-up of leads apart from timber sale activities now seldom occurs.

A nesting area, which in Southeast Alaska can be 2,000 acres (800 hectares) in size (Iverson et al.1996, Flatten et al. 2001), is defined as the area containing all nests used by a pair of goshawks; it is the portion of a pair's home range that contains all active and inactive nests. Female goshawks tend to move greater distances between nests in sequential years than males; however, a majority of nests remained within a 0.8-mile (1.3-kilometer) radius of the previous year's nest and all movements were within 3.2 kilometers of the "year one" nest site (Lewis and Flatten 2004 as cited in USFWS 2007). Adult home ranges on the Tongass are some of the largest recorded for the species, averaging 9,640 acres for females and 10,625 acres for males during the nesting season, and 29,160 acres for females and 29,400 acres for males outside of the nesting season (Lewis and Flatten 2004 as cited in USFWS 2007). The large size of Tongass goshawk home ranges compared to other areas may be related to methological differences; aircraft were used in Southeast Alaska for radiotelemetry and birds were located even if they were "over the ridge" where ground-based radiotelemetry would not have located the bird (Squires and Reynolds 1997, Kenward 2006).

Based on a recent study of 37 nest trees, 54 percent were Sitka spruce, 41 percent were western hemlock, and 4 percent were yellow cedar (Flatten et al. 2002). Lewis et al. (2003) found nest trees in Southeast Alaska to be larger than those around them at the nest site. In a separate analysis of 63 nest sites (habitat immediately surrounding the nest) from 50 nesting areas (a 20- to 30-acre area surrounding a nest, including roosts and prey plucking sites), 89 percent were located in high-volume stands with relatively dense, multi-storied canopies (SD5N, SD5S, and SD67 categories) compared to the surrounding forest (Lewis et al. 2003, McClaren 2004, Doyle 2006); nest areas had significantly more forest, productive forest, hemlock, and canopy cover and less non-forested area than random 12-hectare plots, and less non-forested habitat and forest/non-forest edge than random 65-hectare plots (Lewis 2005). Goshawk nesting density appears to be closely associated with dense overstories and open understories and goshawk habitat may therefore be improved by silvicultural activities which reduce the densities of shrubs, saplings, and small poles, while maintaining or enhancing the canopy of large trees (Crocker-Bedford 1990). Some nests have been found in maturing second-growth (previously harvested) stands (Bosakowski et al. 1999, McClaren 2004). On Vancouver Island, most second-growth stands supporting nests were 60 to 80 years old, and suitable structure was apparently achieved in as little as 50 years (McClaren 2004).

The diet of goshawks in Southeast Alaska is dominated by a few key prey (grouse spp., medium-sized birds such as Steller's jay and varied thrush, and red squirrels, where present). In prey rich areas, blue grouse and red squirrel are the dominant prey items taken (Lewis 2001). On Prince of Wales Island and other islands where blue grouse and red squirrels are not present, spruce grouse, Steller's jays, and ptarmigan are the dominant prey items taken (Lewis 2001). Small mammals make up a small portion of the overall diet in this area. Thrushes, grouse, and squirrels (common forest inhabitants that may be affected by timber harvesting) contribute up to 60 percent of prey deliveries to goshawk nests during the breeding season (Lewis et al. 2004). Recent research from neighboring populations on Haida Gwaii/Queen Charlotte Islands suggests blue grouse populations have probably declined since intensive harvesting was initiated, despite the limited benefit gained from some recent harvesting (e.g., new openings [more than 15 years] are used by breeding birds), and that this decrease in grouse may have substantially impacted the viability of the threatened goshawk population (Doyle 2004a, 2006).

POG forest is an important component of goshawk habitat use patterns in Southeast Alaska and at all scales (nest tree, nest site, post-fledging areas) goshawks select POG forest types. Habitat use of the 1,000-foot beach and estuary buffer was higher for females than males during the nesting and non-nesting season, with peaks in use occuring at 3,000 and 4,000 feet from the beach fringe (*Northern Goshawks on the Tongass National Forest* presented at the Tongass Conservation Strategy Review Workshop 2006). Radio telemetry points within adult home ranges suggest very high use of POG forests. Non-productive forest types and second-growth stands are also used to a lesser extent, and in some areas these matrix lands may be important for long-term goshawk management (Reynolds 2004, Reynolds et al. 1992). Most other habitat types (such as alpine, subalpine, muskeg, and clearcuts) were used infrequently or avoided by goshawks. This is corroborated by recent research conducted in the Southwest and Pacific Northwest, which indicates that although goshawks prefer to place their nests in mature to old-growth forest types, they are much more adaptable than once thought, and when these habitats are not available they will nest in maturing second growth with sufficient structure or in smaller patches of trees, and forage in young forest as well as along edges and in openings (Bosakowski et al. 1999, McClaren 2004, Boyce et al. 2006, Reynolds et al. 2006). Although there is some documented use of second growth in Southeast Alaska, the majority of Southeast Alaska second growth is younger than 50 years and most goshawks are associated with older forests. Use of older second growth (e.g., approximately 90- to 100-year-old stands) by goshawks for nesting in a few instances in Southeast Alaska was used by the assessment panels to suggest that goshawks would benefit from a long timber rotation of 150 or 200 years, providing 50 or 100 years of use.

Timber harvesting on the Tongass and on private lands in Southeast Alaska, has resulted in the conversion of old-growth forest to young growth, and likely has contributed to a decline in goshawk habitat capability due to their association with this habitat and the association of their prey with this habitat (e.g., blue grouse and red squirrels). Although goshawks are considered generalist predators and possess some adaptability to fluctuations in their prey base, large-scale habitat disturbance may diminish breeding success of goshawks in Southeast Alaska through changes in prey availability (Lewis et al. 2004). In the contiguous U.S., such habitat change is believed to reduce the number of breeding goshawks by degrading the structural character of forests used for nesting and foraging, though it is still unclear how goshawk populations respond to habitat modifications because study of effects across a gradient of harvest intensity is lacking (Boyce et al. 2006). However, forest harvest may be compatible with goshawk management provided that habitat needs are provided at multiple spatial scales (Reynolds et al. 1992). For example, Doyle (2004b) concluded that grouse selection of stands with more open canopy with a variety of heights and a patchy shrub layer on the Haida Gwaii/Queen Charlotte Islands, provides for the possibility that there may be a pattern for single tree selection, or a patch retention harvest threshold, that will allow harvesting without impacting grouse populations and thus, goshawks.

In 1996, a conservation assessment was conducted to synthesize literature and original data from Southeast Alaska to describe the habitat relationships and conservation status of the Queen Charlotte goshawk (Iverson et al. 1996). Iverson et al. (1996) concluded that goshawk habitat theoretically could be maintained across the landscape under a 300-year ecological rotation. A risk assessment using a conceptual 300-year rotation revealed that several landscapes (including the North Prince of Wales Biogeographic Province) within the Tongass may be at increased risk of not sustaining goshawks. The assessment suggested that a combination of reserve-based and dynamic-landscape management approaches could sustain well distributed viable populations of goshawks across the Tongass. In 1997, a panel of goshawk experts concluded that, even though they had viability concerns, under the 1997 Tongass Forest Plan, there would be a high likelihood that after full implementation for 100 years, goshawks would still persist across the Forest in some distributional status considerably more dense than in refugia (Iverson 1997).

As noted above under the Threatened and Endangered Species section, a recent court decision has required USFWS to determine whether Vancouver Island is a “significant portion of the subspecies range” and, if so, to determine whether the bird should be listed. USFWS (2007) finalized an update to the 1997 Status Assessment in April 2007. A new Finding, released in November 2007 concluded that that

Vancouver Island is a significant portion of the Queen Charlotte goshawk's range and that listing the subspecies on Vancouver Island is warranted. The review also indicated that the subspecies' populations in British Columbia and Alaska are DPS and that the best available information on biological vulnerability and threats to the goshawk does not support listing the Alaska DPS as threatened or endangered at this time.

Osprey

The best available information indicates that the osprey is naturally rare in Southeast Alaska and this area may represent the northern periphery of the species' range. A total of 16 osprey nest sites have been documented in Southeast Alaska (USDA Forest Service 1997a). Of this total, no more than three have ever been known to be active in any year. Nests can be found along the coasts of Wrangell Island and Kupreanof Island, typically 0.25 to 1.4 miles from the nearest saltwater; ospreys do nest along inland freshwater lakes, but none has been documented in Southeast Alaska. They require large trees and snags or power poles for nesting and, in Southeast Alaska, osprey nests typically occur in broken-top spruce trees or western hemlock snags. Ospreys nest from late April through August and probably overwinter in Mexico and Central America. Historically, there is no evidence that there were additional ospreys in Southeast Alaska, and population numbers have remained stable but low. Limiting factors are unknown, but available nest sites and foraging areas (i.e., larger lakes, rivers, beaver ponds, coastal beaches or large estuaries with abundant fish) do not appear to be limiting. Interaction and competition with the abundant bald eagle population may be a limiting factor.

Peale's Peregrine Falcon

As of 1997, 36 nests of Peale's peregrine falcon have been located in Southeast Alaska; 32 of which are on the Tongass National Forest. Nest surveys are very difficult to conduct, and biologists believe more nests may be present. Peregrine nest distribution is closely associated with large seabird colonies located on the outer coasts or nearby islands. The nest sites are on cliffs ranging from 65 to 900 feet in height; all but one nest faces the open ocean. Seabirds are thought to be major prey of the falcon. Information on falcon breeding biology or reproductive success is limited, but based on USFWS surveys, their population appears to be stable.

Trumpeter Swan

The largest nesting population of trumpeter swans on the Tongass National Forest occurs on the Yakutat Forelands. A smaller breeding population occurs in the Chilkat Valley on non-NFS land. Young cygnets have been located as far south as Traitors Cove on Revillagigedo Island and pairs of swans have been consistently observed during the summer months on Smuggler's Lake on the Cleveland Peninsula. Surveys by USFWS and other cooperating agencies indicate that the Yakutat population continues to be stable. A complete aerial survey was completed in September 2005. Mean brood size was estimated at 3.1 with approximately 27 percent of the total swans counted (n=23,692) reported as juveniles. The mean brood size was 3 percent higher than in 2004, but lower than the 29-year mean. The proportion of juveniles was 30 percent higher than in 2004 and 7 percent above the 29-year average. Trumpeter swans winter in ice-free areas throughout Southeast Alaska. Winter surveys on the Yakutat Forelands documented 646 adults and 98 juveniles in March 2006. Information on wintering habitats and populations elsewhere on the Tongass is very limited, but a traditional winter concentration area has been documented on Mitkof Island near Petersburg. Numerous swans from other parts of Alaska migrate through Southeast Alaska, and many winter in suitable habitats in Southeast Alaska.

Management Indicator Species

Management Indicator Species (MIS) are vertebrate or invertebrate species whose response to land management activities can be used to predict the likely response of other species with similar habitat requirements. NFMA regulations of 1982 require both the selection of MIS during development of forest plans (36 CFR 219.19(a), 1982), and that reasons for species selection be clearly stated. Criteria are to include those species whose population changes are believed to indicate the effects of management activities (36 CFR 219.19(a)(1), 1982).

Though required under the NFMA, the MIS concept is not universally accepted and is difficult to use, especially on the Tongass. First, our fundamental knowledge of many Tongass MIS is limited, as is our understanding of the viability requirements of most Tongass wildlife species. Moreover, although Tongass MIS represent varying needs related to old-growth forest, there is no assurance that all or even most other old growth associated species are adequately represented. Additionally, many current MIS are difficult to monitor or no clear linkage has been established between observed population changes and habitat modification. Some species may be better monitored through surrogate measures such as important habitat features or prey populations. Consequently, an effort is underway to re-evaluate, and possibly reduce, the current list of MIS.

For the 1997 Forest Plan, 13 wildlife MIS were identified and are discussed in this section. Four MIS species with special management concerns (brown bear, marten, Sitka black-tailed deer, and Alexander Archipelago wolf) are discussed in more detail. POG habitat provides essentially all of the highly important habitats and the preponderance of the moderately important habitats for most of the MIS. However, some species (e.g., wolves) use a variety of different habitats but rely on prey species associated with old growth (e.g., black-tailed deer). Table 3.10-2 indicates the relative importance of conifer successional stages as habitat for the MIS. Table 3.9-4 in the *Biodiversity* section displays the elevational distribution of productive and unproductive old growth on the Tongass, based on different elevation constraints thought important for many of the species discussed in this section.

Sitka Black-Tailed Deer

Sitka black-tailed deer (*Odocoileus hemionus sitkensis*) are indigenous to the coastal regions of Southeast Alaska and northwest British Columbia. This subspecies of mule deer occupies the northernmost extreme of black-tailed deer habitat. Deer are strong swimmers, and have occupied almost all islands of the Alexander Archipelago capable of supporting them. On the mainland, deep snow and harsh winters limit populations more than on the islands.

The Sitka black-tailed deer is the wildlife species receiving the highest hunting and subsistence use of all terrestrial species in Southeast Alaska. Table 3.10-7 in the effects section below presents the average deer harvest per year over the last 10 years by Wildlife Analysis Area (WAA). This species represents those that use lower elevation (below 800 feet elevation) POG forest habitats during the winter period. The quantity, quality, distribution and arrangement of winter habitat are considered the most important limiting factors for Sitka black-tailed deer in Southeast Alaska. There are about 4.8 million acres of old-growth forest (3.0 million acres of POG and 1.8 million acres of unproductive old growth below 800 feet elevation within occupied deer habitat on the Tongass National Forest (Table 3.9-4 in the *Biodiversity* section). Currently, approximately 92 percent of the original old growth remains Forest-wide (see Table 3.10-7 for relative deer habitat capability by WAA).

Table 3.10-2
Relative Importance of Conifer Successional Stages as Habitats for Management Indicator Species

Species	Season[2]	Successional Stages[1]: Early (years) 0-25	Mid (years) 26-150	Mid (years) 150-200	Late (>200 years) Unproductive Old Growth	Productive Old Growth Low-Med (SD4S, SD4N, SD5H)	Productive Old Growth High (SD5S, SD5N, SD67)
Mountain Goat	1	L	L	L	L	M-H	H
Sitka B-tail Deer	1	L-M	L	L-M	L-M	M	H
River Otter	2,3	L	L	M	L	H	H
American Marten	1	L	L	L	L	M	H
Brown Bear	3	L	L	L	M-H	M-H	M-H
Black Bear	2,3,4	M	L	L	M	M-H	M-H
Wolf[3]	5	-	-	-	-	-	-
Red Squirrel	5	L	L-H	H	L	M-H	M-H
Bald Eagle	2,3	L	L	L	L	H	H
Red-br. Sapsucker	2,3	L	L	L	L	H	M
Hairy Woodpecker	1	L	L	L	L	L	M-H
Brown Creeper	1	L	L	L	L	L	L-H
Van. Can. Goose	2,3	L	L	L	H	H	H

1 H = Highest importance, high population densities, M = Moderate importance, moderate population densities, L = Least importance, low population densities
2 Season codes: 1 = winter, 2 = spring, 3 = summer, 4 = fall, 5 = all year
3 Wolves use habitats according to the abundance and availability of prey species (primarily Sitka black-tailed deer).

A deer winter habitat suitability index (HSI) model, which takes into account snow depth (indicative of typical, moderate winter severity), elevation, aspect, and conifer forest successional stage, is currently used in Tongass Forest planning to provide an index of habitat capability (referred to as the TLMP deer model, DeGayner 1997). It is a stand-alone model, based on expert opinion, which does not require the collection of new data. Old-growth forests are assigned the highest value because they intercept snow and provide understory forage plants. Generated HSI values are an index of how features are correlated with deer winter habitat. High model scores represent features that are correlated with deer abundance. These features include closed canopy (based on volume class rather than canopy cover), maritime influence, south facing slopes, and low average snow depth.

One shortcoming of the model is the high rating it gives to some large-tree old-growth stands (some of the stands mapped as SD67). These stands consist of widely spaced, very large Sitka spruce trees, most commonly located in riparian floodplains. Riparian floodplains tend to be some of the coldest locations on the landscape due to cold air drainage, shade, and flat terrain, and tend to have greater snow accumulations than neighboring stands, making them less hospitable to deer (T. Hanley, personal communication, 2007). Additionally, despite their high volume, these stands have open overstories that intercept less snow than other stands and, while they typically have a high understory biomass, dominant species include devils club, salmonberry, elderberry, and ferns, all of which provide suitable forage during summer but not during winter (Hanley and Hoel 1996). Thus, these stands constitue poor winter range, but by default, their high volume results in high assigned model values. The effect of this error is to overestimate the value of some large tree stands and to overestimate the impact of their harvest; however, the overall effect is relatively small because these stands comprise a very small fraction of the landscape (T. Hanley, personal communication, 2007).

Recent research indicates the greater importance of summer range for reproduction and population recovery following severe winters, and for building up pre-winter body reserves. This suggests that changes to the 1997 HSI model may be warranted such that higher suitability values are assigned to habitats that provide important summer forage, such as recent clearcuts, unproductive forest, and low volume old growth (Parker et al. 1999). Due to changes in vegetation mapping on the Tongass, model coefficients are currently being refined; however, these modifications will occur outside of the timeframe for the Forest Plan amendment. Therefore, the existing, approved deer HSI model used in the 1997 Forest Plan Revision Final EIS will be used here for alternative comparisons, with the caveat that it likely overestimates the effect of timber harvest on deer habitat quality.

The deer model provides a tool to evaluate the relative differences among alternatives. The winter HSI model is most appropriate for analysis over large planning areas such as the entire Tongass National Forest or at the scale of a WAA or number of WAAs, where the greatest differences in habitat value occur between main habitat types (e.g., old growth versus young clearcuts versus closed-canopy young-growth) and their topographic settings, rather than differences within such classes. Thus, the model has limitations when applied at the watershed or project planning level. A new tool for evaluating deer habitat appropriate for analysis at finer scales, called the Forest Resource Evaluation System for Habitat (FRESH-Deer) model, is currently being developed by the Forest Service in cooperation with the University of Alaska (*Deer Habitat Management*, presented at the Tongass Conservation Strategy Review Workshop 2006). FRESH-Deer is a food-based system that provides a “snap shot” analysis of habitat conditions at one point in time by taking into account the biomass of available forages (by species and by plant part), the nutritional quality of each forage (e.g., digestible energy and digestible protein), and user-specified metabolic requirements (e.g., metabolic energy, digestible protein) that are dependent on the age, sex, season, and reproductive status of the animal. The model identifies limiting factors within the habitat and the most important forages. In contrast to the winter HSI model, FRESH-Deer is a data-driven model that requires the collection of new data. In the future, this model may be available for use in project planning.

In addition to winter habitat conditions, predation can act as a major controlling factor of deer populations. Primary predators include humans, wolves, and black-bears; however, the predominance of each in terms of impacting the deer population varies geographically. For example, studies of deer mortality indicate that on Mitkof and Heceta Islands human harvest and wolf predation were the main causes of deer mortality, but on Prince of Wales Island deer mortality (primarily fawns) was predominantly due to bear predation (*Wolves and Predator-Prey Interactions*, presented at the Tongass Conservation Strategy Review Workshop 2006). Deer are the primary prey of wolves in Southeast Alaska, and the significance of predator/prey interactions on wolf populations led to the conclusion that wolf persistence was directly linked to deer habitat capability. However, even in high-quality habitats increased deer mortality can occur during severe winters. In fragmented landscapes, where small, remnant patches of old growth exist, deep snow may isolate deer by precluding movement between patches (McNay 1995). Concentrated use of these areas can result in overbrowsing of forage and ultimately malnutrition and death (Farmer et al. 2006)

Mountain Goat

Mountain goats (*Oreamnos americanus*) represent species using cliffs, alpine and subalpine, and old-growth forest habitats. The quantity and quality of winter habitat is the most limiting factor for mountain goats in Southeast Alaska. Lack of snow interception in early successional stages and lack of forage in middle successional stages reduces the value of winter habitat. Historically, mountain goats in Southeast

Alaska were present only on the mainland, but they have more recently been transplanted to many of the islands.

Mountain goat populations in Southeast Alaska are currently monitored via ADF&G aerial surveys and harvest records, which are used to estimate population trends. This species is considered one of the easier species in Southeast Alaska to monitor by virtue of their predictable use of open terrain during summer and fall. However, they spend much of their time outside of areas where habitat manipulations (e.g., logging) have occurred or are likely to take place in the future. Additionally, a clear link between timber harvest and mountain goat population trends has not been established. Existing Forest Plan standards and guidelines were developed to reduce the impacts of other activities (e.g., helicopter over-flights) and impacts associated with facilities (e.g., crew camps).

Black Bear

Black bears (*Ursus americanus*) are present throughout the mainland and on the islands south of Frederick Sound. They use habitats from sea level to the alpine. There are about 9.4 million acres (excluding rock, permanent ice fields, and acres of lakes) within occupied black bear range on the Tongass National Forest. Estuarine, riparian, and forested coastal habitats receive the highest use by black bears and appear to have the highest habitat values. Within forested areas, both early and late (old growth) successional stages provide the best forage and/or cover for black bears. A recent interagency study estimated black bear population size on the northern portion of Kuiu Island (Peacock 2005) and conservation genetics more broadly across the Alexander Archipelago (e.g., Peacock et al. 2007).

Black bears were chosen as an MIS because of their importance for hunting and for recreation and tourism. However, this species is difficult to monitor and existing monitoring data, derived from ADF&G sealing records, are not sensitive enough to detect population changes over large expanses, or determine the cause of population change in a given area.

River Otter

The river otter (*Lutra canadensis*) was selected as an MIS because of its association with coastal and freshwater aquatic environments and the immediately adjacent (within 100 to 500 feet) upland habitats. River otters are distributed throughout Southeast Alaska along coastal and inland waters (MacDonald and Cook 1999). Their distribution is Forest-wide in suitable habitats. Beach characteristics affect the availability of food and cover, and adjacent upland vegetation is also important in providing cover for otters. Old-growth forests have the highest habitat value, providing canopy cover, large-diameter trees and snags, and burrow and den sites. They tend to use POG (SDM SD5N, SD5S, SD67 categories) with fairly open understory and greater than 50 percent canopy closure where they commonly rest in cavities or beneath the roots of large conifers or snags (Larsen 1984, Ben-David et al. 1996, Bowyer et al. 2003). Younger successional stages provide lower quality habitat.

The best data currently available on river otter populations typically consist of infrequent, localized density estimates and thus may not be sufficient to monitor population changes at a level of resolution appropriate for the Tongass National Forest (i.e., commensurate with very small changes in habitat). Further, there is no monitoring protocol in place to detect changes in the population due to human-caused habitat change. Beach, Estuary, and Riparian standards and guidelines under the current Forest Plan protect most, if not all, of the key otter habitat components, thus greatly reducing risk to this species and others that rely on such habitats. It is important to note, however, that most streams receive a standard 100-foot buffer which does not protect habitat used by otters beyond this distance.

American Marten

Marten naturally inhabit the mainland of Southeast Alaska and many of the islands in the Alexander Archipelago. Known endemic populations exist on Admiralty, Etolin, Gravina, Kupreanof, Mitkof, Revillagigedo, Woewodski, Wrangell, and Kuiu Islands (MacDonald and Cook 2000). However, many islands remain unsampled but could also support populations. Marten were transplanted to Prince of Wales, Chichagof, and Baranof Islands between 1930 and 1950; whether these transplants were new introductions or just supplemented existing populations is unknown.

Although only one species of marten is formally recognized in Southeast Alaska two distinct lineages exist, including the coastal form *caurina,* which in the Alexander Archipelago occurs only on Kuiu and Admiralty Islands, and the continental form *americana* (Cook et al. 2006). Originally, these lineages were described as separate species but were reclassified as separate subspecies in the 1950s. It is unknown whether these lineages have different life history traits or habitat preferences, and thus, may require different management strategies. However, recent molecular analyses clearly distinguish the two forms and suggest that they have very different evolutionary histories (Stone and Cook 2002, Small et al. 2003, Cook et al. 2006). Hybridization of *caurina* and *americana* individuals has been documented in the two contact zones where both forms coincide, one in Southeast Alaska (Kuiu Island) and one in Montana (Cook et al. 2006).

Marten numbers fluctuate greatly over time in response to food availability habitat conditions and trapping pressure. Results of a multi-scaled study on Chichagof Island conducted between 1990 and 1999 evaluated marten habitat selection, demographics, diet, and prey availability, and indicate that marten abundance is best predicted by the abundance of long-tailed voles (Flynn and Schumacher 2001, Flynn et al. 2004). Habitat requirements reflect a strong interaction between food, cover, climate, and predation, with forest cover being particularly important for travel, dens and resting sites, hunting, and avoiding predation and inclement weather (Flynn and Schumacher 1999, 2001). Consequently, the quantity and quality of winter habitat is a limiting factor for marten in Southeast Alaska. There are about 7.2 million acres of forested land (all age classes and types of conifer forests) below 1,500 feet elevation within occupied marten habitat on the Tongass. Due to lower snow accumulation, habitats at lower elevations have higher value for wintering marten. Coastal habitats (beach fringe) and riparian areas have the highest value, followed by upland habitats below 1,500 feet in elevation. Of the successional stages, larger-sized old-growth forests have the highest value because they intercept snow, provide cover and denning sites, and provide habitat for prey species used by marten. Early successional stages do not provide these habitat components and have lower habitat value. However, studies of eight marten populations in Southeast Alaska conducted between 2001 and 2003 show that marten selected POG but used some second growth 26 to 40 years of age; on Mitkof Island these second growth stands were characterized by abundant understory forage and small mammals (Flynn et al. 2004). In addition, home ranges of marten were well distributed across the landscape and included areas with timber harvest and roads. These findings indicate that although OGRs are still an appropriate model for marten conservation in terms of providing optimal habitat requirements, the management of matrix lands to provide productive habitat and linkages between reserves is also important. Noteably, marten densities are higher in intact forests with less fragmentation (Hargis et al. 1999, Flynn et al. 2004), indicating that large, continguous block of old growth are important for this species.

Dispersal between islands is limited, but marten are fairly mobile on land. Marten are easily trapped and can be overharvested. Forest management activities resulting in increasing access may result in the potential for overtrapping. Currently the ADF&G permits unlimited trapping of marten in the Game Management Units (GMUs) that cover the Tongass (GMUs 1, 2, 3, 4, and 5) from December 1 to February 15. In GMU 3, which includes the endemic population on Kuiu Island, a 9-year average of 188 marten were trapped per year (Lowell 2004). For perspective, across Southeast Alaska the annual average harvest ranged from 224 martens per year on north central Prince of Wales Island to three martens per year on northern Kuiu Island between 1991 and 2002 (Flynn et al. 2004).

Marten were initially selected as an MIS because forest management activities were expected to affect population abundance, and marten pelts represented significant economic value to local residents. In Southeast Alaska, the best available information that can be related to marten populations comes from the ADF&G sealing records; however, this monitoring method was not designed to determine causes of observed population trends. Further, although marten populations appear to be sensitive to habitat alteration, no clear correlation between population trends and habitat change has been defined due to the lack of research on this dynamic and the absence of long-term population datasets. An assumption of the conservation strategy was that large OGRs would support a minimum of 25 female martens; however, in a study of marten densities conducted between 2001 and 2003, Flynn et al. (2004) determined that this minumim number was not met in five of eight study areas, the exception being the Chichagof Island site and possibly the sites near Point Couverden and Thomas Bay. These results illustrate the importance of the matrix lands between reserves for marten survival and the importance of the POG retention requirement under the conservation strategy.

Brown Bear

Southeast Alaska is home to one of the highest concentrations of brown bears (*Ursus arctos*) in the world (ADF&G 2000). Brown bears are important both for hunting (including both outfitter guided and non-guided hunting) and to the recreation and tourism industry of Southeast Alaska. As tourism grows in Southeast Alaska, there is increasing demand for more bear viewing opportunities such as those provided by Pack Creek and Anan Creek. Brown bears are present on the mainland and on most the islands north of Frederick Sound. They are occasionally reported on Mitkof, Etolin, and Wrangell Islands south of Frederick Sound, but are not found on any of the other islands in Southeast Alaska. Brown bears use areas from sea level to the alpine and are habitat generalists. There are about 7.9 million acres (excluding rock, permanent ice fields, and acres of lakes) within occupied brown bear habitat on the Tongass; 7.5 million acres of which are considered to be roadless. Home ranges of brown bears in Southeast Alaska are much smaller than those found in interior portions of North America. Average annual home range sizes for radio-collared bears on Admiralty Island was 39 square mile (100 square kilometers) and 14 square miles (37 square kilometers) for males and females, respectively (Schoen and Beier 1990); these are comparable to home range sizes of radio-collared bears on Chichagof Island (Titus et al. 1999).

The late-summer season has been identified as the most critical or limiting period for brown bears when they must build up energy reserves that are adequate to survive the winter and successfully reproduce (Hildebrand et al. 1999). During this season, many brown bears concentrate along low elevation valley bottoms and salmon streams, with most use occurring within 500 feet of streams (Schoen and Beier 1990, Titus and Beier 1999), where their efforts focus on consuming large quantities of fish in order rebuild their body condition and lay on essential fat reserves. Brown bears have been known to maximize their energy intake by preferentially attacking salmon with the highest energy content (i.e., those that have just entered the stream with protein and fat stores that have not yet been depleted) and by consuming the most energy dense body parts (Gende et al. 2004a, b, Gende and Quinn 2004). These are often the same areas of highest human use and most intense resource development activities. To better understand these relationships, a study on Chichagof Island conducted between 2001 and the present is evaluating brown bear spatial relationships, resource selection, and levels of use during the salmon spawning season in relation to riparian management along two drainages that differ in timber harvest intensity and road building (Flynn et al. 2007). Results showed that in both drainages male brown bears tended to concentrate their use along the stream, whereas females made greater daily movements and used both riparian and adjacent upland areas. In the drainage with more timber harvest and roading, with a smaller riparian buffer, daily movements of female bears tended to be greater and more variable (75 percent of radiotelemetry locations occurring within 2,482 feet of the stream), including more use of adjacent upland areas, than in the less disturbed drainage (75 percent of radiotelemetry locations occurring within 937 feet of the stream). DNA-based population estimates indicated that the number of male bears along both streams was approximately equal and remained constant over time, with an increase in use in September; the number of female bears present declined over the same period. Additionally, diet analyses were conducted with an interest in evaluating the proportion of the diet consisting of salmon, based on the premise that a greater amount of salmon in the diet should support a larger and more productive population. Salmon obtained from mid-summer to early fall represent an important food source for accumulation of energy reserves to sustain bears over-wintering in dens. Results showed that females along heavily managed streams ate less salmon than females along steams with larger riparian buffers, though both drainages still supported high densities of brown bears (22 bears per square kilometer in the less altered watershed and 13 bears per square kilometer in the highly altered watershed, as measured within a 500 meter riparian buffer). A similar study on the Kenai Peninsula reported that female brown bears with cubs tended to avoid areas used by other bears and by humans, apparently in an effort to increase offspring survival, and used less productive salmon spawning areas despite having high nutritional requirements (Suring et al. 2006). These results indicate that small streams are important for female and young bears and forested buffers are important to maintaining high density brown bear populations by providing adequate vegetative cover for secure foraging areas and to support anadromous fish production (Flynn et al. 2007).

Cover for visual obscurity, provided by riparian buffers, is important for minimizing interactions among bears and between humans and bears. Increases in human activity due to an expanding road system in an area may result in increased direct human-induced deaths of bears. This may include legal hunting, illegal kills, wounding losses, and deaths due to the defense of life or property (DLP mortality). Open roads are of greatest concern because they receive the highest, most consistent use; however, closed roads are also important to consider because they provide off-highway vehicle and pedestrian access. ADF&G permits harvest of brown bears in GMU 4, which encompasses Admiralty, Baranof, and Chichagof islands. An annual average of 165 brown bears per year was taken from this area over the last 5 years (ADF&G 2005b). Hunting is also permitted elsewhere in Southeast Alaska.

Alexander Archipelago Wolf

Two Alaskan subspecies of the gray wolf are currently recognized (Weckworth et al. 2005). The wolf found in Southeast Alaska is known as the Alexander Archipelago wolf (*Canis lupus ligoni*). It inhabits the mainland and the larger islands south of Frederick Sound (MacDonald and Cook 2000). However only the largest islands, including Prince of Wales, Kuiu, Kupreanof, Mitkof, Etolin, Revillagigedo, Kosciusko, Zarembo, and Dall islands, are thought to support persistent wolf populations (Person et al. 1996). Recent genetic analyses have shown that wolves on Prince of Wales Island (GMU 2) are a population segment isolated from all other wolves in Southeast Alaska and coastal British Columbia (Weckworth et al. 2005). Wolves require an adequate prey base of ungulates, beaver, and salmon; in most areas of Southeast Alaska the Alexander Archipelago wolf depends heavily on deer. Suitable habitats for wolves equate to areas capable of supporting this prey base. Wolves use a wide variety of habitats when prey are present, and can affect prey populations in those areas.

Wolf densities are closely tied to the population levels of their prey though populations may not exceed certain levels even when prey abundance is high due to other regulatory mechanisms including environmental conditions and social interatcions (Messier 1994, 1995). However, deciphering the influence of each of these factors can be obscured by varying rates of harvest, time lags in carnivore response to changes in prey, or changes in prey vulnerability (Peterson 1977, Fuller and Sievert 2001). Throughout their range, a density of one adult wolf per 10 square miles appears to be high, based on densities reported for wolf populations elsewhere in North America, and this density is often considered as a saturation point beyond which wolf populations would not expand (Person et al. 1996). Wolves have large home ranges (about 100 square miles per pack), use a wide variety of habitats, and are very mobile (Person et al. 1996).

A petition to list the Alexander Archipelago wolf as threatened under the ESA in 1993 illustrated a concern for the viability of this subspecies. USFWS accepted the petition, confirming the concern, but concluded in 1995 that listing was not warranted at this time. However, an interagency wolf conservation assessment was conducted to synthesize available information on wolf ecology and identify management considerations for sustaining viable wolf populations on the Tongass (Person et al. 1996). The assessment concluded that wolf densities are generally lower on the mainland and higher on islands in the southern half of the Tongass.

The large islands south of Frederick Sound (GMUs 2 and 3) support approximately 60 to 70 percent of the total wolf population in Southeast Alaska (Person et al. 1996, Person 2001). Principal concerns exist on Prince of Wales and Kosciusko Islands, where past timber harvest has reduced deer habitat capability and increased road density. Although the wolf population is capable of sustaining harvest, Person (2001) expressed concern that expanding road access, particularly on Prince of Wales Island, may increase mortality of wolves there beyond sustainable levels. Therefore, assessing potential impacts to the wolf population is critical given the complex relationship they have with deer populations and human livelihoods.

Recent analyses presented at the Tongass Conservation Strategy Review Workshop (2006) have modeled the probability of an overkill (average harvest of greater than 30 percent of the population) or destructive harvest (harvest greater than 90 percent of the population occurring once between 1985 and 1999) of the wolf population on Prince of Wales Island taking into account road density and whether the road system was connected to a main road system with access to a ferry. Results indicated that 32 percent of WAAs on Prince of Wales Island have road densities indicatative of a high probability of overkill and 52 percent have road densities indicating a high proability of having had at least one destructive harvest between 1985 and 1999. These results indicated that roads exert a strong influence on wolf mortality, particularly when connected to main road systems. However, it is important to note that roads themselves do not decrease habitat capability for wolves, but increased density of roads may lead to higher hunting and trapping mortality through improved human access. There are other methods available to address unsustainable hunting and trapping mortality including changes to both state and federal hunting and trapping regulations and increased enforcement.

GMUs 2 and 3 support some of the highest wolf densities in the state and populations are thought to be stable in GMU 2 and increasing in GMU 3 (ADF&G 2003). The State permits wolf harvest with a bag limit of five wolves taken by hunting and no limit for trapping; their objective is to maintain an average annual harvest of 39 wolves in GMU 2 based on the average harvest from 1984 to 1990 (ADF&G 2003). However, there is a harvest cap in GMU 2 that does not allow the harvest of more than 30 percent of the estimated fall population to ensure that a sustainable wolf population is maintained. Wolf hunting and trapping regulations for federally qualified users under the auspices of the Federal Subsistence Board are generally the same as that under State of Alaska regulation.

Important components of a wolf conservation strategy include providing core habitats with low road density, maintaining wolf harvest within sustainable limits through regulations, and providing adequate deer habitat to support an abundant and stable deer population. Under the current Forest Plan, this is accomplished through standards and guidelines for road density, deer density, and den site buffers with associated timing restrictions. Current wolf standards and guidelines direct that effective road closures should be implemented when road access has been determined through analysis to be a significant factor in wolf mortality contributing to unusustainable wolf mortality. Preliminary results presented at the Tongass Conservation Strategy Review Workshop (2006) indicate that closed roads also may contribute to wolf mortality and that open and closed roads should be considered in road density calculations. In addition, consideration should be given to excluding high elevations when calculating road densities. Current standards and guidelines related to den site buffers and timing restrictions include buffers of 1,200 feet surrounding active dens from April 15 to July 1, no road construction within 600 feet during this time period, and protection for active dens from disturbance.

The wolf was selected as an MIS because of population viability concerns in some areas of the Tongass. However, the datasets available for monitoring wolves are insufficient for detecting all but very large changes in the wolf population and are not designed to track trends in the population resulting from changes in their habitat. Additionally, although recent efforts have been made to improve information on wolves in the form of multi-year research projects undertaken by ADF&G and the Forest Service, it is difficult to determine the link, if any, between habitat change on the Tongass and changes in the wolf population, especially given confounding factors such as weather-dependent fluctuations in prey abundance or spatially differential hunting pressure (USDA Forest Service 2004i). Further existing observation and monitoring measures do not address the distinct population in GMU 2.

Bald Eagle

North America's bald eagle (*Haliaeetus leucocephalus*) population reaches its highest density in Southeast Alaska. In 1992 the population was estimated at over 13,000 adult birds; more than 8,000 nest sites were identified through 1996. Their nesting habitat is primarily old-growth trees along the coast and within riparian areas. The USFWS and Forest Service maintain an interagency agreement for bald eagle habitat management in the Alaska Region, which includes standards and guidelines for regulating human disturbance within identified bald eagle use areas.

Gende et al. (1998) reported a decrease in active bald eagle nest density with increasing proximity to clearcuts, with reduced nesting activity for locations within 948 feet (300 meters) of clearcuts. Gende et al. (1998) suggested that a buffer of 328 feet would be inadequate to mitigate effects of harvest, and recommended a

984-foot buffer around active nests (Gende et al. 1998). Furthermore, most bald eagles nest within 328 feet (100 meters) of saltwater shorelines in Southeast Alaska and it has been suggested that to prevent loss of this segment of the eagle population, a 1,300-foot buffer be maintained to protect all nesting bald eagles. Currently, a 330-foot radius protective habitat management zone surrounds all identified bald eagle nest trees and a 1,000 foot beach buffer is maintained along the shoreline.

The bald eagle was selected as an MIS because of its use of coastal areas for foraging and nesting. Unlike many current MIS, a reasonably precise estimate of bald eagle population trends in Southeast Alaska can be derived from surveys conducted by USFWS, which could serve as a logical measure of the efficacy of the 1,000-foot beach buffer prescription under the current Forest Plan. USFWS has completed an evaluation of the effectiveness of the 1,000-foot beach buffer prescription for conserving forest-dwelling birds through two separate research projects, which indicated that a minimum of 1,000-foot buffer was beneficial for several species (red breasted sapsucker and some others) and then buffers less than this may not be effective at maintaining nesting habitat for some species (see Kissling 2003 and Sperry 2006 for additional information).

Red Squirrel

The red squirrel is one of only two arboreal rodents in Southeast Alaska. Red squirrels are abundant on many of the islands in the Alexander Archipelago and the mainland. Red squirrels require forests with cone-producing trees and cavities in trees and snags for nesting and denning. The root systems of large spruce trees are also important for den sites. They represent a species that can do fairly well in seed-producing young-growth timber stands. There are about 8.4 million acres of forested land (including all age classes and types of conifer forests) within occupied red squirrel habitat on the Tongass National Forest. Optimum habitat use is believed to occur when patches of preferred habitat are greater than 30 acres.

The red squirrel was selected as an MIS because it is an important prey species for marten and requires forests with cone-producing trees and cavities in trees and snags. However, few data are available describing red squirrel populations over time and changes in local populations do not necessarily imply negative impacts to the overall population. Thus, this presents an impasse in the ability to correlate human-induced habitat change with population trends. Additionally, although habitat capability for red squirrels is reduced through the conversion of POG to second growth, recovery of habitat capability after timber harvest is much faster for red squirrels than other species. That is, although post-harvest formation of structures favored for nesting and food storage (cavities) takes longer, the majority of habitat capability (food availability) is restored quickly as cone production typically begins 40 years after harvest.

Red-breasted Sapsucker

The red-breasted sapsucker (*Sphyrapicus ruber*) is well distributed throughout Southeast Alaska during the spring, summer, and early fall seasons, and occurs in lower elevations during the late fall and winter seasons. They use a wide variety of forested habitats but require the presence of snags during the breeding season and are indicative of low volume POG (SD4H category). They are weak excavators and therefore require rotted or soft substrates in order to create cavities for nesting and roosting. There are about 9.9 million acres of forested land (includes all age classes and types of conifer forests) within occupied red-breasted sapsucker habitat on the Tongass National Forest of which approximately 980,000 acres are in the SD4H category (see Table 3.9-5 in the *Biodiversity* section). Old-growth forests provide the best snag habitat over the long-term; stands with higher densities of snags receive more use. Red-breasted sapsuckers on northern Vancouver Island, British Columbia, preferentially selected large diameter trees (mean diameter at breast height [dbh] 93.3 cm), which Joy (2000) surmised provided an optimal balance of nest space (could accommodate larger clutch sizes), insulation, and protection from predation. In managed landscapes, forest buffers are important for this species. Kissling (2003) found that in Southeast Alaska red-breasted sapsucker densities were positively correlated with forest buffer width, and appeared to be maximized when bufferes were at least 300 meters wide.

The red-breasted sapsucker was selected as an MIS as a representative primary cavity excavator. In Southeast Alaska, currently the best available information that can be related to red-breasted sapsucker populations comes from the US Geological Survey (USGS) Breeding Bird Survey (BBS) and the Audubon Society Christmas Bird Counts (CBC). Additional information has been derived from the Monitoring Avian Productivity and Survivorship (MAPS) program, under which three to seven stations are surveyed by the Tongass National Forest to capture forest birds during the breeding season, and the Alaska Landbird Monitoring Survey (ALMS). However, these are large-scale monitoring programs and may not detect changes in avian populations at a scale and resolution appropriate for the Tongass National Forest. Further, existing monitoring does not relate changes in red-breasted sapsucker habitat directly to changes in their populations under the present limitations of data provided and assumptions used.

Hairy Woodpecker

The hairy woodpecker (*Picoides villosus*) is considered an uncommon, permanent resident throughout Southeast Alaska. Hairy woodpeckers use old-growth forest habitats with snags and dying trees for foraging and nesting. Like the red-breasted sapsucker, hairy woodpeckers are primary cavity excavators for other cavity-using wildlife species. Their winter habitat may be their most limiting. There are about 9.9 million acres of forested land (including all age classes and types of conifer forests) within occupied hairy woodpecker habitat on the Forest. High-volume old-growth forests provide the best long-term snag habitat, with large diameter old-growth trees (particularly SD5S, SD5N, and SD67 categories) receiving more use than stands with smaller diameter trees. There are approximately 2 million acres of old growth in the SD5S, SD5N, and SD67 categories; optimum habitat use is believed to occur when patches of preferred habitat are greater than 500 acres.

The hairy woodpecker was also selected as an MIS as a representative primary cavity excavator. As with the red-breasted sapsucker, the best available information that can be related to hairy woodpecker populations in Southeast Alaska comes from the BBS, CBC, the MAPS program, and the ALMS. However, these are large scale monitoring programs and may not detect changes in avian populations at a scale and resolution appropriate for the Tongass National Forest. Further, existing monitoring does not relate changes in hairy woodpecker habitat directly to changes in their populations under the present limitations of data provided and assumptions used.

Brown Creeper

The brown creeper (*Certhia americana*) is considered an uncommon, permanent resident throughout Southeast Alaska. Brown creepers are likely more common than usually acknowledged, but detectability of this species is relatively low, resulting in abundance estimates that are biased low. This species was selected as an MIS because of its close association with large diameter old-growth trees (particularly SD5S, SD5N, and SD67 categories). As noted above, there are approximately 2 million acres of the SD5S, SD5N, and SD67 category old growth on the Forest. The factor most cited as limiting brown creeper populations is the availability of old-growth and mature woodlands as nesting and foraging sites and research has shown that creepers abandon sites that have been subjected to even light (e.g., partial-cut) logging activity because such activity is typically focused on large, mature trees (Wiggins 2005). In a study of the effects of buffer width on breeding bird communities in the Tongass, a majority (83 percent) of all brown creeper observations occurred in undisturbed control plots (Kissling 2003). Optimum habitat use is believed to occur when patches of preferred habitat are greater than 15 acres (USDA Forest Service 2003).

In Southeast Alaska, the best available information that can be related to brown creeper populations comes from the BBS and the CBC. Additional information has been derived from the MAPS program and the ALMS. However, these are large scale monitoring programs and may not detect changes in avian populations at a scale and resolution appropriate for the Tongass National Forest. Further, existing monitoring does not relate changes in brown creeper habitat directly to changes in their populations under the present limitations of data provided and assumptions used.

Vancouver Canada Goose

Vancouver Canada geese (*Branta canadensis*) are distributed throughout the Alexander Archipelago of Southeast Alaska, with an estimated resident population of 10,000 birds. This population is relatively non-migratory, with the majority of birds moving only locally between nesting, brood rearing, molting, and winter concentration areas. Vancouver Canada geese were selected as an MIS because of their association with wetlands (both forested and non-forested) in the estuary, riparian, and upland areas of the Forest. Vancouver Canada geese are highly mobile and are found throughout the islands of Southeast Alaska.

Nesting and brood-rearing habitats are potentially affected by various forest management activities, though timber harvest in these areas has generally been minimal because these sites are fairly unproductive. Additionally, Riparian and Wetland standards and guidelines in place under the current Forest Plan, which include the use of various Best Management Practices (BMPs), are designed to minimize impacts to and maintain the function of these habitats. Effects of timber harvest and recreation on winter habitats have not been assessed but may result in increased human disturbance to wintering flocks or their habitats. Waterfowl census surveys conducted by the USFWS are the best source of demographic information for Vancouver Canada geese; however, population data are too insufficient to indicate a Forest-wide trend in the population, and thus no clear relationship has been established between population numbers and trends in habitat change.

Other Species of Concern

Marbled Murrelet

The marbled murrelet (*Brachyramphus marmoratus*) is a robin-sized seabird. It feeds below the water's surface on small fish and invertebrates, and in Southeast Alaska, is usually found within 5 miles of shore. The marbled murrelet typically nests on mossy-limbed branches of large, mature coniferous trees within stands of structurally complex, coastal old-growth forest (SD5N, SD5S, SD67 categories). There are roughly two million acres of this habitat on the Tongass. However, on some treeless islands in Southeast Alaska marbled murrelets will lay eggs on bare talus slopes in mountainous areas (Piatt et al. 2007).

The majority of the world population of marbled murrelet breeds in Alaska, with most found in Southcentral and Southeast Alaska. In March 2006, a status review for the marbled murret was initiated by the USFWS for the northern part of the species range to support ESA deliberations over the listing of the species as threatened in the sourthern part of its range (California, Oregon, and Washington). This review compiled published information on the conservation status, population biology, foraging ecology, population genetics, population status and trends, demography, marine and nesting habitat characteristics, threats, and ongoing conservation efforts for marbled murrelets in Alaska and British Columbia (Piatt et al. 2007). Genetic analysis conducted as part of the review identified three distinct population segments: one in the central and western Aleutian Islands, one ranging from the eastern Aleutians to Northern California, and one in central California. Based on historical abundance information, the Alaska population numbered approximately 1 million birds in the recent past and is now estimated to be approximatey 270,000 birds (Piatt et al. 2007). Three areas of greatest abundance include Lower Cook Inlet (35,670 birds), Prince William Sound (33,745 birds), and Southeast Alaska (144,190 birds).

Using trend information from at-sea surveys conducted at eight sites in Alaska, numbers have declined annually at five sites at rates of -5.4 to -12.7 percent per year since the 1990s, representing an overall decline in the Alaska population of 70 percent during the past 25 years (Piatt et al. 2007). Populations at three sites in Southeast Alaska have exhibited overall declines of 46 to 70 percent between the early 1990s and 2001. Likewise, the Prince William Sound population declined by 69 percent between 1989 and 2005 and the population on the outer coast has declined by 43 percent between 1992 and 2002. Possible causes of estimated overall Alaska declines are oil spills, mortality from gill netting, cyclic changes in marine food productivity, and the harvesting of POG forests, though it is likely that it is a combination of these forces, as has been implicated in similar declines observed in other seabird populations in Alaska (Piatt et al. 2007). The 2007 status review concluded that, over the last half century, marbled murrelets have lost about 15 percent of their suitable forested nesting habitat in Southeast Alaska due to large-scale logging, though nesting habitat losses cannot explain the declines observed in areas such as Prince William Sound or Glacier Bay where industrial logging has not occurred on a large scale or at all (Piatt et al. 2007).

Recent research indicates that key microhabitat characteristics of marbled murrelets nest sites include: (1) sufficient height to allow stall landings and jump-off departures, (2) openings in the canopy for unobstructed flight access, (3) sufficient platform diameter to provide a nest sight and landing pad, (4) soft substrate to provide a nest cup, and (5) overhead cover to provide shelter and reduce detection by predators (Hamer and Nelson 1995, Nelson 1997, and Burger 2002). Conceptually, uneven-aged silvicultural practices or extended harvest rotations may maintain sufficient forest structure to support nesting murrelets, depending on gap size and the interspersion of trees and patches in the cutting unit. However, due to their association with old-growth forests it is apparent that nesting habitat for this species is not easily created and is likely that in young stands, suitable nesting habitat will not develop for 150 or more years (Albert and Schoen 2006).

An interagency conservation assessment of marbled murrelets in Southeast Alaska conducted in 1996 concluded that a murrelet conservation strategy should consider a reserve-based approach, especially in those biogeographic provinces where substantial timber harvest has been concentrated and is projected to continue (DeGange 1996). The current Forest Plan satisfies many of the measures identified in the assessment, including a Forest-wide system of OGRs and uneven-aged management in many areas that allow timber harvest. Standards and guidelines pertaining to marbled murrelets include maintaining a 600-foot (200-meter) radius no cut buffer zone around identified murrelet nests. However, marbled murrelet nests are extremely difficult to find, so in the Pacific Northwest where old growth is relatively rare, some resarchers have suggested that a more effective conservation strategy would be to maintain a 5-mile (0.8-km) radius buffer around any stand that is occupied by marbled murrelets (Raphael 2006).

Spruce Grouse

Spruce grouse (*Falcipennis canadensis*) are resident across much of northern North America, occurring from Alaska to Labrador southward into New England and into the northern states of the western U.S. The Prince of Wales spruce grouse is a subspecies that is endemic to Prince of Wales and nearby islands in southern Southeast Alaska.

Spruce grouse are closely associated with taiga and northern montane coniferous forests, with a lush understory of mountain cranberry, blueberry, crowberry, and spiraea growing on a thick carpet of mosses, where they rely heavily on pine and spruce needles as their main food source. Spruce grouse select relatively young successional stands that are dense with a well developed middle story. Microhabitat selection varies between seasons, with habitat selection being driven by snow during winter (they move from open stands to dense stands possibly in relation to the availability of snow of sufficient depth for snow roosting) and by food availability during summer (density of breeding females increases with the abundance of the shrub and herb layer). During dispersal and migration, birds traverse stands of deciduous growth, though they generally avoid non-forested habitat.

Spruce grouse in Southeast Alaska appear to be living in isolated and scattered low-density populations, which fluctuate overtime apparently in response to the degree of maturation of post-disturbance re-growth and predation pressure (Boag and Schroeder 1992). These small and isolated populations are particularly vulnerable to overexploitation associated with advancing roads and settlements. In addition, travel barriers created by development may reduce the exchange between neighboring populations, making it difficult for isolated populations to recruit new breeders. Though they are closely associated with conifer forests, the highest densities of spruce grouse are supported by areas with a mosaic of older coniferous habitats interspersed with regenerating patches of dense trees. Changes in forest structure, (e.g., timber harvest or windthrow) associated with fragmentation may lead to population declines if open areas are too large or forested patches are spread too far apart to enable spruce grouse to move between them. In the GMUs that encompass the Tongass (GMUs 1, 2, 3, 4, and 5), the ADF&G permits taking of spruce grouse between August 1 and May 15, with a bag limit of five per day.

Flying Squirrel

The northern flying squirrel (*Glaucomys sabrinus*) inhabits the boreal forests of Alaska, Canada, and the far northern U.S. and occurs on the mainland and southern islands in Southeast Alaska. The Prince of Wales flying squirrel subspecies (*G. s. griseifrons*) is endemic to Southeast Alaska and has been documented on Dall, El Capitan, Heceta, Kosciusko, Orr, Suemez, Tuxecan, Prince of Wales, and Barrier islands (Demboski et al. 1998, Smith 2005). The subspecies *G. s. zaphaeus* is more widespread in Southeast Alaska and occurs on the mainland.

The flying squirrel is a keystone species in the Pacific Northwest associated with late-seral habitat and is a diet specialist (mycophagous). Their density often increases with forest complexity. However, recent research has suggested that flying squirrels in Southeast Alaska differ ecologically from those in the Pacific Northwest, in that they are more closely associated with important, individual habitat attributes (large standing live and dead trees) that may be present in both old and complex young forests, and have been shown to use peatland-scrub-mixed conifer forests, rather than just old-growth forest (Smith and Nichols 2003, Smith et al. 2004b, Smith et al. 2005a). Surveys on Prince of Wales and Mitkof Islands indicated that the primary habitat of this species is high-volume POG, with some of the highest flying squirrel densities recorded in North America; however, breeding females were found in peatland and mixed-conifer stands, although demographic analyses showed that these were sink habitats (Smith and Nichols 2003). Additionally, a study on Prince of Wales Island found the density of large-diameter trees (greater than 74 cm dbh), abundance of *Vaccinium* shrubs, and density of large-diameter (50 to 74 cm dbh) snags was positively correlated with habitat use (Smith et al. 2004b). Although this study only looked at unmanaged landscapes, the authors suspected that had younger, less complex forest been included in their comparison, more attributes typical of old forest would have emerged as correlates of population density. Flying squirrels use large tree and snags for denning and nesting and require an adequate spacing of trees to travel through the forest. Thus, although flying squirrels may not be good indicators of “old” forest condition, they may be good indicators of landscape permeability in managed landscapes because successful dispersal of the species depends on the functional connectivity of the landscape (Smith et al. 2005a). The Prince of Wales subspecies was identified by the 1997 Forest Plan risk assessment panel as being at risk of extirpation in managed landscapes; however, the recent research described above indicates that this risk is likely less than presumed because abundant noncommercial forests appear to contribute to breeding populations (Smith 2005).

Flying squirrels are an important prey for various predators including great horned owls, Queen Charlotte goshawks, and marten, although few, if any, predators in Southeast Alaska specialize on flying squirrels (AKNHP 2006, Smith and Nichols 2003). Consequently, direct impacts to flying squirrels associated with habitat change may result in indirect impacts to predator populations. Timber harvest can adversely affect flying squirrel populations by creating restricted, isolated populations if clearcut size is too large or if some scattered tall conifers in large cuts are not retained as cover and for travel across the open spaces.

Migratory Birds

Executive Order 13186 (Responsibilities of Federal Agencies to Protect Migratory Birds) provides for the conservation of migratory birds and their habitats and requires the evaluation of the effects of federal actions on migratory birds, with an emphasis on species of concern. Federal agencies are required to support the intent of the migratory bird conventions by integrating bird conservation principles, measures, and practices into agency activities and by avoiding or minimizing, to the extent practicable, adverse impacts on migratory birds when conducting agency actions.

Neotropical migratory birds are far ranging species that require a diversity of habitat for foraging, breeding, and wintering. Therefore, patterns of population declines are generally detected at larger observational scales than those traditionally used to manage lands and by assessing habitat at a larger geographic scale, effects to overall biodiversity can be better incorporated into the planning process (Finch and Stangel 1992).

Over 100 species of birds migrate from the lower 48 states, Central and South America, to nesting, breeding, and rearing grounds in Alaska. Most of the birds fly to the interior or northern Alaska and only pass through southeast Alaska on their way to the breeding grounds. There are 114 “Important Bird Areas” identified by the Audubon Society, and a Partner for BirdLife International is working to identify a network of sites that provide critical habitat for birds. Of those areas identified, 49 sites have been recognized to date as important habitat for migratory birds in Alaska. Though there are no recognized Important Bird Areas within Southeast Alaska, a statewide Important Bird Area program is well underway (Stenhouse 2007). There are 40 protected bird species that may occur on the Tongass National

Forest; however, 20 bird species are identified as species of concern in Southeast Alaska (Boreal Partners in Flight 1999) and listed in Table 3.10-3.

Of the protected bird species, 35 are associated with old-growth and mature forest habitats, and thus are sensitive to timber management activities. Based on nesting behavior, these species fall into four categories including ground-nesting birds (blue and spruce grouse), cavity- and bark-nesting birds (12 species including woodpeckers, the brown creeper, swallows, forest owls, and wrens), tree- and shrub-nesting birds (20 species including flycatchers, warblers, forest raptors, crossbills, thrushes, kinglets, and corvids), and specialized nesters (dippers). Spruce grouse are discussed above in detail. Of the cavity- and bark-nesting birds, only the red-breasted sapsucker and northern saw-whet owl are migratory, the rest being year-round residents in Southeast Alaska. Cavity nesters require suitable nest cavities and adequate foraging habitats such as snags and dead wood material on live trees (e.g., broken tree tops) that are not recruited into harvested stands for more than 100 years (Sallabanks et al. 2001). For example, in a study of the effect of buffer width on breeding bird communities in the Tongass (Kissling 2003), 83 percent of brown creeper observations occurred in undisturbed control plots. Thus, the conversion of old-growth stands to clearcuts and younger successional stages reduces the amount of habitat available to these species. In addition, fragmentation increases forest edge area which can improve predator access and affect ecological dynamics of the forest through microclimatic effects (DellaSala et al. 1996).

Of the forest- and shrub-nesting species in Southeast Alaska, most are migratory. Large proportions of the global population of several species breed in Southeast Alaska (e.g., 21 precent of varied thrushes and 20 percent of Pacific-slope flycatchers). Though there is a general lack of information regarding habitat requirements for most of these species, many occur more commonly in high-volume, lower elevation old-growth forests compared with second-growth stands (DellaSala et al. 1996, Russel 1999, Kissling 2003, Zwickel and Bendell 2005). The Pacific-slope flycatcher, varied thrush, golden-crowned kinglet, and Townsend's warbler have the strongest association with old-growth and mature forest and require interior forest conditions (Stotts et al. 1999 as cited in Cotter 2007c). For Townsend's warblers, large trees have been found to be important as nest sites in Southcentral Alaska, with predation rates higher among nests in small trees than in large trees (Matsuoka et al. 1997a, 1997b). Kissling (2003) measured breeding densities of Townsend's warblers to be more than two times higher in forested beach buffers than in adjacent clearcuts. Like cavity- and bark-nesting species, open cup-nesting birds are also sensitive to fragmentation and tend to avoid nesting near forest edges where they are particularly vulnerable to predation (DellaSala et al. 1996). It is important to note that while studies of bird community response to timber harvest alternatives to clearcutting in Southeast Alaska do indicated that creation of forest edge may increase nest predation rates, the actual response depends on a broad array of factors and is highly variable.

A specialized-breeder, the American dipper is a dependent stream-dweller and a year-round resident of Southeastern Alaska (Gabrielson and Lincoln 1959 as cited in Cotter 2007a). Within Southeast Alaska, American dippers appear to migrate seasonally along an altitudinal gradient as they do elsewhere in their range (Johnson 2003 as cited in Cotter 2007a, Morrissey 2004). American dippers benefit from adequate riparian buffers and thus may serve as an indicator of watershed health throughout the forest (Cotter 2007a). Estuaries and the intertidal zone are also important seasonal habitats for this species (M. Willson, ecologist, Juneau, AK, personal communication 2004 as cited in Cotter 2007a). As with the other nesting guilds, American dippers are known to be sensitive to human activities that negatively affect the riparian zone (Kingery 1996).

Bird community composition and abundance has been shown to be correlated with forest buffer width, with widths in excess of 984 feet (300 meters) appearing optimal for many species (*Forest Birds* presented at the Tongass Conservation Strategy Review 2006). For example, Kissling (2003) found that densities of Pacific-slope flycatchers and Townsend's warblers were similar in buffers greater than 300 meters wide and in control sites, but lower in buffers less than 300 meters wide. Likewise, red-breasted sapsucker densities were positively associated with buffer width at the stand and landscape scales with densities greatest in buffers in excess of 300 meters. The largest effects were detected at the landscape scale, suggesting that a fragmentation threshold may exist for some species (Kissling 2003). Thus, as landsapes become more fragmented, forest buffers become increasingly important for migratory birds. Recent and ongoing studies that have evalatuated the effects of silviculture on bird communities include Deal et al. (2002), DellaSala et al. (1996), De Santo et al. (2003), De Santo and Willson (2001), Hennon et al. (2002), Holimon et al. (1998), Kissling (2003), Kissling and Lewis (ongoing), Matsuoka et al. (ongoing), Sieving and Willson (1998), and Sperry (2006).

Table 3.10-3
Migratory and Resident Birds Identified as Species of Concern in Southeast Alaska[1]

Common Name	Scientific Name	General Habitat	Preferred Habitat[2]	Abundance
Blue Grouse	*Dendragopus obscurus*	Habitat affinities vary by season and region. Coastal birds tend to remain in old-growth or recently logged forests all year. Inland birds prefer forest edges in summer, coniferous forests in winter (Kaufman 1996). Found in coniferous and mixed forests in Southeastern Alaska; also in dwarf conifer forests at treeline.	2, 3	Rare
Western Screech-Owl	*Otis kennicottii*	open coniferous and deciduous forests and along rivers, creeks, ponds and bogs. Also forest edges and in suburban areas in parks, orchards and gardens. Often nest near water (Campbell et al. 1990). In southern part of range in mesquite groves and saguaros (Kaufman 1996). Probably non-migratory in Alaska due to sufficient habitat to meet year-round requirements (P. Schempf, pers. commun.). In Yakutat, appears to favor riparian spruce (B. Andres, pers. commun.).	2	Uncommon
Black Swift	*Cypseloides niger (borealis)*	appear to be restricted to river valleys with steep unvegetated cliffs. Although nesting has not been confirmed in Southeastern Alaska, summer sightings in adequate habitat suggest Black Swifts are a probable breeder.	5	Rare
Vaux's Swift	*Chaetura vauxi*	Nests in coniferous and mixed forests, especially old growth. Often observed foraging over lakes, rivers, open country and clearcuts. Many records from Southeastern Alaska are along rivers and estuaries.	2	Uncommon
Rufous Hummingbird	*Selasphorus rufus*	Found in a variety of habitats throughout breeding range including old growth, second growth, thickets, and shrubby hillsides	2	Common
Red-Breasted Sapsucker	*Sphyrapicus ruber*	Often associated with mature stands, especially hemlock and/or spruce in Pacific Northwest and Southeastern Alaska, but may not be an obligate old-growth species.	2	Abundant
Olive-sided Flycatcher	*Contopus cooperi*	In Central Alaska, most often found in open conifer forest. Usually associated with openings (muskegs, meadows, burns, and logged areas) and water (streams, beaver ponds, bogs, and lakes). Apparently requires an uneven canopy or openings for aerial hawking, and wet areas productive of insect prey.	3	Uncommon
Western Wood-Pewee	*Contopus sordidulus*	In Southeastern Alaska, occurs along large mainland rivers, much less common on islands.	3	Uncommon
Hammond's Flycatcher	*Empidonax hammondii*	In southeastern Alaska, found in riparian deciduous forests.	2, 3	Uncommon
Pacific-slope Flycatcher	*Empidonax difficilis*	Prefers old-growth coniferous forests, especially near streams.	2, 3	Common
Steller's Jay	*Cyanocitta stelleri*	In Alaska, found predominately in coniferous forests	2	Abundant
Northwestern Crow	*Corvus caurinus*	Coastal beaches, rocky shores, estuaries, coastal ponds and inshore islands.	2, 6, 7, 8	Abundant

Table 3.10-3 (continued)
Migratory and Resident Birds Identified as Species of Concern in Southeast Alaska[1]

Common Name	Scientific Name	General Habitat	Preferred Habitat[2]	Abundance
Chestnut-backed Chickadee	*Poecile rufescens*	In Southeastern Alaska, common in mature hemlock/spruce forests and also in pole and sawtimber stages of successional forests	2	Abundant
American Dipper	*Cinclus mexicanus*	Dippers are a riparian-obligate species and are totally dependent on the productivity of streams and rivers.	4, 5	Fairly Common
Varied Thrush	*Ixoreus naevius*	Found mostly in thick, wet, coniferous forests of the coast.	1, 2, 3	Abundant
Townsend's Warbler	*Dendroica townsendi*	Largely restricted to mature forests with tall coniferous trees throughout its breeding range. Most abundant in large undisturbed tracts of contiguous forest, but will also use forests in late successional stages.	2, 3	Common
Blackpoll Warbler	*Dendroica striata*	Habitat preference variable, but usually found in tall shrubs (riparian woodland) or in coniferous or deciduous forest or woodland	2	Rare
MacGillivray's Warbler	*Oporornis tolmiei*	In southeastern Alaska, it is found in shrubs along hemlock/spruce edges, deciduous woodlands with shrubs, clearcuts, and riparian shrubs.	1	Uncommon
Golden-crowned Sparrow	*Regulus satrapa*	Prefers low to tall alder and willow scrub on hillsides and near tundra. Commonly found in proximity to lakes, streams, and bogs. In winter prefers uninterrupted brushland, streamside thickets, and chaparral.	1	Fairly Common
Golden-crowned kinglet	*Zonotrichia atricapilla*	Found in coniferous forests (spruce, fir, and hemlock) all times of year; also in mixed forests in southcoastal and central Alaska. In winter and migration, can be found in other trees and shrubs.	1, 3	Common

1/ Source: Boreal Partners in Flight Landbird Conservation Plan for Alaska Biogeographic Regions (1999)
2/ 1=shrub thicket; 2=hemlock/Sitka spruce/cedar forest; 3=mixed deciduous/spruce woodland; 4=fluvial waters; 5=cliffs, bluffs, and screes; 6=moraines, alluvia, and barrier islands; 7=beaches and tidal flats; 8=rocky shores and reefs.

Endemism

The Federal ESA defines endemic as "a species native and confined to a certain region; having comparatively restricted distribution." Forest Plan standards and guidelines for endemic mammals direct the Forest to "maintain habitat to support viable populations and improve knowledge of habitat relationships of rare or endemic terrestrial mammals that may represent unique populations with restricted ranges." Likewise, the NFMA directs that management prescriptions "shall preserve and enhance the diversity of plant and animal communities, including endemic(s)."

Due to its historic isolation, ecological complexity, and narrow distribution between the Pacific Ocean and coastal mountain ranges the North Pacific Coast is considered a hot spot for endemism (Demboski et al. 1999, Cook and MacDonald 2001, Cook et al. 2006). Southeast Alaska has been found to be a region with an especially high degree of endemism in its small mammal fauna, principally because of the combination of its archipelago geography and its highly dynamic glacial history (Demboski et al. 1998). Roughly 23 percent of the 107 mammalian taxa in Southeast Alaska (species and subspecies) are endemic to the region (MacDonald and Cook 1996 as cited in Cook et al. 2006, Cook et al. 2001). Recent molecular genetic analysis has enabled a more accurate look at the level of genetic divergence among island and mainland populations than previously possible; this analysis has refuted the classification of some taxa previously believed to be endemic and identified other taxa as endemic (see Dawson et al. [2007] for a current list of species and associated ranges). Two of these, the Prince of Wales flying squirrel and the Alexander Archipelago wolf, are incipient species, or subspecies that are beginning to diverge due to lack of interaction with other varieties of the same species (Bidlack and Cook 2001, *Other Mammals Including Endemic* presented at the Tongass Conservation Strategy Review Workshop 2006).

Current understanding of endemism in Southeast Alaska is based on the sampling of only a minority of the islands (just over 100 of the more than 2,000 named islands). The documentation of new distributions, new species, and distinct populations from this effort, much of which occurred between 1991 and 1999, suggests a high level of endemism on the Tongass (Cook et al. 2006). Thus, there continue to be gaps in knowledge about the natural history and ecology of wildlife subspecies indigenous to Southeast Alaska and conclusive geographic ranges of many endemics cannot yet be produced (Hanley et al. 2005, Dawson et al. 2007). Although mammals have been the primary focus of current research on endemics there are potentially other endemic animals (e.g., nonvolant taxa) that exist on the Tongass.(e.g, endemic spruce grouse on Prince of Wales Island and Zarembo Island). These include organisms such as plants, birds, amphibians, or invertebrates that may foreseeably have levels of endemism (Dawson et al. 2007).

Within the Alexander Archipelago, the Prince of Wales Island complex appears to be an endemic hotspot based on evidence that it was an area of refugia during the last glacial event (Cook et al. 2001). This has implications for management because there is notable overlap between this area, past timber harvest, and the potential for future timber harvest (Cook et al. 2006).

The island archipelago setting of the Tongass and naturally fragmented landscapes of Southeast Alaska, create challenges for management as natural interaction between subpopulations and individuals is often problematic, especially for species that cannot move between islands. The insular distribution patterns of many terrestrial mammal species among individual islands illustrates these dispersal limitations. For example, in study of population structure and genetic diversity in eight northern flying squirrel populations in the Alexander Archipelago (six island and two mainland populations), Bidlack and Cook (2001, 2002) found that island populations were less genetically diverse and that, on a genetic level, populations appeared to be isolated by distance, indicating that there is little long-distance geneflow across the archipelago. The authors found that six populations from the Prince of Wales complex are genetically very similar, suggesting current or recent geneflow among these islands, yet no apparent gene flow between the Prince of Wales complex and other populations in Southeast Alaska. Similar recent research on the demography, systematics, phylogeography, and post-glacial expansion of Southeast Alaska endemics has focused on the red-backed vole (Runck 2001, Cook et al. 2004, Smith and Nichols 2004, Runck and Cook 2005, Smith et al. 2005b), long-tailed vole (Conroy and Cook 2000), Keen's mouse (Lucid and Cook 2004, Smith et al. 2005b), dusky shrew (Demboski and Cook 2001), long-tailed shrew (Demboski and Cook 2003), ermine (Fleming and Cook 2002), marten (Stone and Cook 2002, Stone et al. 2002), wolverine (not endemic, but isolated populations with limited dispersal capability occur in Southeast Alaska; Tomasik and Cook 2005), and black bear (Stone and Cook 2000, Peacock et al. 2007). Major factors identified by these studies include reduced genetic diversity, limited dispersal capabilities, and the existence of highly divergent or relatively restricted western, or Pacific coastal, lineages of some species. This last factor was due to the existence of eastern and western forest refugia in North America during past glacial advances, all resulting in populations that are especially vulnerable to environmental stochastisity and anthropogenic disturbances.

Island archipelagos themselves are more sensitive to the effects of introduced exotics, emerging pathogens and disease (e.g., canine distemper), and natural events, such as climate change, than other managed landscapes, due to their insularity. Therefore, there is a higher probability of extinction on islands due to the restricted ranges of species, patterns of extinction are dynamic (i.e., in higher latitude archipelagos geographic ranges of mammals and recolonization abilitites fluctuate with glacial advances and retreats), and the effects of management activities are magnified. In fact, more than 81 percent of mammalian extincions in the last 500 years have been insular, endemic mammals (Ceballos and Brown 1995 as cited in Dawson et al. 2007). Noteably, while the distribution of mammalian species in Southeast Alaska is a function of the size of the island on which they occur and distance to the mainland, the distirubtion of endemic mammals is not (Conroy et al. 1999, Dawson et al. 2007). Thus, designing conservation measures based on island size or location will not effectively maintain the endemic diversity found in this region. Because of the uniqueness of this type of geographic setting and the vulnerability of species within it, some researchers have proposed structuring conservation efforts and land management planning along the North Pacific Coast around the issue of endemism (Cook and MacDonald 2001, Cook et al. 2001).

Invasive Species

Species are considered invasive if they are not native to an ecosystem, and are likely to cause harm to human health, the economy, or the environment (Executive Order 13112). Due to its remote landscape and climate, Alaska has relatively few invasive species compared to the rest of the United States. However, factors such as altered disturbance patterns, climate change, and the expansion of the transportation network in Alaska are expected to increase the prevalence of invasives. Global climate change also creates conditions suitable for new invasives by altering geographic range limits and by making habitats no longer suitable for native species.

Invasive species can affect native species by preying on them, competing with them, hybridizing with them, disrupting or destroying their habitat, or introducing pathogens or parasites that sicken or kill them. At least eight terrestrial species have been introduced into coastal Alaska habitats: Norway rat (*Rattus norvegicus*), European black slug (*Arion atter*), garden slug (*Arion* spp.), leopard slug (*Limax maximus*), elk (*Cervus elaphus*), house mouse (*Mus musculus*), starling (*Sturnus vulgaris*), and rock dove (*Columba livia*). Raccoons and snowshoe hares have also been introduced; however, due to their small population size and limited distribution, these species are not currently considered a threat to coastal Alaska ecosystems (Schrader and Hennon 2005). At this time, only rats are considered to be causing substantial ecological harm in coastal ecosystems and thus invasive, though there is concern about the expanding elk population (Schrader and Hennon 2005). With the exception of elk, which were introduced intentionally as part of a collaborative effort between ADF&G and the USDA Forest Service and are a desired non-native in some areas, all other species were unintentionally introduced.

Norway rats likely became established along the Alaska coast following shipwrecks of early European explorers and now occur in areas of human habitation and along coastal islands where food supplies are abundant (Schrader and Hennon 2005). The primary concern with this species is the adverse effects it may have on ground-nesting birds, as evidenced by rat populations on the Aleutian and Queen Charlotte Islands that prey on bird nests and have substantially impacted breeding bird colonies.

Elk were introduced to Alaska to develop additional hunting opportunities. As recently as 1987, ADF&G introduced elk on Etolin Island. Elk have spread to other islands and areas in the Southeast. A population occurs on Zarembo Island, and there have been reports of elk on other nearby islands including Onslow, Wrangel, Mitkof, Kupreanoff, Kashevaroff, Prince of Wales, Brush, Shrubby, and Farm islands. They have also been spotted on the mainland as far north as Cape Fanshaw, and one of the original transplanted and radio-collared elk was located at the mouth of the Stikine River (J. Brainard, USDA Forest Service biologist, Petersburg District, personal communication). Elk are a desired non-native species on Etolin and Zarembo islands, but there are still many unknowns about their presence and potential ecological effects elsewhere. The ADF&G Division of Wildlife Conservation has prepared a draft elk management plan for Southeast Alaska to manage and better understand the elk population and its potential effect on native plants and animals (ADFG 1999). The main concern is competition with native Sitka black-tailed deer due to the high degree of dietary overlap of the two species (ADFG 1999). This is primarily an issue on deer winter range, where deer are most limited by resource availability. Elk may reduce the available winter forage for deer through browsing, physically displace deer, alter predator-prey dynamics, and directly compete for food. The degree of dietary overlap between the species is the highest reported in the literature, indicating a high potential for direct competition (Kirchhoff and Larsen 1998). Pellet-count surveys on Etolin Island between 1991 and 1998 documented a doubling of the elk population while deer population declined by 56 percent (ADFG 1999). An associated issue is that a decline in deer numbers could lead to fewer deer hunting opportunities. One recommendation for managing the elk population outside Etolin and Zarembo islands is to increase harvest pressure.

There are also two invasive aquatic amphibian species that are present in coastal Alaska. The red-legged frog (*Rana aurora*), which is native to the Pacific Northwest, has established populations in several drainages on Chichagof Island and the Juneau area and recent surveys suggest that its range is expanding (MacDonald 2003). Effects of this species are currently unknown but potentially include the displacement of the endemic boreal toad (*Bufo borealis*) and wood frogs (*Rana sylvatica*) (MacDonald 2003). The Pacific chorus frog (*Pseudacris regilla*) has an established breeding population on Revillagigedo Island in a single pond complex (MacDonald 2003). Currently, this population is thought to be having little effect on native amphibian species, because in recent years boreal toads and rough-skinned newts (*Taricha granulose*) have successfully reproduced in the same pond complex (Schrader and Hennon 2005).

Consumptive Uses of Wildlife on the Tongass

A number of the wildlife species on the Tongass are important for subsistence, general hunting, or trapping. Sitka black-tailed deer, mountain goat, brown bear, black bear, moose, wolf, marten, river otter, and waterfowl (collectively) are all species with hunting and/or trapping seasons managed by the ADF&G. These species are also important for a variety of native and traditional uses that vary across the geographic area and cultural framework of Alaska. This factor must be considered in management actions because of the need to be in compliance with Title VIII of ANILCA requiring that the needs of rural residents be given priority when managing wildlife and fisheries resources in Alaska. This priority adds considerable importance to the job of monitoring management effects. The Federal Subsistence Board has management responsibility for subsistence taking of fish and wildlife on federal lands in Alaska and the State of Alaska has management responbility for subsistence and general taking of fish and wildlife on all lands in Alaska. The primary source of information on annual hunting and trapping is the ADF&G. Except for a summary for Sitka black-tailed deer, consumptive use information is not repeated here (see the *Subsistence* section for more information on subsistence uses of wildlife). The Sitka black-tailed deer is by far the most important, and most "harvested," terrestrial wildlife species for subsistence purposes, and for general hunting.

Based on ADF&G annual harvest summary reports, an average of 10,670 deer per year were harvested in Southeast Alaska from 1996 to 2004. This is approximately 2,400 deer per year lower than the average annual harvest over the previous 15 years (ADF&G 1996). Annual harvest fluctuated from year to year between 1996 and 2004 ranging from 8,574 deer harvested in 2002 to 12,289 in 1998 (ADF&G, various years). Deer harvest has not been evenly distributed throughout Southeast Alaska. Of total deer harvested during this period, approximately 70 percent were harvested from Admiralty, Baranof, and Chichagof islands, and adjacent small islands (GMU 4), where the deer hunting season is longer and bag limits are larger than other parts of Southeast Alaska. Another 23 percent came from Prince of Wales and adjacent Islands (GMU 2). Eight percent of the harvest came from both the group of islands that comprise GMU 3 (Kuiu, Kupreanof, Mitkof, Zarembo, Etolin, and Wrangell islands) and the mainland (GMU 1). Less than 1 percent came from Yakutat (GMU 5). This trend is similar to that reported over the previous 16 years (see 1997 Forest Plan Revision Final EIS for trends in deer harvest between 1981 and 1996), though the proportion of harvest in GMU 3 has increased since that period, likely because much of that area was closed to deer hunting in the 1980s. Total annual harvest has remained stable over the same period in GMUs 1, 2, and 4; ADF&G began conducting surveys in GMU 5 in 1997 and harvest in this area remains low, but appears to be gradually increasing.

The number of deer hunters decreased between 1996 and 2003 from 8,270 to 7,028, for an average of 7,632 deer hunters per year (ADF&G various years). This is approximately 8 percent lower than the long-term average reported for the 15 years prior to 1996 (ADF&G 1996). The average success rate for deer hunting from 1996 to 2003 was 1.4 deer per hunter, which is slightly lower than the long-term average (1.6 deer per hunter). Likewise, the average annual success rate during this period (60 percent success) was lower than the long-term average (63 percent success).

In 1987-1988, ADF&G conducted a survey within Southeast Alaska, asking deer hunters how many deer they desired to harvest (annually). The average from this survey was 4.2 deer, but respondents indicated they would be satisfied with an average of 2.7 deer. It has been estimated that a deer population at carrying capacity could support an annual harvest by hunters of up to about 10 percent of winter carrying capacity, with the population remaining stable and hunter satisfaction (success/effort) remaining fairly high (Flynn and Suring 1993). When harvest approaches 20 percent of carrying capacity, hunter satisfaction may diminish, and the harvest may be unsustainable over time, particularly in areas with high predator populations. If deer populations are above long-term carrying capacity, such as after several mild winters, hunter success may remain temporarily high.

Environmental Consequences

Introduction

This section builds on the effects analysis conducted for the 1997 Tongass Forest Plan Revision Final EIS (USDA Forest Service 1997a). It is based on the known (or estimated) requirements of selected wildlife species with varying needs related to old-growth forest; there is no assurance that all, or even most, other old-growth associated species have similar needs or are adequately represented. Our knowledge of the specific viability requirements of most Tongass wildlife species is limited. We do know that the old-growth forest ecosystem is the dominant forest system in Southeast Alaska and provides habitat for most of these species, and is the primary habitat type potentially affected by the programmatic changes discussed here. Therefore, an analysis that focuses primarily on the old-growth ecosystem will best address or capture the requirements of all the old-growth associated species.

NFMA requires that the Forest Service provide for the diversity of plants and animals, based upon the suitability and capability of each National Forest, as a part of meeting overall multiple-use objectives (16 USC 1604(g)(3)(B)). The NFMA implementing regulations define diversity as "the distribution and abundance of different plant and animal communities and species within the area covered by a [forest plan]" (36 CFR 219.3). In addition to providing diversity direction (at 219.26), the NFMA regulations include the following provisions for managing habitat to maintain viable populations of wildlife species:

> Fish and wildlife habitat shall be managed to maintain viable populations of existing native and desired non-native vertebrate species in the planning area. For planning purposes, a viable population shall be regarded as one which has the estimated numbers and distribution of reproductive individuals to insure its continued existence is well distributed in the planning area. In order to insure that viable populations will be maintained, habitat must be provided to support, at least, a minimum number of reproductive individuals and that habitat must be well distributed so that those individuals can interact with others in the planning area. (36 CFR 219.3)

The Multiple Use-Sustained Yield Act of 1960 states that “the national forests are established and shall be administered for outdoor recreation, range, timber, watershed, and wildlife and fish purposes” (16 U.S.C. 528). The Act further directs the Forest to maintain renewable surface resources for multiple use and sustained yield. Likewise, under NFMA, forest plans are required to incorporate multiple use and sustained yield principles. Accordingly, another important purpose of the Tongass Forest Plan is to manage wildlife resources in such a way that, in addition to ensuring that viable wildlife populations are sustained, consumptive (hunting) and non-consumptive (wildlife viewing) opportunities are maintained.

In order to accomplish these requirements, an Old-Growth Conservation Strategy (Conservation Strategy) was developed within the framework of the 1997 Forest Plan to maintain viable and well distributed populations of old-growth associated species on the Tongass. The Conservation Strategy is the product of the integration of several science-based efforts that were informed by the latest concepts in conservation biology and landscape ecology. These efforts include the Interagency Viable Population Committee’s (VPOP) proposed strategy for conserving old-growth associated vertebrates on the Tongass, which ranked species according to the concern for their viability and well distributed status and developed conservation strategies for the highest concern species (Suring et al. 1993). This proposal, its peer review (Keister and Eckhardt 1994), and ensuing response (Suring et al. 1994) formed the basis for two components of the Conservation Strategy: a coarse filter and a fine filter approach to conserving biodiversity on the Tongass.

The coarse filter component to the Conservation Strategy is the old-growth strategy which divides the Forest into reserves consisting of protected lands which include non-development LUDs, and a system of small, medium, and large OGRs located strategically across the landscape. The reserves, based on the system of large and medium Habitat Conservation Areas (HCAs) originally mapped by VPOP, were designed to protect the “biological heart” of the forest and maintain a functionally interconnected old-growth ecosystem. In general, the size, spacing, and number of reserves were based on the home range and dispersal capabilities of old-growth associated species of concern. In addition, many other non-development LUDs (e.g., wilderness) were identified as functioning as large and medium OGRs. To address the need for larger habitat reserves and minimize fragmentation, the Forest Plan also contains at least one “very large” reserve within each of the 21 biogeographic provinces across the Tongass. However, there was insufficient information to finalize the location of all small OGRs prior to the 1997 Forest Plan.

VPOP recommended placing a small HCA in each 10,000-acre watershed with the objective of "providing temporary functional habitat for animals dispersing between large and medium HCAs and to ensure that species of concern have a relatively high likelihood of occurring in each 10,000^{+}-acre watershed." The task of refining the location of small reserves has been conducted since then on a project-by-project basis per VPOP recommendations. During the current Forest Plan amendment process, an interagency team developed biological recommendations for the majority of the small OGRs on the Tongass. These recommendations were reviewed and refined at the District and Forest Supervisor levels to account for multiple uses and the resulting refined small OGR proposal is incorporated into Alternatives 1, 2, 3, and 6 in this assessment (see Appendix D)..

Between 1997 and 2008, lands within the non-development LUDs have increased by 2,000 acres through reallocation, even though the total lands within the Tongass have decreased (primarily due to land adjustments). The Old-Growth Habitat LUD area has increased based on 24 project analyses conducted during this period, and the percentage of Tongass POG in reserves has increased from 70 to 71 percent (see Appendix D). Matrix lands, which include timber management lands, constitute areas where timber harvest can occur. Primarily since the 1950s, approximately 450,000 acres of POG has been converted to young-growth stands under the Tongass timber management program (Table 3.9-2 in the *Biodiversity* section provides a breakdown of cover types on the Tongass by biogeographic province and Table 3.9-8 provides a breakdown of POG harvest by decade).

The second component of the Conservation Strategy is a fine-filter approach, which includes species and habitat specific standards and guidelines that provide for connectivity between reserves and address old-growth structural needs within the matrix lands. Some of the primary management prescriptions, designed to ensure protection of a significant proportion of high-quality habitat within the matrix, are the 1,000-foot beach and estuary fringe and the riparian buffers. Other standards and guidelines preclude or significantly limit timber harvest in areas of high hazard soils, steep slopes (greater than 72 percent), high vulnerability karst terrain, visually sensitive travel routes and use areas, and timber stands technically not feasible to harvest. In addition to providing additional old-growth protection, many of these prescriptions provide important connectivity functions within and between matrix lands and the larger OGR system lands outlined in the Conservation Strategy. There are also specific standards and guidelines designed to protect key wildlife habitat structure (e.g., reserve trees and cavity nesting habitat).

Matrix lands are receiving growing attention for the importance they potentially play in maintaining well distributed and viable wildlife populations. Some species, particularly those that are wide ranging, require large blocks of continuous habitat to meet their life requirements. They also require surrounding habitat within the matrix for movement. Wolves and nesting pairs of goshawks, for example, require land bases that are larger than most OGRs on the Tongass and use resources within matrix lands to meet their life requisites and facilitate movement. Matrix lands are also important for supporting prey populations of many old-growth associated species.

Previously, little emphasis was given to the young second-growth component of the matrix in terms of its ability to contribute structure, function, or value to wildlife. However, there appears to be a growing perception that, with active management, young stands can contribute at least some of the values commonly associated with old growth (Barbour et al. 2005). Key features of old-growth forest include large, old decadent trees, multiple canopy layers, standing snags, down woody debris, and a diverse and abundant herb layer. These features can be maintained or created by retaining structures and organisms at the time of regeneration harvest of old-growth forest and through active management of young, even-aged stands. Some potential approaches to even-aged management involve thinning of older, "commercial"-aged young-growth stands (Deal 2001, Deal and Tappeiner 2002, Deal et al. 2002), including red alder (*Alnus rubra*) in the reforestation of harvested areas to expedite the production of large-diameter conifers (Deal 1997, Deal et al. 2004, Hanley et al. 2006), and the initial use of alternatives to clearcutting (McClellan et al. 2000). It should be emphasized that additional research on the implementation of these techniques is needed.

For example, both pre-commercial and commercial thinning of young-growth stands have beneficial impacts to black-tailed deer by opening up the forest and promoting the growth of understory vegetation. Likewise, active young-growth management has the potential to benefit both marten and goshawk through an increase in small mammal populations (red squirrels and red-backed voles, major prey items of these species, benefit from more open forests with abundant understory vegetation) and by speeding the succession of older young-growth stands toward old-growth condition (Hanley 1996, 2005). Although the time frame in which young-growth stands become suitable habitat for many species is beyond the lifespan of the Forest Plan, it is something to be considered as part of a long-term vision for management of the Tongass. It must be noted, however, that there research on the effectiveness of young-growth management is on going and peer-reviewed results are not yet available. The evidence in support of the potential benefits of young-growth management for multiple values is derived from a series of demonstration projects that have tested various second-growth management methods (e.g., Zaborske et al. 2002; Deal et al. 2004; McClellan 2004, 2005; Wipfli et al. 2003), retrospective assessments (Hanley and Barnard 1998), and other observations. Thus, there remains much uncertainty about the true benefits of second-growth management to wildlife. Although active management will likely improve habitat conditions in young conifer stands, significant questions remain regarding the types of treatments, treatment timing, and cost/benefit tradeoffs.

Effects Analysis

Framework for Analysis

Alternatives 1, 2, 3, 5, and 6 do not propose to change the framework of the existing Forest Plan Old-Growth Conservation Strategy. That is, these alternatives maintain a strategy divided into coarse filter (system of protected lands) and fine filter (species- and habitat-specific standards and guidelines) management regimes, which appears to be an appropriate framework for maintaining well distributed and viable wildlife populations on the Tongass. Alternative 4 modifies the coarse filter component by requiring OGRs in only four of the most heavily modified biogeographic provinces (North Central Prince of Wales, Kupreanof/Mitkof Islands, Dall Island and Vicinity, and East Chichagof Island) in addition to maintaining two individual reserves including the Wright Lake (mainland southeast of Wrangell), and Myers Chuck (Cleveland Peninsula northwest of Ketchikan) reserves and creating one near Eva Lake (northeast Baranoff Island) in an area currently designated as semi-remote recreation. In addition, all VCUs outside of these biogeographic provinces would be required to retain 33 percent of their old growth with no requirement to consider spacing, location, size, shape, or composition in the design of the retained acres, as are provided by Appendix K of the current Forest Plan (Old-Growth Habitat Reserve Criteria). Alternative 7 maintains substantial area in non-development LUDs, but eliminates the system of OGRs and would not have a specific retention requirement..

Alternative 5 would maintain the current standards and guidelines described in the 1997 Forest Plan. Consistent under Alternatives 1, 2, 3, and 6 are proposed changes that modify the existing standards and guidelines or create new standards and guidelines that are similar to those under Alternative 5. These alternatives would replace the Goshawk Foraging and Marten Habitat standards and guidelines with a Forest-wide Legacy Structure standard and guideline, revise the Goshawk Nest standard and guideline, and modify a number of other standards and guidelines (see Appendix D and the accompanying Forest Plan volume). Alternatives 1, 2, 3, and 6 also propose boundary modifications to the existing system of small OGRs (see the interagency effort described above in the Introduction). Rationale and background for these changes are provided in Appendix D.

Alternatives 4 and 7 eliminate the Goshawk Foraging and Marten Habitat standards and guidelines, but do not apply the Legacy Structure standard and guideline. Alternative 4 maintains the existing Goshawk Nest standard and guideline, whereas Alternative 7 eliminates it and relies on the general Raptor Nest standard and guideline to provide protection.

The following wildlife analysis is subdivided into three major sections. The first section focuses on the Conservation Strategy where changes to LUD designations, impacts to the OGR system and landscape connectivity, and matrix land management are discussed. The old-growth ecosystem is discussed in the *Biodiversity* section, but is briefly addressed here relative to the Conservation Strategy's ability to maintain viable populations of old-growth associated species. The second section focuses on species-specific direct and indirect impacts related to habitat capability for ESA Candidate species, MIS, Forest Service Sensitive species, and other selected terrestrial wildlife species; impacts to ESA-listed species (which only include marine mammals and fish) are discussed in an updated Biological Assessment (Appendix F). Where appropriate, changes to standards and guidelines are discussed. Consideration of endemic and invasive species under the Forest Plan is also briefly addressed. The third section of this analysis evaluates cumulative effects of the proposed Forest Plan amendment on wildlife. Potential effects of the proposed action are discussed inlight of, the risks associated with uncertainties related to existing knowleged of species distributions and habitat relationshiops, the efficacy of the of protective measures under the conservation strategy, the future direction of forest management on the Tongass, and overall unpredictable enrivonmental factors such as climate change.

Old-Growth Forest Conservation Strategy

When considering the viability of old-growth associated species, the possible effects of alternatives, and the likelihood of maintaining viable well distributed populations, the assumption is made that if a functional interconnected old-growth ecosystem is maintained, then its component parts (composition and structure) and processes (function) are maintained. The likelihood of these outcomes is discussed in detail in the *Biodiversity* section. The framework of the old-growth conservation strategy relative to wildlife viability is now further described as two basic components: 1) the reserve system in terms of its ability to effectively maintain the integrity of the old-growth forest ecosystem through non-development LUDs such as Wilderness Areas, Research Natural Areas, Remote and Semi-Remote Recreation, and Old-Growth Habitat, among others, and 2) matrix lands where development, such as timber harvest and road building, is permitted that will alter the old-growth forest ecosystem on a portion of the lands. These development LUDs are restricted by a suitability determination process (see *Timber* section), which precludes the harvest of forest stands that would result in impacts to long-term site productivity or cause irreparable damage (e.g., mass wasting), and other Forest-wide standards and guidelines.

The amount of matrix lands (development LUDs) versus reserve system lands (non-development LUDs) is one measure of the ability of the alternatives to protect the integrity of the old-growth forest ecosystem. There are approximately 3.6 million acres of matrix lands under Alternative 5 (No Action), which would slightly decrease under the Alternative 6. Alternatives 3, 2, and 1 would provide increasingly greater protection by reallocating existing matrix lands to various non-development LUD designations, resulting in approximately 3.0 million, 2.0 million, and 938,000 acres of matrix, respectively. In contrast, Alternatives 4 and 7 would create an additional 1.1 million and 1.5 million acres of matrix lands relative to Alternative 5, respectively (see Table 3.10-4).

Table 3.10-4
Summary of Acres in Matrix and Reserve Lands by Alternative

Alternative	Matrix[1]		Reserve[2]	
	Acres	% of Landbase	Acres	% of Landbase
Alternative 1	840,359	5.0%	15,933,443	95.0%
Alternative 2	1,929,485	11.5%	14,844,321	88.5%
Alternative 3	2,803,945	16.7%	13,969,858	83.3%
Alternative 4	4,727,686	28.2%	12,046,116	71.8%
Alternative 5	3,605,974	21.5%	13,167,834	78.5%
Alternative 6	3,457,420	20.6%	13,316,385	79.4%
Alternative 7	5,049,695	30.1%	11,724,107	69.9%

[1] Includes Modified Landscape, Timber Production, Scenic Viewshed, and Experimental Forest LUDs
[2] Includes all other LUDs where timber harvest is prohibited or restricted

Table 3.9-12 in the *Biodiversity* section shows the acreage and percentage of POG, high-volume POG, and large-tree POG that would be contained within reserves and matrix lands, and the acres that would be protected from harvest in the matrix, under each alternative. Table 3.10-5 (below) provides a summary of the percentage of POG in each category, under each alternative. There are approximately 4.95 million acres of POG remaining on the Tongass. Alternative 5 (No Action) provides a combination of land allocations that protects at least 91 percent of this acreage over the long-term, and is believed to reduce the overall risk and increase the likelihood of maintaining viable and well distributed populations of old-growth associated species. Alternatives 1, 2, 3, and 6 would also protect at least 91 percent of the existing POG. However, Alternatives 4 and 7 would protect 87 and 84 percent, respectively. Within reserves (non-development LUDs), which represent long-term habitat patches or blocks of POG, the greatest percentage of existing POG would be maintained by Alternative 1 (93 percent), followed by Alternatives 2 and 3 (84 and 78 percent, respectively), Alternatives 5 and 6 (71 and 72 percent, respectively), and Alternative 7 (57 percent). Tables 3.9-14 and 3.9-18 in the *Biodiversity* section present additional detail on the percentages of POG protected in reserves and throughout the landscape by biogeographic province and ecological subsection, respectively. Harvest under all of the alternatives would be concentrated in four biogeographic provinces (North Central Prince of Wales Island, Etolin Island and Vicinity, Kupreanof/Mitkof Islands, and Revillagigedo Island/Cleveland Peninsula), where substantial amounts of timber harvest have already occurred. That is, a majority of harvest under all alternatives occurs in or near the roaded base (areas where roads are already constructed) which is concentrated in the four aformetioned biogeographic provinces. As the alternatives increase in harvest intensity, the area harvested progressivly extends beyond that roaded base.

Table 3.10-5.
Percentage of Existing Productive Old-Growth Acreage in Reserves, Protected/Unscheduled in the Matrix, and Suitable for Timber Harvest in 2008

Alternative	POG Area in Reserves	POG Area in Matrix – Protected or Unscheduled		Total Protected POG	Total POG Suitable for Harvest[1]
		Protected in Beach Fringe, Riparian, & Other	Suitable, But Not Scheduled for Harvest		
1	93%	4%	1%	98%	2%
2	84%	10%	2%	96%	4%
3	78%	14%	2%	94%	6%
4	60%	25%	1%	87%	13%
5	71%	18%	1%	91%	9%
6	72%	17%	2%	91%	9%
7	57%	26%	1%	84%	16%

[1] Represents the maximum POG that could be harvested assuming POG harvest takes place at the maximum rate.

The 1997 Forest Plan Revision Final EIS expert panel assessment concluded that due to the Forest-wide system of OGRs and standards and guidelines that provide additional protection to old-growth habitat, Alternative 11 (the basis for Alternative 5 in this EIS) would provide an amount and distribution of habitat adequate to maintain viable populations of vertebrate species across the Tongass and to maintain the diversity of plant and animal communities. Wildlife dependent on old-growth and/or unroaded habitats would have a moderately high likelihood of being maintained as viable and well distributed across the Tongass. Alternative 5 in this EIS was based on the 1997 Alternative 11, but incorporates the amendments that have occurred since 1997. These amendments have slightly increased the proporation of non-development LUDs so Alternative 5 would be slightly more protective than the 1997 Alternative 11.

The same conservation measures are generally maintained under Alternatives 1, 2, 3, and 6. The largest change is the replacement of the goshawk and marten standards and guidelines with the legacy standards and guidelines. As a result of this change, legacy would still be provided in the highest risk areas, but there would be slightly less POG protected within the matrix overall. However, the fact that these alternatives would allocate larger acreages to non-development LUDs produces more POG in reserves and a greater overall percentage of protected POG. In addition, these alternatives would protect a higher overall percentage of the larger tree POG types (both high-volume POG and big-tree POG), and would generally protect more POG and more larger tree POG in the most heavily harvested biogeographic provinces compared with Alternative 5 (see the *Biodiversity* section). Therefore, their likelihood of maintaining viable, well distributed populations of old-growth associated species across the Tongass would be higher. Because of the reduction or elimination of the OGR system under Alternatives 4 and 7, respectively, and the increase in area of development LUDs, these alternatives would have a reduced ikelihood of maintaining viable, well distributed populations relative to Alternative 5.

As discussed above, matrix lands, including both old growth and some older young growth (e.g., stands of 25 to 150 years of age), are important in facilitating movement of wildlife across the landscape and providing life requisites to many species. However, young-growth stands vary in their value to wildlife but can potentially contribute more, in terms of structure and function, through active stand management. There are approximately 687,000 acres of young-growth stands (including both harvested and natural young growth) on the Tongass. Under all the action alternatives, several Forest-wide standards and guidelines have been modified to specifically address young-growth management. The Timber Management standards and guidelines direct the Forest to "implement commercial thinning treatments in young conifer stands to obtain chargeable timber, improve wildlife habitat…" Likewise, wording has been added to the Transportation Road Management standards and guidelines to "consider future needs for commercial thinning." The term "young-growth management" has been incorporated into existing standards and guidelines for Wildlife Habitat Improvement. Finally, the Forest is also planning for thinning in non-development LUDs to improve wildlife habitat. Management of young growth will increase over time and will produce positive benefits to wildlife by shortening the stem-exclusion phase of stand development when tree crowns are crowded and forage availability is at its lowest.

Landscape Connectivity

Fragmentation associated with habitat loss results in smaller sizes of habitat patches available to a species, increased distances among habitat patches, increasing amounts of matrix conditions in which habitat patches are embedded, and altered spatial distribution of habitat types (Haufler 2007). These factors are strongly tied to the structural and functional connectivity of the landscape, and thus the ability of the landscape to support well distributed and viable wildlife populations. When a landscape becomes fragmented (i.e., when habitat patches become small and farther apart), a continuously distributed population may become a series of small, isolated subpopulations that rely on the ability of dispersing individuals to facilitate genetic interchange between populations and to recolonize area following local extirpation. Consequently, smaller, less mobile species that have limited dispersal capabilities and species that occupy limited ranges (e.g., endemics) are likely to experience the largest population level effects of fragmentation. Consequently, matrix lands play a vital role in providing functional connectivity across fragmented landscapes (Szacki 1999).

Timber harvest under all alternatives would increase fragmentation and reduce landscape connectivity. Alternative 7 proposes the greatest amount of timber harvest and therefore would result in the greatest increase in habitat fragmentation, followed by Alternatives 4, 5, 6, 3, 2, and 1, in decreasing order (Table 3.10-5 and Table 3.9-11 in the *Biodiversity* section). Most of this harvest would occur in the North Central Prince of Wales Island, Etolin Island, Kupreanof/Mitkof Island, and Revillagigedo Island/Cleveland Peninsula biogeographic provinces, which have already been heavily impacted by timber harvest.

The OGR system, as noted above, is an important component of the Conservation Strategy aimed at maintaining the amount and distribution of old growth on the Tongass. A reserve system would be maintained under Alternatives 1, 2, 3, 5, and 6. By limiting the OGR system to four highly developed biogeographic provinces and instating a retention requirement elsewhere, Alternative 4 would not be as effective in maintaining landscape connectivity over the long-term if retained acres are widely distributed, in small parcels, are linear in shape, and are not located to specifically protect important habitat features (e.g., suspected goshawk nesting habitat or deer winter range). This is particularly relevant in the Etolin and Revillagigedo Island/Cleveland Peninsula biogeographic provinces where a substantial amount of timber harvest is proposed but where no reserve system would be in place. Alternative 7 would have effects similar to Alternative 4, but to a greater extent because it eliminates old-growth habitat reserves all together.

The following discussion addresses the areas identified as being critical links connecting portions of the landscape in areas where a high amount of timber harvest has occurred, or is likely occur in the future:

Pinch-point No.1: This pinch-point is located in the middle of the East Chichagof biogeographic province, one of the more heavily developed provinces. This area is completely protected by a large OGR under Alternative 5, which provides connectivity between northeast Chichagof Island and the rest of the island. Alternatives 1, 2, 3, and 6 maintain this protection and add to it to varying degrees through the reallocation of the adjacent Timber Production lands to Remote and Semi-remote Recreation where minimal timber harvest is allowed. These alternatives ensure that habitat protection is in place to facilitate wildlife movement through the pinch-point as well as provide connectivity to a large area of LUD II and the West Chichagof-Yakobi wilderness area to the west.

This pinch-point would receive little protection beyond what is provided by the beach fringe in Alternatives 4 and 7, which designate the area as development LUDs. Alternative 4 proposes to shift the large OGR to the southeast, and Alternative 7 removes it completely, eliminating any actual old-growth connectivity across the pinch-point, except that which is provided by the beach buffer, which is only 500 feet wide in Alternative 7. Not only would Alternatives 4 and 7 isolate old-growth habitat in the vicinity of the pinch-point, but they could potentially isolate a portion of Chichagof Island if timber harvest limits wildlife movements through this corridor.

Pinch-point No. 2: The area connecting Lisianski Inlet with the North Arm of Peril Strait on Chichagof Island is pinch-point No. 2. This area is fully protected as a Legislated LUD II area in all alternatives.

Pinch-point No. 3: This area includes the Port Camden-Bay of Pillars connection and the portage between Port Camden and 3-Mile Arm and serves as a major linkage connecting north Kuiu with east Kuiu Island and Rocky Pass on its eastern edge; and North and South Kuiu Island. This area is protected by Old-Growth Habitat, Semi-Remote Recreation, and Remote Recreation LUDs under Alternatives 1, 2, 3, 5, and 6. In contrast, under Alternatives 4 and 7, all of the Old-Growth Habitat LUDs in northern and eastern Kuiu would be reallocated to development LUDs; some non-development LUD would remain around the Bay of Pillars. Thus, Alternatives 4 and 7 could negatively affect wildlife movements between major portions of the island.

Pinch-point No. 4: Pinch-point No. 4 is the narrow area between Lindenburg Peninsula and the remainder of Kupreanof Island and it is largely protected by the Petersburg Creek-Duncan Salt Chuck Wilderness. The remaining small area not included in the Wilderness between Portage Bay and Duncan Salt Chuck is primarily forested peatland. Under all alternatives the beach fringe buffer provides some additional connectivity but to a lesser extent under Alternative 7 because it reduces the buffer from 1,000 to 500 feet.

Pinch-point No. 5: This area connects the extreme north end of Prince of Wales Island to the remainder of the island, where there has been substantial past and on-going forest management activities. Under Alternatives 1, 2, 3, 4, 5, and 6 a cross-island connection is nearly protected by a small OGR around Neck Lake, and fully protected farther south by a very large reserve (including Remote Recreation LUD) around Sarkar Lakes. Because much of the pinch-point is highly developed, additional habitat alterations could create barriers to movement. Furthermore, the critical connecting habitat of this area is primarily inland (both shorelines are private land), and thus existing standards and guidelines for beach fringe and estuary buffers under all alternatives are not likely to maintain much additional connectivity. All action alternatives add a small Special Interest Area south of Neck Lake, which would be withdrawn from timber management. No OGRs exist under Alternative 7, thus reducing the likelihood of functional cross-island connectivity.

Pinch-point No. 6: This area is now all private land, dividing the north-central and south portions of Prince of Wales Island with a non-NFS strip of land one to two miles wide. Continued timber harvesting is anticipated on these private lands, with the potential to create migration and dispersal barriers. All action alternatives provide some additional protection to this pinch-point, relative to Alternative 5 (No Action), by designating a Special Interest Area adjacent to the non-NFS land. However, Alternative 7 eliminates all the Old-Growth Habitat LUDs in the vicinity of the pinch-point, thus reducing the functional connectivity of the old-growth ecosystem in the surrounding area.

Species Assessments

As noted above, the NFMA directs the Forest to manage wildlife habitat to maintain viable and well distributed populations to ensure continued existence in the planning area. Quantitative criteria for viability are not specified by the NFMA or associated regulations. For this analysis, the evaluation of viability includes considerations of its unique island archipelago environment as well as current scientific thinking on population viability and conservation biology, as found in the general literature and that compiled during the recent Tongass Conservation Strategy meeting (2006).

This section briefly discusses potential effects to all Candidate, Forest Service Sensitive listed species, MIS, and selected other species of concern. There are several species that have been identified as species of special management concern, and for which a more in-depth fine filter analysis is necessary. As discussed under the Affected Environment portion of this section, these include two species evaluated for possible listing under the Endangered Species Act (Alexander Archipelago wolf and goshawk), the most important wildlife species for consumptive use (Sitka black-tailed deer, also important as the principal prey for the wolf), and two other species important as old-growth habitat indicator species and long-term viability concerns (brown bear and marten).

The 1997 Forest Plan Revision Final EIS wildlife analysis relied in part upon expert panel evaluations of alternatives in terms of the estimated relative risks to a species or habitat of concern. Seven "panel assessments" were conducted: one for wolf, marten, goshawk, brown bear, marbled murrelet, "other terrestrial mammals" including endemics, and one for the old-growth ecosystem. Each of these old-growth associated species was selected ostensible because collectively their ecologies incorporated the breadth of forest habitat features and other attributes of environmental variation represented across the Forest, and because they were thought to be representative of a subset of species that are sensitive to disturbance and potentially at risk of either becoming locally extirpated or jeaopardizing cultural or subsistence uses. This approach has been effectively used in the Pacific Northwest and was chosen for the Tongass because a substantial amount of uncertainty existed in the understanding of various wildlife habitat and community relations and there was generally inadequate information on which to base predictive models (i.e., population viability anaysis).

The panel assessments resulted in the generation of a set of estimates of the likelihood of various outcomes related to the persistence of each species under each plan alternative, which were then examined to determine the influence of the alternatives on viability across the Tongass (Shaw 1999).The panel assessments evaluated alternatives in terms of their ability to maintain the continued existence of well distributed, viable wildlife populations across the Tongass. A 100-year time period, or planning horizon, was used for the viability analysis, which was assumed to be the minimum period over which viability could be evaluated based on current scientific literature. This time period is the average rotation age under even-aged management and thus the time period over which old-growth characteristics would be affected (see the *Wildlife* section of the 1997 Forest Plan Revision Final EIS for further justification for this planning horizon and additional description of the panel assessments). It should be noted that within its first decade, the current Forest Plan has harvested much less timber than originally estimated in the 1997 Final EIS.

Candidate Species

Kittlitz's Murrelet

Due to the Kittlitz's murrelet's association with glacial habitat, this species occupies areas outside of where timber harvest and associated activities have occurred or are likely to occur. Major threats to this species are global climate change, which is correlated with a loss of suitable habitat (glacial melt) and reduction in prey availability due to warming sea temperatures. Human activity in the marine environment, particularly vessel traffic and fishing operations, are additional threats to this species. There is no indication that any Forest Service management activity is affecting the Kittlitz's murrelet (USDA Forest Service 2004h). Consequently, implementing any of the alternatives will not directly or indirectly affect the Kittlitz's murrelet.

Forest Service Sensitive Species

Queen Charlotte (Northern) Goshawk

Iverson et al. (1996) concluded that landscapes that maintained a forest age structure consistent with a 300-year ecological rotation would provide a high likelihood of sustaining goshawks. This composition would generally consist of one-third each of 0- to 100-year old stands, 100- to 200-year old stands, and 200-year old or older stands, categories with increasing value to goshawks. Additionally, harvest under a 300-year ecological rotation permits a maximum of 3.3 percent of the 1954 old growth to be harvested per decade in order to maintain a forest age structure favorable to goshawks. The 1997 Forest Plan Revision Final EIS compared alternatives in terms of their ability to support viable populations of goshawks over the long-term, by evaluating the number of VCUs where harvest levels met these criteria. This was based on the notion that the average size of a VCU approximates the size of a goshawk territory and that they are old-growth obligates, though recent research has shown that goshawks range wider and use a greater variety of habitats than once thought (Boyce et al. 2006, Reynolds et al. 2006). As a measure of the ability of each alternative to support well distributed viable goshawk populations, this discussion takes a more conservative approach by focusing on impacts to high value goshawk nesting and foraging habitat (SD5N, SD5S, and SD67 stands located below 800 feet in elevation) but on a forest-wide basis, and discusses trends in areas with the greatest risk of not supporting goshawks due to the high levels of past disturbance.

Protection of high value goshawk habitat would be greatest under Alternative 1 (24,000 acres proposed for harvest), followed by Alternatives 2 (48,000 acres), 3 (68,000 acres), 6 (97,000 acres), 5 (102,000 acres), 4 (145,000 acres), and 7 (191,000 acres). Table 3.10-6 summarizes the percentage of high-volume POG and large-tree POG that is suitable for harvest under each alternative. These percentages represent the maximum potentially harvested over 100+ years of Plan implementation. The extent to which harvest impacts the ability of an area to support goshawks is dependent on the amount of suitable habitat remaining in the resulting landscape. That is, areas that originally had a substantial amount high-volume POG before timber harvest began and where much of that amount remains (e.g., Admiralty Island and Central Coastal Range biogeographic provinces) have a higher likelihood of supporting healthy goshawk populations even with additional harvest. Table 3.9-15 in the *Biodiversity* section displays the original acres of high-volume POG and the minimum percentage remaining after 100+ years of Plan implementation by biogeographic province.

Table 3.10-6
Maximum Percentage of Existing High-Volume (SD5N, SD5S, and SD67) and Large-Tree (SD67) Productive Old-Growth Proposed for Harvest by Elevation Category and Alternative after 100+ years

Elevation Category	Alternative						
	1	2	3	4	5	6	7
High-Volume POG							
< 800 feet	2.0%	4.0%	5.6%	11.9%	8.3%	7.9%	15.6%
> 800 feet	2.0%	6.1%	8.5%	16.8%	12.0%	11.6%	19.3%
Total	**2.0%**	**4.8%**	**6.7%**	**13.8%**	**9.8%**	**9.3%**	**17.1%**
Large-Tree POG							
< 800 feet	2.9%	5.1%	7.0%	12.8%	9.5%	9.0%	17.0%
> 800 feet	3.0%	8.5%	10.8%	19.8%	14.6%	13.9%	22.6%
Total	**2.9%**	**6.1%**	**8.1%**	**14.8%**	**11.0%**	**10.4%**	**18.6%**

Biogeographic provinces with greatest potential reduction in high value goshawk habitat include North Central Prince of Wales, Kupreanof/Mitkof, Etolin and Vicinity, and Revilla Island/Cleveland Peninsula. Highest harvest in these provinces would occur under Alternative 7. However, it is important to note that under Alternatives 1, 2, 3, 4, 5, and 6 this loss is limited to old growth within the matrix and that the large and "very large" OGRs established under the Forest Plan were intended to compensate for timber management activities in the most developed areas. In the Prince of Wales Island area, for example, these include the Sarkar/Honker Divide/Karta Wilderness reserve that totals over 200,000 acres, the 200,000-acre reserve on South Prince of Wales, and a 56,000-acre reserve at Mt. Calder/Mt. Holbrook on Kosciusko Island.

Alternative 5 (No Action) also incorporates a set of standards and guidelines that were intended to address aspects of goshawk habitat such as connectivity and stand structure in highly developed areas. These include the goshawk foraging habitat standards and guidelines, which require that timber harvest units must meet certain minimum criteria designed to maintain forest stand structure characteristics thought to be beneficial to goshawks in VCUs on Prince of Wales Island where more than 33 percent of the POG has been converted to young-growth, and the goshawk nest standard and guideline. Additional protection of habitat elements important to goshawks is provided by marten habitat standards and guidelines (see description under marten). Both sets of guidelines only apply to provinces where harvest has been relatively extensive. The retention of additional forest structure in harvest units was thought to result in improved foraging habitat for goshawks and facilitate dispersal among OGRs. However, recent science supports retaining clumps of legacy trees rather than a uniform distribution of legacy trees (see Appendix D and *Northern Goshawks on the Tongass National Forest*, presented at the Tongass Conservation Strategy Review Workshop 2006). That is, even spacing of reserve trees may, in effect, create a thinned stand that over time grows into a forest with understory shrubs and trees filling in spaces under the forest canopy, inhibiting goshawk maneuverability for foraging within the stand.

Based on the 1997 panel assessment ratings (Iverson 1997), Alternative 5 (rated as its precursor, Alternative 11 in the 1997 Forest Plan EIS) was rated as having a high likelihood of sustaining viable, well-distributed goshawk populations during the 100-year planning horizon and unlikely to result in a loss of viability or a declining trend that would require additional protection (see Appendix D). In addition, the panel concluded that there was no possibility of extirpation from the Tongass and virtually no possibility the goshawk would exist only within isolated refugia populations under Alternative 5. It is important to recognize that the panel assessments were conducted prior to the development of the Goshawk and Marten standards and guidelines (discussed above). In addition, recent research suggests that goshawks may be more adaptable to managed forest conditions than once thought, though they rely on prey that are closely associated with old growth. Thus, the 1997 panel ratings, which considered the goshawk an old-growth obligate, may provide a conservative assessment of impacts to goshawks.

Alternatives 1, 2, 3, and 6 maintain the reserve system (slightly to substantially expanded over Alternative 5) and the various buffer standards and guidelines, but propose a new Forest-wide Legacy Forest Structure standard and guideline, in place of the existing Goshawk Foraging Habitat and Marten Habitat standards and guidelines. The Legacy Forest Structure standard and guideline is designed to protect forest legacy components in areas that are already highly developed, as well as areas that will experience increased harvest levels over the life of the Forest Plan. Thus, the Legacy Forest Structure standard and guideline is not limited to certain biogeographic provinces and, therefore, covers more provinces than the Goshawk standard and guideline (see Appendix D for a detailed analysis and comparison of the Legacy and Goshawk standards and guidelines). Because Alternative 6 would protect slightly more POG and a higher percentage of larger tree POG types within reserves, than Alternative 5 (Tables 3.10-5 and 3.10-6) and incorporates the Legacy standard and guideline, it is expected that long-term effects on goshawks would be similar to or slightly less than under Alternative 5. Because Alternatives 1, 2, and 3 would all result in lower harvests than Alternatives 5 and 6, it is expected that they would result in a very high likelihood of sustaining viable, well-distributed populations over the long term (based on their old-growth harvest levels, including larger POG types – see Table 3.10-6).

The reduction of the OGR system, in combination with the absence of species-specific or Forest-wide forest legacy retention, under Alternatives 4 and 7, respectively, would increase risk to goshawk populations. However, Alternative 4 maintains a relatively extensive reserve system in four of the most heavily developed biogeographic provinces, including the above mentioned "very large" reserves in the Prince of Wales Island complex. The distribution of these reserves is such that nearly all matrix habitats outside of these reserves and other protected areas are within the dispersal distance of goshawks, thus increasing the likelihood of re-colonization of landscapes that may be at risk of not supporting goshawks (USDA Forest Service 1997a). However, by significantly reducing reserves elsewhere and not providing legacy tree requirements, Alternative 4 could reduce the dispersal and re-colonization capability of goshawks in areas where timber would be harvested in the future. Even so, Alternative 4 would still only result in a harvest level of less than 12 percent of the existing low elevation, high-volume POG (considered to be the highest value goshawk habitat) after 100 years (Table 3.10-6). Based on the 1997 expert panel assessments (Iverson 1996a), Alternative 4 (equivalent to Alternative 6 in the 1997 FEIS) would be rated as having a moderately high likelihood of maintaining viable, well-distributed goshawk populations; the assessments also noted no possibility of extirpation from the Tongass, but a low likelihood that the alternative would result in the goshawk existing only in isolated refugia (Appendix D).

The likelihood of effects on goshawk distribution would be greater under Alternative 7, which eliminates much of the coarse-filter component of the Conservation Strategy (the Old-Growth Habitat LUD), as well as the species-specific Goshawk Foraging and Marten Habitat standards and guidelines. Full implementation of Alternative 7, would result in harvesting approximately 16 percent of the existing low elevation, high-volume POG after 100 years (Table 3.10-6). Based on the 1997 expert panel assessments (Iverson 1997a) Alternative 7 (equivalent to Alternative 2 in the 1997 FEIS) would be rated as having a moderate likelihood of maintaining viable, well-distributed goshawk populations; the assessments also noted there would be a very low possibility of extirpation from the Tongass and a low likelihood that the alternative would result in the goshawk existing only in isolated refugia.

Osprey

Limiting factors for osprey populations are unknown, but availability of nest sites and foraging areas do not appear to be limiting on the Tongass and Forest-wide standards and guidelines were developed to provide for protection of nest sites as they are identified. In addition to protection around known nest sites, standards and guidelines also include a 1,000-foot beach and estuary buffer that provides suitable dominant or co-dominant trees along shorelines, essentially protecting all suitable or potentially suitable nesting, perching, and foraging habitat for ospreys. Although in other parts of their range ospreys do nest on freshwater lakes, where no such buffer applies, none have been documented in Southeast Alaska. Consequently, no impacts to osprey or osprey habitats are anticipated from Alternatives 1, 2, 3, 4, 5, and 6, which uphold the current Forest Plan standards and guidelines. Ospreys would be at increased risk of effects associated with timber management activities under Alternative 7, which proposes to reduce the beach fringe buffer to 500 feet; however, this distance is likely to protect most nesting habitat.

Peale's Peregrine Falcon

Forest-wide standards and guidelines were developed to provide for protection of Peale's peregrine falcon habitat. Any project level planning requires the evaluation of potential impacts to known falcon nests within 2 miles of a proposed project in an effort to plan project activities to avoid adverse impacts to the falcons and their habitats. These standards and guidelines would be maintained under all the action alternatives, therefore no effects are anticipated for peregrine falcons.

Trumpeter Swan

The largest concentration of nesting trumpeter swans on the Forest is at Yakutat, in the Yakutat Forelands Biogeographic Province (primarily Roadless Area 339). Approximately 96 percent of this province is already within legislated LUD II areas or other natural setting LUDs; none of the alternatives propose changes to these designations. The entire nesting habitat is classified as wetlands and/or riparian habitat. Forest-wide standards and guidelines for wetlands and riparian management apply to these areas, which were specifically developed for trumpeter swan habitats on the Forest.

None of the alternatives would increase the likelihood of any adverse effects on trumpeter swan populations, nesting habitat, or wintering habitat, or would result in a loss of species viability. Therefore, no effects are anticipated for trumpeter swans.

Management Indicator Species

Sitka Black-tailed Deer

This analysis of effects to black-tailed deer uses the deer winter HSI model described in the Affected Environment section to evaluate impacts to winter range habitat capability potentially resulting from each of the alternatives. The Forest Plan model uses four discrete variables (four levels of snow depth, three elevation zones, four aspects, and seven vegetation/successional stages) to predict a habitat suitability index. For this application, a cross-walk was developed to reclassify the new Forest-wide vegetation model (the SDM) into the model vegetation categories (See Appendix B for additional details about the deer model analysis). This results in an overall reduction in average HSI values because fewer stands would be classified as high and medium volume strata and more stands would be classified as low volume strata compared to the old volume strata mapping used in the 1997 Forest Plan Revision Final EIS. However, this makes no difference to the analysis because relative values were used to compare alternatives. For reference, high volume stands include SDM vegetation categories SD5N, SD5S, and SD67; medium volume stands include SD4N, SD4S, and SD5H; and low volume stands include SD4H (see the *Biodiversity* section for further discussion of the SDM categories).

The deer model is used here to compare the alternatives in a relative sense. However, it should be noted that, for several reasons, the model is believed to overestimate the effects of harvest. Please refer to the discussion of these factors under the Sitka Black-tailed Deer subsection of the Affected Environment.

For the purpose of this analysis, the following assumptions were made:

- HSI values were standardized to range from 0 to 1.0, by dividing all values by 1.3, because outputs from such models represent a range from 0 to 100 percent habitat suitability, with higher values indicating higher habitat capability.
- After full implementation of the Forest Plan (100+ years), all suitable acres are harvested; calculations take the model implementation reduction factor (MIRF) into account which is the reduction between planned and actual timber volume/acres due to the presence of karst, unstable soils, and other issues that preclude harvest during timber sale layout. These numbers are based on known differences between the acres of forest land mapped as suitable for timber management and the number actually harvested on the Tongass (see the *Timber* section and the project record for additional discussion).
- To estimate 1954 habitat capability, previously harvested stands were assumed to be medium (SD4N, SD4S, SD5H categories) and high (SD5N, SD5S, and SD67 categories) volume forest; stand with a date of origin prior to 1954 were not changed.
- To project future habitat capability, 25 percent of the current young-growth stands would be in the stand initiation phase (25 years old or younger) and 75 percent would be in the stem exclusion phase (26 to 150 years old) by 2105; previously harvested stands that are unsuitable for harvest would be in the stem exclusion phase.
- This analysis evaluated relative changes in habitat capability; actual habitat capability may be more or less than model predictions.
- Lands under non-federal ownership have an assumed habitat capability of zero (see discussion below).

After the initial years following logging, there is a rapid increase in deer forage production due to the large amount of light penetration created by open stand conditions. However, this nutrition is of lower quality than the same forage types found in old growth. After the initial 20 to 30 years, there is a 100- to150-year period in which the vigorously growing hemlock and spruce shade out the understory forage. Person et al. (2001) described this situation as “succession debt” because the full impacts to deer may not immediately be expressed but will be sustained for many decades after timber harvesting. Under even-aged and two-aged harvest systems, the amount of habitat capability reduction over the 100-year analysis period is substantial and is directly related to the amount of timber harvest. While the short-term (20- to 30-year) effect is also related to the amount of timber harvest, the effect of timber harvest will vary with the average seasonal snow accumulation (since higher accumulations reduce forage availability). Under uneven-aged systems (such as group selection), available forage within any given area would be maintained for a longer time, as would adjacent thermal cover. Assumptions related to future forest condition are intended to model future deer habitat capabilties after harvest. For this analysis, the effects of harvest are modeled over the long term and all harvest is assumed to consist of regeneration methods (e.g., clearcut harvest). Regeneration methods and rotation length depend on site-specific analysis done at the project level.

Effects on winter range habitat capability by WAA, as indicated by changes in HSI scores, are displayed in Table 3.10-7. This does not include any State, City, or private land. Many of these lands have been, or will be, developed for intensive forestry and are expected to have lower habitat capability over time. WAAs are land divisions used by the ADF&G for deer inventories and planning. Table 3.10-7 illustrates the cumulative effect of timber harvest on estimated deer habitat capability, from the beginning of large-scale timber harvest on NFS lands in 1954 to the present and to year 2105 and includes the 10-year (1996 to 2005) average harvest intensity, measured in hunter-days, by WAA.

In addition, the percentage of high value habitats available for timber harvest was also calculated by WAA to quantify impacts to high quality deer winter range (Table 3.10-8). To take into account impacts to deer across the Tongass inhabiting areas that vary naturally in their habitat quality, high quality habitat was defined as the quartile of the land base with the highest HSI scores within in each WAA. Lands not available for timber harvest include areas within LUDs that do not permit timber harvest and areas that are protected by Forest-wide standards and guidelines, such as Riparian or Beach and Estuary Fringe.

Forest-wide, the alternatives are estimated to retain from 77 to 86 percent of the original winter range habitat capability in 100+ years (Table 3.10-7). At the WAA level, Alternatives 4 and 7 show the greatest reductions in deer habitat capability because they propose the greatest amounts of harvest. Most of the largest reductions in habitat quality occur in WAAs that have already experienced a high amount of past timber harvest (e.g., Prince of Wales and Kuiu Islands); however, there are several WAAs (e.g., 2008, 2305, 2927, 3524) where currently over 95 percent of the 1954 deer habitat capability remains, that would receive substantial reductions under some of the alternatives.

On average, the highest percentage of high quality winter range habitat subject to timber harvest is proposed under Alternative 7 (16 percent per WAA), followed by Alternatives 4 (13 percent), 5 (9 percent), and 6 (8 percent), 3 (6 percent), 2 (4 percent), and 1 (1 percent; Table 3.10-8). Forest-wide, however, the alternatives would harvest 1 to 5 percent of the existing high quality winter range (Table 3.10-8). Table 3.10-8 also displays the range of HSI scores in each WAA. At the WAA level, there are some areas where 40 to 55 percent of the high value deer winter range could be harvested under Alternatives 4, 5, 6, and 7. This magnitude of effect would be primarily concentrated on Prince of Wales Island, the Cleveland Peninsula and nearly islands, Baranof Island, and Mitkof Island.

Over the long-term, reductions in habitat capability and harvest of high value deer winter range could reduce carrying capacity, or the numbers of deer in areas capable of supporting them given the available resources, such that deer populations would decrease in areas that could no longer support the current population. This would primarily be a concern during severe winters, when resources are already limited. Ultimately reductions in the deer population resulting from decreased habitat capability could reduce the number of deer available to wolves and hunters. At some low level, wolf predation could actually limit deer population recovery (the “predotor pit” hypothesis (Boutin 1992), though there is no threshold population level or threshold loss of winter range that has been defined for Southeast Alaska with which to predict these potential population responses.

However, it is also important to note that forest management on the Tongass has produced more forage than assumed by the model, through the management of second-growth stands. The purpose of young-growth management is to accelerate the stem exclusion phase of forest development, which occurs roughly 15 to 25 years following a major disturbance when the growing space is fully occupied and tree crowns are crowded. Deer forage availability is at its lowest during this time due to the lack of light penetrating the understory, which causes lower tree limbs and understory plants to die and less vigorous trees to be shaded out. Activities such as thinning, girdling, or pruning, which open the forest canopy, result in increased understory biomass thus increasing the amount of forage available to deer. Since 1970, the Tongass has treated approximately 168,000 acres of second-growth, mostly by precommercial thinning; roughly 16.000 acres were treated specifically for wildlife and riparian objectives (*Young-growth Management*, presented at the Tongass Conservation Strategy Review Workshop 2006). However, it is important to note that there are still many uncertainties related to appropriate young-growth treatment designs, specific beneficial effects of such treatments, and implications for deer. In addition, some studies have shown the opposite results. Farmer (2006) found that the risk of death to fawns was positively correlated with pre-commercial thinning. The Tongass, in collaboration with the Pacific Northwest Research Station, is conducting the Tongass-Wide Young Growth Study (TWYGS) to address many of these uncertainties. TWYGS is the most extensive and intensive study of young-growth ever conducted in Southeast Alaska and is designed to evaluate the potential benefits of treating pre-commercial stands to increase wildlife habitat and wood production. Initial results indicate that the potential for restoring diverse and abundant understory plant communities through the active management of young stands is promising (*Young-growth Management*, presented at the Tongass Conservation Strategy Review Workshop 2006).

Mountain Goat and Black Bear

These species occupy different niches but both are associated with old-growth forest and are susceptible to over-hunting if road access is increased or improved, though most roads are located a long distance (both vertically and horizontally) from goat habitat. The amount of road access, quantified in terms of the amount of road construction and reconstruction proposed under each alternative, is assumed to be inversely related to the amount of POG conserved after full implementation of the Forest Plan (100+ years) and to be representative of the potential for over-hunting. This provides a rough index for assessing risk to these species, since roads can be designed (or closed) at the project level to avoid key habitats. Risk of over-harvest due to human access along roads is mitigated to some extent by Transportation Forest-wide standards and guidelines that require travel access road objectives to be developed for all roads, and Mountain Goat and Black Bear Forest-wide standards and guidelines directed toward assessing and minimizing disturbance and access to meet management objectives. A maximum of 3,874 miles of road construction and 2,100 miles of road reconstruction would be implemented after 100+ years of Forest Plan implementation under Alternative 5 (No Action). Alternative 6 (3,744 miles), Alternative 3 (2,799 miles), Alternative 2 (2,079 miles), and Alternative 1(774 miles) provide decreasing risk to these species associated with new road construction; all of these alternatives maintain or decrease the currently estimated level of road reconstruction (ranging from 2,046 miles under Alternative 6 to 925 miles under Alternative 1). Only Alternatives 4 and 7 would increase the proposed amount of road construction (4,890 miles and 5,825 miles, respectively) and reconstruction (2,182 miles and 2,371 miles, respectively). Thus

Table 3.10-7
Relative Changes in Deer Habitat Capability by Wildlife Analysis Area (WAA) by Alternative

WAA[1/]	Average Deer Harvest (Hunting)[1/]	Percent of 1954 Habitat Capability in 2006	Percent Deer Habitat Capability in 100+ Years[3/] Alternative 1	2	3	4	5	6	7	Average Hunting Pressure (Hunter Days)[2/]	Vicinity
101	112	94	94	89	87	86	86	86	85	715	Gravina Is.
202	11	0	0	0	0	0	0	0	0	60	Annette Is.
303	3	98	98	98	98	98	98	98	98	22	Duke Is.
404	12	100	100	100	100	100	100	100	100	70	Eastern Revilla Is.
405	27	83	80	74	73	73	74	73	71	131	Thorne Arm (Revilla Is.)
406	88	77	71	66	65	60	65	64	57	600	Carrol Inlet (Revilla Is.)
407	27	89	83	75	74	69	73	73	67	296	George Inlet (Revilla Is.)
408	21	96	96	95	95	94	94	94	94	317	Ketchikan
509	23	93	92	88	87	81	86	87	80	214	Naha Area (Revilla Is.)
510	48	68	63	59	58	53	57	58	50	277	Neets Bay Area (Revilla Is.)
511	0	100	100	100	100	100	100	100	100	0	Northern Revilla Is.
612	8	99	99	99	96	73	83	83	70	88	Eastern Cleveland Pen.
613	22	95	95	95	95	72	95	95	66	189	Helm Bay (Cleveland Pen.)
614	6	98	98	98	98	72	98	98	70	38	Meyers Chuck (Cleveland Pen.)
715	3	99	99	99	99	99	99	99	99	40	Redoubt Lake, Neckar Is.
716	0	100	99	100	100	100	100	100	100	6	Unuk Drainage (Cleveland Pen.)
717	0	100	100	100	100	100	100	100	100	0	Lower Chickamin (Misty Fiords)
718	0	100	99	100	100	100	100	100	100	0	Upper Chickamin (Misty Fiords)
719	0	100	100	100	100	100	100	100	100	33	Rudyerd Bay (Misty Fiords)
820	5	100	100	100	100	100	100	100	100	16	Wilson/Blossom Drainages (Misty Fiords)
821	0	100	100	100	100	100	100	100	100	0	Smeaton Bay (Misty Fiords)
822	1	100	100	100	100	100	100	100	100	19	Boca De Quadra Drainages (Misty Fiords)
823	6	100	100	100	100	100	100	100	100	15	Pearse Canal (Misty Fiords)
824	0	100	100	100	100	100	100	100	100	8	Peabody Mtns (Misty Fiords)
825	4	100	100	100	100	100	100	100	100	4	Upper Portland Canal (Misty Fiords)
826	0	100	100	88	87	73	86	86	70	0	Hyder (Misty Fiords)
901	37	97	89	82	79	75	80	78	71	85	Suemez Is.
902	27	100	100	100	99	100	99	99	99	62	Outside Is.
1003	60	66	54	53	53	49	51	52	47	175	Heceta Is.
1105	11	99	99	99	99	96	97	97	94	71	Dall Is.
1106	28	99	99	99	99	99	99	99	99	52	Long Is.
1107	47	98	97	97	97	88	90	90	86	192	Hydaburg, Hetta Inlet, Sukkwan Is.
1108	5	99	99	99	99	99	99	99	99	34	Southwestern Prince Of Wales Is.
1209	4	100	100	100	98	94	98	98	93	9	Southeastern Prince Of Wales Is.
1210	9	100	100	99	89	82	88	88	79	42	Moira Sound (POW)
1211	16	91	85	76	76	67	74	75	62	77	Kitkun, South Arm Cholmondeley (POW)
1212	19	100	100	100	92	91	92	92	90	40	Clover Mtn. (POW)
1213	7	98	98	89	89	80	87	88	74	40	West Arm Cholmondeley (POW)
1214	95	79	70	66	65	62	64	64	53	488	Skowl Arm, Polk Inlet (POW)

Table 3.10-7 (continued)
Relative Changes in Deer Habitat Capability by Wildlife Analysis Area (WAA) by Alternative

WAA[1/]	Average Deer Harvest (Hunting)[-/]	Percent of 1954 Habitat Capability in 2006	Percent Deer Habitat Capability in 100+ Years[3/] Alternative 1	2	3	4	5	6	7	Average Hunting Pressure (Hunter Days)[2/]	Vicinity
1315	241	55	50	49	47	44	47	47	41	1289	Kasaan Peninsula, Thorne Bay (POW)
1316	22	100	100	100	100	100	100	100	100	100	Karta Bay (POW)
1317	88	54	51	49	47	45	47	47	38	411	Twelve Mile Arm, Harris River (POW)
1318	223	92	85	78	76	66	72	75	64	917	Craig, Klawock Areas (POW)
1319	227	74	69	67	66	59	64	64	54	973	Thorne River Drainage (POW)
1323	42	97	94	91	91	88	90	90	84	124	Western Prince Of Wales Is.
1332	43	85	83	82	78	75	77	78	70	119	Trocadero Bay, Waterfall Area (POW)
1420	186	52	43	42	40	39	40	40	36	857	Coffman Cove, Luck Lake, Ratz Harbor (POW)
1421	92	74	66	64	64	64	63	63	55	377	Sweetwater Lake, Logjam Creek (POW)
1422	289	60	50	48	47	46	47	47	43	1494	Staney Creek, Naukati, Sarkar (POW)
1524	0	100	100	100	100	100	100	100	100	1	Warren Is.
1525	14	51	48	47	46	46	46	46	43	64	Southern Kosciusko Is.
1526	13	91	91	91	91	88	89	89	87	58	Holbrook Mt., Northern Kosciusko Is.
1527	46	73	65	61	60	60	59	59	55	128	Prince Of Wales El Capitan Area
1528	52	77	75	74	73	72	72	71	63	171	Salmon Bay (POW)
1529	215	73	63	61	60	56	59	59	50	797	Mt. Calder, Red Bay, Port Protection (POW)
1530	140	62	58	57	55	54	55	55	50	798	Exchange Cove, Whale Passage (POW)
1531	22	61	54	52	52	49	50	52	46	98	Tuxekan, Marble, Sea Otter Sound (POW)
1601	0	100	100	100	100	75	80	82	71	0	Fanshaw-Farragut Area
1602	3	99	99	99	99	98	99	99	98	25	Farragut River Drainage
1603	0	91	91	91	84	80	82	83	78	4	Thomas Bay
1604	0	100	100	100	100	100	100	100	100	0	Baird Glacier
1605	39	76	76	71	64	57	63	63	56	291	Muddy River, Patterson Glacier
1706	6	100	100	100	100	100	100	100	100	32	Horn Cliffs, Le Conte Bay
1707	6	100	100	100	100	100	100	100	100	15	North Arm Of The Stikine
1708	0	100	100	100	100	100	100	100	100	28	Stikine River Drainage
1809	0	100	100	100	100	100	100	100	100	0	Cone Mtn.
1810	2	100	100	100	77	62	75	75	62	8	Virginia Lake, Garnet Mtn.
1811	0	99	99	99	93	87	92	92	84	9	Aaron Creek Drainage
1812	0	97	96	96	93	93	93	93	91	0	Marten Lake, Harding River Drainage
1813	0	68	68	65	63	60	62	63	59	0	Bradfield River Drainages
1814	0	98	98	98	92	88	92	92	85	3	Eagle River, S. Shore Bradfield Canal
1815	5	92	92	92	89	87	88	89	85	12	Anan Creek
1816	2	89	88	85	78	75	77	77	72	15	Seward Passage
1817	9	100	100	100	99	89	89	88	68	59	Vixen Inlet, Union Bay
1901	36	91	87	80	78	70	77	77	64	131	Northern Etolin Is.
1902	7	79	72	72	68	64	68	68	58	16	Deer Is.
1903	62	86	80	73	72	63	71	71	60	821	Wrangell Is.
1904	18	59	58	57	52	48	50	51	43	37	Woronkofski And Stikine Mouth Is.
1905	350	77	72	67	67	59	66	65	57	1249	Zarembo Is.

Table 3.10-7 (continued)
Relative Changes in Deer Habitat Capability by Wildlife Analysis Area (WAA) by Alternative

WAA[1]	Average Deer Harvest (Hunting)[1]	Percent of 1954 Habitat Capability in 2006	Percent Deer Habitat Capability in 100+ Years[3] Alternative 1	2	3	4	5	6	7	Average Hunting Pressure (Hunter Days)[2]	Vicinity
1906	15	59	55	55	55	55	55	55	53	30	Kashevarof Islands
1910	18	96	96	96	94	93	94	94	92	125	Southern Etolin Is.
2007	117	79	74	68	67	62	66	65	58	1155	Mitkof Is.
2008	5	99	99	99	80	77	78	78	72	14	Woewodski Is.
2202	1	90	90	90	90	82	86	86	80	53	Sullivan River And Island
2203	0	92	92	92	92	90	91	91	90	0	Endicott River Drainage
2304	2	94	94	94	94	75	77	79	73	22	St. James Bay
2305	0	97	97	93	92	80	92	91	78	17	Southern Chilkat Range
2306	0	84	84	74	74	66	73	73	63	25	Excursion Inlet
2408	0	100	100	99	91	86	90	90	85	0	Eldred Rock-Pt. St. Mary
2409	0	99	98	97	91	85	91	91	83	5	Berners Bay
2410	0	100	100	100	100	100	100	100	100	18	Berners River Drainage
2411	0	100	100	100	100	100	100	100	100	0	Lace River Drainage
2412	0	100	100	100	100	100	100	100	100	0	Antler River Drainage
2413	0	100	100	100	100	100	100	100	100	0	Gilkey River Drainage
2514	4	100	100	99	94	86	83	94	84	29	Cowee, Davies Creeks
2515	8	100	100	100	100	100	100	100	100	87	Eagle River-Mendenhall River Area
2516	0	100	100	100	100	100	100	100	100	0	Juneau Ice Field
2517	6	100	100	100	100	92	94	95	88	47	Juneau And Lower Taku
2518	0	100	100	100	100	100	100	100	100	0	Taku River
2519	0	100	100	100	100	93	96	95	92	0	Turner Lake, Southern Shore Taku Inlet
2620	17	100	100	100	100	100	100	100	100	93	Lincoln Is.
2621	42	100	100	100	100	100	100	100	100	272	Shelter Is.
2722	275	100	100	100	100	88	100	100	100	2378	Douglas Is.
2823	4	100	100	100	100	92	95	95	89	7	Snettisham Inlet, Speel, Whiting Rivers
2824	0	100	100	100	100	100	100	100	100	5	Holkham Bay-Tracy Arm
2825	0	100	100	100	100	100	100	100	100	9	Endicott Arm
2926	2	100	100	100	98	87	88	89	85	22	Windham Bay, Chuck River, Hobart Bay
2927	2	100	100	100	99	79	87	88	76	14	Port Houghton-Cape Fanshaw
3001	410	81	81	79	79	72	78	79	71	937	Nakwasina, Neva Strait Area (NW Baranof)
3002	328	69	69	68	68	67	68	68	67	1111	Sitka Road System
3003	143	85	84	83	80	73	79	80	72	459	Silver Bay, Deep Inlet
3104	182	73	73	69	68	65	68	68	64	388	Northern Kruzof Is.
3105	130	99	99	99	98	97	97	97	97	207	Southern Kruzof Is.
3206	80	99	99	99	99	99	99	99	99	177	Redoubt Lake, Neckar Islands
3207	147	100	100	100	100	100	100	100	100	239	Crawfish Inlets, Neckar Bay (Baranof Is.)
3308	163	66	64	59	57	53	56	57	51	391	Kook Lake, Sitkoh Bay, False Is.
3309	72	99	99	99	99	93	94	94	92	114	Northern Shore Hoonah Sound
3310	158	93	93	93	93	93	93	93	93	327	South Arm Hoonah Sound
3311	124	97	97	97	97	88	89	91	86	202	Ushk Bay-Kakul Narrows
3312	90	91	91	87	87	80	86	86	79	137	Duffield Penin., Bear Bay
3313	134	65	64	57	56	50	52	53	48	226	Rodman And Saook Bay Drainages
3314	135	88	88	87	87	73	87	87	73	283	Fish Bay Drainages
3315	112	83	82	75	75	71	74	74	69	173	Catherine Island, Lake Eva, Hanus Bay
3416	75	100	100	100	100	100	100	100	100	109	Khaz Penin., Slocum Arm (Chichagof Is.)
3417	157	100	100	100	100	100	100	100	100	361	West Coast Chichagof
3418	65	100	100	100	100	100	100	100	100	116	Yakobi Is.

Table 3.10-7 (continued)
Relative Changes in Deer Habitat Capability by Wildlife Analysis Area (WAA) by Alternative

WAA[1/]	Average Deer Harvest (Hunting)[1/]	Percent of 1954 Habitat Capability in 2006	Percent Deer Habitat Capability in 100+ Years[3/] Alternative 1	2	3	4	5	6	7	Average Hunting Pressure (Hunter Days)[2/]	Vicinity
3419	54	100	100	100	100	100	100	100	100	130	Upper Lisianski Inlet, Lisianski River (Chichagof Is.)
3420	43	100	100	100	100	100	100	100	100	139	Idaho Inlet Drainages
3421	51	100	100	100	100	100	100	100	100	132	Port Althorp, Lower Lisianski, Inian Is.
3523	153	81	76	74	74	72	73	73	63	440	East Side Port Frederick, Game Creek (NE Chichagof)
3524	94	100	100	86	85	79	83	84	78	354	Hoonah Area
3525	171	78	71	67	67	62	65	66	58	443	Freshwater Bay Drainages (NE Chichagof)
3526	120	81	77	73	72	69	72	72	60	418	North Shore Tenakee Inlet (NE Chichagof)
3551	200	83	77	73	72	68	71	72	62	519	Whitestone Harbor, False Bay Drainages (NE Chichagof)
3627	71	76	70	67	65	62	64	65	61	187	Corner Bay, Trap Bay (Chichagof Is.)
3628	12	98	98	98	98	98	98	98	98	34	Kadashan (Chichagof Is.)
3629	62	91	91	89	85	75	79	80	73	143	Southern Shore Tenakee Inlet (Chichagof Is.)
3630	17	99	99	99	99	87	91	94	86	47	Upper Tenakee Inlet (Chichagof Is.)
3731	84	92	92	91	91	86	90	91	83	178	Kelp Bay-Takatz Bay (Baranof Is.)
3732	20	100	100	100	100	100	100	100	100	39	Warm Springs Coast (Baranof Is.)
3733	143	100	100	100	100	100	100	100	100	188	Whale Bay Drainages, Wilderness Coast (Baranof Is.)
3734	75	100	100	100	100	100	100	100	100	117	Southern Baranof Is.
3835	210	100	100	100	100	100	100	100	100	810	Northern Mansfield Penin.
3836	206	100	100	100	100	100	100	100	100	754	Hawk Inlet, Young Bay Drainages (Admiralty Is.)
3837	27	100	100	100	100	100	100	100	100	86	Wheeler, Greens Creeks Drainages (Admiralty Is.)
3938	112	100	100	100	100	100	100	100	100	287	Gambier Bay Drainages (Admiralty Is.)
3939	125	100	100	100	100	100	100	100	100	261	Pybus Bay Drainages (Admiralty Is.)
3940	79	92	92	92	92	92	92	92	92	160	Pt. Gardner, Eliza Harbor (Admiralty Is.)
4041	34	90	90	90	90	90	90	90	90	47	Whitewater Bay, Wilson Cove (Admiralty Is.)
4042	43	100	100	100	100	100	100	100	100	105	Angoon Area (Admiralty Is.)
4043	64	100	100	100	100	100	100	100	100	317	Central Admiralty Lakes
4044	215	100	99	99	99	99	99	99	99	433	Shee-Atika Drainages (Admiralty Is.)
4054	40	100	100	100	100	100	100	100	100	75	Fishery, Thayer Creeks
4055	67	96	96	96	96	96	96	96	96	162	Hood Bay, Chaik Bay Drainages (Admiralty Is.)
4145	82	100	100	100	100	100	100	100	100	243	Tiedeman Is.-Mole Harbor Area (Admiralty Is.)
4146	37	100	100	100	100	100	100	100	100	144	Windfall Harbor, Swan Cove Drainages (Admiralty Is.)
4147	61	100	100	100	100	100	100	100	100	273	Upper Seymour Canal (Admiralty Is.)

Table 3.10-7 (continued)
Relative Changes in Deer Habitat Capability by Wildlife Analysis Area (WAA) by Alternative

WAA[1/]	Average Deer Harvest (Hunting)[-/]	Percent of 1954 Habitat Capability in 2006	Percent Deer Habitat Capability in 100+ Years[3/] Alternative 1	2	3	4	5	6	7	Average Hunting Pressure (Hunter Days)[2/]	Vicinity
4148	53	89	89	89	89	89	89	89	89	156	West Side Glass Penin. (Admiralty Is.)
4149	59	100	100	100	100	100	100	100	100	155	East Side Glass Penin. (Admiralty Is.)
4150	112	100	100	100	100	100	100	100	100	453	Grand Is., Oliver Inlet, Stink Creek (Admiralty Is.)
4222	62	97	96	95	94	86	94	94	86	142	Pt. Adolphus, Mud Bay Area (Baranof Is.)
4252	101	92	92	78	78	70	77	76	69	221	Humpback, Gallagher Creeks (Baranof Is.)
4253	74	85	82	78	77	71	76	76	69	139	Neka Bay Drainages (Baranof Is.)
4256	54	100	100	100	100	100	100	100	100	184	Lemesurier, Pleasant Islands
4302	0	80	80	80	80	66	66	73	63	0	Lower Chilkat, Kelsall River Valleys
4304	0	100	100	100	100	100	100	100	100	0	Chilkat Penin.
4407	0	100	100	100	100	100	100	100	100	0	West Side Taiya Inlet
4408	0	100	100	100	100	100	100	100	100	0	Katzehin River-Eldred Rock
4503	0	100	95	96	96	97	97	97	97	0	Yakutat Forelands E. Of Dangerous River
4504	9	100	100	100	100	100	100	100	100	86	Yakutat Bay Islands
4505	0	100	93	94	94	95	95	95	95	0	Russell Fjord Drainages
4506	0	100	100	100	100	100	100	100	100	14	Eastern Shore Disenchantment Bay
4508	2	92	91	87	82	80	81	81	79	63	Yakutat Forelands W. Of Dangerous River
4607	0	100	98	98	98	98	98	98	99	0	Nunatak Bench
5012	10	76	73	61	60	55	58	59	52	62	Northern Kuiu Is.
5013	2	94	93	92	90	82	84	84	80	17	Port Camden, Bay Of Pillars
5014	5	96	96	96	96	70	75	75	64	20	Eastern Kuiu Is., Conclusion Is.
5015	1	100	100	100	100	100	100	100	100	1	Coronation Is.
5016	2	98	98	98	98	98	98	98	98	2	Tebenkof Bay
5017	2	98	98	98	98	89	98	98	86	10	Southern Kuiu Is.
5018	3	93	92	90	84	79	81	81	78	26	Rocky Pass/Kuiu
5130	6	98	96	96	90	83	86	87	81	51	Rocky Pass/Kupreanof
5131	15	90	86	83	83	80	81	82	79	164	Hamilton Creek, Big John Bay
5132	18	73	71	68	67	64	65	67	62	265	Kake Area
5133	27	98	97	97	96	82	84	85	80	153	West Duncan Canal
5134	40	92	92	92	89	83	87	87	83	157	South Shore Kupreanof
5135	5	98	94	90	90	89	89	89	85	31	North Shore Kupreanof
5136	16	86	76	71	67	60	64	66	58	79	Portage Bay, Nw Kupreanof
5137	4	98	98	97	97	97	97	97	97	20	Petersburg Creek (Kupreanof Is.)
5138	74	88	79	70	69	64	68	68	59	327	Southern Lindenberg Penin. (Kupreanof Is.)
Total		88	86	84	83	79	81	82	77		

[1] Includes only National Forest System lands
[2] Based on 1995 to 2005 ADF&G harvest summary reports
[3] This analysis assumes: 1) maximum timber harvest levels over the 100^{+}-year period, 2) timber harvest from 1954 to 1995 occurred in the high volume stratum (SD 5N, 5S, 67), 3) in 2105 25 percent of the second-growth would be in stand initiation (<25 years) and 75 percent would be in stem exclusion (26-100 years),
[4/] Estimates incorporate the model implementation reduction factor (MIRF), which is the reduction in the number of suitable acres actually harvested during plan implementation (see *Timber* section for further description).

Table 3.10-8
High Quality Deer Winter Range Suitable for Harvest by Alternative

WAA	Vicinity	Range of HSI Scores[1/]		Percent of High Value Deer Winter Range Suitable for Harvest[2/, 3/]						
				Alternative						
		Low	High	1	2	3	4	5	6	7
101	Gravina Is.	0.0	1.0	0	12	16	18	17	17	20
303	Duke Is.	0.0	1.0	0	0	0	0	0	0	0
404	Eastern Revilla Is.	0.0	1.0	0	0	0	0	0	0	0
405	Thorne Arm (Revilla Is.)	0.0	1.0	2	16	17	17	16	19	20
406	Carrol Inlet (Revilla Is.)	0.0	1.0	7	16	17	28	19	19	32
407	George Inlet (Revilla Is.)	0.0	1.0	6	19	20	29	22	22	31
408	Ketchikan	0.0	1.0	0	3	3	3	3	3	3
509	Naha Area (Revilla Is.)	0.0	0.8	1	7	7	15	9	8	16
510	Neets Bay Area (Revilla Is.)	0.0	0.8	6	13	14	24	18	15	30
511	Northern Revilla Is.	0.0	0.5	0	0	0	0	0	0	0
612	Eastern Cleveland Pen.	0.0	0.8	0	0	5	43	27	26	49
613	Helm Bay (Cleveland Pen.)	0.0	1.0	0	0	0	41	0	0	52
614	Meyers Chuck (Cleveland Pen.)	0.0	1.0	0	0	0	47	0	0	49
715	Redoubt Lake, Neckar Is.	0.0	0.8	0	0	0	0	0	0	0
716	Unuk Drainage (Cleveland Pen.)	0.0	0.5	0	0	0	0	0	0	0
717	Lower Chickamin (Misty Fiords)	0.0	0.5	0	0	0	0	0	0	0
718	Upper Chickamin (Misty Fiords)	0.0	0.5	0	0	0	0	0	0	0
719	Rudyerd Bay (Misty Fiords)	0.0	0.5	0	0	0	0	0	0	0
820	Wilson/Blossom Drainages (Misty Fiords)	0.0	0.5	0	0	0	0	0	0	0
821	Smeaton Bay (Misty Fiords)	0.0	0.8	0	0	0	0	0	0	0
822	Boca De Quadra Drainages (Misty Fiords)	0.0	1.0	0	0	0	0	0	0	0
823	Pearse Canal (Misty Fiords)	0.0	1.0	0	0	0	0	0	0	0
824	Peabody Mtns (Misty Fiords)	0.0	0.5	0	0	0	0	0	0	0
825	Upper Portland Canal (Misty Fiords)	0.0	0.5	0	0	0	0	0	0	0
826	Hyder (Misty Fiords)	0.0	0.5	0	12	13	30	15	15	33
901	Suemez Is.	0.0	1.0	7	21	24	33	25	26	40
902	Outside Is.	0.0	1.0	0	0	1	0	1	1	2
1003	Heceta Is.	0.0	1.0	12	19	20	31	25	22	38
1105	Dall Is.	0.0	1.0	0	0	0	4	4	3	8
1106	Long Is.	0.0	1.0	0	0	0	1	0	0	1
1107	Hydaburg, Hetta Inlet, Sukkwan Is.	0.0	1.0	0	1	1	18	15	15	23
1108	Southwestern Prince Of Wales Is.	0.0	1.0	0	0	0	0	0	0	0
1209	Southeastern Prince Of Wales Is.	0.0	1.0	0	0	4	12	4	4	15
1210	Moira Sound (POW)	0.0	1.0	0	1	15	27	18	16	31
1211	Kitkun, South Arm Cholmondeley (POW)	0.0	1.0	0	17	18	33	20	19	44
1212	Clover Mtn. (POW)	0.0	1.0	0	0	15	18	15	17	20
1213	West Arm Cholmondeley (POW)	0.0	1.0	1	11	12	25	15	13	35
1214	Skowl Arm, Polk Inlet (POW)	0.0	0.8	9	16	18	24	20	19	42
1315	Kasaan Peninsula, Thorne Bay (POW)	0.0	1.0	11	17	21	30	23	23	42
1316	Karta Bay (POW)	0.0	0.8	0	0	0	0	0	0	0
1317	Twelve Mile Arm, Harris River (POW)	0.0	0.8	7	14	20	29	22	22	47
1318	Craig, Klawock Areas (POW)	0.0	1.0	5	17	23	39	28	25	43
1319	Thorne River Drainage (POW)	0.0	0.8	6	11	13	28	17	17	40
1323	Western Prince Of Wales Is.	0.0	1.0	3	11	12	21	13	13	29
1332	Trocadero Bay, Waterfall Area (POW)	0.0	1.0	2	3	12	20	14	13	31
1420	Coffman Cove, Luck Lake, Ratz Harbor (POW)	0.0	1.0	13	20	24	29	26	26	39
1421	Sweetwater Lake, Logjam Creek (POW)	0.0	0.8	8	13	14	12	16	16	33
1422	Staney Creek, Naukati, Sarkar (POW)	0.0	1.0	14	23	25	31	28	28	38
1524	Warren Is.	0.0	1.0	0	0	0	0	0	0	0
1525	Southern Kosciusko Is.	0.0	1.0	11	18	21	21	22	24	34
1526	Holbrook Mt., Northern Kosciusko Is.	0.0	1.0	0	0	0	4	3	3	6
1527	Prince Of Wales El Capitan Area	0.0	1.0	10	21	23	25	26	26	34
1528	Salmon Bay (POW)	0.0	0.8	4	6	7	11	11	11	28
1529	Mt. Calder, Red Bay, Port Protection (POW)	0.0	1.0	7	12	13	28	17	14	37
1530	Exchange Cove, Whale Passage (POW)	0.0	0.8	6	9	13	17	15	14	27
1531	Tuxekan, Marble, Sea Otter Sound (POW)	0.0	1.0	11	18	19	28	26	21	38
1601	Fanshaw-Farragut Area	0.0	0.8	0	0	0	36	29	26	41
1602	Farragut River Drainage	0.0	0.8	0	0	0	0	0	0	0

Table 3.10-8 (continued)
High Quality Deer Winter Range Suitable for Harvest by Alternative

WAA	Vicinity	Range of HSI Scores[1/]		Percent of High Value Deer Winter Range Suitable for Harvest[2/, 3/]						
				Alternative						
		Low	High	1	2	3	4	5	6	7
1603	Thomas Bay	0.0	0.8	0	0	12	18	15	13	23
1604	Baird Glacier	0.0	0.2	0	0	0	0	0	0	0
1605	Muddy River, Patterson Glacier	0.0	0.8	0	10	23	36	25	25	39
1706	Horn Cliffs, Le Conte Bay	0.0	0.8	0	0	0	0	0	0	0
1707	North Arm Of The Stikine	0.0	0.8	0	0	0	0	0	0	0
1708	Stikine River Drainage	0.0	0.6	0	0	0	0	0	0	0
1809	Cone Mtn.	0.0	0.5	0	0	0	0	0	0	0
1810	Virginia Lake, Garnet Mtn.	0.0	0.8	0	0	27	48	30	30	48
1811	Aaron Creek Drainage	0.0	0.8	0	0	8	16	10	9	21
1812	Marten Lake, Harding River Drainage	0.0	0.8	0	0	4	4	4	4	6
1813	Bradfield River Drainages	0.0	0.5	0	6	10	16	13	11	17
1814	Eagle River, S. Shore Bradfield Canal	0.0	0.8	0	0	7	13	7	8	17
1815	Anan Creek	0.0	0.8	0	0	4	6	5	4	10
1816	Seward Passage	0.0	0.8	0	5	18	23	20	20	27
1817	Vixen Inlet, Union Bay	0.0	0.8	0	0	2	17	15	15	47
1901	Northern Etolin Is.	0.0	1.0	3	15	17	33	20	19	42
1902	Deer Is.	0.0	0.8	0	0	6	11	6	6	20
1903	Wrangell Is.	0.0	0.8	6	20	21	38	23	23	44
1904	Woronkofski And Stikine Mouth Is.	0.0	0.8	0	4	14	21	17	16	32
1905	Zarembo Is.	0.0	1.0	8	20	21	37	23	23	42
1906	Kashevarof Islands	0.0	1.0	0	15	16	18	18	18	29
1910	Southern Etolin Is.	0.0	1.0	0	0	2	3	2	2	4
2007	Mitkof Is.	0.0	1.0	9	21	22	32	24	26	40
2008	Woewodski Is.	0.0	1.0	0	0	39	45	43	43	56
2202	Sullivan River And Island	0.0	0.8	0	0	0	10	5	5	13
2203	Endicott River Drainage	0.0	0.5	0	0	0	3	1	1	3
2304	St. James Bay	0.0	0.5	0	0	0	28	27	24	32
2305	Southern Chilkat Range	0.0	0.5	0	7	8	28	8	9	30
2306	Excursion Inlet	0.0	0.5	0	13	14	25	15	15	28
2408	Eldred Rock-Pt. St. Mary	0.0	0.5	1	2	12	23	13	13	25
2409	Berners Bay	0.0	0.5	2	4	9	13	8	9	15
2410	Berners River Drainage	0.0	0.5	0	0	0	0	0	0	0
2411	Lace River Drainage	0.0	0.5	0	0	0	0	0	0	0
2412	Antler River Drainage	0.0	0.5	0	0	0	0	0	0	0
2413	Gilkey River Drainage	0.0	0.5	0	0	0	0	0	0	0
2514	Cowee, Davies Creeks	0.0	0.5	0	1	7	16	16	7	19
2515	Eagle River-Mendenhall River Area	0.0	0.8	0	0	0	0	0	0	0
2516	Juneau Ice Field	0.0	0.1	0	0	0	0	0	0	0
2517	Juneau And Lower Taku	0.0	0.8	0	0	0	15	11	10	21
2518	Taku River	0.0	0.5	0	0	0	0	0	0	0
2519	Turner Lake, Southern Shore Taku Inlet	0.0	0.5	0	0	0	11	7	8	15
2620	Lincoln Is.	0.1	0.1	0	0	0	0	0	0	0
2621	Shelter Is.	0.0	0.8	0	0	0	0	0	0	0
2722	Douglas Is.	0.0	0.8	0	0	0	19	0	0	0
2823	Snettisham Inlet, Speel,Whiting Rivers	0.0	0.5	0	0	0	12	7	6	15
2824	Holkham Bay-Tracy Arm	0.0	0.5	0	0	0	0	0	0	0
2825	Endicott Arm	0.0	0.5	0	0	0	0	0	0	0
2926	Windham Bay, Chuck River, Hobart Bay	0.0	0.5	0	0	1	11	9	9	12
2927	Port Houghton-Cape Fanshaw	0.0	0.8	0	0	1	22	13	12	25
3001	Nakwasina, Neva Strait Area (NW Baranof)	0.0	1.0	0	3	5	20	5	5	23
3002	Sitka Road System	0.0	1.0	0	1	1	4	1	1	4
3003	Silver Bay, Deep Inlet	0.0	1.0	0	2	8	19	8	8	21
3104	Northern Kruzof Is.	0.0	1.0	0	13	15	25	17	16	29
3105	Southern Kruzof Is.	0.0	1.0	0	0	4	4	4	4	5
3206	Redoubt Lake, Neckar Islands	0.0	1.0	0	0	0	0	0	0	0
3207	Crawfish Inlets, Neckar Bay (Baranof Is.)	0.0	1.0	0	0	0	0	0	0	0
3308	Kook Lake, Sitkoh Bay, False Is.	0.0	0.8	1	12	16	25	18	17	29
3309	Northern Shore Hoonah Sound	0.0	0.8	0	0	0	9	7	7	10
3310	South Arm Hoonah Sound	0.0	0.8	0	0	0	0	0	0	0
3311	Ushk Bay-Kakul Narrows	0.0	0.8	0	0	0	16	14	11	19
3312	Duffield Penin., Bear Bay	0.0	0.8	0	9	9	22	10	10	24
3313	Rodman And Saook Bay Drainages	0.0	0.8	0	15	17	32	28	24	35
3314	Fish Bay Drainages	0.0	0.8	0	1	1	25	1	1	27

Table 3.10-8 (continued)
High Quality Deer Winter Range Suitable for Harvest by Alternative

WAA	Vicinity	Range of HSI Scores[1/]		Percent of High Value Deer Winter Range Suitable for Harvest[2/, 3/] Alternative						
		Low	High	1	2	3	4	5	6	7
3315	Catherine Island, Lake Eva, Hanus Bay	0.0	0.8	0	11	11	18	12	12	20
3416	Khaz Penin., Slocum Arm (Chichagof Is.)	0.0	1.0	0	0	0	0	0	0	0
3417	West Coast Chichagof	0.0	1.0	0	0	0	0	0	0	0
3418	Yakobi Is.	0.0	1.0	0	0	0	0	0	0	0
3419	Upper Lisianski Inlet, Lisianski River (Chichagof Is.)	0.0	0.6	0	0	0	0	0	0	0
3420	Idaho Inlet Drainages	0.0	0.6	0	0	0	0	0	0	0
3421	Port Althorp, Lower Lisianski, Inian Is.	0.0	0.8	0	0	0	0	0	0	0
3523	East Side Port Frederick, Game Creek (NE Chichagof)	0.0	0.8	2	6	6	12	7	6	27
3524	Hoonah Area	0.0	0.8	0	21	22	30	25	24	31
3525	Freshwater Bay Drainages (NE Chichagof)	0.0	0.8	6	12	13	22	15	14	29
3526	North Shore Tenakee Inlet (NE Chichagof)	0.0	0.8	3	9	9	15	10	10	29
3551	Whitestone Harbor, False Bay Drainages (NE Chichagof)	0.0	0.8	4	11	12	19	13	13	31
3627	Corner Bay, Trap Bay (Chichagof Is.)	0.0	0.8	5	10	13	18	15	14	20
3628	Kadashan (Chichagof Is.)	0.0	0.8	0	0	0	0	0	0	0
3629	Southern Shore Tenakee Inlet (Chichagof Is.)	0.0	0.8	0	4	10	25	19	18	28
3630	Upper Tenakee Inlet (Chichagof Is.)	0.0	0.5	0	0	0	19	13	7	20
3731	Kelp Bay-Takatz Bay (Baranof Is.)	0.0	0.8	0	2	3	10	3	3	14
3732	Warm Springs Coast (Baranof Is.)	0.0	0.5	0	0	0	0	0	0	0
3733	Whale Bay Drainages, Wilderness Coast (Baranof Is.)	0.0	1.0	0	0	0	0	0	0	0
3734	Southern Baranof Is.	0.0	0.8	0	0	0	0	0	0	0
3835	Northern Mansfield Penin.	0.0	0.8	0	0	0	0	0	0	0
3836	Hawk Inlet, Young Bay Drainages (Admiralty Is.)	0.0	0.8	0	0	0	0	0	0	0
3837	Wheeler, Greens Creeks Drainages (Admiralty Is.)	0.0	0.8	0	0	0	0	0	0	0
3938	Gambier Bay Drainages (Admiralty Is.)	0.0	0.8	0	0	0	0	0	0	0
3939	Pybus Bay Drainages (Admiralty Is.)	0.0	1.0	0	0	0	0	0	0	0
3940	Pt. Gardner, Eliza Harbor (Admiralty Is.)	0.0	0.8	0	0	0	0	0	0	0
4041	Whitewater Bay, Wilson Cove (Admiralty Is.)	0.0	0.8	0	0	0	0	0	0	0
4042	Angoon Area (Admiralty Is.)	0.0	0.8	0	0	0	0	0	0	0
4043	Central Admiralty Lakes	0.0	0.8	0	0	0	0	0	0	0
4044	Shee-Atika Drainages (Admiralty Is.)	0.0	0.8	0	0	0	0	0	0	0
4054	Fishery, Thayer Creeks (Admiralty Is.)	0.0	0.8	0	0	0	0	0	0	0
4055	Hood Bay, Chaik Bay Drainages (Admiralty Is.)	0.0	0.8	0	0	0	0	0	0	0
4145	Tiedeman Is.-Mole Harbor Area (Admiralty Is.)	0.0	0.8	0	0	0	0	0	0	0
4146	Windfall Harbor, Swan Cove Drainages (Admiralty Is.)	0.0	0.8	0	0	0	0	0	0	0
4147	Upper Seymour Canal (Admiralty Is.)	0.0	0.8	0	0	0	0	0	0	0
4148	West Side Glass Penin. (Admiralty Is.)	0.0	0.8	0	0	0	0	0	0	0
4149	East Side Glass Penin. (Admiralty Is.)	0.0	0.8	0	0	0	0	0	0	0
4150	Grand Is., Oliver Inlet, Stink Creek (Admiralty Is.)	0.0	0.8	0	0	0	0	0	0	0
4222	Pt. Adolphus, Mud Bay Area (Baranof Is.)	0.0	0.8	0	2	4	14	4	4	14
4252	Humpback, Gallagher Creeks (Baranof Is.)	0.0	0.8	0	22	23	35	23	25	36
4253	Neka Bay Drainages (Baranof Is.)	0.0	0.8	0	8	10	20	11	11	22
4256	Lemesurier, Pleasant Islands	0.0	0.8	0	0	0	0	0	0	0
4302	Lower Chilkat, Kelsall River Valleys	0.0	0.5	0	0	0	22	21	10	28
4304	Chilkat Penin.	0.0	0.4	0	0	0	0	0	0	0
4407	West Side Taiya Inlet	0.0	0.5	0	0	0	0	0	0	0
4408	Katzehin River-Eldred Rock	0.0	0.5	0	0	0	0	0	0	0
4503	Yakutat Forelands E. Of Dangerous River	0.0	0.8	0	0	0	0	0	0	0
4504	Yakutat Bay Islands	0.0	0.5	0	0	0	0	0	0	0
4505	Russell Fjord Drainages	0.0	0.5	0	0	0	1	0	0	1
4506	Eastern Shore Disenchantment Bay	0.0	0.5	0	0	0	0	0	0	0
4508	Yakutat Forelands W. Of Dangerous River	0.0	0.8	0	4	10	13	11	11	13
4607	Nunatak Bench	0.0	0.1	0	0	0	0	0	0	0
5012	Northern Kuiu Is.	0.0	0.8	0	20	23	31	26	25	36
5013	Port Camden, Bay Of Pillars	0.0	0.8	0	3	6	15	12	12	18
5014	Eastern Kuiu Is., Conclusion Is.	0.0	1.0	0	0	0	31	24	24	39
5015	Coronation Is.	0.0	1.0	0	0	0	0	0	0	0
5016	Tebenkof Bay	0.0	1.0	0	0	0	0	0	0	0

Table 3.10-8 (continued)
High Quality Deer Winter Range Suitable for Harvest by Alternative

WAA	Vicinity	Range of HSI Scores[1/]		Percent of High Value Deer Winter Range Suitable for Harvest[2/, 3/]						
				Alternative						
		Low	High	1	2	3	4	5	6	7
5017	Southern Kuiu Is.	0.0	1.0	0	0	0	15	0	0	20
5018	Rocky Pass/Kuiu	0.0	0.8	0	4	14	23	19	20	25
5130	Rocky Pass/Kupreanof	0.0	1.0	2	3	14	26	21	19	31
5131	Hamilton Creek, Big John Bay	0.0	0.8	5	11	12	17	14	13	18
5132	Kake Area	0.0	1.0	4	13	13	21	18	15	23
5133	West Duncan Canal	0.0	1.0	1	2	4	27	23	22	32
5134	South Shore Kupreanof	0.0	1.0	0	0	5	16	10	10	18
5135	North Shore Kupreanof	0.0	1.0	5	12	13	14	14	14	22
5136	Portage Bay, Nw Kupreanof	0.0	1.0	10	22	27	40	32	30	48
5137	Petersburg Creek (Kupreanof Is.)	0.0	1.0	0	1	1	1	1	1	1
5138	Southern Lindenberg Penin. (Kupreanof Is.)	0.0	1.0	10	27	28	38	31	31	50
Average				**1**	**4**	**6**	**13**	**9**	**8**	**16**
Forest-wide				**1**	**2**	**2**	**5**	**3**	**3**	**5**

[1] Scores range from 0 to 1.0, with higher numbers indicating higher habitat quality.
[2] High quality habitat was defined as the top 25 percent of acres within each WAA with the highest HSI scores. The analysis excluded all lands with HSI scores of 0 before identifying high quality habitat; WAA 202 contains only two polygons, both with HSI scores of 0, and therefore was not included in this table
[3] This analysis assumes maximum timber harvest levels and takes the Model Implementation Reduction Factor (MIRF) into account (see the *Timber* section for additional discussion).

Alternatives 4 and 7, in increasing order, would have the greatest potential to lead to over-hunting of mountain goats and black bears because of increased access.

Both mountain goats and black bears are also susceptible to disturbance associated with helicopter overflights and landings. In a study of mountain goat responses to helicopter disturbance, Cote (1996) documented temporary displacement from the area of disturbance, the disintegration of social groups, and injury while fleeing. Cardiac responses (i.e., elevated heart rate) have been documented in bighorn sheep which occupy similar habitats. Distance between animals and helicopters appears to be the most important factor affecting mountain goat responses and disturbance can occur as far away as 2 kilometer from a helicopter flight (Cote 1996). Though no studies have been completed to date that examine the long-term consequences of this disturbance on mountain goats (Wilson and Shacklston 2001), it has been suggested that behavioural disruptions in response to disturbing stimuli result in demographic consequences (e.g., Côté 1996). For example, disturbance increases energy expenditure due to the flight response, and has the potential to affect foraging, socialization, and other life-history strategies which could ultimately affect mortality and natality. This would be most likely when mountain goats are already under seasonal nutritional or energetic stress such as when they are on winter range or kidding areas,.

Recent trends indicate that use of helicopters by the tourism industry to reach remote areas has increased since 1997 and is anticipated to continue increasing (see Recreation section for further discussion). However, Forest Plan standards and guidelines in place address helicopter use at the project scale, though there is still some uncertainly related to their adequacy due to the lack of long-term studies on disturbance effects.

River Otter

River otters prefer habitats immediately adjacent to coastal and fresh water aquatic environments, with most use occurring within 500 feet. Old-growth forests in these areas provide the highest value habitat, providing cover and burrow and den sites (Suring et al. 1988). The majority of otter habitat is secure under the existing Forest Plan because of beach, estuary, and riparian Forest-wide standards and guidelines; therefore, there is no increased risk associated with Alternatives 1, 2, 3, 4, 5, and 6, which maintain existing 1,000-foot Beach and Estuary Buffer standards and guidelines. Alternative 7 proposes to reduce the beach fringe buffer to 500 feet. Although most use by river otters occurs within this distance, the additional 500 feet are important for providing connectivity. Consequently, the reduced buffer under Alternative 7 may result in more road construction and timber harvest closer to areas inhabited by otters thereby providing less protection of otter habitat.

American Marten

The most important factors related to viability of the marten populations on the Tongass are the large amount of habitat in OGRs and non-development LUDs, followed by habitat characteristics of the matrix. Within the matrix, forest structure at the stand level (e.g., forest cover and components that contribute to structural diversity such as large trees, snags, and downed logs) and landscape connectivity are important factors. Marten are strongly associated with late-seral and old-growth forests below 1,500 feet in elevation. They are also wide ranging and require large tracts of contiguous habitat to move across the landscape, as well as habitats capable of supporting an adequate prey-base of small mammals.

The elevation preferences for marten presents the potential for a viability concern in that high quality habitats generally contain a greater, relative proportion of mature forest and thus have also historically received a disproportionately high level of harvest and associated road effects of harvest. That is, new roads may lead to increased human access and thus the potential for increased trapping pressure. Consequently, beach and riparian zones are particularly important for this species in terms of landscape connectivity and prey habitat diversity. As noted under the Affected Environment section, recent research has shown that prey availability and harvest play significant roles in the population dynamics of this species.

There are currently approximately 1.83 million acres of high volume (SD5N, SD5S, and SD67 categories) old growth below 1,500 feet in elevation on the Tongass. Under Alternative 5 (No Action), a maximum of 9.7 percent of these acres could be harvested over the next 100+ years. Alternatives 1, 2, 3, and 6 would each protect more acres of high-volume old growth below 1,500 feet elevation than Alternative 5, with potential harvest ranging from 2.0 percent of the acres under Alternative 1 to 9.3 percent of the acres under Alternative 6. Alternatives 4 and 7 would protect fewer acres of high-value marten habitat, with the potential harvest ranging from 13.8 percent to 17.2 percent, respectively.

Based on the 1997 expert panel assessments for marten (DeGayner 1997), it can be concluded that Alternative 5 (which is the equivalent of Alternative 11 in the 1997 Forest Plan Revision Final EIS) would have a moderate likelihood of sustaining viable, well-distributed marten populations because it incorporates three key features thought important for marten use: wider riparian management buffers; 1,000-foot beach and estuary buffers; and a system of small, medium, and large reserves (Appendix D). Subsequent to the panel assessment, Alternative 5 was strengthened by incorporating additional measures, including the requirement for special prescriptions for managing high-value marten habitat in timber harvest areas to retain important components of forest stand structure in higher risk biogeographic provinces where timber harvest has reduced the abundance of habitat components important to marten. The overall objective was to avoid the creation of additional significant gaps in marten habitat that could inhibit interaction between subpopulations by limiting harvest units to 2 acres in size and applying even-aged harvest at a 200-year rotation in highly fragmented VCUs and, in less fragmented

VCUs, retaining structures that will allow harvested units to regain value as marten habitat in a relative short amount of time by retaining coarse woody debris and green trees to act as a source of woody debris during the next rotation (Appendix N, 1997 Final EIS). These Marten Habitat standards and guidelines only apply to areas identified as high value habitat by the marten habitat capability model.

Alternatives 1, 2, 3, and 6 maintain key features and management prescriptions under Alternative 5, propose the less cumulative harvest of POG (acres after full implementation of the Forest Plan), and protect more POG and a higher percentage of larger tree POG types in reserves. These alternatives also replace the existing Marten Habitat and Goshawk Foraging standards and guidelines with a Forest-wide Legacy Structure standard and guideline. The Legacy Forest Structure standard and guideline continues to meet the objectives of maintaining sources of coarse woody debris important for marten and of reducing fragmentation to facilitate movements of marten between OGRs and is to be applied in the high risk VCUs Forest-wide, including the biogeographic provinces that have not had concentrated past timber harvest activity but where concentrated harvest could take place in the future. Additionally, it specifies a clumped distribution of reserve trees and therefore would implement a larger number of acres of even-aged management, whereas the existing standards and guidelines specify that reserve trees be uniformly distributed across a unit (see Section 2.5 of Appendix D for a detailed analysis and comparison). In addition, the potential road densities are lower under Alternatives 1, 2, 3, and 6, thereby reducing the chances of increasing trapping pressure on marten through increased human access. Therefore, Alternatives 1, 2, and 3 provide better protection of key marten habitat components and connectivity across the landscape than Alternatives 5 (No Action), and are more likely to continue to support well distributed, viable marten populations on the Tongass. Alternative 6, which harvests slightly less timber than Alternative 5, would also be expected to have a moderate likelihood of sustaining well-distributed viable populations of marten (Appendix D). Similar to Alternative 5, Alternative 6 was strengthened by incorporating additional measures that would increase the likelihood of maintaining habitat to sustain viable marten populations. Measures include increased protections of old growth in both the reserve system and within non-development LUDs, standards and guidelines regarding trapping mortality and road density and the Legacy Forest Structure standards and guidelines. Given the smaller suitable land bases and implementation of the Legacy Structure standards and guidelines under Alternatives 1, 2, and 3, these alternatives are expected to have a very high (Alternative 1) to high (Alternatives 2 and 3) likelihood of sustaining viable, well-distributed populations of marten over the long-term (Appendix D).

Alternatives 4 and 7 propose to harvest amounts of POG similar to Alternatives 6 and 2 of the 1997 Forest Plan Revision Final EIS, respectively (greater than under Alternative 5), reduce or eliminate the OGRs system, and eliminate the Goshawk Foraging and Marten Habitat standards and guidelines. In addition, there is no Forest-wide Legacy Forest Structure requirement. Alternative 7 would also reduce the beach fringe from 1,000 to 500 feet. Based on the 1997 expert panel assessments (Iverson 1996a, DeGayner 1997) both Alternatives 4 and 7 would be rated as having a moderate chance of maintaining habitat sufficient to support well-distributed viable marten populations across the Tongass (Iverson 1996a, DeGayner 1997). As a result,it is likely that under these alternatives more isolated populations could result. The extensive planned roading, potentially leading to increased trapping pressure, continued fragmentation of habitat, and the higher harvest rate for the important high-volume old-growth forest component were factors cited by panelists that contributed to these conclusions.

Brown Bear

The quality and quantity of riparian habitats play an essential role in sustaining brown bear populations, both in terms of the maintaining adequate vegetative cover to support anadromous fish production (i.e., regulate stream temperature) and providing visual obscurity of bears from humans and other bears. The existing Brown Bear standard and guideline requires a minimum no-harvest buffer of 500 feet around important brown bear foraging sites. Additionally, the reserve system serves as an important source of roadless refugia for bears, reducing the possibility of human-bear interactions. The 1997 Forest Plan panel members viewed factors that increased road construction and repeated human entry into a watershed as adverse to brown bears. Of particularly concern are activities that are dispersed or occur over an extended time period because once an area is roaded for one development activity, it often results in additional developments that increase human-bear interactions, and ultimately reduce the area's capability for supporting high bear populations. Wilderness and LUD II areas were determined to essentially ensure brown bear persistence somewhere in Southeast Alaska over the 100-year planning horizon.

Alternative 5 (No Action) emphasizes protection of known high value brown bear areas, protection of riparian habitats, control of human access, sanitation management, and the system of OGRs to maintain viable and well distributed brown bear populations on the Tongass. Based on the 1997 Final EIS expert panel assessments, Alternatives 5 and 6 (equivalent to Alternative 11 of the 1997 Final EIS) would be ranked as having a high likelihood of maintaining viable brown bear populations over the long-term due to the reserve system (related to road effects) and the riparian buffer requirements (Meade 1997). Alternatives 1, 2, and 3, which maintain the conservation measures in place under Alternative 5 related to brown bears but propose less timber harvest and road construction, would have a very high (Alternatives 1) or high (Alternatives 2 and 3) likelihood of maintaining well-distributed, viable brown bear populations over the long term (Appendix D).

As noted in the description of the Affected Environment in this section, brown bears are primarily found north of Frederick Sound. Alternative 4 maintains some protection of known high value brown bear areas by requiring OGRs in the Northeast Chichagoff Island biogeographic province within ADF&G GMU 4 (Admiralty, Baranof, Chichagof, and surrounding islands), which supports the highest concentration of brown bears in the world. It is important to note though that Northeast Chichagof Island continues to support this population despite already having experienced a high level of timber harvest with roads having been built in nearly every watershed, many of which are closely associated with major fish streams (ADF&G 2000). In addition, Alternative 4 would also locate an individual reserve, the Eva Lake reserve, which is currently designated as Semi-remote Recreation LUD, in an ADF&G brown bear special use zone on Baranoff Island. Alternative 7 would completely eliminate the OGR system. Based on the 1997 panel assessment (Meade 1997, Iverson 1996b) Alternatives 4 and 7(equivalent to Alternatives 6 and 2 of the 1997 Final EIS, respectively) would be ranked as having a moderately high relative likelihood of maintaining well-distributed, viable brown bear populations with some potential for the development of temporary gaps in distribution, due to the reduction in the reserve system (Appendix D). Although, risk would be greatest under Alternative 7 due to the more extensive timber harvest, associated road construction, and absence of an OGR system. OGRs serve as important roadless refugia for bears where human-bear interactions can be minimized, and that provide connectivity between upland areas and habitats used by bears for foraging (riparian areas, beach fringe, and estuaries). Therefore, Alternatives 4 and 7 are the most likely to adversely affect brown bears by reducing the amount of roadless refugia secured from timber harvest, which could prevent access to important habitats, impede movement through corridors, and increase the risk of over-harvest and DLP mortality.

Road densities are another measure of the potential impact of the alternatives on brown bears. Primary concerns include increased hunting or poaching, and disturbance during critical life stages (e.g., late-summer feeding periods for bear). Habitat fragmentation, as well as habitat loss secondary to activities that are facilitated by vehicular access (e.g., timber harvest, mining, residential development) are other potential impacts. Open roads, which receive the highest and most consistent use, are likely to have the greatest effect on brown bears, although closed roads still facilitate access (e.g., off-highway vehicle, pedestrian) to roadless areas. There is no road density threshold for brown bears, per se, however it can be assumed that increased road density elevates the potential for human-bear interactions.

Road density was evaluated by WAA in ADF&G GMU 4, which includes Admiralty, Baranof, Chichagof, Kruzof, Yakobi, and neighboring islands, and is the only island group in Southeast Alaska with a persistent, high density population of brown bears. Current road densities (all roads included) are highest on Chichagof Island, Northeast Chichagof Island, and North Kruzof Island. These WAAs are likely to experience the greatest cumulative effects of road access (increased potential of human-bear interactions) associated with increased road density. They are also where the greatest increases in road density are proposed under the alternatives. Within these higher risk WAAs, road density increases would be greatest under Alternative 7, followed by 4, 5, 6, 3, 2, and 1; one exception is WAA 3311 where road density would only increase under Alternatives 4, 5, 6, and 7. There are also two WAAs on Baranof Island (3314 and 3315) that could become areas of higher risk under all alternatives;no road density increases would occur under any of the alternatives on Admiralty Island.

Alexander Archipelago Wolf

Two principal management concerns associated with maintaining well-distributed and viable wolf populations in Southeast Alaska are that 1) current mortality rates in localized areas such as north Prince of Wales Island (POW), may result in local declines in the wolf population, and 2) long-term reductions in deer habitat capability resulting from timber harvest may negatively affect wolf populations (Interagency Wolf Conservation Assessment; Person et al. 1996). Though wolves exploit a variety of food resources across the Tongass, deer are their primary prey and predator/prey interactions between wolves and deer have been demonstrated to be implicitly linked to wolf persistence. That is, if deer habitat capability in a territory is reduced to such an extent that it can no longer support a reproductively successful pack, it could create a gap in wolf distribution, particularly on islands that experience a substantial decline in deer numbers, or result in a lower density wolf population with larger pack home range sizes (Mech et al. 1998, Person et al. 2001, Fuller et al. 2003). This concept was identified as the most important factor limiting wolf viability by the 1997 Forest Plan panel assessment. Recent research (*Alexander Archipelago Wolf*, presented at the Tongass Conservation Strategy Review Workshop 2006) has shown that the population on POW Island is genetically isolated from other Tongass populations, which presents profound implications for maintaining well-distributed wolf populations in light of local declines, given that these populations are are more sensitive to human activity and habitat disturbance than wolf populations elsewhere in the state (Schoen and Person 2007). Local declines on POW Island have been linked to the influence of road densities that provide greater trapping and hunting access to significant proportions of the wolf range, which increases wolf vulnerability to both legal and illegal mortality. The following analysis focuses on GMUs 2 and 3, which support 60 to 70 percent of the wolf population in Southeast Alaska.

To address impacts to wolves, the potential effects of the alternatives on the availability of deer to wolves were evaluated. Though prediction of the response of the wolf population to changes in the deer population is speculative at best, a decline in the deer population would likely result in a decline in the wolf population and a reduction in wolf density. Resonating effects could include reductions in opportunities to harvest wolves. The Wolf standards and guidelines state that habitat to support a density of 18 deer per square mile is necessary to provide wolves and hunters with adequate foraging/hunting opportunities (see TPIT clarification letter regarding correct interpretation of deer density stated in Wolf standards and guidelines and additional discussion below regarding subsequent modification). This density does not represent actual population density and is not related to wolf viability, but represents the functioning of the predator-prey system dynamic. Although the Tongass and the ADF&G conduct limited deer pellet surveys to estimate deer population trends, robust deer density estimates are not available for the Tongass because surveys are conducted in a very limited number of areas (they focus on areas with heavy hunting pressure) and are inconsistently conducted from year to year. Given these limitations, impacts to actual deer density cannot be quantified per se; however, some generalizations can be made about the effects of changes in habitat capability on deer numbers if information about current population trends is known.

It can be assumed that the carrying capacity for deer, or the maximum population size that a given area can support, influences how a deer population might react to changes in habitat capability. That is, if habitat capability were substantially reduced in an area, a deer population may simply slow in growth or stabilize if the population is below carrying capacity, or it may dramatically decline if it is at, or exceeding, carrying capacity because resources would no longer be adequate. This in turn relates to the influence of wolf predation on the deer population in that predation can be compensatory if the population exceeds carrying capacity (i.e., wolves kill deer that normally would have died of starvation), or additive if the population is below carrying capacity (i.e., wolves kill healthy deer that normally would have survived the winter). In the latter case wolf predation may contribute to a locally declining deer population and may actually suppress recovery of deer populations following severe declines (Person et al. 1996, Person 2001, Bowyer et al. 2005). This effect is sometimes referred to as a predator pit. For example, the slow rebound in the deer population on some of the south central islands in the Alexander Archipelago following severe winters in the late 1960s and early 1970s have been attributed to a combination of factors, including several severe winters, low-quality winter deer habitat in some locales (such as Kupreanof Island), and predator suppression (Kirchhoff 2003). Clearly, deer populations and the ability of a habitat to support deer are influenced by a myriad of factors not accounted for in this comparison. Weather, hunter effort, current deer population trends, allowed hunting pressure, and the presence of other predators are some of the factors that influence deer numbers and the magnitude of impacts related to changes in habitat capability. Moreover, there are time-lag effects associated with changes in habitat capability.

The 2005 ADF&G deer management report provides general information on deer population trends by GMU (Porter 2005, Lowell 2005). Both GMU 2 and 3 populations have historically fluctuated with the most severe declines having been associated with winter weather; however predation and illegal harvest have extended these declines. Current ADF&G management goals, which are to increase population levels in these units, indicate that deer populations are below carrying capacity. Deer populations in GMU 2 are reported to be at moderate levels but expected to decline; deer populations in GMU 3 are reported to be stable with some localized variation. Continued logging is anticipated to result in a decrease in carrying capacity over the long-term due to reductions the amount of available winter range. In GMU 2 a reduction in carrying capacity of up to 60 percent has been projected (Porter 2005). This means that over the long-term reductions in habitat capability could cause deer numbers to decline, reducing the number of deer available to wolves.

Timber harvest of important deer winter range reduces modeled deer habitat capability over the long term. Immediate concerns with all action alternatives focus on the cumulative effects of past timber harvest on the reduction in deer habitat capability on Prince of Wales and Kosciusko Islands (GMU 2), where a substantial amount of harvest has already occurred. In the 25 WAAs on Prince of Wales and Kosciusko islands, reductions in deer habitat capability would be greatest under Alternatives 4 and 7. Alternatives 1, 2, 3, and 6 would result in an equal or smaller reduction in deer habitat capability on these islands than Alternative 5 (No Action) (Table 3.10-7). The risk of not sustaining a well distributed, viable wolf population increases under Alternatives that have multiple WAAs within a single biogeographic province where large reductions in deer habitat capability would occur and where deer habitat capability is already low, but would be further reduced (e.g., WAAs on North Central Prince of Wales and South Prince of Wales biogeographic provinces). In several cases, deer habitat capability under Alternative 7 would be reduced to below 40 percent of that existing in 1954 prior to large-scale timber harvest. Of the 16 WAAs on Kuiu, Kupreanof, and Mitkof islands (GMU 3) maximum estimated reductions in habitat capability range from 2 to 47 percent. Risks to wolves would be slightly lower on these islands due to the lower level of planned timber harvest.

An index of the ability of the alternatives to support deer populations capable of maintaining sustainable wolf populations and meeting human harvest demands can also be approximated by using the deer habitat capability model to project habitat capability in terms of deer density (i.e., the number of deer per square mile an area may be capable of supporting) for comparison with the Wolf standard and guideline described above. In the wolf conservation assessment (Person et al. 1996), a population density of 13 deer per square mile, was recommended to maintain sustainable wolf populations, assuming an annual deer reproductive rate of 30 percent. This equates to approximately 17 deer per square mile at carrying capacity (Person et al. 1996). That is, to provide for a population of 13 deer per square mile there needs to be an average long-term habitat capability of 17 deer per square mile over broader areas. This number was later revised to the current value of 18 deer per square mile as stated in the standard and guideline. It must be emphasized that these model outputs do not represent actual deer densities and cannot be used to predict changes in the prey base available to wolves and hunters, rather they are intended as one method of making relative comparisons among the alternatives. At the project level, other factors such as local knowledge of habitat conditions, spatial location of habitat, and other site-specific information need to be considered

Based on ADF&G recommendations, habitat capability in terms of deer density was calculated by assuming a density of 100 deer per square mile for an HSI of 1.0. Only WAAs where wolves potentially occur (GMUs 1, 2, 3, and 5) were included. Table 3.10-9 shows long-term wolf habitat capability in terms of deer per square mile.

The Wolf guideline is intended to apply to biogeographic provinces where deer are the primary prey of wolves. Thus, the number of WAAs that appear to fall below 18 deer per square mile in terms of habitat capability is inflated because many either do not naturally contain much suitable deer habitat or are areas where wolves also prey heavily on species other than deer such as moose, beaver, or mountain goats. All of the alternatives increase the number of WAAs that do not maintain habitat capable of supporting 18 deer per square mile, the greatest number being added under Alternative 7, followed by Alternatives 4, 5/6, 3, 2, and 1, respectively. Most of the WAAs that currently meet the Wolf guideline, but may not meet it in the future after 100+ years of implementation, are located in the North Central Prince of Wales and Revilla Island/Cleveland Peninsula biogeographic provinces.

Table 3.10-9.
Comparison of Alternatives in terms of their Long-term Ability to Meet the Wolf Guideline of Providing Sufficient Habitat to Support 18 Deer per Square Mile after 100+ Years of Forest Plan Implementation [1]

	Increase in Percent of WAAs, Relative to 1954 Conditions, with Model-generated Habitat Capability <18 Deer/Sq. Mi. [2]	Biogeographic Provinces of WAAs Affected by Implemention of the Alternatives [3]
1954 Conditions[4]	--	-
Current Conditions	+12%	-
Alternative 1	+16%	14, 15
Alternative 2	+17%	11,14, 15, 18
Alternative 3	+25%	11, 14, 15, 18
Alternative 4	+22%	9, 10, 11, 12, 14, 15, 18, 20
Alternative 5	+22%	9, 10, 11, 12, 14, 15, 18, 20
Alternative 6	+22%	9, 10, 11, 12, 14, 15, 18, 20
Alternative 7	+25%	9, 10, 11, 12, 14, 15, 18, 20

[1] Assumes full implementation of Forest Plan at ASQ levels.

[2] Excludes WAAs where wolves do not occur (Admiralty, Baranof, and Chichagof islands and associated small islands) and WAAs with naturally very low deer densities (WAAs 4302-4607). Habitat capability in terms of deer density calculated using a multiplier of 100 deer per square mile equating to a habitat suitability index score of 1.0.

[3] Biogeographic Provinces: 9 = Northern Coast Range; 10 = Kupreanof/Mitkof Island; 11 = Kuiu Island; 12 = Central Coast Range; 14 = North Central Prince of Wales; 15 = Revilla Island/Cleveland Peninsula; 18 = South Prince of Wales; 20 = South Misty Fiords (some WAAs may overlap more than one biogeographic province)

[4] Approximately 69 out of 122 WAAs (57%) were estimated to have had deer habitat capabilities <18 deer per square mile in 1954.

As noted above, human access on roads may result in wolf mortality by both legal and non-legal harvest. Therefore, road densities are a factor to consider in sustaining wolf populations. Person et al. (1996) suggested that roadless and unfragmented reserves should be established in biogeographic provinces where extensive timber harvesting is planned to reduce long-term risks to wolf viability. Reserves of approximately 50,000 acres for each 192,000 acres of landscape area were considered necessary to support relatively secure core wolf populations. Spacing among reserves was not a critical criterion due to the extensive movement capability of wolves. The 1997 Forest Plan established habitat reserves in excess of this amount in Prince of Wales/Kosciusko islands and Kuiu/Kupreanof/Mitkof islands, including one reserve greater than 200,000 acres in size in the North Central Prince of Wales biogeographic province. Based on reductions in deer habitat capability and the existence of roadless refugia, Alternative 11 in the 1997 Final EIS (Alternative 5 here) was determined to meet the reserve criteria identified by Person et al. (1996) and was ranked as having a high likelihood of sustaining persistent core wolf populations and reducing risks to long-term viability in the two principal areas of concern in Southeast Alaska (GMU 2 and 3) as well as the remainder of the historic wolf range on the Tongass (Iverson 1997c, 1996c) (Appendix D). Alternatives 3, 4, and 6 would also be rated high (Appendix D). Given the higher level of timber harvest and reduction of the Old-Growth Habitat

LUD under Alternative 7 would have a moderately high likelihood of maintaining well-distributed, viable wolf populations.

The current Wolf standards and guidelines state that “where road access has been determined through analysis to significantly contribute to wolf mortality…open road densities of 0.7 to 1.0 mile per square mile or less may be necessary to reduce mortality to sustainable levels.” This metric is appropriately applied at the project level to areas that are the approximate size of an average wolf pack territory (about 74,000 acres; Person et al. 1996). For this analysis, total road densities were calculated by WAA, the average size of which is 90,000 acres. Thus, road densities reported here are likely slightly lower than what could actually be experienced within a wolf pack territory. Currently, out of the 54 WAAs in GMUs 2 and 3, there are 19 WAAs with total road densities greater than 1.0 mile per square mile (including both NFS and non-NFS lands). After full implementation of the Forest Plan (100+ years), the total number of WAAs where this is exceeded would be greatest under Alternative 7 (30 WAAs), followed by Alternatives 4 (29 WAAs), 5 and 6 (28 WAAs), 3 (27 WAAs), 2 (25 WAAs), and 1 (23 WAAs) Although additional research is needed to determine whether or not a direct correlation exists between local wolf population dynamics and road density, research indicates that the likelihood of maintaining viable wolf populations would be lowest in areas that have the highest road densities, due to higher trapping and hunting harvest rates (*Alexander Archipelago Wolf*, presented at the Tongass Conservation Strategy Review Workshop 2006), though this is situation-specific in that it depends on how accessible roads are (i.e., whether they are near main road systems or human settlements). In addition, harvest levels can be controlled through regulations. However, Alternatives 4 and 7, in increasing order, would be most likely to result in increased harvest pressure and illegal mortality associated with higher road densities. However, if a viability concern emerged, there are other Forest-wide standards and guidelines in place that would mitigate road-related effects including road closures that effectively prohibit motorized vehicle traffic (e.g., bridge and culvert removal) and off-highway vehicle restrictions.

Bald Eagle

Bald eagles primarily nest in old-growth trees along the coast and within riparian areas. Over 90 percent of the known nests on the Tongass are within 50 feet of the saltwater beach. The Bald Eagle and Riparian Forest-wide standards and guidelines are specifically designed to protect nesting habitat and the current Forest Plan includes 1,000-foot beach and estuary buffer requirements. The amount of nesting habitat in OGRs, non-development LUDs, and the 1,000-foot beach and estuary buffer protects virtually all bald eagle nesting habitat on the Tongass. All of the action alternatives considered here would maintain these standards and guidelines and provide the same level of protection as the current Forest Plan, with the exception of Alternative 7, which proposes to reduce the beach fringe buffer to 500 feet. Therefore, only slight effects to bald eagles are expected under Alternatives 1, 2, 3, 4, 5, or 6. Under Alternative 7, protection of bald eagle nests occurring beyond 500 feet from saltwater would be reduced to the required 330-foot nest buffer, which would limit protection of nesting habitat to the area around known nests. This would reduce the overall amount of habitat potentially available for nesting in areas where road construction and harvest occur.

Red-breasted Sapsucker, Hairy Woodpecker, Brown Creeper, and Red Squirrel

These species rely on legacy components (e.g., large diameter trees, snags) of the old-growth forest ecosystem for nesting and foraging. A simple index of the level of habitat protection provided by each alternative is the amount of suitable old growth schedule to be harvested. After full implementation of the Forest Plan, the greatest percentage of existing POG could be harvested under Alternative 7 (16 percent), followed by Alternative 4 (13 percent), Alternatives 5 and 6 (9 percent), Alternative 3 (6 percent), Alternative 2 (4 percent), and Alternative 1 (2 percent) (see Table 3.10-5). Thus, Alternatives 7, 4, 5, 6, 3, 2, and 1 would have an increasingly greater chance of maintaining habitat capable of supporting well distributed, viable populations of these species.

Under Alternative 5 (No Action), non-development LUDs provide broader protection for old-growth forest, where as Reserve Tree/Cavity-nesting Habitat, Goshawk Foraging, and Marten Habitat standards and guidelines provide protection to old-growth habitat components within matrix lands. The application of two-aged and uneven-aged management under Alternative 5 provides further habitat protection for these species. The current Goshawk and Marten standards and guidelines are applied to areas of the Forest with the greatest amount of disturbance. Although the new Legacy standard and guideline proposed under Alternatives 1, 2, 3, and 6 would affect less overall area, it would be applied on a Forest-wide basis and require that retained trees and snags be representative of the existing stand age, species composition, and structural components (Appendix D). In contrast, neither the Goshawk Foraging, the Marten Habitat, nor the new Legacy Forest Structure standards and guidelines would be implemented under Alternatives 4 and 7. Therefore under these alternatives there would be no quantitative direction for the retention of structure, and consequently, together with the higher rate of harvest, Alternatives 4 and 7 would have greater effects on these species.

Vancouver Canada Goose

Vancouver Canada geese use wetlands (forested and non-forested) in the estuary, riparian, and uplands areas of the forest. Habitat needs for these species are specifically provided for under the waterfowl standards and guidelines, which apply to specific sites, and a 100-foot buffer around lakes or streams. The beach, estuary, and riparian Forest-wide standards and guidelines provide additional protection to habitats used by Canada geese. Consequently, there is no increased risk of habitat loss associated with any alternatives considered under this Forest Plan amendment, with the exception of Alternative 7, which proposes to reduce the beach fringe buffer to 500 feet and could result in the loss of suitable habitat in areas outside of this buffer if timber harvest and associated activities occur.

Other Species of Concern

Marbled Murrelet

Distributional and ecological information about marbled murrelets in Southeast Alaska is largely lacking but high value habitats appear to be those found within large, contiguous blocks of high volume, low-elevation old-growth forest. Fragmentation and loss of overstory cover are two threats associated with development activities, such as timber harvest, that are correlated with increased predation. Alternative 11 of the 1997 Forest Plan Final EIS (Alternative 5 here) was determined to provide a very high likelihood of sustaining well distributed murrelet populations throughout Southeast Alaska due to the reserve system, which includes at-risk landscapes with high levels of past timber harvest, as well as beach and riparian protection.

Alternative 7 proposes to harvest the greatest amount of existing POG (16 percent), and thus provides the least protection to marbled murrelets due to direct habitat loss and fragmentation and the limited reserve system. This is followed, in decreasing order of potential impacts, by Alternative 4 (13 percent), Alternatives 5 and 6 (9 percent), Alternative 3 (6 percent), Alternative 2 (4 percent), and Alternative 1 (2 percent) (Table 3.9-5). Alternatives 1, 2, 3, 5, and 6 would be judged as having a very high likelihood of maintaining viable and well distributed marbled murrelet populations, Alternative 4 was judged high, and Alternative 7 was judged moderately high (Appendix D).

Spruce Grouse

Spruce grouse have historically inhabited forests showing a disturbance-related patchwork of various stages of regeneration. Timber harvest can produce similar patterns, but only if clearcut areas are small and if sufficient quantities of forested habitat are preserved. Spruce grouse inhabit some of the most highly modified landscapes on the Tongass (e.g., Prince of Wales Island) where additional timber harvest could threaten the long-term survival of these highly isolated and scattered low-density populations. This has particularly important conservation implications since the subspecies that occurs in Southeast Alaska is endemic. Conservation measures including a system of non-development LUDs and standards and guidelines that maintain connectivity within matrix lands (e.g., various buffer requirements) are essential to facilitating dispersal and interchange between isolated populations. Spruce grouse are also vulnerable to hunting and exploitation, correlated with road access, because they are not wary of humans, though viability is not an immediate concern given the level of harvest permitted in this area.

Spruce grouse are an important prey species for goshawks and marten. In a study of goshawk diet during the breeding season in Southeast Alaska, birds (including spruce grouse) comprised a larger proportion of goshawk diet on Prince of Wales Island than elsewhere due to the limited number of prey species, many of which are sensitive to timber harvest activities (Lewis et al. 2006). This study concluded that the ability of goshawks to successfully reproduce in Southeast Alaska and on Prince of Wales Island in particular, appears to be affected by the extensive landscape alteration in this region in combination with the restricted prey base. Thus, alteration of spruce grouse habitat could have a resonating effect on predator populations.

Given the current level of habitat modification in areas of the Tongass occupied by spruce grouse, the greatest protection would be provided by alternatives that propose the least amount of POG harvest and those with provisions for maintaining landscape connectivity. As described above under the marbled murrelet analysis, the greatest amount of habitat protection would be provided by Alternative 1, followed by Alternatives 2, 3, 6, 5, 4, and 7. Alternative 1, 2, 3, and 5, also include the most measures for maintaining landscape connectivity through the existing system of OGRs, where as Alternatives 4 and 7 reduce or eliminate the OGR system, respectively. Thus the alternatives in this order would have a decreasing likelihood of sustaining spruce grouse populations capable of providing an adequate prey base for goshawks and other predatory species and sustaining current levels of harvest.

Prince of Wales Flying Squirrel

Given that flying squirrel density in Southeast Alaska is highest in POG and closely tied to the abundance of large trees and snags, and that timber harvest occurs in forests where these habitat components are most abundant, the number of acres suitable for timber harvest is an appropriate measure of the relative effects of the alternatives on this species. The recent research described in the Affected Environment indicates that this risk is likely less than presumed because abundant noncommercial forests appear to contribute to breeding populations. Alternative 7 proposes the most acres of harvest, followed by Alternatives 4, 5, 6, 3, 2, and 1 (see Table 3.10-5 and the Marbled Murrelet discussion above). In addition to decreasing the abundance of these habitat components, timber harvest can also create openings that may be too large for flying squirrels to travel through, resulting in smaller, isolated populations that may be at risk of local extirpation. Consequently, a system of OGRs and retention requirements for forest legacy components are important for sustaining well distributed populations of flying squirrels.

Alternative 5 maintains the existing system of OGRs and Goshawk Foraging and Marten Habitat standards and guidelines that apply reserve tree requirements to matrix lands in the highest risk biogeographic provinces that have experience the highest cumulative effects of timber harvest (e.g., North Central Prince of Wales). Alternatives 1, 2, 3, and 6 also maintain the Forest-wide reserve system and replace the Goshawk Foraging and Marten standards and guidelines with the Forest-wide Legacy Structure standard and guideline; Alternatives 4 and 7 provide less protection because they include more area in development LUDs and do not include any of these standards and guidelines (see discussion under Red-breasted Sapsucker, Hairy Woodpecker, Brown Creeper, and Red Squirrel). In addition, Alternative 4 limits the OGR system to four of the most heavily logged biogeographic provinces, one of which is North Central Prince of Wales, and thus is not anticipated to affect Prince of Wales flying squirrels in that respect. Alternative 7 eliminates the Old-Growth Habitat LUD entirely. Consequently, Alternative 7 would have the greatest risk of creating isolated populations of flying squirrels susceptible to local extirpation both directly through habitat removal and through increased fragmentation by not incorporating provisions intended to maintain landscape connectivity.

Migratory Birds

Direct habitat and disturbance related effects to migratory birds would occur under all of the alternatives. The primary effect to birds would be nest destruction or abandonment if management activities occur in suitable nesting habitat during the breeding/nesting period, which generally begins in May and ends in September when young birds have fledged. The magnitude of the effects will vary depending on the alternative that is selected and the season in which disturbance would occur. It can be assumed that species most likely to be affected are those that nest in hemlock/Sitka spruce forests (e.g., blue grouse, rufous humming bird, and Pacific-slope flycatcher) where timber harvest occurs, and thus the amount of harvest proposed under the alternatives is a measure of the extent of potential effects.

Alternative 7 would remove the most POG after full implementation of the Forest Plan (roughly 100+ years) followed in descending order by Alternatives 4, 6, 5, 3, 2, and 1, respectively. Total percentage of POG harvest would range from 16.7 percent of existing POG under Alternative 7 to 1.7 percent of existing POG under Alternative 1. In addition, Alternatives 1, 2, 3, 5, and 6 include some provisions for retaining additional legacy forest structure either through the existing Goshawk Foraging, Marten Habitat, and Cavity-nester standards and guidelines (Alternative 5), or through a Forest-wide Legacy Structure standard and guideline. Therefore, these alternatives would provide more available legacy structure to migratory birds for nesting, roosting, and foraging than Alternatives 4 and 7, which do not include any legacy retention requirements.

Other effects of timber harvest and associated activities include the fragmentation and patch size reduction of suitable habitat. For species such as the varied thrush and Townsend's warbler, habitat removal would potentially reduce the effectiveness of interior habitat and increase the potential for nest-site predation from avian predators that are associated with forest edges and fragmented landscapes. The Conservation Strategy was designed to retain large blocks of old-growth distributed across the Forest, such that interior nesting habitat would be retained across the landscape. In addition, other retention in the matix, including the 1000' beach and estuary buffer, benefits migratory birds and mitigate negative effects of fragmentation in the matrix. Therefore, effects to species associated with interior forest conditions would be greatest under Alternatives 4 and 7, in increasing order, because they reduce or eliminated the OGR system, respectively. Effects to other species that are more closely associated with forest edge, riparian, or more open habitats would likely be negligible under Alternatives 1, 2, 3, 4, 5, and 6, which maintain species-specific and/or Forest-wide standards and guidelines that provide protection measures for key habitats (e.g., beach, estuary, and riparian buffers). However, the beach fringe buffer would be reduced to 500 feet under Alternative 7, thus decreasing the amount of protected nesting habitat in these areas and reducing the amount of interior habitat available. Some species, particularly those associated with edge habitats, may benefit from timber harvest proposed under any of the alternatives due to the creation of new habitat. Greatest adverse impacts to migratory birds would occur in the four most heavily disturbed biogeographic provinces where a majority of future timber harvest is concentrated (e.g., North Central Prince of Wales Island, Kupreanof/Mitkof islands, Revillagigedo Island/Cleveland Peninsula, and Etolin Island provinces).

Endemic Mammals

The 1997 Forest Plan Final EIS panel assessments evaluated 14 species or subspecies endemic to Southeast Alaska (Shaw and Smith 1995, Iverson 1997b). All of these species occupy restricted ranges, limited to a subset of islands in Southeast Alaska. Under the current Forest Plan all islands less than 1,000 acres were removed from the timber base to eliminate risk to these species associated with habitat loss or alteration from timber harvest. The 1,000-foot beach buffer, riparian corridors, and OGR system are also features of the current Forest Plan that provide functional habitat for species with relatively small home ranges. In addition, implementation of various standards and guidelines that apply within matrix lands will result in significant old-growth retention, which also benefits many endemic mammals. These protective provisions would be maintained under all the alternatives, with the exception of Alternative 7 under which the beach fringe buffer would be reduced to 500 feet and the system of OGRs eliminated.

The panel assessments emphasized that just being an endemic represented a naturally elevated viability risk and that all alternatives had some likelihood of causing extirpation of endemic species based on historical and proposed timber harvest activity and that this likelihood increased with higher levels of proposed harvest. This is consistent with recent science suggesting that the areas of greatest conservation concern in the Alexander Archipelago are biodiversity hotspots (i.e., areas where multiple endemic mammal lineages occur), many of which coincide with the most heavily impacted areas (Cook et al. 2006). Based on the 1997 expert panel assessments for endemics (Iverson 1997b), it can be concluded that Alternative 5 (which is the equivalent of Alternative 11 in the 1997 Forest Plan Revision Final EIS) and Alternative 6, which proposes to harvest slightly less timber, would have a moderate likelihood of sustaining viable, well-distributed populations of endemic mammals (Appendix D). Alternatives 1, 2, and 3, which propose to harvest less timber than Alternatives 5 and 6, would only build on the above scenario, but also would be ranked as having moderate likelihoods of sustaining viable, well-distributed populations of endemic mammals over the long-term. Because of the level of past harvest, the panel also rated a no-harvest alternative as having a moderate likelihood

Based on the expert panel assessments (Shaw and Smith 1995, Iverson 1997b) Alternative 4 (equivalent to Alternative 6 in the 1997 FEIS) would be rated as having a moderately low likelihood of maintaining viable, well-distributed populations of endemic mammals given proposed harvest levels. Alternative 7 (equivalent to Alternative 2 in the 1997 FEIS) would have a very low likelihood of sustaining well-distributed, viable endemic populations, and would have the highest likelihood among the alternatives to result in endemic populations that exist only in refugia (e.g., northern flying squirrel) or become extirpated (e.g., Keen's myotis).

Invasive Species

Although a number of non-native wildlife species have been accidentally introduced or transplanted in Southeast Alaska, the only species considered invasive (i.e., based on the definition that they cause harm to the economy, environment, or humans) at the present time is the Norway rat; elk in Southeast Alaska may be considered invasive in certain geographic areas due to their effects on habitat in areas to which they were not intentionally introduced. Although the current Forest Plan does not specifically address invasive species, its intent is to manage for native species, as evidenced by the Goals of the Forest Plan, and in the Biodiversity and Forest Health sections, albeit these sections emphasize invasive plants.

At the time of this writing, none of the alternatives propose changes to the management framework of the Tongass in relation to invasives and neither the Norway rat nor elk are addressed under the Forest Plan Monitoring section or standards and guidelines. However, the Alaska Region of the Forest Service is currently developing an invasive species strategy that will apply the principles of prevention, early detection, control, and rehabilitation in cooperation with various agencies and partners.

Activities that create or enhance the habitats preferred by invasive species may facilitate range expansion. This premise can be used as a measure of how the alternatives potentially contribute to, or reduce, the invasive species problem. Norway rats inhabit coastal habitats where the main cause of range expansion, or source of new introductions, is shipping activity. Management activities on the Tongass have no effect on shipping activity and therefore will not influence the occurrence of Norway rats.

In contrast, elk in Southeast Alaska have similar habitat requirements to black-tailed deer and therefore may benefit from habitat enhancement resulting from timber harvest. Timber harvest has been a precursor to both deer and elk population expansions in many parts of the western United States, due to the resulting increase in forage. Although, forest management activities on the Tongass will have no influence on the ability of elk to move between islands, they may affect the success of elk in colonizing new islands, particularly those in the vicinity of Zarembo and Etolin Islands where elk sightings are becoming more frequent, or the likelihood of expanding their distribution on larger islands where smaller populations exist.

Elk, like deer, require a mosaic of habitat types for foraging, finding shelter, and obtaining security from predators and humans. Timber management activities that create gaps in the forest canopy create a favorable environment for the establishment and growth of early seral vegetation, thus increasing the abundance and variety of forage available to elk (Skovlln et al. 1989). However, because of their wariness, elk generally forage in proximity to hiding cover and are not likely to use the interior areas of large gaps due to the lack of accessible cover (Thomas 1979). Elk have also been shown to avoid ongoing road construction and timber harvest, using adjacent areas of cover (e.g., late seral stands) until the conclusion of these activities. Therefore, over the short-term, elk will likely avoid areas of proposed timber harvest activities while activities are ongoing. However, over the long-term all of the alternatives have the potential to promote elk establishment in areas where they propose timber harvest. However, the extent to which this affects the expansion of the elk population is dependent upon the timing and location of timber harvest and associated activities. It is important to note however, that elk are a desired non-native species on Zarembo and Etolin islands where they were introduced. The Forest Service and ADF&G are working collaboratively to identify research needs including determining existing population levels and documenting the distribution of elk on these islands and elsewhere.

Alternate Risk Assessment Method

To determine whether the alternatives provided sufficient habitat to sustain all indigenous wildlife across the planning area the Forest Plan FEIS relied in part on the findings of structured panel assessments. As described above these panel assessments provided estimates of the relative risk, in the form of a probability, that implementating the range of management alternatives would pose to the continued persistence across the landscape of an array of species. Scores from individual panel members were averaged to assign probabilities to 5 possible outcomes related to population distributions: occupancy of historic range (Outcome I), temporary gaps in distribution (Outcome II), permanent gaps in distribution (Outcome III), existence in refugia (Outcome IV), and local extirpation (Outcome V).

Recently, Smith and Zollner (2005) argued that using the most vulnerable species to assess impacts of land management likely underestimates the probability of extinction of wildlife species across the planning area because the risk of local extirpation increases with the number of extinction prone species considered. Additionally, the management alternative that poses the greatest risk to the most vulnerable wildlife species may not pose the greatest risk to the wildlife community as a whole (Smith and Zollner 2005). The authors present an alternative method for assessing risk to wildife viability that considers the risk of “any” extinction among species at risk in the planning area. To accomplish this, an equation is used which calculates the joint probablitity of at least one extinction among the set of selected species to compare the relative, rather than absolute, risk of extinction among land management alternatives (see Appendix D and Smith and Zollner (2005) for the equation and for statistical details).

This method was used to rank the current alternatives in terms of relative level of viability risk, in order to consider an alternate method for risk assessment. The likelihood scores assigned by the 1995/96 and 1997 expert panels were used to develop the index. Section 3.6 in Appendix D presents the results of this alternate risk assessment for Alternatives 4, 5, 6, and 7, which are the alternatives most easily related to the alternatives assessed by the risk assessment panels.

Applying this risk assessment method indicates that, when all evaluated species are considered jointly, Alternatives 4 and 7 would have the greatest risks. This difference is driven primarily by potential risks to the endemic and widely distributed mammals groups, which have the highest risks of any species or group evaluated (Appendix D). The risk index was substantially lower for Alternatives 5 and 6. Because Alternatives 1, 2, and 3 would harvest less timber than Alternative 5 or 6, but maintain equivalent or more protective conservation measures, their risk indices would likely be lower than the corresponding indices for Alternatives 5 and 6. As expected based on harvest acres, the lowest risk indices would be associated with Alternative 1.

Monitoring and Evaluation Program

One facet of the Forest Plan amendment is a rigorous review of the Monitoring and Evaluation Program, including the MIS approach. As noted above, the MIS concept allows a manageable subset of species, whose response to land management activities can be used to predict the likely response of other species with similar habitat requirements, to be used in planning. Consistent with planning regulations under the NFMA, the Tongass has selected the list of 13 MIS described above and has developed monitoring strategies for each species to track population trends.

Forest Plan Standards and Guidelines narrow the selection of suitable indicator species to emphasize management for indigenous wildlife species and natural habitat (WLD112 I(B)), and to provide the abundance and distribution of habitat necessary to maintain viable populations of existing native and desirable introduced species well distributed in the planning area (WILD112 II(B)). To achieve this, the MIS monitoring effort has been designed to determine if population trends for MIS and their relationship to habitat changes are consistent with expectations.

An assessment of monitoring data collected since 1997 indicates several shortcomings. First, monitoring data are not collected at a scale, or with sufficient statistical rigor, to determine population status or trends for an area as expansive as the Tongass. Moreover, due to the inherent difficulty of monitoring many species, which is a fundamental problem underlying the MIS approach on the Tongass, data are derived from the best available sources, yet they are generally not appropriate for answering specific forest management monitoring questions. That is, they are not useful in identifying a link between habitat modification and population trends. Thus, there are few species actually able to provide insight into whether or not the Conservation Strategy is meeting wildlife objectives, as established by the Forest Plan. One challenge related to this is that limited funding may preclude the development of new monitoring strategies, or may be insufficient to support an increase in monitoring efforts to improve statistical rigor. It is important to note however, that these problems are not unique to the Tongass, as many national forests are evaluating their MIS lists, as well as the value of the MIS approach in general.

One potential option for revising the Monitoring and Evaluation program under consideration is to shift the focus to a select number of 'focal' species that could be more intensively monitored. These species would likely be those that are most easily monitored, have the greatest economic and/or cultural value, or whose viability is of greatest concern. Another approach would be to use surrogate measures for monitoring impacts to species of concern, such as habitat characteristics (e.g., snag abundance) or prey species, which may be more conducive to monitoring. For example, focusing monitoring efforts on red squirrels, and establishing a relationship between their population trends and habitat modifications, may provide a better insight as to how management activities are affecting marten and goshawks than actually surveying for these species. The redesignation of MIS for the Tongass is continuing to be evaluated and new MIS are not being proposed at this time. Broader adjustments to the proposed Monitoring and Evaluation Program have been incorporated into the accompanying Forest Plan.

Cumulative Effects

Activities that occur on other land ownerships within and adjacent to the Tongass have the potential to affect the overall context within which effects of Forest management on wildlife population distribution and viability are considered. Such reasonably foreseeable activities include, but are not limited to, timber harvest, residential development, mining, recreation and tourism, and road construction. Typically these activities have the potential to negatively impact wildlife populations through habitat conversion, fragmentation, and disturbance associated with road building, though some activities can have short-term or long-term beneficial impacts, depending on the species (i.e., improved forage quality and quantity for deer following timber harvest). Prediction of the future extent and intensity of such activities has a high degree of uncertainty associated with it on a Forest-wide basis over a broad time scale. As such, cumulative effects associated with specific projects are most appropriately assessed at the project level. Therefore, this analysis will examine effects associated with general trends in activities on non-NFS lands.

Many private lands in Southeast Alaska are already highly developed in terms of roading and timber harvest and are likely to experience a continuing decline in old-growth forest in the future. Therefore, the cumulative long-term trend within the Forest boundary under all alternatives is likely to be a decline in optimum habitat for most old-growth associated species, with non-NFS land contributing to this trend. When combined with other management activities occurring on non-NFS lands, all alternatives would produce additional impacts to some species, but to varying degrees. Cumulative effects are anticipated to be the greatest under Alternative 7, which proposes the highest amount of timber harvest, followed by Alternatives 4, 5, 6, 3, 2, and 1 in decreasing order, and would be most evident in areas where timber harvest is concentrated. Table 3.9-20 in the *Biodiversity* section summarizes the maximum long-term cumulative percent of the original POG that would be harvested in Southeast Alaska on all ownerships by biogeographic province. This table shows that the current cumulative past harvest on public and private lands equals 13 percent of all POG in Southeast Alaska (87 percent POG retention). Looking 100+ years into the future, cumulative POG harvest levels on all lands of Southeast Alaska would vary by alternative, ranging from 18 percent (80 percent POG retention) under Alternative 1 to 29 percent under Alternative 7 (71 percent POG retention). Under Alternatives 5 (no action) and 6 (proposed action), projected cumulative harvest levels would be 24 percent (76 percent POG retention). The highest rates of cumulative harvest would be in the North Central Prince of Wales biogeographic province (49 percent under Alternatives 5 and 6), Dall Island and Vicinity (45 percent under Alternatives 5 and 6), the Chilkat River Complex (44 percent under Alternatives 5 and 6), and Kupreano/Mitkof Island province (39 percent under Alternatives 5 and 6).

Cumulative harvest of high-volume and large-tree POG are summarized in Tables 3.9-21 and 3.9-22 of the *Biodiversity* section. These results show that because of historic disproportionate harvest, especially on private lands, the current cumulative past harvest of high-volume and large-tree POG in Southeast Alaska is estimated at 18 and 32 percent, respectively. Looking 100+ years into the future, cumulative high-volume POG harvest levels would again, vary by alternative, ranging from 25 percent (75 percent high-volume POG retention) under Alternative 1 to 35 percent under Alternative 7 (65 percent high-volume POG retention). Under Alternaties 5 (no action) and 6 (proposed action), projected cumulative harvest levels would be 30 percent (70 percent high-volume POG retention). Similarly, for large-tree POG, cumulative harvest levels would range from 38 percent under Alternative 1 to 48 percent under Altenative 7. Under Alternatives 5 and 6, projected cumulative harvest levels for large-tree POG would be 43 percent.

Evidence from theoretical and empirical studies suggests that the likelihood of a population persisting over time is related to some threshold level of habitat loss across the landscape (Fahrig 1997, 1999, 2003; Flather et al. 2002; Andren 1994). Haufler (2006) reviewed the literature and found that, based on modeling, habitat loss and reduction of population size are linearly related, up to some threshold. Below this threshold, the additional effects of habitat fragmentation increase the rate of population reduction, and in turn, the risk of extinction. Haufler (2006) also concluded that empirical studies provided support for this relationship.

Reported threshold levels for the percentage of habitat maintained at which the rate of landscape extinction increases range from 20 percent (Fahrig 1997) to 50 percent (Soule and Sanjayan 1998), depending in part on the dispersal capability of the species under consideration. In a modeling analysis, With (1999) demonstrated that landscape connectivity became a concern for species with some dispersal capability (e.g., wolves) when habitat was reduced to below 20 percent of the landscape, whereas when the landscape consisted of less than 40 percent habitat it became a concern for species with limited dispersal capabilities (e.g., flying squirrels). Natural fragmentation of habitats can also affect the level of additional fragmentation that can be supported.

None of the alternatives would result in less than 71 percent of the original POG remaining on the Southeast Alaska landscape after 100+ years. In addition, at least 51 percent of the original POG would be retained within each of the 23 individual biogeographic provinces under Alternatives 1, 2, 3, 5, and 6. Only under Alternatives 4 and 7, would this percentage fall below 50 percent, and then only in one province – North Central Prince of Wales (Table 3.9-20). Likewise, on a Southeast Alaska basis, none of the alternatives would result in less than 65 percent of the original high-volume POG remaining after 100+ years. At least 41 percent of the original high-volume POG would be retained in all 23 individual provinces under Alternatives 1, 2, 3, 5, and 6. In Alternatives 4 and 7, this percentage would decline to 39 and 33 percent in the North Central Prince of Wales province (Table 3.9-21). Finally, under each of the alternatives at least 52 percent of the large-tree POG would be retained over the entire landscape in Southeast Alaska after 100+ years. Under Alternatives 1, 2, 3, 5, and 6, this minimum percentage would range from 57 to 62 percent. For individual provinces, this percentage could drop as low as 31 to 33 percent in the East Baranof Island and Chilkat River Complex provinces under each of the alternatives, except Alternative 7 (Table 3.9-22). Under the latter alternative, the minimum percentage in the Kupreanof/Mitkog province could decline to 29 percent.

Although some wildlife species make higher use of the larger forest types defined by high-volume and large-tree POG, none of the wildlife species of concern are restricted to these habitats. In fact, all wildlife species make at least some use of types other than mapped POG (e.g., unproductive old-growth and older young-growth forests). Therefore, based on the reported habitat loss thresholds, it is unlikely that cumulative timber harvest would result in significant viability concerns for any species of wildlife in any of the provinces, except under Alternatives 4 and 7. The reduction of POG to below 50 percent in North Central Prince of Wales province, coupled with the greater reduction of larger forest types, would result in greater long-term viability concerns in this province under Alternatives 4 and 7. Under these alternatives, species with low dispersal capabilities, in particular, would have landscape connectivity concerns over the long term.

Additional effects, associated with the cumulative timber harvest described above, include road construction, which has the potential to impact wildlife species through habitat fragmentation, and access-related disturbance. Species that may be especially sensitive to this include forest interior species and large predators. Table 3.10-10 summarizes existing and proposed total (open and closed roads) road density by the number of WAAs within road density categories on NFS and combined (NFS and non-NFS) land ownerships. Generally road densities on private and state lands are greater than those found on adjacent NFS lands. In addition, there are no road closure/access management guidelines in place on these lands to reduce effects to sensitive species. The greatest cumulative road densities (NFS and non-NFS lands) would occur under Alternative 7, followed by Alternatives 4, 5 , 6, 3, 2, and 1. Maximum (i.e., proposed under Alternative 7) cumulative road densities would be greatest on Prince of Wales, Kupreanof, and Chichagof islands where a number of WAAs would exceed total road densities of 2 miles per square. Therefore the potential for habitat fragmentation, increased human access, and overharvesting of some species would be greatest under Alternative 7 followed by Alternative 4, followed by Alternatives 5, 6, 3, 2, and 1.

Cumulative habitat disturbance is especially problematic for archipelagos such as the Tongass, where habitat is already naturally fragmented among oceanic islands, average population size is smaller than in mainland habitats, source populations are isolated, and demographic stochasticity and inbreeding depression increase risk of extinction (Cook et al. 2006). This is particularly pertinent for endemic taxa (e.g., POW flying squirrel) that already exist in isolated populations by default, and for species that are less mobile (e.g., spruce grouse). The Conservation Strategy was designed to address this through the network of non-development LUDs, including the OGR system, and Forest-wide standards and guidelines both of which were intended to maintain habitat components important to a variety of species and maintain connectivity across the landscape. Alternative 5 would continue to do so by maintaining all elements of the current Forest Plan. By proposing less harvest and strengthening some of the existing standards and guidelines, Alternatives 6, 3, 2, and 1 in increasing order would have a greater chance of maintaining wildlife habitats and connectivity. However, because the Conservation Strategy is weakened under Alternatives 4 and 7, and these alternatives proposed the greatest amount of harvest and road construction, these alternatives would result in greater habitat loss, fragmentation and population isolation, and therefore have the greatest relative risk of not sustaining well distributed, viable wildlife populations across the Tongass over the long-term.

While this analysis is informative and updates the analysis of cumulative effects, it is important to note that the conclusions drawn by the wildlife viability panels done for the 1997 Forest Plan and brought forward for this Amendment fully considered the level of past and likely future harvest and associated development on non-NFS lands. Likelihood scores recognized the combined effects of harvest and road development on these land ownerships. Therefore, the viability ratings represent a cumulative effects prediction for each alternative. The goshawk, deer, marten, and marbled murrelet panels identified habitat loss as a key impact of the alternatives on these species. The old-growth reserve system was specifically identified as being important to the likelihood of maintainging viable, well-distributed populations of marbled murrelets, marten, and goshawks. Population isolation resulting from habitat fragmentation and barriers to migrating individuals in some biogeographic provinces was also identified as a key impact of the alternatives on endemic mammals. Effects associated with human access associated with road development were identified as key impacts to brown bears (in relation to DLP mortality and hunting pressure) and wolves (in relation to legal and illegal hunting and trapping).

Because wildlife populations exist across all land ownerships, managing adverse effects of management activities on wildlife often must be dealt with collaboratively. In addition, the population viability and distribution of wildlife on the Tongass is influenced in part by state and federal regulatory mechanisms such as harvest limits, season length, and population management objectives. Overall, the wildlife resources and associated habitat on the Tongass remain in good condition and are mostly dominated by old growth. As development continues through timber harvest, associated activities, and community expansion, particularly in areas where extensive development has already occurred (i.e., Prince of Wales Island) maintaining connectivity and roadless refugia will become increasingly important, particularly for wide-ranging species whose distribution depends on the availability of travel corridors and known “pinch-points” to access important habitats and move across the landscape. In addition, the management of human resources will continue to play a role in the viability and distribution of wildlife across the Forest.

While research since 1997 has provided a wealth of information on wildlife populations and habitat relationships in Southeast Alaska, there continue to be gaps in knowledge about the ecology and distribution of many species and direct correlations between land management activities and population impacts. The conservation strategy itself is a major step toward maintaining landscape connectivity on the Tongass, however, the effectiveness of its reserves and buffers in relation to their size, landscape pattern, and geographic distribution has yet to be scientifically tested (Powell et al. 1997). The future importance of individual elements of the conservation strategy in terms of their ability to support well-distributed and viable wildlife populations given potential cumulative effects of activities on forest system and non-forest system lands will depend on the direction of future managment activities (i.e., whether road construction will be prohibited in currently roadless areas, whether timber harvest will occur in pristine watersheds, etc.; Hanley 2005). However, despite these uncertainties, the risks associated with implementation of the Forest Plan are very low. The life of this amendment is expected to be 10 to 15 years at most, at which time another review will be undertaken. The current levels of harvest and road construction are at a 5-decade low and even if timber sales are made available and the timber industry responds very rapidly, there will be a period of preparation and transition prior to reaching the maximum harvest level allowed by the ASQ, particularly if one of the higher ASQ alternatives is selected.. Therefore, it is estimated that old-growth harvest levels are likely to be well below the maximum values evaluated in this EIS.

The effects of climate change may also contribute to cumulative effects. Warmer temperatures and decreased precipitation are anticipated to result in changes to vegetation and thus, the suitability of wildlife habitat, among other impacts (see *Climate and Air* section). Although many species may benefit (e.g., greater overwinter survival of deer, and thus a greater prey base for wolves, resulting from warmer winter termperatures during normal years), habitat changes resulting from a longer growing season, wind, fires, insect infestations, and disease may have variable effects on others. For example, Juday et al. (1998) concluded that the dramatic increase in gale force winds in coastal Alaska since the 1970s suggests that the risk of windthrow will be much greater in the future.

The greatest concerns for wildlife populations in relation to climate change, however, are the weather extremes that can be expected to occur periodically (Bermann et al. 1998). Periodic severe winter snowfalls, which may seem counterintuitive given the general warming trend, are anticipated (Juday et al. 1998). These stochastic events would be of greatest concern for populations that are limited in number or distribution. The predator-prey dynamic of wolves and deer provide an example of one system where these effects may be realized. Preliminary modeling has shown that during periodic severe winters reduced deer habitat capability due to snowfall would result in a disproportionately greater decline in the deer population (Person 2001). This could have repercussions on the wolf population, whose trends in size and volatility are sensitive to the available habitat capability for deer. At this time, no models exist that can be used in Forest Planning to accurately predict these effects. Some authors have noted though that the most effective means for managing for climate change impacts is through the development of ecosystem resistence which can be accomplished by maintaining a reserve system where active management is minimized (WWF 2003, Noss 2001). Thus the Forest Plan, with the reserve system through the conservation strategy represents a valid method to maintain a resilent ecosystem in the face of uncertain, future change.

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Table 3.10-10.
Estimated Maximum Average Road Density and Percent of WAAs in Road Density Categories on NFS Lands[1] and on All Lands Combined[2] for All Roads and for Open Roads Only within the Tongass National Forest Boundary by Alternative over 100+ Years

Road Density Category (miles per sq. mi.)	Percentage of WAAs															
	Existing		Alt 1		Alt 2		Alt 3		Alt 4		Alt 5		Alt 6		Alt 7	
	NFS Lands Only	All Lands	NFS Lands Only	All Lands	NFS Lands Only	All Lands	NFS Lands Only	All Lands	NFS Lands Only	All Lands	NFS Lands Only	All Lands	NFS Lands Only	All Lands	NFS Lands Only	All Lands
All Roads																
0	38.8%	34.6%	38.3%	15.7%	37.8%	15.7%	33.0%	15.2%	27.1%	13.1%	31.4%	14.7%	30.9%	14.7%	27.1%	13.1%
0 to 0.7	47.3%	46.1%	44.7%	58.1%	41.5%	55.5%	43.6%	54.5%	44.1%	49.7%	41.0%	50.8%	41.5%	50.8%	42.0%	47.6%
0.7 to 1.0	5.9%	5.2%	5.9%	6.3%	4.3%	5.8%	5.9%	6.3%	5.9%	8.9%	8.5%	8.4%	9.6%	9.4%	5.9%	7.9%
1.0 to 2.0	7.4%	11.0%	8.5%	13.1%	13.8%	15.2%	13.8%	15.2%	18.1%	18.3%	14.9%	17.3%	13.8%	16.2%	17.6%	18.8%
2.0 to 3.0	0.5%	3.1%	2.7%	5.2%	2.7%	6.3%	3.7%	7.3%	4.8%	8.4%	4.3%	7.3%	4.3%	7.3%	7.4%	11.0%
>3.0	0.0%	0.0%	0.0%	1.6%	0.0%	1.6%	0.0%	1.6%	0.0%	1.6%	0.0%	1.6%	0.0%	1.6%	0.0%	1.6%
Average Total Road Density – All WAAs	0.19	0.31	0.26	0.43	0.29	0.46	0.32	0.49	0.40	0.56	0.35	0.52	0.35	0.52	0.43	0.59
Open Roads																
0	54.3%	45.5%	53.2%	18.3%	52.1%	18.3%	46.3%	17.3%	36.2%	14.7%	41.5%	16.2%	41.0%	16.2%	35.6%	14.7%
0 to 0.7	40.4%	40.8%	41.5%	63.9%	42.6%	63.4%	48.4%	63.9%	58.5%	66.5%	53.2%	64.9%	53.2%	64.9%	59.0%	65.4%
0.7 to 1.0	4.3%	5.8%	4.3%	4.7%	3.7%	5.2%	3.2%	5.8%	3.2%	5.8%	3.2%	5.8%	3.7%	5.8%	3.2%	6.8%
1.0 to 2.0	1.1%	6.8%	1.1%	8.9%	1.6%	8.9%	2.1%	8.9%	2.1%	8.9%	2.1%	8.9%	2.1%	8.9%	2.1%	8.9%
2.0 to 3.0	0.0%	1.0%	0.0%	3.1%	0.0%	3.1%	0.0%	3.1%	0.0%	3.1%	0.0%	3.1%	0.0%	3.1%	0.0%	3.1%
>3.0	0.0%	0.0%	0.0%	1.0%	0.0%	1.0%	0.0%	1.0%	0.0%	1.0%	0.0%	1.0%	0.0%	1.0%	0.0%	1.0%
Average Open Road Density – All WAAs	0.10	0.23	0.10	0.23	0.10	0.23	0.11	0.23	0.11	0.23	0.11	0.23	0.11	0.23	0.11	0.23

[1] For NFS Lands, percentages are based on 188 WAAs that contain at least 100 acres of NFS lands.
[2] For All Lands combined, percentages are based on all 191 WAAs inside the Forest boundary, including Annette Island.

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Human Uses and Land Management

Lands

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Affected Environment

This section addresses land ownership administration and adjustments and special uses of Tongass National Forest System (NFS) lands. Transportation and utility systems and land uses related to minerals are discussed in separate sections. Adjustment of land ownership within the Tongass boundaries can occur through Congressionally mandated conveyances, exchanges, and acquisitions, or through Forest Service administrative activities. Authorized special uses on the Tongass include industrial or commercial uses, such as commercial fishing camps, transportation facilities, electronic and other communications sites, and a variety of recreational uses. The *Recreation* section of the EIS discusses the recreation special uses; non-recreation special uses are discussed below. (Appendix E to the Forest Plan lists the approved communications sites on the Tongass.)

The exterior boundary of the Tongass National Forest established by Congress includes lands that had been conveyed to other ownership both prior and subsequent to creation of the Forest. Table 3.11-1 indicates the distribution of acreage by ownership type within the exterior boundary. Of the approximately 17,867,000 total acres (based on GIS analysis), nearly 16,774,000 acres (nearly 94 percent of the total) are federal lands administered by the Forest Service (this total includes lakes surrounded by NFS lands). The State of Alaska accounts for the largest non-federal ownership, with about 286,000 acres or almost 2 percent of the total (this figure does not include lakes surrounded by NFS lands). The Alaska Native regional corporation (Sealaska) accounts for approximately 293,000 acres, and 12 village corporations collectively own another 287,000 acres. The remaining acreage consists of lands owned by units of local government (cities and boroughs), private lands, and miscellaneous ownerships.

Table 3.11-1
Land Ownership Distribution, Tongass National Forest[1]

Ownership Type	Acres	Percent of Total
Federal/Forest Service administered[2]	16,774,000	93.9
State of Alaska[3]	286,000	1.6
Local Governments	44,000	0.2
Native Regional Corporation (Sealaska)	293,000	1.6
Native Village Corporations	287,000	1.6
Private Owners and Unknown	183,000	1.0
Total	**17,867,000**	**100**

[1] Table indicates calculated ownership of total acreage within the exterior boundary of the Tongass National Forest.
[2] Figure includes 296 acres administered by other federal agencies. Figure includes lakes surrounded by NFS lands.
[3] Figure does not include lakes surrounded by NFS lands.
Source: USDA Forest Service 2007

Land Ownership Administration and Adjustment

A number of land adjustments have occurred on the Tongass since the adoption of the 1997 Forest Plan. Some lands have been conveyed from federal to other ownership, and these adjustments need to be documented on the Forest Plan maps. New lands that have become NFS lands during this period have not been formally given LUD designations. Specific designations need to be updated in a Forest Plan amendment.

From 1998 through August 2006, 50,277 acres of Tongass National Forest lands were conveyed to other entities. Most of these land adjustments were conveyances to the State of Alaska and Native corporations as authorized by the Statehood Act and the Alaska Native Claims Settlement Act of 1971 (ANCSA), and conveyances of Alaska Native Allotments as authorized by the 1906 Alaska Native Allotment Act. This acreage figure also includes parcels conveyed through land exchanges, a Small Tracts Act sale, and the disposal of two lighthouse reserves. Through land exchanges, purchases, and donations, the United States acquired 5,864 acres of new lands for inclusion within the Tongass during the same period. The balance of conveyances and acquisitions represents a net decrease of 44,413 acres of federal ownership.

Legislated Alaska Conveyances

Land ownership status within the Tongass is complicated by several ongoing Alaska land conveyances created under various federal legislation (USDA Forest Service 2003b). The Alaska Native Allotment Act of 1906 provided for Native individuals who had occupied lands prior to their designation as national forest to apply for conveyance of up to 160 acres, under conditions prescribed by the Act and federal regulations. As of August 2006, approximately 4,500 acres in 44 Native allotments had been conveyed, with an additional 3,500 acres pending adjudication by the Bureau of Land Management (BLM).

The 1958 Alaska Statehood Act authorized the State of Alaska to select 400,000 acres of vacant and unappropriated land from within the Tongass and Chugach National Forests in Alaska, to further the development and expansion of Alaskan communities. To date, under this provision of the Statehood Act, the state has received title to approximately 258,600 acres located in the Tongass National Forest. Approximately 37,400 acres remain to be conveyed to the state from the Chugach and Tongass National Forests.

ANCSA established processes for transfer of federal land to Alaska Native village corporations and regional corporations, and to Native individuals. ANCSA provided for the conveyance of 23,040 acres of surface estate lands (a full township, 36 square miles) to each of the 10 Native village corporations and 2 urban corporations located in Southeast Alaska. ANCSA provided that the subsurface estate under the village and urban corporation land would be conveyed to the Native regional corporation. ANCSA also included other provisions addressing land conveyances to Native regional corporations. Under Section 12c of ANCSA, 11 regional corporations were to share in the selection of 16 million acres. Section 14(h)(8) set aside a pool of 2 million acres to be transferred to the Native regional corporations in the state after certain other conveyances are completed. After the specified conveyances have been implemented, the remaining land in the pool will be divided among the regional corporations based on population, with approximately 22 percent of the balance going to Sealaska Corporation, the regional corporation for Southeast Alaska. Finally, ANCSA provided for selection and transfer of up to 160 acres to Native individuals who had occupied that land as a primary place of residence on August 31, 1971.

To date, approximately 571,000 acres within the Tongass have been conveyed under ANCSA. Each of the 10 Native village corporations and 2 urban corporations in Southeast Alaska has selected its authorized acreage; virtually all of that land has been conveyed, amounting to a total of approximately 279,000 acres. Approximately 292,000 acres have been conveyed to date to Sealaska Corporation, in addition to the subsurface estate under the lands owned by the village and urban corporations. Sealaska has selected about 171,000 additional acres. It is expected that approximately 64,000 acres of these lands will be conveyed to Sealaska.

Potential Future Conveyances

The major land conveyances described above have been authorized by Acts of Congress and implemented through additional legislation and regulations. In recent years there have been a number of other formal and informal proposals that, if authorized, might result in the transfer of Tongass NFS lands out of federal ownership. Several of these conveyance proposals are summarized below (see Appendix C for more detailed information):

- **Southeast Alaska Native Land Entitlement Finalization Act.** This bill was introduced in Congress in late 2007 as H.R. 3560, and is to provide for the completion of certain land selections by Sealaska under ANCSA and for other reasons. This legislative proposal represents the evolution of a Sealaska proposed land exchange (discussed below under Land Exchanges); however, the bill, as introduced, more closely resembles a conveyance rather than a land exchange. The bill allows Sealaska to select its remaining entitlement from areas outside the ten Southeast Alaska village withdrawal areas. It authorizes Sealaska to select and receive conveyance of its remaining land entitlement from three categories including economic development lands; sites with sacred, cultural, traditional, or historic significance; and Native enterprise sites.
- **University of Alaska Lands Bill.** Under the terms of Senate Bill 293, introduced in Congress on February 3, 2005, the University of Alaska would be allowed to select up to an additional 250,000 acres of federal land that would be managed to provide income for the university system. If enacted, the university would not be allowed to select lands within a federal conservation system area (e.g., a national park or a wilderness area) or Tongass NFS lands other than those within development Land Use Designations (LUDs), and the selections would be limited to areas of second-growth timber where timber harvest occurred after January 1, 1952.

- **Unrecognized Southeast Alaska Native Communities Recognition and Compensation Act.** Senate Bill 1746, introduced on June 29, 2007, proposes to allow Alaska Native residents of Haines, Ketchikan, Petersburg, Tenakee Springs, and Wrangell to organize as five Urban Corporations and to each receive 23,040 acres of surface estate lands and other compensation. (Sealaska Corporation would receive the subsurface estate to these lands.) These five communities were not included among the villages authorized to form corporations and receive land entitlements in 1971 under ANCSA, presumably because they did not meet the eligibility requirements. The language in Senate Bill 1746 does not identify the specific areas that would be available for selection and/or conveyance.
- **Alaska Natives Veterans Land Allotment Equity Act.** Introduced on August 2, 2007, as House Bill 3350, this proposes to redress certain obstacles created by the 1998 Alaska Native Veterans Allotment Act (Public Law 105-276). That Act amended ANCSA to provide Alaska Native veterans another opportunity to apply for a Native allotment of up to 160 acres of land under the repealed Native Allotment Act of 1906 (discussed above). This Act intended to compensate for the fact that Natives serving in Vietnam may not have been able to apply for their allotments prior to closure of the allotment program. The 1998 legislation contained several provisions regarding federal land status, prior use of the claimed land, and eligible military service dates that may be viewed by some as barriers to Native veterans obtaining their allotments.
- **Alaska State Forest Proposal.** State officials or interests have at times advocated the establishment of an additional Alaska State Forest to be managed to provide income for state government programs. One concept for such a management unit was for a 2-million-acre area on or near Prince of Wales Island, which would require transfer of extensive areas of current Tongass NFS lands to the State. To date, no federal legislation to implement such a proposal has been introduced in Congress.

Land Disposal

Federal agencies responsible for administering public lands sometimes dispose of lands to other governments or private parties. Such disposals typically involve relatively small land parcels that have been determined to be “surplus” or “excess” property under federal property regulations.

With respect to the Tongass, one example of land disposal involves the conveyance of historic lighthouse or light station properties in Southeast Alaska that have been managed jointly by the U.S. Coast Guard and the Forest Service. The National Historic Lighthouse Preservation Act of 2000 authorizes the General Services Administration (GSA) to dispose of historic light stations to “eligible entities” that are required to make the light stations available to the general public for education, park, recreation, cultural, or historic preservation purposes (USDA Forest Service 2005c). The Forest Service has been working with GSA to dispose of light stations while granting Forest Service easements to the recipients for occupancy of the underlying NFS lands. Two light stations have been disposed of under this program; four other stations have been identified as candidates for disposal. Most of these stations have small land reserves associated with them, although the Forest Service is working with the Coast Guard and BLM to reduce the acreage of larger reserves associated with some stations.

Land Exchanges

Administrative land exchanges, in which NFS lands can be conveyed to another entity in exchange for lands of equal value, are another form of land ownership adjustment. Complex land exchanges are sometimes authorized by Congress through special legislation. In addition to the Alaska conveyances discussed above, the Forest Service has completed several land exchanges involving Tongass NFS lands. These adjustments are summarized below:

- Under the Kake Tribal Corporation Land Transfer Act (Public Law 106-283), approved by Congress on October 6, 2000, the Forest Service was directed to convey 1,389 acres of Tongass NFS lands (which had previously been selected by the State of Alaska) in the Jenny Creek area near Kake to the Kake Tribal Corporation. This Act also provided for transfer of 1,430 acres of land owned by the Kake Tribal Corporation and Sealaska to the City of Kake an exchange of the subsurface estate (mineral rights) for two areas (each of over 1,100 acres) between the Forest Service and Sealaska. The Act, technically an amendment to ANCSA, was enacted to provide protection and management of the Kake municipal watershed.
- Under the Hood Bay Land Exchange, the Forest Service received a 54-acre parcel that had formerly been a private inholding within Admiralty Island National Monument and the Kootznoowoo Wilderness (USDA Forest Service 2006c). The United States conveyed and relinquished all reversionary interests on 144 acres of land at Sitka to the Alaska Pulp Corporation.
- Through an exchange with the Kennecott Greens Creek Mining Company, Inc., the Forest Service received one 50-acre parcel within the Misty Fiords National Monument Wilderness and two parcels totaling approximately 139 acres within Admiralty Island National Monument Kootznoowoo Wilderness (USDA Forest Service 2006c). The United States conveyed the subsurface mineral estate on 7,301 acres at Hawk Inlet/Young Bay on Admiralty Island.

There have also been discussions regarding potential future land exchanges between the Forest Service, a number of Native corporations, and other entities that could adjust land ownership on the Tongass.

In late 2007, Shee Atika, Incorporated (an Alaska Native Village Corporation) approached the Forest Service about a possible exchange of NFS lands on West and North Yakobi Island and on western Chichagof Island, for Shee Atika surface estate located at Cube Cove. Both parties are discussing the concept and neither party has made any binding commitments on proceeding further.

Also in late 2007, the Trust Land Office (State of Alaska, Department of Natural Resources) representing the Mental Health Trust Authority, presented a conceptual proposal to the Forest Service to exchange approximately 20,000 acres of lands managed by the Trust Land Office in Southeast Alaska for an equal value of Tongass National Forest lands on Prince of Wales Island. The parcels the Trust has offered for exchange are mostly adjacent to NFS lands and are also adjacent to, or in the immediate vicinities of, Skagway, Juneau, Petersburg, Wrangell, Sitka, and Ketchikan. At this point, the Forest Service is considering the concepts of the proposal and has made no agreements on whether or not it will pursue this exchange further.

The potential exchange that has received the most attention and discussion is known as the Sealaska Proposed Comprehensive Tongass-wide Land Exchange (USDA Forest Service 2005d). In August 2002, Sealaska Corporation submitted a proposal to the Forest Service to exchange approximately 100,000 acres of NFS lands for Sealaska Corporation lands and selection rights under ANCSA. The Tongass-wide exchange proposed by Sealaska involves lands throughout Southeast Alaska. The goals of the exchange are to consolidate NFS lands and Sealaska lands, and to finalize Sealaska's remaining land selections under ANCSA. This proposal has recently evolved into the Southeast Alaska Native Land Entitlement Finalization Act which has been introduced in Congress (see above under Potential Future Conveyances).

At present, about 171,000 acres in the ANCSA withdrawal areas are encumbered by Sealaska selections. Other lands within these areas have not been selected by a Native corporation but will remain withdrawn until the ANCSA conveyances are completed.

Based on current information from BLM, Sealaska has approximately 64,000 acres of lands yet to be conveyed. This includes approximately 20,000 acres of unconveyed ANCSA entitlement under Section 14(h)(8), in addition to approximately 44,000 acres of 14(h)(8) lands resulting from the 2004 Alaska Land Transfer Acceleration Act, P.L. 108-452.

The proposed land exchange would enable Sealaska to acquire other lands outside of the ANCSA withdrawal areas, in addition to the Native heritage 14(h)(1) parcels. This is not authorized under ANCSA except by exchange. Land exchanges are discretionary, voluntary real estate transactions between federal and non-federal parties. At present, there is no binding land exchange agreement in place signed by the Forest Service and Sealaska that would enable Sealaska to receive lands outside of the withdrawal areas.

The Forest Service completed a draft feasibility report on the exchange proposal in 2003. After lengthy discussions and several modifications to the proposal, in 2005 the Forest Supervisor informed Sealaska that the Forest Service was not willing to move forward with the exchange because of a lack of substantial agreement on the parcels to be exchanged, concerns over a variety of resource issues, and the need for a revision to the Forest Plan to accommodate the exchange due to the magnitude of the resulting changes in LUDs.

Land Acquisition

Land ownership adjustments can also occur through the outright purchase of lands or the acceptance of land donations for inclusion in the Forest. Purchases typically involve small inholdings, always involve a willing seller, and usually involve parcels surrounded by designated wilderness or other sensitive resource lands. Since 1997, the Forest Service has acquired 17 parcels totaling approximately 5,864 acres of land in various locations within the Forest (USDA Forest Service 2006c). These figures include the parcels obtained through the Hood Bay and Greens Creek exchanges discussed above; apart from these exchanges, the acquisitions total 12 parcels and 5,621 acres. The largest acquisition involved two parcels and 2,939 acres near Petersburg Creek and 1,045 acres at Mt. Verstovia near Sitka. Other purchases included an Unuk River parcel in the Misty Fiords National Monument Wilderness and parcels at Favorite Bay and Hood Bay in the Admiralty Island National Monument/Kootznoowoo Wilderness. Donations included a parcel at Cape Bingham and two at Bohemia Basin, including portions in the West Chichagof-Yakobi Wilderness in both locations, and a parcel at Windham Bay in the Chuck River Wilderness.

The Forest Service obtained the Petersburg Creek and Verstovia parcels through a legislated program with the State of Alaska Mental Health Land Trust, which has as its mission to generate revenue to support mental health services in Alaska.

Congress directed the Forest Service to purchase lands from the Trust and allocated funds for the purchases. The Forest Service is currently working on an acquisition in the Deer Mountain area near Ketchikan, which will be the last component of this program.

Congress has directed the Forest Service to make a similar purchase under the Craig Recreation Land Purchase Act (PL 108-325), passed in October 2004. The Act provides for the Forest Service to acquire the surface rights to approximately 350 acres surrounding and near the Sunnahae Trail from the City of Craig (USDA Forest Service 2005e). The city would use the funds received under this acquisition to purchase 10 acres of property within Craig for harbor expansion, development, and other purposes. Congress has not yet appropriated funds for the purchase of the Sunnahae Trail lands.

Withdrawals/Encumbered Areas

Withdrawals and encumbrances are other key aspects of land ownership administration. Withdrawal is the withholding of an area of federal land from settlement, sale, mineral location, or entry under some or all of the general land laws for the purpose of limiting activities under those laws in order to maintain public values in the area. In general, an encumbrance is a claim, lien, charge, or liability attached to and binding real property (Black 1979, as cited in USDA Forest Service 2003b). In the context of the Tongass, an encumbrance is a land claim of some type that removes NFS lands from the full range of Forest Service administrative functions.

By acreage, the largest withdrawal action applies to the more than 5.7 million acres in designated wilderness areas, which are withdrawn from entry under the mining laws. Many of the administrative withdrawals date back several decades and include withdrawals around lighthouse and light station sites, and a large number of power site withdrawals intended to preserve options for hydroelectric development at promising sites.

The land conveyance processes established by ANCSA delineated areas of federal lands within which Native village corporation land selections were to be located. These areas, totaling an estimated 1.8 million acres (including large areas of saltwater) on the Tongass, were withdrawn and will likely remain encumbered in the land status records until all lands to which the Native corporations are entitled have been conveyed. Other areas of the Forest have not been formally withdrawn, but are similarly encumbered as a result of land selections. For example, while the Alaska Statehood Act did not withdraw specific federal land areas identified for land selection by the state, those lands that have been selected by the state but not yet conveyed are nevertheless encumbered. Likewise, Native allotments that have been claimed but not conveyed and a number of small-scale Sealaska selections under ANCSA Section 14 (h)(1) are outside of the ANCSA withdrawal areas and are encumbered. Altogether, approximately 395,000 acres of Tongass NFS lands are encumbered by such transitional ownership situations (USDA Forest Service 2006e).

Special Use Authorizations

Uses of NFS lands by entities other than the Forest Service can be authorized under a special use permit, subject to applicable regulations found in 36 CFR 251. Generally, most permits are issued for periods of 5 years or less. Complex permits for long-term uses such as hydroelectric facilities may be issued for periods of up to 50 years. As of August 2006, there were 715 special use permits currently issued on the Tongass. The number of permits on the Tongass at any given time may fluctuate between 700 and 750. Nearly half of the permits issued on the Tongass are related to outfitter and guiding and other recreational uses of NFS lands. The remainder involve a wide variety of uses including, but not limited to, communications sites, roads, cabins, organization sites, hydroelectric projects, temporary facilities, aquatic farming activities, military training, sanitary landfills, and fish camps.

Communication and Other Electronic Sites

A communication or other electronic site is a dedicated land use allocation of NFS land. These sites are used for electronic communication systems, including electronic transmitters, receivers, and passive microwave reflectors. These uses of federal land are authorized by the Federal Land Policy and Management Act of 1976 and the Telecommunications Act of 1996. As of August 2006, there were 69 designated electronic sites throughout the Tongass (see Appendix E to both the 1997 Tongass Land and Resources Management Plan and the proposed Forest Plan Amendment). Fifty-two (52) of these sites were occupied under special use permits by non-Forest Service parties, while the remaining sites are for Forest Service facilities. A few of the sites have several special uses authorized. The majority of sites are limited to one user. All sites are currently open to more than one user if the need arises. Some of the sites are operated by the Coast Guard, the Federal Aviation Administration, the National Weather Service, and a variety of other private and public entities. Applicants for new communications uses will be encouraged to co-locate their facilities at existing, approved sites.

Recreation-Related Permits

As of August 2006, the Forest Service administers 390 special use permits for purposes related to recreation. These included 275 outfitter/guide permits, 65 isolated cabins, and 15 recreation residences. Isolated cabins and recreation residences, although similar in many ways, are managed differently because of the different authorities used to grant use and occupancy. Construction of new cabins is regulated by Alaska National Interest Lands Conservation Act of 1980 (ANILCA) and generally prohibited, except under limited circumstances. Existing cabins are expected to decrease in number over time as a result of ANILCA direction limiting the transfer of permits.

Camps and Cabins

Two organization camps operated on the Tongass under special use permit in 2005. Based on prior authorizations, the Forest Service also administered 15 permits for summer homes or recreational cabins. Construction of new cabins is prohibited except under quite limited circumstances, and the existing cabins are expected to decrease in number over time as a result of restrictions on transfer of the permits.

Roads and Rights-of-Way

Inholders and other landowners are allowed reasonable access across NFS lands to use their own lands under provisions of ANILCA and other federal laws. Easements are also issued to the Alaska State Department of Transportation for state-managed highways. The Forest Service administered 39 easements or right-of-way permits in 2006. The types of authorizations include 1 railroad right of way, 1 Department of Transportation easement, 13 Forest Road and Trail Act easements, 4 Federal Land Policy and Management Act easements, and 20 Federal Land Policy and Management Act rights-of-way.

Other Special Uses

Non-recreation special use authorizations accounted for 325 permits in August 2006. Types of uses in this group included hydroelectric projects, mariculture- and agriculture-related activities, uses for schools and municipalities, weather monitoring, filming and photography, and power lines.

Hydroelectric Projects*.* There are 11 existing hydropower projects on the Tongass that are operated under license from the Federal Energy Regulatory Commission (FERC). Of the 11, 8 are also under special use permit from the Forest Service and authorized under the Federal Land Policy and Management Act. As of August 2006, there were an additional 11 proposed projects that are in various stages of the FERC licensing process.

The Forest Service is currently conducting environmental review under the National Environmental Policy Act (NEPA) for the proposed Angoon hydroelectric project, located approximately 6 miles north of the City of Angoon on Admiralty Island. Kootznoowoo, Incorporated, the Native village corporation for Angoon, proposes to develop a 1 megawatt hydro project on Thayer Creek to supply electricity for Angoon. The project is authorized under ANILCA Section 506(a)3(B), subject to conditions imposed by the Forest Service, and is not subject to the Wilderness Act of 1964. FERC has determined that it does not have jurisdiction over the project because Admiralty Island is a Congressionally designated National Monument on NFS lands. Therefore, FERC is not involved in project review. As directed by ANILCA, the Forest Service will issue special use permits, with specified conditions, to allow construction and operation of the project when the environmental analysis is complete and all NEPA requirements are met.

Other Energy Resources. The Tongass has recently received some interest from energy companies exploring for oil and gas and geothermal resources (see related discussion in the *Minerals* section of this chapter). These exploration activities require a special use permit when they occur on NFS lands.

Environmental Consequences

Direct and Indirect Effects

No significant environmental consequences within the Lands category are anticipated for any of the alternatives. The NFS land base is the same for all seven alternatives, at just under 16.8 million acres. An adjustment to the suitable timber land base has been made for each alternative for lands anticipated to be conveyed in the future ("encumbered"). Minor changes to the land base may continue to occur as a result of the ongoing conveyance processes, or from future land exchange, disposal, and acquisition actions. Any such changes that would occur are irrespective of the goals associated with any alternative, as none of the alternatives incorporate any specific land adjustment that is unique to the alternative.

The Forest Service would continue land administration activities under the respective Forest-wide standards and guidelines presented in Chapter 4 of the Forest Plan. Those standards and guidelines reflect minimal changes from the current Forest Plan direction. The only substantive change in the standards and guidelines is the additional statement that motorized access may be authorized as part of a special use authorization, subject to the provisions of 36 CFR 212, 251 and 261. In other respects, administration of special use permits would continue as at present under all alternatives. The number of communication and other electronic sites on NFS lands under special use permit has increased somewhat in recent years, and additional sites may be permitted in the future. Permits for camps and cabins may decrease somewhat over time because of restrictions on new uses of this type. Based on recent trends, minor future increases in special use permits for other recreation purposes, rights-of-way, and other special uses are possible.

Additional special use permits may be granted in the future; the environmental impacts of those actions would be evaluated through the permit approval process. The Forest Service would issue permit conditions to address the impacts of new permits and renewed permits. Special use permits generally apply to small, specific areas and activities that have limited impacts. Impacts from permitted activities can not be predicted at this time, would not vary among the alternatives, and are not likely to be significant. The future addition of electronic sites by private industry could help improve electronic signal coverage Forest-wide.

Cumulative Effects

Forest Service land administration activities under the updated Forest Plan are not considered to have the potential to create or contribute to significant cumulative effects. To the extent that special use permits increase in number and affected acreage, environmental effects from future permits would add to those of permits already in effect. As noted above, however, those effects are not likely to be significant. In general, land ownership adjustments executed by the Forest Service are made in response to direction from others, primarily Congress through legislated land conveyances or exchanges. No land ownership adjustments are proposed under any of the Forest Plan alternatives, and none of the potential adjustments discussed above and in Appendix C is considered reasonably foreseeable. To the extent that any of the potential conveyance or exchange proposals were adopted in the future, they would have a cumulative effect on the NFS land base within the Tongass. There has been a substantial transfer of federal lands in Southeast Alaska to other ownership since statehood.

Transportation and Utilities

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Affected Environment

There are three principal types of travel in Southeast Alaska: air, water, and ground. Historically, marine transportation has been the major method of moving freight and passengers; however, during the last five decades, air services have developed to serve the growing demand for rapid transportation between communities within Alaska and to the contiguous United States. Residents of the region are dependent on air and water transportation for travel between most communities, rather than roads or rail. A roaded transportation system has developed on National Forest System (NFS) lands, largely in support of timber harvesting.

Only three cities in Southeast Alaska are connected to the continental road system: Haines, Skagway, and Hyder. Several cities in Southeast Alaska are linked to Bellingham, Washington via the Alaska Marine Highway. Ketchikan is also linked by ferry to the Canadian community of Prince Rupert, British Columbia. In addition, several ferries connect communities on a weekly or twice-weekly basis. Prince of Wales Island has the only road system in Southeast Alaska that interconnects island communities. Several possibilities exist for state highways that could connect some communities of Southeast Alaska to the continental road system. Several new internal corridors are also possible.

The Alaska Department of Transportation and Public Facilities (DOT&PF) issued the Southeast Alaska Transportation Plan (SATP) in August 2004 (Alaska DOT&PF 2004). The SATP requested 34 essential transportation and utility corridors be reserved and incorporated into the Tongass Land and Resource Management Plan. Most corridors are planned for infrastructure construction by Alaska DOT&PF. For other corridors, Alaska DOT&PF has requested the Forest Service improve and connect forest roads. The SATP proposes doubling the forest highway system, which would result in a 1,032-mile system.

Historically, Southeast Alaska has relied on a “marine highway system” to augment its limited roads and highways. The Marine Highway System primarily consisted of long line ferries, which are becoming obsolete with current Coast Guard regulations, and are increasingly costly to operate. The SATP calls for transitioning away from the long line ferries to a system of expanded roads and shuttle ferries. Strategically, the plan calls for centering transportation and access around three major highway linkages: the Juneau Access Road (which would link Juneau to the continental road system via Skagway), a Sitka highway (which would link Sitka with the east side of Baranof Island), and a mid-region connector to the Cassier Highway in British Columbia, Canada (the Bradfield Canal Corridor is one alternative under consideration).

Public Law 109-59, the Safe Accountable Flexible Efficient Transportation Equity Act: A Legacy for Users, was passed in August 2005. It refers to Map 92337, which shows marine access points, log transfer facilities (LTFs), and proposed transportation corridors in Southeast Alaska. This map shows 22 corridors, all but one of which is also in the SATP (the Whale Pass to Exchange Cove corridor on Prince of Wales Island is not included in the SATP).

Because the Southeast Region of Alaska DOT&PF lies largely within the Tongass National Forest's boundaries, many of the proposed road projects would cross NFS lands and require Forest Service coordination and U.S. Department of Transportation easements. The proposed major linkages for the Juneau Access, a Sitka Highway System, and the Cassier Highway connection would each cross Tongass National Forest land. The completion of the SATP has initiated more site-specific planning, and has focused on a request for a change in land use designation (LUD) in the Forest Plan.

The Forest Service signed a Memorandum of Understanding with the State of Alaska in 2006 to provide rights-of-way for the road corridors covered by Public Law 109-59. These corridors are displayed on the alternative maps. The Memorandum of Understanding also grants easements to the Forest Service for marine access points and LTFs listed on Map 92337. To date, eight rights-of-way have been granted to the State, and work is proceeding on the remaining right-of-way grants. The Federal Highway Administration issued a Record of Decision (ROD) in 2006 approving a road on the east side of Lynn Canal from the current terminus of State Highway 7 to the Katzehin River. From there, shuttle ferries would continue to Haines and Skagway. Site-specific planning is also underway for the Sitka Access and the Northern Panhandle Transportation Study. The Forest Service continues to be involved as a cooperating agency with Alaska DOT&PF for all highway National Environmental Protection Agency (NEPA) efforts, identifying the impacts to the Tongass National Forest, and creating opportunities for appropriate mitigation and recreational enhancements. This analysis considers the request for reserving these transportation corridors (refer to the alternative descriptions in Chapter 2).

In addition to the corridor reservation request, the SATP identifies the Forest Service as a "transportation partner" highlighting that there are 3,600 miles of Forest Service roads on the Tongass National Forest that many communities rely on. The SATP also calls out the merits of the Forest Service's role as a public roading agency, recognizing the need for lower standard public road links to Southeast Alaska's smaller communities.

The SATP is based on two fundamental concepts: 1) an integrated multi-modal transportation system (a combination of road segments linked to shuttle and mainline ferry services within key corridors), and 2) a combination of sub-area or zone and regional transportation services and facilities. The four identified major travel corridors or zones are: 1) Juneau-Haines-Skagway, 2) Juneau-Sitka-Petersburg, 3) Petersburg-Ketchikan, and 4) Ketchikan-Prince Rupert, British Columbia. New ferry terminals have been completed at Mitkof Island and Coffman Cove. The Inter-Island Ferry Authority, which operates a route between Hollis and Ketchikan, also operates the new route serving Wrangell, Coffman Cove, and Mitkof Island.

A number of different groups have identified several corridors for consideration as major transportation routes. The SATP identifies several potential extensions of the Inside Passage Highway among its long-term actions. Several possibilities are under consideration, including extensions or new highway construction on Kupreanof Island (to connect Kake and Petersburg), Cleveland Peninsula, and Revillagigedo Island (including an extension of the Revilla road to Shelter Cove, and a road from Carroll Inlet to Shrimp Bay). The SATP recommends reserving these possible future alignments as highway corridors. The SATP also proposes a study to consider the viability of constructing a road to connect Sitka with the east side of Baranof Island, either at Rodman Bay or Warm Springs Bay.

Other potential routes that have been discussed in recent years include a route along the west shore of Lynn Canal, two Juneau-to-Canada routes along Taku Inlet, the East Bradfield River corridor connection to the Cassiar Highway, several other road corridors near Wrangell, a coastal alignment connecting Thorne Bay and Coffman Cove, a road connecting North Whale Pass and the East Prince of Wales road, and a road to the southeastern tip of the Kasaan Peninsula. In addition to the routes listed above, draft Transportation System Concept maps prepared for the Southeast Conference identify a potential route connecting Hoonah and Tenakee Springs, and a short connector route between the Chatham and Corner Bay road systems. The Southeast Conference maps also identify an alternative corridor between Kake and Petersburg via a ferry across Duncan Canal.

When a National Forest Transportation System road (discussed in the next subsection) provides a connection between communities, serves local needs such as mail delivery, or connects public roads within the Tongass National Forest, it can be designated as a forest highway (see 23 U.S.C. 101 for technical definition). Forest highways are usually upgraded to state highway standards, during which jurisdiction passes to the State. To date, the Alaska DOT&PF, Federal Highway Administration, and Forest Service have agreed to designate a potential 362 miles as forest highways; the State would assume jurisdiction and maintenance responsibility for 181 miles of these highways.

Other transportation facilities within Southeast Alaska include more than 300 marine facilities (docks, small boat harbors, refuge floats, and boat launch ramps), 12 major airports, approximately 35 seaplane bases or floats, and numerous heliports and airstrips (Alaska DOT&PF 2004).

National Forest Transportation System Roads

National Forest Transportation System roads are constructed to provide access to NFS lands and are included in the Forest Development Transportation Plan (see Transportation Standards and Guidelines in Chapter 4 of the Forest Plan [USDA Forest Service 1997b]). They are considered NFS roads, as are other roads that are wholly or partially on NFS lands and are intended to be maintained for the long term (see text box on Road Types). They are functionally classified as arterial (serving large land areas and usually connecting to public highways), collector (serving smaller areas, usually connecting to arterials or public highways), and local (terminal roads, may connect to any other type).

NFS roads are also managed by a system of maintenance levels, depending on their intended use and suitability for various types of vehicles. These levels range between level 1 (closed), level 2 (suitable for high-clearance vehicles), level 3 (suitable for passenger vehicles, rough surface), level 4 (suitable for passenger vehicles, smooth surface), and level 5 (suitable for passenger cars, dust free, possibly paved). Maintenance can include reconditioning the original road template, grading the road surface, cleaning roadside ditches, and removing vegetation that may encroach upon the road or block vision. Grading and other maintenance would generally take place more often on a maintenance level 4 road than on a level 3 road, and would be expected to occur less often on a level 2 road. Level 1 roads are left to a self-maintaining condition that requires little or no maintenance.

With the exception of a few administrative sites and campgrounds, most forest roads are single lane, constructed with blasted quarry rock, and designed for off-highway loads. Typical collector and local roads are 14 feet wide with a rough gravel surface. Higher standard arterial roads are normally 16 feet wide, may have a smooth gravel surface, and are designed for speeds of up to 30 miles per hour. Travel speed on lower standard roads is often controlled more by surface roughness than by horizontal alignment or road gradient.

For the Tongass, the demand for roads has primarily been a function of the demand for access to timber resources. The maintenance and reconstruction requirements of the existing system depend mainly on the volume of timber hauled and, to a lesser extent, on recreational use. The amount of future construction is anticipated to continue to be largely determined by the need to access timber resources.

> ***Road Types***
>
> National Forest System roads: Roads wholly or partially within National Forest System (NFS) land that the Forest Service determines are needed for the protection, administration, and utilization for the NFS and the use and development of its resources.
> Unauthorized roads: Roads that are not forest roads or are temporary roads not included in the forest transportation atlas.
> Temporary roads: Roads that are not forest roads and are not listed on the forest road atlas, but are necessary for emergency operations or authorized by contract, permit, lease, or other written authorization.

Currently, there are approximately 3,532 miles of authorized roads on NFS lands, approximately 2,485 miles of which are not maintained for highway vehicles (maintenance level 1 and 2). There are another 607 miles of roads that are on non-NFS lands. In addition, there are about 1,409 miles of unauthorized roads—roads that are not maintained by the Forest Service. These roads provide access to about 8 percent of the Tongass National Forest. Over half of the roads suitable for highway vehicles are connected to communities. Between 1984 and 1993, an average of 168 miles of road was constructed annually. The 1997 Forest Plan estimated that 106 miles of road would be constructed annually in the first decade of the Plan. However, actual construction was well below that level, averaging less than 25 miles annually between 1997 and 2005. During that same time period, approximately 94 miles of road were decommissioned. The result was a net addition of 126 miles of road, compared to the 954 miles predicted for the first 9 years.

The steep, densely vegetated terrain of Southeast Alaska limits the use of typical off-highway vehicles (OHVs) such as three-wheelers and all-terrain vehicles to beaches, communities, road systems, braided river channels, and frozen or snow-covered areas. Most trails in Southeast Alaska do not lend themselves well to the use of such vehicles because of wet ground conditions that often necessitate the use of boardwalks. With the exception of a few specific areas, the Tongass has not experienced the kinds of resource damage typically associated with OHVs elsewhere. The Tongass contains many unauthorized roads, some utilize old roadbeds and some are user-created. Many of these unauthorized roads and trails are used by OHVs for recreation. It is anticipated that travel management plans scheduled for completion by December 2009 will decide which of these unauthorized roads are incorporated into the Forest transportation system and which will be closed as funding becomes available.

Prior to 2005, the Forest was designated open to OHVs except for Wilderness, National Monuments, and Research Natural Areas. Site-specific closures were considered in specific locations where conflicts with other uses, public safety problems, or damage to resources could occur. The goal of OHV management is to ensure resource protection and public safety, minimize user conflicts, and provide diverse opportunities for Forest users. A specific set of closures was consolidated in the Juneau area in November 1985 as the "Off-Road Vehicle Travel Plan" for the Juneau Ranger District. This travel plan was incorporated in the Forest Plan by reference. In November 2005, the Forest Service adopted a final rule for managing motor vehicle use, including OHV use, on national forests throughout the United States. Under this rule, the travel management plans will designate a system of roads and trails for OHV use, and identify if any areas for cross country travel are appropriate and do not cause resource damage. Use maps are scheduled to be completed by 2010.

In early 2001, the Forest Service adopted a new road management policy that requires the agency to maintain a safe, environmentally sound road network that is responsive to public needs and affordable to manage. The policy includes a science-based roads analysis process designed to help managers make better decisions on roads. The Forest completed a Forest-wide roads analysis for maintenance level 3, 4, and 5 roads in 2003. Ranger Districts are in the process of completing roads analysis on maintenance level 1 and 2 roads as well as unauthorized roads.

The transport of harvested timber from isolated islands in Southeast Alaska requires both land and water routes to reach processing facilities. LTFs are used to transfer logs to barges or rafts for towing. About 116 LTFs currently exist on the Tongass and there are 59 marine access points suitable for transferring logs to barges that have current permits on NFS lands. Another 10 marine access points no longer have permits. The Memorandum of Understanding discussed above grants the

Forest Service easements to use the 126 LTFs on state lands listed on Map 92337. In addition, 59 proposed LTF sites have been identified on NFS lands.

Power Transmission Lines

A number of power transmission lines link existing hydroelectric projects with the nearest larger community in Southeast Alaska. The State of Alaska has proposed corridors for transmission lines and/or undersea cables to link many Southeast Alaska communities to each other and to British Columbia. Several projects are either in the NEPA stage or under construction. The Swan Lake–Lake Tyee Intertie corridor runs from the Swan Lake Hydro project near the head of Carroll Inlet, north to the Tyee Hydro project at the head of Bradfield Canal. The route is shown as a potential power transmission corridor on the alternative maps. NEPA was completed in 1997 and construction began in 2002; most of the corridor has been cleared and approximately three-quarters of the power pole foundations have been built. The State Legislature approved $46.2 million for the project. As a result of the Swan Lake-Lake Tyee Intertie, another potential corridor, which runs down the Cleveland Peninsula connecting the Tyee power line with Ketchikan and Meyers Chuck, is not likely to be needed.

Construction of a transmission line connecting Ketchikan with Metlakatla via Saxman is expected to begin soon. The route is shown as a potential power transmission corridor on the alternative maps. This corridor is primarily on private land. It would run from Ketchikan to Saxman, then across the channel to Annette Island, and then southwest and south along the northern portion of the island to Metlakatla.

Kootznoowoo Inc., a Native village cooperative, has proposed developing a hydroelectric facility on Thayer Creek and a transmission line between the Thayer Creek facility and Angoon. The route is shown as a potential power transmission corridor on the alternative maps. This project is authorized by Congress and is currently being analyzed by the Forest Service in an EIS. The 1-megawatt, run-of-the-river hydroelectric project on Thayer Creek (north of Angoon) includes a 10-foot-high diversion dam, a diversion pond, 1.3 miles of pipeline and penstock, a powerhouse, and 6 miles of overhead transmission line (plus a marine segment) to carry the power south to Angoon. The DEIS was released in May 2007.

The Juneau to Hoonah Transmission Line route runs from Juneau across northern Douglas Island and underwater to the north end of Admiralty Island and then underwater again to approximately 10 miles east of Hoonah, where it transitions onto land and continues to Hoonah. NEPA has been completed and the line has been constructed to Hawk Inlet at the north end of Admiralty Island (the Juneau to Greens Creek portion of the transmission line). The route is shown as a potential power transmission corridor on the alternative maps.

The Kake to Petersburg Transmission Line would cross the Wrangell Narrows (going from Mitkof to Kupreanof Island) near the Tonka LTF and proceed west across Duncan Canal. It would follow existing logging roads for the majority of its length. The route is shown as a potential power transmission corridor on the alternative maps.

Other potential projects include power lines between Juneau and Skagway, Juneau and Hoonah (the Juneau to Greens Creek portion has been completed), Hoonah and Pelican, Hoonah and Tenakee Springs, Tenakee Springs and Angoon, Angoon and Sitka, Sitka and Kake, Thorne Bay and Ketchikan, and Klawock and Hydaburg. Also planned are power lines between the proposed Lake Dorothy, Otter Creek, and Sunrise Lake Hydroelectric Projects and existing power lines or communities. A power line from the Tyee hydropower site along a potential Bradfield Canal/Craig River road corridor route to Canada is also a potential route that has been considered.

Transportation and Utility Systems in the Forest Plan

The Forest Plan applies the Transportation and Utility Systems LUD to the potential rights-of-way corridors and associated uses for selected potential and existing transportation systems and utility corridors. These systems include state and federal highways, power lines of 66 kilovolt capacity or greater, and pipelines 10 inches or more in diameter, if they are a public utility. This LUD is intended to minimize potential conflicts, such as over-determining the appropriate visual quality objective, should development of any of these projects occur. With certain exceptions, transportation and utility systems are allowed throughout the Tongass as directed by Title XI of the Alaska National Interest Lands Conservation Act of 1980.

Environmental Consequences

Direct, Indirect, Effects

The following discussions address the direct, indirect, and cumulative effects of the alternatives on the transportation and utilities infrastructure of Southeast Alaska. Analyses examine both the existing system and all reasonably foreseeable changes.

Effects on the National Forest Transportation Road System

Table 3.12-1 displays the maximum anticipated road construction by alternative over the next 100 or more years. These numbers tend to overestimate total road miles because they include unauthorized roads, most of which are likely to be decommissioned during the next few decades. New road construction estimates are directly related to proposed timber harvesting activities; they are based on the maximum harvest levels projected for each alternative. These estimates are primarily based on the logging system and transportation analysis (LSTA) completed in 2007 for the majority of the mapped suitable lands on the Tongass under the alternatives (refer to the *Timber* section). Where suitable lands were not covered by the LSTA (primarily in portions of Alternatives 4 and 7), they were estimated using the ratio of road miles to suitable acres based on the LSTA by Value Comparison Unit.

Table 3.12-1
Estimated Maximum Road Construction and Cumulative Miles of National Forest System Roads by Alternative After Full Implementation (100+ years)[1]

Alternative	New Road Construction	Existing Roads [2]	Cumulative Roads [2]
1	774	4,941	5,715
2	2,079	4,941	7,020
3	2,799	4,941	7,740
4	4,890	4,941	9,831
5	3,874	4,941	8,815
6	3,744	4,941	8,685
7	5,825	4,941	10,766

[1] Estimates are based on the maximum harvest allowed under each alternative; therefore, they represent a maximum estimate. Numbers do not include decommissioning of roads.
[2] Includes unauthorized roads, most of which are likely to be decommissioned.

Roads have the potential to affect fish habitat, soils, and water quality by increasing erosion and landslide potential, changing recreation settings and opportunities, altering scenery, and increasing legal and illegal wildlife harvest. These types of effects are discussed in the subject resource sections of this chapter, as applicable.

Based on current practices, most new roads would be closed to motorized traffic once their initial use is over. These roads are built for silvicultural purposes under exemptions granted under Section 404(f)(1) of the Clean Water Act. The construction or maintenance of forest roads used for the sole purpose of silvicultural activities is exempt from regulation under Section 404 of the Clean Water Act. Roads that remain open for recreation or subsistence use do not qualify under this exemption (U.S. Army Corps of Engineers 2004); therefore, these roads should be closed following completion of silvicultural activities. The roads would either be decommissioned or placed in storage. Bridges and culverts may be removed (or culverts may be bypassed), erosion control measures would be applied as needed, and the roadbeds would be allowed to revegetate naturally.

In addition to normal maintenance that would accompany all alternatives, each alternative would result in reconstruction of a portion of the existing road system in each decade, primarily roads that have been placed in storage (maintenance level 1). Estimates range from 925 miles under Alternative 1 to 2,371 miles under Alternative 7 (Table 3.12-2). Reconstruction of a road maintains the original investment and makes the road suitable and safe for intended use. Reconstruction involves the rehabilitation of the original roadbed, and can include cleaning ditches, replacing drainage structures, re-installing bridges, and grading and shaping.

Table 3.12-2
Estimated Miles of Road to be Reconstructed by Alternative[1]

Alternative						
1	2	3	4	5	6	7
925	1,784	1,932	2,182	2,100	2,046	2,371

[1] Estimates are based on the existing miles of maintenance level 1 and 2 roads, existing miles of unauthorized roads incorporated into the LSTA, and the amount of young growth to be treated over the long term (100 + years) for each alternative.

Effects on Log Transfer Facilities

LTFs can adversely affect the marine benthic habitat (plants and animals that live in and on the ocean bottom). Effects are expected from two sources: structural embankment (placing rock in the water) and bark deposition (bark that accumulates underwater). Structural embankment is estimated to cover approximately one-quarter acre per site.

LTFs have affected approximately 2 acres of marine benthic habitat for the average site (Faris and Vaughan 1985). Bark and debris accumulation may decrease over time due to water currents, but there are no reliable estimates on the length of time required before a bark accumulation is completely eliminated. Using this 2-acre average, about 232 acres of marine benthic habitat associated with the existing LTFs on NFS lands have bark accumulations. This is roughly 0.05 percent of the total estuarine area less than 60 feet deep. The biological effects of LTFs are described in the 1997 Tongass Forest Plan Revision Final EIS (USDA Forest Service 1997a). Currently, many timber sale contracts require logs to be loaded directly onto barges rather that placed in the water and bundled into log rafts. This greatly reduces the amount of bark and wood debris that enters the water. In situations where logs are rafted, placing of LTFs in areas where the current will disperse debris can greatly reduce bark accumulation.

The 1991 Land Management Plan Revision Draft EIS estimated that 200 to 350 acres of benthic habitat could be adversely affected by new LTFs over the next 30 years (approximately another 0.04 to 0.08 percent of estuarine habitat under 60 feet deep). This figure was not recalculated for the 1997 Final EIS. The 1991 estimate was based on harvest levels that ranged from 139 to 513 million board feet (MMBF). Harvest levels associated with the alternatives considered under this analysis range from 49 to 421 MMBF. Based on the 2007 LSTA and modeling conducted for this EIS, it is estimated that a maximum of 115 new LTFs would be needed under Alternative 7, resulting in an estimated maximum of 230 additional acres of benthic habitat disturbance. Also, the 1991 estimate and the 2 acres of disturbance per LTF figure, assume that logs would be placed into the water and rafted, rather than loaded onto barges as is currently required on many sales. Therefore, the effects of the proposed alternatives are likely to be less than those anticipated in 1991 or 1997, especially for Alternatives 1, 2, and 3. The effects of continuing operation at existing LTFs are likely to be similar under all alternatives; except under Alternative 1, which would use fewer existing LTFs.

Effects on Off-Highway Vehicle Access

The Forest is in the process of preparing access and travel management plans for the Tongass National Forest. The travel management plans will designate a system of roads and trails for OHV use, and identify if any areas for cross country travel are appropriate and do not cause resource damage. The proposed alternatives would not affect this process because all alternatives include the roaded land base. Travel management decisions are scheduled to be completed in 2009.

Effects on Transportation and Power Transmission Line Opportunities

The Transportation and Utility LUDs proposed under the action alternatives include the transportation corridors covered by Public Law 109-59 and the subsequent Memorandum of Understanding with the State. There would be no difference in how these corridors would be managed under any of the action alternatives. Under all of the alternatives, the Transportation and Utility LUDs would be given priority over all underlying LUDs, including LUDs that do not normally allow road construction.

None of the alternatives would affect other regional transportation opportunities or power transmission line opportunities. No new Wilderness or LUD II areas are proposed under any of the alternatives. None of the alternatives proposes changing any of the currently roaded areas to LUDs that would not allow road construction, road expansion, or transmission line construction.

Wilderness and LUD II lands are identified in the current Forest Plan as Transportation and Utility System "Avoidance Areas." Utility sites and corridors may be located in these LUDs if an analysis of potential Transportation and Utility LUD corridors has been completed and no feasible alternatives exist outside this LUD.

Cumulative Effects

Cumulative road miles projected for the next hundred years for each alternative are displayed in Table 3.12-1. In addition, there are approximately 3,756 miles of road on non-NFS lands within the Tongass National Forest boundary (including Annette Island). These include 400 miles on state land, 1,252 miles on Sealaska lands, 1,535 on lands owned by Native corporations, and 569 miles on other lands (including towns and cities). There are another 149 miles on lands outside the Forest boundary. Table 3.12-3 displays the maximum cumulative road miles projected for Southeast Alaska over the next 100 years under the proposed alternatives. The total road miles are likely to be an over-estimate because these numbers include unauthorized roads on NFS lands, most of which are expected to be decommissioned.

The road construction projected for non-NFS lands primarily includes roads needed for timber harvest, but also includes roads likely built to serve communities, such as the Juneau access road on the east side of Lynn Canal, which has an approved ROD. This road and other road corridors covered by Public Law 109-59 would, if approved under NEPA and funded, connect additional areas in Southeast Alaska to the continental highway system and improve transportation between communities. These transportation corridors are displayed on the alternative maps. If all roads envisioned under Public Law 109-59 are built, it would have a major effect on transportation in the region.

Table 3.12-3
Estimated Maximum Road Construction and Cumulative Miles of Roads for All of Southeast Alaska by Alternative After Full Implementation (100+ years)[1]

Alternative	New NFS Roads	New Non-NFS Roads	Existing NFS Roads[2]	Existing Non-NFS Roads	Cumulative Roads[2]
1	774	2,657	4,941	3,906	12,278
2	2,079	2,657	4,941	3,906	13,583
3	2,799	2,657	4,941	3,906	14,303
4	4,890	2,657	4,941	3,906	16,394
5	3,874	2,657	4,941	3,906	15,378
6	3,744	2,657	4,941	3,906	15,248
7	5,825	2,657	4,941	3,906	17,329

[1] Approximately 100+ years
[2] Includes unauthorized roads, most of which are likely to be decommissioned.
Estimates are based on the projected harvest for each alternative; therefore, they represent a maximum estimate. If new wood processing facilities and markets are not developed, these levels of harvest are unlikely to occur. Numbers do not include decommissioning of roads.

Reasonably foreseeable hydroelectric projects include the Ketchikan to Metlakatla transmission line, the Swan Lake to Lake Tyee transmission line, the Kake to Petersburg transmission line, and the Angoon hydro project and transmission line.

There is considerable uncertainty concerning the future development of Southeast Alaska's road and transmission system. New roads linking communities and linking Southeast Alaska to the continental highway system would be expensive to build and maintain, and funds have yet to be approved for their construction. The 2004 SATP estimated in 2004 that the cost would be $1.8 billion over 20 years. Most of the funding was anticipated to come from the federal government. To date, there has been no commitment for this level of funding from either the state or federal governments. Similarly, power transmission lines would be difficult and expensive to build and a lack of funding may limit the development of a power transmission system in Southeast Alaska.

Roads associated with timber harvest are based on the projected harvest for each alternative; therefore, they represent a maximum estimate. If new wood processing facilities and markets are not developed, these levels of harvest are unlikely to occur and new road construction would be less than projected in Table 3.12-3. There is also uncertainty concerning the funds to maintain the existing forest road network, place existing roads into storage status, and to decommission roads that are no longer needed. Risks associated with inadequate funding include adverse affects to fish and water quality and increased safety hazards as older roads and stream crossings deteriorate.

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Timber

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Affected Environment

Introduction

The forests of Southeast Alaska are the main source of raw materials for the region's wood products industry. From 1980 through 2005, the Tongass National Forest accounted for between 18 and 49 percent of the total annual Southeast Alaska timber harvest, averaging approximately 42 percent. During this period, timber harvest on all ownerships in Southeast Alaska ranged from peak levels of just under 1,000 million board feet (MMBF) in 1989 and 1990 to a low of 169 MMBF in 2004. Timber harvested on National Forest System (NFS) lands is available for processing by the local wood products industry but most timber harvested on non-NFS lands is exported. The State increased the sales volume from its forest lands in Southeast Alaska in most recent years to help bridge the gap between national forest harvest and local industry needs. The wood products industry and associated regional employment is discussed in more detail in the *Economic and Social Environment* section of this document.

The forests of Southeast Alaska are primarily the western hemlock-Sitka spruce forest type. This forest type is part of the temperate rain forest that occupies a coastal strip 2,000 miles long from northern California to Southcentral Alaska. The most extensive occurrence of the western hemlock-Sitka spruce type is in Southeast Alaska. Within the Tongass, western hemlock-Sitka spruce stands cover 98 percent of the forest lands. Western hemlock and Sitka spruce comprise the majority of the stocking in this forest type, associated species include, depending on location, yellow-cedar, western redcedar, mountain hemlock, and silver fir (Harris and Johnson 1983). The remaining 2 percent of forest lands support relatively small stands dominated by yellow-cedar, lodgepole pine (shore pine), red alder, or black cottonwood. Western hemlock is used for pilings, poles, railway ties, windowsills, doors, and construction lumber, and has been an important fiber source for pulp. Sitka spruce is used for lumber and commodity products, as well as specialty products, such as piano sounding boards, guitar faces, oars, planking, masts, and spars for custom-made or traditional boats, and ladders. For centuries Alaska Natives have used cedar species for canoes and paddles, housing (along with Sitka spruce), and totem poles. Today, redcedar is primarily used as a roofing material and yellow-cedar has many uses, including boats, utility poles, heavy flooring, framing, and marine decking and piling.

Current Condition of the Forest Land Base

The timber inventory on the Tongass, including the forest type composition, age class distribution, and volume classes, is described in Chapter 3 of the 1997 Tongass Forest Plan Revision Final EIS (USDA Forest Service 1997a). This information was updated with inventory data published in 2001 (van Hees, W. W. S. 2001). Current management practices are also described in the 1997 Final EIS (USDA Forest Service 1997a). Vegetation management practices prescribed under the current Forest Plan, including regeneration methods, reforestation, and intermediate treatments, are described in the standards and guidelines of the 1997 Tongass Forest Plan (USDA Forest Service 1997b). Definitions for each of these practices, how they are applied, and the expected effects on the timber resource are provided.

Forests occupy slightly less than 10 million acres, or approximately 60 percent of the Tongass land area. The remaining 40 percent is non-forested, e.g., water, muskeg, ice, snow, and rock. The forests vary from sparse muskeg forests to heavily timbered stands of 50 thousand board feet (MBF) (long-log bureau scale) per acre or more.

Productive forest land – Forest land capable of producing at least 20 cubic feet of wood fiber per acre per year, or having greater than 8,000 board feet per acre.

Approximately 57 percent of the forest land on the Tongass National Forest (approximately 5.6 million acres) is classified as productive forest land; these lands are considered biologically capable of producing industrial wood products. Approximately 0.5 million acres of the productive forest lands on the Tongass have been harvested to date or have been converted to young growth due to fire or wind. This is approximately 3 percent of the total Tongass land base and 9 percent of the productive forest lands and represents approximately 15 billion board feet of harvested timber. In addition to productive forest lands, the Tongass includes approximately 4.2 million acres of "other forest land." These are lands that are not capable of producing industrial forest products, but are important for watershed protection, wildlife habitat, recreation, and other uses. "Other forest land" is land incapable of yielding crops of industrial wood, usually because of adverse site conditions. These conditions may include sterile or poorly drained soil, subalpine conditions, and steep rocky areas where landslides or avalanches curtail timber development. This land has been called noncommercial or nonproductive forest land in previous documents.

An analysis of timber resource land suitability on the Tongass was completed by the Forest Service for the 1997 Forest Plan Revision Final EIS and updated for this analysis (Appendix A). The National Forest Management Act (NFMA) requires the Secretary of Agriculture to identify lands not suited for timber production due to physical and other pertinent factors. NFMA also included consideration of economic factors in the identification of suitable lands, but the Tongass Timber Reform Act (TTRA) exempted economic considerations as a requirement for identifying suitable lands on the Tongass.

Tentatively suitable lands are lands that have the biological capability, and availability, to produce commercial wood products. To be considered tentatively suitable, the forested land must (36 CFR 219.14):

- Be at least 10 percent occupied by trees or have formerly had such tree cover, and not be developed for non-forest uses;
- Be capable of harvest with available technology to ensure timber production without irreversible resource damage to soil productivity or watershed conditions;
- Be capable of being restocked within 5 years after final harvest; and
- Not be withdrawn from timber production by an Act of Congress, the Secretary of Agriculture, or the Chief of the Forest Service.

In the 1997 Forest Plan Revision Final EIS, it was estimated that there were 2.4 million acres of tentatively suitable lands on the Tongass. The estimated tentatively suitable land base was recalculated for this analysis, and remains at slightly less than 2.4 million acres (Table 3.13-1). Small differences in the tentatively suitable land base are due to updates in the Tongass Geographic Information System (GIS) coverages resulting from changes in land ownership and updates from additional field work, as well as from a different computer measurement method, i.e., using polygon areas rather than extrapolation from a grid system. Figure 3.13-1 illustrates the changes that have occurred to the tentatively suitable forest land base on the Tongass as a result of legislation and the land allocation process over the past 100 years. Of the 2.4 million acres of tentatively suitable land, approximately 1 million acres are estimated to be in land allocations that allow timber harvest and, thus, are mapped as suitable for harvest. After considering factors that are not apparent on aerial photos, such as Class III streams that are not visible under the canopy and unstable areas, there are an estimated 781,000 acres of actual suitable land. Appendix A in the Land and Resource Management Plan describes how the suitable land base was derived.

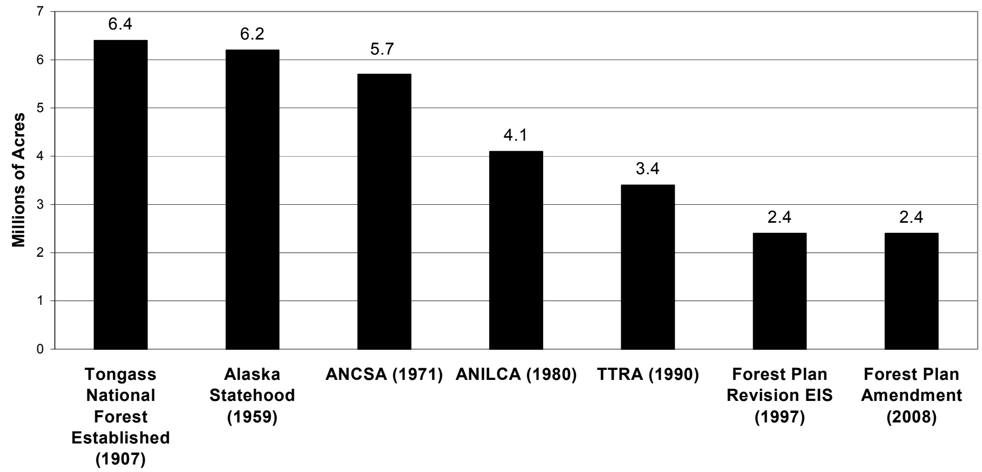
Table 3.13-1
Land Classification (thousands of acres) of Tentatively Suitable and Suitable Lands

Classification	Acres (thousands)[1]
Total National Forest land (items 1 and 2)	16,774
1. Non-forest land (includes water)	6,918
2. Forest land	9,856
3. Forest land withdrawn from timber production	4,234
4. Available forest land (item 2 minus item 3)	5,621
5. Non-productive forest land	2,339
6. Available forest lands (item 4 minus item 5)	3,282
7. Forest lands physically unsuitable for timber management	572
8. Forest lands with inadequate information	345
9. Tentatively suitable forest land (item 6 minus items 7 and 8)	2,365
10. Tentatively suitable forest land allocated to land use designations that do not allow timber management	1,328
11. Mapped suitable forest land (item 9 minus item 10)	1,037
12. Model implementation factor acreage (MIRF)	255
13. Estimated suitable forest land available for timber production	781

[1] Sums and differences may not appear exact due to rounding.
Source: Forest Service GIS database.

A detailed logging system and transportation analysis (LSTA) was completed in 2007. The LSTA covered all suitable land supporting productive old-growth forest and young growth at least 35 years old, utilizing the Forest's GIS database, orthophotos, aerial photos, existing LSTAs, and National Environmental Policy Act (NEPA) documents (EAs and EISs). Suitable lands with productive old-growth forest and with young-growth stands that may be candidates for thinning in 10 to 15 years were divided into logging settings based on a range of factors, such as topography, visual absorption capacity (VAC), scenery integrity objectives (SIO), Land Use Designation (LUD), and logging system. Areas that could not be roaded because of physical limitations or economics were considered helicopter units. Risk factors were assigned to account for possible "falldown" based on photo interpretation and local knowledge. Possible falldown factors included low merchantable volume, slope stability, karst, steep V-notch streams, and riparian concerns. This information was used to complete an operability analysis for all mapped suitable land on the Forest. Table 3.13-2 summarizes the gross acres and volumes (prior to falldown factors being considered).

Figure 3.13-1
Estimated Tentatively Suitable Forest Land (millions of acres) in the Tongass National Forest, 1907 to Present



Notes: ANCSA – Alaska Natives Claims Settlement Act, ANILCA – Alaska National Interest Lands Conservation Act, TTRA – Tongass Timber Reform Act
Source: Forest Service historical data and GIS analysis.

Table 3.13-2
Estimated Gross Acres and Volume by Logging System for Productive Old Growth Based on 2007 LSTA

Logging System	Acres	Volume (MMBF)
Ground Based	161,000	4,000
Short-span Skyline	225,000	6,100
Long-span Skyline	25,000	700
Helicopter less than 0.75 mile	184,000	4,800
Helicopter 0.75 to 2.0 miles	72,000	1,700
Helicopter greater than 2.0 miles	57,000	1,400
Total	**724,000**	**18,600**

Ground Based: areas up to 35 percent slope, 800 foot yarding distance
Short-span Skyline: 1,300-foot yarding distance
Long-span Skyline: 1,300-to 2,000-foot yarding distance
Helicopter less than 0.75 mile: yarding distance less than 0.75 mile
Helicopter 0.75 to 2.0 miles: yarding distance more than 0.75 mile, less than 2 miles
Helicopter greater than 2.0 miles: yarding distance more than 2 miles
Source: Tongass 2007 LSTA includes mapped suitable lands supporting productive old-growth forest and supporting young growth at least 35 years old. Mapped suitable acres do not include falldown factors. Numbers may not appear to add correctly due to rounding.

Current Condition of the Timber Resource

There are six conifer forest types within the Tongass. Western hemlock and western hemlock-Sitka spruce forest types account for approximately 96 percent of the tentatively suitable lands and about 75 percent of all forest lands on the Tongass. The remaining forest lands are occupied by the yellow-cedar (sometimes referred to as Alaska yellow-cedar), western redcedar, lodgepole pine, and Sitka spruce forest types (USDA Forest Service 1997a).

Age Class Distribution. The Tongass is a mix of old-growth stands and naturally regenerated young-growth forest, which consists of both wind-created and harvest-created young-growth forest. Harvest-created young-growth amounts to less than 7 percent of the total forest land area. Suitable forest lands are classified into five stand conditions: 1) old-growth sawtimber, 2) young growth sawtimber, 3) pole timber, 4) seedling and sapling, and 5) non-stocked. For timber inventory purposes, stands of trees 150 years old or older are designated as old growth. More than 85 percent of forest lands meet the criteria for old-growth sawtimber (Table 3-13-3).

To help define tree ages on the Tongass, Farr and McClellan (unpublished manuscript) measured and analyzed age data from 67 plots located throughout the Tongass (excluding the Yakutat Area). They found that 90 percent of all overstory trees were more than 180 years old; 84 percent were more than 200 years; 47 percent were more than 300 years; 15 percent were more than 400 years; and 5 percent were more than 500 years old.

Forests less than 150 years cover approximately 0.7 million acres; forests that are 150 years of age or greater cover nearly 5 million acres. Table 3.13-3 lists the total acres of productive forest land and the acres that are suitable for timber production within two broad age classes.

Table 3.13.3
Estimated Age Class Distribution of All Productive Forest Land and Suitable Productive Forest Land (acres)

Age (Years)	All Productive Forest Lands[1]	Suitable Forest Lands[1,2]
0 to 149	689,000[3]	250,000[3]
150+	4,951,000	532,000
Total	5,640,000	781,000

[1] Numbers may not appear to add correctly due to rounding..
[2] Mapped suitable acres adjusted (reduced) for falldown (MIRF).
[3] Includes natural young growth and regeneration after harvest.
Source: Tongass National Forest GIS database

Table 3.13-4 displays the acres harvested by age class. Approximately 45 percent of the area harvested over that past century is no longer suitable, due to changes instituted by Congress or due to Forest Plan decisions. For example, areas designated as Wilderness or LUD II by Congress are no longer tentatively suitable. Tentatively suitable areas harvested within the 1,000-foot-wide beach fringe, riparian areas, and old-growth reserves are no longer suitable for timber harvest.

Table 3.13.4
Estimated Age Class Distribution of Harvested Stands (acres)

Age Class (Years)	All Forest Lands[1]	Suitable Forest Lands[1,2]
0 to 35	282,000	163,000
36 to 70	162,000	64,000
>70	10,000	1,000
Total	**455,000**	**228,000**

[1] Numbers may not appear to add correctly due to rounding..
[2] Mapped suitable acres adjusted (reduced) for falldown (MIRF).
Source: Tongass National Forest GIS database

Species Mix and Log Types

Timber harvest on the Tongass generally results in a mix of species and log types. The majority of the logs cut in most sales are western hemlock; Sitka spruce is the second most common species. Together these two species account for the majority of the harvest, based on the SPECTRUM model results (refer to Appendix B for a discussion of the Spectrum model) and the estimated species mix identified in the 1997 FEIS for the current Forest Plan. Yellow-cedar and western redcedar account for most of the remaining volume. Cedar, especially yellow-cedar, often commands high prices on the export market and is generally exported (refer to the *Economic and Social Environment* section for discussion of utilization).

Trees harvested from old-growth stands on the Tongass often contain three types of logs: sawlogs, utility logs, and cull logs. Figure 3.13-2 shows one possible example of a tree containing all three log types. Sawlogs are logs that come from that portion of the tree that is of suitable size and quality to be cut into dimension lumber. Sawlogs usually come from the lower portion of the tree, the part of the tree with larger diameter logs. Higher quality sawlogs come from that portion of the tree with fewer branches, which can result in lumber with fewer knots, while lower quality sawlogs often come from that portion of the tree that still retains a live crown. Utility logs are logs that cannot be used to produce lumber but are suitable for chips. They contain at least 50 percent sound wood. Utility wood is also produced from portions of sawlogs that cannot be cut into lumber (refer to Figure 3.13-2). The third type of logs, referred to as cull logs, are logs that do not have enough sound wood to be merchantable, even for chips. These logs are usually left in the woods and contribute to large woody debris (LWD) component and structure left on the forest floor.

Timber Inventory Methodology and Scientific Accuracy

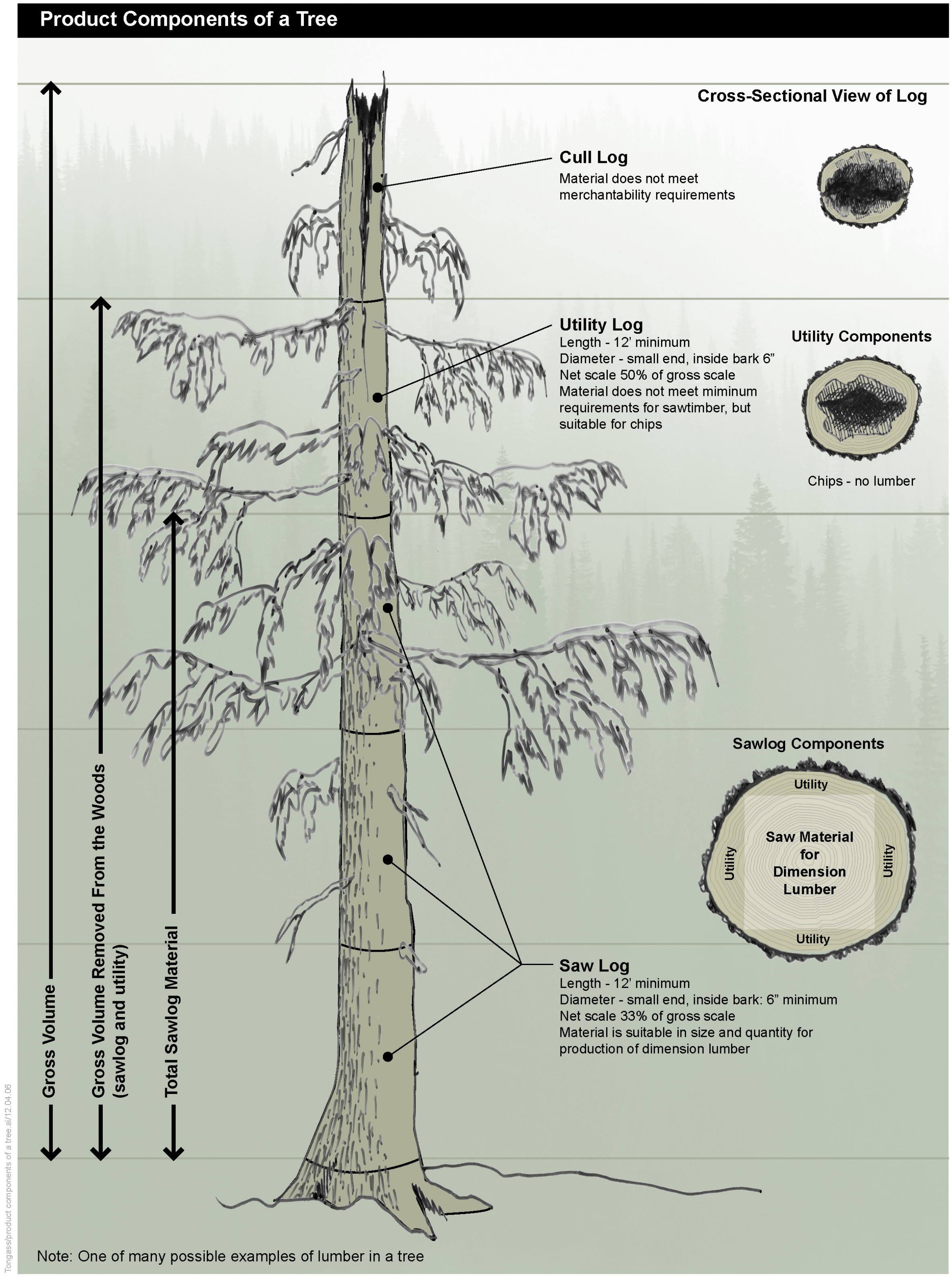
The first Southeast Alaska-wide timber inventory began in 1953 and was completed in 1958. Due to the extensive area to be covered, the inventory was subdivided into Juneau, Sitka, Petersburg/Wrangell, Yakutat, and Ketchikan/Craig working circles. Ten years later, a portion of the original inventory was re-measured to improve estimates of growth and mortality trends in young-growth stands in Southeast Alaska. Young-growth stands, for timber management considerations, were defined as being less than 150 years old and normally less than 20 inches in diameter (measured at “breast height”).

A complete re-inventory program to re-evaluate Southeast Alaska’s forest area and volume began in the early 1970s and was completed by 1975. Several new categories of information were collected, including data to evaluate the level of stocking (the number of existing trees compared to full stocking of trees for a site), strata classes (timber categorized by several attributes such as species, decadence, stocking, site index, and board feet per acre), soils, slope, a better definition of harvest categories, and a redefinition of quality guides. Detailed data, such as risk class and soil microsite, were collected on individual trees to better estimate their potential for timber management considerations.

In 1979, an extensive point sampling system inventory developed for the Tongass Land Management Plan gathered specific information across the Tongass to provide specific information for the completed 1970s forest inventory. In the early 1980s, this inventory was redesigned by the three Administrative Areas (Chatham, Stikine, and Ketchikan, which correspond to the north, central, and southern portions of the Tongass). Field data collection for this inventory was completed in 1985.

The 1980s inventory was designed to estimate the standing volume on the Forest within certain error limitations. The sampling errors for area and volume met the requirements of Forest Service Handbook (FSH) 2409.13 (plus or minus 10 percent per billion net cubic feet at a 68 percent confidence level). A review of the inventory methodology and results was conducted in September 1989 by a Forest Service Biometrician, Jim Brickell. He concluded that the inventory results are reliable as an

Figure 3.13-2
Product Components of a Tree



assessment of forest areas and volumes at the forest and area levels (Brickell 1989). Although the data for the inventory were gathered on a forest-wide basis, the inventory was designed to be specific only to the Administrative Area level. The inventory was not designed to collect all timber resource information, nor was it designed for comparison of individual plot results to timber type map polygons or volume strata.

The results of the 1980-85 inventories showed that the Tongass National Forest had a net growing stock of 22.7 billion cubic feet on 4.3 million acres of available lands (5.3 thousand cubic feet per acre). This would indicate that the 2.42 million acres of tentatively suitable land had approximately 12.8 billion cubic feet of growing stock. The net growing stock for the 5.7 million acres of productive forest land was 31.5 billion cubic feet, or 5.5 thousand cubic feet per acre (approximately 27.5 MBF per acre).

Forest Strata

The Forest established four volume classes of commercial timber in the 1979 Forest Plan (amended 1985). Using net inventory volumes per acre, these classes are:

- Class 4: 8,000 to 20,000 board feet
- Class 5: 20,001 to 30,000 board feet
- Class 6: 30,001 to 50,000 board feet
- Class 7: 50,001 board feet or greater

There were a number of concerns from within and outside the agency regarding the reliability of this information (usually referred to as the volume class map). Therefore, a study addressing concerns about the volume class map reliability was commissioned in 1989. It concluded that there was no statistical difference among volume classes 5, 6, and 7 with respect to mean board feet per acre, and the existing volume class map should not be used to determine volume per acre (Brickell 1989).

The volume class map was used by the Alaska Region to calculate long-term timber sale contract timber volume proportionality, as required by Section 301 of TTRA. However, this procedure was successfully challenged in court by The Wildlife Society, Alaska Chapter. The court disputes over TTRA Section 301 proportional harvest methodology were settled, with issuance of an updated Forest Service Handbook Supplement (Region 10, FSH 2409.18 Supplement No. 2409.18-96-1), and alternative methods of assigning timber volume (or the capability to produce different timber volumes) to lands currently supporting old-growth forests were considered for the 1997 Forest Plan Revision. Five different options were studied and evaluated (Julin and Caouette 1997). Statistical analysis indicated that three strata can be distinguished for the available forest lands (lands not legislatively or administratively withdrawn) using the existing inventory and additional information on soils and slope. The polygon characteristics of the three-strata approach are displayed in Table 3.13-5. In the development of the new size-density model (SDM) (see *Biodiversity* section), these strata were redefined using improved information on hydric soils and aspect. Table 3.13-5 is based on these redefined strata. These strata were used to model timber outputs for this analysis (refer to Appendix B for a discussion of the SPECTRUM model).

Table 3.13-5
Tongass National Forest Strata Characteristics–Productive Old-Growth Forest

Geographic Area	Trees/ Acre	Gross Volume (MBF/ Acre)	Net Sawlog Volume (MBF/Acre)	Net Utility Volume (MBF/Acre)	Total Net Sawlog and Utility Volume (MBF/Acre)
North Islands[1]					
Low	102	17.8	11.1	1.8	12.9
Medium	89	27.8	17.7	3.0	20.7
High	89	39.8	25.6	4.8	30.4
North Mainland[1]					
Low	137	12.3	7.6	0.9	8.5
Medium	148	35.0	19.6	4.5	24.1
High	89	39.8	24.6	4.7	29.3
South Island[1]					
Low	151	20.9	13.7	2.0	15.7
Medium	100	30.3	20.7	2.9	23.6
High	97	41.7	29.3	5.1	34.4
South Mainland[1]					
Low	97	22.9	15.1	2.0	17.1
Medium	100	30.3	21.0	3.0	24.0
High	111	41.3	30.2	5.4	35.6
Yakutat					
Low	21	6.5	4.7	0.5	5.2
Medium	187	40.4	27.7	5.0	32.7
High	196	45.2	32.7	4.1	36.8

[1] North Islands: Chichagof, Baranoff, Admiralty, and associated islands; North Mainland: mainland north of the Stikine River; South Islands: Kupreanof, Mitkof, Kuiu, Prince of Wales, and associated islands; South Mainland: mainland south of the Stikine River.
Refer to USDA Forest Service 2006, SDM Data for documentation on why forests were grouped in these geographic areas. Numbers not exact due to rounding.

While the three-strata approach is useful for estimating timber volume for forest planning purposes, it is not a good tool for identifying other important forest elements, including forest structure, ecosystem diversity, and wildlife habitat. For example, two stands may have the same volume, but one may be a dense stand of medium-sized trees with a single canopy layer, while the other stand may be a combination of widely spaced large overstory trees and two or three lower canopy layers containing small- and medium-sized trees. The SDM, which uses a combination of two common forest measurements, tree sizes and tree densities (Caouette et al. 2001), has proven to be a better tool for representing these other forest elements. Using tree sizes and densities provides a more comprehensive forest measuring system for describing habitat than timber volume (Spies and Franklin 1991). The new SDM (Caouette and DeGayner 2005) is described and used in the *Biodiversity* and other sections.

Non-National Forest System Lands

The State of Alaska, Native village corporations, Sealaska (the Native regional corporation) and individuals own over 1,050,000 acres of land in Southeast Alaska, inside the Forest boundary. Approximately 408,000 acres of this land currently consists of productive old-growth forest and 351,000 acres consists of young growth. This means that approximately 46 percent of the original productive old growth has been harvested (as of 2006 based on GIS analysis and information provided by the landowners). Most timber harvested from state lands in recent years has been processed locally, while timber harvested from University Trust and Mental Health Trust lands has been exported.

Current Practices

Regeneration Methods

Even-aged Systems. This system includes clearcuts, seed tree, and shelterwood harvest methods. These methods are described in detail in Appendix G of the 1997 Tongass Land Management Plan Final EIS. Under an even-aged system, the intention is to replace the entire (or nearly the entire) stand with a new crop of trees that are all of the same age. Under NFMA, clearcutting can only be used when it is the optimum system. This is determined through a site-specific prescription approved by a certified silviculturist. Also under NFMA, a stand must have reached at least 95 percent of culmination of mean annual increment (CMAI). This is the point at which the stand reaches its highest average growth. The exact age that this occurs varies by site and stand treatment. A stand on a high site will generally reach CMAI sooner than one on a lower site. However, stand treatments, such as precommercial thinning and commercial thinning, will generally extend the period of fast growth, causing the stand to take longer to reach CMAI.

Clearcutting, with reliance on natural seeding, has been the most commonly used silvicultural system in the Sitka spruce-western hemlock forest type of Southeast Alaska (Ruth and Harris 1979, Deal et al. 2002). Clearcutting is used where timber production is the primary use and where it is the optimal method. The clearcutting method is favored for several reasons. Clearcutting increases exposure to the sun, which raises soil temperature, speeds up organic decomposition, and thus improves soil productivity. Sitka spruce is less tolerant of shade than western hemlock (USDA Forest Service 1990); therefore, in the mixed spruce-hemlock forests of Southeast Alaska, the open conditions created by clearcutting favor the regeneration of Sitka spruce (Ruth and Harris 1979). Clearcutting in stands infected by dwarf mistletoe substantially reduces infection in the regenerated stand (Shaw and Hennon 1991). Logging costs are lower than with other systems, and the clearcut method has proven very successful in the regeneration (regrowth) of healthy forested stands (refer to Appendix G in the 1997 FEIS for additional discussion).

A variant of this system, referred to as clearcutting with reserves, involves retaining approximately 10 percent of the stand, either in single trees or in small groups. This method is generally used to meet scenery or wildlife needs in areas where timber production is the primary goal.

In 1992, the Chief of the Forest Service directed that the even-aged system (clearcutting) be limited to areas where it is essential to meet Forest Plan objectives. Clearcutting has traditionally been used in the hemlock-spruce forests of Southeast Alaska to reduce mistletoe infection by eliminating infected trees from the overstory, reduce heartrot and stem diseases that may result from logging damage to leave trees, and to eliminate the risk of blowdown of residual trees. In addition, it requires fewer miles of road for a given volume (Ruth and Harris 1979, USDA Forest Service 1983). Because more volume is harvested from each acre than would be the case under uneven-aged management, many fewer acres are impacted for the same harvest volume.

Two-aged Systems. In this system, for example, up to 30 percent of a stand is left as residual (or reserve) trees, either as single trees or in patches, and the rest of the stand is harvested. The reserve trees remain unharvested and provide structural diversity and an older aggregation of trees within the otherwise young-growth stand. This system has been used on the Tongass to meet scenery objectives. Logging costs can be higher because of the need to protect the reserve trees.

Experience in other regions indicated that retaining overstory trees led to regeneration of more shade-tolerant species (which would favor hemlock over Sitka spruce in Southeast Alaska), reduced growth, increased dwarf mistletoe infection in understory trees, and resulted in windthrow of overstory trees (Harris and Farr

1974). However, a retrospective study of 18 partial cut stands in Southeast Alaska found that partial cutting had little effect on tree species composition, diameter growth, or dwarf mistletoe levels (Deal and Tappeiner 2002, Deal 2002). Mortality of residual trees was only marginally higher in partial cut stands than in uncut stands; although the location of these stands may have contributed to the relatively low level of wind damage. The stands sampled in this study were all below 100 feet in elevation and within 1.25 miles of the shoreline. Stands on exposed south-facing ridges and on slopes are likely to have a greater risk of windthrow (Nowacki and Kramer 1998). Windthrow may be of particular concern because one of the predicted outcomes of climate change in Southeast Alaska is an increase in the frequency of severe wind storms. Juday et al. (1998) considered it highly likely that there would be increased blowdown across Southeast Alaska in the future.

Uneven-aged Systems. This system typically involves harvesting of single trees or of small groups of trees (usually less than 2 acres) from within a stand. This method maintains a multi-aged, multi-layered stand structure by removing some trees in all age groups. It has been used on the Forest to meet scenery and wildlife habitat needs. Uneven-aged management often involves higher costs and affects larger areas than would be needed for the same harvest volume under an even-aged or two-aged system (Ruth and Harris 1979). Also, the frequent entries in the stand to remove individual or small groups of trees increases logging costs and the risk of damaging the remaining trees (USDA Forest Service 1983).

There is little scientifically documented experience with uneven-aged harvest in Southeast Alaska (McClellan et al 2000). Deal (2001) concluded that it may closely mimic the natural disturbance regime of Southeast Alaska based on a retrospective study of 18 partial cut stands. Stand structures were similar to uncut old-growth stands, and cutting had no significant effect on species composition (Deal and Tappeiner 2002). Uneven-aged systems have potential benefits, including protection of wildlife habitat, scenery, and slope stability as well as the maintenance of biological diversity (McClellan et al. 2000).

Young-Growth Management

Managing young-growth forests in Southeast Alaska is likely to become an increasingly important component of forest management on the Tongass in the coming years. Young-growth stands can be treated through thinning and other intermediate treatments to concentrate growth in fewer, larger trees, improve lumber quality, and/or to enhance habitat conditions for wildlife. Zaborski et al. (2000) concluded that the types of treatments applied to young stands will have a profound effect on the types of materials available in the future, including log diameter, knot size, and wood strength.

Over 100,000 acres have been precommercially thinned on the Tongass since 1979. In recent years, precommercial thinning has averaged approximately 5,600 acres per year. The Forest has much less experience with other young-growth management techniques, such as pruning and commercial thinning.

Barbour et al: (2005) estimated that a precommercial thinning at age 20 with a spacing of 12 by 12 feet would produce more merchantable wood volume at age 70 than wider spaced thinnings. However, there is a trend toward wider tree spacing in precommercial thinning prescriptions to maintain or enhance understory plant cover. These treatments could increase taper and stimulate the production of epicormic branches (in spruce) and knot size. These changes could adversely affect wood strength and stiffness (McClellan 2005). There is also a concern that wider spacing may increase the occurrence of fluting on sites where this is a problem (Julin et al. 1993, Holsten et al. 2001).

Pruning removes lower branches and can increase future lumber quality; however, care must be taken not to remove too much of the live crown. Petruncio (1994) recommends that 33 percent of the live crown (no more than 40 percent) can be removed in a western hemlock-Sitka spruce forest without affecting tree growth. Pruning may also increase epicormic branches in Sitka spruce. Deal et al. (2003) reported that 232 out of 236 Sitka spruce had between 9 and 11 sprouts per meter of tree bole. Significantly more large sprouts were produced in the highest pruning lift.

There has been increased interest in commercial thinning in recent years, not only to improve timber values, but as a tool to improve wildlife habitat. Studies in other forest types in the Pacific Northwest indicate that stand structures that are similar to old-growth forest conditions can be developed through thinning (Thysell and Carry 2000). However, there are many unanswered questions as to how to implement thinning treatments that provide a sustainable source of high-value wood products while maintaining biological diversity (Zaborske et al. 2000). In a study comparing the lumber harvested from thinned and unthinned, 90-year-old stands on the Tongass National Forest, Christensen et al. (2002) found that there was no difference in volume recovery or lumber grade in thinned and unthinned Sitka spruce. For western hemlock, the unthinned stands produced more wood volume, but the thinned stands produced more high-grade lumber. There was no difference in the bending module of elasticity for lumber produced from thinned or unthinned stands for either species.

There is also increased interest in managing young-growth stands to increase and maintain understory vegetation, especially as forage for deer and other wildlife. Hanley et al. (2005) noted that much research is needed on new approaches involving thinning of older stands and on including red alder in the secondary successional sequence. Zaborske et al (2002) found that thinning greatly increased forage production, though the amount of useful forage produced varied by the type of thinning implemented. Refer to the *Wildlife* section for a discussion of habitat manipulation.

In additional to their continuing research on managing young forests, scientists at the Pacific Northwest Research Station joined with the Tongass National Forest in 2001 to establish an operational-scale adaptive management study of young-growth management options. This program, called the Tongass-wide Young-Growth Studies (TWYGS), is designed to evaluate the potential benefits of treating young-growth stands to increase wildlife habitat and wood production. Currently, TWYGS includes experiments that test the effectiveness of alder interplanting, precommercial thinning, and pruning.

Yarding Methods

On the Tongass, most logs have been yarded downhill using cable logging systems such as highlead and skyline. Access has usually been from valley bottoms, because road building on steep slopes is difficult and costly. Most logging occurs inland, with logs transported via road systems to marine access points, also referred to as log transfer facilities (LTFs), at tidewater (see the *Transportation and Utilities* section). Harvest by tractor (shovel yarding) has proven effective on flat to moderate slopes; it is not practical on steep slopes. Harvest by helicopter has been limited in the past but is increasing; it is typically the costliest method, but also has fewer adverse effects on other resources.

Yarding methods can be divided into three "operability" classes, which relate to the methods necessary to harvest and transport trees under various conditions. Normal operability includes the standard ground-based and cable logging systems used in areas where access is relatively easy and helicopter logging with distances of up to 0.75 mile. These areas have the lowest logging costs. Difficult operability includes long-span cable systems and helicopter logging with distances between 0.75 and 2.0 miles, occurring where ground access is difficult or not possible. Difficult operability involves higher costs. The third class, isolated operability, consists of isolated stands 2.0 miles or more from a helicopter landing site. These tend to be uneconomical under even high timber markets.

The recent LSTA indicates that approximately 89 percent of the suitable timber land would be accessible using normal harvest methods, 10 percent would be difficult, and 1 percent would be isolated. When economic and environmental risk factors are considered, additional areas are likely to be identified as difficult or isolated during project planning. Risk factors assigned by the LSTA team and district personnel, indicate that about 85 percent of the suitable acres with old-growth forest would be in the normal category.

Tongass Timber Sale Program

One objective of the Alaska National Interest Lands Conservation Act (ANILCA) was the maintenance of timber supply for the Southeast Alaska timber industry because of its contribution to the local and regional economies of Southeast Alaska. For similar reasons, TTRA (Section 101) directs the Forest Service to seek to provide a supply of timber from the Tongass that meets annual market demand and the market demand for each planning cycle to the extent consistent with providing for the multiple-use and sustained-yield of all renewable resources. The planning cycle is assumed to be the 10- to 15-year period between Forest Plan revisions.

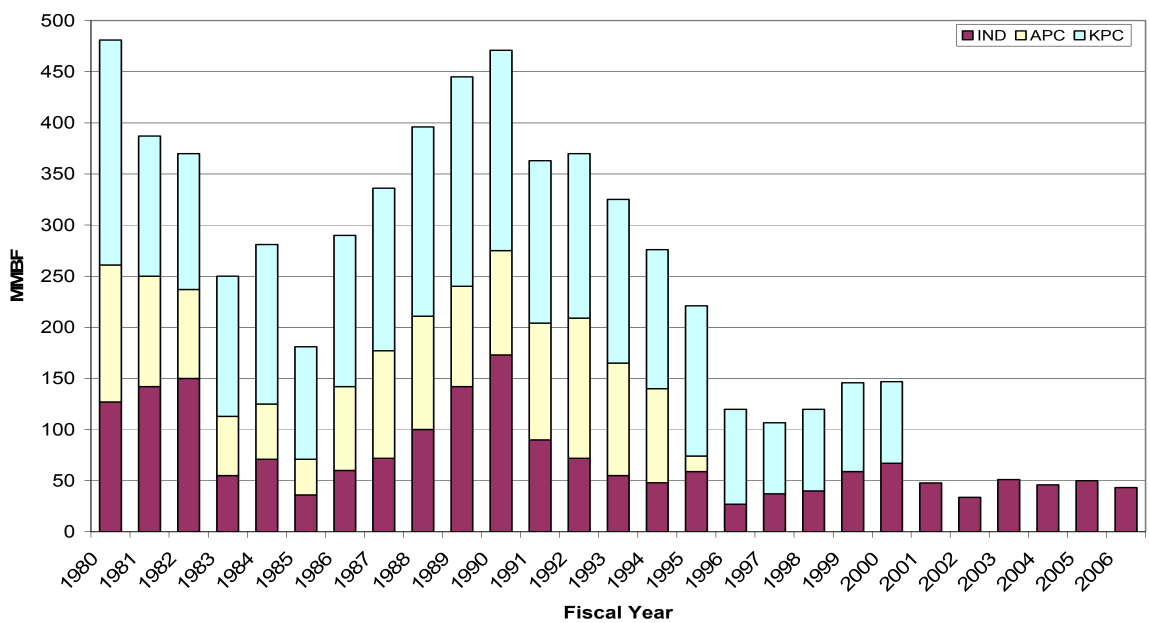
The Tongass timber program is part of a long-term cooperative effort among the federal government, the State of Alaska, and local governments to provide economic diversity and stability in Southeast Alaska and more year-round employment. During the 1920s, the Forest Service proposed several long-term sales to help establish a pulp industry in Southeast Alaska. The objective was to provide a sound economic base in Alaska through establishment of a permanent year-round pulp industry. The Forest Service established requirements to process timber in Alaska, including the construction of pulp mills, via 50-year timber sale contracts awarded in the early 1950s. The first successful sale was made in 1951, and the construction of a pulp mill was completed at Ward Cove near Ketchikan in 1954. This long-term contract was held by Ketchikan Pulp Company (KPC). During the 1950s, the Forest Service offered three additional long-term sale contracts. The belief was that a long-term sale was necessary to ensure the supply of timber and attract an integrated wood products industry to Alaska.

These long-term timber sale contracts are no longer operating. The U.S. Plywood-Champion Paper contract in the Juneau District was canceled by mutual consent in 1976; no operations were performed on the ground. The Pacific Northern Timber Company contract, located on the Wrangell District, required the construction and operation of both a sawmill and pulp mill for 50 years. Only the sawmill was built and operated and the contract was limited to 25 years. All ground activities for the Wrangell Unit were completed in 1981 (USDA Forest Service 1997a). The Alaska Pulp Corporation (APC) closed their Sitka pulp mill in 1993 and the Wrangell sawmill closed in 1995. Their contract was terminated by the Forest Service in 1994. An end to the KPC contract, which was due to expire in 2004, was negotiated in February 1997. The KPC pulp mill closed in 1997.

The average annual timber harvest on the Tongass was about 40 MMBF per year from the early 1900s to 1952. Timber harvest averaged about 358 MMBF per year (sawlog and utility) for the next 45 years after establishment of the long-term contracts in the 1950s. This volume was generated primarily from the KPC, Pacific Northern Timber, and APC contracts. Harvests peaked in 1973 at approximately 591 MMBF and then declined to a low of about 181 MMBF by 1985 (Figure 3.13-3). Harvest levels rose again until 1990 and then declined to their current levels.

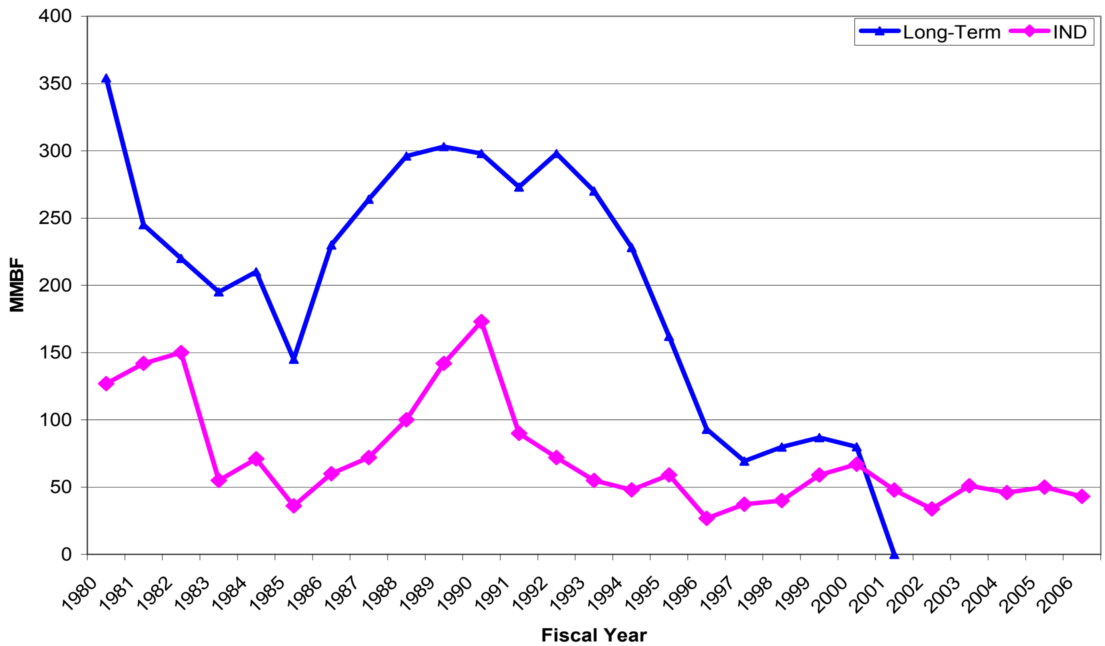
Long-term sales comprised almost three-quarters of the timber volume made available during the period of 1980 through 1991 (USDA Forest Service 1997a; Table 3-74). Between Fiscal Years 1980 and 1995, an annual average of 247 MMBF of volume was made available to the long-term contract holders. Because of market fluctuations, appeals and litigation, and other factors, the long-term contract holder annual average harvest between 1980 and 1995 was about 249 MMBF. Total annual average harvest was approximately 340 MMBF over the same time period. KPC continued to harvest timber until 2000 (Figure 3.13-3). Annual timber harvest averaged approximately 46 MMBF from 2001 to 2005. This represents approximately 13 percent of the total average annual harvest from 1980 to 1995 (340 MMBF). This decrease is largely due to the termination of the long-term contracts with APC and KPC. However, there has also been a decrease in harvest by independent timber operators since 1990 (Figure 3.13-4). Independent timber operators harvested an average of more than 100 MMBF per year between 1980 and 1990. Harvest peaked at 173 MMBF in 1990, about 37 percent of that year's total harvest. Independent harvest decreased sharply in the early 1990s, with a low of 27 MMBF harvested in 1996 (refer to the Economics and Social section for a discussion of this decline). Annual independent harvest has continued to fluctuate since then, ranging from 34 MMBF in 2002 to 67 MMBF in 2000 (Figures 3.13-3 and 3.13-4).

Figure 3.13-3
Tongass National Forest Timber Harvest Histogram for 1980 to 2006



KPC – Ketchikan Pulp Company; APC – Alaska Pulp Corporation; IND – Independent timber operators
Source: USDA Forest Service harvest records

Figure 3.13-4
Tongass National Forest Timber Harvest Line Graph for 1980 to 2006



Long-Term – Long-term contract holders (APC and KPC); IND – Independent Timber Operators
Source: USDA Forest Service harvest records

The current Tongass timber program is composed of a large sale program, a small sale program, and a firewood and personal use program. Harvest volumes averaged 45 MMBF between 2002 and 2006, notably lower than the average annual harvest of 358 MMBF for 1952 to 1997 (Table 3.13-6 in the following sub section) and the Allowable Sale Quantity (ASQ) of 267 MMBF per year approved in the 1997 Record of Decision.

The timber sale program has been in transition since the end of the long-term contracts. Many small operators are in the process of developing direct markets for value-added products, such as molding, tongue-in-groove, paneling, and furniture. There were 15 small mill operators on Prince of Wales Island alone as of August 2005 (Petersen and Bruns 2005). The Forest has created a program to make wood available to small operators, referred to as the microsale program. This program makes dead and down wood with a value of $10,000 or less available to local purchasers by competitive means. The Forest Service and the University of Alaska have created the Ketchikan Wood Technology Center to focus on ways to help the local timber industry. Among other things, the center has developed log grades for Alaskan wood products.

The primary sources of timber in Southeast Alaska are the Tongass National Forest, private corporations (principally Alaska Native Corporations formed through the Alaska Natives Claims Settlement Act [ANCSA]), and the State of Alaska (USDA Forest Service 1997a; Table 3-75). Timber harvest patterns are discussed in greater detail in the *Economic and Social Environment* section of this document.

Timber Sale Management

The Forest Service employs a “pipeline” approach to timber sale planning to provide a stable timber sale program and a continuous flow of timber to regional timber processors. The resulting program is complex and requires that the Forest Service manage four “pools” of timber volume, commonly referred to as the timber pipeline:

- **Timber volume identified in the Forest Service’s 10-year Timber Sale Plan.** This pool contains sales available for future timber sale planning and preparation.
- **Timber volume in preparation.** This pool contains sales that are being analyzed and are undergoing public comment through the NEPA process. This can take from 2 to 4 years to complete and ends when a NEPA decision is made.
- **Timber volume available for sale.** This pool contains NEPA-approved sales. Administrative appeals have been resolved, and litigation, if any, has also been resolved. This volume is available to program managers to schedule for sale offerings. Managers need to maintain enough volume in this pool to be able to schedule future sale offerings in an orderly manner and of the size and configuration that best meets regional demand. The Forest Service tries to announce probable future sale offerings at least a year in advance to allow potential purchasers an opportunity to conduct their own evaluations of these offerings in order to determine whether to bid and, if so, how much to offer.
- **Timber volume under contract.** This pool contains sales that have been sold, but not yet harvested. Timber contracts typically give the purchaser 3 to 5 years to harvest or remove the timber purchased. The Forest Service attempts to maintain about 3 years of unharvested timber volume under contract to purchasers. This practice is not limited to the Alaska Region, but is particularly relevant to Alaska because of the nature of the land base. The relative absence of roads, the island geography, and steep terrain mean that much of the timber is isolated and timber purchasers need longer-than-average lead times to plan operations, stage equipment, set up camps, and construct roads prior to beginning harvest.
- Timber sales can take from 3 to 5 years to complete. Sales offered by the Forest Service vary in size to meet the needs of different purchasers. The time taken to complete a sale may vary with the size of the offering. Uncertainty and delays may be introduced through appeals and litigation. The pipeline approach and the variable length of the timber sale process generally make it difficult to draw a direct relationship between particular sales and regional timber demand. Not all of the volume offered for sale since 2001 has been sold. Some sales did not receive bids and many others have been held up by appeals and/or litigation (Table 3.13-6). There were both project- and Forest Plan-related appeals and litigation (i.e., the Roadless Rule).

Timber under Contract

As of May 19, 2006, there were approximately 70 timber sales with approximately 118 MMBF of timber volume under contract on the Tongass National Forest. Although there are nearly 50 timber companies and individuals that either purchase timber or have shown an interest in purchasing timber from the Tongass, over 85 percent of the timber under contract is under contract with four operators: Viking Lumber Company (49.8 percent), Pacific Log and Lumber (26.1 percent), Icy Straits Lumber (7 percent), and Alcan Forest Products (5 percent). These figures do not include all microsales (sales under $10,000). Timber under contract is discussed in greater detail in the *Economic and Social Environment* section.

Long-term sales comprised almost three-quarters of the timber volume harvested during the period of 1980 through 1995 (Figure 3.13-3). During this period, an annual average of 249 MMBF of volume was harvested under the long-term contracts. During this same period, independent sales averaged 91 MMBF per year, ranging from a low of 36 MMBF in 1983 to a high of 173 MMBF in 1990.

The primary sources of timber within Southeast Alaska are the Tongass National Forest, private corporations (principally Alaska Native Corporations formed through ANCSA), and the State of Alaska (Table 3.13-7). Between 1980 and 1990, harvest from the Tongass contributed about 50 percent of the timber supply in Southeast Alaska. However, timber harvest since 1990 has fallen to less than 50 percent of total supply. The Tongass contributed approximately 23.6 percent of the total timber supply in Southeast Alaska between 2001 and 2005.

Table 3.13-6
Volume of Timber Offered, Sold, and Harvested from the Tongass National Forest for FY 2002-2006 (MMBF) [1]

Fiscal Year	Offered	Sold	Harvested
2002	56.9	24.4	33.8
2003	88.8	30.5	51.3
2004	72.6	87.1	46.4
2005	110.4	67.3	49.6
2006	24.0	85.0	43.0
5-Year Average	**70.5**	**58.9**	**44.8**

[1] Volumes do not include re-offered sales, re-sold sales, or credit volumes
Source: USDA Forest Service, Alaska Region. Data on file with Regional Economist, Ecosystems Planning, USDA Forest Service, PO Box 21628, Juneau, AK 99802-1628

Table 3.13-7
Timber Harvest and Imports for Southeast Alaska, 1992-2005 (MMBF)[1]

		1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Tongass NF	Sawlogs	303.1	268.3	221.8	181.3	97.4	94.4	107.6	132.8	133.7	39.8	30.0	44.1	40.9	43.3
	Utility Logs[2]	66.6	56.7	54.0	39.8	22.8	12.2	12.2	12.9	13.0	7.9	3.8	6.7	5.4	6.2
State of Alaska[3]	Sawlogs	14.9	5.0	18.1	3.6	4.5	5.2	5.6	7.3	47.8	48.0	48.0	32.7	21.9	40.7
	Utility Logs	0.1	0.0	2.7	2.2	2.5	0.3	1.9	0.1	12.1	5.2	9.3	2.1	2.3	2.2
BIA	Sawlogs and Utility[2]	4.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.4	0.0	0.0	0.0	0.0
Alaska Native Corporations[4]	Sawlogs	348.7	328.2	275.0	233.9	292.4	335.9	157.6	193.6	114.6	106.5	93.6	98.1	92.0	99.3
	Utility Logs[2]	97.0	82.2	12.3	81.1	37.7	47.6	59.0	45.4	46.0	13.3	8.1	7.6	6.9	4.6
Southeast Alaska Total	Sawlogs	671.2	601.5	514.9	418.8	394.3	435.5	270.8	333.7	296.2	194.3	171.6	174.9	154.8	183.3
	Utility Logs[2]	163.7	138.9	69.0	123.1	63.0	60.1	73.1	58.4	71.1	26.3	21.2	15.4	14.6	13.2
	Total	834.9	740.4	583.9	541.9	457.3	495.6	343.9	392.1	367.2	220.6	192.8	190.3	169.4	196.5
Alaskan Imports[5]	Sawlogs	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	--	--	--	--	--
	Utility Logs[2]	3.0	3.0	3.0	11.5	34.1	0.0	0.0	0.0	0.0	--	--	--	--	--
	Chips	0.0	1.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	--	--	--	--	--

[1] National Forest and Bureau of Indian Affairs (BIA) harvests reported for fiscal years. All other ownerships reported in calendar years.
[2] Utility volume includes logs with less than one-third net sawlog but at least one-half firm usable pulp chips.
[3] Harvests from Alaska Mental Health Trust and University of Alaska lands omitted prior to 2000.
[4] Estimated by telephone survey. Metric tons converted to log scale at a ratio of 2.7 tons per thousand board feet (MBF).
[5] Compiled from trade statistics available from the U.S. Department of Commerce. Metric tons converted to log scale at a ratio of 2.7 tons per MBF.
Source: USDA Forest Service, Alaska Region. Data on file with: Regional Economist, Ecosystems Planning, USDA Forest Service, PO Box 21628, Juneau, AK 99802-1628

Timber Demand

Demand for timber products from the Tongass National Forest is discussed in detail in the *Economic and Social Environment* section.

Environmental Consequences

The analysis of the potential effects of the alternatives addresses the following questions:

- How much land would be allocated to timber production?
- What silvicultural systems and vegetative practices would be utilized?
- What would the ASQ be under each alternative?
- What projected log grade or quality would be provided?
- What would the product mix be, in terms of sawlogs and utility logs?
- What would the long-term sustained yield (LTSY) be under each alternative?
- What are the factors that affect the attainment of the ASQ?
- What would be the future condition of the Forest in 150 years?

The analysis of timber supply and demand for timber products, as well as how existing sales under contract and timber volume in preparation may be affected by the alternatives, is discussed in the *Economic and Social Environment* section.

The effects on the timber industry infrastructure and employment levels are also discussed in that section.

Suitable Timber Lands

There are approximately 2.4 million acres of tentatively suitable lands, as defined by NFMA regulations (36 CFR 219.14(a)) and Section 102 of TTRA. Slightly over 1 million acres of this is mapped as suitable under Alternative 5 (No Action) However, as described below (see factors affecting the ASQ), only an estimated 781,000 acres are suitable for harvest and only 687,000 acres are scheduled for harvest under Alternative 5. This includes old-growth and young-growth forest. Appendix A of the Forest Plan contains a detailed discussion of the tentatively suitable determination process. The amount of suitable land would vary by alternative.

Table 3.13-8 displays the distribution of forest lands, tentatively suitable lands, and suitable lands by alternative. The amount of suitable land that would be scheduled for harvest in order to meet the ASQ under each alternative is also shown. The amount of suitable land would vary from less than 2 percent of the Forest under Alternative 1 to nearly 7 percent of the Forest in Alternative 7. No alternatives have a suitable land base greater than 1.2 million acres. Differences result from assigning the Old-growth Habitat, Remote Recreation, Semi-remote Recreation, and other non-development LUDs. Alternatives 1, 2, 3, 5, and 6 have substantial acres of tentatively suitable lands assigned to the Old-growth Habitat LUD. Alternative 4 uses a different strategy to provide old-growth habitat and primarily assigns land to the Old-growth Habitat LUD in four Biogeographic provinces. In other areas, 33 percent of the productive forest land in each Value Comparison Unit would be maintained in an old-growth condition. Alternative 7 would have the least restriction on harvest in old-growth forest; it does not include Old-Growth Habitat LUDs nor would it have minimum old-growth retention requirements.

Table 3.13-8
Land Classification (thousands of acres), Tentatively Suitable and Suitable Lands[1]

Classification	Alternative 1	2	3	4	5	6	7
Total National Forest land (Items 1 and 2)	16,774	16,774	16,774	16,774	16,774	16,774	16,774
1. Non-Forest land (includes water)	6,918	6,918	6,918	6,918	6,918	6,918	6,918
2. Forest land	9,856	9,856	9,856	9,856	9,856	9,856	9,856
3. Forest land withdrawn from Timber production	4,234	4,234	4,234	4,234	4,234	4,234	4,234
4. Available Forest Land (Item 2 minus item 3)	**5,621**	**5,621**	**5,621**	**5,621**	**5,621**	**5,621**	**5,621**
5. Non-Productive Forests: Forest land not capable of producing crops of industrial wood	2,339	2,339	2,339	2,339	2,339	2,339	2,339
6. Available forest lands (PFL) (Item 4 minus item 5)	**3,282**	**3,282**	**3,282**	**3,282**	**3,282**	**3,282**	**3,282**
7. Forest lands: physically unsuitable	572	572	572	572	572	572	572
8. Forest lands: inadequate information	345	345	345	345	345	345	345
9. Tentatively suitable forest lands	**2,365**	**2,365**	**2,365**	**2,365**	**2,365**	**2,365**	**2,365**
(Item 6 minus Items 7 and 8)							
10. Tentatively suitable forest lands that are not appropriate for timber production by LUDs:							
a. Semi-Remote Recreation	1,231	853	669	367	494	494	381
b. Remote Recreation	127	122	109	95	77	76	95
c. Old-Growth Habitat	458	458	458	138	432	458	0
d. Wild Scenic or Recreation Rivers	42	42	42	42	42	42	42
e. Special Interest Areas	50	50	50	50	33	50	50
f. Experimental Forest (proposed)	6	6	6	6	-	6	6
g. Scenic Viewsheds-SV (Beach Fringe, Riparian)	8	28	38	90	55	53	63
h. Modified Landscapes-ML (Beach Fringe, Riparian)	24	39	49	92	63	60	65
i. Timber production-TM (Beach Fringe, Riparian)	42	85	105	177	133	126	128
Total (Items 10a through 10i):	**2,116**	**1,682**	**1,526**	**1,058**	**1,328**	**1,364**	**829**
11. Mapped Suitable (Item 9 minus Item 10)	**378**	**683**	**839**	**1,308**	**1,037**	**1,001**	**1,536**
12. Model Implementation Reduction Acreage	65	138	178	309	255	227	362
13. Suitable Acres Available for Timber Production (Item 11 minus Item 12)	**312**	**545**	**661**	**1,000**	**781**	**774**	**1,174**
14. Suitable Acres Scheduled	**144**	**394**	**514**	**892**	**687**	**663**	**1,070**
14a Scheduled Old growth	86	215	313	656	463	445	807
14b Scheduled Young Growth	58	179	200	236	224	218	262
Allowable Sale Quantity (average annual volume)							
1st Decade							
Sawlog (MMBF)	43	132	177	270	232	232	384
Utility (MMBF)	7	20	27	42	35	35	37
Total	**49**	**151**	**204**	**312**	**267**	**267**	**421**
2nd Decade							
Sawlog (MMBF)	43	130	179	310	231	230	384
Utility (MMBF)	7	21	26	50	36	37	37
Total	**49**	**151**	**205**	**360**	**267**	**267**	**421**

[1] Sums and differences may not appear exact due to rounding.
Source: Forest Service GIS database.

Removing land from the suitable land base reduces both potential ASQ and long-term timber growth and yields. While the effect is not perfectly linear, the magnitude of the reduction is generally related to the proportion of lands removed. The timber production lost is irretrievable but is not irreversible. If future designation of these lands is changed to allow timber management, it would be possible to resume timber management activities. Where land is dedicated to road construction or development of facilities, minerals, or rock excavation, the loss of land for timber production is generally irretrievable and may be irreversible.

Silvicultural Systems and Practices

This section describes vegetation management practices prescribed in the Forest Plan, including regeneration methods, reforestation, and intermediate treatments. Definitions for each of these practices, how they will be applied, and expected effects on the timber resource are provided.

Regeneration Harvest Methods

For modeling and planning purposes, the current Forest Plan considered the three regeneration methods discussed under Regeneration Systems: even-aged system, two-aged system, and uneven-aged system (group selection). These same methods were also considered in this Plan Amendment. This does not mean that these are the only these regeneration methods that will be used on the Tongass. Other even-aged methods such as shelterwood, which may be utilized to meet specific objectives, would be similar to clearcut with reserves in regards to appearance and effects (or to clearcuts if the shelterwood is later cut). For this reason, only these three methods were modeled and displayed. Appendix G of the 1997 Land Management Plan Revision FEIS contains detailed descriptions of the various silvicultural systems and their advantages and disadvantages. In addition, other regeneration methods may be applied on a limited scale to test their utility in achieving other forest management objectives.

Implementation of any Forest Plan alternative would include a full array of silvicultural prescriptions, including modification of these methods, depending on the site-specific conditions. The choice of the regeneration method and rotation length would be based upon site-specific analysis done at the project level, would consider multiple resource needs and objectives, and would include the rationale for using the selected regeneration method. This would be documented in the silvicultural prescription, which must be approved by a certified silviculturist.

Table 3.13-9 displays the annual number of acres estimated for each of the three main regeneration methods by alternative for the first and fifth decades of the Plan (based on the SPECTRUM model outputs). The acreages displayed are for modeling purposes in order to estimate Forest Plan outputs and do not limit the manager's ability to use any regeneration method to best meet project goals and objectives. The model used to develop the current Forest Plan (FORPLAN) estimated that 80 percent of the harvest under the selected alternative (the current Forest Plan) would be even-aged and the remaining 20 percent would be two-aged. Sales sold in recent years have averaged 76 percent even-aged harvest, 16 percent two-aged harvest, and 8 percent uneven-aged harvest. The acres modeled for regeneration harvest under the No-Action Alternative vary somewhat from estimates in the current Forest Plan. The regeneration harvest acres in the current Forest Plan were based on FORPLAN model outputs, while the estimates used in this analysis are based on the SPECTRUM model. Changes were made in the assumptions used in the SPECTRUM model based on experience gained under the current Plan.

SPECTRUM models suitable land as either full, modified, or incidental timber yield (Table 3.13.10). For this analysis, lands identified by the model as full timber yield were categorized as likely to be prescribed for even-aged management. Lands identified as modified timber yield were categorized as likely to be prescribed as two-aged management or small patch cuts, while areas identified as incidental timber yield were categorized as likely to be prescribed as uneven-aged management, including openings less than 2 acres.

Table 3.13-9
Vegetative Management Practices

Average Annual Harvest Acres of Suitable Lands Modeled in First Decade

	Alternative						
	1	2	3	4	5	6	7
Regeneration Harvest							
Even-aged[1]	1,180	3,758	5,220	7,226	5,902	6,829	10,033
Two-aged[2]	600	1,534	2,081	3,695	3,819	2,269	5,484
Uneven-aged[3]	2	60	115	351	244	234	429
Regeneration Treatments							
Natural and Artificial	1,780	5,291	7,301	10,921	9,721	9,459	15,516
Precommercial Thinning							
	0	0	0	1,066	617	1,691	2,251
Commercial Thinning							
	0	183	169	629	451	430	435

Average Annual Harvest Acres of Suitable Lands Modeled in Fifth Decade

	Alternative						
	1	2	3	4	5	6	7
Regeneration Harvest							
Even-aged[1]	820	2,367	2,912	7,992	4,445	4,976	8,549
Two-aged[2]	595	1,464	2,064	3,259	3,577	2,583	4,541
Uneven-aged[3]	64	310	386	793	529	563	820
Regeneration Treatments							
Natural and Artificial	1,415	3,831	4,977	11,250	8,022	7,559	13,090
Precommercial Thinning							
	2	1,055	717	2,256	1,355	994	1.330
Commercial Thinning							
	0	571	910	1,779	1,227	1,550	2,307

[1] Acres modeled as Full Timber Yield by SPECTRUM.
[2] Acres modeled as Modified Timber Yield by SPECTRUM, two-aged harvest or patch cuts.
[3] Acres modeled as Incidental Timber Yield by SPECTRUM, uneven-aged harvest or openings less than 2 acres.
[4] Natural regeneration refers to seedlings established from seeds falling to the ground from trees growing (or that grew) on the site. Artificial regeneration refers to planted seedlings.

Note: Acres harvested per year decreases with time as more young-growth reaches harvest age. Young-growth forest generally has lower defect rates and higher volume per acre.

Source: SPECTRUM Model (Forest-wide Activity and Output Results)

Table 3.13-10
Timber Management Intensity by Alternative over 100+ Years (acres)[1]

Alternative	High Timber Yields	Moderate Timber Yields	Incidental Yields[2]
1	80,682	48,074	4,865
2	284,729	121,791	30,065
3	397,585	164,152	37,628
4	758,520	263,744	72,679
5	504,600	176,504	48,232
6	563,090	205,897	49,117
7	823,478	445,896	76,133

[1] Suitable timber lands, cumulative treatments over 100 years, including second entry to harvest mature young-growth stands. Not all suitable lands would be harvested.
[2] Suitable land in areas where maintenance of scenic quality is important and sensitive wildlife habitat areas.
Source: SPECTRUM Model

Species composition. Of the four major commercial tree species on the Tongass, western hemlock is the most shade tolerant, followed by western redcedar, yellow-cedar, and Sitka spruce, in that order (USDA Forest Service 1990). Western hemlock is by far the most prevalent species, making up 83 percent of the old-growth forests (Farr and McClellan 1994). Dwarf mistletoe commonly infects western hemlock. Sitka spruce and yellow-cedar are rarely infected by dwarf mistletoe and western redcedar is not infected (Holsten et al. 2001). Having a diverse species mix contributes to wildlife habitat quality, species diversity, and minimizes losses due to insect and diseases that are species specific. In addition, Sitka spruce, yellow-cedar, and redcedar have higher economic values than western hemlock.

Regeneration harvest methods that create open conditions and expose bare mineral soil, such as clearcutting, encourage germination and growth of Sitka spruce (Ruth and Harris 1979). Group selection with openings of at least 2 acres, could also encourage germination and growth of Sitka spruce and the cedars, but may do so to a lesser degree than clearcutting due to side shading. The amount of sun reaching the surface would vary depending on the size, shape, and aspect of the opening. Regeneration methods that create less ground disturbance and smaller openings in the canopy such as single tree selection, smaller sized groups in group selection, overstory removals, and treatments with many reserve trees may encourage growth of western hemlock at the expense of less shade-tolerant species (Sitka spruce and yellow-cedar). However, limited retrospective studies indicate that Sitka spruce can be maintained in mixed hemlock-Sitka spruce stands over a wide range of cutting intensities if enough Sitka spruce trees are present in the stand after harvest (Deal and Tappeiner 2002, Deal et al 2002). Regeneration under two-aged systems would be similar to regeneration under even-aged harvest if leave trees are concentrated near the unit boundaries but may be more like uneven-aged harvest if reserve trees are scattered through the unit, due to shading from the residual overstory.

Alternatives 1, 2, and 3 are projected to have the least amount of two-aged and uneven-aged harvest (Table 3-13-9), followed by Alternatives 6 and 5, respectively. Alternatives 4 and 7 would have the most acres of two-aged and uneven-aged harvest. Alternatives that harvest fewer acres, especially Alternatives 1 and 2, would tend to maintain species composition across the Tongass similar to that found in the old-growth forests, because much less old-growth forest would be harvested. Forested areas in non-development LUDs normally subject to gap wind disturbance effects (refer to the *Forest Health* section) are likely to maintain the current species mix unless one of the predicted effects of climate change, an increase in catastrophic wind events, occurs. Juday et al. (1998) rated many potential impacts on the coastal forests of Southeast Alaska due to climate change. They concluded that there was a high risk of increased large scale blowdown across Southeast Alaska and an increased windthrow around harvest units. If this occurs, more area may come to resemble natural forests currently exposed to catastrophic winds. Alternatives with higher even-aged harvest, especially Alternatives 4 and 7, but also Alternatives 5 and 6, are more likely to create stand conditions that mimic catastrophic disturbance to some extent. However, these stands would lack the large amount of down wood found in natural stands created by catastrophic windstorms and many would be in areas that normally are subjected to gap disturbance.

Damage to residual trees. Western hemlock and Sitka spruce are thin-barked, shallow rooted species and are easily wounded during timber harvest activities (Harris and Farr 1974, USDA Forest Service 1983). These wounds provide an avenue for disease organisms to enter trees, causing rot and reducing their future economic value (Hennon and DeMars 1997). The size and shape of the opening affects the amount of damage. A retrospective study of 18 stands reported that overstory trees did have a greater incidence of wounding in stands that had been partial cut than in uncut stands and that the wounding increased with intensity of cutting; although, the study concludes that there was no significant increase in tree mortality, or in growth loss (Deal et al. 2002). McClellan (2005) reported that a recent operational-level study (part of the Alternatives to Clearcutting Study) found that there were increased problems during tree falling and yarding in group selection openings of less than 30 meters diameter (approximately 100 feet). Alternatives 1, 2, and 3 would have the least amount of two-aged and uneven-aged harvest, followed by Alternatives 6 and 5, respectively. Alternatives 4 and 7 would have the most acres of two-aged and uneven-aged harvest (Table 3.13-9).

Diseased trees may be more susceptible to windsnap and snow breakage (Nowacki and Kramer 1998), although one retrospective study found that many uprooted or broken-stemmed trees had died before falling (Hennon and McClellan 2003). In either case, the loss of residual trees that are left standing to provide structural diversity would result in management objectives not being met. The cedars are also susceptible to damage and subsequent attack by disease organisms. However, their wood appears to be more resistant to decay (USDA Forest Service 1990). Refer to the *Forest Health* section for a discussion of how the alternatives may affect dwarf mistletoe, insects, disease, and windthrow.

Growth rates. Estimation of future yields from young-growth stands created by timber harvest is critical for developing ASQs for the Forest Plan. Growth and yield tables have been developed for even-aged stands in Southeast Alaska (Taylor 1934, Farr 1984). Published growth and yield tables have not been developed for stands regenerated under two-aged or uneven-aged methods. Unpublished yield tables for these harvest types were developed by the Forest Service for use in estimating ASQ. These are part of the planning record.

Given that over 30 percent of the volume in old-growth stands is defective (Farr and Harris 1971), it is unlikely that these trees would respond to the additional growing space made available through partial harvest. While young western hemlock stands respond well to thinning, trees older than 100 years respond poorly to release (USDA Forest Service 1990). Information on growth rates for trees growing under a canopy in Southeast Alaska is limited. Western hemlock is shade tolerant and may grow well under partial shade. Sitka spruce is less shade tolerant than hemlock and it is reasonable to expect some growth loss when Sitka spruce is grown under residual overstory trees. However, Deal and Tappeiner (2002) reported that, in most cases, concerns about greatly reduced stand growth and vigor were unsubstantiated, based on a retrospective study of 18 stands in Southeast Alaska that had been partially cut 12 to 90 years earlier. Analysis of these stands did not detect significant changes in tree species composition, stand growth, hemlock dwarf mistletoe infection, or mortality rates (Deal et al. 2002).

One measure of future growth rates is the total amount of slow-growing old forest that would be harvested over the rotation. Alternative 7 would result in the most harvest, and the most even-aged harvest, followed by Alternatives 4, 5, 6, 3, 2, and 1, in that order. Alternative 7 would result in more than nine times the acres of old forest converted to productive young-growth stands as Alternative 1 (more than 807,000 compared to nearly 86,000 acres) and approximately 75 percent more than Alternative 5, No Action (more than 807,000 compared to nearly 464,000 acres).

Reforestation

The NFMA requires assurance that all areas receiving final removal harvest can be adequately restocked with trees within 5 years of that harvest. On the Tongass, natural restocking is usually adequate to meet this objective because both western hemlock and Sitka spruce are prolific seed producers (USDA Forest Service 1983). The new stand originates from advance regeneration and from seeds that come from residual trees or from trees adjacent to the harvest unit. Since 1988, natural regeneration has accounted for 94 percent of the reforestation program. The remaining 6 percent has been artificial regeneration (planting). The future need for planting would be determined on a site-specific basis to achieve management objectives such as increasing the abundance of Sitka spruce where western hemlock or brush may have a competitive edge or increasing the abundance of yellow-cedar or western redcedar, where natural regeneration of these species is anticipated to be inadequate. The desired species composition, required number of seedlings, and method of regeneration should be displayed in the silvicultural prescription. Table 3.13-9 lists the acreages that would require reforestation (natural or artificial) in the first and fifth decades by alternative.

Intermediate Treatment Methods

Intermediate treatments are any manipulation in a stand that occurs between two regeneration periods (Daniel et al. 1979). The regeneration period establishes the new stand, either through natural regeneration or through planting. Intermediate treatments are done to ensure that the new stand has the desired species composition, tree health, growth, and spacing, as well as to recover product value. They can also be used to create or improve habitat for wildlife. Intermediate treatments may be used if approved as part of a site-specific silvicultural prescription. Currently, the only intermediate treatment commonly used on the Tongass is pre-commercial thinning.

Precommercial thinning is applied in young stands that have not reached merchantable size. It is the most commonly applied intermediate treatment in Southeast Alaska. It is used to:

- Favor preferred tree species.
- Concentrate tree growth on fewer individuals to produce larger trees in a shorter period of time.
- Increase the amount of light reaching the forest floor, thereby retaining understory vegetation that is valuable wildlife forage (DellaSalla et al. 1994).

There are concerns over the effects of precommercial thinning on future wood quality, especially wider spacing of residual trees (McClellan 2005). Thinning can increase epicormic sprouting on the Sitka spruce trees (Deal et al. 2003). Lower density thinnings could increase taper and increase the size and longevity of lower branches, thus reducing future wood quality (McClellan 2005). Larger lower branches increase fluting in western hemlock, which reduces wood quality (Julin et al. 1993) (refer to the *Forest Health* section for a discussion of fluting).

Pruning removes the lower branches of a tree at an early age in order to produce knot-free wood. It is the only way to produce clear lumber in rotations less than 100 years (Daniel et al. 1979). However, pruning Sitka spruce trees can encourage epicormic sprouting in Sitka spruce and can limit diameter growth for all species. Deal et. al. (2003) found that the total number of sprouts was similar among different levels of pruning but significantly more large sprouts were produced when more of the crown was removed.

Commercial thinning is applied to young stands that have reached merchantable age. The primary difference between commercial and precommercial thinning is that the trees cut in a commercial thinning operation are removed and sold. Commercial thinning can be used to:

- Meet market demand for wood products, either from suitable or unsuitable lands (harvest would only be used on unsuitable lands to meet resource objectives, such as improving wildlife habitat, and where no irreversible damage would occur).
- Maintain or increase the growth rate of dominant and co-dominant trees by removing trees in the lower crown classes, increasing merchantable yields over the rotation.
- Stimulate development of more complex canopy structures or enhance forage in the understory in order to meet wildlife habitat needs.
- Improve scenic quality.

By maintaining or increasing growth rates, commercial thinning lengthens the time needed for a stand to reach CMAI, extending the rotation length (Daniel et al. 1979).

Precommercial thinning would be implemented under all alternatives based on funding. Pruning is likely to play a minor role in the foreseeable future under all alternatives. Commercial thinning is expected to play a larger role in meeting future demand under all alternatives over the next few decades, as areas harvested in earlier decades reach commercial size. Over the long term, alternatives with high harvest levels would create more stands, which in time would be available for commercial thinning. Also, alternatives that would facilitate creation of an integrated timber industry, especially Alternatives 4 and 7, are likely to lead to more commercial thinning because there would be a greater demand for smaller logs if, for example, a medium density fiberboard mill is built (refer to the *Economic and Social Environment* section for a discussion of the likely product mix under the proposed alternatives).

Allowable Sale Quantity

Allowable Sale Quantity and Timber Sale Program Quantity

The ASQ of each of the alternatives is an indicator of possible future timber supply level that each alternative could produce. ASQ is the maximum quantity of timber that may be scheduled for harvest from suitable lands on the entire Forest for the next 10 years (36 CFR 219.3). It is usually expressed as an annual average. The yearly quantity may exceed or be less than the annual average for the decade. The ASQ is a ceiling; it is not a future sale level projection or target and does not reflect all of the factors that may influence future sale levels.

The ASQ is an expression of the biological potential of the forest to produce timber within the constraints of other resource needs; it is constrained by harvest limitations necessary to meet LTSY requirements, multiple-use considerations, and environmental restrictions. Changes in the timber land base, timber inventory, or silvicultural prescriptions would affect ASQ. An ASQ is, to some extent, imprecise because it is based on estimating techniques (the SPECTRUM model) and Forest-wide data rather than on detailed, on-the-ground data from the timber sale area. Given the uncertainties inherent in developing an ASQ, shortfalls between the ASQ and timber sales are very possible.

The timber sale schedules for each Ranger District include that portion of the timber inventory that is scheduled for sale for a specific year. The schedule may include harvests from unsuitable lands and convertible products (such as beach log salvage and fuel wood) in addition to sales counting towards the ASQ. Schedules are updated annually or more frequently.

Table 3.13-11 displays the projected timber output for the first and fifth decades that could result from implementing each of the seven alternatives in both board feet and cubic feet. This output is composed of two categories: sawlogs and utility logs. The use and marketability of these log types is discussed in the *Economics and Social Environment* section. Alternatives with higher timber outputs may require a "ramp-up period"; therefore, ASQ is higher for these alternatives in later decades than in the first. Refer to the discussion in the *Economics and Social Environment* section.

Table 3.13-11
Allowable Sale Quantity (First Decade, Average Annual)

Alt	Sawlog (MMBF)[1]	Sawlog & Utility (MMBF)[1]	Sawlog (MMCF)[2]	Sawlog & Utility (MMCF)[2]
1	42.6	49.3	8.5	9.9
2	131.5	151.2	26.8	30.8
3	176.9	204.0	36.4	41.9
4	270.0	311.5	55.2	63.6
5	231.9	267.0	47.7	54.9
6	231.8	267.0	47.6	54.8
7	384.0	421.0	78.5	85.9

Allowable Sale Quantity (Fifth Decade, Average Annual)

Alt	Sawlog (MMBF)[1]	Sawlog & Utility (MMBF)[1]	Sawlog (MMCF)[2]	Sawlog & Utility (MMCF)[2]
1	46.0	49.3	9.6	10.2
2	147.7	153.6	31.9	33.1
3	197.6	204.6	42.7	44.0
4	326.9	360.0	68.4	75.1
5	250.0	267.0	53.1	56.5
6	250.8	267.0	53.8	57.1
7	397.2	421.0	83.0	87.7

[1] MMBF = million board feet, long log bureau scale
[2] MMCF = million cubic feet
Source: SPECTRUM model outputs.

Factors Affecting the Allowable Sale Quantity

Within LUDs where timber harvest is compatible with the resource objectives of the area, there may be "intrusions," "physical factors," and "unmapped" standards and guidelines that limit timber management opportunities. These factors (discussed below), often termed "falldown," have been recognized at the forest level, and the anticipated timber output adjusted appropriately. These limitations may include lands that are not capable of supporting a sustained timber management program. In other cases, where there are physical limitations, a less intensive or perhaps unregulated output may be scheduled for this period. Other factors also contribute to differences between ASQs and timber sales, such as budgets and legal challenges.

The Forest-wide estimates used to develop the ASQ considered many of the factors contributing to differences between ASQs and the actual volumes produced in timber sales. These include factors affecting the suitability determination of forest lands that are usually encountered in on-the-ground examinations (e.g., sale reconnaissance, stand exams, layout, and sale preparation). For each alternative, areas were set aside (not scheduled for harvest) to allow for those factors most often encountered. Data from previous case studies, monitoring, site visits, inventory data, the GIS database, and the new Stand Density Model map were used to develop the acreage estimates (see Appendices A and B for more information).

More specifically, the following questions were considered:

1. Is it tentatively suitable? (36 CFR 219.14[a])

Appendix A of the proposed Forest Plan outlines the process used to determine the tentatively suitable land base. The three most common factors encountered during project implementation are: 1) unmapped streams that need buffers due to TTRA or Forest Plan standards and guidelines; 2) unmapped extreme hazard soils; and 3) forest land incorrectly mapped as capable of growing industrial wood products.

2. Is it appropriate for timber production? (36 CFR 219.14[c and d])

The Forest Plan standards and guidelines were reviewed for elements that are not mapped or in the GIS database and that could cause a loss of suitable acres. Eight factors were identified:

Land Selections – reduction due to the conveyance of selected lands to the State of Alaska and Native interests.

TTRA Stream Buffers – reduction due to unmapped Class I and II stream buffers (i.e., streams that were not mapped as Class I or II).

Non-Commercial Forest – reduction due to volume class mapping errors.

Slope/Soil Hazard – reduction due to unmapped steep slopes (i.e., areas with steep slopes or high hazard soils that could not be identified correctly by GIS mapping).

Cost Efficiency – excludes stands with the lowest economic potential from the suitable base.

Riparian Habitat (Class III streams) – reduction due to unmapped Class III stream buffers (i.e., Class III streams that could not be identified during mapping, usually due to canopy cover).

Karst/Caves – reduction due to upgrading of the karst classification to high vulnerability on some areas during field exams.

Remaining Standards and Guidelines – reduction due to unmapped raptor and murrelet nests, wolf dens, mountain goat habitat, and habitat linkages.

The sum of these subfactors produces the overall Model Implementation Reduction Factors (MIRF) for each category (geographical area, volstrata, operability class, alternative). The process and results are discussed in Appendix B. The average MIRF is 42 percent for the north districts, 17 percent for the central districts, and 23 percent for the southern districts.

Cost efficiency: TTRA provides that:

ANILCA is further amended by deleting section 705(d)(16 U.S.C. 539d(d)) in its entirety and inserting in lieu thereof:

> [d] All provisions of section 6(k) of the National Forest Management Act of 1976 (U.S.C. 1604[k]) shall apply to the Tongass National Forest

> except that the Secretary need not consider economic factors in the identification of lands not suited for timber production. (TTRA, Sec. 102.)

Economics is an important consideration in determining whether lands should be harvested; however, experience has proven that it is not feasible to effectively factor in economics as part of the suitability determination. Economic conditions fluctuate greatly during the course of a plan period. One year a certain area of land or species may be uneconomic to harvest, and another year market conditions may have changed to where the same area or species would be in demand. This makes it difficult to meaningfully assess the economics of harvesting a particular site over a 10-year period. Also, the value of the timber sale program must be considered as a whole rather than by only evaluating individual timber sales or harvest units in isolation, because some sales or units of low value are offset by other higher-value sales or units. The economics of harvesting any particular site can be considered as part of the project decision to approve harvest of the area.

Non-interchangeable components

The ASQ is partitioned into two portions, referred to as non-interchangeable components (NICs). The ASQ is partitioned to prevent overharvest of the best operable ground and to identify that portion of the timber supply that is more economic to harvest. The total ASQ is derived from the sum of the timber volumes from both NICs. For the Tongass, the following are identified as the NICs:

NIC I: Normal Operability (85 percent of the suitable land based on the LSTA). This is volume scheduled from suitable lands using existing logging systems. Most of these lands are expected to be economic under most market conditions. On average, sales from these lands have the highest probability of offering a reasonable opportunity for a purchaser to profit from his/her investment and labor. This is the best operable ground. The percent of volume from NIC I lands that contributes to ASQ varies from 87 to 99 percent, depending on the alternative (Table 3.13-12).

Normal operability includes those systems most frequently used on the Tongass. These systems are tractor, shovel, standard cable, and helicopter yarding up to a distance of 0.75 mile.

NIC II: Difficult and Isolated Operability (15 percent of the suitable land based on the LSTA). This is volume scheduled from suitable lands that are available for harvest using systems not in common use in Southeast Alaska. Most of these lands are presently considered economically and technologically marginal. The percent of volume from NIC II lands that contributes to ASQ varies from 1 to 13 percent, depending on the alternative (Table 3.13-12).

Difficult operability includes those systems used on the Tongass that have significantly higher costs. These may include long-span skyline, multi-span, or helicopter with yarding distances greater than 0.75 mile. This category also includes lands that have limited access as a result of being isolated by prior harvest activities or other management activities.

Isolated operability refers to small stands of isolated timber that are extremely difficult to harvest. The harvest system could vary, but would be more costly due to the location of the stand, with average yarding distances greater than 2 miles.

Table 3.13-12
Estimated Harvest by Operability Class (NIC I and NIC II) in the First Decade (MMBF[1] and percent)

Alternative	NIC I		NIC II		Total
1	48.8	99%	0.6	1%	49.3
2	143.5	95%	7.6	5%	151.1
3	185.5	91%	18.5	9%	204.0
4	271.8	87%	39.8	13%	311.5
5	238.5	89%	28.5	11%	267.0
6	237.7	89%	29.3	11%	267.0
7	366.5	87%	54.5	13%	421.0

[1] MMBF: million board feet
Source: SPECTRUM model. Numbers may not appear to add correctly due to rounding.

Harvest during the first few decades would come primarily for old-growth forests within NIC I areas. Harvest in the later decades would come, almost entirely, from mature young-growth forests (also in NIC I areas), which are expected to have less defect and, therefore, higher volumes per acre.

Other Factors that Affect the Timber Sale Program

Other factors that may affect the amount of timber actually sold include the cost of preparing a timber sale, administrative appeals and lawsuits (which may delay or forestall sales), transportation and fuel costs (which affect the cost of harvesting a sale, especially a helicopter sale), and market conditions that may discourage purchasers from bidding on sales. Additional harvest may occur on lands that are not suitable for timber management, for example, to stimulate development of more complex canopy structures or to enhance forage in the understory in order to meet wildlife habitat needs. This would only occur if it is determined that there would be no irreversible damage to resources. Another example would be incidental harvest on steep slopes. These types of harvest would not contribute to ASQ, but would add to the total timber harvest on the Forest.

Allowable Sale Quantity and Long-term Sustained Yield Capacity

LTSY is the maximum timber yield that can be sustained indefinitely from lands managed for timber production when all stands have been converted to a managed state. This varies by alternative, depending on the amount of suitable land and on standards and guidelines particular to each alternative. LTSY is a function of the total number of acres allocated to timber management, the management intensity, standards and guidelines, silvicultural systems, and the productive capacity (conifer growth) of the suitable lands. The harvest schedule is based on: 1) a harvest schedule that exhibits non-declining yield at or below LTSY capacity, 2) a regeneration harvest age at or beyond culmination (maximum) of Mean Annual Increment, and 3) a planning horizon of 150 years.

The projected yield over the next 15 decades that could contribute to the ASQ is expected to increase over time as second-growth forests mature and become available for harvest. The average volume per acre of old-growth forest is approximately 29 MBF per acre. The expected volume of 100-year-old stands of second growth in the central portion of the Tongass is approximately 56 to 60 MBF per acre (based on the Forest's managed yield tables for this area), depending on stand management (see below). As more 100-year-old stands become available for harvest, the ASQ could increase, or the land base needed to produce a given ASQ could decrease. In addition, commercial thinning would add to harvest volume.

The ASQ does not exceed the LTSY during the 100-year-plus planning horizon. The potential ASQ is expected to be between 49 and 92 percent of LTSY for the rotation under all alternatives based on the LTSY calculations. Table 3.13-13 displays the ASQ and LTSY by alternative. For all alternatives, the ASQ never exceeds the LTSY during the planning horizon. Alternatives that would allocate a greater number of acres for timber management and/or have more acres under intensive management would produce the highest LTSYs.

Table 3.13-13
Allowable Sale Quantity and Long-term Sustained Yield Capacity (MMBF[1])

Alt.	Decades 1 to 5 Average Annual	Decades 6 to 10 Average Annual	Decades 11 to 15 Average Annual	LTSY (MMCF)[2]	Maximum Percent of LTSY
1	49.3	49.8	52.0	21.5	49
2	152.6	153.6	153.8	48.3	69
3	204.5	204.6	204.7	59.9	76
4	350.3	360.0	360.0	92.4	88
5	267.0	267.0	267.0	68.4	87
6	267.0	267.0	267.0	72.9	82
7	421.0	421.0	421.0	102.5	92

[1] MMBF: million board feet
[2] MMCF: million cubic feet. SPECTRUM only expresses long-term sustained yield in the cubic foot measure. Direct conversion from MBF to MCF is complex, varying by tree size and taper but is approximately 5 MBF to 1 MCF

Future Conditions

Approximately 90 percent of the existing timber stands on the Tongass are beyond CMAI. Timber stands that exceed CMAI are either in decline or are not growing at optimal rates for their site's potential productivity. The western hemlock-Sitka spruce forest type is one of the world's most productive forest types (USDA Forest Service 1983); it is capable of producing prodigious amounts of wood. The updated forest yield tables for the central part of the Tongass estimate that a normally stocked stand 40 years old would contain 7 MBF of merchantable wood per acre. By age 70, volume should increase to 29 MBF of wood per acre, assuming no precommercial thinning occurred. The age of CMAI would be around 100 years with a merchantable volume of 56 MBF per acre, assuming no precommercial or commercial thinning. If the same stand is thinned, volume at CMAI is estimated to be 60 MBF, in addition to an estimated 8 MBF of commercial thinning volume obtained at age 60. Yields from uneven-aged silvicultural systems would be considerably less, approximately 28 MBF at age 200, based on the updated forest yield tables.

As a greater proportion of the Forest is converted from slower growing, highly-defective stands to stands well-stocked with vigorously growing conifers, total forest growth would increase. Because of higher volumes and lower defect, managed young-growth would be able to provide higher harvests on the same land base or support the same harvest on a smaller land base. Under a 100-year rotation, between one-forth and one-third of the suitable land would not be needed to provide a given ASQ, depending on alternative. This portion of the timber base could revert to some other land use and be available to provide old-growth habitat, or the ASQ could be increased if market conditions allowed.

Only a portion of the Forest would emphasize timber management; most of the existing mature and old-growth stands on the Forest would be maintained. Various amounts of old-growth conifer stands would be maintained or allowed to develop under each alternative. Alternatives that allocate the most acres to development-oriented land allocations would gradually have more stands in younger timber age classes, and fewer stands of old growth. However, more than 150 years from now, the predominant age class on the Tongass would still be greater than 150 years

(Table 3.13-14). The percent of total productive forest land that would be managed stands of less than 150 years of age is expected to be a relatively small component of the forest landscape on a Forest-wide basis for all alternatives. Old growth would still be the predominant vegetative structure on the Tongass (Table 3.13-15).

Conifer growth in young stands can be accelerated through silvicultural treatments to control conifer stocking. Benefits from such treatments may include larger piece size and consequently lower logging costs, increased stand variability, higher quality wood, and employment opportunities. In addition, treatments may shorten the time period spent in the stem exclusion phase of stand development and offer other resource benefits.

Table 3.13-14
Age Class Distribution of Mapped Suitable Acres after 160 years

	Alternative						
Age Class	**1**	**2**	**3**	**4**	**5**	**6**	**7**
0 to 10	8,537	37,229	50,026	92,198	71,233	69,918	109,874
11 to 20	13,013	26,248	41,859	74,522	63,141	52,245	97,694
21 to 30	11,385	27,044	40,029	79,772	67,128	55,510	104,374
31 to 40	10,591	31,271	44,004	87,118	64,534	62,892	113,901
41 to 50	11,030	34,182	50,868	99,463	78,711	70,789	120,941
51 to 60	9,003	32,245	46,596	93,342	78,763	67,621	119,473
61 to 70	10,549	34,125	49,027	83,138	69,299	62,176	111,485
71 to 80	13,179	14,087	16,509	34,367	29,436	22,621	45,926
81 to 90	7,189	24,038	28,096	50,227	31,847	43,327	54,324
91 to 100	9,044	20,631	16,744	47,864	28,550	35,092	50,097
101 to 110	10,556	22,024	25,545	70,148	42,499	40,866	71,307
111 to 120	10,044	19,336	25,566	30,146	25,399	31,355	21,714
121 to 130	17,419	23,609	34,580	15,481	10,483	21,019	9,019
131 to 140	15,858	29,370	23,570	4,340	5,287	7,096	5,193
141 to 150	8,236	6,586	5,189	1,624	1,423	2,910	2,121
Total 0 to 150 Years	**165,633**	**382,025**	**498,208**	**863,750**	**667,733**	**645,437**	**1,037,443**
Total Greater than 150	**197,345**	**289,455**	**332,588**	**440,743**	**366,324**	**352,761**	**489,463**
Total	**362,978**	**671,480**	**830,796**	**1,304,493**	**1,034,057**	**998,198**	**1,526,906**

Source: SPECTRUM model 2006. Numbers may not add correctly due to rounding. Represents all suitable, not just scheduled suitable.

Table 3.13-15
Forest-wide Stand Structures after 160 Years (acres)

	Alternative						
Stand Structure	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Stand Initiation (0 to 20 Years)	21,550	63,477	91,885	166,720	134,374	122,163	207,568
Stem Exclusion (21 to 120 years)	89,488	300,047	401,448	449,245	526,870	550,762	802,661
Understory Reinitiation (121 to 150 years)	102,570	258,983	342,984	675,585	516,166	492,249	813,542
Productive Old-growth (>150 years)	4,806,213	4,711,868	7,769,622	4,848,450	4,779,014	4,751,489	4,894,171

Source: SPECTRUM model 2006. Numbers may not add correctly due to rounding.

Managing stands to enhance wildlife and fish habitat carrying capacity is one of the objectives of the Tongass National Forest. To help meet this objective, the Forest Service has implemented studies on stand management, including TWYGS, the Alternatives to Clearcutting study, and other Pacific Northwest research, some of which has been discussed in this section. Appendix B of the Forest Plan includes a list of information needs.

Cumulative Effects

Cumulative effects to timber include past and present and proposed harvest discussed above. Table 3.13-13 presents a comparison of harvest and LTSY by alternative, an important measure of the cumulative effect on the growing stock on NFS land. Maximum harvest levels on NFS lands proposed under all alternatives are well within the LTSY. Table 3.13-14 displays the age class of forests on NFS lands by decade for the next 160+ years; Table 3.13-15 displays the projected stand structure over the same period. Cumulative effects on timber resources across Southeast Alaska are presented below.

In 1954, there were approximately 6.5 million acres of productive forest land on all ownerships in Southeast Alaska. The amount of forest land in Southeast Alaska that is available for timber management has declined over the past century, largely due to Wilderness and LUD II designation by Congress and to land allocated to non-development LUDs in the current Forest Plan. This, along with mill closures and changes in timber markets, has contributed to a decline in timber harvest. Harvest on all lands in Southeast Alaska peaked in the 1980s and has been in decline since then. Total harvest on federal, state, and private lands declined from just under 1,000 MMBF in 1989 to less than 200 MMBF in 2005. Approximately 767,000 acres of productive forest land have been harvested since 1954 in Southeast Alaska, approximately 59 percent of this is NFS land and 41 percent is on state, Native corporation, and other private lands.

Currently, there are more than 0.75 million acres of NFS lands considered suitable for timber management on the Tongass. In addition, nearly 0.75 million acres of state, Native corporation, and other private lands are available for harvest. The maximum annual harvest from the Tongass National Forest is 267 MMBF under the current Forest Plan, although actual harvests have averaged near 50 MMBF per year for the last few years. Potential annual harvest on state and private land has been estimated to be approximately 109 MMBF (Brackley et al. 2006a); although, comments from Sealaska Corporation indicate it may be much lower. Based on past experience, most of the harvest on private land would be exported and would not contribute to meeting local demand. Using this estimate, cumulative harvest in Southeast Alaska would range from as low as 158 MMBF under Alternative 1 to approximately 530 MMBF under Alternative 7. Table 3.13-16 displays the cumulative harvest under the proposed alternatives.

Table 3.13-16
Maximum Estimated Annual Timber Harvest in Southeast Alaska during the First Decade (MMBF)

Alternative	National Forest[1]	State and Private[2]	Total
1	49	109	158
2	151	109	260
3	204	109	313
4	312	109	421
5	267	109	376
6	267	109	376
7	421	109	530

[1] SPECTRUM model estimates, 2007
[2] 102 MMBF/year from Native corporation lands and 7 MMBF/year from state land (Brackley et al. 2006a). Most harvest on private land is exported.
MMBF: million board feet.

There are several risk factors and uncertainties that may affect timber outputs; these include the reliability of existing information of forest stands, accessibility, economics, budget, harvest on private land, development of new markets, investments in new processing facilities, and climate change.

The recent LSTA indicates that approximately 85 percent of the suitable timber land would be accessible using normal harvest methods, just under 10 percent would be difficult, and just under 6 percent would be isolated. When economic and environmental risk factors are considered, additional areas are likely to be identified as difficult or isolated during project planning. Risk factors assigned by the LSTA team and district personnel indicate that about 85 percent of the suitable acres with old-growth forest would be in the normal category. However, until field work is completed, actual conditions remain uncertain and there is a risk that some areas considered suitable for timber management are actually unsuitable and that areas considered to be accessible using normal harvest methods will prove to be difficult or isolated. Increasing fuel costs may restrict the use of helicopters, which would mean some areas with suitable timber would be too expensive to harvest. Similarly, increases in road construction costs may affect the economic viability of some sales. In addition, funding levels for preparing timber sales are uncertain they depend on the amount Congress chooses to allocate in any given year.

The harvest levels associated with the alternatives discussed above, especially Alternatives 4, 5, 6, and 7, depend on developing new processing facilities and/or new markets. If these are not developed, harvest levels may not increase much beyond current levels. Also, total harvest projections for Southeast Alaska depend, in part, on how much timber is harvested from state and private lands. The estimates used in this analysis are derived from published reports. However, comments received following publication of the DEIS indicate that actual harvest levels, especially on Sealaska land, may be lower than those estimates. Sealaska indicates that, without the land adjustments they propose, they will be unable to continue to harvest at current levels. Conversely, if suitable land is transferred to Sealaska in exchange for lands that, while valuable for wildlife habitat or recreation, are not suitable for timber production, harvests on NFS lands will likely need to be reduced.

Timber harvest programs under any of the proposed alternatives, as well as on state and private land may be affected by factors related to climate change. Juday et al. (1998) rated many potential impacts on the coastal forests of Southeast Alaska due to climate change. They concluded that there was a high risk of increased large scale blowdown across Southeast Alaska, increased windthrow around harvest units, increased damage from black-headed budworm outbreaks and other insects, and increased risk that new fungal tree diseases will appear in Southeast Alaska. These factors, if they occur, could alter harvest and growth projections outlined in this analysis, as well as have a major affect on wildlife habitat. In contrast, Juday et al. also concluded that there was some likelihood of increased tree growth and increased site productivity; previously non-commercial forest could become commercial forest. Refer to the *Forest Health* and the *Climate and Air* sections for additional information.

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Minerals

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Affected Environment

A wide variety of mineral deposit types and mineral resources occur within the boundaries of the Tongass National Forest, including gold, silver, molybdenum, and uranium, and nationally designated "strategic" and "critical" minerals such as lead, zinc, copper, tungsten, and platinum group metals. The Forest Service recognizes that minerals are fundamental to the Nation's well being and, as policy, encourages the exploration and development of the mineral resources it manages. The Secretary of Agriculture has provided regulations (36 Code of Federal Regulations [CFR] 228) to ensure surface resource protection, while encouraging the orderly development of mineral resources on National Forest System (NFS) lands.

Southeast Alaska has a long history of mineral prospecting and mining. The first mineral location in Southeast Alaska was recorded in 1867 by a Russian trader near New Kasaan on Prince of Wales Island. In 1880, gold was discovered in placer gravels near Juneau. This discovery sparked keen interest and, by the turn of the century, dozens of mines were in production from the Juneau Mining District to the Ketchikan Mining District. Mining remained active until World War II. From the close of World War II to the mid-1970s, mineral exploration and production in Southeast Alaska remained low compared to the activity documented at the beginning of the century. Prospecting and exploration generally increased during the mid-1970s, in part due to the Quartz Hill and Greens Creek discoveries, improved metal prices, technological advances, and the deregulation of gold. Metal prices have maintained generally favorable trends since the mid-1980s, resulting in increased exploration and renewed interest in precious metals, mainly gold.

With respect to National Forest management, mineral resources are legally divided into three groups: locatable minerals, leasable minerals, and salable minerals. The authority of the Forest Service to influence and regulate the exploration, development, and production phases of mining operations varies with each group. As a result, the Forest Service manages mineral resource programs that are specific to each group of minerals.

Locatable Minerals

A locatable mineral is any mineral that is "valuable" in the usual economic sense, or has a property that gives it distinct and special value. These are typically what are known as "hardrock" minerals. Locatable minerals may be recovered from load deposits (solid rock) or placer (surficial) deposits. Examples of some locatable minerals on the Tongass National Forest are gold, silver, copper, molybdenum, iron, nickel, lead, and zinc.

The General Mining Law of 1872, as amended, grants every United States citizen the right to prospect and explore public domain lands open to mineral entry. The right of access is guaranteed and is not at the discretion of the Forest Service. Upon discovering a valuable mineral deposit, citizens have the right to locate a mining claim and remove the mineral resources. The citizen holding a mining claim is called the claimant. The claimant is responsible for initiating mining activities and investing the capital required to conduct mineral exploration, site development, mine operation, and reclamation of the site.

The Forest Service works with mining claimants to provide reasonable access to their claims, minimize adverse environmental impacts on surface resources, and ensure reasonable reclamation of disturbed lands affected by mining operations. Protection of surface resources is accomplished by reviewing the mining plan of operations submitted by the claimant, disclosing impacts of the proposed mining operations in a site-specific environmental document, approving only those activities that are reasonably necessary for the proposed operation, monitoring operations to ensure environmental standards are met, and ensuring prompt and reasonable reclamation of disturbed areas.

By law, designated Wilderness, National Monuments, Research Natural Areas, Enacted Municipal Watersheds, and Wild Rivers (when designated by Congress) are withdrawn from mining claim location. These withdrawn areas are, however, subject to mining claims with valid existing rights established before the date the areas were withdrawn from mineral entry. As a consequence, some mining claims located within existing or proposed withdrawn areas could be developed in the future.

On the Tongass, the Primitive Recreation, Semi-Remote Recreation, Old-Growth Habitat, Experimental Forest, Special Interest Areas, Scenic Rivers, and LUD II Land Use Designations (LUDs) remain open to mining activities. Special stipulations and more stringent mitigation measures are required for mining activities in these LUDs; therefore, there is a higher cost to develop minerals in these LUDs. Modified Landscape, Scenic Viewshed, Recreational Rivers, Timber Production, and Minerals LUDs remain open to mineral activities and do not require special stipulations or more stringent mitigation measures; therefore, mineral development in these LUDs would be at an average cost.

Leasable Minerals

Certain types of minerals, primarily energy resources, are not subject to mining claim location, but are available for exploration and development under provisions of the Mineral Leasing Act of 1920. Access to these types of minerals is provided through leases, permits, or licenses that include fee and/or royalty payment conditions. Federally owned leasable minerals include oil, gas, coal, geothermal resources, potassium, sodium, phosphates, and sulfur. The authority to manage these minerals is presently administered by the U.S. Department of Interior, Bureau of Land Management (BLM) in cooperation with the Forest Service.

No leasable minerals are presently being produced on the Tongass National Forest, and the anticipated demand is expected to remain low. BLM recently conducted an assessment of mineral resource potential in support of a resource management plan for the Ring of Fire planning area (BLM 2006), which includes Southeast Alaska. The assessment indicated the potential for oil and gas occurrence in the Yakutat region was considered to be high, based on geologic factors (URS Corporation 2006). While there has been exploration activity in the Yakutat area in the relatively recent past, the resource development potential is considered low; therefore, BLM expects no exploration or development activity within the next 10 to 15 years. Outside of the Yakutat area, oil and gas occurrence potential elsewhere in the Tongass is considered low to none.

Occurrences of coal found at several locations in Southeast Alaska has prompted the identification of the Angoon, Admiralty, and Kuiu coal districts; the coals in the two former districts are classified as bituminous, while the Kuiu deposits are ligmite (URS Corporation 2006). Several small mines on Admiralty Island produced coal during the late 1800s and early 1900s. Lignite deposits also occur at several other locations in Southeast Alaska, although they are of small extent. Similarly, the occurrence potential for coalbed natural gas (coalbed methane) is considered high for the Admiralty and Kuiu Islands coal deposits and the Yakutat area. BLM considers development of these resources to be uneconomic over the next 10 to 15 years, other than possibly for local use, and does not foresee associated exploration or development activity.

Geothermal resources occur in 19 known locations in Southeast Alaska. Thermal springs in several locations have been developed for small-scale commercial uses such as tourism, aquaculture, community bathhouses, and district heating of buildings (URS Corporation 2006). There has been some recent interest in geothermal resources in the Bell Island area, but BLM has undertaken no leasing activity to date. While the occurrence potential for geothermal resources is considered high in several locations and some exploration could occur, BLM does not anticipate geothermal development activity over the next 10 to 15 years.

Salable Minerals

Salable, or "common variety," minerals on NFS lands are sold rather than located or leased. These minerals include petrified wood and common varieties of sand, rock, building stone, gravel, pumice, clay, and other similar materials. Such common variety mineral materials include deposits that, although they have economic value, tend to be relatively widely available and used close to the source of production. These minerals are most commonly used as building materials and are also used for agriculture, cleaners and abrasives, and as inputs to manufacturing processes.

The predominant salable commodity extracted on the Tongass National Forest is crushed rock used to construct roads. The supply of quality rock sources is largely dependent upon the locations of active logging operations. Presently, there is an adequate supply of rock sources with suitable quality (hardness and durability) in the southern third of the Tongass. However, rock quality is poor in the northern two-thirds of the Forest, and good material sources are difficult to locate in current timber production areas. Sand and gravel sources are scarce throughout the Forest, except within the Yakutat Ranger District.

All roads built in the Tongass require rock for construction because the subgrade soils have poor strength characteristics. The demand for crushed rock will closely follow the need to construct new timber sale roads. The total in-service use of rock for existing roads was 43,962,500 cubic yards, which was used to construct 3,355 miles of road. As the use of forest roads increases, and both the Alaska State Department of Transportation and the Federal Highway Administration assume responsibility for maintenance of some roads, the demand for crushed rock will increase. It will be expensive to locate mining sites with suitable quality and quantity in the northern part of the Forest, and haul distances will increase. Outside NFS lands, new and existing communities will require mineral materials for development of roads and for foundations for homes, schools, and other buildings. The demand for rock from public land in support of these growing communities is likely to increase.

Limestone and marble are abundant in Southeast Alaska, and both have historically been produced from quarries in the region for use as building stone (BLM 2006). Identified marble resources in the region are estimated at over 800 million tons. Large quantities of limestone have been quarried from Prince of Wales and Dall Islands. Continued exploitation of these building material resources could be expected in the future. While several areas in Southeast Alaska also have geologic formations that are favorable for the occurrence of pumice deposits, market and location conditions indicate there will be little or no foreseeable development potential for pumice (URS Corporation 2006).

Mineral Resource Inventory and Development Potential

Most estimates of locatable mineral resource potential use a format developed by the U.S. Bureau of Mines and the U.S. Geological Survey (U.S. Bureau of Mines and U.S. Geologic Survey 1980, as cited in USDA Forest Service 1997a). The U.S. Bureau of Mines was abolished in 1996. Mineral resources are divided into "identified resources" and "undiscovered resources." The Tongass contains both identified and undiscovered reserves.

Identified Mineral Resources

The identified mineral resources on the Tongass were described by the U.S. Bureau of Mines, Alaska Field Operations Center, in An Economic Analysis, Tongass Land Management Plan, Mineral Resource Inventory (Coldwell 1990). For summaries of this report, see the 1991 Forest Plan Revision Supplement to the Draft EIS and the 1997 Forest Plan Revision Final EIS (USDA Forest Service 1991, 1997a).

The methods used by the U.S. Bureau of Mines included the steps discussed below. First, a mineral resource inventory was compiled from all available sources, resulting in the identification of 148 locatable mineral deposit areas within the Tongass National Forest. These 148 deposits were assigned to a mineral deposit model (Berg 1984). Tonnage and grade were determined for each based on published information, or were calculated using models developed by Cox and Singer (1986). The gross metal value for each deposit area was calculated by combining the tonnage and grade figures with an average price from 1978 to 1987 for each commodity. Each deposit area was evaluated to determine its pretax net present value.

Next, the 148 deposit areas were grouped into 52 identified mineral activity tracts that had high mineral development potential (MDP). These 52 tracts were further ranked from 1 to 3, based on the likelihood of exploration and development activity within the next 10 to 15 years. Areas assigned a ranking of 1 have the highest potential for development. Rank 1 areas contained at least one deposit with a positive after-tax net present value (at a 4 percent discounted cash flow rate of return) and/or at least one active gold deposit (site of current industry activity). Rank 2 areas contained at least one deposit with a positive pre-tax net present value (at a zero percent discount rate) and/or at least one "critical" and "strategic" mineral deposit with a vulnerable supply source. Rank 3 areas do not meet these criteria; their lower rankings may be due to a lesser likelihood of mineral occurrence, or because of a lack of available information.

Of the 52 tracts, 22 are categorized as Rank 1, 7 are categorized as Rank 2, and 23 are categorized as Rank 3. The tracts are listed in Table 3.14-1. The gross metal value of the identified mineral resources within the boundaries of the Tongass was estimated at $37.1 billion (expressed as 1988 dollars) in the U.S. Bureau of Mines study (Caldwell 1990). Highest among the individual minerals were molybdenum ($14.4 billion) and iron ($12.7 billion), with gold third at $2.26 billion.

The Coldwell (1990) report is the most recent comprehensive study of mineral resources for the entire Tongass. Additional studies of mineral resources in the Tongass have since been conducted, however. These include Mineral Investigations in the Ketchikan Mining District, Southeastern Alaska (Maas et al. 1995); Mineral Resources of the Chichagof and Baranof Islands Area, Southeast Alaska (Bittenbender et al. 1999); and Mineral Assessment of the Stikine Area, Central Southeast Alaska (Still et al. 2002). These studies conducted further investigations on known mineral deposit areas (KMDAs) within the Tongass. These

Table 3.14-1
Identified Mineral Resources of the Tongass National Forest Displayed by Mineral Activity Tract

Tract Name	Ref. 1 (acres)	Ref. 1 Rank	Ref. 2 MDP	Ref. 3 MDP	Ref. 4 MDP/ MEP	Gold (tons)	Silver (tons)	Lead (tons)	Zinc (tons)	Copper (tons)	Moly (tons)	Iron (tons)	Other Minerals
Chilkat Peninsula	40	3				1	-	-	-	-	-	-	
Sullivan	7,938	1				-	-	-	-	-	-	-	Critical Minerals
Bohemia Basin	9,376	1		H		-	-	-	-	41,000	-	-	Nickel; Cobalt; Critical Minerals
Berners Bay	10,318	1				69	-	-	-	-	-	-	
Juneau Gold Belt	85,699	1				189	164	100,920	100,747	82	-	-	Critical Minerals
Fremming	501	3				0	1	150	2,100	-	-	-	
Douglas Island	1,319	2				12	-	-	-	-	-	-	
Funter Bay	11,499	1				-	-	-	-	1,960	-	-	Nickel; Cobalt; Critical Minerals
Greens Creek	7,528	1				22	2,880	136,500	339,500	-	-	-	Critical Minerals
Taku Mo	3,199	3				-	-	-	-	-	1,000	-	
Enterprise	1,505	3				0	-	-	-	-	-	-	
Apex-El Nido	4,603	2		H		1	-	-	-	-	-	-	
Basaltic Cu	4,484	3		M		-	-	-	-	1,360	-	-	Critical Minerals
Mirror Harbor	2,242	2		M		-	-	-	-	1,265	-	-	Nickel; Critical Minerals
Pinta Bay	1,301	3		H		-	-	-	-	-	-	-	Critical Minerals
Chichagof	12,946	1		M		25	7	-	-	-	-	-	Critical Minerals
Slocum Arm	8,625	3		L		-	-	-	-	-	-	-	Critical Minerals
Silver Bay	22,706	3		L		-	-	-	-	-	-	-	Critical Minerals
Pyrola	3,261	2				-	196	8,255	27,800	-	-	-	Barite; Critical Minerals
Hasselborg	1,860	3				-	-	-	-	-	-	-	Critical Minerals
Crystal/Friday	1,391	2				2	-	-	-	-	-	-	Platinum
Windham Bay	23,909	3				1	1	2	2	-	-	-	Critical Minerals
Sumdum	41,419	3				0	279	112	18,501	156,988	-	-	Critical Minerals
Pt Astley	2,004	3				2	3	1,200	5,893	379	-	-	Critical Minerals
Zarembo	27,886	1			L/H	0	109	5,030	15,774	567	-	-	Critical Minerals
Portage Mountain	1,280	3			L/H	0	2	-	-	-	-	-	Critical Minerals
Duncan	2,393	3			L/H	-	-	-	-	27	-	-	Critical Minerals
Grnd Hog/Glacier	15,859	1			L/H	-	23	63,115	202,115	143	-	-	Critical Minerals
Shakan	42,763	1	M			-	-	-	-	-	248	-	
N, Bradfield Cn	1,120	3			L/M	-	-	-	-	1,710	-	313,500	Critical Minerals
Hyder	56,396	1	M			4	60	26,899	2,337	960	75	-	Tungsten; Critical Minerals
Franks Ridge	5,866	3	L			-	-	-	-	-	-	-	Critical Minerals
Khayyam	23,450	1	M			0	1	-	781	1,436	-	-	Critical Minerals
South Arm	7,943	3	H			-	-	-	-	-	-	-	Critical Minerals
Niblack	8,915	1	H			-	-	-	-	-	-	-	Critical Minerals
Dolomi	8,634	1	M			-	-	-	-	-	-	-	Critical Minerals
Lime Point	900	3	M			-	-	-	-	-	-	-	Barite
Big Harbor	3,535	3	M			-	-	-	-	-	-	-	Critical Minerals
Jumbo	12,326	1	M			1	2	-	-	2,250	-	293,800	Critical Minerals
Hollis	17,148	1	L			-	-	-	-	-	-	-	
Kasaan	8,176	1	M			1	3	-	-	11,494	-	2,437,700	Critical Minerals
Salt Chuck	4,817	1	M			1	1	-	-	1,070	-	-	Palladium; Critical Minerals
Union Bay	17,492	3	M			-	-	-	-	-	-	190,000,000	
Helm Bay	7,204	1	M			4	-	-	-	-	-	-	
Tongass Narrows	4,488	1	M			6	-	-	-	-	-	-	
Thorne Arm	7,657	1	L			4	-	-	-	-	-	-	
George Inlet	6,198	3	M			3	-	156	-	-	-	-	Critical Minerals
Quartz Hill	2,402	2	M			560	69	-	-	-	1,258,698	-	
Barrier Island	4,414	3	L			-	-	-	-	-	-	-	Critical Minerals
Nichols Mountain	16,882	3	L			-	-	-	-	-	-	-	Critical Minerals
Bokan	17,750	2	L			-	-	-	-	-	-	-	Uranium; Critical Minerals
McLeod Bay	2,287	1	L			-	-	-	-	-	-	-	

Notes: Critical minerals are those minerals necessary to supply military, industrial, and essential civilian needs during a national defense emergency, and not found or produced in sufficient quantities to meet emergency needs (as defined in the Strategic and Critical Materials Stock Piling Act of 1979). Examples of critical minerals include lead, zinc, copper, tungsten, and the platinum group metals.
Reference 1: Coldwell 1990; Reference 2: Maas et al. 1995; Reference 3: Bittenberger et al. 1999; Reference 4: Still et al. 2002
L=low; M=medium; H=high; MDP=mineral development potential; MEP=mineral exploration potential

KMDAs included the original tracts studied by Coldwell (1990). Each study reported estimates of MDP as low, medium, and high for each KMDA, as well as for individual mines, prospects, and occurrences. The designations given in Table 3.14-1 for these reports are for the highest rating given for any prospect studied in that tract.

The 1995, 1999, and 2002 area studies give essentially identical definitions for the following MDP designations:

> High—High grades and probable continuity of mineralized rock exist. The property is likely to have economically mineable resources under current economic conditions. A high potential exists for developing tonnage or volume with reasonable geologic support for continuity of grade.
>
> Medium—Either a high grade or continuity of mineralization exist. Mineralization is confined by geology, structures, and/or grades are overall low. It could serve as a material source if economics were not a factor, but is presently uneconomic at existing conditions.
>
> Low—The property exhibits uneconomic grades and/or little evidence of continuity of mineralized rock. There is little or no obvious potential for developing resources or is an insignificant source of the material of interest.

Differences in MDP designations between these area studies and Coldwell (1990) reflect additional geologic and chemical data, changes in prices, and cost and likelihood of development based in part on LUDs at the time of the study. In addition, Still et al. (2002) ranked each mine prospect and occurrence by mineral exploration potential (MEP). The MEP ranking takes into account the potential for extent of mineralized rock but not current land status of the site. The highest MDP and MEP rankings for each area are summarized in Table 3.14-1.

Undiscovered Mineral Resources

The methods used by the U.S. Geological Survey, Branch of Alaskan Geology to identify "undiscovered" locatable mineral resources are detailed in their report, Undiscovered Locatable Mineral Resources of the Tongass National Forest and Adjacent Lands, Southeastern Alaska (Brew et al. 1991). Their work involved the definition of areas or "tracts" that may permit the occurrence of one or more deposit types; the estimation of the numbers of undiscovered deposits of each type in each tract, along with the expected tonnage and grade of each type; and the use of computer simulation using these estimates to produce a probability distribution of the quantities of metal contained in the tract. This resulted in the preparation of location maps along with descriptions of 930 metal-bearing localities. The 930 metal-bearing localities were grouped into four classes, based on the estimated value of undiscovered mineral resources per acre: Class 1 has a relatively high mineral value per acre, Class 2 has a moderate mineral value per acre, Class 3 has a relatively low mineral value per acre, and Class 4 has nominal mineral value per acre.

Each tract is considered likely to contain one or more different types of mineral deposits. The estimation of the number of deposits of a given type in a tract is the single most-critical step in probabilistic mineral resource assessment. It requires re-evaluating all of the factors used in initially defining the tract, together with three additional factors: thoroughness of exploration (tracts already thoroughly explored are less likely to contain undiscovered deposits), size of tracts (smaller tracts are likely to contain fewer undiscovered deposits), and physical dimensions of deposit types (different types of deposits occupy different volumes of rocks).

The U.S. Geologic Survey study (Brew et al. 1991) included estimation of the gross metal value of undiscovered mineral resources for the Tongass National Forest. In 1990, this value was $28.3 billion (expressed as 1988 dollars). Highest among the individual minerals were copper ($6.8 billion), iron ($4.6 billion), molybdenum ($4.35 billion), and tin ($3.4 billion). These totals cover the entire Tongass National Forest, and thus include areas currently withdrawn from mineral activity.

Mineral Resource Demand

The extent to which identified and undiscovered mineral resources on the Tongass will be exploited in the future will depend largely upon the level of demand for those resources. Demand for mineral resources can be inferred based on the amount of money spent by the mining industry to prospect and explore for mineral resources in Southeast Alaska. Increases in the amount of money spent on exploration reflect an increase in demand for mineral resources. Between 1982 and 1987, the mineral industry spent an average of $2.92 million per year on mineral exploration in Southeast Alaska, with a high of $5.85 million in 1987 (USDA Forest Service 1997a). Exploration expenditures increased drastically for the 1988 to 1991 period, when the industry spent more than $20 million each year. Expenditures generally declined for the next 10 years, reaching $1.6 million in 2001, before increasing again to a level of $9.4 million in 2005 (Alaska Department of Natural Resources [ADNR], Alaska's Mineral Industry annual reports and summaries for 1997 to 2005).

Demand for mineral resources can also be inferred by modeling the economic viability of identified mineral resources. Identified mineral resources with high degrees of economic viability will reflect an increase in mineral-related activities or in demand for those resources by industry. The economic viability of 148 mineral deposits located within the Tongass National Forest were modeled by the U.S. Bureau of Mines (Coldwell 1990), as discussed previously. Based on economic criteria or the presence of an active gold deposit, 22 of 52 mineral activity tracts were identified as most likely to be developed (Rank = 1), and 10 were identified as likely to provide a positive rate of return when cash flow was discounted at zero percent.

Mineral Production

Mineral production in Southeast Alaska in recent years has been dominated by the Greens Creek Mine at the north end of Admiralty Island. Greens Creek is an underground mining operation that opened in 1989 and produces silver, zinc, lead, and gold. The mine processed nearly 806,000 tons of ore in 2004 and provided 265 full-time jobs (ADNR 2005). Other Southeast Alaska mining activity in 2004 was comprised of at least 18 different rock, sand, and/or gravel operations. These mines produced a total of nearly 3 million tons of material during the year and supported 83 employees. The Forest Service approved a Plan of Operations for the Kensington Gold Mine north of Juneau in 2005, and Coeur Alaska, Inc. subsequently began construction activities on the site. However, a lawsuit was filed against the U.S. Army Corps of Engineers and the Forest Service, challenging the permitted tailings disposal facility, citing violations to the Clean Water Act. The plaintiffs failed in District Court but were upheld on appeal by the 9th Circuit Court in 2007. The Forest Service anticipates the submittal of a revised Plan of Operations in 2008.

Tongass Land Management for Minerals

As described previously, the Forest Service administers mineral exploration, development, and production activities through the legal/regulatory systems for locatable, leasable, and salable minerals. The Forest Service also accounts for mineral resources in the land management planning process. One way of recognizing the importance and potential of mineral resources is through the designation of Minerals LUDs in the Forest-wide land allocation. The intent of the Minerals LUD designation is to encourage exploration and development of locatable minerals in areas of high mineral potential, while taking other resource values into account. The Tongass Forest Plan includes management prescriptions for those areas, and standards and guidelines specific to minerals and geology.

The current Tongass Forest Plan, as amended, allocates 13 areas of the Forest to the Minerals LUD. These areas total 170,514 acres and are widely distributed across most portions of the Tongass. Several Minerals LUDs are clustered around Juneau and Lynn Canal, and there is another cluster near Clarence Strait and the southern part of Prince of Wales Island.

Unlike other LUDs, the Minerals LUD is an “overlay” designation that applies management prescriptions for minerals to the affected area, in addition to the prescriptions of the underlying LUD. For example, a Minerals LUD in the northern part of Admiralty Island, northeast of the Greens Creek mining area, overlies part of the Young Bay Experimental Forest LUD. The Minerals LUD and Experimental Forest management prescriptions both apply in this area, with the Minerals LUD having priority.

Environmental Consequences

Trend in expenditures for mineral prospecting and exploration, the demand for access to National Forest lands for the purpose of mineral exploration, and development is expected to increase over the next 10 years. Mineral entrants will continue to submit plans of operation to the Forest Service for approval, and regulations under which those operating plans are processed will not change by alternative. Identified and undiscovered mineral resource tracts, characteristics and location of mineral deposits, and Southeast Alaska geology will not vary as a result of implementing any of the alternatives.

Direct and Indirect Effects

Locatable Minerals

Under any alternative, future exploration and development (except for valid, currently existing rights) would be precluded in areas withdrawn from mineral entry, such as Wilderness. The availability of mineral resources of the Tongass National Forest may also be affected by the allocation of other LUDs in each alternative, and the use of Forest-wide standards and guidelines during project implementation. The standards and guidelines of certain LUDs could affect the cost of conducting exploration, development, and reclamation activities, and thus influence the exploration of some areas for their mineral resources.

Most withdrawn lands are designated so by the U.S. Congress (i.e., wilderness withdrawals). On other NFS lands, the Forest Service does not have the authority to approve or disapprove most mineral operations (the exception being salable minerals), but can impose stipulations on how mineral resources are developed in order to protect surface resources. Thus, the potential effects of alternatives on mineral resources can be estimated by analyzing the relative degree to which LUDs and their associated prescriptions could economically constrain proposed mineral activities.

For this purpose, three categories of LUDs are identified: withdrawn areas (which assume higher costs for the development of valid existing rights), and two “open” categories; one with average costs and one with higher-than-average costs. Table 3.14-2 shows the LUDs corresponding to each category.

Wilderness, National Monument, and LUD II acres remain the same for all Forest Plan alternatives, as do existing withdrawals within the Research Natural Area, Enacted Municipal Watershed, and Wild, Scenic, and Recreational River designations. Open areas with higher costs generally correspond to non-withdrawn areas in the Mostly Natural Setting LUD group, while open areas with average costs correspond to those areas within the moderate and intensive development LUD groups. Alternative 5 (No Action) retains the existing acreage in Experimental Forest and Special Interest Area designations, while all of the other alternatives would increase the acreage in these LUDs. In addition, all alternatives except Alternative 5 would add or expand three Minerals LUD overlays; one new area north of Hyder, an

Table 3.14-2
Economic Availability of Minerals Relative to Land Use Designations

Mineral Availability	LUDs
Withdrawn – Existing *(Areas remain open to mineral rights established prior to the area being withdrawn)*	Wilderness National Monument Research Natural Area Municipal Watershed Wild River
Open Areas – High Cost *(Mineral exploration and development requires special stipulations and more stringent mitigation measures)*	Remote Recreation Semi-Remote Recreation Old-Growth Habitat LUD II Experimental Forest Special Interest Area Scenic River Minerals LUD Overlay on Withdrawn Areas (prior rights only)
Open Area – Average Cost	Recreational River Scenic Viewshed Modified Landscape Timber Production Minerals LUD Overlay on All Open Area LUDs

expansion of the area near Niblack (on the north side of Moira Sound) on south Prince of Wales Island, and a new area north and south of the West Arm Cholmondeley Sound on south Prince of Wales Island. The Minerals LUD overlay may have the effect of changing the exploration and development costs from high to moderate, depending on the basic LUD of the area.

Locatable minerals are divided into identified resources and undiscovered resources. As described in the Affected Environment section, there are 52 identified mineral resource tracts on the Tongass. Using the Forest-wide acreage breakdowns of LUD groups (as grouped in Table 3.14-2) by alternative indicates the overall effects on economic availability of mineral resources. Table 3.14-3 compares the Forest Plan alternatives using the cost/LUD group concept for the 52 areas with identified mineral resources (593,000 acres). For all seven alternatives, 25 percent of the acreage of identified mineral resources is in areas that have been withdrawn. Alternatives 7 and 4 have the fewest acres of identified mineral resources in allocations potentially causing higher costs for their exploration and development; Alternative 1 has the most acreage. The other four alternatives fall between these two in a fairly close grouping near the middle of the range.

Rank 1 mineral tracts are those most likely to see mineral exploration or development. Identified mineral resource areas in the Rank 1 category encompass an area of approximately 380,000 acres on the Tongass. Table 3.14-4 compares the Forest Plan alternatives using the cost/LUD group concept for these Rank 1 identified mineral resource areas. The results are similar to those indicated in Table 3.14-3. For all seven alternatives, 15 percent of the acreage of Rank 1 mineral

Table 3.14-3
Effects on Economic Availability of Identified Mineral Resources[1]

Alternative	Withdrawn Areas	Open Areas	
		Higher Cost	Average Cost
Alternative 1	25%	36%	39%
Alternative 2	25%	29%	45%
Alternative 3	25%	26%	49%
Alternative 4	25%	20%	55%
Alternative 5	26%	29%	45%
Alternative 6	25%	25%	50%
Alternative 7	25%	18%	56%

[1] Percentage of total area (593,000 acres) within each category.

Table 3.14-4
Effects on Economic Availability of Rank 1 Identified Mineral Resources[1]

Alternative	Withdrawn Areas	Open Areas	
		Higher Cost	Average Cost
Alternative 1	15%	36%	50%
Alternative 2	15%	28%	58%
Alternative 3	15%	25%	61%
Alternative 4	15%	19%	66%
Alternative 5	15%	31%	54%
Alternative 6	15%	24%	61%
Alternative 7	15%	17%	68%

[1] Percentage of total area (380,000 acres) within each category. Rank 1 mineral tracts have the highest likelihood of being developed.

resources has been withdrawn. Alternatives 7 and 4 again have the fewest acres of Rank 1 mineral resources in allocations potentially causing higher costs for their exploration and development, at 17 and 19 percent, respectively; Alternative 1 has the most (36 percent). The other four alternatives fall between these two in a fairly close grouping near the middle of the range.

A similar analysis has been performed for the 6.6 million acres of undiscovered mineral resources, as shown in Table 3.14-5 below. Here Alternative 1 again has the most acres in allocations potentially causing higher costs, followed by Alternatives 2, 3, and 5 or 6. Alternative 1 has the least area of LUDs assumed to have average costs for mineral development.

Table 3.14-5
Effects on Economic Availability of Undiscovered Mineral Resources[1]

Alternative	Withdrawn Areas	Open Areas	
		Higher Cost	Average Cost
Alternative 1	35%	57%	8%
Alternative 2	35%	51%	14%
Alternative 3	35%	45%	20%
Alternative 4	35%	35%	30%
Alternative 5	35%	41%	23%
Alternative 6	35%	41%	23%
Alternative 7	35%	33%	31%

[1] Percentage of total area (6.6 million acres) within each category.

The undiscovered mineral resource areas are also classified according to their estimated development potential, based on resource value. Class 1 and 2 undiscovered mineral areas are believed to have moderate to high per-acre mineral values. Table 3.14-6 shows the distribution of these Class 1 and 2 areas among the different LUD groups, by alternative. These table entries again show a consistent pattern in which Alternatives 7 and 4 are the least restrictive and Alternative 1 is the most restrictive with respect to likely mineral development costs.

Table 3.14-6
Effects on Economic Availability of Class 1 and 2 Undiscovered Mineral Resources[1]

Alternative	Withdrawn Areas	Open Areas	
		Higher Cost	Average Cost
Alternative 1	38%	50%	12%
Alternative 2	38%	43%	19%
Alternative 3	38%	37%	25%
Alternative 4	38%	26%	36%
Alternative 5	38%	39%	23%
Alternative 6	38%	36%	26%
Alternative 7	38%	25%	37%

[1] Percentage of total area (989,000 acres) within each category. Class 1 has a high mineral value per acre; Class 2 has a moderate mineral value per acre.

Only the 52 mineral activity tracts (identified resources) and adjacent areas were considered for allocation to the Minerals LUD. Table 3.14-7 shows how these allocations are distributed by alternative in terms of likely development cost. Even though all LUDs in the Open Area categories are expected to have average costs if they have a Minerals LUD overlay, it is likely that, even with the Minerals LUD overlay the higher cost LUDs identified in Table 3.14-2 would have slightly higher costs than the average cost LUDs. Therefore, Table 3.14-7 provides an indication of these smaller differences. With Alternative 1, 97 percent of the lands assigned the Minerals LUD overlay have underlying LUDs in the high-cost category. By comparison, Alternative 7 would result in only 43 percent in the high-cost category. Alternatives 2, 3, and 6 are similar to Alternative 1 in placing a higher proportion of the Minerals LUDs in high-cost areas than the average-cost areas, while Alternatives 4 and 5 have percentage distributions closer to Alternative 7.

Table 3.14-7
Effects on Economic Availability of Areas Covered by the Minerals LUD Overlay[1]

Alternative	Withdrawn Areas[2]	Open Areas[3]	
		Higher Cost LUDs, in the absence of Minerals LUD Overlay	Average Cost LUDs, in the absence of Minerals LUD Overlay
Alternative 1	1%	97%	2%
Alternative 2	1%	85%	14%
Alternative 3	1%	69%	29%
Alternative 4	1%	50%	49%
Alternative 5	0%	49%	51%
Alternative 6	1%	58%	40%
Alternative 7	1%	43%	56%

[1] Percentage of total area (249,570 acres).
[2] Note that the 3,000 acres in the Withdrawn Category are in Wilderness and cover prior rights only.
[3] Note that the Minerals LUD overlay converts all of these areas to the Average Cost category; however, there may still be some differences in cost.

Leasable and Salable Minerals

The effects of the Forest Plan alternatives on leasable minerals are not discussed in detail, as there are no aspects of the Forest Plan that would have a specific direct or indirect effect on activity related to leasable minerals. The Tongass has no current leasable mineral activity, and the anticipated demand for leasable minerals is expected to remain low. The Forest Service is aware of some level of interest in oil and gas, coal, and geothermal resources in specific areas of the Tongass. The proposed Forest Plan includes revisions to the standards and guidelines to address management of potential future leasable mineral activity. In general, those revisions provide that any mineral leasing activity would need to be consistent with the standards and guidelines for the respective LUDs affected by leasing. The revisions also include surface occupancy and other prescriptions intended to protect Forest resources in areas of leasing activity. The effects of any mineral leasing activity will be analyzed at the appropriate future time if the Forest Service receives specific requests for access to leasable minerals.

Salable or common variety minerals, primarily crushed rock, are utilized in each of the alternatives. Their predominant use is to construct roads in support of the Tongass National Forest transportation system, and thus the amounts used will correspond closely to the miles of new road construction by alternative. These are shown in *Chapter 2* as well as the *Transportation* section of this chapter.

Effects on Other Resources

The development of mineral resources in the Forest generally requires construction of an underground mine complex, a millsite, road and pipeline systems, tailings and waste rock disposal areas, a marine transfer/docking facility, and lodging accommodations if the mine location is not close to an existing community. Total surface-disturbing acreage can vary markedly with specific project characteristics; the operating Greens Creek mine involves about 320 acres for facility development, and the proposed Kensington mine project will use about 280 acres. The effects of any such development are analyzed at the time a specific project is proposed.

Cumulative Effects

The potential for cumulative effects associated with Forest Service management of minerals on the Tongass will depend upon the extent to which mining interests elect to pursue mineral exploration, development, and production activities on NFS lands in the future under the amended Forest Plan. Impacts from future mineral resource activities on the Tongass would add to the baseline impacts from past, present, and ongoing mineral activity within Southeast Alaska. Alterantive 5 would allocate about 171,000 acres to the Minerals LUD, and all of the other alternatives would allocate about 250,000 acres. This difference may indicate that Alternative 5 has a slightly lower potential for long-term cumulative effects; however, no major projects are proposed on these additional acres and NEPA analyses would need to be conducted prior to any project authorizations. Alternatives 4 through 7 allocate similar proportions (66 to 68 percent) of the Rank 1 known mineral resource tracts to LUDs expected to produce average mineral development costs, while the other alternatives would allocate from 50 to 61 percent of these areas to average-cost LUDs. Therefore, Alternatives 4 through 7 would have a relatively greater, but unknown, potential to contribute to cumulative effects associated with mineral activity. Other than mineral resources that are currently under development (specifically, the Kensington deposit), the Forest Service does not have sufficient information to identify any specific mineral development as reasonably foreseeable.

Recreation and Tourism

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Affected Environment

The affected environment portion of the recreation and tourism analysis is divided into two broad sections, the first addressing the supply of recreation opportunities, and the second addressing existing use levels and trends. The supply section discusses the existing supply of recreation opportunities in terms of the Forest Service's Recreation Opportunity Spectrum (ROS) classes and inventoried recreation places on the Tongass. The existing use and trends section discusses overall forest use, resident recreation, tourism, and commercial outfitter/guide use.

The remainder of this introductory section provides a general overview of recreation in Southeast Alaska and the Tongass National Forest, which comprises approximately 80 percent of the region. Southeast Alaska possesses a remarkable and unique combination of features including inland waterways with over 11,000 miles of shoreline, mountains, fiords, glaciers, and large or unusual fish and wildlife populations that provide opportunities for a wide range of outdoor recreation experiences. Southeast Alaska imparts a sense of vastness, wildness, and solitude. These sentiments are enhanced by a small resident population and a relative absence of development compared to most other National Forests.

Recreation and tourism on National Forests encompasses more than the provision of facilities or recreation sites. This is especially true on the Tongass National Forest where most recreation and tourism attractions occur in remote undeveloped areas. Many Alaska residents purposefully live in proximity to such settings as a part of their lifestyle. Most visitors who travel long distances to see Alaska expect to find it in a wild and "unspoiled" state, but also expect comfort and convenience, reliable transportation, and other features requiring some level of infrastructure and development. The challenge to managers is to identify and understand the relationship between the settings and the variety of client groups. Commercial providers of recreation activities base much of their marketing strategy on particular environmental settings and identified recreation places within those settings.

The Tongass National Forest includes approximately 17 million acres of land available for recreation. This land contributes greatly to the feeling of vastness and solitude that dominates the region; however, much of the land is not suitable for outdoor recreation. Difficult and steep terrain, wetlands, icefields, glaciers, and heavy vegetation confine most recreation activities to accessible shorelines, river and stream bottoms, and around the many lakes within the Forest. Extensive use is made of some of the icefields and alpine areas (above tree line), but access to these areas is usually by aircraft. Both residents and visitors use the developed campground and picnic areas, beaches, trails, cabins, shelters, and visitor centers that are located near communities. A current inventory of developed recreation sites on the Tongass is presented in Table 3.15-1.

Table 3.15-1
Tongass Recreation Facilities

Type of Facility	Number
Anchor Buoys	28
Major Campground Developments	10
Number of Sites	207
Minor Campground Developments	15
Number of Sites	28
Major Interpretive Sites (Visitor Centers)	2
Wildlife/Fish Viewing Sites	12
Organized Camps	2
Picnic Areas	24
Number of units	95
Recreation Cabins	
- Wilderness	52
- Nonwilderness	97
Total Recreation Cabins	149
Recreation Residences	15
Isolated Cabins	65
Resorts and Lodges	3
Trails (number of miles):	
- Nonwilderness	419.4
- Wilderness	85.1
Total Trail Miles	504.5
Shelters	38
Developed Trailheads	13

Source: USDA Forest Service 1997a (Table 3-34).

The National Park Service manages 3.3 million acres in three park units in Southeast Alaska. The majority of this land is located within the Glacier Bay National Park and Preserve. The other two park units are the Sitka National Historic Park and Klondike Goldrush National Historic Park.

The State of Alaska also administers land for recreation. Many of the state land selections were made with recreation opportunities for the residents of local communities in mind. Most of these opportunities are still undeveloped. State selections were also made for future development of a system of marine parks. Currently, Alaska State Parks manages about 80,000 acres and 34 park units, including 16 marine parks, in Southeast Alaska. In addition, the Alaska Department of Fish and Game (ADF&G) manages two state wildlife refuges, two critical habitat areas, and one wildlife sanctuary, and the Alaska Division of Forestry manages the 247,000-acre Haines State Forest (Alaska State Parks 2004).

Community road systems are limited and heavily used for access to recreation sites and attractions near local communities. Existing road systems are primarily located near the larger communities of Juneau, Sitka, Ketchikan, Petersburg, and Wrangell. There is an extensive road system connecting the small communities on Prince of Wales Island, to systems developing near the communities of Hoonah and Kake. There is no interconnecting highway system between islands or between communities on the mainland.

Haines, Skagway, and Hyder all have highway connections to Canada and the Alaska Interior, as well as the lower 48 states, and serve as gateways for tourists heading north. Haines and Skagway are also visited by cruise ships and served by the Alaska Marine Highway System (AMHS).

Roads exist in other locations where timber harvest has taken place. Independent visitors from outside the state and residents from other parts of Southeast Alaska use road systems that are accessible from the AMHS ferries or from local communities for recreational purposes. Roads in locations where there are no communities or interconnecting access to the AMHS receive relatively low levels of recreation use. However, recreation-related vehicle use has been growing on some remote islands, including Kruzof, Zarembo, and Etolin Islands, and isolated systems on Kuiu and Kupreanof Islands. While the total amount of recreation use on these islands is low, it can be heavy at times, such as during hunting season.

Cruise ship passengers account for a large and growing share of visitors to Southeast Alaska. For example, the number of cruise ship visitors to Juneau more than doubled over the past decade from 462,542 in 1996 to 948,226 in 2005 (see Table 3.15-10). Other Southeast Alaska ports visited by cruise ships include Ketchikan, Sitka, Wrangell, Skagway, and Haines.

Supply of Recreation Opportunities

The supply of recreation opportunities is described in this analysis using two concepts: ROS and recreation places. These concepts describe the quantity of recreation opportunities. Quality is addressed using the “Home Range” concept and by assigning a value to the recreation places. These concepts are discussed in the following sections.

Recreation Opportunity Spectrum

The Tongass National Forest has the potential to provide a wide variety of recreation settings. The ROS has been developed to help identify, quantify, and describe these settings. The ROS system portrays the combination of activities, settings, and experience expectations along a continuum that ranges from highly modified to primitive environments. Seven classifications are identified along this continuum: Urban (U), Rural (R), Roaded Natural (RN), Roaded Modified (RM), Semi-Primitive Motorized (SPM), Semi-Primitive Non-Motorized (SPNM), and Primitive (P). The ROS inventory may be used to assess the potential effects of the alternatives on recreation settings.

The seven ROS classes are summarized in Table 3.15-2, based on seven elements that are considered in the allocation and management of recreation settings. Forest-wide ROS acres are presented in Table 3.15-3.

Viewed in terms of acres, the Primitive ROS setting is the largest on the Tongass, with approximately 10.4 million acres allocated to this setting (Table 3.15-3). The Wilderness and Natural Setting Land Use Designation (LUD) groups currently account for 47 and 45 percent of this total, respectively. Approximately 36 percent of the areas presently inventoried as SPNM (3 million acres) are located in the moderate development (12 percent) or intensive development (24 percent) LUD groups, with 19 percent located in existing Wilderness. Areas inventoried as SPM account for approximately 1.5 million acres Forest-wide and are mostly located in the Wilderness (31 percent) and Natural Setting (47 percent) LUD groups. Approximately 76 percent of areas allocated to the RN, RM, Rural, and Urban settings are located in the moderate development (23 percent) or intensive development (53 percent) LUD groups (Table 3.15-4).

Existing Wilderness on the Tongass is mostly associated with the Primitive ROS setting (82 percent), with the remaining 18 percent comprised of SPNM (10 percent) and SPM (8 percent). Much of the area inventoried as SPM on the Tongass is accessed via motorized watercraft. The Primitive ROS setting also comprises a large share of the Natural Setting LUD group (65 percent), with the remaining area allocated to other ROS settings, including 19 percent inventoried as SPNM (Table 3.15-4).

Table 3.15-2
Comparison of ROS Classes

	Urban (U)	Rural (R)	Roaded Modified (RM)	Roaded Natural (RN)
Scenic Quality	Alterations to landform and vegetation dominate landscape; nonrecreational activities not to exceed Low SIO - FG; Very Low SIO - MG.	Alterations to landform and vegetation dominate landscape; nonrecreational activities not to exceed Low SIO - FG; Very Low SIO - MG.	Alterations dominate the landscape; nonrecreational activities/structures evident, but do not exceed Very Low SIO.	Alterations to landscape subordinate; nonrecreational activities not to exceed Low SIO though typically Moderate SIO.
Access[1]	Access and travel facilities are highly intense, motorized, and often with mass transit supplements.	All methods of access and travel may occur, but subject to formal regulation.	All methods of access and travel when needed and compatible with intended activities.	All methods of access and travel may occur when compatible with intended activities; zones of non-motorized use.
Remoteness	Remoteness from sites and sounds of human activity not available or important.	Remoteness from sites and sounds of human activity not available or important.	Remoteness from continuous sounds of human activity is expected.	Remoteness from continuous sounds of human activity is of moderate importance.
Visitor Management	Intensive on-site controls are numerous and obvious.	On-site regimentation and control is obvious.	On-site regimentation and controls are few.	On-site regimentation and control is obvious.
On-site Recreation Development	Recreation structures and facilities readily evident, but appropriate for setting; designed for high use levels. Information and interpretive facilities may be large and complex.	Recreation structures and facilities readily evident, but appropriate for setting, designed for high use levels. Information and interpretive facilities may be large and complex.	Recreation structures and facilities may be present, but are provided primarily for protection of the resource rather than user convenience. Facilities are rustic and harmonize with a backcountry setting.	Recreation structures and facilities provided for site protection and user convenience. Facilities are contemporary but of rustic design and harmonize with natural setting.
Social Encounters	High concentrations of people at one time.	Moderate to high concentrations of people at one time.	Moderate concentration of users on roads and little evidence of others or interactions at campsites.	Interactions with others may be moderate to high. Moderate concentrations of people, especially on trails and in dispersed areas.
Visitor Impacts	Very noticeable, but managed to prevent physical resource degradation.	Very noticeable, but managed to prevent physical resource degradation.	Human use noticeable, but not degrading to resources. Site hardening dominates campsites, parking areas.	Visitor use noticeable, but not degrading to resources; established SIOs.

Table 3.15-2 (continued)
Comparison of ROS Classes

	Semi-Primitive Motorized (SPM)	Semi-Primitive Non-Motorized (SPNM)	Primitive (P)
Scenic Quality	Alterations few and subordinate to landscape; designed and located to not exceed Moderate SIO.	Alterations few and subordinate to landscape; nonrecreational activities and structures designed not to exceed High SIO.	Alterations to landscape not evident; structures do not exceed High SIO.
Access[1]	Travel on trails designed for/open to motor vehicles; roads maintained for high clearance vehicles; motorboats operating on waterways; may establish zones of non-motor use for facility/resource protection.	Trails closed to motorized use; nonmotorized boats used on freshwater lakes and streams.	Trails closed to motorized use; non-motorized boats used on freshwater lakes and streams.
Remoteness	Nearby sights and sounds of human activity are rare; distant sounds may occur.	Nearby sounds of human activity are rare; distant sounds may occur.	Sounds of human activity are very infrequent to nonexistent.
Visitor Management	On-site regimentation and controls are few.	On-site regimentation and controls are rare.	On-site regimentation and controls are very rare.
On-site Recreation Development	Recreation structures and facilities may be present, provided primarily for protection of site rather than user convenience. Facilities, when present, are rustic and harmonize with natural setting.	Recreation structures and facilities may be present but provided primarily for protection of site. Facilities, when present, are rustic and harmonize with natural setting.	Recreation structures are rarely present, provided primarily for the protection of the site. Facilities, when present, are rustic and harmonize with natural setting.
Social Encounters	Low interaction between users. Campsites seldom within sight or sound of another group except during peak periods.	Low interaction between users. Campsites seldom within sight or sound of another group except during peak periods.	Very low interaction between users and no other groups in sight or sound of overnight camps.
Visitor Impacts	Human use noticeable, but not degrading to resource or backcountry setting.	Human use noticeable, but not degrading to resource elements.	Human use essentially unnoticeable. Site hardening—boardwalks, boat moorings, food caches.

[1] Subject to ANILCA provisions.
Note: SIO = Scenic Integrity Objective, FG = Foreground, MG = Middleground
Source: USDA Forest Service 1997a (Table 3-30).

Table 3.15-3
Forest-wide Recreation Opportunity Spectrum Acres, 2006

ROS Class	Acres
Primitive (P)	10,358,097
Semi-Primitive Non-Motorized (SPNM)	3,046,573
Semi-Primitive Motorized (SPM)	1,486,874
Roaded Natural (RN)	160,614
Roaded Modified (RM)	1,713,361
Rural and Urban (R and U)	5,728

Note:
The total acres by ROS class shown in this table is slightly lower than the Forest-wide total because the ROS inventory does not include the entire Forest.

Table 3.15-4
Forest-wide Recreation Opportunity Spectrum Acres by LUD Group, 2006

LUD Group	P	SPNM	SPM	RN	RM	R+U
Acres by LUD Group and ROS						
Wilderness	4,840,497	568,994	457,695	21,707	18,949	151
Mostly Natural	4,692,925	1,384,844	701,158	85,471	326,650	4,313
Moderate Development	172,876	363,111	184,202	40,428	388,568	508
Intensive Development	651,799	729,625	143,819	13,007	979,189	747
Percent of ROS Setting						
Wilderness	47	19	31	14	1	3
Mostly Natural	45	45	47	53	19	75
Moderate Development	2	12	12	25	23	9
Intensive Development	6	24	10	8	57	13
Percent of LUD Group						
Wilderness	82	10	8	0	0	0
Mostly Natural	65	19	10	1	5	0
Moderate Development	15	32	16	4	34	0
Intensive Development	26	29	6	1	39	0

Notes:
1. P=Primitive, SPNM=Semi-Primitive Non-Motorized, SPM=Semi-Primitive Motorized, RN=Roaded Natural, RM=Roaded Modified, R+U=Rural and Urban
2. The total acres by ROS class shown in this table is slightly lower than the Forest-wide total because the ROS inventory does not include the entire Forest.

Recreation Places

Recreation Places are areas that are used for recreation activities and are easy to access. These areas are identified based on patterns of use associated with protected boat anchorages and landings, aircraft landing sites, and roads.

The Tongass offers a unique recreation setting because it provides an island and marine environment in close proximity to major mountain ranges and icefields. Forested mountains rising from the saltwater provide unique and remote coastal recreation opportunities not found in other areas of the United States. Recreation enthusiasts are able to view a variety of natural landforms and wildlife, such as glaciers, old-growth forests, humpback whales, spawning salmon, brown bears, and bald eagles. The immense amount of land on the Tongass National Forest provides a great diversity of recreation attractions and opportunities. Most recreation activities take place in, and are dependent on, settings that are primarily undeveloped and widely dispersed. The surrounding saltwater, which is not managed by the Forest Service, allows for motorized boat and floatplane access throughout Southeast Alaska.

The pattern of use associated with known protected boat anchorages, boat landings, aircraft landing sites, and the limited road systems makes it possible to identify specific “recreation places.” Recreation places are those areas that are used for recreation activities and are easy to access. Approximately 1,436 recreation places, totaling about 3.6 million acres (22 percent of the total Tongass National Forest), have been identified. Approximately 22 percent, or 311 of these places, are located in existing designated wildernesses. Although these areas comprise only 22 percent of the Forest-wide number of recreation places, they account for 36 percent of total recreation place acres.

The setting of a recreation place plays a key role in its attractiveness and use. Many recreation opportunities, such as viewing scenery or pursuing solitude, are dependent on this relationship and require a natural type of setting, whereas others, such as hunting or fishing, are less dependent on the type of setting. Table 3.15-5 identifies the distribution of recreation place acres by ROS class. Recreation places can be categorized into three general groupings based on their principle uses and attractions. These three general groupings, marine, freshwater, and land-based, are discussed in the *Recreation and Tourism* section of the 1997 Forest Plan Revision Final Environmental Impact Statement (EIS) (USDA Forest Service 1997a, pp. 3-107, 3-108). The distribution of recreation places among these general groupings is presented in Table 3.15-6.

For the purposes of this analysis, recreation places are classified in two basic ways. First, recognizing that access plays a key role in recreation in Southeast Alaska, "home ranges" were defined for each community. Inventoried recreation places were classified into two categories: those located within a radius of approximately 20 miles from communities ("home range") and those outside ("rest of forest"). Almost half (48 percent) of the recreation place acres are within a community home range. Second, recreation places are identified as either important or ordinary/ common based on five categories: facilities, marine, hunting, fishing, and tourism. The Forest Service developed this rating system in response to public comments received on the 1990 Draft EIS. Recreation places may be important for one, several, or none of the identified categories. Important recreation places by category are summarized in Table 3.15-7 and discussed further in the *Recreation and Tourism* section of the current Forest Plan Revision Final EIS (USDA Forest Service 1997a, pp. 3-109, 3-111).

Table 3.15-5
Distribution of Recreation Place Acres by Recreation Opportunity Spectrum Class

ROS Class	Acres (1,000s)
Primitive	1,306
Semi-Primitive Non-Motorized	916
Semi-Primitive Motorized	870
Roaded Natural	103
Roaded Modified	432
Rural and Urban	3

Note: These totals include all identified recreation places within the Tongass National Forest boundary, including those on state and private lands.

Table 3.15-6
Distribution of Recreation Places by General Use

	Number of Places	Percent of Total	Acres (1,000s)[1]	Percent of Total
Marine	617	43	1,234	34
Freshwater	302	21	908	25
Land-based	531	37	1,488	41
Total	**1,436**	**100**	**3,630**	**100**

[1] Updated acreages were calculated using the ratios from USDA Forest Service 1997a (pp. 3-107, 3-108) and the total acres identified in Table 3.15-5. Totals may not sum exactly due to rounding.

Table 3.15-7
Important Recreation Places by Category[1]

	Number of Places	Percent of Total[2]	Acres (1,000s)	Percent of Total[2]
Facilities[3]	402	28	1,053	29
Marine[4]	617	43	1,089	30
Hunting[5]	373	26	1,452	40
Fishing[6]	187	13	472	13
Tourism	876	61	1,924	53
Total Acres/Places	**1,436**	**NA**	**3,630**	**NA**

[1] Recreation places are rated as either important or common/ordinary.
[2] Percent columns sum to more than 100 because a recreation place can be rated important in more than one category.
[3] All recreation places with facilities were rated as being important. In addition, other recreation places with some type of facility, such as a viewing platform, and facilities authorized by a special use permit for recreation purposes, were identified as important.
[4] The marine category identified here is different to the marine type identified in Table 3.15-6. The marine category in this table only includes those recreation places that are truly unique or typify the Southeast Alaska marine experience.
[5] Important hunting areas were distinguished from ordinary hunting areas based on a number of factors, including heavy recurring use, hunter success, ease of access, opportunities for several species, and prized species, such as mountain goats and moose.
[6] Important fishing recreation places were identified using ADF&G ratings for recreational fishing.
Note: This estimate of total recreation place acres is slightly higher than the estimate used in the current Forest Plan Revision Final EIS (USDA Forest Service 1997a). The database used to develop these estimates has been updated and these estimates were developed using a more precise methodology than the grid-sampling approach that was employed in the 1997 Forest Plan Revision Final EIS analysis.
Source: USDA Forest Service 1997a (pp. 3-109, 3-111).

Existing Use Levels and Trends

The following section is divided into four parts that discuss forest use in general, resident recreation, tourism, and commercial outfitter/guide use on the Tongass National Forest.

Forest Use

Although there are some locations on the Tongass where fees are collected and locations where people can be easily counted, much of the information regarding general public use has been historically based on long-term observations, anecdotal information, and professional estimates, adjusted by quantitative indicators where available. In general, many residents and nonresidents seek the same type of recreation experiences and many engage in similar activities. Alaska has a reputation for vastness, rugged beauty, and solitude, and both residents and nonresidents usually expect to find these qualities in recreation settings. Expectations often vary by group and individual, however, with some people having higher expectations of wilderness and solitude than others.

The Alaska Region of the Forest Service (Region 10) began participating in the Forest Service's National Visitor Use Monitoring (NVUM) program in 2000. The final results of this program, which involved surveys conducted over 3 years, were published in August 2004 (Kocis et al. 2004). According to the NVUM analysis, there was an estimated total of 1.83 million National Forest visits and 2.13 million site visits to the Tongass in 2003 (Kocis et al. 2004). NVUM has standardized definitions of visitor use measurement to ensure that all National Forest visitor measurements are comparable. A National Forest visit, as defined by the NVUM, is the entry of one person onto the Forest to participate in recreation activities for an unspecified period of time and may include multiple site visits. A site visit, as defined by the NVUM study, is the entry of one person onto a National Forest site or area to participate in recreation activities for an unspecified period of time.

The results of the NVUM surveys on the Tongass indicate that the top five activities of survey respondents were viewing natural features (64.4 percent), hiking/walking

(59.6 percent), relaxing (32.5 percent), viewing wildlife (16.4 percent), and nature center activities (15.1 percent) (Table 3.15-8). Survey respondents were also asked to identify the primary activity that they were engaged in at the time of the survey. The top activities were hiking/walking (30.5 percent), viewing natural features (26.7 percent), fishing (8.3 percent), relaxing (8 percent), and gathering forest products (4.2 percent) (Table 3.15-8). Three of these activities (viewing natural features, hiking/walking, and relaxing) are also in the top five activities ranked by participation.

Table 3.15-8
Activity Participation and Primary Activities Identified in the 2004 Tongass NVUM Survey

Activity	Percent Participation	Primary Activity (Percent)[3]
Viewing Natural Features	64.4	26.7
Hiking/Walking	59.5	30.5
Relaxing	32.5	8.0
Viewing Wildlife	16.4	2.9
Nature Center Activities	15.1	3.1
Fishing	13.5	8.3
Nature Study	9.9	2.3
Picnicking	8.9	3.2
Gathering Forest Products	8.9	4.2
Driving for Pleasure	8.1	1.8
Motorized Water Activities	7.9	0.4
Visiting Historic Sites	6.2	0.3
Resort Use	4.1	1.9
Hunting	3.6	3.2
Other Non-motorized	3.2	0.6
Non-motorized Water	2.9	0.6
Other Motorized Activity	2.6	0.2
Bicycling	2.3	1.2
Backpacking	2.2	0.0
Developed Camping	1.7	0.6
OHV Use	1.3	0.0
Cross-country Skiing	1.0	1.0
Primitive Camping	0.6	0.1
Downhill Skiing	0.5	0.4
Horesback Riding	0.3	0.0
Snowmobiling	0.2	0.2

Source: Kocis et al. 2004 (Table 13)

Resident Recreation

Many residents of Southeast Alaska place a high value on the quality and availability of outdoor recreation opportunities in the region. This is evidenced by the fact that the proportion of Alaskan residents who participate in outdoor activities is generally much higher than elsewhere in the United States (Bowker 2001). Many local residents engage in dispersed recreation activities on National Forest System (NFS) land and adjacent saltwater. Accurate data on this type of use are difficult to obtain and estimates tend to either underestimate the nature and extent of much of this use or overcompensate in inconsistent ways (USDA Forest Service 1997a, p. 3-120). The net result is that while there is a general consensus that outdoor recreation opportunities and activities provided by the Tongass are highly important to residents, there is limited data that accurately quantifies resident recreation use.

Resident recreation demand is influenced by a number of factors, including regional population levels, per capita participation rates, and recreation travel behavior. Over time, the supply of certain recreation opportunities in Southeast Alaska has increased. Road systems have expanded into previously inaccessible areas and visitor services and tourism marketing have also increased. In some cases, supply-induced increases in participation have occurred. This appears to be the case on Prince of Wales, Wrangell, and Mitkof Islands where road systems developed for timber harvesting created an opportunity for road-related access to previously inaccessible recreation settings and an opportunity for recreation activities involving wheeled vehicles.

Supply-induced participation changes have also been accompanied by additional demand for specific recreation places or facilities for a related activity. Increased opportunities for roaded access and activities are typically accompanied by a need for parking, dispersed campsites, picnic sites, trails to scenic attractions, and additional short access routes to cabin sites and previously inaccessible beaches. Increased tourism has resulted in increased demand for interpretive services as well as walking and hiking opportunities near the major communities.

The use of off-highway vehicles (OHVs) is another growing activity on the Tongass. Use is limited by topography, dense vegetation, and wet soils. These types of vehicles are most frequently used on road systems connected to communities, with riders seeking out primitive roads or spurs. Limited accessibility often results in OHV use on muskegs, beaches, tidal areas, and river channels during low flows.

A new travel management policy established for the Forest Service in 2005 requires each National Forest to identify and designate those roads, trails, and areas that are open to motor vehicle use. This policy is presently being implemented on the Tongass with each District Ranger required to seek public input and coordinate with federal, state, county, and other local governmental entities, as well as tribal governments, before any decision is made to consider use on a particular road, trail, or area. This decisionmaking process also involves completing National Environmental Policy Act (NEPA) analyses, as appropriate. Unplanned, user-created routes will be considered at the local level during the designation process (USDA Forest Service 2005e).

Tourism

Nonresident pleasure visitors or tourists can be divided into independent and package visitors. Independent visitors, who constitute a small but growing group, are characterized as those who get off the ferries and planes and engage in a variety of activities. They spend more time in the communities and on the Forest, and may secure the services of outfitters and guides, restaurants, motels, and transportation services such as floatplanes, boats, and gas stations. Independent travelers tend to plan their own itineraries, but often secure the services of mini-packages, such as day excursions or fishing charters. Approximately 89 percent of non-cruise ship visitors to Southeast Alaska in 2006 purchased some type of multi-day package (McDowell et al. 2007). These types of visitors compete more directly with residents for recreation opportunities on the Forest. Lodges have grown in popularity in recent years, with fishing lodges in particular playing an important role in the tourism industry in some local areas. A recent study, for example, identified nine recreational fishing lodges in the vicinity of Elfin Cove, a small town located west of Hoonah (Dugan et al. 2006). Fishing lodges accounted for 63 percent of the non-cruise, multi-day packages identified in 2006, with Wilderness lodges accounting for a further 13 percent of the total. Adventure tours (7 percent), rail packages (3 percent), motorcoach tours (3 percent), and “other” (12 percent) accounted for the remaining share of multi-day packages (McDowell et al. 2007).

Package visitors are typically the cruise ship clients, though some arrive by ferry and airplane. This is a very large group that uses the Tongass National Forest primarily as a scenic resource. These visitors spend less time in the area and generally follow preplanned and regimented itineraries. Shore excursions have, however, become an important part of the cruise ship experience, with much of this activity centered around communities. Half-day and day excursions into the Forest are also increasing in popularity.

The marketing of recreation opportunities by commercial suppliers has important similarities to resident recreation concerns. For example, many businesses that provide boat or aircraft access for wildlife viewing and other activities have a low tolerance for the presence of other groups in the same area. The presence of more than two or three other parties in a bay or area may cause such operators to seek substitute locations. The ability to market Alaska tourism, in part due to the high cost of visiting Alaska, is dependent on meeting customer expectations of seeing and experiencing vast, untamed land and its wildlife. Resident recreationists who traditionally use an area may, however, be discouraged by commercial businesses operating in the same area.

Reasons for Visiting Southeast Alaska

Two of the top three attractions in the state in 1993 were directly associated with the Tongass: the Inside Passage ranked first and Mendenhall Glacier ranked third. Southeast communities accounted for four of the six most frequently visited communities and places in the state: Juneau ranked second, Ketchikan third, Skagway fourth, and Glacier Bay sixth (USDA Forest Service 1997a).[1]

The most recent comprehensive survey of the motivations of visitors to Southeast Alaska was conducted in 1988. Outstanding scenery was identified as the most cited reason for visiting the region (Table 3.15-9). Opportunities for seeing whales, bald eagles, bears, and other wildlife add to the experience. Wildlife was the second most cited reason for visiting the area. Scenery and wildlife were the most frequently cited attractions by both independents and visitors as a whole (Table 3.15-9).

Table 3.15-9
Reasons for Visiting Southeast Alaska

Reason	Independents	All Visitors
Scenery	66%	66%
Wildlife	31%	35%
Recommendations	25%	25%
Visit friends/relatives	23%	7%
Fishing/hunting	19%	8%
Wildernesses	16%	13%
Specific attractions	13%	10%
Part of cruise	9%	60%
Advertising	7%	10%
Price	2%	8%

Source: USDA Forest Service 1997a (Table 3-37). (Original Source: Data Decisions Group 1989. *Southeast Alaska Pleasure Visitor Research Program*, Summer 1988, p. 20.)

As noted, the 1988 survey is the most recent comprehensive survey of this type. The State of Alaska has not commissioned any similar comprehensive surveys of the motivations of Southeast Alaska visitors since that time. The information summarized in Table 3.15-9 provides an interesting snapshot of visitor motivations in 1988, but the number of visitors to the region has more than doubled since 1993, with the number of cruise ship visitors increasing more than threefold over this period. While the exact percentages may be different, it seems reasonable to assume that the Tongass-specific reasons identified in 1988—scenery, wildlife, fishing/hunting, and wilderness—continue to be valid today.

[1] These data, presented in Table 3-35 of the current Forest Plan EIS, are originally from the 1993 Alaska Visitor Statistics Program (AVSP). These data have not been collected in subsequent AVSPs.

Although there has not been a similar comprehensive survey specifically designed to address the motivations of visitors to Southeast Alaska, the results of three more recent surveys provide some insight. These surveys are the 2001 statewide Alaska Visitor Statistics Program (AVSP)[2], a 2005 survey of non-cruise visitors to central Southeast Alaska, and a 2005 survey of cruise visitors to Juneau (Northern Economics 2002, McDowell Group 2006a, McDowell Group 2005).

The 2001 statewide AVSP found that sightseeing was far and away the most common non-business activity for summer visitors to Alaska in 2001, cited by 53 percent of visitors as the primary non-business activity they hoped to enjoy in Alaska on their trip (Table 3.15-10). The second most frequently cited activity—fishing—was identified by only 9 percent of those surveyed. These relatively low figures for everything but sightseeing are partially a product of the survey design with survey respondents asked to identify the primary activity rather than multiple activities, but also reflect the importance of sightseeing and the range of other available activities.

Table 3.15-10
Most Common Non-Business Activities for Visitors to Alaska, 2001

Activity[1]	Percent of Surveyed Visitors
Sightseeing	53
Fishing	9
Touring Glaciers	3
Hiking	3
Wildlife Viewing	3

[1] These are the five most common responses to the question: "What is the primary non-business activity you hope to enjoy in Alaska on this trip?" The results were not disaggregated by region.
Source: Northern Economics 2002.

The McDowell Group (2006a) found that fishing, cited by 49 percent of surveyed visitors, was the primary reason to visit most frequently cited by non-cruise visitors to central Southeast Alaska in 2005. Visit friends/family and outdoors/scenic beauty were identified by 32 and 22 percent of surveyed visitors, respectively (Table 3.15-11). Fishing was identified by 46 percent of surveyed visitors as the activity they enjoyed most on their trip, with outdoors/scenic beauty and visit family/friends cited by 43 percent and 20 percent of those surveyed, respectively (Table 3.15-11). These data are for visitors to central Southeast Alaska, but are likely to be broadly representative of all non-cruise visitors to rural areas in Southeast Alaska.

The McDowell Group also surveyed cruise ship visitors to Juneau in 2005 and provided summary data from similar surveys conducted in 2003 and 2001. A survey of cruise ship passengers docking at Juneau may be considered broadly representative of all cruise ship visitors to Southeast Alaska because most cruise ships visiting Southeast Alaska stop there. These data again support the importance of scenery and sightseeing to the overall visitor experience, with 44 percent of cruise ship passengers surveyed in Juneau in 2005 identifying scenery/sightseeing as one of their most enjoyed activities (Table 3.15-12). Glaciers and whale watching were identified by 27 percent and 16 percent of surveyed visitors in 2005, respectively. The top three cited activities in 2005—scenery/sightseeing, glaciers, and whale watching—were also the most frequently cited activities in 2001 and 2003.

[2] The AVSP is a significant visitor industry research project conducted periodically by the State of Alaska. The most recent study was conducted in 2006 (McDowell et al. 2007).

Table 3.15-11
Reasons for Visiting and Most Enjoyed Activities for Rural (Non-Cruise) Visitors to Central Southeast Alaska, 2005

	Percent of Surveyed Visitors[1]	
Activity	**Reason for Visit[2]**	**Most Enjoyed[3]**
Fishing	49	46
Visit Friends/Family	32	20
Outdoors/Scenic Beauty	22	43
Wildlife	13	21
Inside Passage	11	NA
People	NA	12

[1] Central Southeast was defined for the purposes of the McDowell Group study as Petersburg, Wrangell, Kake, Alaska and Prince of Wales Island. Note: Multiple responses were allowed.
[2] Activities identified in response to the survey question: "Why did you choose to visit the Central Southeast Alaska area?"
[3] Activities identified in response to the survey question: "What did you enjoy most about visiting the Central Southeast Alaska area?"
Note: NA = not included in the top five cited activities for this category
Source: McDowell Group 2006a

Table 3.15-12
Most Enjoyed Activities for Cruise Visitors to Juneau, 2001, 2003, and 2005

	Percent of Surveyed Visitors		
Activity	**2005[1]**	**2003**	**2001**
Scenery/Sightseeing	44	34	20
Glaciers	27	20	18
Whale Watching	16	8	9
Shopping	15	5	7
Weather	9	3	2

[1] The percentages for 2005 sum to more than 100 because multiple responses were allowed in the survey for that year.
Source: McDowell Group 2005

Taken together, these studies indicate that the scenery and sightseeing are consistently among the top reasons, and in most cases the top reason, attracting visitors to Alaska, Central Southeast, and Juneau. They are also most frequently cited as "most enjoyed" by surveyed visitors. This is largely consistent among different types of visitors (i.e., cruise and non-cruise) and consistent with the results of the 1988 survey (see Table 3.15-9). The other activities identified as reasons for visiting in 1988 also show up in the more recent surveys to varying degrees. These results also suggest that while the scenery is important for all visitors, the relative importance of other activities varies by the type of visitor (cruise versus non-cruise) and the survey location.

The estimated number of summer visitors to Southeast Alaska more than doubled between 1993 and 2007, increasing from 502,800 in 1993 to 1.160.000 in 2007.

Trends in Visitation

The number of visitors to Southeast Alaska has increased considerably over the past decade. Statewide, the total number of summer visitors increased from 861,100 in 1993 to 1,631,500 in 2006, which equates to an average annual growth rate of 5 percent and a total net increase of 89 percent. The number of summer visitors to Southeast Alaska increased by 131 percent over the same time period, increasing from 502,800 in 1993 to 1,160,000 in 2006 (McDowell Group et al. 2007). Statewide, increases in cruise ship passengers accounted for 66 percent of the growth in visitors between 1993 and 2006. Arrivals by air increased by 44 percent over the same period, while the number of visitors arriving by ferry, highway, and other modes of entry decreased (Northern Economics 2002, McDowell et al. 2007).

Data for 2006 indicate that 63 percent of visitors to Southeast Alaska entered Alaska via cruise ship, 32 percent entered by air, with 3 percent and 1 percent entering via highway and ferry, respectively (McDowell et al. 2007).

The number of cruise ship passengers visiting Juneau more than trebled between 1993 and 2005, increasing from approximately 306,600 in 1993 to 948,200 in 2005.

The number of cruise ship passengers visiting Juneau more than doubled between 1993 and 2000, increasing from approximately 306,600 in 1993 to 632,000 in 2000 (Table 3.15-13). This number has continued to grow over the past 5 years, with a total of 953,000 cruise ship visitors to Juneau in 2006, a 51 percent increase from 2000 and a more than threefold increase from 1993. The number of passengers docking at Juneau is considered representative of the total number of cruise ship passengers because most cruise ships visiting Southeast Alaska stop there.

Other ports in Southeast Alaska, including Ketchikan, Skagway, and Haines, also experienced net increases in passenger volumes during the 1990s. Sitka and Wrangell were exceptions to this general trend with absolute decreases in passenger volumes during the latter half of the 1990s. Recorded passenger volumes at Sitka decreased from a high of 252,256 in 1996 to a low of 160,652 in 2000, but have since increased, peaking with 256,782 passengers in 2003. A total of 229,793 cruise ship passengers visited Sitka in 2005 (USDA Forest Service 2001c, Sitka Convention and Visitors Bureau 2006). The subsequent decrease in passenger volumes at Sitka was likely associated with the start-up of the Icy Strait Point development in Hoonah (see below).

The rapid growth and sheer magnitude of the cruise ship industry has important implications for recreation planning on the Tongass. Shore excursions have become an integral part of the cruise ship experience, providing increased revenues for ship operators and opportunities for local entrepreneurs. Much of this activity has been concentrated at ports of call that accommodate large or mid-sized cruise ships. Recent survey data (2005) indicate, for example, that approximately 83 percent of cruise visitors to Juneau participated in at least one tour while they were in Juneau. Glacier tours were the most popular type of tour in 2005, with 42 percent of cruise visitors taking this type of tour. Wildlife/marine life viewing, the Mt. Roberts Tramway, and flightseeing via helicopter were also popular (McDowell Group 2005).

Alongside the international cruise lines, several small and mid-size cruise operators are active in the region, often taking their customers to places such as Metlakatla and Petersburg in addition to the larger communities. Icy Strait Point, an old cannery located approximately 1.5 miles from Hoonah, is Alaska's first cruise destination built specifically for tourists. Owned by the Hoonah Totem Corporation and operated by Pt. Sophia Development Corporation, this facility opened in 2004. A total of 67,620 cruise passengers visited Hoonah in 2004, 77,498 visited in 2005, and 135,519 cruise visitors were projected for 2006 (Cruise Line Agencies of Alaska 2006). Another destination of this type is planned by the Goldbelt Corporation for Hobart Bay, north of Petersburg.

While the number of cruise ship passengers visiting Juneau has more than doubled over the past decade, the total number of Southeast Alaska State ferry passengers has shown an overall pattern of decline, with about 36 percent fewer passengers served in 2005 than in 1990, 233,618 versus 363,122 (Table 3.15-13).

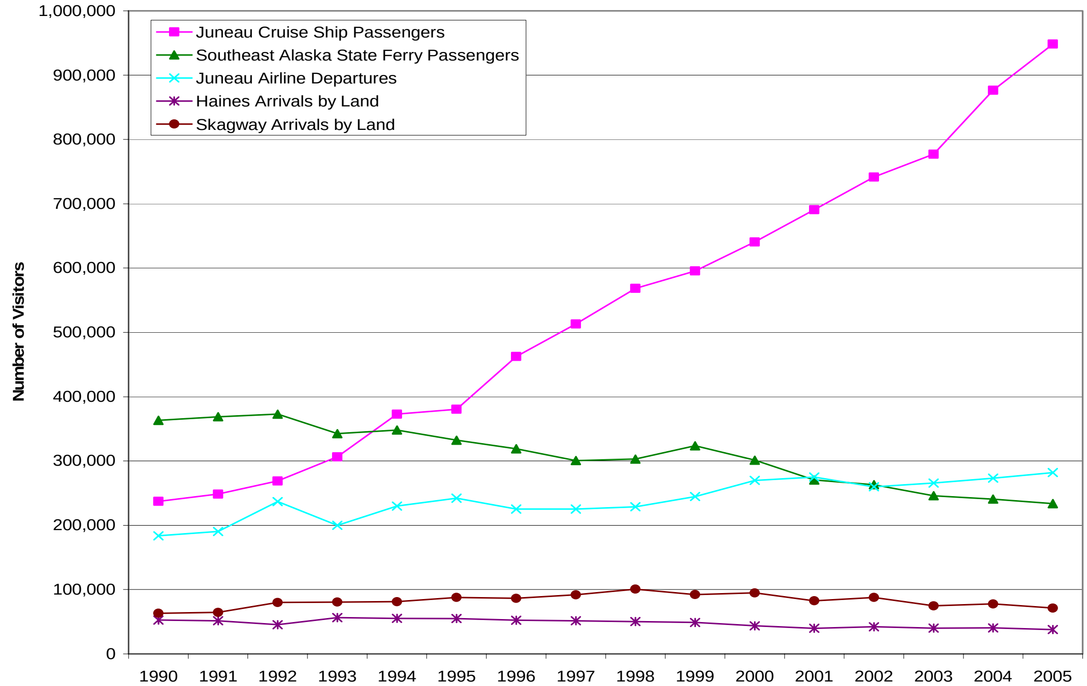
Table 3.15-13
Southeast Alaska Visitation, 1990 to 2005

Year	Juneau Cruise Ship Passengers[1,2]	Southeast Alaska State Ferry Passengers[2,3]	Juneau Airline Departures[2]	Haines Arrivals by Land[4]	Skagway Arrivals by Land
1990	237,070	363,122	183,677	52,719	63,237
1991	248,428	368,780	190,244	51,605	64,610
1992	269,000	372,680	236,824	45,355	79,946
1993[5]	306,600	342,613	200,066	56,406	80,709
1994	372,923	347,998	229,820	55,356	81,172
1995	380,529	332,312	242,084	55,148	87,977
1996	462,542	318,864	225,397	52,326	86,536
1997	513,181	300,653	225,397	51,495	91,849
1998	568,348	303,076	228,842	50,234	100,784
1999	595,595	323,540	244,645	48,997	92,291
2000[6]	640,477	301,176	269,880	43,621	94,925
2001	690,648	270,443	275,074	39,865	82,629
2002	741,512	263,040	259,759	42,290	87,851
2003	776,991	245,818	265,815	40,238	74,750
2004	876,203	240,666	273,152	40,438	77,837
2005	948,226	233,618	281,870	37,756	71,387

[1] These figures for passengers at Juneau are representative of cruise ship visitation trends because the majority of cruise ships visiting Southeast Alaska stop at Juneau.
[2] These data are presented for 1980 through 1994 in the 1997 Forest Plan Revision Final EIS (USDA Forest Service 1997a, Table 3-38).
[3] These totals do not include Inter-Island Ferry Association passengers.
[4] Arrivals by land are per passenger.
[5] The ferry Taku was out of service during May and June, which reduced total passengers.
[6] The ferry Columbia was out of service for most of the summer season, which reduced total passengers.
[7] The town of Hyder also receives a considerable number of arrivals by land. Based on estimates provided by the Hyder Community Association, approximately 28,000 visitors were recorded at the Fish Creek viewing platform in 1999. This number grew to 31,000 in 2001. A total of 35,676 visits were estimated at the viewing platform in 2005 (USDA Forest Service 2006f).
Sources: Alaska Department of Transportation 2006, Alaska Travel Industry 2006, Haines Convention and Visitors Bureau 2006, Skagway Convention and Visitors Bureau 2006, USDA Forest Service 1997a (Table 3-38) (Original Sources: Alaska Marine Highway Traffic Reports, Juneau Convention and Visitors Bureau, and Juneau Airport Manager's Office); USDA Forest Service 2001c.

Juneau airline departures increased between 1990 and 2005, but at a much slower rate than cruise ship passengers. Skagway and Haines arrivals by land stayed relatively constant over this period, showing an overall downward trend since the late 1990s (see Table 3.15-13 and Figure 3.15-1). Hyder also receives arrivals by land but data are not available for the early part of the decade. Essentially, all cruise ship use is by nonresident tourists. Ferry and airline passenger volumes and arrivals by land, on the other hand, also include Alaska residents and nonresidents visiting for reasons other than recreation and tourism, such as business or visiting relatives or friends. Larger communities also provide medical and other services that are not available in smaller communities.

Figure 3.15-1
Southeast Alaska Visitation, 1990 to 2005



Notes:
1. Longitudinal data are not available for arrivals in Hyder (see the note to Table 3.15-13).
2. State ferry data do not include Inter-Island Ferry Authority (IFA) passengers.
Source: See Table 3.15-13.

Data on the division between visitor and resident arrivals are not available for Southeast Alaska, but are available for the state as a whole. In summer 2004, residents accounted for an estimated 26 percent of total arrivals, down from 28 percent in 2001 (Northern Economics 2004, 2002). The percent of total arrivals accounted for by residents varied by type of transport, ranging from 0 percent for cruise ship arrivals to 44 percent of arrivals by highway and personal vehicle. Residents accounted for 41 percent and 38 percent of domestic air and international air arrivals, respectively, and 29 percent of arrivals by ferry (Table 3.15-14). These data are for the state as a whole, but are likely broadly representative of Southeast Alaska and illustrate the importance of the state ferry and domestic airlines to local residents.

Table 3.15-14
Alaska Arrivals by Transport Type and Visitor/Resident, Summer 2004

	Total Arrivals	Percent Visitor	Percent Resident
Domestic Air	1,030,200	59	41
International Air	44,800	62	38
Highway			
Personal vehicle	123,900	56	44
Motorcoach	13,400	85	15
Ferry	22,800	71	29
Cruise Ship	712,400	100	0
Total	**1,947,500**	**74**	**26**

Source: Northern Economics 2004.

The ferry data provided in Tables 3.15-13 and 3.15-14 and Figure 3.15-1 are for the AMHS only. These data do not include passengers transported by the Inter-Island Ferry Authority (IFA), which is a public corporation providing transportation to island communities in southern Southeast Alaska. Roundtrip service is currently (as of summer 2006) provided between Hollis and Ketchikan and seasonally from Coffman Cove to Wrangell and Petersburg.

Service has been provided between Hollis and Ketchikan since 2002. This service transported 25,197 passengers in 2002, its first year of operation. A total of 28,658 passengers were served by this ferry in 2005. The service between Coffman Cove and Wrangell and Petersburg was established in 2005 and served 2,955 passengers between May and August of that year (IFA 2006a). IFA ferries connect with vessels of the AMHS at Ketchikan, Wrangell, and Petersburg (IFA 2006b). The continued availability of these ferry services could affect resident recreation patterns in the future, as well as the recreation patterns of independent visitors to the region.

Visitation trends for two popular excursions, Juneau Icefield and Mendenhall Glacier, are presented in Table 3.15-15. The number of visitors to these areas has increased considerably since 1990. There were almost three times as many Juneau Icefield helicopter landing tour passengers in 2005 than in 1990, 93,902 versus 34,765. The number of visitors to the Mendenhall Glacier nearly doubled over this period, increasing from 188,000 in 1990 to 367,333 in 2005 (Table 3.15-15).

Table 3.15-15
Juneau Icefield and Mendenhall Glacier Visitation, 1990 to 2005

Year	Juneau Icefield Tour Passengers[1]	Mendenhall Glacier Visitors[1]
1990	34,765	188,000
1991	41,887	145,482
1992	45,638	160,000
1993	53,600	210,000
1994	62,449	265,000
1995	55,818	212,411
1996	65,709	276,000
1997	75,491	237,233
1998	84,632	238,366
1999	85,174	273,488
2000	85,531	NA
2001	89,961	236,340
2002	85,680	250,363
2003	85,407	284,867
2004	94,928	319,630
2005	93,902	367,333

[1] These data are presented for 1980 through 1989 in the 1997 Forest Plan Revision Final EIS (USDA Forest Service 1997a; Table 3-38).

Sources: 1990 to 1994: USDA Forest Service 1997a (Table 3-38) (Original Source: Juneau Ranger District Records); 1994 to 2000: USDA Forest Service 2001c; 2001 to 2005: USDA Forest Service 2006g; 2006h.

Outfitter/guides on the Tongass range from small family, run operations to larger corporations. Most firms serve less than 100 clients per year, with a smaller number of firms serving much larger numbers and one firm serving more than 100,000 clients in 1999.

Commercial Outfitter/Guide Use

The Forest Service authorizes commercial activities to make it easier for the public to visit National Forests. Due to its remote and rugged nature, recreation use on much of the Tongass National Forest requires good outdoor skills and/or specialized equipment. Commercial outfitters and guides provide access and equipment to assist people who might not otherwise be able to pursue certain recreation activities on the Forest. Outfitter/guides on the Tongass range from small family-run operations to larger corporations and non-profit organizations.

A survey of commercial recreation businesses in Southeast Alaska conducted in 2000 indicated that the majority of surveyed businesses were small, with 86 percent earning gross revenues of less than $100,000. Six firms reported revenues over $1 million, including one firm with revenues exceeding $10 million. A similar distribution is evident in terms of clients served, with the majority of firms serving less than 100 clients, a smaller number of firms serving considerably larger numbers, and one firm serving more than 100,000 clients in 1999 (Alaska Division of Community and Business Development [DCBD], 2001).

Both residents and nonresidents use the services of outfitter/guides, but nonresidents tend to use outfitter/guides more often because they do not have the local knowledge or necessary equipment. Local residents tend to use their own boats and equipment to reach the Forest. Personal boats are often smaller than charter boats used by nonresidents, resulting in visiting groups of residents generally being smaller than nonresident groups.

Outfitter/guides require special use permits to operate on the Tongass and are required to report annual use as part of their permit. In 2005, there were almost 270 special use authorizations issued for outfitter/guide services on the Tongass National Forest.

The survey of commercial recreation businesses in Southeast Alaska conducted in 2000 found that 73 percent of the businesses surveyed had experienced an increase in the number of clients they serve since 1995 (Alaska DCBD 2001). Nineteen percent reported no change over this period, with the remaining 8 percent reporting a decrease in number of clients served. Sixty-eight percent of responding firms indicated that they had been in business less than 10 years. Cruise ship passengers accounted for 41 percent of total clients for all of the surveyed businesses, ranging from 22 percent of clients for businesses with fewer than 200 clients a year to 91 percent of clients for businesses with more than 10,000 clients a year.

Recreation activities in Southeast Alaska and on the Tongass National Forest cover a broad spectrum of uses, ranging from fishing and hunting to helicopter flights and photography. The principle activities engaged in by the businesses surveyed in 2000 are identified in Table 3.15-16. Saltwater fishing was the most popular activity, followed by nature viewing/sightseeing, then wildlife viewing. The survey found that motorized watercraft was the most popular transportation mode used by commercial recreation businesses in Southeast Alaska.

Most outfitter/guides using the Forest shorelines access them via boat from saltwater. Some clients are dropped off on beaches, while others are also guided on land. The majority of charter boats in Southeast Alaska operate exclusively on saltwater for fishing or sightseeing without ever using the Forest (USDA Forest Service 2004g). These businesses are included in the data presented in Table 3.15-16.

While people often participate in several different activities in one or more settings on any given trip, different activities result in different numbers of people in a group and different amounts of time spent on the Forest. At one end of the spectrum, guided bear hunting consists of many small groups of one or two people. Hunters

Table 3.15-16
Principle Activities Engaged in by Southeast Alaska Commercial Recreation Businesses in 1999

Activity	Percent	Activity	Percent
Saltwater Fishing	63	Hiking, Mountain Climbing	14
Nature Viewing/Sightseeing	49	Cultural/Historical Sites	10
Wildlife Viewing	44	Camping	6
Photography	35	Backpacking	3
Motorized Boating	25	Northern Lights Viewing	3
Freshwater Fishing	21	Downhill Skiing, Snowboarding	1
Bird Viewing	21	Cross-Country Skiing, Snowshoeing	1
Non-Motorized Boating	15	Bicycling, Mountain Biking	1
Hunting	14		

Source: Alaska DCBD 2001

are dispersed across a large area and are on the Forest for long periods of time, typically 5 to 10 days, during spring and fall. At the other end of the use spectrum are mid-sized nature-viewing tour boats with relatively large group sizes (from 12 to 70 people). These groups are typically concentrated in a few areas of the Forest. Their use is short-term and concentrated in the summer season.

The Shoreline Outfitter/Guide FEIS, prepared for four northern Ranger Districts on the Tongass (USDA Forest Service 2004g), notes that recreation group size is highly variable along shorelines in that study's project area. Groups generally consist of less than 12 people, although larger groups, often associated with commercially guided groups from tour boats, may also be present. The largest shoreline group reported in the north part of the Forest in 1999 was a tour boat with 70 people.

This type of use accounts for a large number of visitors, but tends to be concentrated in relatively few areas of the Forest. Businesses providing services to these types of larger groups are heavily influenced by physical conditions that allow for large boat access and their schedules.

Helicopter landing tours are another form of outfitter/guide use that has been increasing in popularity in recent years. The number of clients and groups participating in helicopter tours are identified by area in Table 3.15-17.

Of 948,226 cruise ship passengers visiting Juneau in 2000, 93,902, or 10 percent, participated in helicopter landing tours on the Juneau Icefield (Tables 3.15-13 and 3.15-15). These tours to the Juneau Icefield involve high volumes of people concentrated at specific locations for short periods of time, typically 2 to 4 hours. Helicopter traffic, in groups of one to three helicopters, is almost continuous to and from icefield locations during the summer. Clients are typically outfitted and guided to walk, photograph, hike, or trek on, and explore the glacial environment.

Dogsled mushing tours on the Juneau Icefield are also increasing in popularity, with approximately 21,600 helicopter tour passengers engaging in this activity in 2005 (USDA Forest Service 2006i). This is more than twice the number of passengers (approximately 9,550) who participated in this type of tour in 2001. The number of helicopter passengers visiting the Juneau Icefield increased by 4 percent over this period, from approximately 90,000 to 93,900 (see Table 3.15-15). The large increase in the number of people taking dogsled mushing tours reflects the number of permitted helicopter tour operators offering this type of tour, with operators likely offering this type of tour in response to expressed and perceived demand. There were four permitted helicopter tour operators from 2001 through 2005. In 2001 and 2002, only one helicopter tour operator under permit offered dog mushing tours. In 2003 and 2004, there were two helicopter tour operators under permit who offered

Table 3.15-17
Helicopter Tour Locations by Client and Group, 2005

Area	Number of Groups[1]	Number of Clients
Juneau Icefield 1 – Gilkey Backcountry	600	2,702
Juneau Icefield 3 – Herbert	1,992	8,965
Juneau Icefield 4 – Mendenhall	11,736	52,813
Juneau Icefield 5 – Lemon	16	70
Juneau Icefield 6 – Death Valley	6	27
Juneau Icefield 7 – Norris	535	2406
Juneau Icefield 8 – Taku	1,982	8,920
P24 Baird Patterson Glaciers	94	424
Skagway Icefield – Denver	2,360	10,621
Skagway Icefield – East Fork	58	262
Skagway Icefield – LeGrande	10	47
Skagway Icefield – Meade	811	3,648
Skagway Icefield – Shubee	32	142

[1] These numbers are an estimate of the number of helicopters based on an average helicopter group size of four to five passengers per trip.
Source: USDA Forest Service 2006h

dogsled mushing tours. In 2005, three of the operators under permit offered dogsled mushing tours (USDA Forest Service 2006g).

Helicopter landing tours also occur in a number of locations elsewhere on the Forest, including the Revilla and Spires (Patterson Glacier) roadless areas. The numbers of visitors are, however, much lower than those visiting the Juneau Icefield. In 2000, a total of 1,205 helicopter landing tour service days were reported for the Revilla Roadless Area, east of Ketchikan. A total of 727 helicopter landing service tour days were reported for the Spires Roadless Area, northeast of Petersburg. After 2000, this service was no longer available (USDA Forest Service 2006h). The number of helicopter passengers visiting Patterson Glacier, northeast of Petersburg, decreased by 42 percent, from 727 passengers in 2000 to 424 passengers in 2005 (USDA Forest Service 2006h).

Summary data for outfitter/guide use for 2004 and 2005 are presented in Table 3.15-18. This table identifies the number of reported outfitter/guide clients and groups by Ranger District. A total of 618,000 clients and 12,250 groups were reported in 2005, which represented a 22 percent increase in clients from 2004 and a 5 percent increase in the number of groups. The Juneau Ranger District accounted for 88 percent of the total clients in 2005, with 68 percent of these clients (366,191) visiting the Mendenhall Glacier Visitor's Center.

This diversity in the range of activities and types of recreation experience offered by outfitter/guide businesses can lead to conflicts between businesses when incompatible activities occur in close proximity. Comments received during the Shoreline Outfitter/Guide EIS process highlighted conflicts between helicopter and wheeled airplane access on one hand and some boat or foot travel access on the other. Several comments noted that the activities of smaller operations often tend to

Table 3.15-18
Outfitter/Guide Use by Ranger District, 2004 and 2005

	2004		2005		2004-2005 Change	
Ranger District	**Clients**	**Groups**	**Clients**	**Groups**	**Clients**	**Groups**
Admiralty National Monument	3,553	760	3,318	702	-235	-58
Craig	1,662	246	2,063	403	401	157
Hoonah	4,890	664	4,668	647	-222	-17
Juneau[1]	439,413	NA	541,941	NA	102,528	NA
Ketchikan - Misty	22,630	2,710	22,036	2,618	-594	-92
Petersburg	7,059	1,113	11,420	1,444	4,361	331
Sitka	11,212	1,610	12,281	1,776	1,069	166
Thorne Bay	1,392	484	802	318	-590	-166
Wrangell	9,333	1,201	14,472	1,531	5,139	330
Yakutat	4,246	1,889	4,572	2,005	326	116
Total	**505,390**	**NA**	**617,573**	**NA**	**112,183**	**NA**

Note:
NA = Not available
[1] Data on the number of groups on the Juneau Ranger District do not include an accurate accounting of the number of groups visiting Mendenhall Glacier and are, therefore, not reported here.
Source: USDA Forest Service 2006i

be similar and compatible resulting in minimal conflicts, while larger operations often tend to detract from the setting and expectations of smaller groups. Some smaller operators believe that they are being displaced from their traditional use areas by larger commercial operations. On the other hand, some tour boat operators providing services to large groups felt they have been progressively excluded from areas on the Tongass National Forest over the past two decades (USDA Forest Service 2004g).

The number of big game guides has increased substantially over the past decade, which has raised concerns that current levels of guided hunting may not be sustainable due to increasing user conflicts and game population concerns. Some comments received on the Draft 2002 Forest Plan SEIS noted that growth in the guiding industry has led to these activities expanding into portions of Southeast Alaska that were not historically subject to this type of pressure. These types of concerns about user conflict are evaluated by the Forest Service when addressing the outfitter/guide experience provided on NFS lands. The Forest Service works with the State of Alaska and the Federal Subsistence Board to address game population concerns. The State of Alaska manages recreational hunting throughout the state, while the Federal Subsistence Board manages all federal lands in the state with respect to wildlife species taken for subsistence.

While many Southeast Alaska residents support the growing tourism industry, some residents are questioning the benefits and believe that unregulated growth of this industry would be detrimental and result in high social costs to communities. Concerns have been expressed that the existing and increasing level of commercial use is causing crowding or displacement of local residents and independent travelers who recreate on the Forest (USDA Forest Service 2004g). However, while some members of the public support limits on commercial use, others are concerned about the economic impacts of restrictions and limitations on commercial use.

Environmental Consequences

Direct and Indirect Effects

This section describes the potential direct, indirect, and cumulative effects of the proposed alternatives on recreation and tourism. The section is divided into three parts. The first two parts address effects on the supply of recreation opportunities and effects on recreation use and demand, respectively. The supply section discusses the effects of the alternatives on the existing supply of recreation opportunities in terms of the Forest Service's ROS settings and inventoried recreation places on the Tongass. The use and demand section discusses the potential effects on resident recreation and tourism. The final section summarizes the potential effects by alternative.

Effects on Supply

The following section discusses the potential effects of the proposed alternatives on ROS settings and recreation places.

Recreation Opportunity Spectrum

As discussed in the preceding affected environment section, the ROS system is designed to help identify and quantify different types of recreation setting on the Tongass National Forest and portrays the appropriate combination of activities, settings, and experience expectations along a continuum that ranges from highly modified to primitive environments (Table 3.15-2). The Forest-wide mix of ROS settings would vary by alternative. Estimated acres by ROS setting and alternative are presented in Table 3.15-19. The changes shown in this table are long-term changes that are expected to occur 150 years in the future and would take place gradually over several decades. ROS settings are projected to change in those areas allocated to intensive and moderate development LUDs. As a result, changes in settings are related to projected levels of future development. The ROS projections provide a general overview of how the recreation settings of the Forest would change over time with each alternative.

Viewed in terms of total Forest-wide acres, Alternatives 1 and 2 would provide the greatest amount of primitive and semi-primitive opportunities, with little change occurring from the existing condition. Alternative 7 would result in the greatest shift from the existing condition to roaded opportunities, followed by Alternatives 4, 5, 6, and 3, in that order. These shifts would occur as a result of timber harvest activities.

The percentage of acres classified as RM would increase over the 150-year period under all of the alternatives, including Alternatives 1 and 2. The largest gains would occur under Alternatives 4 and 7, with the percent of Forest-wide acres classified as RM increasing from approximately 10 percent to approximately 23 percent and 24 percent, respectively (Table 3.15-19). Under the most intensive timber harvest alternative (Alternative 7), approximately 66 percent of the Forest would remain at the undeveloped end of the recreation opportunity spectrum (Primitive and SPNM) after 150 years, a decrease of 14 percent from the current distribution.

It may be noted that these projections assume for the purposes of analysis that the supply of SPM settings would not increase over time. This is not necessarily the case. The ROS system helps identify, quantify, and describe recreation settings and essentially represents an inventory of existing recreation areas. Shoreline areas or other areas accessible by floatplane or helicopter that are presently allocated to Primitive or SPNM settings could be reallocated to the SPM setting in the future if patterns of use or other factors change. This type of change would result in an increase in the supply of SPM settings.

Table 3.15-19
Forest-wide ROS Acres after 150 Years of Implementation, by Alternative

	Primitive	SPNM	SPM	RN	RM	R+U	Total
Current	10,358,097	3,046,557	1,486,674	160,594	1,713,018	5,715	**16,770,654**
	62%	18%	9%	1%	10%	0%	**100%**
1	10,246,686	2,957,732	1,424,696	393,438	1,744,877	5,749	**16,773,179**
	61%	18%	8%	2%	10%	0%	**100%**
2	10,202,344	2,644,438	1,345,098	408,886	2,166,667	5,749	**16,773,181**
	61%	16%	8%	2%	13%	0%	**100%**
3	9,880,140	2,471,124	1,293,060	431,942	2,691,163	5,749	**16,773,179**
	59%	15%	8%	3%	16%	0%	**100%**
4	9,179,816	2,150,522	1,167,523	494,990	3,774,577	5,749	**16,773,177**
	55%	13%	7%	3%	23%	0%	**100%**
5	9,501,363	2,374,608	1,267,907	449,592	3,173,962	5,749	**16,773,181**
	57%	14%	8%	3%	19%	0%	**100%**
6	9,553,690	2,401,633	1,266,316	448,995	3,096,797	5,749	**16,773,180**
	57%	14%	8%	3%	18%	0%	**100%**
7	9,133,989	2,074,083	1,138,811	509,657	3,910,889	5,749	**16,773,178**
	54%	12%	7%	3%	23%	0%	**100%**

Notes:
SPNM=Semi-Primitive Non-Motorized, SPM=Semi-Primitive Motorized, RN=Roaded Natural, RM=Roaded Modified, R+U=Rural and Urban
1. The total acres shown in this table are slightly lower than the Forest-wide total because the ROS inventory does not include the entire Forest.
2. ROS settings are projected to change in those areas allocated to the Semi-Remote Recreation, Scenic Viewshed, Modified Landscape, and Timber Production LUDs. These projected changes are based on the following assumptions:
- Semi-Remote Recreation: 5 percent of Primitive, SPNM, and SPM would be converted to RN over the 150-year evaluation period.
- Scenic Viewshed: 25 percent of Primitive, SPNM, and SPM would be converted to RM; 25 percent of Primitive would change to SPNM; and 50 percent of Primitive and 75 percent of SPNM and SPM would stay the same over the 150-year evaluation period.
- Modified Landscape: 50 percent of Primitive, SPNM, and SPM would be converted to RM; 50 percent of Primitive would change to SPNM; and 50 percent SPNM and SPM would remain the same
- Timber Production: 80 percent of Primitive, SPNM, and SPM would be converted to RM; 10 percent of Primitive, SPNM, and SPM would change to RN; 10 percent of Primitive would become SPNM; and 10 percent of SPNM and SPM would remain the same.

Recreation Places

This analysis assesses the potential effects of the proposed alternatives on recreation places based on projected changes in the LUDs within which these places are located. In general, recreation places located in intensive and moderate development LUD groups would trend toward RM and RN setting opportunities in the future if they are not currently in these settings. Recreation places in the Natural Setting and Wilderness groups would likely retain their existing settings. It is important to remember that these effects are the result of long-term changes that are expected to occur gradually during the next 150 years.

Home Range Recreation Places

Home range recreation places are those inventoried recreation places within an approximate 20-mile radius from one or more communities. The long-term effects of the proposed alternatives on home range recreation places are summarized in Table 3.15-20. These effects are presented in terms of the distribution of recreation place acres by LUD group. Home range recreation places in development LUDs (moderate or intensive) would range from 10 percent of total home range acres under Alternative 1 to 44 percent and 40 percent under Alternatives 7 and 4, respectively. The percent of home range recreation place acres allocated to Wilderness LUDs would be 22 percent under all of the alternatives (Table 3.15-20).

Table 3.15-20
Home Range Recreation Places by LUD and Alternative (percent of acres)

Alternative	Wilderness	Natural Setting	Moderate Development	Intensive Development
1	22	67	5	6
2	22	58	9	10
3	22	53	12	13
4	22	37	19	21
5	22	48	14	15
6	22	49	13	15
7	22	33	21	23

Important Recreation Places

Recreation places are identified as either important or ordinary/common based on five categories: facilities, marine, hunting, fishing, and tourism. Individual recreation places may be important for one, several, or none of these categories. The following sections discuss the long-term effects of the proposed alternatives on important recreation places by category.

Facilities. The long-term effects of the proposed alternatives on important recreation places with facilities are summarized in Table 3.15-21. These effects are presented in terms of the distribution of recreation place acres by LUD group, which indicates the relative degree of potential impact that each alternative would have on existing recreation places with important facilities. The potential effects of timber harvest would likely vary by the type of facility. The importance of a remote public recreation cabin may, for example, be greatly enhanced by the solitude and natural scenery the area provides. This type of setting may be of only secondary importance for a similar cabin where the attraction might be the outstanding steelhead fishing in the spring.

Approximately 29 percent of inventoried recreation places acres are currently important for recreation facilities. The overall percentage of these acres that would be allocated to development LUDs (moderate or intensive) ranges from 5 percent (Alternative 1) to 21 percent (Alternative 7). The percent of recreation place acres important for facilities allocated to Wilderness LUDs would be 41 percent under all of the alternatives (Table 3.15-21).

Table 3.15-21
Recreation Places Important for Facilities by LUD and Alternative (percent of acres)

Alternative	Wilderness	Natural Setting	Moderate Development	Intensive Development
1	41	55	3	2
2	41	49	6	4
3	41	47	8	4
4	41	40	13	6
5	41	46	9	5
6	41	46	9	4
7	41	38	15	6

Marine. The long-term effects of the proposed alternatives on recreation places that are important for marine recreation are summarized in Table 3.15-22. These effects are presented in terms of the distribution of recreation place acres by LUD group. The perception of naturalness and scenery are very important values among Forest visitors engaged in the unique marine recreation opportunities offered by the

Tongass. Approximately 30 percent of inventoried recreation places acres are currently important for marine recreation activities. Many of these recreation places are within the beach fringe and are allocated to the SPM ROS.

The overall percentage of recreation place acres that are important for marine recreation and would be allocated to development LUDs (moderate or intensive) ranges from 4 percent under Alternative 1 to 33 percent under Alternative 7. The percent of recreation place acres important for marine recreation allocated to Wilderness LUDs would be 36 percent under all of the alternatives (Table 3.15-22).

Table 3.15-22
Recreation Places Important for Marine Recreation by LUD and Alternative (percent of acres)

Alternative	Wilderness	Natural Setting	Moderate Development	Intensive Development
1	36	60	3	1
2	36	54	6	5
3	36	48	7	9
4	36	33	15	15
5	36	43	9	12
6	36	43	9	12
7	36	31	17	16

Hunting. The long-term effects of the proposed alternatives on recreation places that are important for hunting are summarized in Table 3.15-23. These effects are presented in terms of the distribution of recreation place acres by LUD group. Hunters who favor hunting in an undisturbed, natural setting would likely prefer those alternatives that have the most acres in the Natural Setting and Wilderness LUD groups. Hunters who prefer using roads and road access would generally benefit from those alternatives with more acres in the intensive and moderate development LUD groups. Approximately 40 percent of inventoried recreation places acres are currently important for hunting.

The overall percentage of recreation place acres that are important for hunting and are allocated to development LUDs (moderate or intensive) would range from 5 percent under Alternative 1 to 41 percent under Alternative 7. The percent of recreation place acres important for hunting allocated to Wilderness LUDs would be 26 percent under all of the alternatives.

Fishing. The long-term effects of the proposed alternatives on recreation places that are important fishing places are summarized in Table 3.15-24. These effects are presented in terms of the distribution of recreation place acres by LUD group. There would be some variation in the Forest-wide standards and guidelines applied across the different alternatives, but all alternatives would maintain fish habitat. The

Table 3.15-23
Recreation Places Important for Hunting by LUD and Alternative (percent of acres)

Alternative	Wilderness	Natural Setting	Moderate Development	Intensive Development
1	26	69	2	3
2	26	64	4	7
3	26	57	6	11
4	26	35	12	27
5	26	45	10	20
6	26	49	9	16
7	26	33	13	27

quantity of fish available would likely remain constant across alternatives and immediate stream-side areas would remain natural along fish-bearing streams. It may, however, be noted that the Forest-wide beach and estuary fringe buffers would be reduced under Alternative 7.

Access to streams and areas immediately adjacent to streams may be subject to modifications at various levels. This may affect the quality of the fishing experience for some. Approximately 13 percent of inventoried recreation places acres are currently important for fishing.

Alternatives with more acres in the intensive and moderate development LUD groups would generally provide increased road access to fishing areas. However, the setting adjacent to the stream side corridors would appear more modified over time. The Natural Setting and Wilderness LUD groups maintain the settings in a more natural condition, with access generally more challenging. Access may affect the quality of the fishing experience regardless of the degree of setting changes leading up to the stream.

The percentage of recreation place acres that are important for fishing and would be allocated to development LUDs (moderate or intensive) ranges from 3 percent under Alternative 1 to 41 percent under Alternative 7. The percent of recreation place acres important for fishing allocated to Wilderness LUDs would be 31 percent under all of the alternatives (Table 3.15-24).

Table 3.15-24
Recreation Places Important for Fishing by LUD and Alternative (percent of acres)

Alternative	Wilderness	Natural Setting	Moderate Development	Intensive Development
1	31	66	2	1
2	31	58	5	6
3	31	48	7	14
4	31	30	13	25
5	31	43	8	18
6	31	44	8	17
7	31	28	15	26

Effects on Use and Demand

The following section is divided into two parts that discuss the potential effects of the alternatives in terms of resident recreation use and tourism, respectively.

Resident Recreation

Forest-wide LUD allocations are presented by alternative in Table 3.15-25. This table also highlights the net change in development LUDs from Alternative 5 (No Action). Net changes in development LUDs would range from a 16 percent decrease under Alternative 1 to a 9 percent increase under Alternative 7. Projected changes in ROS settings are shown for 150 years into the future in Table 3.15-19. The effects of the LUD allocations on important recreation places are discussed in the preceding section.

Table 3.15-25
Forest-Wide LUD Allocations and Net Change in Development LUDs by Alternative (percent)

	Alternative						
Land Use Designation	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Wilderness and Natural Monument	35	35	35	35	35	35	35
Mostly Natural Setting	60	53	48	37	43	44	35
Moderate Development	2	3	5	9	7	6	10
Intensive Development	3	8	12	19	15	14	20
Total	**100**	**100**	**100**	**100**	**100**	**100**	**100**
Net Change in Development LUD from Alternative 5 (No Action) (percent)[1]	-16	-10	-5	7	0	-1	9

[1] This is the net change in Development LUDs as a share of total LUDs.

As noted in the Affected Environment part of this section, resident recreation demand, like other forms of recreation demand, is influenced by a number of factors, including regional population levels, per capita participation rates, and recreation travel behavior. The alternatives evaluated here are unlikely to affect broader trends in recreation behavior, but it is possible that they could result in different supply-induced changes in participation. These potential changes, along with the potential effects of the alternatives on recreation places, would likely affect resident recreationists.

Supply-induced changes in participation on the Tongass have, to date, been mainly related to changes in road systems and road access. This type of change in participation appears to have occurred on Prince of Wales, Wrangell, and Mitkof Islands, for example. In these locations, road systems developed for timber harvesting created an opportunity for road-related access to previously inaccessible recreation settings and, therefore, an opportunity for recreation activities involving wheeled vehicles. In addition, new roads that provide easier access to a wider area may create new semi-primitive opportunities that increases the capacity of a recreation place or creates a new recreation place.

While there would be some new road access under all alternatives in the long run, nearly all new roads constructed under the alternatives would be closed following harvest. These roads would, therefore, not be available for use by highway vehicles or high-clearance vehicles. They would, however, be available for access by other methods and would, as a result, have the potential to affect existing recreation patterns.

Viewed at a programmatic level, changes in participation related to road systems and access are more likely to occur under alternatives that involve higher levels of projected road construction. Based on the miles of new road construction projected under each alternative, Alternative 1 would have the lowest impact on existing recreation access patterns with less than half the road miles projected under Alternative 5 (No Action) (755 miles versus 3,881 miles). Also, new road construction under Alternative 1 would be almost entirely limited to areas outside existing Inventoried Roadless Areas (IRAs), and would, therefore, tend to increase road density in already roaded areas rather than provide new access to presently undeveloped areas.

Alternatives 2 and 3 would also have relatively low impacts on existing recreation access patterns with 1,798 and 1,072 fewer projected new road miles, respectively, than under Alternative 5. These alternatives would also limit the construction of new roads in IRAs and, therefore, limit potential changes in access, but to a lesser extent than under Alternative 1. Alternative 6 (Proposed Action) would have an effect similar to Alternative 5, while Alternatives 4 and 7 would involve 854 and 1,893 more new road miles, respectively, than Alternative 5, and have the potential to provide new access to presently undeveloped areas.

As the preceding discussion suggests, the general trend across all alternatives is toward an increase in motorized opportunities and a corresponding decrease in primitive recreation opportunities. Viewed at this level, Alternative 1 would have the lowest impact on primitive areas and associated opportunities because timber management would be limited to areas outside the existing IRAs on the Tongass. Alternatives 2 and 3 would have the next lowest potential impacts in that order, with timber management under Alternative 2 limited to areas outside the existing IRAs except in locations where existing roads could logically be extended. Alternative 3 would keep the 23 areas proposed for wilderness in House Resolution (HR) 987 and the 18 special interest areas in the 1999 Record of Decision (ROD) in a natural condition. Alternatives 5 and 6 would be more likely to involve timber harvest in IRAs, and this likelihood would be increased further under Alternatives 4 and 7. Alternatives 4 and 7 have an increased emphasis on timber production with respective long-term annual Allowable Sales Quantities (ASQs) of 342 million board feet (MMBF) and 421 MMBF compared to 267 MMBF under Alternative 5 and 49 MMBF under Alternative 1.

Given the programmatic nature of this planning document, it is not possible to predict site-specific changes that would occur under any of the alternatives. Potential impacts to recreation places and recreation activities in other areas would be evaluated on a project-by-project basis and in accordance with the applicable Forest Plan standards and guidelines under all alternatives. The Forest-wide standards and guidelines and LUD prescriptions of the current Forest Plan would continue to be implemented as part of Alternative 5, where they apply. An updated and edited version of the current Forest Plan (Volume II), which includes edits to the existing Recreation and Tourism Standards and Guidelines, would apply under all of the action alternatives, with some exceptions for Alternatives 4 and 7.

These edits include changes to OHV management and wilderness group sizes and use. Under the updated Forest Plan, OHV planning would be in accordance with 36 CFR 212, 251, and 261—Travel Management; Designated Routes and Areas for Motor Vehicle Use. Under the existing Forest Plan, open roads on the Forest are designated open to OHVs unless site-specific closures are made. Although not specified in the current Forest Plan, the new travel management rule is presently being implemented on the Tongass. Travel management would, as a result, be the same under all alternatives.

Recreation activities in Wilderness would be managed to meet appropriate levels of social encounters. This would include limiting group sizes to no more than 12 persons for commercial and general public use of a wilderness, limiting the length of stay at one location to 14 days, and limiting commercial recreation use to two groups of 12 people from a single vessel (or other form of transportation), with the groups required to disperse out of sight and sound from each other. Exceptions may be approved by the District Ranger or Monument Ranger in response to unusual circumstances. The updated Forest Plan authorizes one exception—the Stikine River valley—where larger group size would be allowed for general public use. Outfitted groups would still be required to comply with the 12 person limit.

The Forest will change over time under all of the alternatives, including Alternative 5, and recreation demand and use patterns are also likely to change. Recreationists may respond to changes to specific areas and locations in three general ways. Many will likely adapt to new situations, and changes in settings will have little or no impact to these current Forest users. For others, change may not be acceptable, and these users will be displaced to other areas where the setting and use patterns are more in line with their expectations and needs. A third group of current recreationists may find that they cannot adapt to the new situation nor find suitable substitute areas, and as a result, substitute other leisure activities in place of recreating on the Forest.

Tourism

The tourism industry and number of visitors to Southeast Alaska has increased dramatically since the early 1990s, with much of this growth linked to increased cruise ship travel to the region. Cruise ships bring the most visitors to Southeast Alaska, accounting for approximately 63 percent of visitors in 2001 (McDowell et al. 2007). Future development of the tourism industry in Southeast Alaska and elsewhere in the United States is dependent on a wide range of factors, including the value of the dollar in foreign countries, the price of oil, world events and international unrest, and political and social change. In addition, regions like Southeast Alaska directly compete with other locations and activities for tourist dollars. As a result, changes in other tourist markets, both positive and negative, have the potential to affect the tourism industry in Southeast Alaska. These factors are, for the most part, unrelated to management of the Tongass National Forest.

Other potential factors affecting tourism development in the region include the reactions of local communities and residents to increased tourism development. Cruise ship visitation is concentrated in a few locations in the region with the large ships usually calling at five key ports: Juneau, Ketchikan, Skagway, Sitka, and Haines. This concentration results in an uneven distribution of tourism-related benefits throughout the region, as well as a concentration of tourism-related concerns in particular communities (Schroeder et al. 2005). There is some evidence that there may be limits to the amount of unconstrained tourism development that Southeast Alaska communities are willing to tolerate. Local initiatives aimed at managing tourism include an advisory measure to limit the number of cruise ship dockings in Haines, which was approved by voters in 2000, as well as initiatives in Juneau and Haines proposed in response to helicopter and floatplane traffic over residential areas. Another example of local reaction was provided by Sitka voters who rejected a measure in 2000 to expand the public dock in Sitka to accommodate cruise ships (Schroeder et al. 2005). In addition, Alaska voters recently approved the Alaska Cruise Ship Ballot Initiative that established a statewide tax of $50 per passenger on cruise ship passengers visiting Alaska.

While it is reasonable to assume that the vast majority of tourism activity in the region is related to the natural environment, many visitors experience the Tongass passively—from the deck of a cruise ship, for example—without directly using the Forest for recreation purposes. The alternatives would have very little effect on this type of visitor because the scenic quality of heavily traveled cruise ship corridors and tourism industry use areas would be largely protected under all of the alternatives. The Scenery Standards and Guidelines provide special emphasis for scenic quality in LUDs allowing timber harvest in visual priority travel routes and use areas. This is discussed further in the *Scenery* section of this chapter.

However, cruise ships have heavily marketed Forest-related activities in recent years, and many passengers take at least one trip to the Forest during their visit, with icefield helicopter tours and visits to the Mendenhall Glacier by cruise ship passengers increasing substantially (Table 3.15-15). As discussed in the affected environment portion of this section, the tourism industry and outfitter/guides in Southeast Alaska offer a wide spectrum of recreation activities, ranging from guided bear hunting through helicopter tours and guided wildlife-viewing boat tours. Viewed in terms of Forest management, the requirements of these activities are often at odds with one another. Some activities require developed facilities, utilities, and easy access, while others require vast and remote areas in a natural setting, with outfitter/guides providing only the basic essentials for their clients.

The following discussion addresses the potential effects of the alternatives on recreation places important for tourism and future recreation and tourism developments.

Recreation Places Important for Tourism

The effects of the proposed alternatives on recreation places that are important for tourism are summarized in Table 3.15-26. These effects are presented in terms of the distribution of recreation place acres by LUD group. Approximately 53 percent of inventoried recreation places acres are currently considered important for tourism. All of the proposed alternatives provide a mix of opportunities, with some alternatives emphasizing natural settings and others allowing more timber harvest and road building. These changes may be viewed as opportunities or detriments to various sectors of the tourism industry and their clients. Based on numerous surveys and marketing campaigns for visitors, it is widely accepted that natural beauty and scenery are some of the principal factors attracting visitors to the region. However, the State of Alaska and part of the tourism industry expressed a desire during the planning process for the current Forest Plan for increased access and opportunities for development, as they believed that some existing areas are at or near capacity (USDA Forest Service 1997a, p. 3-136).

There are indications that demand exceeds supply in some recreation places, especially those used more extensively by tourist operators and outfitter/guides. Activities that are presently near or at capacity include bear-viewing areas and helicopter use in the immediate vicinity of urban areas. Other areas may be able to accommodate current levels of tourism and potential increases in the future without negatively affecting the tourist experience or causing detrimental environmental effects. The number of visitors cruising the Inside Passage or viewing Mendenhall Glacier may, for example, be sustainable at current and future levels of use (Schroeder et al. 2005).

Table 3.15-26
Recreation Places Important for Tourism by LUD and Alternative (percent of acres)

Alternative	Wilderness	Natural Setting	Moderate Development	Intensive Development
1	46	51	2	1
2	46	47	4	3
3	46	43	5	6
4	46	34	10	10
5	46	40	7	7
6	46	40	6	7
7	46	33	11	10

The overall percentage of recreation place acres that are important for tourism and would be allocated to development LUDs (moderate or intensive) ranges from 2 percent under Alternative 1 to 21 percent under Alternative 7. The percent of recreation place acres important for tourism allocated to Wilderness LUDs would be 46 percent under all of the alternatives (Table 3.15-26).

Given the programmatic nature of this planning document, it is not possible to predict site-specific changes that would occur under any of the alternatives. Management practices for specific areas, such as limiting the number of visitors by permit, would continue to be evaluated on a project-by-project basis and in accordance with the applicable Forest Plan standards and guidelines under all alternatives. The Forest-wide standards and guidelines and LUD prescriptions of the current Forest Plan would continue to be implemented as part of Alternative 5, where they apply. An updated and edited version of the current Forest Plan, which includes edits to the existing Recreation and Tourism Standards and Guidelines, would apply under all of the action alternatives, with some exceptions under Alternatives 4 and 7. These edits are discussed further in the preceding section that address effects to resident recreation.

Assuming that the volume of tourists remains at its current level or continues to increase as it has done over the last decade, the overall recreation trend would likely be toward more group experiences on the Tongass and less opportunities for solitude and isolation in natural areas close to cruise ship stops (Schroeder et al. 2005).

Developments

Increased tourism has led to the development of new tourism facilities in Southeast Alaska, including the Icy Point Strait development near Hoonah. The rapid growth and large volume of cruise ship passengers and the growth in shore excursions suggest that there will be demand for new developed facilities on the Tongass in the future. This section identifies the share of the Forest that would be available for recreation and tourism developments under each alternative.

The recreation and tourism Forest-wide standards and guidelines in the current Forest Plan address commercial development of facilities and opportunities by LUD. Developments are classified as either major or minor. These standards and guidelines remain substantially unchanged in the Proposed Forest Plan accompanying this EIS. Abbreviated definitions of these terms are provided below.

> **Major Development.** Major recreation and tourism developments provided by the private sector involve a long-term commitment of the land base, with a moderate to high level of site modification. They involve large buildings or complexes of buildings and facilities, and often provide several services in a concentrated area. Comfort and convenience are provided for guests, and facilities can generally accommodate more than 12 people. Subsequent site reclamation involves extensive removal of facilities; improvements, revegetation, recontouring, etc.; and a period of at least 5 years to attain a natural appearance.
>
> Examples of this type of development include destination resorts and lodges, food and beverage services, downhill ski areas, marinas and gas stations, and full-service campgrounds.
>
> **Minor Development.** Minor recreation and tourism developments provided by the private sector involve only minor site modifications. They involve small rustic facilities and/or improvements, generally with a single purpose or service, and may involve several sites or an extensive area. Basic essentials are typically provided and can generally accommodate 12 or fewer people per site. Site reclamation involves simple removal of facilities and little or no revegetation; a natural appearance can be attained in a few years.
>
> Examples of this type of development include cabins, huts, small docks, cross-country ski trails with simple facilities, temporary or portable camps, and simple rustic campgrounds.

The major and minor recreation development standards and guidelines by LUD are summarized in Table 3.15-27. The percent of Tongass acres available for major or minor tourism development is presented by alternative in Table 3.15-28.

Both major and minor developments are prohibited in Wilderness, National Monument Wilderness, and Research Natural Areas, which together account for approximately 35 percent of the Forest under all alternatives. Major developments are also prohibited in Wild River LUDs, which account for about 1 percent of the Forest. Major developments are discouraged in the Municipal Watershed, Remote

Recreation, and Experimental Forest LUDs and LUD II areas (Table 3.15-27). These LUDs account for 17 to 19 percent of all of the alternatives (Table 3.15-28). Minor developments are discouraged in the Municipal Watershed and Experimental Forest LUDs, which, combined, account for less than 1 percent of the Forest (Table 3.15-28).

The share of the Forest that would be compatible with major or minor recreation developments ranges from 20 percent under Alternatives 4, 5, and 7 to 31 percent under Alternative 1. The Semi-Remote Recreation LUD accounts for most of the compatible lands and ranges from 15 percent of the Forest under Alternatives 4 and 7 to 32 percent under Alternative 1 (Table 3.15-28). Developments in other parts of the Forest would be evaluated on a case-by-case basis. The share of the Forest where major developments would be evaluated on a case-by-case basis ranges from 13 percent under Alternative 1 to 27 percent under Alternatives 4 through 7.

Table 3.15-27
Major and Minor Recreation Developments by LUD

	Major	Minor
Not Allowed	Wilderness Wilderness National Monument Research Natural Area Wild River	Wilderness Wilderness National Monument Research Natural Area
Discouraged	Nonwilderness National Monument Remote Recreation Municipal Watershed LUD II Experimental Forest	Municipal Watershed Experimental Forest
Case-by-Case	Special Interest Area Old-growth Habitat Scenic River Modified Landscape Timber production Minerals Transportation and Utility Systems	Nonwilderness National Monument Remote Recreation Special Interest Area Old-growth Habitat Wild River Modified Landscape Timber production Minerals Transportation and Utility System LUD II
Compatible	Semi-Remote Recreation Recreational River Scenic Viewshed	Semi-Remote Recreation Recreational River Scenic Viewshed Scenic River

Notes:
Not Allowed: Recreation special-use developments are not allowed by law or regulation or are not consistent with agency policy and regulations.
Discouraged: Recreation special-use developments are generally not consistent with the objectives of the LUD. Development proposals require scrutiny of magnitude and scope for LUD conformance.
Case-by-Case: Recreation special-use developments may be compatible with the LUD objectives depending upon the scope, purpose, and magnitude of the proposal. Proposals will be evaluated on a case-by-case basis.
Compatible: Recreation special-use developments are generally compatible with this LUD, and applicants are encouraged to examine these areas first where there is a public need and no private lands are available or suitable for development.
Source: USDA Forest Service 1997a (Table 3-51).

Table 3.15-28
Percent of Tongass Acres Available for Tourism Developments

	Alternative						
	1	2	3	4	5	6	7
Major Developments							
Not Allowed	36	36	36	36	36	36	36
Discouraged	19	19	18	17	17	17	17
Case-by-case	13	19	23	27	27	27	27
Compatible	32	27	23	19	20	21	20
Minor Developments							
Not Allowed	35	35	35	35	35	35	35
Discouraged	0	0	0	0	0	0	0
Case-by-case	32	37	41	44	44	43	44
Compatible	32	27	23	20	20	21	20

Note: See the notes to Table 3.15-27 for an explanation of Not Allowed, Discouraged, Case-by-Case, and Compatible.

Development of tourism opportunities is a cooperative effort. Investments in the development of tourism facilities, such as destination resorts, are typically the responsibility of the private sector. Federal, state, and local agencies may also play a role in facilitating the development of these types of opportunities. The LUDs and standards and guidelines that would apply under each alternative provide a framework within which these types of developments may take place. They also provide direction for the Forest Service to respond to and address the needs of the recreation and tourism industry.

Juneau Icefield Land Use Designation

The LUD classification for the area north of Juneau that encompasses the Juneau Icefield would be changed from Remote Recreation to Semi-Remote Recreation under all of the action alternatives. The areas would remain classified as Remote Recreation under Alternative 5, No-Action Alternative. This change has been proposed because the snow accumulation zone on the icefield has retreated to higher elevations as a result of climate change, which has resulted in a number of minor development sites (e.g., dog sled camps) becoming unsuitable for use as the thinning snow layers expose crevasses during the middle of the operating season. The proposed change in LUD boundaries would allow the Forest Service to consider moving minor developments into areas with snow, where these types of development would not be allowed under the existing LUD. This proposed change would not affect the Forest Service's ability to allow an expansion of helicopter landing sites in the area, because glacier landing tours are allowed under both the existing (Remote Recreation) and proposed (Semi-Remote Recreation) LUDs for this area.

Effects by Alternative

The following section discusses the potential impacts by alternative.

Alternative 1. This alternative would keep all remaining IRAs in a natural condition. This alternative would preserve the largest amount of Primitive and Semi-Primitive recreation opportunities both Forest-wide and within community home ranges. Alternative 1 would also maintain existing recreation places located within IRAs in their current natural condition. Potential changes in access resulting from new road construction would be almost entirely limited to areas outside the existing IRAs. This alternative would most closely maintain current outdoor recreation setting conditions Forest-wide and support the maintenance of existing use patterns and opportunities.

There would be a relatively small shift toward the Roaded end of the ROS under this alternative, with approximately 78 percent of the Forest expected to be either Primitive or SPNM after more than 100 years, compared to approximately 80 percent at present. There would be an increase in the share of important recreation places in Natural Setting LUDs relative to Alternative 5.

Alternative 2. This alternative would keep most IRAs in a natural condition and emphasize a wide range of recreation and tourism opportunities in a natural setting. This alternative would preserve the second largest amount of Primitive and Semi-Primitive recreation opportunities after Alternative 1 both Forest-wide and within community home ranges. Potential changes in access resulting from new road construction would take place on lands outside of IRAs except for some areas where roads could be logically extended. This alternative would largely maintain current outdoor recreation setting conditions Forest-wide and support the maintenance of existing use patterns and opportunities.

The shift toward the Roaded end of the ROS would be larger under this alternative than under Alternative 1, but still relatively small, with approximately 77 percent of the Forest expected to be either Primitive or SPNM after 150 years, compared to approximately 80 percent at present. There would be an increase in the share of important recreation places in Natural Setting LUDs relative to Alternative 5.

Alternative 3. This alternative provides a mix of National Forest uses and activities similar to Alternative 2, with additional emphasis on timber management. This alternative would keep the 23 areas proposed for Wilderness in HR 987 and the 18 Areas of Special Interest in the 1999 ROD in a natural condition.

There would be smaller amounts of Primitive and Semi-Primitive recreation opportunities preserved under this alternative than under Alternatives 1 and 2, but still a relatively large amount, both Forest-wide and within community home ranges. Potential changes in access resulting from new road construction would take place in lands outside of the 23 areas proposed for Wilderness in HR 987 and the 18 Areas of Special Interest in the 1999 ROD.

Approximately 73 percent of the Forest would be either Primitive or SPNM after 150 years, compared to approximately 80 percent at present. There would be an increase in the share of important recreation places in the Natural Settings relative to Alternative 5 for all categories except facilities, where the share of important recreation places in Natural Setting LUDs would remain essentially the same as under Alternative 5.

Alternatives 4 and 7. Alternative 4 would provide for a mix of National Forest uses, with an emphasis on timber production. Timber management would occur in some IRAs not managed for timber production in the current Forest Plan. This would also be the case under Alternative 7, which would place additional emphasis on timber. Timber would be managed on a considerably expanded land base compared with the current Forest Plan (Alternative 5) and on a larger land base than under Alternative 4.

These alternatives would place a relative emphasis on the roaded end of the ROS spectrum, with 23 percent of the Forest expected to be RM after 150 years, compared to approximately 10 percent at present. This would be matched with a corresponding decrease in Primitive and SPNM settings, which combined would comprise about 67 percent of the Forest after 150 years under both alternatives compared to 80 percent at present.

These alternatives would involve the largest amount of new road construction, with approximately 4,735 miles and 5,774 miles projected under Alternatives 4 and 7, respectively, compared to about 3,881 miles under Alternative 5. While there would be a relative increase in new roads, with access provided to presently undeveloped areas, nearly all new roads would be closed following harvest and would, as a result, not be available for use by highway or high-clearance vehicles. The closed roads would, however, be available for access by other methods and would, as a result, have the potential to affect existing recreation patterns.

The share of home range recreation places within Wilderness and Natural Setting LUD groups would decrease from 79 percent under the current Forest Plan (Alternative 5) to 59 percent and 55 percent under Alternatives 4 and 7, respectively. There would be a decrease in the share of important recreation places in Natural Setting LUDs relative to Alternative 5.

Alternatives 5 and 6. Alternative 5 (No Action) is the current Forest Plan (1997 ROD, as amended) and provides for a moderately high level of timber production along with strong resource protection measures. Alternative 6 (Proposed Action) is similar to Alternative 5, but includes adjustments to the plan based on information generated during the recent 5-Year Plan Review and other minor clarifications and updates.

These alternatives would provide a mixture of Primitive and Roaded recreation opportunities relative to the other alternatives, which range from maintaining almost all IRAs in a natural condition (Alternative 1) to intensive timber management (Alternatives 4 and 7). Approximately 71 percent of the Forest would be either Primitive or SPNM under Alternatives 5 and 6 after 150 years, compared to approximately 80 percent at present. Approximately 19 percent of the Forest would be RM compared to 10 percent at present and 11 percent under Alternative 1 after 150 years.

There would be more new roads constructed under these alternatives than under Alternatives 1 through 3 and fewer than under Alternatives 4 and 7. The share of home range recreation places within Wilderness and Natural Setting LUD groups would be lower under these alternatives than under Alternatives 1 through 3 and higher than under Alternatives 4 and 7. This would also be the case with the share of important recreation place acres within Wilderness and Natural Setting LUDs.

Cumulative Effects

This section considers the incremental effects of the alternatives when added to other past, present, and reasonably foreseeable actions. The effects of past and present actions on recreation are included in the Affected Environment portion of this section, which discusses current recreation facilities and activities on the Tongass. Past actions include past timber harvest and road building that has facilitated roaded recreation and changed ROS settings, as well as the development of recreation facilities, such as cabins, campgrounds, interpretive sites, and visitor centers. Present actions include the impacts of current management policies on existing recreation patterns, particularly those that are authorized by special use permits.

One of the major trends in recreation in Southeast Alaska has been the continued growth in the number of cruise ship passengers visiting the region. The effects of the alternatives are considered in conjunction with this trend because it underpins current and future recreation demand on the Tongass. Current recreation patterns on the Tongass also reflect past timber harvest and road building activities on adjacent private and Native corporation lands, as well as wildland recreation opportunities on federal- and state-managed lands elsewhere in the region.

Reasonably foreseeable actions on NFS lands include the projected levels of future timber harvest and road building that are used in the preceding analysis to assess the potential impacts of the alternatives on the supply of recreation opportunities and recreation use and demand.

Other reasonably foreseeable actions include transportation and utility developments proposed by the State of Alaska. These proposals are summarized in the *Transportation and Utilities* section of this document. A total of 1,523 miles of roads are projected to be constructed on non-NFS lands in Southeast Alaska after full implementation of the plan (100+ years) under each of the alternatives (see Table 3.12-3). Most of the projected non-NFS roads are forest roads that would be developed for timber harvest, but the total miles also include roads likely to be built to serve communities, such as the Juneau access road on the east side of Lynn Canal. This road, and other road corridors covered by Public Law 109-59, would, if approved under NEPA and funded, connect additional areas in Southeast Alaska to the continental highway system and improve transportation between communities. They would also improve access for recreation use and would in some cases likely facilitate new types of use.

It is not possible at this time to predict exactly which roads would be developed or their likely impact on future recreation patterns. None of the alternatives is expected to affect this type of future road development, which would be expected to go or not go forward regardless of the selected alternative. The overall cumulative effect of new regional road corridors viewed in conjunction with the proposed Forest Plan alternatives would be a trend toward the roaded end of the ROS spectrum that would be relatively high under Alternative 7 and relatively low under Alternative 1. Planned timber harvest activities on adjacent private and Native corporation lands would also result in a cumulative trend toward more land in roaded ROS settings. This would also be most pronounced under Alternative 7 and least pronounced under Alternative 1.

Other reasonably foreseeable future actions include an expected growth in recreation and tourism businesses based on continued growth in the cruise ship industry, as well as the development of additional fishing and other lodges. This type of development would facilitate additional recreation and tourism in the region and on the Forest. Human settlement expansion is expected to occur around the region's larger cities, such as Juneau and Sitka, with residential expansion also expected as a result of state land auctions. These developments would likely result in increased demand for a range of recreation activities, with some developments favoring developed recreation opportunities, and others more dependent on undeveloped lands.

Mining activities are expected to expand at existing sites, including Greens Creek on Admiralty Island and Berner's Bay north of Juneau, with an increase in mining exploration and new development also anticipated. Regional energy and transmission projects are also expected to occur, including the Swan-Tyee transmission line and the Juneau-Hoonah transmission line. Mining and regional energy projects are for the most part expected to have a negative effect on recreation activities, because most recreational activities are incompatible with these types of land use. Improvements in reliable electrical service could, however, benefit some recreation businesses and, by extension, recreationists.

Risk and Uncertainty

As stated in a number of locations in this section, recreation and tourism in Southeast Alaska and on the Tongass is influenced by a number of factors that are largely independent of forest management decisions. Factors affecting the current level of visitation to the region, for example, likely include the impact of events at the World Trade Center on September 11, 2001, and the relatively weak U.S. dollar, both of which favor domestic over international travel and may have prompted some to take a trip to Southeast Alaska, rather than a trip abroad. Future recreation and tourism demand is difficult to predict with any precision and no attempt is made to quantify future demand in this section. The number of cruise ship visitors to the region is generally expected to remain at current levels or continue to increase, but there is uncertainty that this will be the case for the foreseeable future.

Likely impacts to the supply of recreation opportunities on the Forest are easier to project, as they are directly affected by management decisions, at least to the extent that different LUD classifications influence potential ROS classes and, therefore, different types of recreation. Much of the analysis in this section is based on this relationship, which allows a comparison between alternatives over time.

Changes in Southeast Alaska's climate (discussed in the *Climate and Air* section) could affect recreation and tourism in the region in the future. Many tourists visiting the region travel long distances from across the United States, as well as from other countries. Many tourists arriving by cruise ships travel a considerable distance by air before even boarding the cruise ship in Seattle, Vancouver, or elsewhere. Others travel directly to Southeast Alaska via air. Future regulatory or market-based pressures to reduce transportation-related greenhouse gases could affect the level of visitation to the region.

Recreation activities could also be directly affected by global warming, with, for example, fewer winter recreation opportunities available and for shorter periods of time. Climate change could also affect recreational fishing through changes in biodiversity and water levels, as well as changes in the length of season and user experience (Kelly et al. 2007).

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Scenery

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Affected Environment

The Tongass National Forest offers a variety of scenery to its visitors, from spectacular mountain ranges and the glaciers of the mainland to low-lying marine landscapes composed of intricate waterways, bays, and island groups. The Forest is viewed from a variety of vantage points, including the communities of Southeast Alaska, the Alaska Marine Highway ferry route, cruise ship routes, existing road systems, popular small boat routes and anchorages, developed recreation sites and facilities, and hiking trails. Tourist-related flight seeing via small aircraft is increasing in popularity and provides aerial views of the forest landscape.

The Forest Service developed a Visual Management System (VMS) in 1974 to integrate aesthetic considerations into large-scale resource management decisions. VMS included objective criteria, such as viewing distance and the degree of visual change to the landscape for estimating the effects of management activities. However, VMS used somewhat subjective definitions of what constituted an aesthetic landscape and relied on professional judgment to quantify effects. The Scenic Management System (SMS) was released in 1996 to integrate the increased understanding of ecosystem processes and cultural landscapes in identifying the effects of various management practices on scenic resources. The SMS was used in this analysis to inventory existing scenic resources, provide measurable scenic quality management objectives for each portion of the landscape, and estimate the landscape's sensitivity based on the visibility from priority travelways and use areas.

In order to apply SMS to the Forest, a viewshed analysis of the entire Tongass National Forest was completed using GIS. The analysis was completed separately for each Ranger District. Step one involved identifying the Visual Priority Routes (VPRs) and use areas. These are the major points from which people view the forest. They include the Alaska Marine Highway; cruise ship and small boat routes; major roads, trails, and anchorages; and important recreation areas on the land. The viewshed analysis identified points at regular intervals along the VPRs and use areas. Each viewpoint along a route was assigned a viewing height from which a person would observe the forest. For example, the average height of a person was selected for the viewing height along a hiking trail, and the height of the cruise ship's deck was used for the cruise ship route. Each cell in the digital elevation model was evaluated for visibility from each of the points along each VPR and use area. Visibility was assessed separately for each marine viewpoint and land viewpoint.

The second phase of the analysis identified distance zones, breaking the visible areas into foreground, middleground, and background from each viewpoint, based on distance. Foreground is the visible area within 0.5 mile of a VPR; background is the visible area greater than 5 miles and less than 15 miles from a VPR; and middleground is the visible area between foreground and background of a VPR. Areas more than 15 miles from any viewpoint and those not seen from any of the VPRs or Use Areas were considered seldom seen. Distance zones were also assessed separately for land and water viewpoints. The final layers for each Ranger District were generated by combining the results from the marine analysis and the land analysis. Any point that was visible from either a land or marine viewpoint was considered visible in the final layer. Any area that was foreground from either a land or marine viewpoint was considered foreground, and any land that was background from either a land or marine viewpoint became background. All other visible land became middleground. The distance zones were subsequently overlaid with the LUDs to generate the Scenic Integrity Objectives (SIOs) (refer to the Forest-wide standards and guidelines in the Tongass Land and Resource Management Plan for details on how SIOs were determined for each LUD).

Existing Scenic Integrity

The existing scenic resources of the Tongass encompass everything from vast tracts unmodified by human activity to extensive areas of heavily modified landscapes. Existing Scenic Integrity (ESI) ratings are used by the Forest Service to analyze the degree of intactness of the landscape character. These ratings are used to categorize the degree of alteration visible in the landscape on a continuum from a natural setting to a heavily altered landscape. The ratings apply to the broad landscape affected, not just the acres altered. As described below, ESI ratings range over six levels of integrity, from Very High to Unacceptably Low.

- Very High—Landscapes where the valued landscape character is intact with only minute deviations, if any. The existing landscape character and sense of place is expressed at the highest possible level.
- High—Landscapes where the valued landscape character appears intact. Deviations may be present, but must repeat the form, line, color, texture, and pattern common to the landscape character so completely and at such scale that they are not evident.
- Moderate—Landscapes where the valued landscape character appears slightly altered. Noticeable deviations must remain visually subordinate to the landscape character being viewed.
- Low—Landscapes where the valued landscape character appears moderately altered. Deviations begin to dominate the valued landscape character being viewed, but they borrow valued attributes such as size, shape, edge effect and pattern of natural openings, vegetative type changes or architectural styles outside the landscape being viewed. They should not only appear as valued character outside the landscape being viewed, but compatible or complimentary to the character within.
- Very Low—Landscapes where the valued landscape character appears heavily altered. Deviations may strongly dominate the valued landscape character. They may not borrow from valued attributes such as size, shape, edge effect and pattern of natural openings, vegetative type changes, or architectural styles within or outside the landscape being viewed.
- Unacceptably Low—Landscapes where the valued landscape character being viewed appears extremely altered. Deviations are extremely dominant and borrow little if any form, line, color, texture, pattern or scale from the landscape character.

Table 3.16-1 displays the acres of each ESI for the Tongass. In this and succeeding tables, a breakdown between "seen" and "seldom seen" areas is presented. Seen areas are those areas that can be viewed in the foreground, middleground, or background from inventoried VPR and Use Areas with a concern level of 1 or 2, the travelways and use areas with the highest number of users. Seldom seen areas are all the rest of the Forest. The ESI for wilderness is also included in this table. Approximately 88 percent of the Tongass is rated as a Very High ESI, which is a visually unaltered condition. About 10 percent of the land is rated in as Low, Very Low, or Unacceptably Low, which indicates noticeable development activity. The remainder of the Forest is rated as High or Moderate. Some of the wilderness acres have a High or lower rating. This is mostly due to the landscape effect of developments adjacent to wilderness and past development activities within wildernesses.

Table 3.16-1
The Existing Scenic Integrity of the Tongass National Forest (percent)

ESI Rating	Very High/High	Moderate	Low	Very Low	Unaccept-ably Low
Seen	23.6	1.2	1.6	3.4	0.1
Seldom seen	30.5	0.2	1.4	3.4	0.1
Wilderness	30.2	0.1	0.1	-	-
Subtotals	**88.3**	**1.5**	**3.1**	**6.8**	**0.2**

Note: Numbers are GIS estimates and are not exact. Columns and rows may not sum exactly due to rounding. Less than 2 percent of the Forest is unclassified.

Under the 1997 Forest Plan, all land has a designated Land Use Designation (LUD), which guides the types and intensity of development actions. The LUDs designate the SIOs for each area, which define the degree to which the natural landscape can be altered, and provide guidelines for timber harvest, road building, and other activities to ensure they are conducted in a way that allows the scenic objectives to be achieved. A LUD may have different SIOs depending on the distance zone (foreground, middleground, background) in which the development activity is to take place. SIOs are classified using the same terms outlined above for ESI: Very High, High, Moderate, Low, and Very Low. The Unacceptably Low rating is only used to inventory existing conditions and cannot be used as a management objective.

1. The current adopted SIOs for all land within the Tongass are displayed in Table 3.16-2. This table separates the acres of each SIO into five categories: foreground, middleground, background, seldom seen, and other (municipal watersheds and non-wilderness national monuments where the SIO is determined on a project-by-project basis). The Very High SIO is typically assigned to wilderness; however, it is not used for Tongass wilderness because of the potential alterations allowed under the Alaska National Interest Lands Conservation Act (ANILCA). In reality, the vast majority of wilderness acreage will be managed through the specific wilderness plans with a Very High SIO. Thus, over 60 percent of the Tongass is to be managed at the High or Very High Scenic Integrity level.

2. Demand for scenic quality can best be represented by the increase in tourist-related travel to the Tongass, as well as a heightened awareness and sensitivity of Alaskan residents to scenic resource values. Southeast Alaska's Inside Passage is advertised and promoted by the Division of Tourism, cruise ship operators, and the Southeast Alaska Tourism Council. Their marketing strategy focuses on the scenery of the Tongass National Forest as a major attraction. The visitors to Southeast Alaska would, therefore, arrive with expectations and an image of the environment and scenery awaiting them. If current trends continue, demand for viewing scenic landscapes will increase. Studies published by the Alaska Department of Community and Economic Development show a 62 percent increase in visitor

Table 3.16-2
Adopted Scenic Integrity Objectives for the Tongass (percent)

	Visual Quality Objective				
	High	**Moderate**	**Low**	**Very Low**	**Other[1]**
Foreground	8.0	3.7	1.6	-	0.2
Middleground	24.2	9.3	2.2	8.0	0.3
Background	1.6	0.6	-	0.4	-
Seldom seen	25.9	6.3	-	5.7	0.7
Unmapped	1.1	0.3	-	-	-
Total	**59.7**	**19.9**	**3.8**	**14.1**	**1.2**

[1] Includes land in the Municipal Watershed and Nonwilderness National Monument LUDs. SIOs in these LUDs are to be determined on a project-by-project basis. Generally, the High SIO will be met.

Source: USDA Forest Service, GIS. Numbers are not exact and may not sum correctly due to rounding.

arrivals to Alaska since 1993. Lands adjacent to the Alaska Marine Highway, cruise ship routes, flight-seeing routes, high-use recreation areas, and other marine and land-based travel routes will be seen by more people, more frequently, and for greater duration.

Environmental Consequences

The Tongass has adopted specific management objectives for scenic resources (SIOs) for each LUD in the Forest. The adopted SIOs indicate the desired or acceptable level of human-induced alteration to the valued landscape character. Each alternative described in this FEIS would, if implemented, maintain, alter, or enhance the visual character of the landscape to varying degrees, depending on the mix of LUDs in that alternative. By varying the amount of land in each LUD, the alternatives would result in different amounts of land managed under each SIO. The adopted SIO is, therefore, the unit used to measure potential change in visual resources for each alternative.

Adopted SIOs can be thought of as an indicator of long-term cumulative effects, especially on development LUDs. SIOs are adopted to provide a threshold for the amount of modification to the landscape during land altering activities; therefore, land may have an adopted SIO of Low, but currently meet the High SIO.

The potential effects to the scenic resource are described in the following three ways:

1. A Forest-wide display of acres of each SIO adopted as a result of each alternative.
2. A display of the number of acres within the three development LUDs that would be suitable for timber harvest under each alternative. The acres suitable for harvest are listed by their location within the foreground, middleground, background, or seldom seen area.
3. A display of the effects of each alternative on a selected group of viewsheds throughout the Tongass.

Direct, Indirect, and Cumulative Forest-wide Effects

Table 3.16-3 displays the acres in each SIO that would result from the seven alternatives. Table 3.16-3 also shows the acres under each alternative and SIO that would be located within seen and seldom seen areas. Seen areas are those areas

Table 3.16-3
Scenery Integrity Objectives (percent)

	Scenery Integrity Objectives					
	High	**Moderate**	**Low**	**Very Low**	**Other[1]**	**Total**
Alternative 1						
Seen Areas	34%	22%	1%	2%	1%	**60**
Seldom Seen Areas	27%	10%	0%	1%	1%	**39**
Unmapped Areas[2]	1%	0%	0%	0%	0%	**1**
Total	**62%**	**32%**	**1%**	**3%**	**2%**	**100**
Alternative 2						
Seen Areas	35%	18%	2%	5%	1%	**60**
Seldom Seen Areas	27%	9%	0%	3%	1%	**39**
Unmapped Areas[2]	1%	0%	0%	0%	0%	**1**
Total	**62%**	**27%**	**2%**	**7%**	**1%**	**100**
Alternative 3						
Seen Areas	35%	15%	3%	7%	1%	**60**
Seldom Seen Areas	26%	8%	0%	4%	1%	**39**
Unmapped Areas[2]	1%	0%	0%	0%	0%	**1**
Total	**61%**	**23%**	**3%**	**11%**	**2%**	**100**
Alternative 4						
Seen Areas	31%	13%	5%	11%	1%	**60**
Seldom Seen Areas	24%	6%	0%	7%	1%	**39**
Unmapped Areas[2]	1%	0%	0%	0%	0%	**1**
Total	**56%**	**19%**	**5%**	**18%**	**2%**	**100**
Alternative 5						
Seen Areas	34%	13%	4%	8%	1%	**60**
Seldom Seen Areas	26%	6%	0%	6%	1%	**39**
Unmapped Areas[2]	1%	0%	0%	0%	0%	**1**
Total	**61%**	**19%**	**4%**	**14%**	**2%**	**100**
Alternative 6						
Seen Areas	34%	13%	4%	8%	1%	**60**
Seldom Seen Areas	25%	7%	0%	5%	1%	**39**
Unmapped Areas[2]	1%	0%	0%	0%	0%	**1**
Total	**60%**	**20%**	**4%**	**13%**	**2%**	**100**
Alternative 7						
Seen Areas	29%	13%	5%	12%	1%	**60**
Seldom Seen Areas	24%	6%	0%	8%	1%	**39**
Unmapped Areas[2]	1%	0%	0%	0%	0%	**1**
Total	**54%**	**19%**	**5%**	**20%**	**2%**	**100**

[1] Consists of land in the municipal Watershed and Nonwilderness National Monument LUDs. SIOs in these LUDs are to be determined on a project-by-project basis. Generally, the High SIO will be met.
[2] Consists of unmapped portions of the Forest.
Note: Numbers are based on GIS estimates and are not exact due to rounding.

that can be viewed in the foreground, middleground, or background from inventoried travelways and use areas. Wilderness areas are included in these acreages. The acres displayed for Alternative 5 (No Action) represent the current mix of adopted SIOs.

The number of acres designated as High SIO would be similar under all alternatives except Alternatives 4 and 7, which have fewer acres in the High SIO category (56 and 54 acres, respectively, compared to 61 percent under Alternative 5). However, the area with an SIO of Low or Very Low would vary considerably between alternatives, especially within the seen areas. The acres of Low or Very Low SIO in the seen area under Alternative 1 would be approximately 3 percent of the Tongass, compared to 12 percent under Alternative 5. Conversely, the seen area with an SIO of Low or Very Low under Alternatives 4 and 7 would be approximately 16 and 17 percent, respectively. Alternatives 2 and 3 would be between Alternatives 1 and 5 in terms of the amount of seen area with an SIO of Low or Very Low. Alternative 6 would result in a mix of SIOs that would be similar to Alternative 5.

Another way to assess the relative effects of the alternatives on scenic integrity is to compare the area under each alternative that would be suitable for timber harvest.

The percent of land that is suitable for timber harvest within the three development LUDs (Scenic Viewshed, Modified Landscape, and Timber Production) under each alternative is shown in Table 3.16-4. The table indicates the amount of land suitable for timber harvest within the foreground, middleground, and background as seen from high priority travel routes and use areas. The percent of suitable land within seldom seen areas is also shown.

Under all the alternatives, approximately two-thirds of the suitable lands for timber harvest are within the Timber Production LUD. The number of suitable acres allocated to this LUD varies from approximately 312,000 acres under Alternative 1 to approximately 1,174,000 under Alternative 7. This compares to approximately 781,000 under Alternative 5 (No Action). Although all harvest units would meet the SIO for the individual distance zone and LUD, the degree of change to the visual resources are likely to be the greatest in the Timber Production LUD. Approximately one-half of the suitable acres allocated to Timber Production would be in seen areas.

Alternative 1. Under Alternative 1, approximately 62 percent of the Forest would have an adopted SIO of High and would be managed for a Natural Setting (Table 3.16-3). This is similar to Alternative 5 (No Action), which would have 61 percent with an SIO of High. Areas with a High SIO are managed so that the valued landscape character appears intact. As is the case with all the alternatives, over one-half of the land with the High SIO would be within Wilderness or National Monument LUDs. Approximately 32 percent of the Forest under Alternative 1 would have a Moderate SIO. Landscapes with this SIO are managed to achieve a mostly natural condition. This alternative has the highest acreage designated as High and Moderate SIO. Most of the remaining Forest lands (6 percent) would have an adopted SIO of Low or Very Low (compared to approximately 18 percent under Alternative 5). Areas with these SIOs are managed so that the valued landscape character would appear moderately or heavily altered.

This alternative has the least amount of land suitable for timber harvest compared to the other alternatives. Alternative 1 would have less than one-half the suitable acres as Alternative 5 (No Action). Approximately 7 percent of the suitable acres would be designated Scenic Viewshed, 22 percent Modified Landscape, and 71 percent Timber Production LUD (the LUD projected to have the greatest degree of change) (Table 3.16-4). Alternative 1 would result in the least amount of new road construction (approximately 1,766 miles) over the next 10 decades.

Table 3.16-4
Distance Zone breakdown of the Estimated Suitable Forest Land for Each Alternative by Development LUD

	Alternatives						
	1	**2**	**3**	**4**	**5**	**6**	**7**
Scenic Viewshed							
Foreground	2%	4%	4%	5%	4%	3%	5%
Middleground	5%	7%	8%	11%	10%	9%	11%
Background	0%	0%	0%	0%	0%	0%	0%
Seldom Seen Area	0%	0%	0%	1%	1%	1%	1%
Unmapped	0%	0%	0%	0%	0%	0%	0%
Subtotal	**7%**	**12%**	**13%**	**17%**	**14%**	**14%**	**18%**
Modified Landscape							
Foreground	9%	7%	6%	4%	5%	5%	5%
Middleground	11%	10%	11%	10%	11%	11%	11%
Background	0%	0%	0%	0%	0%	0%	0%
Seldom Seen Area	2%	2%	2%	2%	2%	2%	2%
Unmapped	0%	0%	0%	0%	0%	0%	0%
Subtotal	**22%**	**18%**	**18%**	**16%**	**18%**	**18%**	**18%**
Timber Production							
Foreground	15%	12%	11%	9%	9%	9%	9%
Middleground	41%	42%	40%	40%	40%	40%	39%
Background	1%	2%	2%	1%	2%	2%	1%
Seldom Seen Area	14%	15%	16%	16%	17%	17%	15%
Unmapped	0%	0%	0%	0%	0%	0%	0%
Subtotal	**71%**	**70%**	**69%**	**68%**	**68%**	**68%**	**65%**
Total	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**
Estimated Suitable (thousands of acres)	**312**	**545**	**661**	**999**	**781**	**774**	**1,174**

Note: Numbers are based on GIS estimates and are not exact. Columns do not sum correctly due to rounding.

Alternative 2. The overall distribution of adopted SIOs would be similar to those under Alternative 1 (Table 3.16-3), except that there would be fewer acres in the Moderate SIO (27 percent compared to 32 percent under Alternative 1 and 19 percent under Alternative 5) and more in the Low and Very Low SIOs (9 percent compared to 4 percent for Alternative 1). This alternative has approximately one-third more suitable land than Alternative 1. Alternative 2 has slightly more acres of suitable lands for timber harvest in the Scenic Viewshed LUD than Alternative 1, and more of these lands are in the foreground, which is the area likely to have the least change in the visual condition (Table 3.16-4). Alternative 2 would result in approximately 2,600 miles of new road construction over the next 10 decades.

Alternative 3. Alternative 3 would have more acres in the development LUDs than Alternatives 1 and 2, but there would be only a slight decrease in the amount of land in the High SIO (61 percent versus 62 percent under Alternatives 1 and 2). This is due primarily to allocating more land to the Scenic Viewshed LUD, in which the foreground lands are managed as High SIO (Table 3.16-3). There would be less land in the Moderate SIO than Alternatives 1 and 2, but more than under

Alternatives 4, 5, 6, or 7. More land would have Low and Very Low SIOs compared to Alternatives 1 and 2 (slightly over 14 percent compared to 4 and 9 percent, respectively). Alternative 3 would have more suitable land for timber harvest than Alternatives 1 or 2 (Table 3.16-4). Alternative 3 would result in approximately 3,464 miles of new roads over the next 10 decades.

Alternative 4. Alternative 4 would have more acres in development LUDs than Alternative 5 and less land in the High SIO (nearly 56 percent compared to 62 percent under Alternative 1 and 61 percent under Alternative 5). Alternative 4 would have more land in Low and Very Low SIOs (23 percent compared to 4 percent under Alternative 1 and 18 percent under Alternative 5). Alternative 4 would have more suitable land for timber harvest than Alternative 5 and more acres in the Timber Production LUD. Alternative 4 would result in approximately 5,487 miles of new road construction over the next 10 decades.

Alternative 5. Alternative 5, the No-Action Alternative, would have approximately 61 percent of the land in the High SIO, which is similar to Alternatives 1, 2, 3, and 6 (Table 3.16.3). This alternative would have a relatively low percentage of land suitable for harvest in the foreground (18 percent), compared to 25 percent under Alternative 1. A relatively high percent of the suitable lands (20 percent) would be within the seldom seen areas. Alternative 5 would result in approximately 4,351 miles of new roads over the next 10 decades.

Alternative 6. Alternative 6, the Proposed Action, is very similar to Alternative 5 in terms of its effect on the visual resource. The mix of SIOs would be nearly the same under Alternative 6 as it would be under Alternative 5. Alternative 6, along with Alternative 5, would have a relatively high percentage of land in the seldom seen areas. Alternative 6 would result in approximately 4,285 miles of new roads over the next 10 decades, which is slightly less than under Alternative 5.

Alternative 7. Alternative 7 would have the most acres in development LUDs of all the alternatives and the least land in the High SIO (nearly 54 percent compared to 62 percent under Alternative 1 and 61 percent under Alternative 5). Alternative 7 would have the most land in Low and Very Low SIOs (nearly 25 percent compared to 4 percent under Alternatives 1 and 18 percent under Alternative 5). Alternative 7 would have more suitable land for timber harvest than Alternative 5 (over 3 times as much as Alternative 1 and approximately 50 percent more than Alternative 5) and more acres in the Timber Production LUD. Alternative 7 would result in the highest amount of new road construction (approximately 6,264 miles) over the next 10 decades.

Effects on Selected Viewsheds

To help focus the visual effects on more familiar areas, the alternatives were also analyzed by selected viewsheds in the Tongass. These viewsheds were selected for their popularity and intensity of public use and travel. Table 3.16-5 compares the amount of land in each SIO under the six alternatives for each of the viewsheds from these selected routes. Discussion of the effects on scenic resources for each viewshed follows the table.

Two points to consider when reviewing the alternative effects are:

1. Where an area is allocated to the Semi-remote Recreation LUD, the formally adopted SIO is Moderate; however, the resulting SIO is essentially High because this LUD precludes commercial timber harvest. The Moderate SIO is primarily intended to provide a standard for recreation and tourism types of development and facilities associated with these developments, from small

Table 3.16-5
Estimated Percentage of Selected Viewsheds Classified by Adopted SIOs under Each Alternative [1,2,3]

Scenic Integrity Objective	Alternative 1	2	3	4	5	6	7
Behm Canal (West)							
High	16%	19%	19%	6%	19%	21%	6%
Moderate	48%	21%	21%	19%	20%	19%	19%
Low	24%	36%	36%	46%	36%	36%	46%
Very Low	12%	24%	24%	29%	25%	24%	29%
Caroll Inlet							
High	14%	14%	14%	0%	12%	14%	0%
Moderate	50%	19%	19%	19%	20%	19%	19%
Low	15%	22%	22%	26%	22%	22%	26%
Very Low	21%	46%	46%	55%	46%	46%	55%
Chatham Strait							
High	58%	59%	58%	47%	56%	59%	39%
Moderate	31%	17%	8%	10%	9%	8%	11%
Low	4%	5%	5%	7%	6%	5%	9%
Very Low	7%	20%	29%	36%	30%	29%	41%
Cholmondeley Sound							
High	39%	39%	39%	4%	35%	39%	4%
Moderate	59%	6%	5%	7%	5%	5%	7%
Low	1%	19%	19%	26%	20%	19%	26%
Very Low	1%	36%	37%	63%	40%	37%	64%
Clarence Strait							
High	44%	45%	46%	34%	45%	46%	22%
Moderate	40%	27%	20%	20%	21%	20%	25%
Low	6%	9%	13%	14%	13%	13%	20%
Very Low	9%	19%	21%	32%	21%	21%	33%
Duncan Canal							
High	21%	21%	21%	9%	18%	21%	1%
Moderate	64%	52%	52%	18%	18%	18%	20%
Low	5%	6%	6%	16%	12%	12%	19%
Very Low	11%	22%	22%	58%	52%	49%	59%
Eastern Passage							
High	15%	18%	19%	11%	19%	19%	9%
Moderate	78%	66%	51%	59%	51%	51%	61%
Low	5%	6%	13%	12%	13%	13%	12%
Very Low	2%	10%	17%	18%	17%	17%	18%
Ernest Sound							
High	29%	29%	29%	23%	30%	29%	2%
Moderate	71%	71%	38%	12%	11%	11%	13%
Low	0%	0%	15%	18%	20%	18%	23%
Very Low	0%	0%	18%	47%	39%	42%	63%
Frederick Sound							
High	21%	23%	25%	14%	23%	25%	6%
Moderate	67%	52%	34%	23%	25%	28%	23%
Low	2%	5%	8%	12%	10%	10%	12%
Very Low	10%	21%	33%	52%	42%	37%	59%

Table 3.16-5 (continued)
Estimated Percentage of Selected Viewsheds Classified by Adopted VQOs under Each Alternative [1, 2, 3]

Scenic Integrity Objective	Alternative 1	2	3	4	5	6	7
Hyder/Salmon River Highway							
High	0%	10%	10%	18%	11%	11%	18%
Moderate	100%	85%	85%	57%	83%	83%	57%
Low	0%	0%	0%	0%	0%	0%	0%
Very Low	0%	5%	5%	25%	6%	6%	25%
Icy Strait							
High	47%	49%	49%	27%	48%	49%	26%
Moderate	46%	22%	22%	26%	22%	22%	26%
Low	5%	7%	7%	8%	7%	7%	8%
Very Low	2%	22%	22%	39%	23%	22%	40%
Lynn Canal							
High	32%	33%	33%	32%	34%	34%	32%
Moderate	67%	65%	58%	57%	57%	57%	57%
Low	0%	0%	7%	9%	7%	7%	8%
Very Low	0%	1%	2%	3%	2%	2%	3%
Mendenhall Glacier							
High	34%	34%	34%	34%	55%	34%	34%
Moderate	66%	66%	66%	66%	45%	66%	66%
Low	0%	0%	0%	0%	0%	0%	0%
Very Low	0%	0%	0%	0%	0%	0%	0%
Peril Strait							
High	41%	42%	42%	16%	35%	37%	12%
Moderate	59%	34%	30%	11%	19%	18%	15%
Low	0%	3%	3%	8%	4%	3%	8%
Very Low	0%	22%	25%	64%	43%	41%	65%
Salmon Bay Lake							
High	38%	39%	38%	41%	39%	39%	4%
Moderate	41%	37%	37%	19%	20%	20%	39%
Low	15%	15%	15%	28%	29%	29%	32%
Very Low	6%	10%	10%	12%	12%	12%	25%
Stephens Passage							
High	38%	38%	38%	31%	38%	40%	31%
Moderate	62%	62%	59%	44%	38%	40%	44%
Low	0%	0%	0%	2%	1%	1%	2%
Very Low	0%	0%	3%	23%	23%	20%	23%
Stikine Strait							
High	28%	35%	38%	13%	36%	38%	13%
Moderate	58%	32%	29%	45%	30%	29%	45%
Low	3%	7%	7%	9%	7%	7%	9%
Very Low	11%	26%	27%	33%	27%	27%	33%
Sumner Strait							
High	31%	31%	31%	23%	30%	31%	21%
Moderate	52%	47%	30%	10%	20%	20%	10%
Low	5%	6%	8%	14%	11%	11%	14%
Very Low	12%	16%	31%	54%	40%	39%	55%

Table 3.3.6-5 (continued)
Estimated Percentage of Selected Viewsheds Classified by Adopted VQOs under Each Alternative [1, 2, 3]

Scenic Integrity Objective	Alternative						
	1	2	3	4	5	6	7
Sweetwater Lake/Honker Divide							
High	69%	69%	69%	50%	63%	63%	21%
Moderate	16%	16%	14%	18%	16%	16%	30%
Low	9%	9%	11%	18%	14%	14%	31%
Very Low	5%	5%	6%	14%	7%	7%	18%
Tenakee Inlet to Tenakee Springs							
High	82%	82%	76%	21%	33%	40%	18%
Moderate	13%	5%	1%	2%	1%	18%	3%
Low	0%	1%	2%	7%	4%	3%	8%
Very Low	4%	11%	22%	69%	62%	39%	72%
West Coast Waterway/Prince of Wales							
High	38%	38%	38%	27%	32%	35%	17%
Moderate	39%	24%	20%	11%	19%	19%	11%
Low	6%	9%	9%	15%	13%	11%	16%
Very Low	17%	29%	33%	48%	36%	35%	56%
Wrangell Narrows							
High	31%	33%	37%	30%	38%	36%	20%
Moderate	60%	48%	41%	45%	40%	41%	53%
Low	9%	16%	18%	21%	18%	18%	22%
Very Low	1%	3%	4%	4%	4%	4%	5%
Zimova Strait							
High	39%	40%	42%	22%	42%	42%	20%
Moderate	42%	29%	19%	33%	19%	19%	36%
Low	10%	10%	15%	21%	15%	15%	21%
Very Low	9%	21%	24%	23%	23%	24%	24%

[1] VQO terms are defined in the *Affected Environment* portion of this section.
[2] The percentages in the table are based on the approximate acres seen from a Visual Priority Travel Route and Use Area. The numbers are not exact and columns may not add correctly due to rounding.
[3] Other includes private lands, municipal watersheds, and National Monuments.

cabins to resorts. In most cases, the effects would be confined to small sites that would be inconspicuous over a landscape. Therefore, much of the area identified as Moderate would be managed as High.

2. The Tongass adopts the High SIO for wildernesses rather than Very High because of the direction in ANILCA; however, the Very High SIO is likely to be achieved in most areas within wilderness.

Behm Canal (West)

Alternatives 4 and 7 would each adopt an SIO of High for approximately 6 percent of the viewshed and an SIO of Low or Very Low for 75 percent of the viewshed (Table 3.16-5). This compares to Alternative 1 which would manage 16 percent with an SIO of High and 36 percent of the viewshed with an SIO of Low or Very Low. Therefore, Alternatives 4 and 7 would have the greatest effect on scenery in the Behm Canal Viewshed, while Alternative 1 would have the least. Effects on scenery under Alternatives 2, 3, 5, and 6 would be intermediate, with 19 to 21 percent managed with an SIO of High and 60 to 61 percent Low or Very Low. In some areas, particularly on the Revella Island side of the Canal, existing harvest has reached or exceeded the level allowed by the adopted SIOs. Additional harvest may need to be reduced or deferred in these areas in the coming decade.

Carroll Inlet

Alternatives 4 and 7 would manage approximately 81 percent of the viewshed with an SIO of Low or Very Low and almost none of it with a High (Table 3.16-5). This compares to Alternative 1 which would manage 14 percent in High and 36 percent in Low or Very Low. Alternatives 2, 3, 5, and 6 have similar distribution of LUDs and thus would result in similar SIO designations, with approximately 12 to 14 percent of the land with an SIO of High and 68 percent with an SIO of Low or Very Low. Therefore, Alternatives 4 and 7 would likely result in the highest level of change in visual condition of the alternatives and Alternative 1 would have the least. Effects on scenery under Alternatives 2, 3, 5, and 6 would be intermediate.

Chatham Strait

Under all of the alternatives except Alternatives 4 and 7, 56 to 59 percent of the Chatham Strait Viewshed would be managed as High SIO (Table 3.16-5). Under Alternatives 4, approximately 47 percent of the viewshed would have an SIO of High and under Alternative 7, 39 percent. Under Alternative 1, 11 percent of the viewshed would be managed with an SIO of Low or Very Low. This compares with 25 percent under Alternative 2, between 35 and 43 percent for Alternatives 3, 4, 5, and 6, and 50 percent for Alternative 7. Therefore, Alternative 7, followed by Alternative 4, would result in the greatest level of change. In some areas, particularly between Peril Strait and Tenakee Inlet, where existing harvest has reached or exceeded the level allowed by the adopted SIOs. Additional harvest may need to be reduced or deferred in these areas in the coming decade.

Cholmondeley Sound

Approximately 90 percent of the viewshed would have an SIO of Low or Very Low under Alternatives 4 and 7, compared to 2 percent under Alternative 1 (Table 3.16-5). Alternatives 2, 3, 5, and 6 would result in 55 to 60 percent in Low or Very Low SIOs. Between 35 and 39 percent of the viewshed would have a High SIO under all alternatives except Alternatives 4 and 7, which would manage 4 percent under a High SIO. Alternatives 4 and 7 would have a much greater effect on scenery than the other alternatives. Alternative 1 would have a much lower level of effects than Alternatives 4 and 7. Effects on scenery under Alternatives 2, 3, 5, and 6 would be intermediate. Under all of the alternatives, most of the outer part of the bay would be in an extensively altered condition due to harvest on private lands.

Clarence Strait

Clarence Strait is a large viewshed, extending along both sides of the strait from its northern end south to Gravinia Island. The viewshed includes portions of the South Etolin Wilderness Area, which would have an SIO of High under all alternatives. While the wilderness has a designated SIO of High, a Very High SIO would likely be achieved. All alternatives except Alternatives 4 and 7 would adopt an SIO of High for 44 to 46 percent of the viewshed (Table 3.16-5). Alternative 4 would adopt an SIO of High for 34 percent of the viewshed, while Alternative 7 would adopt an SIO of High for 22 percent. Alternatives 3, 5, and 6 would result in approximately 34 percent Low or Very Low SIO, compared to 15 percent under Alternative 1 and 28 percent under Alternative 2. Approximately 46 percent of the viewshed would be Low or Very Low under Alternative 4 and 53 percent would be Low or Very Low under Alternative 7. Therefore, Alternative 7 would result in the highest level of change to the viewshed, while Alternative 1 would result in the least. Effects on scenery under Alternatives 2, 3, 5, and 6 would be midway between the two, with slightly lower effects under Alternative 2 than under Alternatives 3, 5, and 6. Effects Under Alternative 4 would be similar, but somewhat lower, than under Alternative 7.

Duncan Canal

All of the alternatives except Alternatives 4 and 7 would adopt an SIO of High for approximately between 18 and 21 percent of the viewshed (Table 3.16-5), due primarily to the Old-Growth LUD located along both sides of the southern end of Duncan Canal. Alternatives 4 and 7 would have 9 and 1 percent High, respectively. Alternatives 5 and 6 would designate 61 to 64 percent as Low or Very Low SIO. Alternatives 2 and 3 would adopt an SIO of Low or Very Low for 28 percent of the viewshed. Alternatives 4 and 7 would have 74 and 78 percent Low or Very Low, respectively, and thus would have the greatest effect on scenery in the viewshed. Alternative 1 would have the least, closely followed by Alternatives 2 and 3. Alternatives 5 and 6 would result in a greater level of change than Alternatives 1, 2 or 3, but a lower level than Alternatives 4 or 7.

Eastern Passage

All alternatives except Alternatives 4 and 7 would adopt an SIO of High for 15 to 19 percent of the viewshed, versus 11 percent under Alternative 4 and 9 percent under Alternative 7 (Table 3.16-5). Alternatives 1 and 2 would adopt an SIO of Low or Very Low for 7 and 16 percent of the viewshed, respectively, compared to 30 percent under Alternatives 3, 4, 5, 6, and 7 (Table 3.16-5). Therefore, Alternatives 1 and 2 would likely result in less change to the visual condition of the viewshed compared to the other alternatives. Alternatives 4 and 7 would likely have a somewhat greater effect on scenery than Alternatives 3, 5, and 6.

Ernest Sound

Under all of the alternatives except Alternatives 4 and 7, 29 or 30 percent of the viewshed would be managed as High SIO (Table 3.16-5), due to the Old-Growth LUD located on the northwestern shore of Cleveland Peninsula. Approximately 23 and 2 percent would have a High SIO under Alternatives 4 and 7, respectively. There would be no Low or Very Low SIOs under Alternatives 1 and 2, compared to 33 percent under Alternative 3, and 59 or 60 percent under Alternatives 5 and 6. Alternatives 4 and 7 would designate 65 and 86 percent as Low or Very Low, respectively. Therefore, Alternatives 1 and 2 would likely result in less change to the visual condition of the viewshed compared to the other alternatives. Alternative 7 would likely have the greatest effect on scenery, and Alternative 4 would likely have the second largest effect after Alternative 7.

Frederick Sound

All of the alternatives except Alternatives 4 and 7 would adopt an SIO of High for approximately 21 to 25 percent of the Frederick Sound Viewshed (Table 3.16-5). Most of the High SIO occurs within a large area of Old-Growth LUD on the northeast shore of Kupreanof Island, as well as several smaller Old-Growth LUDs along the eastern shore of Kupreanof and Mitkof islands. Under Alternatives 4 and 7, approximately 14 and 6 percent would have an SIO of High, respectively. Alternative 4 would adopt an SIO of Low or Very Low for 64 percent of the viewshed, compared to 52 to 47 percent for Alternatives 5 and 6, respectively, 41 percent for Alternative 3, 26 percent for Alternative 2, and 71 percent for Alternative 7. Alternative 1 would adopt an SIO of Low or Very Low for 12 percent of the viewshed, approximately one-sixth the Low and Very Low under Alternative 7 (Table 3.16-5). Alternative 1 would have the least effect on scenery in the viewshed, and Alternatives 4 and, especially, 7 would have the greatest effect on scenery in the viewshed. The other alternatives would be intermediate.

Hyder/Salmon River

All alternatives would all have a moderate effect on scenery in the Hyder/Salmon River viewshed (Table 3.16-5). Alternatives 4 and 7 would likely have a somewhat greater effect on scenery in the viewshed than the other alternatives because they would adopt a Low or Very Low SIO for 25 percent of the viewshed, compared to 0 to 6 percent under Alternatives 1, 2, 3, 5, and 6.

Icy Strait

All of the alternatives except for Alternatives 4 and 7 would adopt an SIO of High for between 47 and 49 percent of the viewshed (Table 3.16-5), due partly to the Wilderness LUDs on Pleasant and Lemesurier Islands and the LUD II and Old-Growth LUD at Point Adolphus. Wilderness areas would have an SIO of High under all alternatives, but would likely achieve an SIO of Very High. The amount of the viewshed with an SIO of High would drop to 27 to 26 percent under Alternatives 4 and 7, respectively. Alternatives 2, 3, 5, and 6 would all adopt an SIO of Low or Very Low for 29 to 30 percent of the viewshed, compared to 7 percent for Alternative 1 and 47 to 48 percent for Alternatives 4 and 7. Alternatives 4 and 7 would have the greatest effect on scenery in the viewshed, while Alternative 1 would have the least. There would be little difference between the other alternatives, which would have effects midway between Alternative 1 and Alternatives 4 and 7. Under all of the alternatives, much of the south shore of the strait would be in an altered condition due to harvest on private lands.

Lynn Canal

Scenic effects within the Lynn Canal Viewshed would be very similar under all of the alternatives (Table 3.16-5). All alternatives would adopt an SIO of High for approximately one-third of the viewshed, due primarily to the large Remote Recreation LUD on the east side of Lynn Canal. All of the alternatives would have relatively low percentages of land with an SIO of Low or Very Low, with less than 2 percent for Alternatives 1 and 2 and 9 percent for Alternatives 3, 5, and 6. Alternatives 4 and 7 would have 11 to 12 percent of land with a Low or Very Low SIO (Table 3.16-5). Therefore, while all alternatives would have a moderate effect on scenery in the viewshed, Alternatives 1 and 2 would result in a somewhat lesser change to the scenery that the other alternatives.

Mendenhall Glacier

The effects of all of the alternatives on the Mendenhall Glacier Viewshed are similar for all alternatives except Alternative 5 (Table 3.16-5). Over half the viewshed would have an SIO of High, while the remainder would be Moderate under Alternative 5 (No Action). In contrast, all of the action alternatives would adopt an SIO of High for 34 percent of the viewshed and a Moderate for 66 percent (Table 3.16-5). All the alternatives have a large Remote Recreation LUD located north of Taku Inlet, with most of the remaining viewshed designated as Semi-Remote Recreation. Under Alternative 5, the Remote Recreation LUD is larger, extending further to the west, resulting in 55 percent of the viewshed managed as High SIO, compared to 34 percent for the other alternatives. As noted above, Semi-Remote Recreation LUDs generally achieve an SIO of High, making Alternative 5 almost identical to the other alternatives in terms of effects on scenery.

Peril Strait/Neva-Olga Strait/Sitka

Approximately 35 and 42 percent of the viewshed would be have an SIO of High under all alternatives except Alternatives 4 and 7, which would adopt an SIO of High for 16 and 12 percent of the viewshed, respectively (Table 3.16-5). Approximately three-fourths of the viewshed would have an SIO of Low or Very Low under Alternatives 4 and 7, compared to 0 percent for Alternative 1, 25 percent for Alternative 2, 28 percent for Alternative 3, 47 percent for Alternative 5, and 44 percent under Alternative 6. Therefore, the effects on scenery would be lowest under Alternative 1, followed by Alternatives 2 and 3, and then Alternatives 5 and 6. The level of change would be greatest under Alternatives 4 and 7. Existing harvest in a few areas (particularly the Sitkoh Bay/False Island areas) may have reached or exceeded the level allowed by the adopted SIOs. Site-specific analysis may indicate that even-aged harvest may need to be reduced or deferred in these areas for the next decade.

Salmon Bay Lake

Between 38 and 41 percent of the viewshed would have an SIO of High under all alternatives except Alternative 7, which would adopt an SIO of High for 4 percent of the viewshed (Table 3.16-5). Alternatives 1, 2, and 3 would adopt an SIO of Low or Very Low for 21 to 25 percent of the viewshed, Alternatives 4, 5, and 6 would adopt an SIO of Low or Very Low for 40 to 41 percent of the viewshed, and Alternative 7 would adopt an SIO of Low or Very Low for 57 percent, and would have the greatest effect on scenery in the viewshed.

Stephens Passage

All of the alternatives except Alternatives 4 and 7 would adopt an SIO of High for 38 to 40 percent of the viewshed (Table 3.16-5), due in part to the Wilderness/National Monument LUDs, which include portions of the Admiralty Island National Monument and the Tracy Arm Ford's Terror Wilderness Area. These areas would have an SIO of High under all alternatives but would likely achieve an SIO of Very High. Alternatives 4 and 7 would adopt an SIO of High for 31 percent of the viewshed. Alternatives 1 to 3 would adopt an SIO of Low or Very Low for between 0 and 3 percent of the viewshed, while Alternatives 4, 5, 6, and 7 would have between 21 and 25 percent. Alternatives 4 and 7, followed closely by Alternatives 5 and 6, would have the greatest effect on scenery, while Alternatives 1 to 3 would have the least.

Stikine Strait

All alternatives except Alternatives 4 and 7 would adopt an SIO of High for between 28 and 38 of the viewshed (Table 3.16-5). Alternatives 4 and 7 would adopt an SIO of High for 13 percent. Alternative 1 would adopt an SIO of Low or Very Low for 14 percent of the viewshed, while Alternatives 3, 5, and 6 would have 33 percent and Alternatives 4 and 7 would have 42 percent. Therefore, Alternative 1 would have the least effect on scenery, and Alternatives 4 and 7 would have the most; Alternatives 3, 5, and 6 would have an intermediate level of effects on scenery.

Sumner Strait

The Sumner Strait Viewshed includes portions of the Kuiu Wilderness and the Mt. Calder/Mt. Holbrook and Salmon Bay LUD II areas. These areas would have an SIO of High under all alternatives but would likely achieve an SIO of Very High. All alternatives except Alternatives 4 and 7 adopt an SIO of High for between 30 and 31 percent of the Viewshed (Table 3.16-5). Alternatives 4 and 7 would adopt an SIO of High for 23 and 21 percent, respectively. Alternatives 4 and 7 would adopt an SIO of Low or Very Low for between 68 and 69 percent of the viewshed, compared to 50 to 51 percent for Alternatives 5 and 6, 39 percent for Alternative 3, and 17 to 22 percent for Alternatives 1 and 2 (Table 3.16-5). Therefore, Alternatives 4 and 7 would have the greatest effect on scenery and Alternative 1 would have the least, closely followed by Alternative 2, and then by Alternatives 3, 5, and 6, in that order.

Sweetwater Lake/Honker Divide

All alternatives except Alternative 4 and 7 would adopt an SIO of High for between 63 and 69 percent of the viewshed (Table 3.16-5). Alternatives 1, 2, and 3 would adopt an SIO of Low or Very Low for between 14 and 17 percent of the viewshed, while Alternatives 5 and 6 would adopt an SIO of Low or Very Low for 21 percent of the viewshed. Alternative 4 would adopt an SIO of High for 50 percent and an SIO of Low or Very Low for 32 percent. Alternative 7 would adopt an SIO of High for 21 percent of the viewshed and a Low or Very low for 49 percent. Therefore, Alternative 7 would have the greateest effect on scenery in the viewshed, while Alternatives 1, 2, and 3 would have the least, followed closely by Alternatives 5 and 6. Effects under Alternative 4 would be between those under Alternatives 5 and 7.

Tenakee Inlet to Tenakee Springs

This viewshed contains the Trap Bay and Kadashan LUD II areas, which have an SIO of High under all alternatives (Table 3.16-5). The viewshed also contains land designated as Research Natural Area and Wild River LUDs, which also have a High SIO under all alternatives. Alternatives 1, 2, and 3 would adopt an SIO of High for between 76 and 82 percent of the viewshed and an SIO of Low or Very Low for between 4 and 24 percent of the viewshed, while Alternatives 5 and 6 would adopt an SIO of High for 33 to 40 percent and an SIO of Low or Very Low for 66 and 42 percent, respectively. Alternative 4 would adopt an SIO of High for 21 percent and an SIO of Low or Very Low for 76 percent. Alternative 7 would have the least area with an SIO of High (18 percent) and 80 percent with an SIO of Low or Very Low. Therefore, Alternative 7 would have greatest effect on scenery in the viewshed, while Alternative 1 would have the least, followed closely by Alternative 2 and then by Alternative 3.

West Coast Waterway/Prince of Wales

This viewshed contains the Mt. Calder/Mt. Holbrook LUD II area, which would have an SIO of High under all alternatives. All alternatives except Alternatives 4 and 7 would adopt an SIO of High for between 32 and 38 percent of the viewshed, while Alternatives 4 and 7 would adopt an SIO of High for 27 and 17 percent, respectively (Table 3.16-5). Alternatives 2, 3, 5, and 6 would adopt an SIO of Low or Very Low for between 38 and 49 percent of the viewshed. Alternative 1 would have 23 percent of the viewshed in the Low and Very Low SIOs. Alternative 4 would adopt an SIO of Low or Very Low for 63 percent of the viewshed and Alternative 7 for 72 percent. Therefore, Alternative 7 would have a greatest effect on scenery in the viewshed, while Alternative 1 would have the least. Alternatives 2, 3, 5, and 6 would be midway between Alternatives 1 and 7 in terms of the degree of change to scenery in the viewshed, while Alternative 4 would be close to Alternative 7.

Wrangell Narrows

All alternatives except Alternative 7 would adopt an SIO of High for between 30 and 38 percent of the viewshed (Table 3.16-5). Alternative 7 would adopt an SIO of High for 20 percent of the viewshed. Alternative 1 would adopt an SIO of Low or very Low for 10 percent of the viewshed, compared to between 19 and 27 percent for the other alternatives. Alternative 7 would have a somewhat greater effect than the other alternatives. A small portion of the viewshed would be in the Petersburg Municipal Watershed LUD where SIOs would be determined on a case-by-case basis for any projects proposed in the watershed.

Zimova Strait

All alternatives except Alternatives 4 and 7 would adopt an SIO of High for 39 to 42 percent of the viewshed (Table 3.16-5). Alternatives 4 and 7 would adopt an SIO of High for 22 and 20 percent of the viewshed, respectively. Alternative 1 would have the least land with an SIO of Low or Very Low (19 percent). Alternatives 2, 3, 5, and 6 would designate 31 to 39 percent as Low or Very Low, compared to 44 to 45 percent for Alternatives 4 and 7. Alternative 1 would have the least effect, followed by Alternatives 2, 3, 5, and 6, which are very similar. Alternatives 4 and 7 would have the greatest effect.

Subsistence

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Affected Environment

Subsistence hunting, fishing, trapping, and gathering activities are a major focus of life for many Southeast Alaska residents. Some individuals participate in subsistence activities to supplement personal income and provide needed food. Nearly all rural Alaska communities depend on subsistence resources to meet some portion of their nutritional needs (Wolfe 2000). Others pursue subsistence activities to perpetuate cultural customs and traditions. Still others participate in subsistence activities for reasons unconnected with income or tradition. For all these individuals, subsistence is a lifestyle reflecting deeply held attitudes, values, and beliefs.

Within the context of Southeast Alaska's seasonal and cyclical resource-based employment, subsistence harvest of fish and wildlife resources takes on special importance. The use of these resources may play a major role in supplementing cash incomes during periods when the opportunity to participate in the wage economy is either marginal or nonexistent. Because of high prices of commercial products provided through the retail sector of the cash economy, especially in remote communities, the economic role of locally available fish and game takes on added importance.

Native and non-Native communities both have high subsistence participation rates and rely heavily on wild foods, with approximately 86 percent of rural Alaska households using wild game and 95 percent using fish (Wolfe 2000). The opportunity to participate in subsistence activities reinforces a variety of cultural and related values in both Native and non-Native communities. For example, the distribution of harvested fish and wildlife contributes to the cohesion of kinship groups and community stability through the sharing of resources. Subsistence resources provide the foundation for Native culture, forming the basis for different clans and potlatch ceremonies, as well as reinforcing basic values of respect for the earth and its resources. Participating in subsistence activities contributes to the self-reliance, independence, and ability to provide for oneself; values that social surveys indicate are important reasons why many non-Native people emigrate to or remain in Southeast Alaska (USDA Forest Service 1997a).

The Legal Context for Subsistence Use

While there are a variety of cultural, popular, and sociological definitions and interpretations of subsistence, Congress addressed this subject in Title VIII of the 1980 Alaska National Interest Lands Conservation Act (ANILCA). Section 803 of ANILCA defines subsistence use as:

> "the customary and traditional uses by rural Alaska residents of wild renewable resources for direct, personal, or family consumption as food, shelter, fuel, clothing, tools, or transportation; for the making and selling of handicraft articles out of non-edible byproducts of fish and wildlife resources taken for personal or family consumption; for barter, or sharing for personal or family consumption; and for customary trade."

ANILCA provides for "the continuation of the opportunity for subsistence uses by rural residents of Alaska, including both Natives and non-Natives, on the public lands." It also states, in part, that "customary and traditional" subsistence uses of renewable resources "shall be the priority consumptive uses of all such resources on the public lands of Alaska."

The provisions in ANILCA established a harvest priority for rural residents in an attempt to protect subsistence resource harvest. Under ANILCA, in times of resource scarcity or when demand exceeds biologically sound harvest levels, subsistence harvests have priority over other consumptive use of resources. In practice, this meant that commercial, sport, or other harvests were to be curtailed by state or federal fish and wildlife management authorities before subsistence harvests were limited. The Alaska legislature subsequently passed a regulation to comply with ANILCA, but in 1989, the Alaska Supreme Court ruled in McDowell v. State of Alaska that a harvest priority for rural residents conflicted with the state constitution, which guarantees all Alaskans equal access to the state's natural resources. This ruling took the state out of compliance with ANILCA and the federal government has managed subsistence resources on federal lands in Alaska since 1990. As a result, subsistence harvests of fish and wildlife on the Tongass National Forest are presently managed by the Forest Service (Schroeder and Mazza 2005).

ANILCA requires the analysis of the potential effects on subsistence uses of all actions on federal lands in Alaska. This analysis most commonly focuses on those food-related resources most likely to be affected by habitat degradation associated with land management activities. Three factors related to subsistence uses are specifically identified by ANILCA: 1) resource distribution and abundance, 2) access to resources, and 3) competition for the use of resources. These factors are discussed in general terms in the following paragraphs.

Abundance and Distribution

Southeast Alaska subsistence resources include terrestrial wildlife (including deer, moose, mountain goat, black and brown bear, furbearers, and small game), waterfowl (including ducks, geese, and seabirds), marine mammals (harbor seal), salmon, other finfish, marine invertebrates, plants, and firewood. The abundance and distribution of these resources on the Tongass is described in the 1997 Land Management Plan Revision Final EIS, as well as in other sections of this EIS.

Access

Road building, a byproduct of timber harvesting and, to a much lesser extent, mining, is an important agent of change in Southeast Alaska. These road networks provide greater access to areas previously unconnected and can affect subsistence both positively and negatively by providing access, dispersing hunting and fishing pressure, and creating the potential for increased competition. On Prince of Wales

Island, for example, areas that have become road-connected are now more easily reached through the ferry system, thus providing greater access from Ketchikan, one of the largest cities in the region. While road systems tend to bring more people into an area, they also give subsistence hunters access to previously remote regions and provide a greater opportunity for subsistence harvest.

Southeast Alaska is comprised of isolated islands unconnected by road systems; however, with the transportation means available (floatplanes, ferry systems, automobiles, boats), Southeast Alaska residents are very mobile in their subsistence resource use activities. Wrangell, the fifth largest community in Southeast Alaska, has documented their subsistence gathering from the southern tip of Prince of Wales Island to Yakutat, covering most of the islands in between (Kruse and Muth 1990).

Competition

The Tongass National Forest, with nearly 17 million acres of largely undeveloped land, includes extensive subsistence resources. These resources are not, however, distributed or used evenly across the Forest. Where the resources are confined to island groups or river systems and access is costly or nonexistent, use of the resources is low. Where the resource is abundant, and a community is present but access by other communities is costly, the resource tends to be used primarily by the community that resides in the area. Where resources are abundant and access is available to local and other communities of Southeast Alaska, competition for resources may exist.

Increased competition may result when less expensive access to the area or within the area is provided. Such is the case when road systems are established to local communities. When areas historically not used for subsistence purposes are made available because of easier, more cost-effective access, the new area then tends to be used. When communities with road access to abundant resources are connected to the ferry systems or to commercial air services, competition for the resources may be generated from outside communities with lower abundance of the same resource.

Examples of the effect of ease of access are readily available in Southeast Alaska. Chichagof Island, Prince of Wales Island, and the Yakutat Forelands at one time were isolated portions of the Tongass with limited use from communities in the vicinity. Today, road construction, primarily a result of timber harvest activities, has created relatively large areas that are easily accessed from local communities. Access provided by the ferry systems and small commuter planes to Chichagof and Prince of Wales Islands allows relatively easy access from off-island communities. Access to the Yakutat Forelands has been made easier because of commercial jet service and ferry service to the community of Yakutat.

The Southeast Alaska Federal Subsistence Regional Advisory Council noted an increased use of subsistence resources in the 1990s, and recommended decreases in harvest of deer, moose, and other wildlife species for non-rural residents. Competition for these resources typically increases with growth in the regional population and changes in access, such as the addition of new ferry services.

Subsistence Users

Under ANILCA only rural Alaska residents qualify for subsistence hunting and fishing on federal lands. Alaska residents living in urban areas can harvest under sport, personal use, or commercial regulations, but not under subsistence regulations. Following the Alaska Supreme Court's 1989 ruling in McDowell v. State of Alaska, all Alaska residents qualify as subsistence users on state lands with federal lands continuing to be managed under ANILCA.

In 2005, Southeast Alaska had an estimated population of 70,800, with the majority (about 91 percent) living in 32 established communities (Alaska Department of Labor [DOL] 2006). About 63 percent of the area's population lived in the city and borough of Juneau or Ketchikan Gateway Borough, the only two communities considered as urban areas for subsistence purposes. An additional 24 percent of the area's population resided in the communities of Sitka, Petersburg, Wrangell, Haines, and Craig. The remaining 13 percent of the population lived in communities ranging in size from Meyers Chuck with 15 people to Metlakatla with 1,342 people (Alaska DOL 2006).

In addition to permanent communities, there are a small number of logging camps across the Tongass National Forest that, in the past, were large enough and existed long enough to have had an effect on local uses of fish and wildlife. Currently, the remaining camps have few residents and do not have much effect on competition for resources.

A relatively small number of Southeast Alaska residents live at remote isolated locations. These include people living at homesites throughout Southeast Alaska, at summer fishing sites along the outer coast, tree thinners camped near areas where they have Forest Service contracts, trappers, and people living on floathouses and fishing boats. This diverse group is typically transient, generally has very low cash income, and is closely tied to non-commercial harvest of fish, game, and other renewable natural resources.

As in other parts of Alaska, Southeast Alaska's population grew with the expansion of government services following the oil boom. A number of new communities evolved around State land selections or timber harvesting activities in the 1980s and 1990s. Edna Bay, Coffman Cove, North Whale Pass, Thorne Bay, and other small Prince of Wales Island communities are examples. The population in Southeast Alaska increased in the 1990s, but has decreased since 2000, with approximately 2,300 fewer people living in the region in 2005 than in 2000 (Alaska DOL 2006).

Alaska Natives made up 17 percent of the region's population in 2000 and comprised about 23 percent of the total population of Southeast Alaska's 30 rural communities in 2000 (Figure 3.17-1). These rural communities include places that are predominately Native, such as Angoon, Hydaburg, and Metlakatla, other logging and fishing communities that may be predominately non-Native, and places with more mixed ethnicity. The Bureau of Indian Affairs identifies 17 localized Indian tribes in the region, including the Metlakatla of the Annette Island Reserve. At the time of contact, tribes occupied seasonal camps and temporary villages throughout traditional territories. In the late 1800s, the individual tribes of the region coalesced at what had been their winter villages. The area's extant tribes live within their earlier territories and use a similar set of subsistence resources and in this way maintain long standing ties to place. For Native people, this tie to place and the harvest and use of traditional foods are key elements in fostering Native cultural identity (Alaska Native Heritage Center 2000).

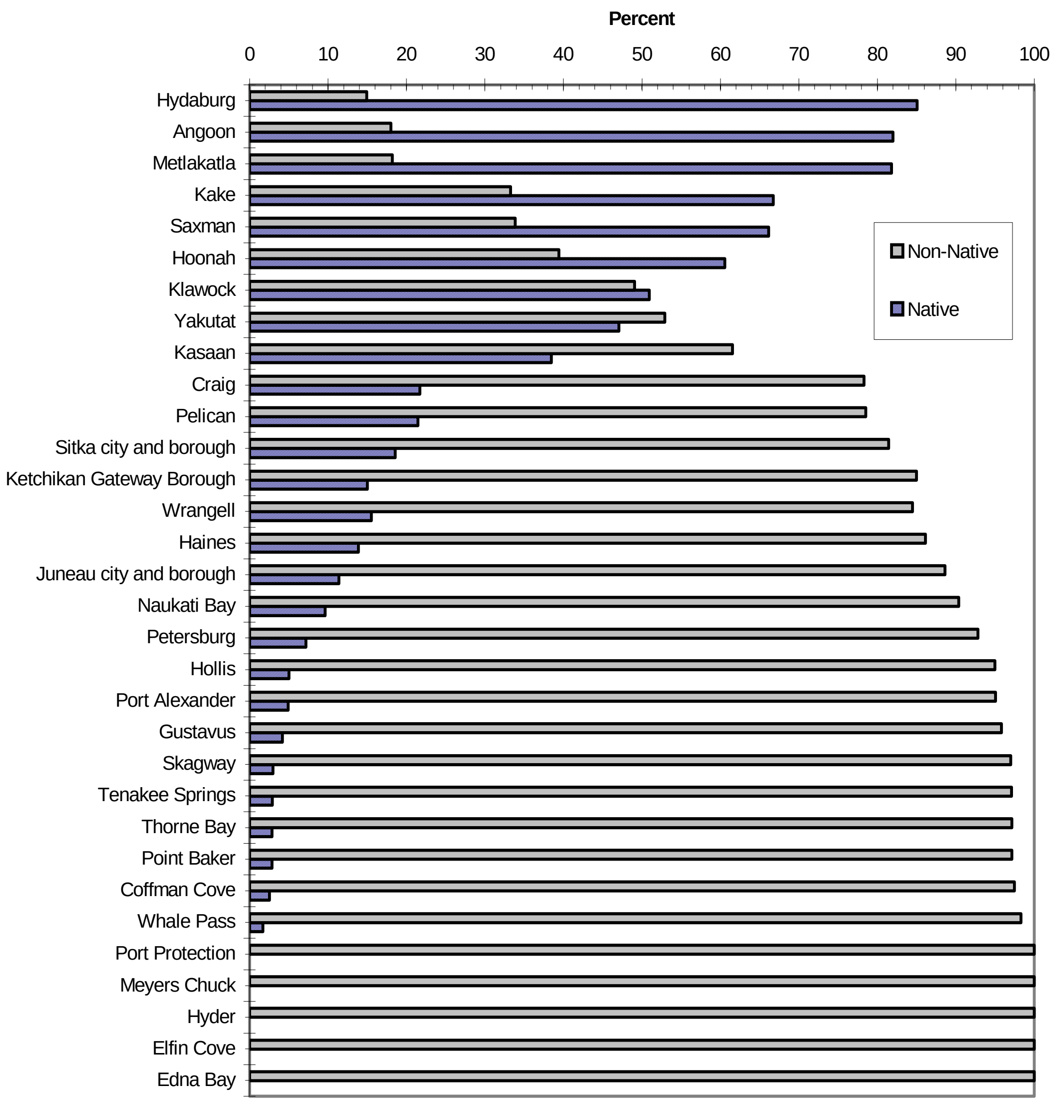
Economy

Subsistence use of fish and wildlife continues to be an important component of the economies of Southeast Alaska communities. In Native communities, harvest and use of wild resources supported the subsistence-based economy that predated the introduction of cash income. In the modern era, beginning in the late-1700s, the economies of Native communities have undergone a progressive transformation, incorporating cash income into the subsistence-based system. Southeast Alaska communities that were settled primarily by non-Native immigrants have also depended on a mix of subsistence use of wild resources and cash income.

Cash income in most Southeast Alaska rural communities is limited and intermittent, and frequently supports the purchase of fuel and equipment that are part of subsistence harvest technology. Subsistence harvests have been found to fill essential food needs in most rural communities in the region. These harvests are also customarily shared among community residents and between members of different communities. Some subsistence products are traded and bartered within the region. Subsistence harvests are not geared toward market sale or commercial profit. A mixed subsistence-market economy in which subsistence harvests and cash income are complementary characterizes the economies of most of the region's rural communities (Wolfe 2004).

Subsistence research conducted in Southeast Alaska over the past two decades has included detailed community studies, use area mapping, household surveys, and studies of specific subsistence harvests. During the 1980s, the Forest Service supported research that examined the impacts of timber harvests in the Tongass National Forest on subsistence resources in the area. The Tongass Resource Use Cooperative Survey (TRUCS) was completed in 1988 and followed by the Tongass Subsistence Studies. Data from TRUCS are summarized in the 1997 Tongass Land Management Plan Revision Final EIS.

Figure 3.17-1
Native/Non-Native Components of Southeast Communities, 2000



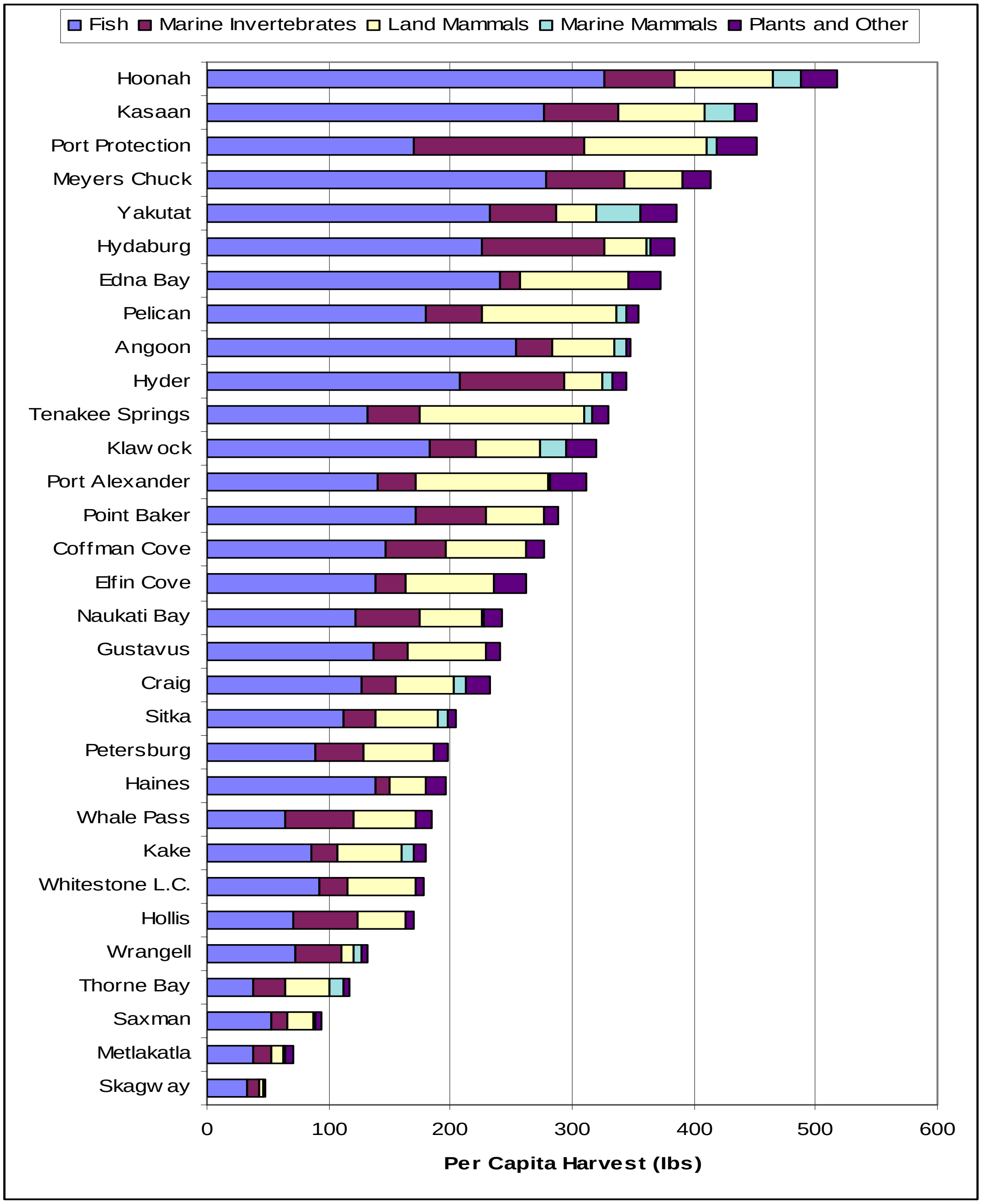
Source: U.S. Census Bureau 2001.

From 1987 to 2001, interviews were conducted with 1,064 households in 24 Southeast Alaska communities as part of the Forest Plan subsistence administrative studies. This fieldwork was conducted cooperatively with the Forest Service, Alaska Department of Fish and Game (ADF&G), and the area's tribes and communities all participating. Summary data from this and past community harvest assessments were compiled from the ADF&G Subsistence Community Profile Database (www.state.ak.us) and harvest levels are presented by community and species in Figure 3.17-2. The data presented in Figure 3.17-2 are the most recent available in the ADF&G database. The year these data were collected does, however, vary by community and the data summarized in Figure 3.17-2 should be considered a general overview of harvest patterns rather than an exact representation of current harvest activities.

The preliminary findings of this research are summarized in a recent unpublished paper by Schroeder and Mazza (2005) who identify a number of key subsistence characteristics that are evident in these data and generally consistent with the following past findings:

- Wild foods account for a large share of the diet for residents of the studied communities, ranging from 48 pounds per capita for Skagway in 1986 to over 500 pounds per capita for Hoonah in 1996 (see Figure 3.17-2). The average American diet includes about 225 pounds of meat, fish, and poultry on a per capita basis. In most of the study communities, wild foods came close to, or exceeded, this national average. Although residents of subsistence communities purchase food, most could meet their entire protein need from wild sources.
- Marine resources, including fish, mammals, and plants, comprise the majority of subsistence harvests in all communities when measured by food weight. Marine resources account for more than half of total per capita harvest in all Southeast Alaska communities, ranging from 55 percent in Tenakee Springs to 89 percent in Wrangell (Figure 3.17-2). As a result, management activities that restrict access for subsistence harvest of land mammals have had a relatively small effect on overall subsistence harvest by weight.
- Recent subsistence harvest levels in the main Native communities and the larger non-Native communities appear very similar to harvest levels estimated in the late 1980s or before. Harvest levels identified in the recent assessments conducted in Angoon, Hoonah, Hydaburg, Kake, Petersburg, Wrangell, and Yakutat, for example, are very similar to those identified in earlier studies. In a few communities, such as Coffman Cove, Kasaan, Klawock, and Port Protection, there are large differences in harvest levels over time. However, these differences seem to be more influenced by special events or small community sizes than by patterned changes in subsistence harvests.
- Subsistence harvest levels vary considerably from community to community. Recent research and other data suggest that intercommunity variability may not be fully explained by ethnicity, income, community size, or access to resources. Other factors, such as community demographic composition, cultural traditions and orientations, and community history, may have a larger influence on harvest levels than more easily analyzed standard socioeconomic variables.
- Subsistence harvesters use a wide variety of species, but use tends to be concentrated on a relatively small number of species. In Yakutat, for example, individual subsistence harvesters use as many as 65 of the 150 different species that are harvested in the community, but 84 percent of overall community harvest (in food weight) involves just 10 species. That said, the contribution of a particular species to the total subsistence harvest generally appears to vary from year to year, although the overall total harvest in food weight may remain nearly constant.

Figure 3.17-2
Per Capita Subsistence Harvest by Community and Resource Type



Note:
The year these data were collected varies by community, as follows:
1987: Elfin Cove, Gustavus, Hyder, Metlakatla, Meyers Chuck, Pelican, Petersburg, Port Alexander, Saxman, Skagway, Tenakee Springs, and Wrangell
1996: Angoon, Haines, Hoonah, Kake, Point Baker, Port Protection, Sitka, and Whitestone Logging Camp
1997: Craig, Hydaburg, and Klawock
1998: Coffman Cove, Edna Bay, Hollis, Kasaan, Naukati Bay, Thorne Bay, and Whale Pass
2000: Yakutat
Source: ADF&G 2006

- A small number of high harvesting households account for a disproportionate share of the total community harvest and tend to harvest more fish and wildlife than their family members can consume. The surplus is distributed to other subsistence users through a kinship network and through barter and trade. These networks are also used to distribute specialty subsistence products such as herring roe and hooligan oil, which are produced in large quantities in only a few communities. In Yakutat, for example, just 25 percent of subsistence households account for about 75 percent of total community subsistence harvest (in terms of food weight), with the lowest harvesting 50 percent of households taking just 8 percent of the total community harvest.

Subsistence Use Areas

Historically, subsistence use occurred where access to the resources cost less in energy than the resources gathered. Many of the gathering activities occurred in easily accessible areas. These activities occurred close to settlements where they could be accessed by foot or boat. Over time, as new technology developed, ease of access meant a movement outward into new resource use areas. The motorboat and development of road systems associated with timber harvest activities in Southeast Alaska have had perhaps the greatest influence on subsistence gathering activity. Today, all communities use motorized boats and many are tied to nearby lands by road systems. As new roads are developed, access is improved to a number of areas and subsistence use has moved to these areas.

The distribution of subsistence harvest activity is described in further detail in the 1997 Tongass Land Management Plan Revision Final EIS, with traditional household deer hunting areas mapped in Appendix H. These areas were identified based on the 1987 TRUCS (Kruse and Muth 1990). The traditional household deer hunting areas mapped in Appendix H show that the road systems are extensively used. This is particularly true on Prince of Wales Island. These maps also show that subsistence use is concentrated in close proximity to individual communities and along the beaches.

Each of the communities in Southeast Alaska has a distinct home range with concentrated use occurring within this range. A wide range of use typically occurs on a less concentrated scale outside the normal home range. More than half (54 percent) of all households surveyed in rural Southeast Alaska in 1987 traveled a minimum of 11 miles by boat to reach the one reliable deer hunting area that they chose to describe in TRUCS (Kruse and Muth 1990). An additional 18 percent of all households also used boats to reach their reliable deer hunting area, but traveled shorter distances (10 miles or less). Only 15 percent of all households used cars or trucks to travel to the most reliable areas. Thirteen percent used some other form of transportation, such as airplanes, walking, all-terrain vehicles, and the Alaska Marine Highway System (Kruse and Muth 1990).

While the majority of use occurs within about a 15-mile radius of rural communities, nearly all of the forested lands of the Tongass are used to some degree for subsistence deer hunting (USDA Forest Service 1997a). Appendix H in the 1997 Tongass Land Management Plan Revision Final EIS also displays, by community, the individual Wildlife Analysis Areas where approximately 75 percent of the average annual deer harvest occurred.

Kruse and Muth (1990) found that nearly one-half of the households harvesting deer mentioned the existence of clearcuts of various ages occurring in presently reliable areas (44 percent), most-often-used areas (48 percent), and areas no longer used (55 percent). They also reported that old-growth forests were mentioned as most reliable by 90 percent of households harvesting deer, were most-often-used areas by 91 percent of households, and were areas no longer used by 90 percent of those households harvesting deer.

Many of the fish and wildlife resource values of Southeast Alaska watersheds, based on the Value Comparison Unit (VCU) classification of the Tongass, are summarized in the 1998 Tongass Fish and Wildlife Resource Assessment (ADF&G 1998). This report shows the relative value of areas for black bear, brown bear, deer, sport fishing, salmon production, and subsistence use. This resource assessment also included a ranking of the VCUs that have the highest community use values.

Environmental Consequences

The analysis of the likely effects of the EIS alternatives on subsistence resources and uses is in two parts. Effects on subsistence resources and uses important to each rural community are discussed individually by community in the *Subregional Overview and Communities* section. Here, the Forest-wide evaluation is presented, based on general considerations in the three categories of effects previously identified: abundance and distribution, access, and competition. This general analysis relies on the community discussions and also on the Forest-wide effects analyses from the related resource sections (primarily *Fish* and *Wildlife*) where abundance and distribution are of concern.

Section 810 of ANILCA requires the Forest Service, in determining whether to withdraw, reserve, lease, or otherwise permit the use, occupancy, or disposition of NFS lands in Alaska, to evaluate the potential effects on subsistence uses and needs, followed by specific notice and determination procedures should there be a significant possibility of a significant restriction of subsistence uses. The Alaska Land Use Council's definition of "significantly restrict subsistence use" is one guideline used in the evaluation:

> "A proposed action shall be considered to significantly restrict subsistence uses, if after any modification warranted by consideration of alternatives, conditions, or stipulations, it can be expected to result in a substantial reduction in the opportunity to continue subsistence uses of renewable resources."

It should be noted that the term "significant" as used in this context does not have the same definition as used in the implementing regulations for NEPA. See 40 CFR Section 1508.27 for definitions of "significant" in a NEPA context.

Considerations of abundance and distribution, access, and competition (by non-rural residents) are mentioned.

The U.S. District Court Decision of Record in *Kunaknana v. Watt* provided additional clarification. In part it states:

> "restrictions for subsistence uses would be significant if there were large reductions in abundance or major redistribution of these resources, substantial interference with harvestable access to active subsistence-use sites, or major increases in non-rural resident hunting."

Direct and Indirect Effects

Abundance and Distribution

Based on the 1987 survey information compiled as part of TRUCS, 61 percent of subsistence resources (by weight) are fish or marine invertebrates, 21 percent are deer, 4 percent are other land mammals, and another 3 percent are marine mammals. More recent community data compiled by ADF&G (2006) indicate that fish and marine invertebrates still comprise the majority of subsistence harvest per capita (in pounds), ranging from 53 percent in Tenakee Springs to 88 percent in Skagway (see Figure 3.17-2).

The subsistence analysis conducted for the 1997 Forest Plan Revision Final EIS found that the primary subsistence resource likely to be significantly affected by the alternatives was Sitka black-tailed deer. Some effects to fish habitat may also result from land management activities, but the magnitude of the effects could not be calculated. Risk to fish habitat is generally expected to increase with increased timber harvest, increased roading, and narrower riparian areas along streams. A panel evaluation of alternatives was conducted for the 1997 Final EIS. Alternative 11, which essentially represents the adopted Forest Plan (Alternative 5 [No Action] in this EIS), was judged to have relatively low risk relative to the other alternatives.

As a result of their association with old-growth forest habitat, which is the main terrestrial habitat type affected by the alternatives, deer are considered the "indicator" for potential subsistence resource consequences concerning the abundance and distribution of the resources. The community-based subsistence analysis (see the *Subregional Overview and Communities* section) focuses largely on deer, which is, in most cases, by far the largest terrestrial component of subsistence food resources.

In the subsistence analysis in the 1991 Forest Plan Revision Supplemental Draft EIS (SDEIS), it was determined that at that time all of the Forest Plan alternatives, if implemented, could result in a significant restriction on the abundance and/or distribution of subsistence uses of Sitka black-tailed deer, brown bear, and marten sometime during the next 50 years. This conclusion was based on an analysis of the current status of huntable wildlife resources, and identified portions of the Tongass where such restrictions may already be occurring (i.e., were the result of existing conditions) (USDA Forest Service 1991, pp. 3-762 and 3-763). The unpublished 1992 Draft Final EIS reached the same conclusion for deer and brown bear. Such restrictions were most likely for communities with subsistence use areas in the northern portion of the Tongass (Chichagof and Baranof Islands, primarily). The Revised SDEIS came to the same conclusion in its analysis for deer.

In the 1997 Forest Plan Revision Final EIS, hunting demand and huntable populations of wildlife were only re-examined for Sitka black-tailed deer. Using a revised habitat capability model, the new deer analysis reached similar conclusions to that of the Revised SDEIS, based on specific areas where recent deer harvests are high relative to deer habitat capability. (This analysis was summarized at the end of the affected environment portion of the *Wildlife* section of the 1997 Forest Plan Revision Final EIS; see also Iverson 1996.) This analysis identified seven areas (near Juneau, Hoonah, Sitka, and Craig/Klawock) where current deer harvests exceeded 20 percent of the estimated habitat capability. This analysis also found another 23 areas exceeding 10 percent of capability (four on Admiralty, five on Chichagof, four on Baranof, eight on Prince of Wales, and two near Ketchikan). Areas exceeding 20 percent are those where deer harvest may be restricted, either directly through restrictions in seasons and bag limits, or indirectly through reduced hunter efficiency and increased difficulty in obtaining deer relative to historical rates. Hunters in areas between 10 to 20 percent may experience reduced hunter efficiency and moderate difficulty in obtaining deer. This analysis may underestimate negative effects when deer populations are below carrying capacity. Adverse effects to deer hunters may be further amplified with either reductions in deer habitat capability or increases in deer demand/harvest or both.

The 1997 deer analysis was much in line with the earlier (1991, 1992, and 1996) analyses, which also used the 10 and 20 percent harvest cutoffs and the same land units. It indicated that deer habitat capabilities in several portions of the Tongass may not be adequate to sustain the current levels of deer harvests, and that implementation of any Forest Plan alternative could, therefore, be accompanied by a significant possibility of a significant restriction on the abundance and/or distribution of subsistence uses of deer. (Sport hunting restrictions would, however, occur first, followed by selective subsistence reductions, based on ANILCA Section 804.) This possibility, at least in the short term, is largely due to the continuation of reduced habitat capabilities resulting from past habitat alterations, which is why it applied to all alternatives.

Under the alternatives analyzed in this EIS, the possibility of a significant restriction, resulting from a change in abundance or distribution, would be the same as or less than the possibility under Alternative 11 of the 1997 Forest Plan Revision Final EIS for five of the seven alternatives. This risk would, however, likely be higher under Alternatives 4 and 7 because these alternatives anticipate a higher level of timber harvest than the current Forest Plan (Alternative 5, No Action). It should be noted that actual timber harvest has been much lower under the current Forest Plan than the levels projected under Alternative 11.

In the short term, the risk of a significant restriction would be about the same under any of the alternatives because the effects of past harvest would override the effects of new harvest during the next 10 years. In the long term, those alternatives that limit the areas available for future timber harvesting the most would result in the largest reduction in risk.

Alternatives 5 and 6 would result in a similar possibility of a significant restriction relative to Alternative 11 of the 1997 Final EIS because they would not produce a substantial change in old-growth harvest rates relative to the that Forest Plan. Development LUD acreage under Alternative 5 is about 3 percent less than under Alternative 11 of the 1997 Final EIS and Alternative 6 would have about 7 percent fewer acres in development LUDs. These reductions are due to land adjustments that have occurred since 1997 and, in the case of Alternative 6, increases in the acreage of land in old-growth reserves and other non-development LUDs. Alternative 6 would have 4 percent fewer acres in development LUDs than Alternative 5, which is the 1997 Forest Plan, as amended. Alternatives 1, 2, and 3 would reduce the possibility of a significant restriction because of a 67, 46, and 18 percent reduction, respectively, in development LUD acreages compared with Alternative 5. Alternatives 7 and 4 would each result in an increase in the possibility of a significant restriction due to respective increases in development LUD acreages of 40 percent and 31 percent relative to Alternative 5.

Access

Subsistence users typically hunt and fish in traditional areas surrounding their communities. Many of the communities in Southeast Alaska are not located on the Alaska road system and tend to be compact, centralized places surrounded by undeveloped land with limited infrastructure. Most subsistence food production is supported by a central or core use area surrounding a community. Traditional household deer hunting areas are identified for the 32 communities in Southeast Alaska in Appendix H to the 1997 Forest Plan EIS. Access to and use of surrounding areas for subsistence activities may be guided by local customary rules, as well as federal and state regulation and economic considerations, with traditional use areas for different communities often overlapping at their margins. Customary rules guiding subsistence harvest may be related to local histories and social customs of clans and communities (Wolfe 2004).

Forest plans are programmatic, meaning that they establish direction and allowable activities for broad land areas, rather than schedule specific activities in specific locations. This makes it difficult to evaluate the effects of the alternatives on particular groups of subsistence users or resources. The following discussion addresses potential impacts at the programmatic or forest scale and assesses relative potential impacts in terms of overall proposed road construction and timber management activities.

Viewed at this scale, none of the alternatives would directly limit the use of public lands for the purposes of subsistence gathering activities. Historical access (by foot, boat, and floatplane) would remain available under all the alternatives for present and foreseeable future activities.

Data on documented deer harvest by transportation type are available at the Game Management Unit (GMU) level (Table 3.17-1). Data from the 2003 Deer Harvest Survey are presented by transportation type and GMU in Table 3.17-1. GMU 4, the ABC Islands (Admiralty, Baranof, and Chicagof Islands), accounted for 69 percent of deer harvested in Southeast Alaska in 2003 (7,621 deer), with GMU 2, Prince of Wales Island, accounting for 16 percent (1,783 deer). Hunters accessing hunting areas by boat accounted for 63 percent of total deer harvest in 2003. Hunters accessing the area by highway vehicle accounted for 23 percent of total deer harvest. The relative share of harvest by transportation type varies by GMU, with boat access, for example, accounting for 76 percent of harvest in GMU 4, but just 20 percent in GMU 2. Highway vehicle was the most frequently used method of access in GMU 2, Prince of Wales Island, accounting for 73 percent of deer harvest in 2003 (Table 3.17-1). This relatively high share reflects the more densely roaded nature of Prince of Wales Island and may be considered generally indicative of the effects of timber harvest and associated road building.

Table 3.17-1
Deer Harvest by Game Management Unit and Transportation Type, 2003

GMU Number[1/]	Area	Deer Harvested	Percent of Deer Harvested by Transportation Type[2/]					
			Airplane	Boat	3- or 4-Wheeler	Highway Vehicle	Foot	Un-known
1A	Ketchikan	211	0	64	11	18	6	0
1B	Petersburg	82	0	39	44	0	17	0
1C	Juneau	467	0	33	0	48	16	2
2	Prince of Wales Island	1,783	2	20	1	73	3	2
3	Central Islands	901	1	52	11	31	1	2
4	ABC Islands[3/]	7,621	11	76	2	9	1	1
	Total	**11,065**	**883**	**6,938**	**329**	**2,529**	**240**	**139**
	Percent of Total	100	8	63	3	23	2	1

Notes:
1 Game Management Units (GMUs) are a geographic unit of measurement established and used by ADF&G.
2 These data were compiled as part of the 2003 Deer Hunter Survey and were collected in response to a question requesting the survey respondent to identify the Transportation Used to Get to the Hunt Area.
3 The ABC Islands are Admiralty, Baranof, and Chichagof Islands.
Source: ADF&G 2004.

New road construction is likely to result in the development of new use patterns around some communities, but these changes are not likely to lead to a significant possibility of a significant restriction of subsistence access to the resources. New use patterns may, however, favor some subsistence groups and disadvantage others. Subsistence access may be via a number of different transportation types and often involves more than one form of transportation. Subsistence users may, for example, access an area via boat followed by road (and on-foot) or via boat and on-foot, with types of access varying by location and user. Some hunters may access specific areas using more than one form of transportation, but others may favor one form of transportation over another, say highway vehicle over foot.

While there would be some new road access under all alternatives in the long run, nearly all new roads constructed under the alternatives would be closed following harvest. These roads would, therefore, not be available for use by highway vehicles or high-clearance vehicles. They may, however, be available for access by other methods and would, as a result, have the potential to affect existing subsistence patterns.

Based on the miles of new road construction projected under each alternative and viewed at a programmatic level, Alternative 1 would have the lowest impact on existing subsistence access patterns with only about 20 percent of the maximum road miles projected under Alternative 5 (No Action) (774 miles versus 3,874 miles). Also, new road construction under Alternative 1 would be limited to areas outside existing Inventoried Roadless Areas (IRAs) and would, therefore, tend to increase road density in already roaded areas rather than provide new access to presently undeveloped areas.

Alternatives 2 and 3 would also have relatively low impacts on existing subsistence access patterns with 1,751 and 887 fewer projected new road miles than under Alternative 5, respectively. These alternatives would also limit the construction of new roads in IRAs and, therefore, limit potential changes in access, but to a lesser extent than under Alternative 1. Alternative 6 (Proposed Action) would have a similar effect to Alternative 5, while Alternatives 4 and 7 would involve 1,136 and 1,913 more new road miles than Alternative 5 (No Action), respectively, and have the potential to provide new access to presently undeveloped areas.

Some subsistence users have a preference for unroaded areas. Viewed at a programmatic level, Alternative 1 would have the lowest impact on subsistence users who prefer unroaded areas because timber management would be primarily limited to areas outside the existing IRAs on the Tongass. Alternatives 2 and 3 would have the next lowest potential impacts, in that order, with timber management under Alternative 2 limited to areas outside the existing IRAs except in locations where existing roads could be logically extended. Alternative 3 would keep the 23 areas proposed for wilderness in HR 987 and the 18 Areas of Special Interest in the 1999 Record of Decision in a natural condition. Alternatives 5 and 6 would be more likely to involve timber harvest in IRAs; this likelihood would be increased further under Alternatives 4 and 7. Alternatives 4 and 7 have an increased emphasis on timber production with respective annual Allowable Sale Quantities (ASQs) of 313 million board feet (MMBF) and 421 MMBF in the first decade, compared to 267 MMBF under Alternative 5 (No Action) and 49 MMBF under Alternative 1.

Another potential access impact relates to the effects of clearcut harvesting on the landscape. Subsistence hunters have varying opinions on the effects of clearcut harvest on hunting success. Some hunters say that timber harvest clearcuts are productive for some years after harvest, while others prefer not to use clearcuts. Hunters interviewed on Prince of Wales Island, for example, reported that the best hunting in clearcut areas begins approximately 2 years after an area is logged, with hunt quality typically starting to decline 9 years after the area was cut (Brinkman 2006). Concern has been expressed by hunters that clearcuts in the process of regrowth become impassable to hunters after a period of time (Galginaitus 2004).

In addition to long-term access effects, timber management activities may also have short-term, temporary displacement effects for subsistence users because it is standard practice to close logging roads to outside traffic when logging is taking place. Subsistence users who use existing roads for access would be preempted from using those roads for the duration of logging activity in the affected area. These types of effects would, however, be short term and temporary, and would not be likely to lead to a significant possibility of a significant restriction of subsistence access to the resources. In addition, as previously noted, most or all new roads would be closed following harvest.

Competition

Just over half of the population in Southeast Alaska in 2005 resided in Juneau or Ketchikan (55 percent) and is, therefore, considered non-rural from a subsistence perspective. Residents in the remaining 30 communities and surrounding areas are considered rural. Competition for the more abundant wildlife and fisheries resources near rural communities results from a combination of factors, such as fish and game regulations, mobility, the natural distribution of game species across the Tongass, decreases in resource populations as a result of habitat reductions, decreases in resource populations as a result of over-harvest, and access provided to rural communities in the form of roads, ferries, and commercial air carriers.

For analyzing competition, the following assumptions are made:

- New road construction adjacent to communities with ferry access will result in increased competition from outside communities.
- New road construction adjacent to existing road systems where interties between communities exist will result in increased competition from surrounding communities associated with the interconnected roads.
- Habitat reductions will result in increased competition if regulations allow sport use to remain constant, with the same number of users seeking fewer huntable resources.
- The demand for resources will remain constant or increase slightly as the habitat capability remains the same or declines over time.

Given these assumptions, the 1997 Forest Plan Revision Final EIS concluded that implementation of Alternative 11 (the Selected Alternative) would result in a significant possibility of a significant restriction of subsistence use by increasing competition for some subsistence resources by non-rural, as well as rural residents. This was judged most likely to occur on Chichagof, Baranof, and/or Prince of Wales Islands, where competition for deer and some other land mammals is currently heavy, and habitat capability has been reduced as a result of timber harvest.

The possibility of a significant restriction, resulting from a change in competition, would be the same as or less than the possibility under Alternative 11 (the Selected Alternative) of the 1997 Forest Plan Revision Final EIS for Alternatives 5 and 6. There would be a relative reduction in risk under Alternatives 1, 2, and 3, and an increase in risk under Alternative 4 and especially under Alternative 7 (see the *Transportation and Utilities* section of this chapter).

Cumulative effects are discussed in four categories.

Cumulative Effects

1. **Effects Resulting from Timber Harvesting of Private Lands**. Native corporation lands adjacent to the Tongass National Forest support extensive timber harvest operations. Over the last two decades, old-growth forest wildlife habitat capability on Native corporation lands (especially that for deer) has declined, and this decline is expected to continue for at least the next two decades. This decline has occurred primarily on North Chichagof, Kupreanof, Admiralty (localized), and Prince of Wales Islands, as well as on mainland areas. Overall, approximately 351,000 acres, or 46 percent, of the original old growth has been harvested on non-National Forest System lands within the Forest boundary. The resulting lower habitat capabilities on these private lands are likely to increase hunting demands in adjacent National Forest areas, increasing competition and potentially leading to reduced hunter success, reduced or eliminated sport seasons, and in some places reduced or eliminated subsistence seasons.
2. **Effects from Past Activities**. Timber harvest has been more influential in changing the landscape than any other use of the resources of the Tongass National Forest. With timber harvest comes roading, log transfer facility development, and reductions in old-growth forest habitat. Intensive timber harvesting, which began in the 1950s, has resulted in approximately 455,000 acres of old growth harvest on National Forest System (NFS) lands.

3. **Effects of Present Activities**. Implementation of the current Forest Plan allowed an annual maximum timber harvest of approximately 267 MMBF (based on the ASQ), with an annual conversion of up to 8,900 acres of old-growth habitat to young growth (although a much lower volume and acreage has been harvested in recent years). This timber harvest involved the projected construction of up to 106 miles of classified road each year. In reality, less than 25 miles of new road has been built each year since the plan was implemented. One major mining operation, the Greens Creek Mine on Admiralty Island is currently operating. In addition, construction of the Kensington Mine project north of Juneau is partially underway and the mine may become operational in the near future.

4. **Effects of Reasonably Foreseeable Future Activities**. The conversion of old-growth forest habitat to young growth would occur at varying rates under all alternatives. The principal subsistence resource effect will be on Sitka black-tailed deer habitat, as previously discussed. If timber harvesting were to continue at maximum allowable rates (under Alternative 7) over the next 10 years, a maximum of 159,000 acres of old-growth habitat could change to young-growth and about 880 miles of road could be built on NFS lands. The comparison of alternatives at the end of Chapter 2, as well as the *Timber* and *Transportation and Utilities* sections, displays the estimated miles of road predicted under each alternative. With timber harvest activities would come new access, possibly new camps, and potential increased use of subsistence resources by rural and non-rural residents. The effects of timber harvest on deer habitat capability would be reduced somewhat, through more intensive management (e.g., thinning) of the existing and future closed-canopy, young-growth forests.

   Counting all lands in Southeast Alaska, an estimated 87 percent of the original old growth remains today. After 100+ years, it is estimated that the percentage of the original old growth remaining would range from 71 percent (Alternative 7) to 82 percent (Alternative 1), due to combined harvest on NFS and non-NFS lands, assuming maximum rates of harvest. Although the overall percentage reduction would not be excessively high overall, areas of concentrated harvest would have higher effects on subsistence. Areas of concentrated harvest are described in the *Biodiversity* section, which quantifies the estimated effects of cumulative future harvest on the amount of old growth by biogeographic province for all of Southeast Alaska (see Tables 3.9-20, 3.9-21, and 3.9-22).

Timber harvest of Native corporation lands is anticipated to continue at a relatively low but constant level over the next decade. New land selections could result in some previously unharvested areas being logged. Actual mineral development is difficult to predict, but effects to subsistence resources would be highly localized where it does occur.

ANILCA Determination

An ANILCA Section 810 evaluation and determination is not required for approval of a Forest Plan amendment, which is a programmatic level decision that is not a determination whether to “withdraw, reserve, lease, or otherwise permit the use, occupancy, or disposition” of National Forest land. This EIS is part of the Forest Plan Amendment process and, therefore, does not require an ANILCA Section 810 evaluation and determination. A Forest-wide evaluation and determination was, however, included for the 1997 Tongass Forest Plan Revision Final EIS to facilitate project-level planning and decisionmaking in compliance with ANILCA Section 810. The analysis and findings conducted for this EIS complement the 1997 effort.

Consistent with Section 810 of ANILCA, the alternatives considered in the Revised SDEIS (prepared prior to the 1997 Forest Plan EIS) were evaluated for potential effects on subsistence uses and needs, as described above. Based on that evaluation, it was determined that, in combination with other past, present, and reasonably foreseeable future actions, one or more of the Revised SDEIS alternatives (if implemented through project-level decisions and actions) may result in a significant restriction of subsistence uses of deer, and possibly other land mammals, due to potential effects on abundance and distribution, and on competition.

As a result of this finding, the Forest Service notified the appropriate state agencies, local communities, the Southeast Alaska Federal Subsistence Regional Advisory Council, and State Fish and Game Advisory Committees, and held hearings in affected communities throughout Southeast Alaska after publication and dissemination of the Revised SDEIS.

Using the information described earlier in this section and comments from the ANILCA 810 Subsistence Hearings, the alternatives considered in the 1997 Forest Plan Revision Final EIS were evaluated for potential effects on subsistence uses and needs, as described above. Based on this evaluation it was again determined that, in combination with other past, present, and reasonably foreseeable future actions, one or more of the 1997 Final EIS alternatives (if implemented through project-level decisions and actions) may result in a significant restriction of subsistence uses of deer, and possibly other land mammals, due to potential effects on abundance and distribution, and on competition.

ANILCA 810 Subsistence Hearings were also held in conjunction with the public meetings/hearings on the 2002 Draft SEIS. These meetings took place in 17 communities across Alaska; an internet hearing was also conducted. Subsistence hearings were also conducted for this EIS. They were held in 24 Alaska communities and on the internet as well (see Chapter 1).

Considering the input from these hearings and the analysis presented here, the same overall conclusion is reached regarding the alternatives evaluated in this EIS. The risk of a significant restriction would be the same or less than for the Selected Alternative from the 1997 Final EIS (current Forest Plan) under five of the alternatives, with the potential risk expected to higher under Alternatives 4 and 7.

Section 810 (a)(3) of ANILCA requires that when a significant restriction may result, three determinations must be made, including the following:

1. **Necessary and Consistent with Sound Management of Public Lands**. The alternatives proposed in this EIS have been examined to determine whether they are necessary and consistent with sound management of public lands. In this regard, the National Forest Management Act, the Alaska National Interest Lands Conservation Act, the Tongass Timber Reform Act, the Wilderness Act, the Alaska Regional Guide, the 1997 Forest Plan Revision Final EIS, as amended, the Alaska State Forest Resources and Practices Act, and the Alaska Coastal Zone Management Program have been considered.

   National Forest land management plans are required by the National Forest Management Act and must provide for the multiple-use and sustained yield of renewable forest resources in accordance with the Multiple-Use Sustained Yield Act of 1960. Multiple-use is defined as "the management of all the various renewable surface resources of the National Forest System so that they are utilized in the combination that will best meet the needs of the American people" (36 CFR 219.3). The alternatives presented herein represent different ways of managing Tongass National Forest resources in combinations that are intended to meet the needs of the American people. Each provides a different mix of resources uses and opportunities and has some potential to affect subsistence uses, although the effects would be the same or less than under the current Forest Plan for five of the alternatives, with the potential effects expected to higher under Alternatives 4 and 7. The potential restrictions associated with each alternative are necessary and consistent with the sound management of public lands.

2. **Amount of Public Land Necessary to Accomplish the Proposed Action**. The amount of land necessary to implement each alternative is, considering sound multiple-use management of public lands, the minimum necessary to accomplish the purpose of that alternative. The entire forested portion of the Tongass is used by at least one rural community for subsistence purposes for, at a minimum, deer hunting. It is not possible to avoid all of these areas in implementing resource use activities, such as timber harvesting and road construction, under any Forest Plan alternative, and attempting to reduce effects in some areas can mean increasing the use of others. The current and proposed Forest-wide standards and guidelines and LUD prescriptions provide for special management or limit activities in many of the areas most important for subsistence uses, such as beaches and estuaries, areas adjacent to roads, and areas with high fish and wildlife habitat values. Forest-wide standards and guidelines and LUD prescriptions are discussed in more detail below.

   The alternatives considered in this EIS, with the exception of Alternatives 4 and 7, would maintain the same levels of resource use and associated activities or would reduce them. There would be an increase in resource use under Alternatives 4 and 7. There would be a reduction in the beach and estuary buffers in the revised Forest Plan under Alternative 7. In addition, the Old-Growth Habitat LUD and its management prescription would be eliminated under Alternative 7.

3. **Reasonable Steps to Minimize Adverse Impacts to Subsistence Uses and Resources**. The Forest-wide standards and guidelines and LUD prescriptions of the current Forest Plan would continue to be implemented as part of Alternative 5 (No Action), where they apply. An updated and edited version of the current Forest Plan has been developed for Alternative 6 (Proposed Action), and for Alternatives 1, 2, and 3. Alternatives 4 and 7 also follow the Proposed Forest Plan, with some exceptions. One important exception in this context is the reduction in the beach and estuary buffers that would occur under Alternative 7. Beaches and estuaries are often important subsistence areas and reducing the buffers in these areas would reduce the level of protection and could have long-term impacts on subsistence users. In addition, the Old-Growth Habitat LUD and its management prescription would be eliminated under Alternative 7. Under Alternative 4, there would be Old-Growth Reserves would be limited to four high risk-biogeographic provinces. In other areas, 30 percent of old-growth would be reserved in each VCU.

   Subsistence use is addressed specifically in a Forest-wide standard and guideline, and subsistence resources are covered by the Forest-wide standards and guidelines for wildlife, fish, riparian areas, and biological diversity, among others. Fish and wildlife habitat productivity would be maintained at the highest level possible under all alternatives, consistent with the overall multiple-use goals of the current Forest Plan, with improved protection under the Proposed Forest Plan. Alternatives 1, 2, 3, and 6 would harvest less productive old-growth than Alternative 5 (No Action) and maintain a larger proportion of original old-growth on the Tongass. Alternatives 4 and 7 would harvest more productive old-growth than Alternative 5. There would be less deer habitat maintained in old-growth reserves under Alternative 4 than under Alternatives 1, 2, 3, 5, and 6. Alternative 7 would not include old-growth reserves and would have the largest potential long-term effects on the availability of deer for subsistence purposes. The potential effects of the alternatives on wildlife productivity are discussed in more detail in the *Wildlife* section of this EIS.

A final determination was made in the Record of Decision for the 1997 Tongass Forest Plan Revision Final EIS, which was consistent with the analysis above. A summary of the evaluation, findings, and determination for the alternative selected following this EIS process will be presented in the Record of Decision for this EIS.

Heritage Resources and Sacred Sites

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Affected Environment

Heritage Resources

Heritage resources located within the Tongass National Forest include a diverse range of ancient and historic sites and artifacts that span approximately 10,000 years of human occupation and resource use. Ancient remains include campsites, village sites, graves, resource areas, rock art, portages, and rockshelters. Historic sites include houses, cabins, mines, trails, portages, canneries, boatworks, shipwrecks, and military installations. Many of these heritage remains provide the only record of former human occupation, work areas, and lifestyles.

The Tongass has implemented a Forest-wide heritage database (INFRA) to provide a more definitive tracking system for heritage surveys and sites. Based on this database, as of the end of Fiscal Year 2005, approximately 295,567 acres of National Forest System (NFS) lands have been inventoried for heritage resources and 2,096 heritage resource sites have been identified. As of the end of Fiscal Year 2005, 22 heritage resource sites or properties are listed in the National Register of Historic Places (National Register), while 878 sites or properties have been determined eligible for listing either through concurrence with the Alaska State Historic Preservation Office (SHPO) or by a decision of the keeper of the National Register. The Forest has added 421 newly discovered sites to the Alaska Heritage Resource Survey (a state-wide listing of heritage resources) in the last 4 years. Only a small portion of the Tongass National Forest has been surveyed; therefore, additional heritage sites are expected to be located within the Forest in the future. Information gathered from these inventory efforts provides information about heritage resource distribution and sensitivity to damage. Specific locations associated with Alaska Native traditional and religious use (sacred sites) are identified on an ongoing basis, with site-specific data kept confidential.

Certain types of heritage resources, such as sites, artifacts, and other observable results of human activity, have a greater probability of being located in specific areas, which create patterns of human use across the landscape through time. The environmental characteristics that invited human use and habitation in ancient times are often the same factors that invite use today. These high sensitivity areas, which are not evenly distributed across the landscape, are often below 100 feet in elevation and/or are areas of animal, plant, or mineral resource abundance. In addition, because of elevation and sea level changes after deglaciation, the locations of the earliest human activity areas may be farther inland and at higher elevations than more recent activity areas.

The Forest has established and maintains a heritage resource management program to identify, evaluate, protect, and enhance significant heritage resources on a Forest-wide and project-specific level in compliance with the National Historic Preservation Act (NHPA), as amended, as well as a number of other acts and implementing regulations. The Forest's ability to protect its heritage resources is affected by four factors: the location of the heritage property, the type of management activity conducted in that location, the environmental characteristics of the locality, and an active, effective heritage resource management program. Impacts to the resource may result from natural forces, public use, or project-related activities. Future management options will vary and are likely to be influenced by increased demands for scientific study, educational interpretation, public enjoyment, and preservation of traditional resources and sacred sites.

Inventory of these heritage resources is an ongoing process. Information gathered from inventories will provide insight into resource distribution and the sensitivity of sites to damage. Further scientific study will increase knowledge about early human migration, later exploration and development of the region, and human behavior in response to social and environmental change. Once data are collected, the Forest has the responsibility to curate artifacts and conserve records, photographs, and other data specific to heritage resource projects and sites under the 2005 Curation Agreement with the University of Alaska-Fairbanks Museum.

Sacred Sites

Sacred sites are places that have traditional spiritual values for Alaska Native people (Indian tribes or Indian religious practitioners) that are reverently dedicated to a person, object, event, or activity, and are secured against violation or infringement or interference.

In order to protect and preserve Indian religious practices, Executive Order 13007 and other laws and Executive Orders of the U.S. Government require the Forest Service, to the extent practicable, permitted by law, and not clearly inconsistent with essential agency functions to:

- Accommodate access to, and ceremonial use of, Indian sacred sites by Indian religious practitioners,
- Avoid adversely affecting the physical integrity of sacred sites, and
- Where appropriate, maintain the confidentiality of sacred sites.

Alaska Native groups or an appropriately authoritative representative of an Indian religion shall be responsible for identifying such sites to the Forest Service as the managing agency.

The Forest has developed Sacred Sites Protection Activities within the Heritage Resources Forest-wide standards and guidelines for the management of sacred sites as an integral part of its land management. The Forest also seeks to accommodate access to, and ceremonial use of, sacred sites by Indian religious practitioners, and to avoid adversely affecting the physical integrity of these sites. As early as possible, the Forest consults with tribes and their representatives on a government-to-government basis to provide notice of proposed actions or policies that may restrict access to or adversely affect the physical integrity of sacred sites.

The Forest is developing a knowledge base about sacred sites and tribal protocols, management recommendations, proposed guidelines, policies, or concerns about proposed actions that may affect sacred sites. Management includes undertaking government-to-government consultations with Alaska Native tribes and corporations and their representatives to monitor and protect sites from public access or other disturbance as needed. The Forest is also providing information and assistance on Alaska Native rights, trust responsibilities, preserving traditional beliefs and practices, and the laws and policies affecting management of historical, cultural, and traditional uses of NFS lands.

Heritage Resource and Sacred Sites Management Program

According to Forest-wide Heritage Resource Standards and Guidelines, the Forest maintains a heritage resource and sacred sites management program to identify, evaluate, protect, and enhance ancient heritage resources on a Forest-wide and project-specific level in compliance with federal legislation, their amendments, and implementing regulations. This includes coordinating management of heritage resources with the Alaska SHPO, Advisory Council on Historic Preservation (ACHP), and neighboring Alaska Native tribes and corporations. ACHP outlines this historic preservation review process in the Code of Federal Regulations (CFR) (36 CFR 800). Public involvement is a cornerstone of successful Section 106 review, and 1992 amendments to the NHPA place major emphasis on the role of Indian tribes. Subsequent revisions to ACHP's regulations, published December 12, 2000, incorporate specific provisions for federal agencies to involve Indian tribes throughout the Section 106 review process.

Heritage resource activities also include identifying and developing appropriate interpretive messages for heritage resource sites and activities; coordinating the management, access, and use of forest products to perpetuate Alaska Native culture and art forms; and developing a heritage resource management assessment that provides a framework for management decisions. The Forest annually reports upon all activities of the Heritage Program to the Alaska SHPO and the ACHP as stipulated in their Programmatic Agreement.

The Programmatic Agreement between the Forest Service – Alaska Region, ACHP, and Alaska SHPO regarding heritage resource management on National Forests was first signed in 1995, with amendments in 1999 and 2002. The purpose of this Agreement is to expedite compliance with the ACHP’s regulations (36 CFR 800) implementing Section 106 of the NHPA. In lieu of the individual undertaking procedural requirements of the regulations, implementation of the Agreement enables the Forest Service to fufill some of its Section 110 responsibilities, such as the continuation of preservation and fostering appreciation of heritage resources through inventory, evaluation, protection, research, enhancement, education, restoration, stewardship, and interpretation programs. These programs are part of an effective heritage resource management program focused on heritage stewardship and public outreach. Section 110 of the NHPA and Executive Order 13287 directs federal agencies to use, to the maximum extent feasible, historic properties available to the agency. This direction must be taken into account as the agency considers the future of its administrative and recreation facilities in light of decreasing budgets. The Agreement recognizes the role of consultation with Alaska Native tribes and corporations on a government-to-government basis as well as the public.

The active participation of Alaska Native tribes and corporations and Alaska Native religious practitioners is critical to the success of sacred sites management. Heritage resource and tribal government relations specialists will collaborate to provide the Forest’s line officers information necessary to make decisions related to sacred sites management. Tribal consultation will be conducted in a professional manner with tribal government officials, recognized Tribal Elders, and authoritative representatives. The consultation process will include regular review of proposed federal actions, development of a sacred sites knowledge base, protection of the physical integrity of sacred sites, and use alternative dispute resolution processes, if needed. The Forest will implement procedures to protect confidential information related to sacred sites.

If a tribal government chooses not to consult, the Forest will rely on the best available information to make decisions about sacred sites.

Environmental Consequences

Direct and Indirect Effects

Erosion and other environmental processes may deteriorate heritage sites through decomposition or mechanical destruction. Decomposition is most evident in objects or structures made of wood. Stabilization, regular maintenance, rehabilitation, and data recovery are means for preventing the loss of such objects or structures and the information they contain.

Public use may destroy heritage sites or sacred sites inadvertently or by intent. Inadvertent damage results from accessing sites resulting in compaction, or from other ground-disturbing activities. Intentional damage is looting and vandalism, including relic collecting, theft, and defacement, which result in the loss of information and destruction of the resource. Significant sites may be protected from destructive public uses by establishing public education programs, maintaining confidentiality about site-specific locations, monitoring, and directing public use away from the most vulnerable sites.

Areas managed for recreation provide opportunities for heritage resource protection and interpretation to promote public education and enjoyment. Active educational and interpretive programs can create a greater awareness of the importance of heritage resources and foster a sense of stewardship, while adding to the recreational experience. At the same time, protective measures must be implemented to control or eliminate intentional destruction of these areas by relic collecting, theft, and other forms of vandalism.

While multiple-use activities have benefited heritage resources by providing opportunities for inventory, evaluation, and interpretation in remote areas of the Forest, ground-disturbing activities have the most potential to adversely affect these resources and their environmental settings. The amount of impact an activity has is determined largely by the location and nature of the activity, the characteristics of the soils, and the degree of use.

Heritage resource and sacred sites management may increase the cost of project implementation. Some areas may need to be avoided entirely in order to protect the resource. This may increase the cost of site access and result in some loss of commercial products, such as timber. Protection of significant heritage resources or sacred sites often precludes ground-disturbing activities within a designated site boundary. When preservation of heritage resources in place is not desired or possible, mitigation of adverse effects to the resources may be necessary, and this in turn may delay projects and increase project costs. Normally, when the Section 106 process of the NHPA is completed early in the planning process, project delays and additional costs are minimal.

Under all of the alternatives, the preferred management of heritage resource sites eligible for, nominated to, or listed in the National Register is avoidance and protection. When this is not possible or feasible, it may be necessary to implement a mitigation program in order to achieve a finding of no adverse effect. Mitigation plans are developed in consultation with the Alaska SHPO, ACHP, Alaska Native tribes and corporations, and, possibly, other consulting parties. The potential for adverse effects, and therefore the need for mitigation, is diminished when the physical settings around significant heritage resources are maintained in a natural state.

Management of sacred sites includes early consultation with Indian religious practitioners and Indian tribes, development of site-specific protection strategies and enforcement mechanisms, and protection of the confidentiality of site-specific information. If sacred sites are identified during a project, the surrounding natural environment should be maintained and protected while consultation takes place and a protection plan is developed. If a sacred site is inadvertently disturbed or sacred or burial objects are exposed by natural causes, affiliated tribal governments will be notified within 24 hours.

LUDs allowing timber harvesting, mining, and road construction are most likely to affect heritage resources or sacred sites through alteration of environmental settings or damage to unknown sites as projects are implemented. However, existing standards and guidelines (e.g., those for riparian and beach and estuary buffer zones) result in the protection of most of the Forest's heritage resources. Recreation and special uses pose the greatest threat to heritage resources or sacred sites today, simply because people want to recreate and use the forest in the same places people have for thousands of years. In many instances, retention of a natural setting is crucial to imparting and protecting the values that qualify a heritage resource for National Register status or allow the undertaking of religious practices at sacred sites. Conversely, the opportunity for identifying new heritage resource sites is greater within these areas because such developments require more intensive heritage resource inventory efforts. ACHP, in their direction on sacred sites, point to the possibility that a sacred site (per Executive Order 13007) may not meet the eligibility criteria for the National Register. For example, a property with poor integrity might not be eligible to the National Register, but it may still be an important sacred site worthy of protection and other future management under EO 13007. An indirect effect common to all alternatives and prescriptions is that the discovery of new sites can lead to vandalism if locations become known to the public. An indirect effect specific to alternatives with proposed Wilderness designations is that such designation can indirectly lead to adverse effects to historic structures.

Potential effects to heritage resources and the differences in risk between the alternatives are difficult to measure. Table 3.18-1 identifies the maximum estimated acres of old growth and second growth that can be harvested and miles of road likely to be constructed under each alternative. These acreages and mileages provide relative indicators of potential adverse effects, with the alternatives having the most acreage and mileage are likely to produce the highest risk of effects. Under this scenario, Alternatives 4 and 7 have the highest risk because they include more area where development would be permitted. They would be followed by Alternatives 5, 6, 3, 2, and 1, in decreasing order of risk level. However, because project areas are inventoried for ancient and historic heritage resource sites and tribal consultation for sacred sites should occur prior to implementation and avoidance of impacts is the preferred option for resource protection, the levels of risk are considered relatively low for all alternatives. In addition, existing standards and guidelines should result in the protection of most heritage resources and sacred sites in those areas.

Table 3.18-1
Approximate Maximum Acres Likely to be Disturbed over 100+ Years

Alternative	Estimated Maximum Acres of Old Growth to be Harvested	Estimated Maximum Acres of Second Growth to be Harvested	Estimated Maximum Miles of New Road Construction
1	85,972	58,293	774
2	214,511	179,426	2,079
3	313,426	200,250	2,799
4	656,473	235,513	4,890
5	462,556	224,027	3,874
6	445,103	218,368	3,744
7	807,396	262,228	5,825

Source: Tongass National Forest GIS database

While it is true that increased project activity might accelerate the loss of heritage resources, primarily by improving public access and increasing the probability for looting and vandalism of heritage resource sites, there are potential positive effects as well. Over time, decay, neglect, and natural landscape changes threaten the preservation of significant heritage resources. By expanding the Forest's inventory of its heritage resources, development projects result in identification of many sites that might otherwise decay unnoticed. Once sites are known, the Forest is better able to protect and encourage collection of information from a greater number of them. By providing sufficient staff and funding to monitor known heritage resources and sacred sites, the Forest should be able to minimize looting and vandalism.

The Forest Plan and all of the alternatives include requirements for inventory, protection, preservation, and interpretation, and for consultation with Indian tribes or Indian religious practitioners and the Alaska SHPO as described in the Heritage Resource Standards and Guidelines. Effects are avoided or mitigated through a variety of measures at the project level. Avoidance measures may include protective enclosures, systematic monitoring of project activities, or mandatory restrictions on project design. Mitigation at heritage resources is undertaken when impacts cannot be avoided, and includes systematic recovery of the information through excavation, collection of materials, and detailed documentation as determined through consultation with the Alaska SHPO, ACHP, Indian tribes, and others. Protection of significant heritage resource sites and sacred sites from damage through public use includes establishing public education programs, maintaining confidentiality about specific locations, monitoring, and directing public use away from the vulnerable sites. The Forest is also required to consult with Alaska Native tribes and corporations when effects may involve sites of religious and/or cultural importance to them.

Cumulative Effects

The vast majority of Southeast Alaska (16.8 million acres) is occupied by the Tongass National Forest, so the disturbances described above for the Tongass are the major disturbances affecting heritage resources. However, Glacier Bay National Park, Haines State Forest, and other ownerships in the Haines/Skagway area occupy 3.6 million acres, while state, Native corporations, and other ownerships inside the Forest boundary occupy a combined 1.1 million acres. Therefore, activities on these lands contribute to Southeast Alaska cumulative effects. Disturbances in Glacier Bay and Haines/Skagway National Parks are generally very minor and contribute insignificantly to cumulative effects. However, extensive timber harvest, road construction, and urban development occur on these other ownerships. Because of the level of inventory required prior to development and the level of heritage resource protection required for discovered resources on Tongass National Forest lands, none of the alternatives should contribute significantly to the cumulative effects on heritage resources of Southeast Alaska.

Extensive landscape changes and ground disturbance have occurred and will continue to occur on many non-federal lands in Southeast Alaska. Federal laws requiring consideration for the protection of heritage resources do not apply to non-federal lands. Heritage resources are nonrenewable, and once disturbed they are permanently damaged or destroyed; their information and values are lost and cannot be recovered. Preservation of these resources and values on federal lands is critical so that future generations can continue to enjoy the heritage and knowledge about our past that we enjoy today.

Roadless Areas

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Affected Environment

This section addresses inventoried roadless areas. The discussion is divided into three parts: the current roadless area inventory, the roadless area conservation rule, and the current situation on the Tongass.

Roadless Area Inventory

The 1996 Tongass roadless inventory was updated following the March 2001 U.S. District Court of Alaska ruling (*Sierra Club v. Lyons*), which ordered the Forest Service to prepare a Supplemental EIS (SEIS) to evaluate roadless areas and to consider wilderness recommendations. As part of that effort, the Analysis of the Management Situation relative to roadless areas and their relative contribution to the National Wilderness Preservation System was completed.

Roadless Area Terms

Roadless Area: For purposes of this EIS, this is a generic term that includes inventoried roadless areas and unroaded areas.

Inventoried Roadless Area: An undeveloped area typically exceeding 5,000 acres that meets the minimum criteria for wilderness consideration under the Wilderness Act.

Unroaded Area: An undeveloped area typically less than 5,000 acres but of a size and configuration sufficient to protect the inherent characteristics associated with its roadless condition.

This process involved a comprehensive update of the inventory of existing roads (including all classified and unclassified roads), harvest units, and land ownership on the Tongass National Forest. Developed areas were subsequently identified by buffering existing roads and harvest units. All areas within 1,200 feet of an existing road and within 600 feet of an existing harvest unit were considered developed; however, in order to be more inclusive, isolated beach-logged and helicopter units were not identified as developed areas. Narrow stringers of land between developed areas were also included as developed. All National Forest System (NFS) lands outside of areas defined as developed were identified as roadless areas. These roadless areas were then divided into two groups: areas greater than 5,000 acres and areas less than 5,000 acres. Inventoried roadless areas were identified as all roadless areas greater than 5,000 acres, as well as all inventoried roadless areas identified in previous inventories, which included some areas less than 5,000 acres. In addition, all other areas less than 5,000 acres were examined to determine if they were eligible for wilderness consideration. These included small roadless areas adjacent to existing wilderness.

The final inventory identified in the Final SEIS included 109 inventoried roadless areas covering 9.6 million acres. These inventoried roadless areas and other unroaded areas on the Tongass are identified on the roadless inventory map produced as part of this assessment and currently available on the SEIS Web site at www.tongass-seis.net.

Detailed descriptions of each individual roadless area that include an overview and a description of the capability, availability, and need for each area to be designated as wilderness are included as Appendix C to the Final SEIS (USDA Forest Service 2003b) and are also available on the SEIS Web site. These descriptions reflect current conditions and Forest Service Manual and Handbook direction. They also include an updated rating for each roadless area called the Wilderness Attribute Rating System (WARS), as well as a description of how each individual roadless area could contribute to the National Wilderness Preservation System.

The roadless area inventory displays the extent of the roadless resource and provides data for use by managers, legislators, and others to formulate land management proposals. Roadless areas may retain their roadless character by being managed in a way that emphasizes relatively large undeveloped or natural areas, such as areas usually required for old-growth habitat, scenic backdrops, or primitive recreation. Roadless areas identified in the inventory that are outside of existing the Wilderness Land Use Designation (LUD) may be considered for wilderness recommendation, or managed for a wide range of other resource management activities.

On the Tongass, the goals for a number of LUDs include the maintenance of areas in a primarily roadless state. One of these is called LUD II; these areas are to be managed in a roadless state to retain their wildland character. LUD II is a permanent LUD that was used by Congress in the Tongass Timber Reform Act (TTRA). TTRA established 12 permanent LUD II areas totaling 730,463 acres (including 2,701 acres of non-NFS land) (Table 3.19-1).

Table 3.19-1
National Forest System Land, Non-National Forest System Land, and Productive Old Growth within Each of the Legislated LUD II Areas Designated by the Tongass Timber Reform Act (in acres)

Name of LUD II Area	Total	National Forest System	Non-National Forest System	Productive Old Growth
Yakutat	139,045	139,035	10	72,312
Berners Bay	45,233	45,233	0	15,390
Anan	38,313	38,313	0	16,426
Kadashan	34,441	34,281	160	20,609
Lisianski/Upper Hoonah	149,088	147,132	1,956	44,178
Mt. Calder-Holbrook	60,863	60,863	0	38,682
Nutkwa	21,723	21,723	0	13,102
Outside Islands	75,720	75,342	378	45,999
Trap Bay	6,595	6,595	0	4,297
Pt. Adolphus/Mud Bay	116,877	116,695	182	38,249
Naha	31,365	31,350	15	17,875
Salmon Bay	11,200	11,200	0	4,811
Total	**730,463**	**727,762**	**2,701**	**331,930**

Source: USDA Forest Service 1997a, Table 3-55.

Roadless Area Conservation Rule

In May 2001, the Forest Service issued the Roadless Area Conservation Rule (Roadless Rule). This rule established prohibitions on road construction, road reconstruction, and timber harvest in inventoried roadless areas on NFS lands. In May 2001, the U.S. District Court for the District of Idaho enjoined the Forest Service from implementing the Roadless Rule, a decision that was subsequently appealed. In December 2002, a three-justice panel of the Ninth Circuit Court of Appeals reversed the Idaho ruling. The case was returned to the Idaho District Court for evaluation of the merits, and the State of Idaho then requested review by the full Ninth Circuit. Several other states, including the State of Alaska, filed lawsuits similar to that filed by the State of Idaho.

The litigation with the State of Alaska was settled in June 2003 and resulted in the July publication of a proposal to temporarily exempt the Tongass National Forest from the prohibitions of the Roadless Rule. On December 30, 2003, the Department of Agriculture adopted a final rule that withdrew the Tongass National Forest from the Roadless Rule, and the management of inventoried roadless areas on the Tongass is currently governed by the 1997 Forest Plan.

In May 2005, in response to legal challenges and the ongoing controversy surrounding the Roadless Rule, the Forest Service issued the Special Areas; State Petitions for Inventoried Roadless Area Management Final Rule, and decision memo (State Petitions Rule), which amended the Roadless Rule and established a petitioning process that provides Governors an opportunity to seek establishment of or adjustment to management requirements for NFS inventoried roadless areas within their states. Governors had until November 2006 to submit petitions.

Three states—California, Oregon, and New Mexico—filed a lawsuit in August 2005 challenging the May 2005 amendment, with Washington State later joining the case. In addition, Earthjustice filed a similar lawsuit in October 2005 on behalf of 20 environmental groups. The U.S. District Court, Northern District of California ruling on this case in October 2006 overturned the State Petitions Rule and reinstated the Roadless Rule, including the Tongass Amendment. (Updated information on the Roadless Rule is regularly posted on the Forest Service's Roadless Area Conservation Web site [www.roadless.fs.fed.us]).

The inventoried roadless areas included in the 2001 Roadless Rule are identified in a set of maps, contained in the Forest Service Roadless Area Conservation, Final Environmental Impact Statement, Volume 2, dated November 2000. For the Tongass, these maps represent 9.3 million acres and correspond closely with the 1996 roadless area inventory that was done for the 1997 Forest Plan Revision. Table 3.19-2 compares the areas protected by the Roadless Rule with the areas included in inventoried roadless areas for the 2003 Final SEIS, which covers 9.6 million acres. The differences are due to additional road building between 1996 and 2003, refinements of boundaries in 2003, and projects that were expected to be built in 1996 that were never implemented. Approximately 9.1 million of the 9.6 million acres in the Final SEIS inventoried roadless areas are also included under the Roadless Rule.

Current Situation

The Tongass National Forest, the largest Forest in the NFS, is more than 90 percent roadless, including wilderness. Only small areas where communities are developing, or where road construction and timber harvest have occurred, are "developed" to any noticeable degree. At various times in the past, "boom and bust" development (associated with fox farming, salmon canneries, mining, and military activity) resulted in the temporary development and occupation of small areas, mostly near the shoreline, that have since been largely reclaimed by nature. Developed areas cover about 1.3 million acres, or about 8 percent, of the Tongass (based on the updated roadless mapping described above). Southeast Alaska residents (approximately 71,000) are, for the most part, surrounded by land that has many of the characteristics of wilderness. Routine travel and ordinary outdoor recreation activities typically require a higher degree of skill, risk-taking, and self-reliance than is usually required of adventurous backcountry visitors on other National Forests. This wildness and the lifestyles associated with it are highly prized by residents and visitors alike.

Summary information is presented for the 109 inventoried roadless areas evaluated in the 2003 Final SEIS in Table 3.19-3 (USDA Forest Service 2003b). This information includes the size of each area in 2003, the amount of each area that is in productive old growth (POG), and the amount of each area that is considered suitable for timber harvest. The table also lists the WARS score for each of the roadless areas as a general indication of the wilderness attributes of the area. There are currently 9,514,105 acres in Inventoried Roadless Areas (IRAs) on the Tongass. This represents about a 44,000-acre reduction since the 2003 analysis, which is due to land adjustments, refinements to boundaries, additional road construction and harvest activity, and mapping corrections. If the additional 5,749,083 acres of the Tongass in Wilderness and Wilderness National Monument are combined with the IRA acreage, the total of 15,263,188 acres represents 91 percent of the Tongass.

Table 3.19-2
Tongass National Forest Inventoried Roadless Areas Analyzed in the Final 2003 SEIS Compared with Roadless Areas Covered by the Roadless Area Conservation Rule

Roadless Area Number	Roadless Area Name	Final SEIS National Forest Acres	Roadless Rule National Forest Acres	Acreage Difference
201	Fanshaw	48,446	48,194	252
202	Spires	542,829	533,269	9,560
203	Thomas	5,232	0	5,232
204	Madan	69,126	68,502	624
205	Aaron	79,147	78,689	458
206	Cone	127,874	127,776	98
207	Harding	179,350	174,209	5,141
208	Bradfield	204,133	198,919	5,214
209	Anan	38,162	36,648	1,514
210	Frosty	45,522	39,865	5,656
211	North Kupreanof	99,566	114,590	(15,023)
212	Missionary	14,825	16,662	(1,837)
213	Five Mile	19,284	19,433	(149)
214	South Kupreanof	213,122	216,645	(3,523)
215	Castle	52,432	49,151	3,281
216	Lindenberg	25,136	25,836	(699)
217	Green Rocks	11,059	11,074	(15)
218	Woewodski	10,647	10,046	601
220	East Mitkof	9,444	8,770	674
223	Manzanita	10,436	8,394	2,042
224	Crystal	19,609	18,962	647
225	Kadin	2,022	2,022	0
227	North Wrangell	11,602	8,089	3,513
229	South Wrangell	14,959	14,211	748
231	Woronkofski	12,932	11,097	1,835
232	North Etolin	41,740	40,911	829
233	Mosman	56,757	53,226	3,531
234	South Etolin	28,678	26,230	2,449
235	West Zarembo	8,544	6,781	1,764
236	East Zarembo	16,175	10,844	5,331
237	South Zarembo	41,999	36,246	5,752
238	Kashevarof Islands	5,743	4,623	1,120
239	Keku	11,170	10,829	340
240	Security	35,497	31,375	4,122
241	North Kuiu	9,544	6,352	3,192
242	Camden	40,395	36,671	3,725
243	Rocky Pass	79,103	77,580	1,523
244	Bay of Pillars	28,728	27,363	1,365
245	East Kuiu	46,395	27,513	18,882
246	South Kuiu	63,063	62,150	913
247	East Wrangell	7,634	7,610	24
288	West Wrangell	-	10,281	(10,281)
289	Central Wrangell	15,210	13,394	1,815
290	Southeast Wrangell	20,297	18,363	1,934
301	Juneau-Skagway Icefield	1,201,473	1,186,606	14,867
302	Taku-Snettisham	685,712	662,400	23,312
303	Sullivan	66,143	67,252	(1,110)
304	Chilkat-West Lynn Canal	198,109	199,418	(1,310)
305	Juneau Urban	94,800	101,518	(6,718)
306	Mansfield Peninsula	51,988	54,883	(2,895)
307	Greens Creek	19,959	27,166	(7,207)
308	Windham-Port Houghton	161,922	161,697	225
310	Douglas Island	25,008	28,055	(3,047)
311	Chichagof	534,309	555,200	(20,891)
312	Trap Bay	13,821	13,213	608
313	Rhine	16,675	22,979	(6,304)
314	Point Craven	10,961	10,900	61
317	Point Augusta	15,629	15,438	191

Table 3.19-2 (continued)
Tongass National Forest Inventoried Roadless Areas Analyzed in the Final 2003 SEIS Compared with Roadless Areas Covered by the Roadless Area Conservation Rule

Roadless Area Number	Roadless Area Name	Final SEIS National Forest Acres	Roadless Rule National Forest Acres	Acreage Difference
318	Whitestone	5,747	5,617	130
319	Pavlof-East Point	4,731	5,368	(638)
321	Tenakee Ridge	21,854	20,523	1,330
323	Game Creek	51,436	54,432	(2,995)
325	Freshwater Bay	47,070	44,909	2,160
326	North Kruzof	25,373	32,961	(7,588)
327	Middle Kruzof	15,127	14,698	428
328	Hoonah Sound	97,329	79,661	17,668
329	South Kruzof	55,726	55,074	653
330	North Baranof	324,317	313,611	10,706
331	Sitka Urban	114,460	111,983	2,477
332	Sitka Sound	20,878	13,390	7,488
333	Redoubt	74,570	67,993	6,577
334	Port Alexander	124,021	120,183	3,838
338	Brabazon Addition	500,597	498,589	2,008
339	Yakutat Forelands	337,374	321,402	15,973
341	Upper Situk	18,411	16,772	1,639
342	Neka Mountain	53,019	6,130	46,889
343	Neka Bay	7,826	7,090	736
501	Dall Island	111,245	105,178	6,066
502	Suemez Island	24,478	19,853	4,626
503	Outer Islands	99,891	99,439	452
504	Sukkwan	49,759	44,055	5,704
505	Soda Bay	63,147	77,937	(14,790)
507	Eudora	200,493	194,220	6,273
508	Christoval	7,367	9,081	(1,714)
509	Kogish	71,420	65,081	6,340
510	Karta	55,527	52,106	3,421
511	Thorne River	74,362	72,971	1,391
512	Ratz	6,414	5,323	1,091
514	Sarkar	62,170	51,635	10,535
515	Kosciusko	71,578	63,878	7,699
516	Calder	12,218	9,807	2,411
517	El Capitan	30,854	26,688	4,166
518	Salmon Bay	27,412	22,697	4,714
519	McKenzie	80,650	82,766	(2,117)
520	Kasaan	7,605	7,573	31
521	Duke	46,863	44,535	2,328
522	Gravina	38,978	37,299	1,679
523	South Revilla	53,559	51,942	1,617
524	Revilla	30,941	29,293	1,648
525	Behm Islands	4,944	4,735	210
526	North Revilla	225,444	215,371	10,073
528	Cleveland	191,477	189,007	2,471
529	North Cleveland	109,639	105,131	4,509
530	Hyder	116,304	121,703	(5,399)
531	Nutkwa	56,818	53,632	3,186
532	Fake Pass	876	466	410
533	Hydaburg	13,720	11,161	2,559
534	Twelvemile	34,333	37,921	(3,587)
535	Carroll	11,180	11,364	(184)
536	Kasaan Bay	-	7,358	(7,358)
577	Quartz	146,657	142,941	3,716
	Total Acres	**9,558,266**	**9,320,651**	**237,613**

Table 3.19-3
Tongass National Forest Inventoried Roadless Area Descriptors (2003)

Roadless Area Number	Roadless Area Name	National Forest Acres	Productive Old-Growth Forest Acres	Estimated Suitable Forest Lands Acres[1]	Wilderness Attribute Rating (WARS)[2,3]
201	Fanshaw	48,443	29,508	8,251	26
202	Spires	543,319	68,220	6,833	26(27)
203	Thomas	5,297	2,031	480	18
204	Madan	69,128	33,372	11,386	25
205	Aaron	79,147	17,159	4	27
206	Cone	127,874	10,698	-	28
207	Harding	179,350	58,288	3,165	20(22)
208	Bradfield	204,128	23,623	1,999	20
209	Anan	38,162	16,038	-	22
210	Frosty	45,522	22,583	4,989	19(21,24)
211	North Kupreanof	103,094	20,746	5,475	19(22)
212	Missionary	17,382	7,307	1,709	16
213	Five Mile	19,272	8,247	2,232	23
214	South Kupreanof	215,391	82,241	19,365	24
215	Castle	52,432	20,313	3,098	25
216	Lindenberg	26,757	11,793	4,639	18
217	Green Rocks	11,216	5,052	337	19
218	Woewodski	10,632	5,786	2,346	21
220	East Mitkof	10,332	3,502	427	15
223	Manzanita	10,792	6,037	1,921	18
224	Crystal	20,003	8,330	2,129	19
225	Kadin	2,022	1,997	-	20
227	North Wrangell	11,518	7,202	2,206	15(17)
229	South Wrangell	14,959	6,489	1,935	20
231	Woronkofski	12,932	6,690	2,216	20
232	North Etolin	42,519	20,276	3,973	18
233	Mosman	56,757	27,040	5,576	22(21,23,24)
234	South Etolin	28,678	11,109	3,204	24(23,25)
235	West Zarembo	8,544	3,945	68	14
236	East Zarembo	21,469	7,113	2,490	14
237	South Zarembo	42,191	17,294	3,634	20
238	Kashevarof Islands	5,743	4,197	-	23
239	Keku	10,770	6,266	1,096	19
240	Security	35,952	24,185	1,510	22
241	North Kuiu	10,214	8,479	3,538	15
242	Camden	40,260	20,549	5,901	23(19,26)
243	Rocky Pass	81,107	39,493	863	26
244	Bay of Pillars	28,994	20,541	3	25
245	East Kuiu	46,438	29,626	7,656	26
246	South Kuiu	63,063	37,388	-	27
247	East Wrangell	7,634	5,032	1,241	17
289	Central Wrangell	15,654	6,887	1,326	16
290	Southeast Wrangell	20,353	8,686	1,109	17
301	Juneau-Skagway Icefield	1,201,474	60,528	1,722	25(24,25)
302	Taku-Snettisham	685,704	99,498	4,027	24
303	Sullivan	66,143	12,883	955	26
304	Chilkat-West Lynn Canal	198,525	47,442	5,981	25
305	Juneau Urban	95,633	34,833	3,256	21
306	Mansfield Peninsula	52,553	25,794	-	20
307	Greens Creek	20,703	12,464	-	19(22)
308	Windham-Port Houghton	161,867	107,308	20,546	25(25,25)
310	Douglas Island	27,761	13,557	-	17
311	Chichagof	545,419	173,701	11,164	25(20,22,23,23,26,26)
312	Trap Bay	13,923	7,058	266	19(23)
313	Rhine	19,628	2,332	335	18
314	Point Craven	11,310	6,907	895	18
317	Point Augusta	15,629	9,246	1,170	19(20)

Table 3.19-3 (continued)
Tongass National Forest Roadless Area Descriptors

Roadless Area Number	Roadless Area Name	National Forest Acres	Productive Old-Growth Forest Acres	Estimated Suitable Forest Lands Acres[1]	Wilderness Attribute Rating (WARS)[2,3]
318	Whitestone	5,745	2,841	439	19
319	Pavlof-East Point	5,348	3,628	255	16
321	Tenakee Ridge	22,014	6,375	1,309	18
323	Game Creek	51,994	18,999	2,243	18
325	Freshwater Bay	48,227	18,612	1,928	17
326	North Kruzof	25,373	12,519	489	22
327	Middle Kruzof	15,127	7,894	1,815	15
328	Hoonah Sound	97,329	34,993	2,226	25
329	South Kruzof	55,840	17,164	885	22
330	North Baranof	331,425	82,901	6,521	25
331	Sitka Urban	114,875	13,747	550	20
332	Sitka Sound	20,878	10,260	486	20
333	Redoubt	74,516	33,122	1,448	21
334	Port Alexander	124,021	30,875	-	25
338	Brabazon Addition	500,597		-	27
339	Yakutat Forelands	336,976	34,829	4,137	22
341	Upper Situk	18,411	6,885	1,236	19
342	Neka Mountain	53,014	23,090	2,066	21
343	Neka Bay	7,826	4,128	-	20
501	Dall Island	110,667	64,784	2,547	23(21,23,24)
502	Suemez Island	24,940	15,060	2,904	20
503	Outer Islands	99,873	52,919	1,170	23(25)
504	Sukkwan	49,614	19,801	1,829	23
505	Soda Bay	63,363	21,288	5,621	20(20,20)
507	Eudora	201,729	87,687	11,572	24(19.25)
508	Christoval	7,367	5,396	24	19
509	Kogish	72,553	29,497	8,090	20(23)
510	Karta	56,816	19,863	6,121	19
511	Thorne River	76,454	38,611	2,816	21(22)
512	Ratz	6,414	3,298	812	19
514	Sarkar	63,656	30,407	2,177	23
515	Kosciusko	71,613	40,810	3,013	24
516	Calder	12,519	8,983	302	22
517	El Capitan	31,141	16,658	3,046	20
518	Salmon Bay	28,602	11,157	1,682	20
519	McKenzie	83,822	30,391	4,849	22(24)
520	Kasaan	7,602	3,082	-	18
521	Duke	46,863	7,360	-	26
522	Gravina	38,845	18,849	4,468	21
523	South Revilla	55,321	21,896	1,598	20(19,20,22)
524	Revilla	30,826	10,427	585	17
525	Behm Islands	4,943	3,263	-	14
526	North Revilla	230,679	102,108	10,274	20(18,19,21,22,23)
528	Cleveland	191,363	98,658	15,556	25
529	North Cleveland	109,639	47,354	199	26
530	Hyder	122,408	11,135	54	25
531	Nutkwa	56,477	32,739	4,697	23
532	Fake Pass	876	765	-	22
533	Hydaburg	13,688	7,880	-	19
534	Twelvemile	36,171	11,811	1,035	16
535	Carroll	11,152	4,474	1,744	16
577	Quartz	146,655	48,475	-	25
	Total Acres	**9,558,266**	**2,684,657**	**307,465**	

[1] The estimated suitable acreage is based on the 1997 Tongass Forest Plan and was adjusted by the Model Implementation Reduction Factor (MIRF) and a Scheduling factor (see the *Timber* section of this chapter).

[2] The Wilderness Attribute Rating System (WARS), which was developed as part of the Roadless Area Review and Evaluation (RARE) II process in 1977, has a potential range from a minimum of 4 to a maximum of 28. WARS considers four main attributes and several supplemental ones. The main attributes are natural integrity, apparent naturalness, opportunity for solitude, and opportunity for primitive recreation.

[3] When more than one number is given, the roadless area was rated once for the entire roadless area and separate rating(s) were done for identified portions of the area. The ratings for portions of the roadless area are in parentheses.

Several characteristics of roadless areas on the Tongass are rather unique relative to other areas in the NFS. The Tongass has very large undeveloped land areas that could potentially be managed as wilderness or in an unroaded condition. Several portions of the Forest constitute contiguous roadless areas exceeding 1 million acres, and thus represent large, unfragmented wildlife habitats and exceptional opportunities for solitude.

Many of the Tongass roadless areas represent wildlife habitats, ecosystems, and visual character, such as coastal islands facing the open Pacific, extensive beaches on inland saltwater, old-growth temperate rain forests, ice fields, and glaciers that exist nowhere else in the NFS. Many of these areas are remote and difficult to access for primitive recreation, and many contain other important resources, such as timber, minerals, and salmon-producing streams. Of the slightly over 1 million acres of forest land that is mapped as suitable for timber production, approximately 763,000 acres are POG forest. Approximately 307,000 acres, or 40 percent, is within roadless areas.

Environmental Consequences

Direct, Indirect, and Cumulative Effects

There are currently 9,514,103 acres in IRAs on the Tongass. The allocation of these acres by LUD is presented for each alternative in Table 3.19-4. The individual LUDs are grouped into one of four categories: Wilderness and National Monument, Natural Setting, Moderate Development, and Intensive Development. The percent of IRA acres allocated to each category is summarized for each alternative in Table 3.19-5.

In general, management prescriptions for LUDs that allow moderate to intensive development include timber harvest with associated road and log transfer facility construction. There are guidelines for the extent and visual impact of such activities. LUDs that emphasize maintaining the natural setting and undeveloped character of the area generally do not allow timber harvesting or the development of major recreation facilities, although roads linking transportation systems, particularly major state corridors, may occur.

Not all areas allocated to LUDs that allow development would actually be developed. Development would occur mainly in areas with suitable forest lands. Some of the road construction would occur in areas already roaded. Some of the road construction would fragment existing roadless areas, either creating new roadless areas (if more than 5,000 acres remains) or simply resulting in small blocks of undeveloped land surrounded by roads and harvest areas. In addition, not all of the effects of the alternatives would occur at once.

Effects of Alternatives

The roadless lands allocated to Natural Setting LUDs would essentially remain roadless for the life of the current/proposed Forest Plan and, therefore, there would be no effect on the roadless values in these areas unless a vital transportation linkage or major utility system was constructed. Site-specific environmental analysis would be undertaken if this type of development were proposed.

Roadless lands allocated to moderate and intensive development LUDs would likely change over time. The amount of acres allocated to development LUDs and acres of forest land suitable for harvest are presented in Table 3.19-6.

It should be noted that the discussion below for each alternative assumes that the current/proposed Forest Plan is in effect and does not assume any effects of the Roadless Rule that was originally promulgated in January 2001 and has since been the subject of a number of lawsuits. As noted in the Affected Environment section,

Table 3.19-4
Allocation of Inventoried Roadless Areas by LUD and Alternative (acres)

	Alternative						
	1	**2**	**3**	**4**	**5**	**6**	**7**
Wilderness and National Monument[1]							
Non-wilderness National Monument	155,092	155,092	155,092	155,092	155,092	155,092	155,092
Subtotal	**155,092**	**155,092**	**155,092**	**155,092**	**155,092**	**155,092**	**155,092**
Mostly Natural Setting							
LUD II	709,892	709,892	709,892	709,898	709,898	709,892	709,897
Research Natural Area	25,680	25,680	25,680	25,679	25,680	25,680	25,680
Old Growth	996,902	996,902	996,902	306,488	974,757	996,902	0
Special Interest Area	203,629	203,631	203,631	203,631	167,093	203,631	203,631
Enacted Municipal Watershed	39,250	39,250	39,250	39,250	39,250	39,250	39,250
Wild, Scenic, & Recreational River	101,421	101,421	101,421	101,417	101,421	101,421	101,421
Remote Recreation	2,364,733	2,340,364	2,178,552	2,085,536	2,128,353	2,030,967	2,084,639
Semi-Remote Recreation	4,890,486	4,130,193	3,431,241	2,458,814	2,781,758	2,937,123	2,527,327
Subtotal	**9,331,993**	**8,547,333**	**7,686,569**	**5,930,713**	**6,928,210**	**7,044,866**	**5,691,845**
Moderate Development							
Modified Landscape	0	104,631	246,427	497,746	360,831	354,145	572,965
Scenic Viewshed	0	93,714	199,460	554,770	344,424	312,913	599,569
Experimental Forest	27,018	27,018	27,017	27,019	12,708	27,018	27,018
Subtotal	**27,018**	**225,363**	**472,904**	**1,079,535**	**717,963**	**694,076**	**1,199,552**
Intensive Development							
Timber Production	0	586,317	1,199,538	2,348,764	1,712,839	1,620,071	2,467,614
Subtotal	**0**	**586,317**	**1,199,538**	**2,348,764**	**1,712,839**	**1,620,071**	**2,467,614**
Total	**9,514,104**	**9,514,105**	**9,514,104**	**9,514,104**	**9,514,104**	**9,514,105**	**9,514,103**

[1] Table lists only Non-wilderness National Monument in this LUD group because Wilderness and Wilderness National Monument are not identified as Inventoried Roadless Areas (IRAs), even though they are roadless. In addition to the 9,514,105 acres of IRAs, the Tongass has 5,749,083 acres of Wilderness and Wilderness National Monument , for a total of 15,,263,188 acres (representing 91% of the Tongass).

Table 3.19-5
Allocation of Inventoried Roadless Area Acreage by LUD and Alternative (percent)

	Alternative						
	1	**2**	**3**	**4**	**5**	**6**	**7**
Wilderness and National Monument[1]	2%	2%	2%	2%	2%	2%	2%
Mostly Natural Setting	98%	90%	81%	62%	73%	74%	60%
Moderate Development	0%	2%	5%	11%	8%	7%	13%
Intensive Development	0%	6%	13%	25%	18%	17%	26%
Total	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**

[1] Only Non-wilderness National Monument is included in this LUD group because Wilderness and Wilderness National Monument are not identified as Inventoried Roadless Areas (IRAs), even though they are roadless. The Tongass currently contains 15,263,188 acres (representing 91 percent of the Tongass) of roadless lands if IRAs are combined with Wilderness and Wilderness National Monument.

Table 3.19-6
Acres of Development LUDs and Forest Land Suitable for Harvest within Current Inventoried Roadless Areas[1] by Alternative

Alternative	Acres of Development LUDs (includes Experimental Forests)		Acres of Forest Land Suitable and Scheduled for Harvest[2]	
	Acres	Percent of IRA Acres	Acres	Percent of IRA Acres
1	27,018	<0.5%	0	0.0%
2	811,680	9%	88,773	0.9%
3	1,672,442	18%	185,647	2.0%
4	3,428,299	36%	497,596	5.2%
5	2,430,802	26%	315,674	3.3%
6	2,314,147	24%	306,592	3.2%
7	3,667,166	39%	583,094	6.1%

[1] Inventoried Roadless Areas (IRAs) do not include Wilderness and Wilderness National Monument, even though they are roadless. In addition to the 9,514,105 acres of IRAs, the Tongass has 5,749,083 acres of Wilderness and Wilderness National Monument, for a total of 15,263,188 acres (representing 91 of the Tongass).
[2] Incorporates a reduction of 33 to 51 percent from mapped suitable, based on old-growth falldown and scheduling factors.

the Roadless Rule including the Tongass Ammendment, was reinstated in October 2006 by the U.S. District Court, Northern District of California.

Alternative 1

This alternative would keep virtually all existing IRAs in a natural condition. Less than 0.5 percent of the IRAs would be allocated to development LUDs under this alternative, compared to 26 percent under Alternative 5 (No Action). Less than 0.1 percent of the IRAs (less than 200 acres) would potentially be harvested (Table 3.19-6).

Alternative 2

This alternative keeps most IRAs in a natural condition, with timber harvest featured on lands outside of these roadless areas except for some areas where roads could logically be extended. Approximately 9 percent of the IRAs would be allocated to development LUDs under this alternative, compared to 26 percent under Alternative 5 (No Action). Approximately 0.9 percent of the IRAs (89,000 acres) would potentially be harvested under this alternative (Table 3.19-6).

Alternative 3

This alternative would keep the 23 areas proposed for wilderness in House Resolution 987 and the 18 Areas of Special Interest in the 1999 ROD in a natural condition. Approximately 18 percent of the IRAs would be allocated to development LUDs under this alternative, compared to 26 percent under Alternative 5 (No Action). Approximately 2.0 percent of the existing IRAs would potentially be harvested under this alternative (Table 3.19-6).

Alternative 4

Alternative 4 would provide for a mix of National Forest uses, with a greater emphasis on timber production relative to Alternatives 1, 2, 3, 5, and 6. Timber management would occur in some IRAs not managed for timber production in the current Forest Plan. Approximately 36 percent of the IRAs would be allocated to development LUDs under this alternative, compared to 26 percent under Alternative 5 (No Action). Approximately 5.2 percent of the existing IRAs would potentially be harvested under Alternative 4 (Table 3.19-6).

Alternatives 5 and 6

Alternative 5 (No Action) is the current Forest Plan (1997 ROD, as amended) and provides for a moderately high level of timber production along with strong resource protection measures. Alternative 6 (Proposed Action) is similar to Alternative 5 (No Action), but includes an expansion of the old-growth reserves and other adjustments to the Plan based on information generated during the recent 5-Year Plan Review, minor clarifications, and updates.

Approximately 26 and 24 percent of existing IRAs would be allocated to development LUDs under Alternatives 5 and 6, respectively. Approximately 3.3 and 3.2 percent would potentially be harvested under Alternatives 5 and 6, respectively.

Alternative 7

Alternative 7 would emphasize timber production relative to the other alternatives. Timber would be managed on a larger land base than under Alternative 4. Approximately 39 percent of the IRAs would be allocated to development LUDs under this alternative and approximately 6.1 percent would potentially be harvested (Table 3.19-6).

Cumulative Effects

This section considers the incremental effects of the alternatives when added to other past, present, and reasonably foreseeable actions. The effects of past and present actions on roadless areas are included in the affected environment portion of this section, which discusses the existing IRAs on the Tongass. IRAs are identified based on past actions—specifically, timber harvest and road development, with all areas on the Forest within 1,200 feet of an existing road or within 600 feet of an existing harvest unit considered developed. Present actions include the impacts of current management policies on roadless areas.

Reasonably foreseeable actions on NFS lands include the projected levels of future timber harvest and road construction. The direct and indirect effects analysis assesses the impacts of these actions on roadless areas under each alternative in terms of the percent of the IRAs that would be allocated to development LUDs and considered suitable for harvest.

Other reasonably foreseeable actions include transportation and utility developments proposed by the State of Alaska. These proposals are summarized in the *Transportation and Utilities* section of this document and in the *Introduction* to Chapter 3. A total of 2,657 miles of roads are projected to be constructed on non-NFS lands throughout all of Southeast Alaska after full implementation of the plan (100+ years) under each of the alternatives (see Table 3.12-3). Most of the projected non-NFS roads are forest roads that would be developed for timber harvest, but the total miles also include road corridors that would connect different communities and connect additional areas in Southeast Alaska to the continental highway system. A number of these state-proposed corridors covered by Public Law 109-59, would, if approved under NEPA and funded, cross IRAs. The Lynn Canal Highway corridor, for example, crosses IRAs 301-Juneau-Skagway Icefield and 305-Juneau Urban, north of Juneau. The Sitka to Baranof Warm Springs road corridor crosses IRAs 331-Sitka Urban and 330-North Baranof. The Bradfield Canal road corridor crosses a number of IRAs, including 208-Bradfield and 207-Harding.

If one or more of these or the other state-proposed corridors that cross IRAs were developed, the overall effect would be a reduction in the existing IRAs. It is not possible at this time to predict exactly which roads would be developed. None of the alternatives is expected to affect this type of future road development, which would be expected to go or not go forward regardless of the selected alternative. The overall cumulative effect of these regional road corridors viewed in conjunction with the proposed Forest Plan alternatives would be a reduction in existing IRAs. This trend would be would be most pronounced under Alternative 7 and least pronounced under Alternative 1, which, with the exception of potential regional transportation corridors, would virtually all remaining IRAs in a natural condition.

New utility line projects, if they were to go forward, would have similar effects. Potential utility projects include power lines between Juneau and Skagway, Juneau and Hoonah, Hoonah and Tenakee Springs, Tenakee Springs and Angoon, Angoon and Sitka, Sitka and Kake, Kake and Petersburg, Thorne Bay and Ketchikan, and Klawock and Hydaburg. Also planned are powerlines between the proposed Lake Dorothy, Otter Creek, Thayer Lake, and Sunrise Lake Hydroelectric Projects and existing powerlines or communities. A powerline from the Tyee hydropower site along a potential Bradfield Canal/Craig River road corridor route to Canada is also a potential route that has been considered. None of the alternatives would affect these developments, which would be expected to go or not go forward regardless of the selected alternative. The overall cumulative effects if one or more of the utility projects that cross IRAs were developed would be a reduction in the existing IRAs; this would be most pronounced under Alternative 7 and least pronounced under Alternative 1.

The Tongass National Forest comprises about 78 percent of the land area of Southeast Alaska. Over 90 percent of the Tongass is currently roadless or wilderness. The other major land ownership in Southeast Alaska is Glacier Bay Park and Preserve (12.5 percent of Southeast Alaska), the vast majority of which is managed as wilderness by the National Park Service. In addition, the State of Alaska and the Bureau of Land Management manage another 6 percent of Southeast Alaska, a large portion of which is roadless. Combining all ownerships, approximately 90 percent of Southeast Alaska is currently roadless. In addition, it is estimated that at least 70 percent of all existing IRAs would remain roadless under any of the alternatives after 100+ years of Forest Plan implementation. As a result, it is estimated that at least 73 percent of Southeast Alaska would remain in wilderness or roadless after 100+ years (assuming all non-NFS lands become roaded, except for Glacier Bay and 50 percent of non-NFS lands in the Haines/Skagway area). Although these percentages remain high, it is likely that a higher proportion of lower elevation lands containing POG forest would become roaded over the long term.

Wilderness

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Affected Environment

Introduction

This section provides a general overview of wilderness, describes existing wilderness in Alaska and on the Tongass National Forest, discusses the relative contribution of Tongass wilderness to the National Wilderness Preservation System, and addresses wilderness management direction in Alaska. The only other National Forest in Alaska, the Chugach National Forest, currently has no designated wilderness, but includes 2 million acres of wilderness study area.

Roadless areas within the Tongass National Forest were evaluated for recommendations as potential wilderness in the 2003 Forest Plan Supplemental EIS (SEIS) (USDA Forest Service 2003b). The 2003 SEIS evaluated eight alternatives that ranged from no new recommended wilderness to 9.6 million acres (all inventoried roadless areas) of new recommended wilderness. None of the alternatives evaluated in this EIS includes new Wilderness or LUD II recommendations.

Wilderness Overview

The Wilderness Act of 1964 defines wilderness "as an area where the earth and its community of life are untrammeled by man, where man himself is a visitor who does not remain." The Act further elaborates on the definition to mean:

> an area of undeveloped federal land retaining its primeval character and influence, without permanent improvements or human habitation, which is protected and managed so as to preserve its natural conditions and which 1) generally appears to have been affected primarily by the forces of nature, with the imprint of man's work substantially unnoticeable; 2) has outstanding opportunities for solitude or a primitive and unconfined type of recreation; 3) has at least five thousand acres of land or is of sufficient size as to make practicable its preservation and use in an unimpaired condition; and 4) may also contain ecological, geological, or other features of scientific, educational, scenic, or historical value.

Wilderness Character

The Wilderness Act does not define wilderness *character*, but according to Landres et al. (2005), wilderness character may be described as the "combination of biophysical, experiential, and symbolic ideals that distinguish wilderness from all other lands." Landres et al. identify four qualities of wilderness that may be used to approximate wilderness character for the purposes of monitoring changes to wilderness character over time. These qualities, which were identified based on the Definition of Wilderness, Section 2(c) from the 1964 Wilderness Act, and are described below, are equally important and reinforce one another.

Untrammeled—The Wilderness Act states that wilderness is “an area where the earth and its community of life are untrammeled by man” and “generally appears to have been affected primarily by the forces of nature.” This quality refers to wilderness being essentially unhindered and free from modern human control or manipulation.

Natural—The Wilderness Act states that wilderness is “protected and managed so as to preserve its natural conditions.” This quality refers to the intended and unintended effects of modern people on ecological systems inside wilderness since the time of designation.

Undeveloped—The Wilderness Act states that wilderness is “an area of undeveloped federal land retaining its primeval character and influence, without permanent improvements or human habitation.” The undeveloped quality refers to the presence of structures, construction, habitations, and other evidence of modern human presence or occupation, including the development level of trails and campsites.

The undeveloped quality also refers to the absence of mechanical transport and motorized equipment. Wilderness was partly established “in order to assure that…growing mechanization, does not occupy and modify all areas within the United States…” (Wilderness Act, Section 2a).

Outstanding opportunities for solitude or a primitive and unconfined type of recreation—The Wilderness Act states that wilderness has “outstanding opportunities for solitude or a primitive and unconfined type of recreation.” This quality includes the values of inspiration and physical and mental challenge. Primitive recreation in wilderness has largely been interpreted as travel by nonmotorized and nonmechanical means. It also encompasses reliance on personal skills to travel and camp in an area. Unconfined encompasses attributes such as self-discovery, exploration, and freedom from societal and managerial controls.

The existing wilderness on the Tongass was established under the 1980 Alaska National Interest Lands Conservation Act (ANILCA) and the 1990 Tongass Timber Reform Act (TTRA), which subsequently amended ANILCA. In ANILCA, Congress reaffirmed and expanded upon the purposes of wilderness as stated in the 1964 Wilderness Act, specifically for wilderness established in Alaska. In recognition of unique situations and established uses in Alaska, ANILCA also provided a number of important specific exceptions to the prohibitions of the Wilderness Act. These included exceptions related to subsistence, access, and public use cabins among others. These exceptions are addressed in detail in the final part of this Affected Environment section and also apply to wilderness established under TTRA.

Wilderness Values

People value wilderness for a variety of reasons, but most reasons involve three central themes: the *experiential* value, the *scientific* and *ecological resource* value, and the *symbolic* and *spiritual* values (slightly modified from Hendee and Dawson 2002). The *experiential* value is the direct value of the wilderness experience. The experience is seen as valuable in its own right because of its primitive recreation, aesthetic, closeness to nature, education, freedom, solitude, simplicity, spiritual, and mystical dimensions. The value of wilderness as a *scientific* and *ecological resource* includes the importance of wilderness to science, including its importance in preservation of fauna and flora, particularly those species requiring large tracts of unmodified habitats. Finally, the *symbolic* and *spiritual* values of wilderness are represented by the high values some people place on the knowledge that wilderness exists, whether they use it or not. In a world characterized by rapid change and complexity, wilderness symbolizes comforting stability and simplicity to many.

Wilderness in Alaska and the Tongass

Congress has the sole authority for designating additions to the National Wilderness Preservation System. Congressionally designated wilderness on the Tongass National Forest comes from two pieces of legislation: ANILCA of 1980 and TTRA of 1990. Fourteen wildernesses totaling 5.5 million acres were established under ANILCA. Two of these areas, Admiralty Island and Misty Fiords, are also designated as National Monuments. Prior to ANILCA, there was no designated wilderness on the Tongass. TTRA subsequently amended ANILCA and designated five new wildernesses and one wilderness addition totaling 296,080 acres. As a result of these two pieces of legislation, there are currently 5.8 million acres of wilderness on the Tongass in 19 separate wildernesses (Table 3.20-1).

Wilderness recommendations were not considered in the 1997 Forest Plan Final EIS and Record of Decision (ROD) because additional wilderness had been created under TTRA. In March 2001, the U.S. District Court of Alaska ruled in response to a lawsuit filed by the Sierra Club (*Sierra Club v. Lyons*) and other environmental groups that the 1997 Final EIS should have considered making additional wilderness recommendations and ordered the Forest Service to prepare a Supplemental EIS (SEIS) to evaluate wilderness recommendations and update the Analysis of the Management Situation (AMS) relative to roadless areas and their relative contribution to the National Wilderness Preservation System. The Forest Service subsequently updated the AMS and determined the eligibility of each of the inventoried roadless areas for wilderness recommendation. Eight alternatives that identified roadless areas within the Tongass for recommendation as potential wilderness were evaluated in a Final SEIS to the 1997 Forest Plan Final EIS in 2003 (USDA Forest Service 2003b). The ROD for the Final SEIS concluded that it was not "the appropriate time for significantly changing land use designations on the Tongass National Forest" and did not recommend any additional wilderness on the Tongass at that time (USDA Forest Service 2003b).

The wilderness acreages summarized in Table 3.20-1 reflect the legal descriptions as reported to Congress. These acres are not exactly the same as those generated by the geographic information system (GIS) used in the analysis for the 1997 Tongass Forest Plan Revision Final EIS or for this Final EIS. The differences are due to different resolutions in mapping and the method of generating acres. The 1997 Final EIS used a point grid system to measure acreage using the GIS, based on the legal descriptions. This Final EIS measures the area based on the mapped GIS polygons. In addition, there were slight differences in mapping small islands or large rocks in saltwater. These differences in measurement and mapping result in a total wilderness acreage of 5,756,472, compared to the legal description total of 5,752,221. This represents a difference of less than 0.1 percent. The slightly higher total is used in this document for the purposes of analysis.

Table 3.20-1
Existing Wildernesses on the Tongass National Forest

Name	Total Acres	Non-National Forest Acres	National Forest Acres
Wildernesses Established December 2, 1980, by ANILCA			
Kootznoowoo Wilderness (Admiralty Island National Monument)	988,050[1]	32,129	955,858[1]
Coronation Island Wilderness	19,232	0	19,232
Endicott River Wilderness	98,729	0	98,729
Maurelle Islands Wilderness	4,937	0	4,937
Misty Fiords National Monument Wilderness	2,142,907	600	2,142,307
Petersburg Creek-Duncan Salt Chuck Wilderness	46,849	0	46,849
Russell Fiord Wilderness	348,701	0	348,701
South Baranof Wilderness	319,568	0	319,568
South Prince of Wales Wilderness	91,018	50	90,968
Stikine-LeConte Wilderness	449,951	1,025	448,926
Tebenkof Bay Wilderness	66,839	27	66,812
Tracy Arm-Fords Terror Wilderness	653,179	0	653,179
Warren Island Wilderness	11,181	0	11,181
West Chichagof-Yakobi Wilderness	265,529	1,038	264,491
Wildernesses Established November 28, 1990, by TTRA			
Chuck River Wilderness	74,990	692	74,298
Karta Wilderness	39,894	5	39,889
Kuiu Wilderness	60,581	0	60,581
Pleasant-Lemusurier-Inian Islands Wilderness	23,151	55	23,096
South Etolin Wilderness	83,371	752	82,619
Total Acreage	**5,788,657**	**36,436**	**5,752,221**

[1] Kootznoowoo Wilderness includes 18,486 acres, including 24 acres of Non-National Forest System lands in the Young Lake Addition established by TTRA, November 28, 1990.

Source: Total acreages are as reported to Congress with official boundary maps. These wildernesses include only the public lands above mean high tide.

Relative Contribution of Tongass Wilderness

General Perspective

The National Wilderness Preservation System includes almost 105 million acres. More than half of this acreage is in Alaska (Figure 3.20-1). In addition to having the largest land area in wilderness, Alaska also has the highest percentage of its land area in wilderness among the 50 states (Figure 3.20-2). The states with both the greatest land area and highest percent land area in wilderness are Alaska, California, Washington, Idaho, and Arizona (Landres and Meyer 2000).

In addition to having the greatest amount of land and the highest percentage of its land base in wilderness, Alaska also has the highest number of wilderness acres per resident, with almost 90 acres per resident. This ratio increases to slightly more than 120 acres per resident when only Southeast Alaska is considered. The next closest state is Wyoming with about 6 acres of wilderness per resident.

Existing wilderness on the Tongass, approximately 5.8 million acres, represents about 34 percent of the forest land base and 28 percent of the land in Southeast Alaska. Viewed on a national basis, existing wilderness on the Tongass represents 17 percent of all wilderness on National Forest System (NFS) lands and 5.5 percent of all lands in the National Wilderness Preservation System (USDA Forest Service 2000a).

Two of the largest wildernesses on the Tongass, Misty Fiords National Monument Wilderness (2.1 million acres) and Kootznoowoo (Admiralty Island) Wilderness (almost 1 million acres), contain vast, virtually intact ecosystems. Five other wildernesses are each more than 250,000 acres. The wildernesses of the Tongass are mostly in a pristine condition, with the imprint of humans generally not noticeable. They offer outstanding opportunities for solitude and primitive recreation.

In the remainder of this section, the Tongass National Forest is evaluated in terms of how well its landforms and ecosystems are represented in existing wilderness (and LUD II areas). Four ways of classifying the Tongass landforms and ecosystems are considered, ranging from very broad (e.g., ecoregions, with two categories covering the Tongass) to fairly detailed (e.g., ecological subsections, with 73 categories covering the Tongass).

Ecoregions

DeVelice and Martin (2001) provide a national summary of acreage in National Forest roadless areas versus designated wilderness, National Parks, and other areas primarily managed to maintain natural values (i.e., conservation reserves). In Alaska, all but 1 of 15 ecoregions (as defined by Ricketts et al. 1999) have greater than 12 percent of its area in reserves. No other region in the country surpasses Alaska in ecological representation in reserves.

Two ecoregions cover the Tongass National Forest: the Northern Pacific Coastal Forest and the Pacific Coastal Mountain Tundra and Ice Fields (Ricketts et al. 1999). These two ecoregions extend from eastern Kodiak Island to the southern end of the Alaska panhandle. Approximately 19 percent of the Northern Pacific Coastal Forest and 37 percent of the Pacific Coastal Mountain Tundra and Ice Fields ecoregions are in reserves (DeVelice and Martin 2001). The portions of both of these areas protected in wilderness are well above the 12 percent threshold considered by some authorities (e.g., World Commission on Environment and Development 1987) as the minimum area for representation (DeVelice and Martin 2001).

Figure 3.20-1. Acres of Wilderness by State

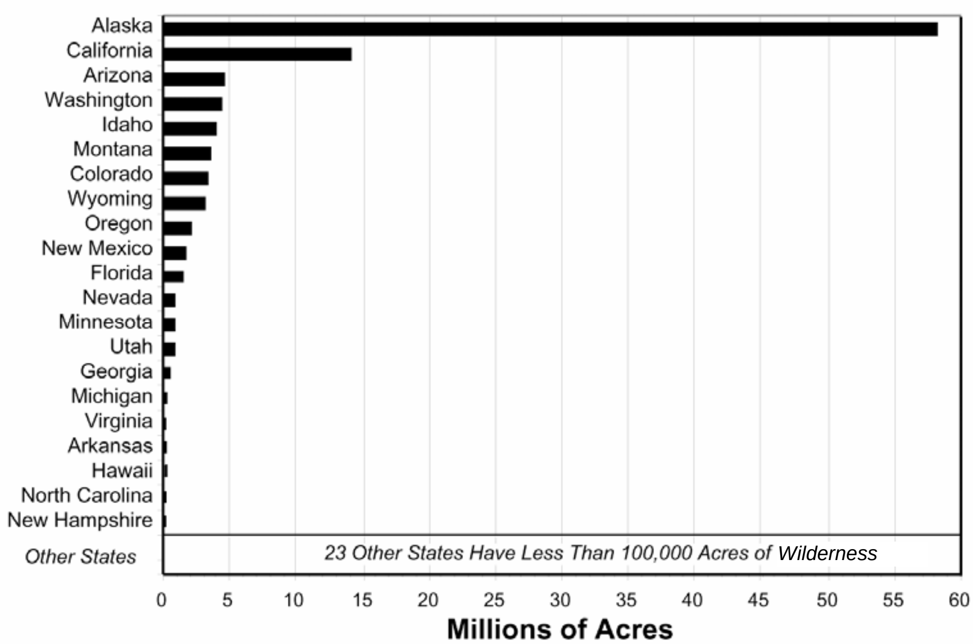
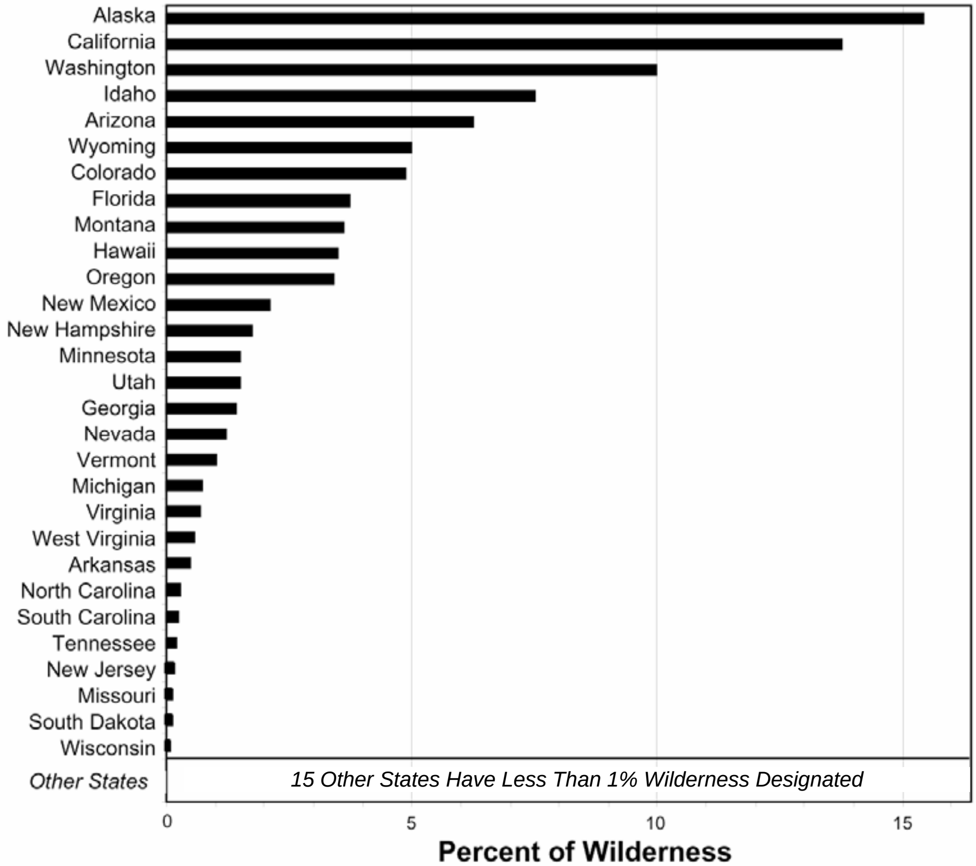


Figure 3.20-2. Percentage of Land Area in Wilderness by State



When the acreage of inventoried roadless areas is added to the acreage of conservation reserves in the two ecoregions, the percentage increases to 64 percent for the Northern Pacific Coastal Forest and 66 percent for the Pacific Coastal Mountain Tundra and Ice Fields ecoregions (DeVelice and Martin 2001). These values are in the 25 to 75 percent range that Noss and Cooperrider (1994) argue is required to achieve representation and are substantially higher than the 12 percent threshold.

When one considers only NFS lands, the percentage of NFS lands area in wilderness in these ecoregions is 25 percent for the Northern Pacific Coastal Forest and 21 percent for the Pacific Coastal Mountain Tundra and Ice Fields. If all inventoried roadless areas are counted along with wilderness, the total area of wilderness plus inventoried roadless areas on the Tongass in these ecoregions increases to 69 percent and 79 percent, respectively (DeVelice and Martin 2001).

Land Cover Classes

The various wildland ecosystems of Southeast Alaska are generally represented within the Tongass' wilderness. These areas include glaciers and ice fields, off-shore islands and seacoasts facing both the open Pacific Ocean and inland passages, major river systems, and 1.5 million acres of old-growth temperate rain forests. Viewed in terms of broad National Forest land cover classes, designated Wilderness on the Tongass exceeds 12 percent of the area in five land cover classes that are prevalent in Southeast Alaska. These five classes are: 1) Evergreen Forest (23 percent), 2) Tundra (15 percent), 3) Barren Land (37 percent), 4) Water (23 percent), and 5) Glaciers-Snow (15 percent). Designated

Wilderness does not exceed 12 percent of the area for Deciduous Forest (0 percent), Mixed Forest (0 percent), and Shrub-Brush (9 percent) (Martin et al. 2000). However, these latter three land cover types are not prevalent in Southeast Alaska.

Biogeographic Provinces

The extent to which identifiable landform types and ecosystems are represented in the wildernesses (and other natural setting LUDs) of the Tongass National Forest is addressed by reviewing the extent to which the biogeographic provinces of Southeast Alaska are represented. The Tongass can be subdivided into 21 biogeographic provinces characterized by similar species composition, similar patterns in distribution for many species, similar geologic barriers and historic events (such as glaciation), and similar climatic conditions. These provinces are discussed in the *Biodiversity* section of this chapter. Table 3.20-2 identifies the percentage of each biogeographic province that is included in existing wilderness. This table also identifies the percentage in LUD II areas because these are Congressionally designated areas managed for long-term protection to retain their wildland character. It also includes the percentage of each biogeographic province in other natural setting LUDs.

Table 3.20-2
Percent of Each Biogeographic Province in Wilderness, LUD II, or other Natural Setting LUD (within the Tongass National Forest boundary)

	Province	Percent in Wilderness or National Monument	Percent in LUD II	Percent in Other Natural Setting LUDs[1]	Total Percent in Wilderness or Natural Setting LUDs[1]
1	Yakutat Forelands	2%	39%	38%	79%
2	Yakutat Uplands	37%	0%	62%	100%
3	East Chichagof Island	6%	25%	16%	47%
4	West Chichagof Island	81%	6%	12%	99%
5	East Baranof Island	23%	0%	50%	73%
6	West Baranof Island	29%	0%	55%	84%
7	Admiralty Island	90%	0%	5%	96%
8	Lynn Canal	15%	6%	58%	78%
9	North Coast Range	23%	0%	48%	71%
10	Kupreanof/Mitkof Island	6%	0%	27%	32%
11	Kuiu Island	26%	1%	38%	64%
12	Central Coast Range	38%	0%	37%	75%
13	Etolin Island	16%	0%	25%	41%
14	North Central Prince of Wales	3%	5%	28%	35%
15	Revilla Island/Cleveland	18%	5%	35%	58%
16	South Outer Islands	16%	33%	23%	72%
17	Dall Island and Vicinity	0%	0%	51%	51%
18	South Prince of Wales	22%	5%	33%	61%
19	North Misty Fiords	82%	0%	14%	96%
20	South Misty Fiords	100%	0%	0%	100%
21	Ice Fields	33%	0%	62%	95%
	Total	**33%**	**4%**	**37%**	**74%**

[1] Note that totals may not add due to rounding.

Seventeen of the 21 biogeographic provinces on the Tongass have 20 percent or more of their lands within the National Forest boundary, in Wilderness, National Monument, or LUD II areas; 18 of the 21 have 15 percent or more. Three provinces—Dall Island and Vicinity, Kupreanof/Mitkof Island, and North Central Prince of Wales—have from 0 to 8 percent in Wilderness, National Monument, or LUD II areas. However, these areas have from 32 to 51 percent of their land areas within wilderness or natural setting LUDs. Overall, 17 of the 21 provinces have more than 50 percent of their land areas in either wilderness or natural setting LUDs. The remaining four have 32 to 47 percent.

Ecological Subsections

The extent to which identifiable landform types and ecosystems are represented in wilderness LUDs (and other natural setting LUDs) of the Tongass can also be evaluated by reviewing the extent to which the ecological subsections of Southeast Alaska are represented (Nowacki et al. 2001). These subsections are discussed in the Biodiversity section of this chapter. Table 3.20-3 identifies the percentage of each subsection that is covered by existing Wilderness (or National Monument), LUD II areas, and other natural setting LUDs.

Table 3.20-3
Percent of Each Ecological Subsection in Wilderness, LUD II, or Other Natural Setting LUD (within the Tongass National Forest boundary)

Number	Ecological Subsection	Percent in Wilderness or National Monument	Percent in LUD II	Percent in Other Natural Setting LUDs[1]	Total Percent in Wilderness or Natural Setting LUDs[1]
M244Ca	St. Elias-Fairweather Icefields	27%	1%	70%	98%
M244Cb	Puget Peninsula Metasediments	100%	0%	0%	100%
M245Bc	Yakutat-Lituya Forelands	9%	33%	39%	80%
M246Aa	Chilkat Complex	0%	0%	95%	95%
M246Ba	Boundary Ranges Icefields	32%	1%	61%	94%
M246Bb	Stikine-Taku River Valleys	43%	0%	53%	97%
M247Ac	Wachusett-Adams Hills	100%	0%	0%	100%
M247Ag	Berg Bay Complex	99%	0%	0%	99%
M247Ak	Chilkat Peninsula Carbonates	26%	0%	51%	77%
M247Bb	North Chichagof Granitics	19%	38%	15%	72%
M247Bc	Outer Coast Wave-cut Terraces	75%	0%	21%	96%
M247Bd	West Chichagof Complex	94%	6%	0%	99%
M247Be	Ushk-Patterson Bay Granitics	19%	43%	6%	67%
M247Bf	Peril Strait Granitics	0%	25%	15%	40%
M247Bg	North Baranof Complex	0%	0%	36%	36%
M247Bh	Sitka Sound Complex	0%	0%	67%	67%
M247Bi	Mount Edgecumbe Volcanics	0%	0%	75%	75%
M247Bj	Central Baranof Metasediments	20%	0%	64%	84%
M247Bk	Necker Bay Granitics	83%	0%	16%	100%
M247Bl	South Baranof Sediments	32%	0%	68%	100%
M247Ca	Point Adolphus Carbonates	0%	16%	32%	48%
M247Cb	Freshwater Bay Carbonates	0%	0%	28%	28%
M247Cc	Kook Lake Carbonates	0%	15%	16%	31%
M247Da	Stephens Passage Glaciomarine Terraces	36%	5%	31%	72%
M247Db	North Admiralty Complex	82%	0%	7%	89%
M247Dc	Stephens Passage Volcanics	58%	0%	26%	84%
M247Dd	Thayer Lake Granitics	100%	0%	0%	100%
M247De	Mitchell-Hasselborg Till Lowlands	100%	0%	0%	100%

Table 3.20-3 (continued)
Percent of Each Ecological Subsection in Wilderness, LUD II, or Other Natural Setting LUD (within the Tongass National Forest boundary)

Number	Ecological Subsection	Percent in Wilderness or National Monument	Percent in LUD II	Percent in Other Natural Setting LUDs[1]	Total Percent in Wilderness or Natural Setting LUDs[1]
M247Df	Hood-Gambier Bay Carbonates	98%	0%	0%	98%
M247Dg	South Admiralty Volcanics	100%	0%	0%	100%
M247Ea	Holkham Bay Complex	32%	0%	28%	60%
M247Eb	Cape Fanshaw Complex	0%	0%	29%	29%
M247Ec	Thomas Bay Outwash Plains	0%	0%	25%	25%
M247Ed	Wrangell Narrows Metasediments	11%	0%	18%	29%
M247Ee	Eastern Passage Complex	23%	3%	29%	55%
M247Ef	Stikine River Delta	77%	0%	5%	82%
M247Eg	Bell Island Granitics	14%	9%	57%	81%
M247Eh	Stikine Strait Complex	0%	0%	42%	42%
M247Ei	Etolin Granitics	37%	0%	19%	55%
M247Ej	Zimovia Strait Complex	5%	0%	26%	30%
M247Ek	Clarence Strait Volcanics	15%	0%	34%	50%
M247El	Ketchikan Mafics/Ultramafics	0%	0%	46%	46%
M247Em	Vixen Inlet Till Lowlands	0%	0%	40%	40%
M247En	Traitors Cove Metasediments	0%	10%	26%	36%
M247Eo	Behm Canal Complex	65%	0%	18%	83%
M247Fa	Kuiu-POW Granitics	19%	23%	36%	78%
M247Fb	Rowan Sediments	27%	0%	27%	54%
M247Fc	North POW-Kuiu Carbonates	0%	2%	25%	27%
M247Fd	Alvin Bay Sediments	53%	0%	25%	78%
M247Fe	Affleck Canal Till Lowlands	38%	2%	60%	100%
M247Ff	North POW Complex	0%	28%	18%	46%
M247Fg	Elevenmile Till Lowlands	0%	0%	52%	52%
M247Fh	Gulf of Esquibel Till Lowlands	12%	40%	48%	100%
M247Fi	Klawock Inlet Till Lowlands	0%	0%	7%	7%
M247Fj	Soda Bay Till Lowlands	0%	0%	44%	44%
M247Ga	Kake Volcanics	0%	0%	23%	23%
M247Gb	Duncan Canal Till Lowlands	6%	0%	35%	41%
M247Gc	Sumner Strait Volcanics	0%	1%	32%	32%
M247Gd	Central POW Till Lowlands	0%	3%	42%	45%
M247Ge	Kasaan Peninsula Volcanics	0%	0%	21%	21%
M247Gf	Skowl Arm Till Lowlands	0%	0%	29%	29%
M247Ha	Outer Islands Complex	100%	0%	0%	100%
M247Hb	Dall-Outside Complex	0%	19%	40%	59%
M247Ia	Central POW Volcanics	8%	0%	23%	31%
M247Ib	Hetta Inlet Metasediments	1%	9%	14%	25%
M247Ic	Moira Sound Complex	23%	0%	35%	59%
M247Ja	South POW Granitics	39%	0%	48%	88%
M247Jb	Duke Island Till Lowlands	0%	0%	72%	72%
M247Jc	Thorne Arm Granitics	19%	0%	40%	58%
M247Jd	Princess Bay Volcanics	62%	0%	8%	70%
M247Je	Foggy Bay Till Lowlands	100%	0%	0%	100%
M247Jf	Boca De Quadra Complex	100%	0%	0%	100%
M247Ka	Misty Fiords Granitics	96%	0%	2%	98%
	Total	**33%**	**4%**	**37%**	**74%**

[1] Note that totals may not add due to rounding.

Forty-two of the 73 ecological subsections on the Tongass National Forest have 20 percent or more of their lands inside the National Forest boundary within Wilderness, National Monument, or LUD II areas; 47 of the 73 subsections have 15 percent or more. Twenty-six of the subsections are not represented in Wilderness, National Monument, or LUD II areas. All of these subsections are represented in natural setting LUDs. Sixteen of the 17 ecological subsections with no Wilderness, National Monument, or LUD II representation have more than 20 percent of their areas in natural setting LUDs. The Klawock Inlet Till Lowlands has only 7 percent in natural setting LUDs.

Wilderness Management in Alaska

Monitoring has been minimal in most of the wilderness, but some resource damage and user conflicts have been observed in localized concentrated use areas. Monitoring in some of the more remote areas, such as the South Prince of Wales and Coronation Island wildernesses, indicates very little use but some resource damage and occupancy trespass. The areas with the greatest use and most management activities tend to have the greatest need for additional management direction to help resolve user conflicts and preserve the wilderness resource.

Implementation of existing direction has varied greatly between the various wildernesses. Some areas, such as Kootznoowoo (Admiralty Island) and Misty Fiords Wildernesses, have had significant management programs and accomplishments, while others have had minimal management activities. Some of these activities, such as fisheries enhancement projects and the authorization of temporary facilities for the taking of fish and wildlife, have resulted in administrative appeals by user groups who view these activities as conflicting with their use or wilderness values.

Management under the Wilderness Act

The Wilderness Act of 1964 mandates that designated “wilderness areas … shall be administered for the use and enjoyment of the American people in such a manner as will leave them unimpaired for future use and enjoyment as wilderness, and so as to provide for the protection of these areas, the preservation of their wilderness character, and for the gathering and dissemination of information regarding their use and enjoyment as wilderness.”

Subject to existing private rights, the Act prohibits permanent roads and, except as necessary for realizing the recreation and other wilderness purposes of the area, commercial enterprises. Temporary roads, the use of motor vehicles, motorized equipment, other mechanized equipment, motorboats, the landing of aircraft, and structures and installations are prohibited except as necessary to meet minimum requirements for the administration of the area as wilderness. The Act provides that the use of aircraft or motorboats, where these uses have already become established, may be permitted to continue subject to restrictions by the Secretary of Agriculture. Wildernesses were withdrawn from mineral entry as of December 31, 1983, and patenting of valid claims is limited to subsurface mineral rights.

Management under the Alaska National Interest Lands Conservation Act

In ANILCA, Congress reaffirmed and expanded upon the purposes of wilderness as stated in the Wilderness Act of 1964, specifically for wilderness established in Alaska. In recognition of unique situations and established uses in Alaska, ANILCA also provided a number of important specific exceptions to the requirements of the Wilderness Act. These apply equally to TTRA Wilderness.

Subsistence Policy
Section 811 mandates that the Secretary "shall ensure that rural residents engaged in subsistence uses shall have reasonable access to subsistence resources on public lands." This section further directs that, other laws (including the Wilderness Act) notwithstanding, the Secretary "shall permit on the public lands appropriate use for subsistence purposes of snowmobiles, motorboats, and other means of surface transportation traditionally employed for such purposes by local residents, subject to reasonable regulation."

Transportation and Utility Systems
Section 1105 provides that in any case in which there is no applicable law with respect to a transportation or utility system, the head of the federal agency concerned shall make recommendations to authorize the system within the Conservation Unit concerned (including Wilderness) if he determines that the system would be compatible with the purposes for which the unit was established, and there is no economically feasible and prudent alternative route for the system. ANILCA (Section 506) includes specific exceptions for Admiralty Island National Monument Wilderness regarding the right to develop hydroelectric resources and public access and use.

Special Access
Section 1110(a) requires that the Secretary "shall permit" on Conservation Units, which include Wilderness, "the use of snowmachines (during periods of adequate snow cover or frozen river conditions, in the case of Wild or Scenic rivers), motorboats, airplanes, and nonmotorized surface transportation methods for traditional activities (where such activities are permitted by this Act or other law) and travel to and from villages and homesites." Such use is subject to reasonable regulation, but shall not be prohibited unless after notice and hearing the Secretary finds that such use would be detrimental to the resource values of the area.

Inholding Access
Section 1110(b) assures adequate and feasible access to state and private land and to valid occupancies, including valid mining claims.

Navigation Aids and Facilities
Section 1310(a) provides that reasonable access to, and operation and maintenance of, existing air and water navigation aids, communication sites, facilities for national defense, and related facilities and existing facilities for weather, climate and fisheries research, and monitoring shall be permitted. "Nothing in the Wilderness Act shall be deemed to prohibit such access, operation and maintenance within wilderness areas designated by this Act." Section 1310(b) provides that the establishment, operation, and maintenance of new such facilities shall be permitted within wilderness after consultation with the Secretary and in accordance with mutually agreed upon terms and conditions to minimize the adverse effects within the unit.

Aquaculture
Section 1315(b) provides that the Secretary may permit fishery research, management, enhancement, and rehabilitation activities within National Forest System Wilderness, in a manner that adequately assures protection, preservation, enhancement, and rehabilitation of the wilderness resource. Subject to reasonable regulations, permanent improvements and facilities such as fishways, fish weirs, fish ladders, fish hatcheries, spawning channels, stream clearance, egg planting, and

other accepted means of maintaining, enhancing, and rehabilitating fish stocks may be permitted.

Public Use Cabins

Section 1315(c) provides for the continued use, maintenance, and replacement of existing public use cabins within wilderness. Section 1315(d) authorizes the construction and maintenance of a limited number of new public use cabins and shelters, if necessary, for public health and safety, and also requires the Secretary to notify Congress of his intention to remove an existing or construct a new public use cabin or shelter.

Beach Log Salvage

Section 1315(f) allows the Secretary to permit or otherwise regulate the recovery and salvage of logs from the coastlines of National Forest Wilderness and National Monuments.

Temporary Hunting and Fishing Facilities

Section 1316(a) provides that the Secretary shall permit, subject to reasonable regulation to ensure compatibility, the continuation of existing uses and future establishment and use of temporary campsites, tent platforms, shelters, and other temporary facilities and equipment directly and necessarily related to the taking of fish and game. Facilities and equipment shall be constructed, used, and maintained in a manner consistent with the protection of the area where they are located. New facilities shall be constructed of materials that blend with and are compatible with the surrounding landscape. Section 1316(b) allows the Secretary to deny new facilities and equipment upon making a determination, after public notice, that the establishment and use of new facilities or equipment would constitute a significant expansion of existing facilities or uses that would be detrimental to the purposes for which the unit was established, including “wilderness character.”

Other Forest Plan Restrictions

In spite of its many exceptions to the Wilderness Act, ANILCA defines “wilderness” as having the same meaning as when it is used in the Wilderness Act (Sec. 102(13)). Further, Section 707 states that, except as expressly provided in ANILCA, Alaskan wilderness “shall be administered in accordance with applicable provisions of the Wilderness Act governing areas designated by that Act as Wilderness.” Some of the additional restrictions identified for Tongass wilderness by the current Forest Plan include the following:

- New roads and airstrips are not permitted, except to access state and private inholdings and valid mining claims, subject to stipulations for protection of natural and other values of the land.
- Helicopter use is generally not permitted, except on a case-by-case basis. In the 1997 Record of Decision for the Helicopter Landings in Wilderness Final EIS, the Regional Forester decided not to allow establishment of helicopter access areas within wilderness on the Tongass National Forest for use by individuals and helicopter companies transporting the general public.
- There is a party size limitation for outfitter/guide operations of no more than 12 persons for any one site or activity.
- No new permanent administrative facilities are allowed, except as consistent with ANILCA.

Environmental Consequences

None of the alternatives involves recommending new areas for Wilderness or LUD II designation. Roadless areas within the Tongass National Forest were evaluated for recommendations as potential wilderness in the 2003 Forest Plan SEIS (USDA Forest Service 2003b). The 2003 SEIS evaluated eight alternatives that range from no new recommended wilderness to 9.6 million acres (all inventoried roadless areas) of new recommended wilderness. This evaluation and the ROD for the 2003 SEIS are incorporated here by reference.

Direct and Indirect Effects

Existing wilderness on the Tongass, which encompasses approximately 5.8 million acres and represents about 34 percent of the forest land base and 28 percent of the land in Southeast Alaska, would remain unchanged under all of the alternatives. The existing 19 wildernesses on the Tongass are identified in Table 3.20-1. The acres of each biogeographic province and ecological subsection presently in Wilderness or LUD II areas on the Tongass would also remain unchanged (see Tables 3.20-2 and 3.20-3).

Alternatives 1 through 4, 6, and 7 would, however, differ from Alternative 5 (No Action) because under these alternatives wilderness on the Tongass would be managed under the updated and edited version of the current Forest Plan presented as Volume II to this EIS. The updated version of the Forest Plan includes substantial edits and clarifications to the Wilderness and Wilderness National Monument LUD prescriptions. These edits emphasize that wilderness should remain untrammeled and free from modern human control or manipulation, including actions taken to manage wilderness. The edits also modify the objectives of both LUD prescriptions to emphasize primitive Recreation Opportunity Spectrum (ROS) classes, rather than both primitive and semi-primitive ROS classes. Areas managed as semi-primitive within a wilderness are an exception and are not encouraged. In addition, new standards and guidelines that address forest health with respect to non-native, invasive species, sacred site protection activities, and karst management are included in the revised Wilderness and Wilderness National Monument LUD prescriptions. These edits and others are shown in the revised Forest Plan included in Volume II.

The updated Forest Plan also provides more specific standards and guidelines with respect to managing recreation activities to meet appropriate levels of social encounters. This includes limiting group sizes to no more than 12 persons for commercial and general public use of a wilderness, limiting the length of stay at one location to 14 days, and limiting commercial recreation use to two groups of 12 people from a single vessel (or other form of transportation), with the groups required to disperse out of sight and sound from each other. Implementation of these standards and guidelines is expected to help preserve outstanding opportunities for solitude and emphasize primitive recreation opportunities.

These edits and revisions are not intended to change the management of Wilderness or Wilderness National Monument areas. Rather, the intent is to ensure that the objectives of the LUD prescriptions laid out in the current Forest Plan are met. As a result, with the possible exception of the revised Recreation and Tourism Standards and Guidelines (discussed above), there is not expected to be a substantial difference between Alternative 5 (No Action) and the other alternatives in this respect.

Cumulative Effects

There would be no change in the number of acres with Wilderness or LUD II designations on the Tongass under any of the alternatives. While there are edits and clarifications to the Wilderness and Wilderness National Monument LUD prescriptions under six of the alternatives, these would not substantially change the management of these areas.

The Tongass National Forest comprises about 78 percent of the land area of Southeast Alaska. The other major land ownership is Glacier Bay Park and Preserve, the vast majority of which is managed as wilderness by the National Park Service. Combining the Glacier Bay Wilderness with the wildernesses on the Tongass, nearly 40 percent of Southeast Alaska is in wilderness under existing conditions. Thus, the proportion of lands in wilderness in Southeast Alaska is substantially higher than the statewide average for Alaska (15 percent). Further, the State of Alaska contains more wilderness, on both an acreage and percentage basis, than any of the other 49 states. In addition, as discussed in the *Roadless* section of this EIS, at least 60 percent of all existing inventoried roadless areas would remain roadless after 100+ years of Forest Plan implementation. As a result, it is estimated that at least 73 percent of Southeast Alaska would remain in wilderness or roadless after 100+ years (assuming all non-NFS lands become roaded, except for Glacier Bay and 50 percent of non-NFS lands in the Haines/Skagway area). Thus, the potential for cumulative effects associated with precluding options for future wilderness is considered low.

Other Special Land Use Designations

Affected Environment **3-469**
Experimental Forests 3-469
Research Natural Areas 3-470
Special Interest Areas 3-472
Wild and Scenic Rivers 3-474
Environmental Effects **3-479**
Direct and Indirect Effects 3-479
Cumulative Effects 3-487

A number of specific areas on the Tongass National Forest that have not been designated as Wilderness or Land Use Designation (LUD) II areas are given special LUDs because they possess outstanding resources, research opportunities, or other factors of special interest. These areas include experimental forests, research natural areas, Special Interest Areas, and wild and scenic rivers. Each of these special areas is described, as are the effects of the alternatives on these areas, in this section.

Affected Environment

Experimental Forests

Experimental forests provide areas for conducting manipulative research that serves as a basis for forest management. Natural resources in experimental forests are used or altered under controlled scientific studies. The Tongass currently has two experimental forests, Maybeso and Young Bay, with a combined area of 17,260 acres. Their locations are indicated on the alternative maps.

Maybeso

Established in the early 1950s as a part of an intensive research program to document the effects of large-scale clearcutting on hydrology, fisheries, and timber productivity, the Maybeso Experimental Forest (10,600 acres) is located in a large steep-sided alluvial valley with a south to southeast-facing aspect near the central-eastern coast of Prince of Wales Island. By the early 1960s, most of the suitable forest land on the experimental area had been harvested. Permanent research plots were established and monitored to study hillslope erosion, movement of large woody debris in and through streams, forest regeneration, and silvicultural responses to precommercial thinning. Most of these plots are still monitored. The upper slopes of the Maybeso watershed are included in Roadless Area 510.

Because nearly all of the old-growth timber on the Maybeso Experimental Forest has been harvested, the timber in the area is primarily young growth. Consequently, there are limited opportunities to design new harvest-related experiments, except potential experiments concerning second-growth timber of up to 45 years in age. Only a limited variety of vegetation and timber types are now available within the area.

Young Bay

The Young Bay Experimental Forest (6,660 acres) is located just south of Juneau on northern Admiralty Island. Originally selected for long-term hydrologic and fisheries monitoring with a paired comparison between streams, this site was used extensively for fisheries and hydrology research in the 1960s and 1970s.

The Young Bay Experimental Forest has an extensive terrace, or bench, underlain by poorly drained marine silt (the Gastineau Formation) that extends across its lower slopes between sea level and an elevation of 100 feet. As a result of this formation, part of the experimental forest is open and relatively unproductive, which is atypical of areas normally managed for timber production in Southeast Alaska. Young Bay exhibits little forest vegetation-type diversity, making its use for studies not related to timber production difficult. High winds often limit access to the area during winter. There are no roads and, to date, no experimental vegetation treatments have occurred. The Young Bay Experimental Forest is located entirely within the Greens Creek Roadless Area 307.

The Tongass Timber Reform Act (TTRA) designated lands to the east of the Young Bay Experimental Forest as the "Young Lake Addition" to be managed as part of the Admiralty National Monument and Kootznoowoo Wilderness.

Young Bay has been considered for delisting as an experimental forest. This area has limited research opportunity, and limited applicability to other areas of the Forest. Manipulative research may not be compatible with the adjacent Monument/Wilderness addition.

Because of the TTRA legislation or other resource conflicts, Shaheen Creek, Trap Bay, Staney Creek and Chicken Creek watersheds, previously identified as possible experimental forests in the 1990 DEIS, are no longer appropriate for consideration and these areas were not included in the 1997 Forest Plan.

Research Natural Areas

Research Natural Areas (RNAs) are part of a national network of ecological areas designated for research and education and/or to maintain biological diversity of representative ecosystems on National Forest System (NFS) lands. RNAs are used for non-manipulative research, observation, and study. They also may serve to carry out provisions of special acts, such as the Endangered Species Act and the monitoring provisions of the National Forest Management Act.

Current Situation

Six RNAs were established within the Tongass National Forest prior to 1996. One of the six, Pack Creek, was declassified in the Record of Decision (ROD) for the 1997 Tongass Land Management Plan due to a long history of human presence related to viewing brown bears. At the same time, Pack Creek was re-designated as a zoological area to be managed under the Special Interest Area LUD. Seven additional areas were classified as RNAs by the 1997 ROD. That action resulted in the current total of 12 Tongass RNAs incorporating a total area of 66,059 acres. Brief descriptions of each follow below.

Cape Fanshaw RNA

Established in 1965, this 614-acre RNA is located at the junction of Frederick Sound and the Stephens Passage in Roadless Area 201. This area was established to represent undisturbed old-growth yellow-cedar and western hemlock forests. It represents a good example of cedar decline on the mainland, and has been used for long-term monitoring of changes in species composition and stand dynamics.

Dog Island RNA

Established in 1976, this 705-acre RNA is located on Dog Island in Roadless Area 521. The area represents a small island ecosystem containing the northern limit of

Pacific yew (*Taxus brevifolia*), associated scrub timber, and low-volume, mixed-conifer sites of southern Southeast Alaska.

Kadin Island RNA

Established in 1997, this 1,623-acre RNA is located just north of Wrangell in Roadless Area 225. Kadin Island experiences high winds blowing down through the Stikine River corridor. The high winds pick up silt from the unvegetated glacial river floodplain and cause the deposition of loess on the island at the river's mouth. The continuing rain of loess onto the upper soil layers provides a supply of unleached, nutrient-rich soil material to the forests of the island. The loess deposition overcomes the process of acid bog formation (paludification) that overtakes most stable sites of moderate topographic relief on the Tongass National Forest. Few areas in the world have a combination of high rainfall and recent loess deposition, so the properties of the soils here are of special interest. The fringe of the island is subject to tidal influence and changes in water level because of shifts of the river. Wetland marsh communities are included in this area. The bald eagle nest concentration on Kadin Island is second only to parts of Admiralty Island, according to the U.S. Fish and Wildlife Service.

Marten River RNA

Established in 1997, this 6,213-acre RNA is located within the Misty Fiords National Monument Wilderness adjacent to the Red River RNA. The Marten River RNA contains riparian spruce stands and has excellent habitat for brown bears along its major mainland streams.

Limestone Inlet RNA

Established in 1951 and expanded in 1971, this 9,102-acre RNA is located in Stephens Passage in Roadless Area 302. The area represents typical vegetation types common to the Juneau mainland, including many avalanche chutes and a mainland stream with a good fish population. In 1951, Limestone Inlet was considered the most pristine drainage in the northern mainland coast, making it an excellent area for documenting baseline conditions on the mainland. Alaska Department of Fish and Game has altered the native salmon runs since 1980 by operating a hatchery in nearby Snettisham Lake; however, upland areas remain intact.

Old Tom Creek RNA

Established in 1951, this 4,544-acre RNA is located on central Prince of Wales Island in Roadless Area 519. Situated in a low-site, cedar-dominated watershed, this RNA was established as an example of cedar-hemlock old-growth forest. It also includes some examples of riparian spruce forest, extensive tidal meadows, and dense bald eagle and black bear populations.

Red River RNA

Established in 1980, this 8,031-acre RNA is located in Misty Fiords National Monument Wilderness. This RNA represents the northern range of Pacific silver fir (*Abies amabilis).*

Rio Roberts RNA

Established in 1997, this 1,560-acre RNA is located on central Prince of Wales Island in Roadless Area 511. This area contains riparian flood plain spruce stands, upland old-growth and natural young-growth stands, and upland hemlock on drumlin fields. A high level of recreation use occurs in the area, including hiking, camping, boating, and fishing in the Thorne River near this RNA.

Robinson Lake RNA

Established in 1997, this 4,297-acre RNA is located in the Misty Fiords National Monument Wilderness. This RNA focuses on a natural slump lake, forest types typical of the southern portion of mainland Southeast Alaska, and some uncommon plants of restricted distribution in Alaska. Robinson Lake formed in recent years when a natural earthslide dammed Robinson Creek. The area extends to the shore of Behm Canal in order to include habitat diversity associated with the shoreline and proximity to deep water.

Tonalite Creek RNA

Established in 1997, this 9,515-acre RNA is located south of Tenakee Springs across Tenakee Inlet in Roadless Area 311. This RNA includes pristine examples of Sitka spruce, western and mountain hemlock, and yellow cedar forest types. The Tonalite drainage is a narrow glacial valley that supports runs of pink, chum, and coho salmon. The drainage is prime brown bear, Sitka black-tailed deer, and beaver habitat.

Warm Pass Valley RNA

Established in 1997, this 8,306-acre RNA is located along the U.S.-Canada border between the Taku River and Chilkat Pass in Roadless Area 301; the valley includes the northernmost example of subalpine fir in Alaska. The valley is also an important migration corridor for interior vegetation species that mix with the coastal forest and tundra. The Warm Pass Valley RNA has a very different climate caused by a pronounced rain shadow effect. The valley supports a good population of moose that use both the alpine shrub belt and riparian shrubs at lower elevation.

West Gambier Bay RNA

Established in 1997 to replace the Pack Creek RNA, this 11,549-acre RNA is located at the head of the west arm of Gambier Bay in Admiralty Island National Monument-Kootznoowoo Wilderness. The area includes long, narrow Pybus Lake and several smaller lakes; productive wildlife habitat; an anadromous fish stream; and a variety of geological features, including karst. West Gambier Bay contains forest and nonforest vegetation types typically found on the islands of northern Southeast Alaska.

Special Interest Areas

Special Interest Areas are areas possessing unique or unusual scenic, historic, prehistoric, scientific, natural, or other characteristics. The objective of designating and managing such areas is to protect their unique values and, where appropriate, to foster public use and enjoyment of these areas. Special Interest Areas may be designated as scenic, recreation, historic, archaeological, geological, botanical, zoological, or paleontological areas. Special Interest Areas differ from RNAs in that management may promote public use as well as scientific study.

Special Interest Area designations are intended to maintain natural to near-natural conditions in most cases; the Recreation Area designation may include developed facilities within a natural or near-natural setting. The resources contained within these areas are not available for development, except for public facilities designed to allow recreation use while protecting the values of the area, or for interpretation and scientific study. Each area may require unique management direction determined through individualized study and planning. Special Interest Areas may be withdrawn from mineral entry. The LUD for Special Interest Areas applies to all the designated areas.

Current Situation

Twenty-four Special Interest Areas have been designated within the Tongass National Forest. They occupy a total area of 629,782 acres (it should be noted that many of these acres are sometimes tabulated under another LUD category when the Special Interest Area occurs within a Congressionally designated area, e.g., Wilderness, National Monument, and LUD II). Eight of the 24 areas were designated prior to the 1997 Land Management Plan Revision. These include the following:

- Mendenhall Glacier Recreation Area (5,791 acres)
- Ward Lake Recreation Area (440 acres)
- Walker Cove-Rudyerd Bay Scenic Area (93,540 acres)
- Admiralty Lakes Recreation Area (8,710 acres)
- New Eddystone Rock Geological Area (1 acre)
- Hubbard Glacier Geological Area (46,000 acres)
- Tracy Arm-Fords Terror Scenic Area (283,000 acres)
- Naha Recreation Area (2,363 acres)

The remaining 16 Special Interest Areas, plus 1 expansion, were identified and designated with the 1997 Land Management Plan Revision as the following:

- Arena Cove/Cape Felix Geological Area (9,465 acres)
- Bailey Bay Hot Spring Recreation Area (3,510 acres)
- Blind Slough Recreation Area (8,150 acres)
- Blue River Lava Flow Geological Area (13,520 acres)
- Clear River Zoological Area (11,530 acres)
- Duke Island Zoological Area (44,650 acres)
- Falls Creek Windthrow Botanical Area (820 acres)
- Fish Creek Hotsprings Recreation Area (100 acres)
- Karst Areas Geological Areas (multiple areas totaling 13,635 acres)
- Keku Islet Geological and Scenic Area (2,300 acres)
- Mt. Edgecumbe Geological Area (49,050 acres)
- North Hamilton River Red Cedar Cultural and Botanical Area (80 acres)
- Pack Creek Zoological Special Interest Area (5,837 acres)
- Patterson Glacier Geological and Botanical Area (13,900 acres)

- Pike Lakes Recreation Area (2,340 acres)
- Soda Springs Geological Area (3,515 acres)
- Ward Lake Recreation Area Expansion (7,535 acres)

Eight of the Special Interest Areas have been designated within Wildernesses and/or National Monuments, or LUD II areas. These areas are already managed in a way that accounts for the Wilderness, National Monument, or LUD II area surrounding them. They include the following:

- Admiralty Lakes (Admiralty Island National Monument and Kootznoowoo Wilderness)
- Blue River Lava Flow (Misty Fiords National Monument and Wilderness)
- Hubbard Glacier (Russell Fiord Wilderness)
- Naha Recreation Area (Naha LUD II)
- New Eddystone Rock Geological Area (Misty Fiords National Monument and Wilderness)
- Pack Creek Zoological Special Interest Area (Admiralty Island National Monument and Kootznoowoo Wilderness)
- Tracy Arm-Fords Terror (Tracy Arm-Fords Terror Wilderness)
- Walker Cove-Rudyerd Bay (Misty Fiords National Monument and Wilderness)

Because the National Monument, Wilderness, and LUD II designations recognize and protect the same values for which the areas were originally designated, the Special Interest Area designation may have become redundant, and the possibility of declassifying these areas as Special Interest Areas is being explored by the Forest Service. No proposals for declassification are being made at this time.

The Tongass also contains a small portion of the 5-acre Fort Durham National Historic Landmark (most of which is on private land).

Special Interest Areas are not available for timber harvest, and roads would be allowed only if they are compatible with the interpretive goals of a particular area. Other restrictions may be imposed on a case-by-case basis to protect an area's unique values. These could include closures to off-highway (or off-road) vehicle (OHV) use, and withdrawals from mineral entry. Currently, the Mendenhall Glacier, Ward Lake, and Naha Recreation Areas are withdrawn from mineral entry. The need for such restrictions for newly designated or expanded areas may be determined during Forest Plan implementation.

Wild and Scenic Rivers

This section describes the process for Wild and Scenic River designation, and the rivers on the Tongass National Forest that are currently managed as wild and scenic rivers.

Background

The Wild and Scenic Rivers Act of 1968, as amended, provides a means for recognizing and protecting the "outstandingly remarkable" scenic, recreation, geologic, fish and wildlife, historic, cultural, ecological, and other values of selected rivers. The intent of including a river in the National Wild and Scenic Rivers System is to preserve the free-flowing condition of the river itself, as well as the characteristics of the river's immediate environment for the enjoyment and benefit of present and future generations. The U.S. Congress is responsible for final designation of rivers to be included in the National Wild and Scenic Rivers System.

ANILCA designated 26 rivers in central and northern Alaska as components of the National Wild and Scenic Rivers System under the Wild and Scenic Rivers Act of 1968. No rivers in Southeast Alaska or the Tongass National Forest were designated under ANILCA. An additional 12 rivers were designated as “study rivers” by ANILCA, of which only one, the Situk River near the community of Yakutat, is in Southeast Alaska and in the Tongass National Forest.

The Situk River, including the West Fork and Old Situk Creek, was studied in 1983 and was found to possess outstandingly remarkable fish, wildlife, and recreational values of national significance, but was not recommended for designation. The community of Yakutat, the local and regional Native corporations, the Citizens Advisory Council of Federal Areas, the Governor of the State of Alaska, and the Regional Forester on behalf of the Forest Service, signed an agreement to recognize each others’ responsibility in cooperative management of the Situk River corridor in lieu of designation as a Wild and Scenic River. The Alaska Land Use Council supported development of a management plan for the Situk River, rather than designation as a Wild and Scenic River (USDA Forest Service 1993a)) and the Secretary of the Interior formally determined to not recommend designation of the Situk River. The Situk River corridor continues to be managed through a cooperative process among the signatories to that agreement.

The National Park Service initiated an evaluation to determine the eligibility of the rivers within the National Parks and Preserves in Alaska. The Alsek River near Yakutat is included in that evaluation. The Tongass National Forest includes the surface and west bank of an 18-mile segment that was found to be eligible and meeting a “Scenic” classification.

The analysis and planning that led to the 1997 Forest Plan included a process for identifying rivers that could be eligible for inclusion in the National Wild and Scenic Rivers System. The process started with an inventory and evaluation to determine the eligibility, potential classification, and suitability for inclusion in the National Wild and Scenic Rivers System.

Rivers are eligible to be considered for inclusion in the National Wild and Scenic River System if they are essentially free-flowing (without major dams, diversions, or channel modifications), and if they possess at least one “outstandingly remarkable” scenic, recreational, geologic, fish and wildlife, historic, cultural, or other similar value. These values should be a unique or exceptional representation for the area studied, and must be related to the river or its immediate environment.

The potential classification for each eligible stream segment was done according to the criteria in the Wild and Scenic Rivers Act into either Wild, Scenic, or Recreational Rivers defined as follows:

- Wild River areas are defined as those rivers or sections of rivers that are free of impoundments and generally inaccessible except by trail, with watersheds or shorelines essentially primitive in character and waters unpolluted. These represent vestiges of primitive America.
- Scenic River areas are defined as those rivers or sections of rivers that are free of impoundments with shorelines or watersheds still largely primitive and shorelines largely undeveloped, but accessible in places by roads.
- Recreational River areas are defined as those rivers or sections of rivers that are readily accessible by road or railroad, that may have undergone some development along their shorelines, and that may have undergone some impoundment or diversion in the past.

Eligible rivers are further evaluated for “suitability.” Generally this analysis considers the appropriateness of Congressional designation as a Wild, Scenic, or Recreational

River in light of social and economic values, or the resource opportunities enhanced, curtailed, or foregone, and the effect on private lands and other uses of the area. Suitable rivers may be recommended to Congress by the administration for designation. If designation occurs, a final boundary is established and a management plan developed.

There are nearly 900 watersheds on the Tongass National Forest containing some 42,500 miles of perennial stream. All of the rivers and streams on the Forest were examined and evaluated for eligibility for the National Wild and Scenic Rivers System. An initial evaluation identified 300 rivers and streams for further study. Of these, 112 rivers with 1,394 stream miles were determined to be eligible for consideration as components of the National Wild and Scenic Rivers System. More detail about the process that was used and the individual rivers studied is available in the 1997 Tongass Forest Plan Revision Final EIS.

Based on a suitability analysis, the Regional Forester recommended 32 of the 112 eligible rivers for inclusion in the National Wild and Scenic Rivers System as either Wild, Scenic, or Recreational (Table 3.21-1). Appendix E of the 1997 Tongass Land Management Plan Revision Final EIS provides descriptions of each river. The 1997 ROD contains the rationale for the decision made for each river. The recommendation was a preliminary administrative recommendation that would be forwarded to the Chief of the Forest Service. It could receive further review and possible modification by the Secretary of Agriculture and the President of the United States. Congressional action is necessary to designate rivers as part of the National Wild and Scenic Rivers System.

Because this was a preliminary administrative recommendation, the 1997 Forest Plan directs that the rivers be managed, within the existing authorities of the Forest Service, to retain their free-flowing character and outstandingly remarkable values. Three LUDs were created for these rivers, one for each classification: Wild River, Scenic River, and Recreational River. The 1997 Forest Plan includes goals, objectives, desired conditions, and specific management prescriptions for each LUD. The Wild and Scenic Rivers Act provides that the study boundary includes, at a minimum, the area within 0.25 mile of the ordinary high water mark on each side of the river (USDA Forest Service 1993b). Final boundaries can and do vary from this minimum, but generally follow the 0.25-mile guideline. The area of the recommended rivers managed under the Wild, Scenic, and Recreational River LUDs were determined so as to maintain the eligibility of the total miles of river for each classification.

Subsequent to the Regional Forester's 1997 Wild and Scenic River recommendations, the Acting Forest Supervisor determined that the recommendation for Niblack Lakes and Streams was based on incorrect information related to the anadromous fish productivity of the system. In November 1998, a non-significant of the 1997 Forest Plan rescinded the Wild and Scenic River recommendation and associated LUDs for Niblack Lakes and Streams (USDA Forest Service 1999c); therefore, Niblack Lakes and Streams is not included in this analysis.

Table 3.21-1
Rivers (Segments) Recommended for Inclusion in National Wild and Scenic River Program (in miles)

River Name	Wild	Scenic	Rec.	Fish	Wildlife	Recreation	Scenic	Hist./Cult.	Geology	Ecology
				Outstandingly Remarkable Values						
Aaron, Oerns, Berg Creeks	-	21	16	X	X	X	X	-	-	-
Anan Creek	17.5	.5	-	X	X	X	-	-	-	-
Blind River	-	-	5	X	X	X	-	-	-	X
Blue River	26	-	-	-	X	-	X	-	X	X
Chickamin River	94	2	-	X	X	X	X	X	X	-
Essowah Lake and Streams	13	-	-	X	X	-	X	-	-	-
Fall Dog Creek (local)	4	-	-	X	X	-	X	X	-	-
Farragut River	29	1	-	X	X	-	X	-	-	-
Gilkey River	9	-	-	-	-	-	X	-	X	-
Glacial River	10	-	-	-	-	-	X	-	X	X
Gokachin-Mirror-Low-Fish Creeks	30	-	-	X	X	X	X	X	-	-
Harding River	-	16	-	X	X	X	-	-	-	-
Hasselborg River and Lakes	24	-	-	X	X	X	-	X	-	-
Kadake Creek	-	-	23	X	X	X	X	X	-	-
Kadashan River	-	8	-	X	X	-	-	-	-	X
Kah Sheets Creek and Lake	5	4	-	X	X	X	-	X	-	-
Katzehin River	10	-	-	X	-	-	X	-	X	-
Kegan Lake and Streams	9	-	-	X	-	X	X	-	-	-
King Salmon River	8	-	-	X	X	-	-	-	-	-
Kutlaku Creek and Lake	2	-	-	X	-	-	-	-	-	-
LeConte Glacier	6	-	-	-	-	-	X	-	X	-
Lisianski River	5	-	-	-	X	-	-	-	-	X
Naha River	17	2	-	X	X	X	-	X	-	-
Niblack Lakes and Streams[1]	5	-	-	X	-	-	-	-	-	-
Orchard Creek and Lake	10	-	16	X	X	X	X	-	-	X
Petersburg Creek	7	-	-	X	-	X	X	X	-	-
Salmon Bay Lake and Stream	4	2	-	X	X	-	X	-	-	-
Santa Anna Creek - L. Helen	-	4	-	X	-	X	-	-	-	X
Sarkar Lakes	14	3	2	X	X	-	X	X	-	-
Thorne River-Hatchery Creek	-	24	18	X	X	X	X	-	-	-
Virginia Lake and Creek	-	-	9	X	-	X	-	-	-	-
Wolverine Creek-McDonald Lake	6	-	-	X	X	X	-	-	-	-
Total Miles	**359.5**	**87.5**	**89.0**							

[1] Niblack was later removed from the list.

Current Situation

Congress has not yet designated any rivers on the Tongass National Forest to be included in the National Wild and Scenic Rivers System.

The goal for management of the rivers that were recommended for Wild and Scenic designations is to maintain their outstandingly remarkable values and their free-flowing conditions. The objective is to manage the 31 rivers (or segments), pending designation by Congress as Wild, Scenic, or Recreational Rivers, to maintain the eligibility of the total miles of river for the Wild, Scenic, or Recreational classification.

The goal is to be achieved through the management of the rivers (or segments) under the LUD of Wild River, Scenic River, or Recreational River and implementation of the standards and guidelines specified for the LUD. These are summarized below and described in more detail in the 1997 Forest Plan.

Wild River LUD. This is the most restrictive of the three LUDs. Scheduled timber harvest and construction of major recreation facilities, roads, and hydroelectric power projects are not allowed. Mining may be allowed or the area may be withdrawn from mineral entry by Congress at the time of designation as a Wild River. Some fish and wildlife habitat enhancement are permitted. This is a Transportation and Utility Systems "Avoidance Area," but corridors will be allowed in accordance with ANILCA, Title XI. Twenty-three river segments, or 359.5 river miles, are currently managed under this LUD.

Scenic River LUD. Hydroelectric power projects are not allowed, but timber harvest is allowed if the adjacent LUD allows timber harvest. Major recreational developments may be compatible with this LUD and minor developments are allowed. The construction of NFS roads is allowed and bridges may occasionally span the river. Mining and some fish and wildlife habitat enhancement are permitted. This is a Transportation and Utility Systems "Avoidance Area" but corridors will be allowed in accordance with ANILCA, Title XI. Twelve river segments, or 87.5 river miles, are currently managed under this LUD.

Recreational River LUD. Although hydroelectric power projects are not allowed, many other management activities are permitted. Timber harvest is allowed if the adjacent LUD allows timber harvest. Major and minor recreational developments and NFS roads that make the river easily accessible are allowed. Mining and some fish and wildlife habitat enhancement are permitted. This is a Transportation and Utility Systems "Avoidance Area," but corridors will be allowed in accordance with ANILCA, Title XI. Seven river segments, or 89 river miles, are currently managed under this LUD.

The LUD(s) for adjacent land can have significant influence on the management of resources inside Wild, Scenic, or Recreational River LUDs. Many of the corridors designated to the Wild River, Scenic River, or Recreational River LUD are narrow and include the width of the river plus 0.25 mile on each side. The most obvious example of the adjacent LUD influence is that the ability to harvest timber in Scenic or Recreational River LUDs is dependent on the management prescription for timber in the LUD(s) of the adjacent land. In a more indirect way, it may influence other resources, such as scenery, recreation, or road building. For example, if the surrounding land is designated Remote Recreation where no new roads are allowed, it is less likely that a road will be proposed for a Scenic or Recreational River area.

Of the 536 miles of recommended Wild, Scenic, or Recreational Rivers, 221 miles of seven rivers, or 41 percent of the river miles in Wild, Scenic, or Recreational River LUDs, are already in areas allocated to Wilderness or National Monument Wilderness. Most of the remaining Wild, Scenic, or Recreational River miles outside of designated wilderness are surrounded by land currently in non-development LUD designations. Although there are differences in specific management prescriptions for each of the LUDs, there are some common directions. In general, timber harvest is not suitable in the non-development LUDs, and new roads are not allowed or are restricted to specific uses. Minor recreational development is consistent with most non-development LUDs and major recreational development is consistent only with Semi-Remote Recreation. Generally, the non-development status and resulting management prescriptions in these adjacent lands may reduce the likelihood of development in the Scenic or Recreational River LUD.

Wild and Scenic Rivers and Wilderness Management

According to the Wild and Scenic Rivers Act, any portion of a component of the Wild and Scenic Rivers System that is within a wilderness shall be subject to the provisions of both the Wilderness Act and the Wild and Scenic Rivers Act. In the case of conflict between the provisions of these Acts, the more restrictive provisions shall apply (USDA Forest Service 1993b). Thus, there are the dual, but overlapping goals of the preservation of the wilderness resources while at the same time preserving the river and its immediate environment. Because the two laws differ somewhat, legislative action should address specific issues in a particular river corridor.

A variety of recreation types are allowed by managing the rivers as Wild, Scenic, or Recreational. Wild River designation is compatible with wilderness designation because they both provide primitive and semi-primitive recreation opportunities. Scenic and Recreational River designations provide other opportunities that are more developed than those allowed in areas designated as Wild River.

Environmental Effects

Direct and Indirect Effects

Experimental Forests

The primary proposed change involving experimental forests under the action alternatives is the recommended replacement of one of the two existing experimental forests with a management unit better suited to this purpose. As indicated in the Affected Environment discussion, the Young Bay Experimental Forest provides limited opportunities for forestry research and has not been used for experimental purposes in recent decades. Therefore, all alternatives except Alternative 5 propose to eliminate the Young Bay Experimental Forest and designate the Cowee-Davies area as a new experimental forest. Alternative 5, No Action, continues the current designations and retains the Young Bay Experimental Forest.

The current Forest Plan provides standards and guidelines to maintain research opportunities within the two existing experimental forests. Those standards and guidelines have been updated for the Forest Plan Amendment, primarily to include protection for sacred sites and to address inventory and interpretation activities for minerals and geologic resources. Those changes would have no substantive effects on resources present within the experimental forest areas, other than to provide updated management direction for protection of sacred sites, minerals, and geologic resources. The updated standards and guidelines would be applied to the experimental forests designated under all of the action alternatives.

The potential effects associated with the land use allocations of the alternatives on existing and proposed experimental forest areas are described below.

Maybeso Experimental Forest

The Maybeso Experimental Forest offers limited opportunities in the near term to design new experiments (except relative to thinning regimes and management of very young second-growth timber) because most of the suitable forest land had been harvested by the 1960s. Monitoring of research plots established in this area some time ago would continue under all alternatives. New experiments could be conducted in the future. If so, they would likely be rather limited in scope and would probably occur in areas that had previously been harvested.

Young Bay Experimental Forest

The Young Bay Experimental Forest has for some time been considered for delisting as an experimental forest because of the vegetative and access conditions that limit the value of the area for research. The primary reason to retain Young Bay as an experimental forest is to maintain options in light of the Alaska Region's Ecosystem Management Strategy. Potential research could include alternative silvicultural systems and/or manipulating vegetation to create desired wildlife habitat conditions.

If or when such research activities are undertaken, any silvicultural activity would likely use a helicopter yarding method with no road construction, and would likely focus on alternatives to clearcutting. Vegetative manipulation for desired wildlife habitat conditions would likely result in small openings or single tree selection harvesting, also using a helicopter with no roads. This type of research activity would be a possible occurrence under Alternative 5.

Under Alternatives 1, 2, 3, 4, 6, and 7, the Young Bay area would no longer be designated as an experimental forest. Under these alternatives, the Young Bay area would be changed to the Semi-Remote Recreation LUD, consistent with the adjacent NFS lands to the northwest on the Mansfield Peninsula of Admiralty Island. While this is a non-development, mostly natural LUD that is nominally more restrictive of management activities than the Experimental Forest LUD, there would actually be little tangible change in management of the area given the lack of research activities conducted in this area under the past designation.

Cowee-Davies Experimental Forest

Alternatives 1, 2, 3, 4, 6, and 7 include changing the LUD of approximately 22,300 acres in the Cowee-Davies watershed to experimental forest and recommending this area for official designation as an experimental forest. This area comprises Value Comparison Units 230 and 240 and is located on the east side of Lynn Canal approximately 40 to 50 miles north of Juneau. The southwestern side of the proposed experimental forest follows the Lynn Canal shoreline but is set back a few miles, and the northern edge abuts the Berners Bay LUD II designation. The current LUD for the proposed Cowee-Davies Experimental Forest is Scenic Viewshed which, like the Experimental Forest designation, is a moderate development LUD. There would be little change in the type and intensity of management activities in this area under the proposed designation compared to current management.

Research Natural Areas

This section focuses on the effects of the alternatives on current RNAs. All seven alternatives include continued RNA designation for the 12 existing RNAs at their current respective acreages. Likewise, none of the alternatives includes proposed designation of any new RNAs. Therefore, none of the alternatives would have any direct effects on RNAs. Any potential effects of the proposal would be indirect effects associated with changes in LUDs in areas adjacent to RNAs.

Table 3.21-2 summarizes the types of LUDs surrounding RNAs under each alternative. Alternatives 1 and 2 are the same with respect to the distribution of LUDs in areas adjacent to RNAs. Both alternatives maintain current management practices that would have little to no effect on 10 of the 12 RNAs. In both cases, the only changes from current management direction are that the Limestone Inlet and Tonalite Creek RNAs would be entirely surrounded by LUDs in the natural setting group, while those areas currently have LUDs in the natural setting, moderate development, and intensive development groups. Alternatives 1 and 2 would slightly reduce the chance that management activities in adjacent areas would indirectly affect research activities in those two RNAs.

LUDs surrounding the 12 RNAs under Alternative 3 are very similar to those currently in effect (Alternative 5) and to what would occur under Alternatives 1 and 2. Limestone Inlet would also be surrounded by natural setting LUDs under Alternative 3, instead of the current mix of natural setting, moderate development, and intensive development LUDs. Both natural setting and intensive development

Table 3.21-2
Summary of LUDs Surrounding Research Natural Areas by Alternative

Research Natural Area	Alternative						
	1	2	3	4	5	6	7
Cape Fanshaw	N	N	N	M	N	N	M
Dog Island	-	-	-	-	-	-	-
Kadin Island	-	-	-	-	-	-	-
West Gambier Bay	W	W	W	W	W	W	W
Marten River	W	W	W	W	W	W	W
Limestone Inlet	N	N	N	M/I	M/I/N	M/N/I	M/N/I
Old Tom Creek	N/I	N/I	N/I	N/I	N/I	N/I	I
Red River	W	W	W	W	W	W	W
Rio Roberts	N	N	N	M/I	N	N	N/M/I
Robinson Lake	W	W	W	W	W	W	W
Tonalite Creek	N	N	N/I	N/I	N/I	N/I	N/I
Warm Pass Valley	N	N	N	N	N	N	N

Note: Letter symbols represent the following: N = Natural Setting LUD group; W = Wilderness LUD group; M = Moderate Development LUD group; I = Intensive Development LUD group.

LUDs would adjoin the Tonalite Creek RNA under Alternative 3 because they do under current management.

Under Alternative 4, management designations would change for some lands adjacent to three of the RNAs. The Rio Roberts RNA would be surrounded by LUDs in the moderate and intensive development groups. This would be a change from current management, under which natural setting LUDs surround the RNA. Similarly, the Limestone Inlet RNA would be surrounded by LUDs in the moderate and intensive development groups, while a natural setting LUD (old-growth habitat) currently abuts the west and south sides of this RNA. Finally, the NFS lands adjacent to the Cape Fanshaw RNA would be changed from a natural setting LUD (old growth) to a moderate development LUD (scenic viewshed). Based on these changes, Alternative 4 would increase the chance that management activities in adjacent areas would indirectly affect research activities in these three RNAs.

Alternative 6 would maintain the current LUDs in areas adjacent to all 12 RNAs. Therefore, Alternative 6 would have no direct or indirect effects on RNAs.

Similar to Alternative 4, Alternative 7 would intensify management designations adjacent to three RNAs. As with Alternative 4, the NFS lands adjacent to the Cape Fanshaw RNA would be changed from a natural setting LUD (old growth) to a moderate development LUD (scenic viewshed). The Rio Roberts RNA would be surrounded by LUDs in the natural setting and moderate and intensive development groups, while under current management only natural setting LUDs surround the RNA. Similarly, the Old Tom Creek RNA would be adjoined by an intensive development LUD (timber production), rather than the current mix of natural and intensive development LUDs. Overall, Alternative 7 would increase the chance that management activities in adjacent areas would indirectly affect research activities in these three RNAs.

The West Gambier Bay, Marten River, Red River, and Robinson Lake RNAs are already part of designated wildernesses, and the management situation for these areas would not change under any alternative. Similarly, the Dog Island and Kadin Island RNAs are surrounded by water and would not be affected by any LUD changes among the alternatives.

The current Forest Plan provides standards and guidelines to preserve areas of ecological importance and maintain research opportunities within the existing RNAs. Those standards and guidelines have been updated for the Forest Plan Amendment, primarily to include consultation and protection for heritage and sacred sites and to address inventory and interpretation activities for minerals and geologic resources. The updated standards and guidelines also direct that designation of motorized routes for OHVs in RNAs is generally not allowed. Those changes would have no substantive effects on resources present within the RNAs, other than to provide updated management direction for protection of sacred sites, minerals, and geologic resources. The updated standards and guidelines would be applied to the RNAs designated under all of the action alternatives.

Special Interest Areas

This section focuses on the effects that each alternative would have on existing or proposed Special Interest Areas. Alternative 5 (No Action) would maintain the 24 existing Special Interest Areas at their current acreages, and would result in no direct effects on these areas. Alternatives 1 through 4 and 6 and 7 would also continue the current designations and acreages for 23 of the 24 existing Special Interest Areas, modify the acreage of one geologic area, and add new geologic Special Interest Areas in nine regions of the Tongass.

Under Alternative 5, the total acreage within Special Interest Areas (outside of Wilderness, National Monument, and LUD II) would remain at approximately 174,000 acres. Under all other alternatives this figure would be approximately 221,000 acres, an increase of 47,000 acres. Alternatives 1 through 4 and 6 and 7 would provide increased management protection for sensitive geologic resources on the Tongass, primarily karst and cave areas, and would result in a reduced chance that these resources would be damaged by development activities.

The proposed acreage reduction among geologic Special Interest Areas involves the Arena Cove/Cape Felix area on Suemez Island. The current boundary of this area includes approximately 9,700 acres; the revised boundary encompasses approximately 7,400 acres, which is sufficient to protect the volcanic features that are the primary interest for this area. This change in the LUD represents a technical adjustment to correct a mapping error from the 1997 Tongass Land and Management Plan.

Increased acreage in proposed Special Interest Area LUDs under Alternatives 1, 2, 3, 4, 6, and 7 reflect both designation of new areas and expansion of existing areas. These changes are summarized as follows:

- Eastern Chichagof Geological Areas – 12 new areas encompassing approximately 23,900 acres, primarily to protect alpine karst areas, except for one that includes the Kook Lake cave system.
- Kosciusko Island Geological Areas – two new areas including approximately 9,400 acres with intense karst development.
- Northern Prince of Wales Geological Areas – three new areas and one expanded area (part of the Karst Areas Geological Area) covering approximately 2,800 acres (adding to 11,100 existing designated acres in this region), primarily to protect several cave systems in karst areas.
- Heceta Island Geological Area – one new area of approximately 4,100 acres that includes a number of karst-related caves.
- North-central Prince of Wales Geological Areas – two new areas including approximately 700 acres with similar cave systems.

- Dall Island Geological Areas – minor reductions to two existing areas (part of the Karst Areas Geological Area), based on improved inventory work on cave systems, and one new area for a net increase of approximately 9,100 acres.
- Big Creek Geological Area – one new area of alpine karst near Big Creek, just south of the West Arm of Cholmondeley Sound on southern Prince of Wales Island, incorporating approximately 2,000 acres.
- Calamity Creek Caves Geological Area – one new area of approximately 200 acres on Revillagigedo Island, to protect the Calamity Creek Caves and associated karst features.
- Blake Channel Geological Area – one new area of approximately 700 acres near Aaron Creek, to protect a karst and cave system.

The current Forest Plan provides standards and guidelines for managing the existing Special Interest Areas. Those standards and guidelines have been updated for the Forest Plan Amendment, primarily to include direction to inventory and manage karst resources and minerals and geologic resources. The updated standards and guidelines also direct that designation of motorized routes for OHVs in Special Interest Areas is generally not allowed. Those changes would have no substantive effects on resources present within the Special Interest Areas, other than to provide additional specific direction for protection of resources in those areas. The updated standards and guidelines would be applied to the Special Interest Areas designated under all of the action alternatives.

The acreage allocated to the existing and proposed Special Interest Areas is believed to be sufficient to include and protect the resources of interest for each respective unit. Therefore, none of the alternatives are expected to result in indirect effects associated with management activities that might occur in LUDs adjacent to Special Interest Areas.

Wild and Scenic Rivers

All seven alternatives include continued Wild, Scenic, and/or Recreational River LUD designation for the 31 existing river segments designated as potential Wild, Scenic, and/or Recreational Rivers under the current Forest Plan, and at their current respective acreages. These river segments would continue to be managed to protect the outstandingly remarkable values that make them eligible for designation as Wild, Scenic and/or Recreational Rivers by Congress. Likewise, none of the alternatives include proposed designation of any new Wild, Scenic, and/or Recreational Rivers. Therefore, none of the alternatives would have any direct effects on the potential future status of any Wild, Scenic, and/or Recreational Rivers. Any potential effects of the proposal would be indirect effects associated with changes in LUDs in areas adjacent to RNAs.

The current Forest Plan provides standards and guidelines for managing the existing Wild, Scenic, and Recreational River LUDs. Those standards and guidelines have been updated for the Forest Plan Amendment, primarily to include consultation protection for heritage and sacred sites and direction to inventory and manage karst resources and minerals and geologic resources. The updated standards and guidelines also direct that designation of motorized routes for OHVs in Special Interest Areas is generally not allowed in Wild River LUDs, but is allowed in Scenic and Recreational rivers. Those changes would have no substantive effects on resources present within the Wild, Scenic, and Recreational River LUDs, other than to provide additional specific direction for protection of resources in those areas. The updated standards and guidelines would be applied to the Special Interest Areas designated under all of the action alternatives.

Management Provisions

The kinds and amounts of activities and changes acceptable within a river corridor depend on whether it was recommended as a Wild, Scenic, or Recreational River and, to some extent, the LUDs of areas adjacent to the river segment. Variations in management restrictions among Wild, Scenic, and Recreational River LUDs are summarized below.

Recreation. The recreational objectives for management of Wild, Scenic, and Recreational River LUDs are substantially different. While the Wild River LUD ROS class is the same as Wilderness, there are small differences in specific implementation guidelines. Wilderness management has much more restrictive management than Scenic and Recreational River LUDs. LUD II management is less restrictive than Wild River or Wilderness, but more restrictive than Scenic or Recreational River.

Timber Harvesting. Timber harvesting and associated roads and log transfer facilities are presently only allowed in the Scenic and Recreational Rivers when they are adjacent to LUDs that allow timber harvest. There are only 13 miles of rivers in this situation. Costs of harvest in the Scenic and Recreational River LUDs may be higher than other LUDs as a result of standards to maintain identified values.

Water Project Development. New diversions, water supply dams, and hydroelectric power development are not allowed under the Wild, Scenic, and Recreational River LUDs.

Transportation and Utility Corridors. All three river designations are in Transportation and Utility System “Avoidance Areas.” Thus, transportation and utility sites or corridors may be located within these LUDs only after an analysis of potential sites shows that there is no feasible alternative outside these LUDs.

Mining. Mineral entry is not denied in Wild, Scenic, or Recreational River LUDs, but it does need to be consistent with the purposes of the LUD so the eligibility for Congressional designation is maintained. Costs of mining in these areas may be higher than in other LUDs as a result of standards to maintain identified river values. Congressional designation of a river as Wild under the national program would then deny mineral entry, subject to valid claims, but would not affect Scenic or Recreational Rivers.

Roads. New road construction is not allowed in the Wild River LUD. Roads are allowed in the Scenic and Recreational River LUDs and bridges can span the river. If road construction is not allowed in the adjacent area, it is less likely that roads would be planned in the river area. Only 13 miles of the river corridors in roadless areas are within LUDs that allow road construction for forest development.

Fish Improvement Projects. Fish habitat improvements are generally more restricted under Wild, Scenic, and Recreational River designations than under Wilderness or LUD II. In the three Wild and Scenic River LUDs, the free-flowing characteristic and outstandingly remarkable values must be maintained, which limits the projects that can be implemented. Weirs and other stream obstructions are either prohibited or discouraged. However, weirs are a tool of state management of fisheries, installed seasonally, and are not considered to be stream obstructions in the same vein as dams and permanent facilities.

Wildlife Habitat Improvements. In Wild, Scenic, and Recreational River designations, the wildlife habitat improvements are limited to those with the objective of protecting or restoring the river resource and enhancing the outstandingly remarkable value. Manipulation of vegetation or improvements, such as fencing or artificial nest structures, would likely be incompatible with Wild classification. Other improvements might be compatible with a Scenic designation, as long as the undeveloped character was maintained. Most improvements would be acceptable in a Recreational classification, consistent with the outstandingly remarkable values.

Area-Specific Considerations

In addition to the general issues for the Forest activities described above, there are specific resource issues associated with some individual rivers (segments).

Aaron, Oerns, Berg Creeks – Approximately 4 miles of Aaron and Berg creeks are within and adjacent to a corridor with known mineral potential for zinc, copper, silver, and lead. The Bureau of Land Management (BLM) lists this area's potential for mineral development at its highest level (USDA Forest Service 1997a). It has a Mineral LUD overlay that encourages mineral development and may allow road building for mining purposes. There are no existing mineral claims on the river corridor, but the claims in adjacent land may require roads through the river corridor. This corridor has been recommended as Scenic or Recreational River, and designation by Congress as such would not deny mineral rights.

Glacial River – This is not an area of identified high mineral potential for known resources, but the upper half of the river is in a Class 3 tract of undiscovered mineral resources, as mapped by the U.S. Geologic Survey (USGS). This area was recommended to be included in the National Wild and Scenic Rivers System as Wild. Congressional designation as a Wild River would close the corridor to mineral entry, subject to valid existing claims.

Gokachin-Mirror-Low-Fish Creeks – The area within and adjacent to the corridor near Gokachin Creek has been identified by the BLM as having high priority for minerals development. There are several unpatented mine claims within the corridor. This area was recommended to be included in the National Wild and Scenic Rivers System as Wild, which, with Congressional action, would withdraw it from mineral entry.

Kadake Creek – The timber sale schedule identifies numerous entries in and adjacent to this corridor. The river was recommended as a recreational river, thus preserving the ability to harvest timber on most of the corridor's 23 miles (USDA Forest Service 1997a).

Kah Sheets Creek and Lake – Approximately 5 miles of this area are in the Wild River LUD, where timber production is not allowed. Approximately 2 miles are in a Scenic River LUD and are adjacent to a Timber Production LUD. Timber production is allowed in those 2 miles.

Orchard Creek and Lake – The lower portion of the river was recommended as Recreational River to allow the construction of the Swan Lake-Lake Tyee transmission line (USDA Forest Service 1997a). The transmission line has since been located outside this area.

Sarkar Lakes – This area is extremely popular for recreation, with an emphasis on fishing (USDA Forest Service 1997a). Portions of it were recommended as Scenic and Recreational Rivers. The area on the south side of Sarkar Cove is known to have potential mineral development. BLM has not identified the area as having high potential for mineral development and no mining claims exist (USDA Forest Service 1997a).

Virginia Lake – USGS estimates the undiscovered mineral resource to have a moderate value. BLM lists this area as having potential for mineral development. There are no existing claims in the river corridor in the Recreational River LUD (USDA Forest Service 1997a). The timber sale schedule identifies two sales for this management area that could occur within and adjacent to this corridor, consistent with the Recreational River prescription (USDA Forest Service 1997a).

Ecological, scenic, and recreational attributes within the Wild, Scenic, and Recreational River LUDs could be indirectly affected by activities permitted within adjacent LUDs. Table 3.21-3 summarizes the types of LUDs adjacent to Wild, Scenic, and Recreational River LUDs under each alternative.

For most of the river segments, all seven alternatives are identical with respect to the LUDs for lands adjacent to the rivers. Six of the river LUDs (Blue River, Chickamin River, Hasselborg River and Lakes, King Salmon River, LeConte Glacier and Petersburg Creek) are within designated wilderness areas. Similarly, five river LUDs (Anan Creek, Kadashan River, Lisianski River, Naha River, and Salmon Bay Lake and Stream) are entirely or predominantly within LUD II areas. Aside from these river segments within Congressionally designated units, lands adjacent to nine other Wild, Scenic, or Recreational River LUDs remain the same for all seven alternatives. In almost all cases, these adjacent LUDs are in the mostly natural setting LUD group.

Differences among the alternatives with respect to LUDs adjacent to Wild, Scenic or Recreational Rivers apply to 11 of the river LUDs. In most cases, Alternatives 1 and 2 would result in more lands adjacent to river segments in natural setting LUDs. Alternative 7 and, to a lesser extent, Alternative 4 would result in more extensive areas of moderate and intensive development LUDs adjacent to river segments.

Table 3.21-3
LUDs Adjacent to Wild, Scenic, and Recreational Rivers by Alternative

River Name	Alternative						
	1	2	3	4	5	6	7
Aaron, Oerns, Berg Creeks	N	N	N	N	N	N	N
Anan Creek	N	N	N	N	N	N	N
Blind River	N	N	N	N	N	N	N/M
Blue River	W	W	W	W	W	W	W
Chickamin River	W	W	W	W	W	W	W
Essowah Lake and streams	N	N	N	N	N	N	N
Fall Dog Creek (local)	N	N	N	N	N	N	N
Farragut River	N	N	N	N	N	N	N
Gilkey River	N	N	N	N	N	N	N
Glacial River	N	N	N	N	N	N	N
Gokachin-Mirror-Low-Fish Creeks	N/W	N/W	N/W	N/W/I	N/W	N/W	W/M/I
Harding River	N	N	N	N/M	N/M	N/M	N/M
Hasselborg River and Lakes	W	W	W	W	W	W	W
Kadake Creek	N/M/I	N/M/I	N/M/I	N/M/I	N/M/I	N/M/I	N/M/I
Kadashan River	N	N	N	N	N	N	N
Kah Sheets Creek and Lake	N	N	N/I	N/I	N/I	N/I	N/I
Katzehin River	N	N	N	N	N	N	N
Kegan Lake and streams	N	N	N/I	N/M/I	N/I	N/I	N/M/I
King Salmon River	W	W	W	W	W	W	W
Kutlaku Creek and Lake	N	N	N	N	N	N	N
LeConte Glacier	W	W	W	W	W	W	W
Lisianski River	N	N	N	N	N	N	N
Naha River	N	N	N	N	N	N	N
Orchard Creek and Lake	N	N	N/I	N/M/I	N	N/I	N/M/I
Petersburg Creek	W	W	W	W	W	W	W
Salmon Bay Lake and stream	N/M	N/M	N/M	N/M	N/M	N/M	N/M
Santa Anna Creek - Lake Helen	N	N	N/I	I	N/M/I	N/I	M/I
Sarkar Lakes	N/M/I	N/M/I	N/M/I	N/M/I	N/M/I	N/M/I	N/M/I
Thorne River-Hatchery Creek	N/M/I	N/M/I	N/M/I	N/M/I	N/M/I	N/M/I	M/N
Virginia Lake and Creek	N	N	M	M	M	M	M
Wolverine Creek-McDonald Lake	N	N	I	N	N	N	N

Note: Letter symbols represent the following: N = Natural Setting LUD group; W = Wilderness LUD group; M = Moderate Development LUD group; I = Intensive Development LUD group.

Cumulative Effects

There would be no change in the number of units or acres with RNA or Wild, Scenic, or Recreational River LUDs under any of the alternatives. As a result, there would be no cumulative effects associated with these types of special LUDs under the Forest Plan Amendment. With respect to both Experimental Forests and Special Interest Areas, Alternative 5 would maintain the current acreage within these LUDs, while all other alternatives would recommend increases in the acreage. The net effect of these proposed changes would be a minor increase in the total acreage within mostly natural setting LUDs, and a slight decrease in the extent of developmental activities within the Tongass. As a result, there would be no cumulative effects associated with special LUDs under Alternative 5, and a slightly reduced potential for cumulative effects to Tongass resources under all other alternatives.

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Affected Environment

Introduction

The Tongass National Forest stretches roughly 500 miles from Ketchikan in the southeast to Yakutat in the northwest and includes approximately 80 percent of the land area in Southeast Alaska. The region is sparsely settled with more than 70,000 people living in 32 towns and villages located in and around the Forest. The communities of Southeast Alaska depend on the Tongass National Forest in various ways, including employment in the wood products, commercial fishing and fish processing, recreation, tourism, and mining and mineral development sectors. Many residents depend heavily on subsistence hunting and fishing to meet their basic needs. In addition, natural amenities, subsistence resources, and recreation activities associated with the Tongass National Forest form an important part of the quality of life for many residents of Southeast Alaska. Since there is very little private land in the region to provide these resources and opportunities, appropriate management of the Tongass National Forest is extremely important to local communities and the overall regional economy.

The Tongass National Forest is also an important national and international resource, with an estimated 948,000 cruise ship passengers visiting Juneau in 2005 (McDowell Group 2005), representing a 48 percent increase since 2000. For many, a visit to the Tongass is a once-in-a-lifetime experience and the spending by these visitors drives the recreation and tourism sector, which is the largest natural resource-based sector in the regional economy. The Tongass National Forest contains large areas of essentially undisturbed forest lands, which represent increasingly scarce and, therefore, increasingly valuable ecosystems. These lands have value for many people who may never visit Southeast Alaska, but benefit from knowing that the Tongass National Forest is there. This type of value, often referred to as non-use value, includes existence, option, and bequest values. These values represent the value that individuals obtain from knowing that the Forest exists, knowing that it would be available to visit in the future should they choose to do so, and knowing that it would be left for future generations to inherit.

The economic and social assessment prepared for this EIS is divided into two main sections: 1) Regional and National Economy, and 2) Subregional Overview and Communities. This section—*Economic and Social Environment*—evaluates the potential regional and national economic impacts. The next section—*Subregional Overview and Communities*—also assesses impacts to the economic and social environment, but at the subregional and community level.

Southeast Alaska is divided into five boroughs and three census areas. The five boroughs correspond with the county governments found elsewhere in the United States. Three of these boroughs, Juneau, Sitka, and Yakutat, are city/boroughs. The other two, Ketchikan Gateway and Haines, have independent incorporated communities within their boundaries. The remaining areas that are not part of a borough are allocated to three census areas: Prince of Wales-Outer Ketchikan, Skagway-Hoonah-Angoon, and Wrangell-Petersburg. While census areas are only statistical units, they are widely recognized from a data reporting standpoint by federal agencies and most state agencies as county equivalents.

More than 70,000 people live in the towns, communities, and villages of Alaska's southeastern panhandle, most of which are located on islands or along the narrow coastal strip. Only four of Southeast Alaska's 32 communities met the U.S. Census Bureau's 2000 definition of an urban cluster (population greater than 2,500) in 2005 (Juneau, Sitka, Ketchikan, and Petersburg). Juneau, which is the state capital and a regional trade center, accounted for 43 percent of Southeast Alaska's total population in 2005 (Alaska Department of Labor [DOL] 2006a). Ketchikan Gateway Borough, the second largest borough in Southeast Alaska, accounted for about 19 percent of the region's population in 2005. Ketchikan is a smaller regional trade center that serves Prince of Wales Island and the surrounding area. Population is discussed in more detail in the *Subregional Overview and Communities* section of this EIS.

The remote nature of the region is reflected in a population density of approximately two persons per square mile, which is much lower than the United States' average of 80 persons per square mile. Population densities by borough/census area in 2000 ranged from 0.4 in the Skagway-Hoonah-Angoon census area to 11.4 in Ketchikan Gateway Borough (U.S. Census Bureau 2001). Many locations are accessible only by boat or plane, and landing strips or seaplane facilities are located in virtually all communities. The Alaska State ferry system transports people and vehicles between several ports in Southeast Alaska, and Prince Rupert, British Columbia, and Bellingham, Washington. Haines and Skagway, at the northern end of the Forest, and Hyder at the southern end, offer access to interior and Southcentral Alaska via the Alaska Highway, and Canada via the Cassiar Highway.

The following sections provide an overview of the social and economic conditions in Southeast Alaska and provide a baseline against which the potential effects of the proposed alternatives are measured.

Regional Economic Overview

The Tongass National Forest plays an important role in the formal and informal economies of Southeast Alaska. The formal economy includes those economic activities that are recorded in official statistics. The informal economy includes activities that are not typically recorded in official statistics, such as subsistence, in-kind contributions, non-cash income, unpaid labor and labor exchanges, and care giving to the young and old (Ratner 2000).

Summary economic data are presented for Southeast Alaska for 1996 and 2005 in Table 3.22-1. Annual rates of growth are presented for this period. These data indicate that employment in Southeast Alaska increased by approximately 2 percent over this period (Table 3.22-1). Data compiled by the Alaska DOL indicate that employment in Southeast Alaska has fluctuated over the last decade with a year of job growth often followed by a year of net job loss (Gilbertson 2006).

Adjusted for inflation, total personal income in Southeast Alaska was almost the same in 2005 as it was in 1996 ($2,598 million versus $2,587 million). Total personal income in Alaska and the U.S. increased over this period with respective annual growth rates of 2.2 percent and 2.7 percent. Per capita income in Southeast Alaska was higher in 2005 than 1996, but increased at a slower rate than the Alaska and U.S. averages. Average earnings per job in Southeast Alaska, adjusted for inflation, were 7 percent lower in 2005 then 1996, a decrease of 0.8 percent per year, compared to state and U.S. annual growth rates of 0.2 percent and 1.4 percent over the same time period (Table 3.22-1).

Per capita income in Southeast Alaska was similar to the statewide average in 2005, and six percent higher than the national average. Average earnings per job, which were higher than the national average in 1996 were lower in 2005, with average earnings per job in Southeast Alaska equal to 88 percent of the national average (Table 3.22-1). The region's unemployment rate (7.9 percent) was higher than the state (6.9 percent) and national (5.1 percent) averages in 2005.

Table 3.22-1
Southeast Alaska Economic Overview

	SE AK		1996 to 2005			
	1996	2005	SE AK Percent Change	SE AK Growth Rate (%)	Alaska Growth Rate (%)	U.S. Growth Rate (%)
Total Personal Income (Million 2005 dollars)	2,598	2,587	0%	0.0	2.2	2.7
Population	74,559	71,043	-5%	-0.5	1.0	1.1
Average Annual Employment	50,208	51,188	2%	0.2	1.8	1.5
Per Capita Personal Income (2005 dollars)	34,848	36,411	4%	0.5	1.2	1.6
As percent of Alaska Average	109%	102%	-	-	-	-
As percent of U.S. Average	116%	106%	-	-	-	-
Average Earnings per Job (2005 dollars /year)	37,801	35,170	-7%	-0.8	0.2	1.4
As percent of Alaska Average	95%	87%	-	-	-	-
As percent of U.S. Average	107%	88%	-	-	-	-
Non-Job Related Earnings Per Capita (2005 dollars)	11,148	11,171	0%	0.0	0.2	0.7
As percent of Total Per Capita Income	32%	31%	-	-	-	-
SE Alaska Unemployment Rate	7.0	7.9	-	-	-	-
Alaska Unemployment Rate	7.3	6.9	-	-	-	-
U.S. Unemployment Rate	5.4	5.1	-	-	-	-

Notes:
SE AK = Southeast Alaska
1. Income and earnings figures for 1996 are adjusted for inflation and presented as the amount they would be worth in 2005.
2. Full and part-time employment includes self-employed workers. Employment data are by place of work, not place of residence, and therefore include people who work in Southeast Alaska but do not live there. The nonresident share of total private employment in Southeast Alaska was estimated to be approximately 28.1 percent in 2004 (Hadland et al. 2006). Employment is measured as the average annual number of jobs, full-time plus part-time, with each job that a person holds counted at full weight.

Source: Alaska DOL 2007a, 2007b, 2007c; U.S. Department of Commerce, Bureau of Economic Analysis 2007a, 2007b, 2007c, 2007d; U.S. Department of Labor, Bureau of Labor Statistics 2007

Southeast Alaska employment is summarized by sector in Table 3.22-2. State and local government, consumer services, and retail trade were the largest employers in 2001 and 2005, accounting for 21, 14, and 12 percent of total employment in 2005, respectively. Total employment increased by about 1,630 jobs or 3 percent between 2001 and 2005, with self-employed workers (proprietors) accounting for 66 percent of this increase. The largest increases in absolute terms were in the health care (1,235 jobs), retail trade (510 jobs), and real estate and rental and leasing (444 jobs) sectors. The largest absolute decreases occurred in the construction (-346 jobs) and the professional and technical services (-242) sectors. These gains and losses were not evenly distributed throughout the region, as discussed in the *Subregional Overview and Communities* section.

Table 3.22-2
Southeast Alaska Employment by Sector, 2001 and 2005

	Number of Jobs		Share of Total (percent)		Percent Change	
Total full-time and part-time employment[1]	**2001**	**2005**	**2001**	**2005**	**2001 to 2005**	**2005 Location Quotient**[3]
	49,556	**51,188**	**100**	**100**	**3**	**1.0**
Type of Employment						
Wage and salary employment	37,850	38,401	76.4	75.0	1	1.0
Proprietors employment	11,706	12,787	23.6	25.0	9	1.1
Wage and Salary Employment by Industry						
Farming	29	30	0.1	0.1	3	0.3
Forestry, fishing, related activities, and other	805	775	1.6	1.5	-4	0.5
Mining	36	38	0.1	0.1	6	0.0
Construction	2,388	2,040	4.8	4.0	-15	0.6
Manufacturing	1,838	1,764	3.7	3.4	-4	1.0
Wholesale trade	60	67	0.1	0.1	12	0.1
Retail trade	5,442	5,952	11.0	11.6	9	1.1
Transportation and warehousing	2,757	2,655	5.6	5.2	-4	1.0
Finance and insurance	965	917	1.9	1.8	-5	0.7
Real estate and rental and leasing	1,105	1,549	2.2	3.0	40	0.7
Services (Consumer)[2]	7,117	7,073	14.4	13.8	-1	1.0
Services (Producer)[2]	2,405	2,361	4.9	4.6	-2	0.4
Services (Social)[2]	3,306	4,719	6.7	9.2	43	0.8
Federal government	2,827	3,226	5.7	6.3	14	0.7
State and local government	11,072	10,928	22.3	21.3	-1	1.5

[1] See Table 3.22-1, note 2.

[2] Nine 2-digit North American Industry Classification System (NAICS) categories are combined into these three divisions for ease of presentation. Consumer service includes: other services; arts, entertainment, and recreation; and accommodation and food services. Producer services includes: information; professional and technical services; management of companies and enterprises; and administrative and waste services. Social services includes: educational services; and health care and social assistance.

[3] The location quotient is a relative measure of industry specialization that compares the percentage of employment concentrated in each sector in the study region with a benchmark region, in this case the State of Alaska. A location quotient of 1.0 indicates that the study region has the same percentage of employment in this sector as the benchmark region does. Location quotients above or below 1.0 indicate that the study region is over or under represented in this sector, respectively.

Source: U.S. Department of Commerce, Bureau of Economic Analysis 2007b.

The location quotients in Table 3.22-2 (see note 3) compare the regional employment distribution with the state average and indicate Southeast Alaska's economy is specialized in the state and local government and retail trade sectors (Table 3.22-2). The relative concentration in the government sector largely reflects the location of the state capital in Juneau, but the relatively high proportion of government employment in the other Southeast Alaska communities also plays a part. With the exception of manufacturing, transportation and warehousing, and consumer services, which have location quotients of 1.0, all other sectors in Southeast Alaska are relatively underrepresented.

The government sector is the main source of year round employment in all the communities in Southeast Alaska. In addition to direct employment in the government sector, many of the area's private sector jobs are also dependent on government funding and contracts. Private sector activities dependent on government funding include road construction and even health services, with the region's largest private employer, Southeast Alaska Regional Health Corporation, relying heavily on government funding (Gilbertson 2004).

Recreation and tourism are heavily represented in the economy of Southeast Alaska. This is not readily apparent from Table 3.22-2 because recreation and tourism-related activities are distributed over a number of standard economic sectors, mainly retail trade and consumer services. The percent of the total workforce that is self-employed in Southeast Alaska is slightly higher than the state average, 24 percent compared to 22 percent (location quotient of 1.1), and higher than the national average of 19 percent. Much of this self-employment is associated with the retail trade and consumer services sectors and is sensitive to recreation and tourism activity. Commercial fishing also accounts for a large share of self-employment in Southeast Alaska.

The following section discusses the relative contribution of natural resource-based industries to the regional economy, and more specifically those industries that could be potentially affected by the proposed alternatives.

Natural Resource-Based Industries

Overview

Wood products, recreation and tourism, and mining are the primary natural resource-based industries that could be affected by the alternatives. The following discussion focuses on these industries, but also provides summary information on commercial fishing and seafood processing to provide a more complete overview of the contribution of natural resource-based industry to the regional economy of Southeast Alaska.

In most cases, the employment, income, and revenue figures derived for these industries required a series of steps, each involving assumptions and potential sources of error. Where possible, these assumptions are stated and the nature of the associated problems discussed.

Direct Employment

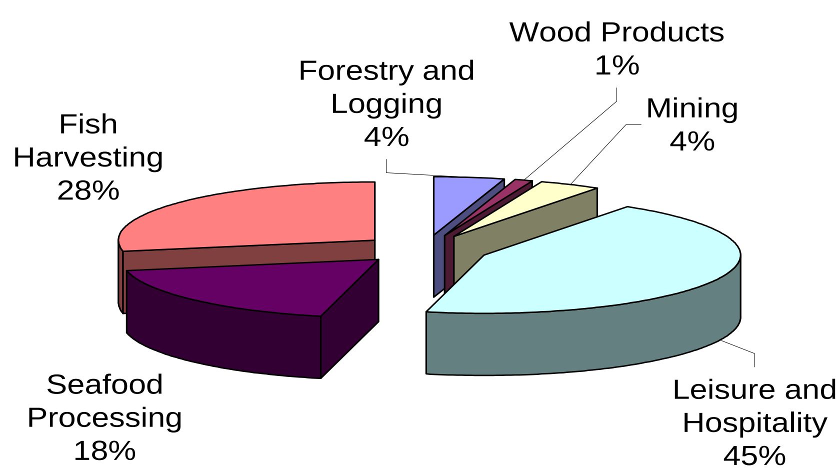
Direct employment in natural resource-based industries accounted for 21 percent of total employment in Southeast Alaska in 2005 (Table 3.22-3). The distribution of resource-dependent employment is shown by industry in Figure 3.22-1. The leisure and hospitality sector, used here to represent recreation and tourism, accounted for 45 percent of direct resource-dependent employment in 2005. Fish harvesting and seafood processing accounted for an estimated 28 percent and 18 percent, respectively. Forestry and logging and wood products together accounted for 5 percent of natural resource employment, with mining accounting for the remaining 4 percent (Figure 3.22-1).

Table 3.22-3
Natural Resource-Based Industry Employment, 2005

Industry	2005 Direct Employment	Direct Employment as a Percent of SE Alaska Total[4/]	2005 Total Employment	Total Employment as a Percent of SE Alaska Total
Forestry and Logging	351	1%	674	2%
Wood Products	105	0%	219	1%
Mining	312	1%	462	1%
Leisure and Hospitality[1/]	3,586	9%	4,339	11%
Seafood Processing	1,500	4%	2,460	6%
Resource Dependent Total[2/]	5,854	15%	NA	NA
Total Wage and Salary Employment[3/]	**36,700**	94%	**36,700**	93%
Fish Harvesting (proprietors)	2,281	6%	2,806	7%
Southeast Alaska Total[4/]	**38,981**	**100%**	**39,506**	**100%**

1/There are no recent available estimates of recreation and tourism employment available for Southeast Alaska. The Leisure and Hospitality sector is used here as a relative indication of the importance of this industry. This sector includes the Arts, Entertainment, and Recreation and Accommodation and Food Services sub-sectors.
2/There is no total provided for 2004 Total Employment because indirect employment for the seafood processing sector includes salmon harvesting and summing the totals for these sectors would result in some salmon harvesting employment being double counted.
3/This total and the direct employment numbers for the above sectors represent non-agricultural wage and salary employment and do not include proprietors or self-employed workers.
4/This total includes proprietors employment for the fish harvesting sector only.
Sources: Alaska DOL 2006a, 2006b, 2007d.

Figure 3.22-1
Direct Resource-Dependent Employment by Sector 2005



Total = 8,135 Employees (Average Annual Employment)
Source: see Table 3.22-3

Total Employment and Earnings

Economic activity in one sector generates activity in others as firms purchase services and materials as inputs (termed "indirect" effects) and employees spend their earnings within the local economy ("induced" effects). In what is known as the multiplier effect, each industry possesses a multiplier that represents its impact on the regional economy given its particular distribution of local purchases and payments. The total effects (i.e., direct, indirect, and induced) generated by an industry are calculated by multiplying employment within that industry ("direct" effects) by the appropriate multiplier.

The analysis presented in this EIS uses industry-specific multipliers to assess the total employment and income effects of the alternatives. These multipliers are also used to estimate total natural resource-based employment in 2005 (Table 3.22-3). The multipliers used in this analysis are presented in Table 3.22-4. These multipliers were estimated using IMPLAN, an input-output model commonly used in this type of application. Total employment and income estimates derived using these multipliers include both indirect and induced effects.

Table 3.22-4
Employment and Income Multipliers

	Employment	Income
Sawmills	2.09	1.51
Logging	1.92	1.39
Mining	1.48	1.25
Recreation and Tourism	1.21	1.32
Salmon Harvesting	1.23	2.37
Seafood Processing	1.64	1.32

Notes:
1. These multipliers were estimated using the 1998 IMPLAN model.
2. The multipliers shown in this table are for total (direct, indirect, and induced) employment or income. Ten direct sawmill jobs would, for example, result in total (direct, indirect, and induced) employment of approximately 21 jobs.

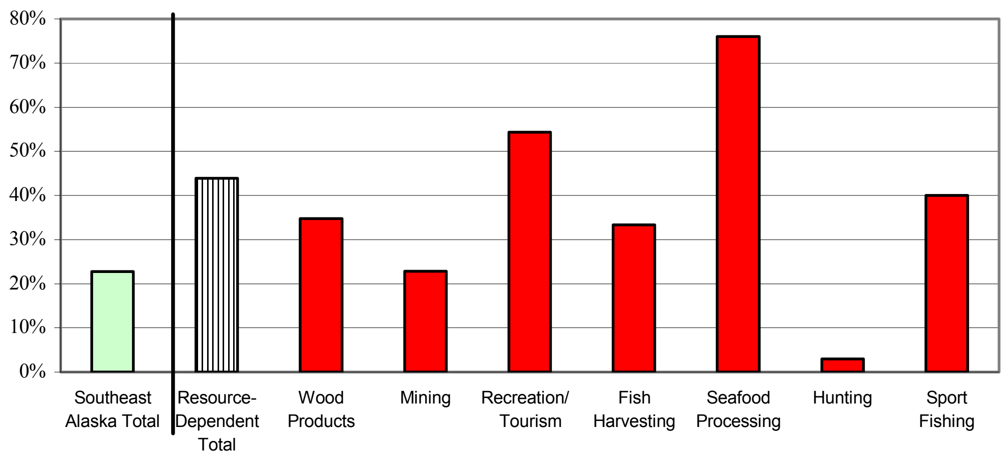
The software and databases necessary to run IMPLAN are available commercially from the Minnesota IMPLAN Group. The IMPLAN system adjusts national level data to fit the economic composition and estimated trade balance of a chosen region and can be used to construct county or multi-county models for any region in the United States. The model used for this analysis consists of the boroughs and census areas that comprise Southeast Alaska. The data used to estimate the multipliers in Table 3.22-4 were obtained from standard data sets produced and maintained by the Minnesota IMPLAN Group. Concerns have been raised with respect to the ability of IMPLAN and similar input-output models to accurately predict indirect and induced effects. Alternate techniques for estimating these effects are, however, subject to the same, or similar, criticisms and more accurate estimates are not readily available for this analysis. While the multipliers presented here should be viewed with caution, the resulting estimates of indirect and induced employment provide a basis for comparison between alternatives.

The estimates of resource-dependent employment shown in Figure 3.22-1 are only for direct employment and, as a result, do not fully illustrate the role that resource-dependent industries play in the regional economy. Adding indirect and induced employment effects alters the relative contribution of the various sectors because employment multipliers vary by industry, but provides a more complete picture of the economic importance of resource dependent industries. The relative contribution is also different when measured in terms of income because wage rates vary by sector, with higher average wages paid in the mining and wood products sectors. Total employment estimates are presented in Table 3.22-3 to provide perspective on the overall contribution of natural resource-based industries to the region's economy, as well as the relative significance of each sector.

Nonresident and Seasonal Employment

Nonresident and seasonal employment are two important and related aspects of resource-dependent employment in Southeast Alaska. Nonresident employment shares are shown for each resource-dependent industry and the region as a whole in Figure 3.22-2. Nonresident workers accounted for 44 percent of employment in the resource-dependent sector as a whole in 1994, approximately twice the regional average. Seafood processing and recreation and tourism had the largest nonresident shares, but all of the resource-dependent industries, with the exception of guided hunting, had nonresident shares above the regional average. Many nonresidents work a relatively short time in Alaska, often for just 2 or 3 months, generally spend the bulk of their earnings elsewhere, and, as a result, contribute less to the regional economy than resident workers.

Figure 3.22-2
1994 Nonresident Share of Direct Employment in Southeast Alaska, Total and Resource-Dependent Industries



Note: All employment figures are standardized to annual average employment.
Source: USDA Forest Service 1997a (Figure 3-16).

Figure 3.22-2 was prepared for the 1997 Forest Plan EIS using data compiled by the Alaska DOL. More recent comparable data are not available. However, statewide nonresident data suggest the nonresident shares shown in Figure 3.22-2 are generally representative of current patterns. Seafood processing had the highest percentage of nonresident workers in Alaska in 2004, with almost three quarters of the labor force (72 percent) comprised of nonresidents. This is comparable with the 1994 data, which showed that 75 percent of workers in the seafood processing sector in Southeast Alaska were nonresidents. Similarly, statewide in 2004, nonresident workers comprised 33 percent of statewide employment in the logging and wood products sector in 2004, compared to 35 percent in Southeast in 1994 (Hadland et al. 2006).

Nonresidents accounted for approximately 28.1 percent of private sector employment in Southeast Alaska in 2004, compared to 21.3 percent for the state as a whole. Within Southeast Alaska, the nonresident share of employment ranged from 18.9 percent in Juneau to 44.3 percent and 49.7 percent in Haines and Skagway-Hoonah-Angoon, respectively. The relatively low level of nonresident employment in Juneau reflects the importance of the government sector, which accounted for 42 percent of employment in Juneau in 2005 (Alaska DOL 2006b).

Average annual seasonal variations in employment are shown for resource-dependent industries and the region as a whole in Figure 3.22-3. As shown in this figure, seasonal variations in resource-based employment—the difference between peak levels of employment in the summer and dips in the winter—are often quite pronounced. The measure shown in the figure is calculated by dividing the difference between summer maximum and winter minimum employment by annual average employment. Expressed as a percentage, this figure allows comparison between different industries and the regional economy as a whole. Seafood processing shows a very high degree of seasonal variation. Data for 2000 through 2004 for salmon harvesting are not shown in Figure 3.22-3, but using the same measure show an annual degree of seasonal variation that is slightly more than twice the variation for seafood processing, with employment ranging from about 100 people in January to as many as 18,700 in July (Patton and Robinson 2006).

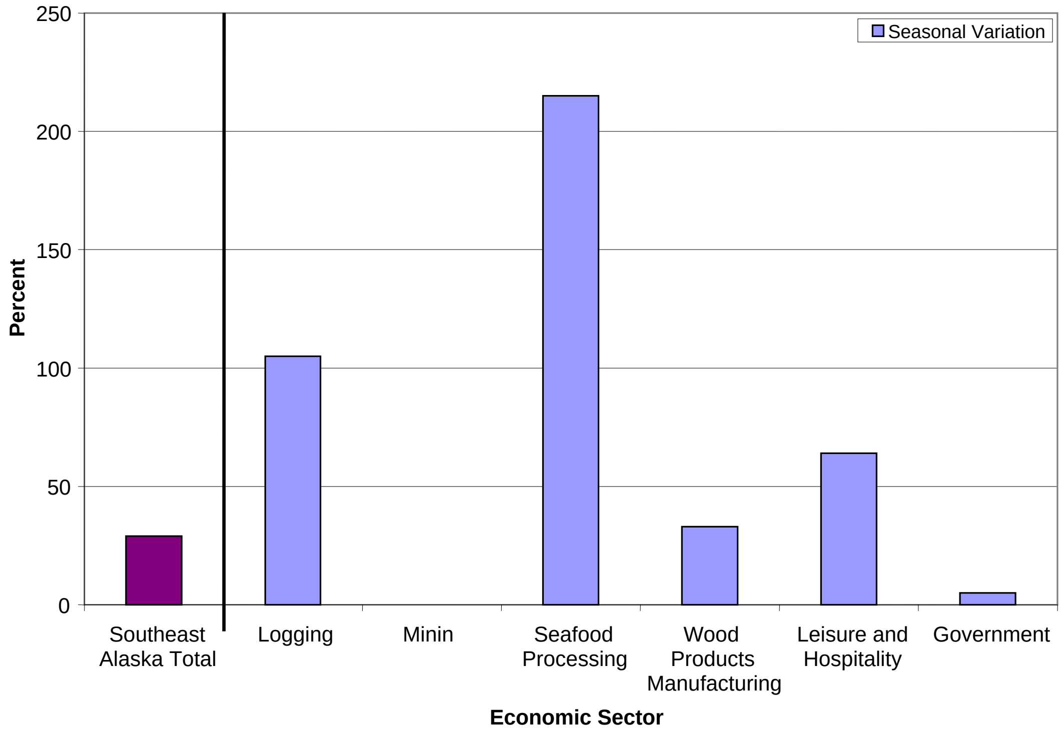
Although not reported here, it is safe to assume, based on the distribution of visitors throughout the year among other things, that recreation and tourism also shows a high degree of seasonal variation. Data are presented for the Leisure and Hospitality sector in Figure 3.22-4 as a proxy for recreation and tourism and show a degree of variation substantially lower than the salmon harvesting and seafood processing sectors, but more than twice the Southeast Alaska average. Data for the logging sector also show a high degree of seasonal variation; about half the variation for the seafood processing sector. Seasonal variation for wood products manufacturing was generally comparable with the Southeast Alaska average. The mining sector showed no seasonal variation, with 300 people reported in this sector for the entire three year period that data are available. Data are also presented for the government sector, which showed much less seasonal variation than the Southeast Alaska average (Figure 3.22-4). There is, however, some variation by type of government employment, with the seasonal variation for federal government employment more than twice the variation for state and local government, but still less than the Southeast Alaska average.

These data indicate that much of the employment in resource-based industries in Southeast Alaska is seasonal and typically relies on a transient labor force. Communities that rely on this type of employment often have difficulty attracting other service providing industries that rely upon year round customers. Gilbertson (2004) suggests that Juneau has experienced relatively large private sector growth over the last decade or so because the stable year round government employment there attracts service providing industries. This is not, unfortunately, the case with many smaller Southeast Alaska communities.

Industry-Specific Descriptions

The following subsections contain more detailed descriptions of each resource-dependent industry.

Figure 3.22-3
Average Annual Seasonal Variation in Employment 2001-2005 (percent)



Notes:
1. Average seasonal variation is calculated here by dividing the difference between summer maximum and winter minimum employment by annual average employment. The resulting measure is expressed as a percentage.
2. The estimates for logging and mining are based on three years data only (2001 to 2003). The wood products manufacturing estimate is based on just two years (2001, 2002). The other estimates are based on five years of data (2001 to 2005).
3. There was no seasonal variation in mining employment during 2001 through 2003.
4. Data for the salmon harvesting sector are available for 2000 through 2004. These data are not included in the graph because the degree of annual seasonal variation is an estimated 447 percent, slightly more than twice the variation for seafood processing.
5. Data for the Leisure and Hospitality sector are used here to represent the Recreation and Tourism sector.
Source: Alaska DOL 2006a, Patton and Robinson 2006

Wood Products

Overview

Direct employment in the wood products industry declined dramatically from its peak of 3,543 jobs in 1990 to 456 jobs in 2005, accounting for approximately 1 percent of total regional employment in 2004. Much of this job loss was associated with closure of the large pulp mills in Sitka (1993) and Ketchikan (1997), which collectively accounted for 899 jobs in 1990. These pulp mills accounted for about half of the federal timber harvest from 1970 up until their closure and also processed much of the chip by-products (manufacturing residues) from the region's sawmills over this period. Closure of the pulp mills had a major effect on the regional demand for timber and the market for wood chips, which has directly affected the region's remaining sawmills.

A larger absolute decline in wood products employment over this period occurred in the logging sector with a net decline of 1,842 jobs over the same period, a decrease from 2,144 jobs in 1990 to just 302 jobs in 2004. This decline in logging employment partly occurred due to a reduction in harvest from the Tongass National Forest, with annual harvest declining from 471 million board feet (MMBF) in 1990 to 46.3 MMBF in 2004, but large reductions in annual harvest also occurred on private lands, with annual private harvests declining from 506.1 MMBF to 98.9 MMBF over the same period.

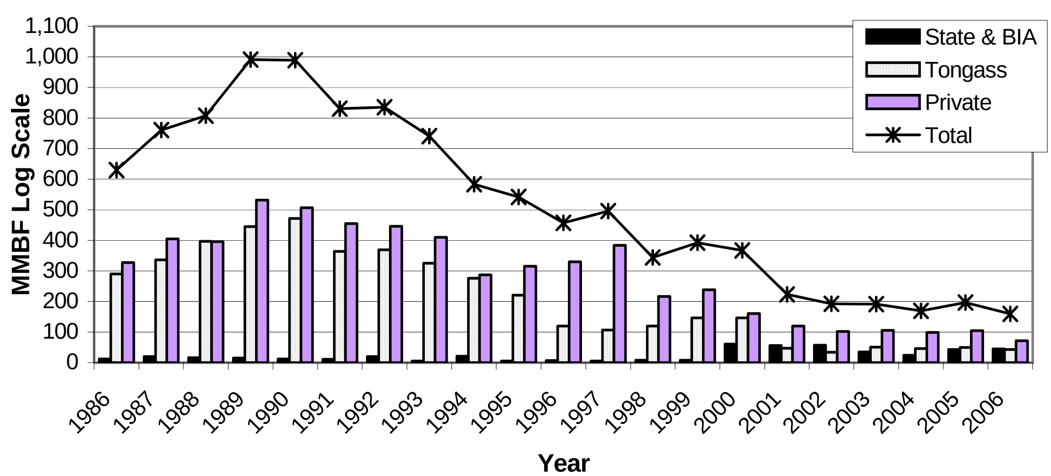
There have been major shifts in markets served by Alaska sawmills over the past decade. Up to 95 percent of production was exported to Japan prior to 1997. Foreign exports have fallen since 2000 and the proportion of volume shipped to domestic markets in the lower 48 states has increased, ranging from 60 percent to 83 percent of total production. Shipments to domestic markets are primarily shop lumber or niche specialty products. Western hemlock is the main species processed by Alaska mills, accounting for 50 to 56 percent of total production (Brackley et al. 2006a). Sawn wood products, like any other commodity, will be sold in the markets that create the most profit for the seller. Domestic markets for Southeast Alaskan sawn wood products are often more attractive at present than foreign markets. Changes in demand, prices, and cost structures have had dramatic effects on the Southeast Alaskan timber industry and on the profitability of the remaining facilities.

Harvest

Timber harvest within Southeast Alaska is the main source of raw materials for the region's wood products industry. Raw material imports averaged just two percent of Southeast Alaska's total round wood consumption from 1983 through 1994 and there have been no notable saw log or utility log imports into the region in recent years (USDA Forest Service 2007d). The Ketchikan veneer mill restarted in 2007 using timber imported from British Columbia. More recently, the mill has acquired timber from a logging contractor that purchased timber from several Southeast Alaska timber sales (Brackley and Haynes, in press; Damstedt 2007). Annual Southeast Alaska timber harvest is shown by landowner for 1986 through 2005 in Figure 3.22-4. Total harvest levels ranged from peak levels of just under 1,000 MMBF in 1989 and 1990 to a low of 169 MMBF in 2004. Total annual harvest increased to about 197 MMBF in 2005, with an increase in harvest on State lands accounting for much of this increase. Total harvest decreased in 2006, with much of the decline (33 MMBF) attributable to further reductions in harvest on Native Corporation lands (USDA Forest Service 2007d).

The overall pattern of harvest levels shown in Figure 3.22-4 generally reflects broader trends in the wood products market. These include the global recession in the wood products industry that depressed output in the early to mid 1980s, the following boom, and the subsequent decline. In Southeast Alaska, harvest levels have shown an overall pattern of decline since 1990 (Figure 3.22-4).

Figure 3.22-4
Southeast Alaska Total Timber Harvests by Ownership, 1986-2006



Notes: Harvests from Alaska Mental Health Trust and University of Alaska lands omitted prior to 2000.
BIA = Bureau of Indian Affairs
Source: USDA Forest Service 2002a, 2007d

The majority of the region's harvest has historically come from two ownerships: the Tongass National Forest and Native corporation (private) lands. Prior to 2000, harvest from these two ownerships ranged from 96 percent to 99 percent of total harvest in Southeast Alaska. The combined Tongass and Native corporation share dropped to 83 and 76 percent in 2000 and 2001, respectively, with the inclusion of the Alaska Mental Health Trust and University of Alaska harvests as part of the state total (Figure 3.22-5). Harvest from the Tongass and Native corporation lands comprised 78 percent of total harvest in 2005. Harvest from Native corporation lands accounted for the majority of this, with harvest from the Tongass accounting for 25 percent (49.5 MMBF) of the total. Harvest from state lands since 2000 has ranged from 59.9 MMBF in 2000 to 24.2 MMBF in 2004, with a total of 42.9 MMBF harvested from state lands in 2005. Most timber harvested from state lands is processed in Alaska. In recent years the state has sold above its annual projected harvest levels to help bridge the gap between national forest harvest and local industry needs.

Timber harvested from the Tongass and Native corporation lands largely flows into different markets which are not solely driven by price. In the case of the Tongass National Forest there are restrictions on shipments of raw materials that dictate how and to whom products can be sold. Yellow-cedar for example can be exported into foreign markets while western redcedar is appraised for local manufacture. Much of the Sitka spruce and western hemlock is processed locally, although under certain circumstances, those species can be shipped out of state. Low grade and small diameter Sitka spruce and western hemlock are appraised for shipment to markets in the lower 48 U.S. states. Once a timber sale is purchased, under certain circumstances, the purchaser can apply for a permit to ship logs to markets other than those they were appraised for. From 2001 to 2006, an average of 19 percent of the total volume harvested on the Tongass has been shipped in whole log form to domestic markets in other states or exported to foreign markets. Levels fluctuated greatly from year to year over this period, ranging from a low of 8 percent to a high of 39 percent. Virtually all of timber harvested on Native corporation land is sold as whole log exports.

Production and Employment

The 1997 Forest Plan EIS (USDA Forest Service 1997a) noted that log exports comprised 43 percent of total Southeast Alaska production on a volume basis from 1981 to 1995. At 36 percent of the total, pulp was the second largest production component over this period and far more stable than log exports. Lumber was noted as the smallest component of total production, averaging 19 percent of the total from 1981 to 1995. The Ketchikan Pulp Corporation (KPC) pulp mill closed in 1997 and brought pulp production in the region to an end. Since 2000, logging has comprised 70 percent of timber sector employment with sawmill employment accounting for the remaining 30 percent.

In 2000 the total annual active sawmill processing capacity in Southeast Alaska was 340 MMBF. A total of 87 MMBF was processed that year, utilizing 26 percent of the existing active capacity. Total active capacity has since declined to around 250 MMBF and the volumes processed from 2003 to 2006 ranged from 31 MMBF (2004) to 34 MMBF (2005), and 12 to 13 percent of total capacity (Brackley et al. 2006b, Juneau Economic Development Council 2006, 2007).

Employment in the Southeast Alaska wood products sector has declined substantially since the peak of 1990 (see Figure 3.22-6), decreasing by 3,093 jobs, or 87 percent, between 1990 and 2004. While this total includes the entire pulp mill labor force, which accounted for 899 jobs in 1990, a larger absolute loss occurred in the logging sector, with 1,842 jobs lost between 1990 and 2004. A total of 456 people were employed in the wood products sector in 2005. Wood products-related indirect and induced employment was estimated at 437 jobs, resulting in a total of 893 jobs supported by the wood products industry in that year (Table 3.22-3).

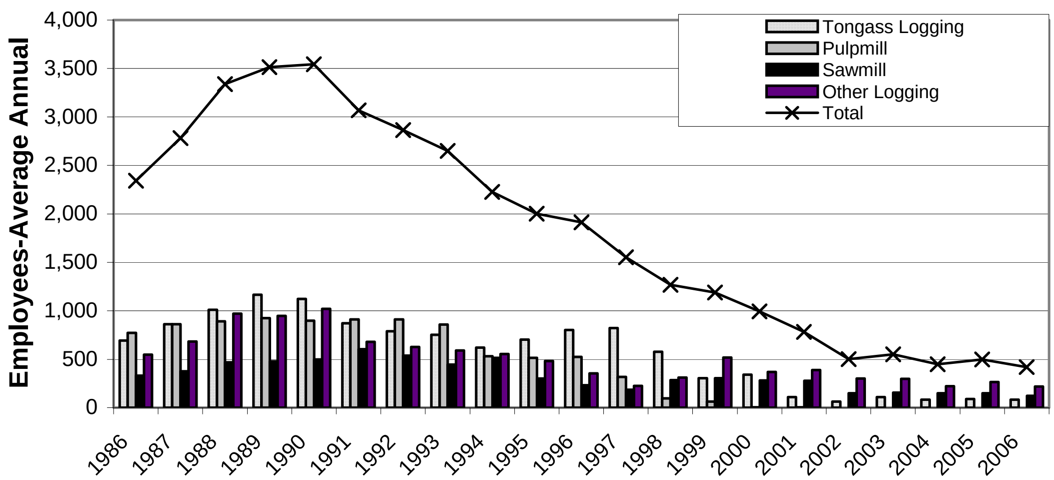
Employment increased slightly in 2005, with a total of 499 people employed in the wood products sector. Logging and sawmills accounted for 70 percent and 30 percent of the total, respectively (USDA Forest Service 2007d). This small increase was mainly associated with an increase in logging employment not related to the Tongass National Forest (Figure 3.22-6). Employment decreased to 421 wood products jobs in 2006, with decreases in employment in all three active categories (Tongass logging, sawmill, and other logging) shown in Figure 3.22-6 (USDA Forest Service 2007d).

Employment decreases tend to lag behind decreases in production, and further declines in employment levels are possible even if there are no further changes in harvest levels.

Current Status of the Industry

It is clear from the preceding sections that the wood products industry in Southeast Alaska has undergone considerable change over the past decade. The closure of the Alaska Pulp Corporation (APC) pulp mill in Sitka and the KPC pulp mill in Ketchikan in 1993 and 1997, respectively, had a substantial effect on the overall regional demand for timber. Wood consumption by these pulp mills accounted for about half of Tongass National Forest timber harvest from 1970 through the early 1990s and chip by-products from the region's sawmills were historically used in pulp production (Brooks and Haynes 1997). The KPC pulp mill, for example, required 190 MMBF of pulpwood and/or chips to operate at its reported full annual capacity of 210,000 tons of pulp (USDA Forest Service 1997a). The analysis prepared for the 1997 Forest Plan Revision Final EIS noted that, on average, 19 percent of Native Corporation harvests were reportedly used in pulp production. The 1997 Forest Plan Revision Final EIS also noted that an average of 17 percent of Tongass National Forest logs were classified as utility grade, meaning that they were more likely to be used for pulp or chips because they could not be made into boards.

Figure 3.22-6
Southeast Alaska Timber Sector Direct Employment by Type, 1986-2006



Sources: USDA Forest Service 2002a, 2007d

Recent harvest data indicate the utility share of total annual harvests on the Tongass decreased from approximately 19 percent in 1996 to around 12 percent in 2004 and 9 percent in 2006 (USDA Forest Service 2002a, 2007d). Approximately 46.1 MMBF of utility and low grade saw logs were chipped in 2000 (26.9 and 19.2 MMBF, respectively). The majority of these chips were shipped to pulp mills in the continental U.S. (61.6 percent) and Canada (31.3 percent), with just 7.1 percent consumed in

Alaska. While these data indicate that a market existed for chips in 2000, the market is limited for low-grade log chips at this time (Brackley et al. 2006a).

Utility logs are logs that are at least two-thirds defective and, therefore, do not meet sawlog specifications. Since utility logs and sawlogs are mixed in the same tree stands, the loss of the market for wood chips has important implications for the economic viability of timber sales on the Tongass. (This is discussed further in the environmental consequences part of this section). As a result, timber sales on the Tongass include an Optional Removal clause (Forest Service Handbook [FSH]: 2409.22 Chapter 630) that allows sale purchasers to leave behind utility logs. These logs still have to be purchased as part of the timber sale but the purchaser no longer has to remove them, saving on logging and haul costs.

The Alaska Regional Forester (Region 10) signed a new policy in March 2007 that approved limited interstate shipments of unprocessed Sitka spruce and western hemlock (Bschor 2007). The policy allows shipment to the lower 48 states of unprocessed Sitka spruce and western hemlock sawlogs smaller than 15 inches in diameter at the small end of a 40-foot log, and grade 3 or 4 logs of any diameter. Shipments are limited on each sale to a maximum of 50 percent of total sawlog contract volume harvested of all species, including western redcedar and Alaska yellow-cedar, unless the Regional Forester grants an exception in advance based on case-specific unusual circumstances.

This policy, referred to as the Limited Interstate Shipment Policy, is expected to increase the utilization of timber harvested on the Tongass and improve the economics of timber sales by providing a market for smaller diameter and low grade material that cannot be processed profitably by sawmills in Southeast Alaska (Alexander et al. 2007).

A federal grant program was approved in 2001 and 2002 to help Alaska operators purchase drying and secondary processing equipment and mills in Alaska now have the ability to dry about 6.6 MMBF annually, with about 3.9 MMBF or 59 percent of the total State capacity located in Southeast Alaska. Approximately 0.8 MMBF of dry, surfaced lumber was produced in Alaska in 2004, with slightly more than half (51 percent or 412 thousand board feet [MBF]) of this total produced in Southeast Alaska (Nicholls et al. 2006). In addition, the Ketchikan Wood Technology Center (KWTC), a nonprofit research and product development center that operates in partnership with the USDA Forest Service and the University of Alaska, was established in 2000. The center's projects include development of new lumber grades and structural design values for Alaska wood species. Yellow cedar, hemlock, Sitka spruce and white spruce have been accepted as unique species for grading purposes by the American Lumber Standards Committee, with new design values for the species. In addition, KWTC implemented a testing program to develop new glued laminated timber beam designs utilizing Alaskan species and has been conducting other tests with potential future benefits to the industry in Southeast Alaska. The increased ability to produce dry, planed wood and updated grading rules for Alaskan lumber has allowed Alaskan producers to sell dimension lumber in local markets.

Market shifts partly reflect the movement of smaller operators away from exporting round logs, chips, or rough-cut green lumber toward value added products and a movement toward direct marketing of finished products. Value-added products produced by small mills on Prince of Wales Island, for example, include molding, tongue-and-groove, log cabin-style paneling, and shingles (Petersen and Bruns 2005), as well as wood for musical instruments.

Utilization of Mill Capacity

Changes in demand and prices have affected the Southeast Alaskan wood products industry and the profitability of the remaining facilities. The 1997 Forest Plan Revision

Final EIS reported an average utilization rate of 66 percent during the 1985 to 1994 time period (USDA Forest Service 1997a, Table 3-133). Utilization rates have shown a consistent downward trend in recent years, with mills in Southeast Alaska using just 12 percent (31 MMBF) of total active capacity in 2004 and 13 percent (32.1 MMBF) in 2005 (Table 3.22-5). Not only has the utilization rate decreased since the 1985 through 1994 time period, but the total active capacity that production is measured against has also declined, stabilizing at 250 MMBF since 2002 (Brackley et al. 2006a). Actual mill output has, however, been fairly consistent over the past five years: 39.7 MMBF in 2002, 32.0 MMBF in 2003, 31.0 MMBF in 2004, 34.7 MMBF in 2005, and 32.1 MMBF in 2006 (Brackley et al. 2006b; Juneau Economic Development Council 2006, 2007).

The results of the utilization studies summarized in Table 3.22-5 include the larger mills and operators in Southeast Alaska. There are also a number of smaller mills not included in the study. According to Petersen and Bruns (2005), for example, there are 16 small operations on Prince of Wales Island and only six of the facilities are included in Table 3.22-5. Although they are relatively small, these facilities may be important sources of economic activity for the communities they are located in or nearby.

Table 3.22-5
Active Timber Processors in Southeast Alaska in Calendar Years 2005 and 2006

			2005		2006	
Mill[1]	Location	Estimated Mill Capacity (MBF)[2]	Actual Mill Output (MBF)[3]	Utilization of Installed Capacity (Percent)	Actual Mill Output (MBF)[3]	Utilization of Installed Capacity (Percent)
Viking Lumber Co.	Craig	80,000	18,000	22.5	19,000	23.8
Silver Bay, Inc.	Wrangell	65,000	8,747	13.5	6,031	9.3
Pacific Log & Lumber	Ketchikan	39,600	4,824	12.2	4,234	10.7
Icy Straits Lumber Co.	Hoonah	20,000	500	2.5	700	3.1
Northern Star Cedar Products[4]	Thorne Bay	14,500	322	2.2	0	0
Porter Lumber Co.	Thorne Bay	12,500	600	4.8	500	4.0
The Mill	Petersburg	8,500	30	0.4	45	0.5
Thuja Plicata Lumber Co.	Thorne Bay	7,500	100	1.3	130	1.7
Thorne Bay Wood Products	Thorne Bay	5,000	682	13.6	600	12.0
Southeast Alaska Wood Products	Petersburg	4,500	100	2.2	200	4.4
D&L Woodworks	Hoonah	1,750	100	5.7	100	5.7
Alaska Fiber[4]	Petersburg	1,500	0	0.0	0	0
W.R. Jones and Son Lumber Co	Craig	1,000	690	69.0	600	60.0
Total	Location	**261,350**	**34,695**	**13.3**	**32,140**	**13.1**

[1] Only mills that were active in 2005 are included here. Two inactive mills were identified in the 2006 mill survey: KPC/Annette Island Hemlock Mill (70 MMBF) and Gateway Forest Products Veneer Mill (30 MMBF), and (15 MMBF). Five mills were identified in the 2006 survey as "out-of-business": Chilkoot Lumber Co., Gateway Forest Products Sawmill, Herring Bay Lumber Co., Kasaan Mountain Lumber & Log, and Metlakatla Forest Products. There are also a number of smaller mills not included in this study.
[2] Annual capacity is estimated based on the volume of material used during 500 eight-hour shifts.
[3] Actual mill production is the net sawlog volume (Scribner log scale) that was used during the year to manufacture sawn products.
[4] The Northern Star Cedar Products and Alaska Fiber facilities did not process timber in 2006. Northern Star was subdivided among three owners and Alaska Fiber sold its primary processing equipment, but reportedly has plans to purchase and install new equipment.
Source: Juneau Economic Development Council 2006, 2007

Market Demand

Demand can be thought of as the different amounts of a product buyers are willing to purchase at different prices. Demand is not a single number, but instead a series of price-quantity relationships. The same is true of supply. It is the combination of supply and demand that determines the quantity and price of goods produced and consumed. When we talk about "timber" on the Tongass we are talking about a spectrum of products that are not necessarily freely exchangeable or replaceable with one another or other sources of timber. Thus, timber includes a mix of species, each with a potentially different demand and price. Timber also includes a range of log types from high quality saw logs to utility logs for which demand and price differ markedly. Finally, the ability of timber to satisfy demand will differ according to the location of that timber relative to mills and other existing infrastructure. Under current market conditions, standing timber in the northernmost portions of the Tongass is unlikely to satisfy the demand for timber by mill operators in Ketchikan almost 500 miles away.

Accurately projecting future demand is difficult and cannot be considered an exact science. Market demand for Southeast Alaska timber and wood products depends upon numerous difficult to predict factors, including changes in technology, growth and exchange rates in key markets, changes in consumer tastes and preferences, as well as developments in other producing regions whose products compete with those of Alaska. While demand is difficult to predict, industry relies on a stable timber supply in order to conduct long-term business planning.

This section examines a number of indicators of demand for Tongass timber for the planning cycle, and discusses the methodologies, limitations, and conclusions of each. The analysis then considers the extent of the timber land base likely to be necessary to satisfy differing levels of demand.

Demand Indicators

Pacific Northwest Research Station Projections

The Forest Service has commissioned the Pacific Northwest Research Station to prepare a number of projections of demand for Tongass timber over time, including Brooks and Haynes 1990, 1994, 1997. In connection with ongoing monitoring and preparation of this EIS, the Forest Service commissioned the Pacific Northwest Research Station to prepare a new set of projections, resulting in Brackley et al. 2006a. Brackley et al. prepared a “derived demand” analysis and projected various demand figures for four potential scenarios using different assumptions about future markets and future processing facilities in Southeast Alaska. Derived demand looks at the overall end-market demand in foreign and domestic markets, and considers what portion of that demand Alaska is likely to fill. An example of end market demand in this case would be projected demand for Southeast Alaskan lumber (a final timber product) from markets in Asia.

Brackley et al.’s model is a trend-based projection of quantities. Trends in consumption (e.g., sawn wood in Japan) and trends in exports (e.g., pulp to all destinations) constitute the basic structure of the model. In preparing this analysis, Brackley et al. used information about U.S. exports to Japan, and Japanese import and consumption data, as a benchmark for the historic data since those exports represented, until recently at least, the majority of sawn-wood production from Southeast Alaska. They considered about 40 years of historic data and trends in manufactured wood products exports to Japan to project 20 years into the future and adjusted projections to address recent shifts and potential additional shifts towards the continental U.S. and other parts of the entire Pacific Rim (including North America), as an end-market for Alaska wood products. Additional information on the Brackley et al. analysis is provided in an addendum report that addresses questions and concerns raised with respect to the original analysis (Brackley and Haynes, in press).

Brackley et al.’s analysis has a number of limitations. Because it is based on trends over a long historic period, it has “smoothed out” short-term fluctuations. The timber industry is currently in a period of transition, increasing the likelihood of volatile shifts. In addition, demand cannot be considered in a vacuum. Demand will be influenced by costs of production, which in turn will be influenced by the willingness of producers to invest in improvements to efficiency. Decisions made in the Forest Plan relating to the timber base are believed likely to also have an impact on the producers willingness to invest.

Although Brackley et al. (2006a) described the following four scenarios, those are not necessarily the only possible scenarios, and considerable variation is possible within any of the scenarios. Each scenario described below assumes the foundation of the preceeding scenario. In other words, Scenario 2, for example, describes an increase in demand beyond Scenario 1 and so forth.

Scenario 1, Limited Timber Production, was an approximation of the current status of the timber industry in Southeast Alaska in 2006 with no market for lower grade logs. The recent policy change (March 2007) that resulted in the Limited Interstate Shipment Policy is expected to change this situation, with timber sale purchasers now able to export lower grade logs to the continental U.S. The current status is believed to be largely the result of supply limitations and not necessarily related to market demand.

Scenario 2, Expanded Timber Production, assumes an increase in the Alaska share of the Pacific Rim markets, but no creation of facilities to process lower grade logs. However, a veneer plant could be a portion of the demand stimulation assumed in Scenario 2, as could the Limited Interstate Shipment Policy.

Scenario 3, Medium Integrated Industry, assumes a demand stimulation in 2008 that creates demand for lower grade logs. Potential forms of demand stimulus identified by Brackley et al. (2006a) included medium density fiberboard (MDF) plants or biomass facilities. The Limited Interstate Shipment Policy could also contribute to this demand stimulus.

Scenario 4, High Integrated Industry, assumes the demand stimulus in Scenario 3 plus an additional stimulus, such as another facility coming on line in 2012.

Scenarios 3 and 4 also assume a form of demand stimulation, such as a veneer plant, that uses medium and low-grade logs. Based on these scenarios, Brackley et al. developed the projections shown in Table 3.22-6. Brackley et al.'s projected volumes for the first two scenarios include decked sawlogs at the sawmills plus a portion of cedar logs that would be exported. They do not reflect the total amount of timber that needs to be sold to produce these decked sawlog timber and cedar volumes.

Table 3.22-6
Timber Production 1983 to 2002 and Demand Projections for 2003 to 2025 (MMBF)

	Brackley et al. Scenarios			
Period[1]	**Limited Lumber Production**	**Expanded Lumber Production**	**Medium Integrated Industry[2]**	**High Integrated Industry[2]**
1983-1987	281.0	281.0	281.0	281.0
1988-1992	414.0	414.0	414.0	414.0
1993-1997	200.2	200.2	200.2	200.2
1998-2002	93.3	93.3	93.3	93.3
2003-2007	**30.0**	**33.7**	**44.4**	**44.4**
2008-2012	**34.7**	**52.0**	**169.0**	**185.8**
2013-2017	**38.7**	**75.4**	**204.4**	**299.0**
2018-2022	**43.0**	**108.1**	**204.0**	**317.0**
2022-2025	**46.7**	**142.9**	**204.4**	**360.1**

1 The projections are for 2003 through 2025 and shown in bold in this table. The data for 1983 through 2002 are the actual volumes processed in the years shown.
2 These projections assume an industry (one or more facilities) will be created that uses pulp chips produced by Southeast Alaska sawmills, low grade logs, and other biomass products in fiber based board, chemical, or energy facilities. Medium density fiberboard is one possible alternative identified in Brackley et al. (2006a). Chemical and energy uses are also possible.
Source: Brackley et al. 2006a, Table 3

Annual projections are presented for all four scenarios in Table 3.22-7. In addition to Brackley et al.'s estimated volume projections, this table also includes the total timber sale volume that would be needed under Scenarios 1 and 2. The total sale volumes for 2022 for each scenario are used in the long-term effects analysis in the Environmental Consequences part of this section.

Installed Capacity and the McDowell Group et al. (2004) Southeast Conference Projections

Another way to consider the potential volumes that might be demanded by the timber industry in Southeast Alaska is to look at installed mill capacity and determine how much timber must be sold and harvested to run the mills at various rates of mill capacity utilization. While we can assume mill owners want to operate their mills at an efficient level if economic timber supply is available, a limitation to this type of analysis is that it assumes there is a purchaser willing to buy the product at a price equal to or greater than the cost of production. In the long run, a mill owner cannot be expected to operate a mill at an "efficient" rate if the mill owner cannot sell the product at a profit. It should also be noted that a mill may not be able to operate indefinitely at a utilization rate far below the economically efficient rate without risking bankruptcy.

Table 3.22-7
Projected Demand for National Forest Timber from Brackley et al. (MMBF)

	Limited Lumber Production		Expanded Lumber Production		Medium Integrated Industry	High Integrated Industry
Year	Estimated Volume[1]	Total Sale Volume[2]	Estimated Volume[1]	Total Sale Volume[2]	Estimated Volume[1]	Estimated Volume[1]
2005	31	47	35	53	45	45
2006	32	48	38	57	55	55
2007	33	50	41	62	67	67
2008	33	50	44	66	139	139
2009	34	51	48	72	151	151
2010	35	53	52	78	166	166
2011	35	53	56	85	184	184
2012	36	54	60	91	204	286
2013	37	56	65	98	204	291
2014	38	57	70	106	204	295
2015	39	59	75	113	204	299
2016	39	59	81	122	204	303
2017	40	60	87	131	204	308
2018	41	62	93	140	204	312
2019	42	63	100	151	204	317
2020	43	65	108	163	204	325
2021	44	66	116	175	204	333
2022	45	68	124	187	204	342
2023	46	69	133	201	204	351
2024	47	71	143	216	204	360
2025	48	72	153	231	204	370

[1] The projections for Scenarios 1 and 2 include sawlogs, cedar export, and chip volumes available from sawmill production. They do not include low grade material or utility logs. Scenarios 3 and 4 include sawlogs, cedar exports, chip volumes, low-grade material, and utility.

[2] The total sale volume projections represent the total harvest that would be necessary to produce the estimated volume under the first two scenarios. These total volumes include the low quality material (low grade material or utility logs) not included in the demand projections. These figures assume that the initial estimated volume would comprise 66 percent of the total required harvest.

[3] The data presented in this table were used to calculate the 4-year averages summarized in Table 3.22-6. The effects analysis uses the projected demand numbers for 2022 to compare scenarios and alternatives.

Source: Appendix G, Table 2

An analysis prepared for the Southeast Conference—"Timber Markets Update and Analysis of an Integrated Southeast Alaska Forest Products Industry" (McDowell Group et al. 2004)—considered installed capacity of Southeast mills, projected a harvest volume that would allow the mills to operate at an efficient level assuming the existence of an integrated industry, and concluded that a minimum of 200 MMBF total harvest would be required.[1] However, they concluded that the most efficient use of timber from the Tongass National Forest would most likely include other added-value manufacturing, such as a veneer mill. The industry would be most efficient with at least two of each type of manufacturing facility to foster competitive bidding for materials and labor. Depending upon the types of facilities, this could require an annual harvest of 350 MMBF or more from the Tongass (McDowell Group et al. 2004; McDowell Group 2006b).

Recent Sales and Harvest Figures

Another possible way to assess timber demand is to consider sale and harvest figures in recent years. Table 3.22-8 shows annual timber sale harvest since 1994.

Use of recent harvest figures as an indicator of demand has several limitations. Since 1997, much of the timber prepared for sale has been subject to appeal and litigation activities that have postponed our ability to offer the material. In recent years, Congressional Appropriation Act provisions have prohibited the Tongass National Forest from offering timber sales that do not appraise positively using the residual-value appraisal method. Many timber sales have not appraised positively and others have been delayed through litigation; it is unclear what the actual harvest levels would have been if these constrictions on supply were not present.

Table 3.22-8
Tongass National Forest ASQ compared to Actual Harvest, 1994 to 2006 (MMBF)

Fiscal Year[1]	ASQ	Actual Harvest
1994 (End of APC contract)[2]	549	276
1995[2]	549	221
1996[2]	549	120
1997 (End of KPC contract)[2]	549	107
1998	267	120
1999	267/187[3]	146
2000 (Last KPC harvest)	187[3]	147
2001	187/267[3]	48
2002	267	34
2003	267	51
2004	267	46
2005	267	50
2006	267	43

[1] Fiscal Year: October 1 to September 30 the following year.
[2] The Allowable Sale Quantity (ASQ) for 1994 through 1997 included 450 MMBF net sawlog volume and 549 MMBF total harvest.
[3] In May 1997, the Tongass Plan was revised, with a resulting allowable sale quantity of 267 MMBF. In April 1999, a new Record of Decision was issued with a resulting allowable sale quantity of 187 MMBF. In March 2001, the 1999 ROD was vacated by the US District Court, District of Alaska and the allowable sale quantity reverted back to 267 MMBF.

[1] Southeast Conference is a regional, nonprofit corporation and the State-designated Alaska Regional Development Organization, the federally designated Economic Development District, and the federally designated Resource Conservation and Development Council for Southeast Alaska (see http://www.seconference.org/index.html).

The Tongass Forest Plan assigns Land Use Designations (LUDs) to various portions of the Forest and designates the types of activities allowable within those LUDs. Suitable land in LUDs where timber management can be considered constitutes the "timber land base" of the Forest. As part of the Forest Plan development process, the Forest Service calculates the average decadal volume that could be produced from that timber base over the rotation period, observing all of the legal requirements and standards and guidelines associated with the Plan. The figure resulting from that calculation is the Allowable Sale Quantity (ASQ). The ASQ should not be equated with the ability of the Forest Service to satisfy timber demand alone. Additional volume, for example, can be produced from wildlife habitat enhancement thinning in young-growth forest in the beach fringe and old-growth reserves. Production of this type of additional volume may be appropriate to meet objectives other than timber production provided no irreversible damage would occur and restocking was assured.

Conversely, not all suitable land is likely to be harvested. Some lands within the suitable base may not be economically feasible to harvest for example. The Forest Plan distinguishes between two types (components) of lands within the suitable base as a function of logging system implications. The two non-interchangeable components (NICs) are referred to as NIC I and NIC II lands. NIC I includes lands that can be harvested with normal logging systems; NIC II, is comprised of lands with especially high logging costs usually due to isolation or special harvesting equipment requirements. Although NIC I timber does not exhibit the problems of NIC II timber, not all NIC I timber, is necessarily economic. The proportion of NIC I lands that would render economic timber sales could increase as the timber industry becomes more integrated. In the absence of a facility that utilizes utility and lower grade logs, a timber sale must be sustained solely on the profits made from the higher grade sawlogs, even though the operator must harvest and pay for the lower grade logs.

The Limited Interstate Shipment Policy increases the likelihood that timber sales in parts of the Tongass National Forest will have a positive appraisal under current market conditions. The policy is also expected to increase the utilization of timber harvested on the Tongass, by increasing the amount of material that can be economically removed from the woods, and concurrently decreasing the amount of material that formerly had to be chipped, stored, or disposed of by the mills (Alexander et al. 2007).

Logistics in Southeast Alaska also influence where and when timber is economic to harvest. Currently the timber base is spread throughout the entire Tongass National Forest, while most of the saw mills are located in the southern portions of the Forest. The high cost of access and transportation between the timber supply and processing mills reduces the likelihood of meeting the needs of mill owners where distances are great.

The ASQ reflects the maximum allowable level of timber harvest under each alternative and assumes every acre modeled and scheduled for timber harvest will actually be harvested. The preceding paragraphs describe the considerations and constraints that make it unlikely that every acre will be scheduled for harvest.

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These groups have made estimates of the minimum timber volume required for the efficient operation of various processing facilities, as discussed later in the effects section and shown in Tables 3.22-17 and 3.22-18. The estimated minimum volume for efficient sawmill operation is approximately 66 percent of existing mill capacity (138 MMBF) based on the four largest existing sawmills in Southeast Alaska, with some allowance for smaller mills (see Table 3.22-17). The minimum estimated volume necessary to supply a veneer plant is 30 MMBF of mid-value logs, with 80 to 100 MMBF of No. 3 sawlogs and utility logs required to support an MDF or Bioenergy facility. Using these estimates a total of 248 MMBF to 268 MMBF is the minimum volume necessary to support an integrated industry. The limitations of this analysis are similar to those in the installed capacity discussion above, in that there must be an end purchaser willing to buy the product at a price equal to or greater than the cost of production.

Relationship between Demand over the Planning Cycle and Annual Demand

Section 705 (a) of the Tongass Timber Reform Act of 1990 states:

Subject to appropriations, other applicable law, and the requirements of the National Forest Management Act of 1976 (Public Law 94-558), except as provided in subsection (d) of this section, the Secretary shall, to the extent consistent with providing for the multiple use and sustained yield of all renewable forest resources, seek to provide a supply of timber from the Tongass National Forest which (1) meets the annual market demand for timber from such forest and (2) meets the market demand from such forest for each planning cycle.

The Tongass Timber Reform Act (TTRA) speaks of annual market demand and demand over each planning cycle (10 to 15 years into the future and beyond). The Forest Plan itself does not authorize any timber harvest. Such harvest is authorized by site-specific timber sale projects, which implement the plan. Thus, it could be said that the Plan itself does not directly meet demand for timber. Rather the Plan sets the conditions under which the Forest Service can seek to meet market demand through the cumulative sales of the annual timber sale program over the planning cycle.

The Forest Service seeks to meet market demand for Tongass timber on an annual basis by establishing annual timber sale objectives using a methodology developed by Morse (2000). This methodology uses a number of inputs including the Pacific Northwest Research Station projections, installed mill capacity, utilization rates, and market trends to determine annual sale offer levels (supply) (see Appendix G, Timber Demand). The goal of the Forest Service is to have a 3-year supply (approximately) of timber under contract to meet sale objectives. The 3-year supply approach recognizes timber cannot be harvested instantaneously and that purchasers must have some flexibility to respond to market changes. Once the 3-year level is reached, the agency builds shelf volume (sale projects with completed NEPA and field work – ready for offer) and sells additional timber as existing inventories are harvested. In this way, the agency seeks to enable the industry to respond to short term changes in markets. The ratio of contract volume to harvest peaked in 2002, at 6.8, but dropped closer to the 3-year supply objective in 2003. In 2004 and 2005 the ratio dropped to 1.7. Recent ratios of volume under contract to harvest are potentially misleading. Harvests have declined considerably over the past few years, resulting in increasing contract volume to harvest ratios through 2002 in spite of declining contract volumes. Some of the volume under contract in 2002 and 2003 was in sales cancelled in 2004 and 2005.

In 2004, Section 339 of the Department of the Interior and Related Agencies Appropriations Act for fiscal year (FY) 2004, Public Law No. 108-108, provided that the Secretary of Agriculture may cancel, with the consent of the timber purchaser, a number of timber sale contracts on the Tongass National Forest awarded between October 1 1995 and January 1 2002. A given sale could be cancelled provided that the Secretary determined, at the Secretary's sole discretion, that the sale would result in a financial loss to the purchaser, and the costs to the government of seeking a legal remedy against the purchaser would likely exceed the cost of terminating the contract. By the end of FY 2005, a total of seventeen sales (with approximately 122 MMBF) on the Tongass National Forest were cancelled. It is the intent of the Tongass National Forest to reconfigure cancelled timber sales and re-offer that portion of the volume that is economically viable.

Projecting demand over the planning cycle has a higher degree of uncertainty and depends on numerous factors that are difficult to predict, including changes in technology, growth and exchange rates in key markets, changes in consumer tastes and preferences, as well as developments in other producing regions whose products compete with those of Alaska. The difficulty in developing long-term projections for the timber industry in Southeast Alaska is further exacerbated by the current circumstances confronting the industry, which, as discussed in the preceding sections, has been in a period of transition since closure of the pulp mills in the 1990s. With this in mind, recent studies (Brackley et al. 2006a; McDowell Group et al. 2004;

McDowell Group 2006b) have considered the demand for timber based on a number of different scenarios that assume different futures for the timber industry. The identified future scenarios range from a projected longer-term demand of 47 MMBF through 360 MMBF. Based on these studies, the Forest Service identified an upper planning cycle demand of 360 MMBF.

Recreation and Tourism

The following section is divided into two subsections or parts. The first part discusses trends in recreation and tourism and related employment for Southeast Alaska as a whole. This discussion draws upon region-wide visitor numbers and related employment estimates to the extent they are available. The second part discusses the same issues with specific reference to the Tongass National Forest. Trends in visitation to Southeast Alaska and the Tongass National Forest are discussed in detail in the *Recreation and Tourism* section of this document and, as a result, are only briefly summarized in the following subsections.

Recreation and Tourism in Southeast Alaska

Trends in Visitation

The number of visitors to Southeast Alaska has grown substantially since the early 1990s. Summer visitors to Southeast Alaska more than doubled between 1993 and 2006, increasing from 502,800 in 1993 to 1,160,000 in 2006, an increase of 131 percent (McDowell Group et al. 2007). Statewide, the total number of visitors increased by 40 percent over the same period. The relatively large increase in visitation to Southeast Alaska reflects the dramatic growth in the number of cruise ship passengers visiting the region. The number of cruise ship passengers visiting Juneau, for example, more than tripled between 1993 and 2006, increasing from approximately 306,600 in 1993 to 953,000 in 2006 (Table 3.15-13 in the *Recreation and Tourism* section; Juneau Convention and Visitors Bureau 2007). The number of passengers docking at Juneau is considered representative of the total number of cruise ship passengers because most cruise ships visiting Southeast Alaska stop there.

Anecdotal evidence suggests that the number of independent visitors (i.e., non-cruise ship visitors) remained relatively constant from 1980 through 2002. Recent estimates by the Juneau Convention and Visitors Bureau suggest, for example, that the number of independent visitors to Juneau has held relatively constant at around 100,000 (Schroeder et al. 2005) over this same period. Data for Southeast Alaska as a whole indicate cruise ship visitors increased from about 64 percent of total visitors to the region in 1985 to 75 percent of the total in 2001. About 90 percent of visitors to Juneau in 2003 were estimated to be cruise ship passengers (Schroeder et al. 2005).

Employment and Contribution to the Regional Economy

Recreation and tourism-related employment is difficult to accurately quantify because visitors spend their money throughout the local economy. There is no single “tourism industry” and no direct measures of tourist-related income or employment. Components of travel and tourism activities are instead partially captured in other economic sectors, such as retail trade (e.g., grocery stores and gift shops), transportation, hotels and other lodging places, and amusement and recreation services.

There are no readily available current estimates of total recreation and tourism-related employment for Southeast Alaska. The most recent study that provided data by Alaska region (McDowell Group 1999) estimated that recreation and tourism (or in their terms vacation/pleasure visitors) supported approximately 4,154 direct jobs in Southeast Alaska in 1998, approximately 22 percent of Alaska’s total recreation and tourism-related employment. The Draft and Final SEIS used the basic approach employed in the McDowell analysis and estimated that recreation and tourism supported 4,185 and 4,278 direct jobs in Southeast Alaska in 1999 and 2001, respectively (USDA Forest Service 2002b, 2003b). Based on these estimates, recreation and tourism accounted for 7 percent and 8 percent of total employment in Southeast Alaska in 1999 and 2001, respectively. Unfortunately it is not possible to update these estimates because the baseline employment data compiled by the Alaska DOL are no longer available in the same format following the national shift from the Standard Industrial Classification (SIC) system to the North American Industrial Classification System (NAICS).

In the absence of a reliable current estimate of recreation and tourism-related employment for Southeast Alaska, employment in the leisure and hospitality sector is used as a proxy for recreation and tourism employment in 2005. Employment in this sector accounted for approximately 9 percent of total employment in Southeast Alaska in 2005 (see Table 3.22-3 for details).

While there are no current estimates of total recreation and tourism-related employment for Southeast Alaska, two studies offer some insight into the economic contribution that recreation and tourism makes to the regional economy. The first study was a survey of commercial recreation businesses that use the public lands and waters of Southeast Alaska. Conducted in 2000, this survey found that cruise ship passengers accounted for 41 percent of total clients, ranging from 22 percent of clients for businesses with fewer than 200 clients a year to 91 percent of clients for businesses with more than 10,000 clients a year (Alaska Division of Community and Business Development [DCBD] 2001). This survey also found that 86 percent of outfitter/guide businesses had annual revenues of less than $100,000 in 1999. Six firms reported revenues over $1 million, including one firm with revenues exceeding $10 million. A similar distribution is evident in terms of clients served, with the majority of firms serving less than 100 clients, a smaller number of firms serving considerably larger numbers, and one firm serving more than 100,000 clients in 1999.

Given the rapid growth in the number of cruise ship passengers visiting the region since 2000, it seems reasonable to assume that the number of clients seeking guided recreation opportunities and the number of outfitter/guides operating in the region has grown. Outfitter/guide data for the Tongass, for example, indicate a 22 percent increase from 2004 to 2005 in the number of clients served by outfitter/guides Forest-wide (see Table 3.15-18 in the *Recreation and Tourism* section).

A second study that provides important insight into the contribution of nature-based tourism to the regional economy was prepared by the Institute of Social and Economic Research at the University of Alaska Anchorage and involved field research conducted in the summers of 2005 and 2006 (Dugan et al. 2006). This study focused on a limited number of communities and sought to provide insight into revenues generated, the types of activities attracting tourists, and the flows of money through the economy. The findings of the study indicate that nature-based tourism generates substantial revenues in the region, with an estimated $250 million generated in annual direct business revenues for the companies surveyed in Sitka, Juneau, and Chichagof Island (Dugan et al. 2006). The study also found that nature-based tourism takes a number of different forms and the ratio of cruise ship passengers to independent travelers varies by location. Most nature-based activities that originate in Ketchikan, for example, fell into four general categories: flightseeing, marine charters, adventure experiences, and general sightseeing. In all cases, the majority of clients participating in these activities were cruise ship passengers. Nature-based tourism on Chichagof Island, on the other hand, included a mix of cruise ship passengers and independent travelers, depending on the location and activity involved (Dugan et al. 2006).

Recreation and Tourism on the Tongass National Forest

The following discussion focuses on existing and projected recreation use levels and related employment. The existing supply of recreation opportunities, which forms an important part of the recreation analysis presented in the environmental consequences part of this section, is discussed with respect to Recreation Opportunity Spectrum (ROS) settings and inventoried Recreation Places in the *Recreation and Tourism* section of this document.

Forest Use and Visitation

The preceding discussion indicates that there has been a substantial growth in the number of visitors to Southeast Alaska over the past decade or so.

While it is reasonable to assume that the vast majority of visitor recreation and tourism activity in the region is related to the natural environment, not all of the activity generating this employment can be directly linked to the Tongass National Forest. Many visitors experience the Tongass passively, from the deck of a cruise ship, for example, without directly using the Forest for recreation purposes. In addition, while the Tongass includes approximately 80 percent of the land area in Southeast Alaska, there are other lands that offer wildland recreation opportunities in the region, including the 3.3 million acres of National Park Service lands and recreation lands managed by the State of Alaska. Further, other popular recreation and tourism activities, such as saltwater fishing, sea kayaking, and shopping, do not take place on the Tongass.

It should, however, be noted that cruise ship companies have heavily marketed Forest-related activities in recent years and many passengers do take at least one trip to the Forest during their visit. Icefield helicopter tours and visits to the Mendenhall Glacier by cruise ship passengers have, for example, increased substantially (see Table 3.15-15 in the *Recreation and Tourism* section). Recent survey data (2005) indicate approximately 83 percent of cruise visitors to Juneau participated in at least one tour while in port. Glacier tours were the most popular type of tour in 2005, with 42 percent of cruise visitors taking this type of tour. Wildlife/marine life viewing, the Mt. Roberts Tramway, and flightseeing via helicopter were also popular (McDowell Group 2005).

With these caveats in mind it is apparent that not all of the recreation and tourism employment and economic activity in Southeast Alaska can be directly attributed to the Tongass. In addition, visitors to the region comprise only part of total recreation use on the Tongass. Residents of local communities also make extensive use of the Forest for recreation purposes.

The question of recreation use is complicated because only limited forest visitation data are presently available. There are currently two main sources of data: the results of the first Alaska National Visitor Use Monitoring (NVUM) program, which were published in 2004, and data that were collected for specific recreation places in the 1980s and early 1990s.

The final results of the first Alaska NVUM program, which involved surveys conducted over 3 years, were published in August 2004 (Kocis et al. 2004). According to the NVUM analysis there were an estimated 1.83 million national forest visits and 2.13 million site visits to the Tongass in 2003 (Kocis et al. 2004). NVUM has standardized definitions of visitor use measurement to ensure that all national forest visitor measurements are comparable. A national forest visit, as defined by the NVUM, is the entry of one person onto the Forest to participate in recreation activities for an unspecified period of time and may include multiple site visits. A site visit, as defined by the NVUM study, is the entry of one person onto a national forest site or area to participate in recreation activities for an unspecified period of time.

Prior to the NVUM program, Forest-wide recreation use statistics were last compiled for the Tongass National Forest in 1995. The basic measurement of recreational activity was the Recreation Visitor Day (RVD), which is usually obtained through the counting of use permits, visitor surveys, or observation. An RVD is 12 hours of recreation use by one individual. The measures used in the NVUM program are not directly comparable with these estimates. In addition, the NVUM estimates were developed for the entire forest, while the data collection efforts in the 1980s and early 1990s focused on identified and specific recreation places (see the *Recreation and Tourism* section of this document).

While the NVUM data are more recent, it is not possible to extrapolate future use from just one year of data, even though all indications suggest that recreation use in the region and on the Tongass has been increasing in recent years. In the absence of more recent detailed information, the following analysis uses RVD data compiled for identified recreation places from 1984 through 1995 to assess existing and future conditions. These data may not accurately reflect current levels of use on the Tongass, but they are sufficient to allow a comparison of alternatives. This comparison is based on the projected effects of the alternatives on recreation supply (in the form of ROS settings). Demand is assumed to be consistent across all the alternatives and the exact number is less important in this analysis than the overall trend.

Existing and Projected Use (RVDs)

RVD data are presented for three groups based on the Recreation Opportunity Spectrum (ROS) system.

ROS 1:
Primitive
Semi-Primitive Non-Motorized
ROS 2:
Semi-Primitive Motorized
ROS 3:
Roaded Natural, Roaded Modified, Rural and Urban

The RVD data compiled for 1984 through 1995 are divided into three groups based on the ROS system that is used to inventory and classify different recreation settings on the Forest (see Table 3.15-2 in the *Recreation and Tourism* section). These three groups consist of Primitive and Semi-Primitive Non-Motorized settings (here termed ROS 1); Semi-Primitive Motorized settings (ROS 2); and Roaded Natural, Roaded Modified, Rural, and Urban settings (ROS 3) (see Table 3.15-2). Semi-Primitive Motorized settings (here termed ROS 2) accounted for a majority of recreation use on the Tongass in 1994, with 62 percent of recorded RVDs occurring in ROS 2 settings. ROS 1 settings, as defined here, accounted for 20 percent of the use, with the remaining 18 percent of RVDs taking place in ROS 3 settings.

Historic and projected recreation use is presented in Figure 3.22-7. Future use projections are based on actual use estimates from 1984 to 1995, with a trend line (based on these data) used to project future levels of demand. Annual estimated use is presented by ROS class for 1984 through 1995 and for 2000, 2005, and 2010 in Table 3.22-9. Total RVDs are divided into ROS classes based on the shares identified for 1994, which are assumed to remain constant throughout this analysis. These shares are presented graphically in Figure 3.22-8, which also identifies the projected supply of these settings based on the Forest-wide Geographic Information System (GIS) database that was updated for this analysis (see the *Recreation and Tourism* section of this document).

A comparison of projected demand with supply by ROS class and recreation place indicates that ROS 2 (Semi-Primitive Motorized) is the only class in which demand is expected to exceed supply over the next decade.

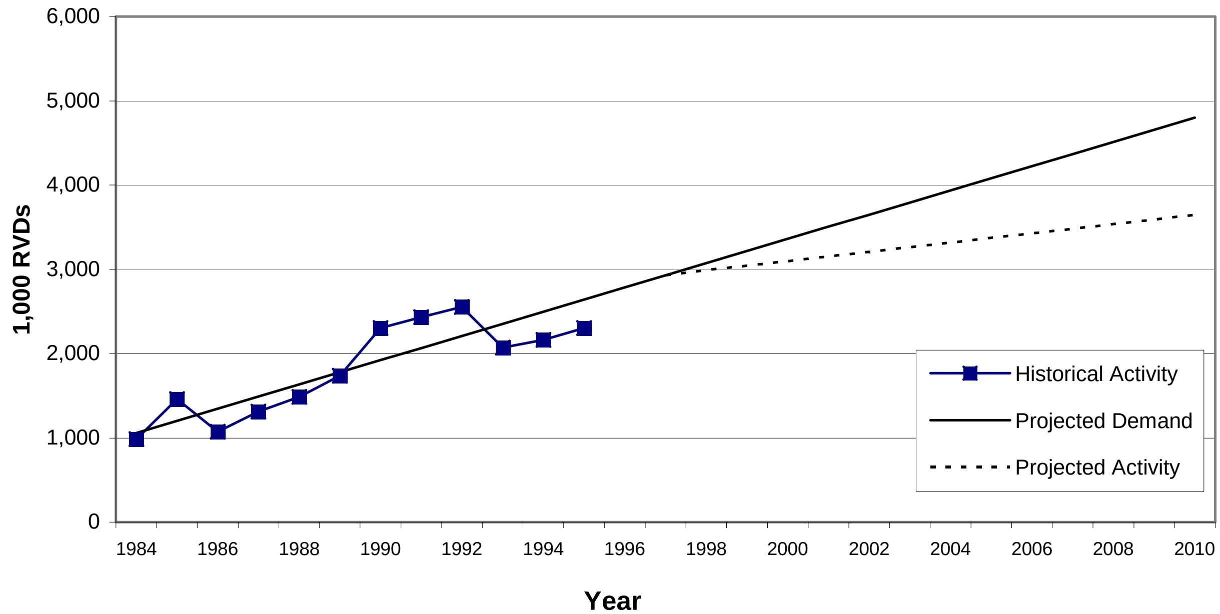
Although outfitter/guides charge clients for services that involve the Tongass National Forest, recreational use on public lands is not typically a market good. In other words, the Forest Service does not typically charge individuals to use the Forest for recreation. As a result, where supply is binding, use restrictions rather than price increases are the most likely result. This analysis assumes that RVD use within a certain ROS class will not exceed supply within that class (for this analysis, supply is equated to the current level available; alternative supply levels are evaluated in the Effects Analysis). ROS 2 is the only class in which demand exceeds supply over the next decade, with the projected number of RVDs having exceeded estimated supply in 1998. In this case, demand is assumed to be constrained by the available supply. The second part of Table 3.22-9 and the dashed line shown in Figure 3.22-7 show the effect that constraining ROS 2 in this manner would have upon projected use. This modified projection, which serves as the baseline for the effects analysis, assumes that recreation use in ROS 1 and ROS 3 settings would not be substituted for the projected unmet ROS 2 demand.

The supply of ROS settings used in this analysis is limited to specifically identified recreation places, with demand also assumed to occur in these places. There are an estimated 870,000 ROS 2 acres in identified recreation places compared to approximately 1.5 million ROS 2 acres Forest-wide (see Tables 3.15-3 and 3.15-5 in the *Recreation and Tourism* section of this document). The recreation economic analysis assumes that demand would continue to focus on ROS 2 areas in recreation places and, therefore, exceed supply in these areas. Viewed on a Forest-wide basis, ROS 2 demand would not exceed Forest-wide supply until sometime after 2010.

This approach recognizes that recreation use is not evenly distributed on the Forest, with some areas, identified here as inventoried Recreation Places, receiving much higher levels of use than others. High levels of recreation activity generally take place during the summer and correspond with cruise ship activity, increased private boating by both residents and non-residents, and a general increase in resident recreation activity. High use levels and/or limited capacity have resulted in reports of use exceeding capacity in certain areas, which generally correspond with the ROS 2 areas evaluated here. The Shoreline Outfitter/Guide EIS prepared for the north portion of the Forest, for example, identified 15 "hotspots" where there was a perception of crowding (USDA Forest Service 2002c). These areas mainly involved popular saltwater bays adjacent to the Forest and included Eliza Harbor, Gambier Bay, Greens Creek, Brothers Islands, George Island, Idaho Inlet, Mud Bay, Pinta Cove, Point Adolphus, Mallard Bay, Williams Cove, Slocum Inlet, Kelp Bay, Lake Eva Trail, and Patterson Bay. Perceptions of and actual crowding exist at other locations on the Forest, including the Anan Creek Wildlife Viewing Area and Margaret Bay near Ketchikan.

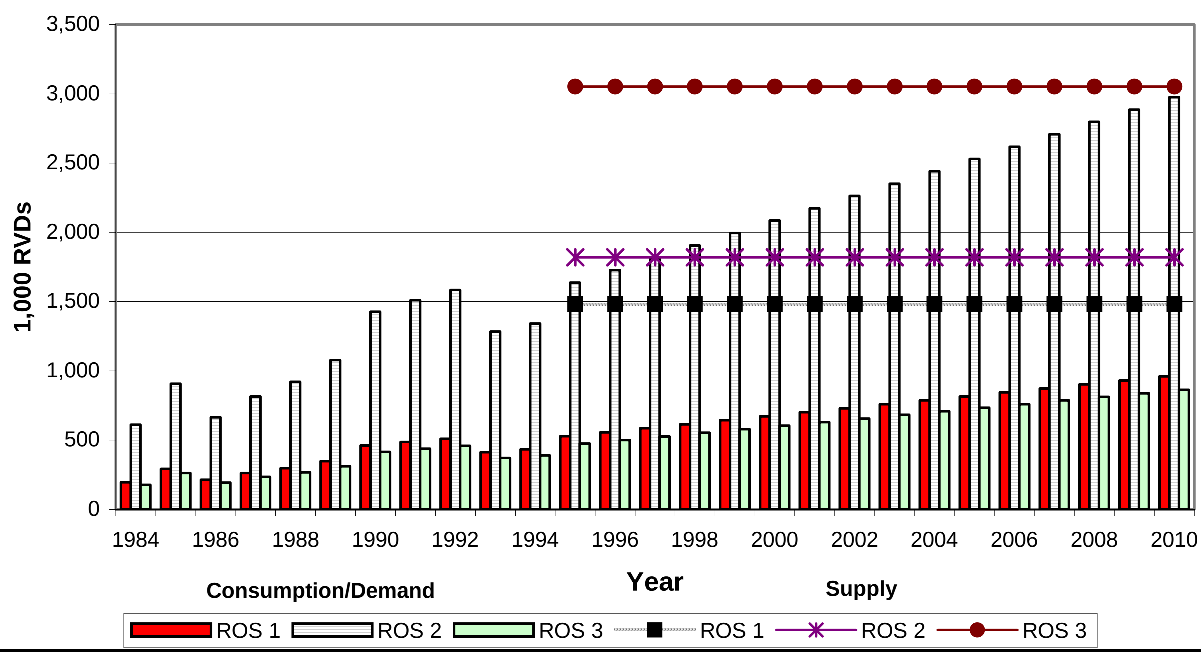
The following analysis also assumes that there would be no change in the current availability of recreational settings. This is not necessarily the case for identified recreation places or the Forest as a whole. Shoreline areas or other areas accessible by floatplane or helicopter that are presently allocated to Primitive or Semi-Primitive Non-Motorized settings (ROS 1) could be reallocated to the Semi-Primitive Motorized setting (ROS 2) in the future if patterns of use or other factors change. While these assumptions represent a simplification of underlying realities, they are necessary to produce a quantified estimate of the relation between recreation supply and demand and allow a comparison of alternatives.

Figure 3.22-7
Historical and Projected Recreational Activity on the Tongass National Forest in RVDs



Note: The dashed line represents future recreational activity constrained by the supply of ROS 2 settings.
Source: USDA Forest Service 1997a (Figure 3-23; updated using 2006 ROS supply data).

Figure 3.22-8
Historical Consumption, Projected Demand, and 2006 Supply for Recreation Activity on the Tongass National Forest by ROS Group



Employment and Earnings

The direct employment estimates presented in Table 3.22-9 are based on a job/RVD ratio of 0.00074. This ratio was developed for the 1997 Forest Plan EIS analysis based on visitor survey data and data from a regional economic model (IMPLAN) (USDA Forest Service 1997a, p. 3-460). This approach assumes that the average amount of employment generated by a single RVD is constant over time and that this number is the same for both Tongass-related recreation and the region as a whole, as well as for different types of recreation on the Tongass. While these assumptions may not accurately reflect underlying realities, they are necessary to produce a quantified estimate of the relation between recreation activity and employment.

Nonresidents were assumed to account for 44 percent of historic and projected RVDs and a commensurate share of employment for the purposes of this analysis. Total employment (direct, indirect, and induced) generated by nonresidents is presented in the last row of Table 3.22-9, entitled “Total from Nonresident.” A reduction in out-of-state recreational activity due to decreased recreational opportunities (ROS settings) is assumed to result in a net economic loss to the region. Local residents, on the other hand, are assumed to spend their money elsewhere in Southeast Alaska, and no net loss in economic activity is incurred. This is not to say that this type of effect would be neutral if it were to occur. This is discussed further in the Environmental Consequences section.

Table 3.22-9
Tongass-Related Recreation and Tourism: Historic and Predicted Consumption in Recreation Visitor Days (RVDs)

Consumption to 1995 and Projected Demand for Tongass-Related Recreation, 2000, 2005, and 2010 (1,000 RVDs)[1]															
	1984	**1985**	**1986**	**1987**	**1988**	**1989**	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**2000**	**2005**	**2010**
ROS 1	197	293	215	263	297	348	461	487	511	414	433	528	672	816	960
ROS 2	612	907	665	815	922	1,077	1,428	1,509	1,584	1,284	1,342	1,638	2,084	2,530	2,976
ROS 3	178	263	193	237	268	313	415	438	460	373	390	476	605	734	864
Total	**987**	**1,463**	**1,073**	**1,315**	**1,487**	**1,738**	**2,303**	**2,435**	**2,554**	**2,071**	**2,165**	**2,642**	**3,361**	**4,080**	**4,800**

Available Recreation Opportunities RVDs by Class in 2005[2] (1,000 RVDs)		Projected Consumption of RVDs by Class (1,000 RVDs)[3]					
			1995	**2000**	**2005**	**2010**	**2015**
ROS 1	1,289	**ROS 1**	528	672	816	960	1,104
ROS 2	2,053	**ROS 2**	1,638	1,819	1,819	1,819	1,995
ROS 3	2,206	**ROS 3**	476	605	734	864	993
Total	**5,548**	**Total**	**2,642**	**3,096**	**3,369**	**3,643**	**4,092**

	Historic and Projected Employment Generated in Average Annual Employment														
	1984	**1985**	**1986**	**1987**	**1988**	**1989**	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**2000**	**2005**	**2010**
Direct Employment[4]	730	1,083	794	973	1,100	1,286	1,704	1,802	1,890	1,533	1,602	1,955	2,291	2,493	2,696
From Nonresident[5]	321	476	349	428	484	566	750	793	832	674	705	860	1,008	1,097	1,186
Total from Nonresident[6]	**389**	**576**	**423**	**518**	**586**	**685**	**907**	**959**	**1,006**	**816**	**853**	**1,041**	**1,220**	**1,327**	**1,435**

[1] Figures for 1984 to 1995 are estimated from historical use data. Figures in subsequent years are estimates based on a linear projection using the 1984 to 1995 estimates of actual use (see Figure 3.22-7). The distribution of RVDs by ROS setting is based on estimates for 1994 ROS classes 1, 2, and 3 are assumed to account for 20 percent, 62 percent, and 18 percent of total RVDs, respectively.

[2] Estimated available recreation opportunities are based on the supply of ROS settings in identified recreation places on the Tongass. These estimates are for National Forest System (NFS) lands only. They do not include State or private lands in recreation places within the Tongass National Forest boundary.

[3] Projected consumption of RVDs by ROS class is based on projected demand with the consumption of ROS 2 opportunities constrained by the existing supply.

[4] Direct employment is calculated using a job/RVD ratio of 0.00074. This ratio was developed for the 1997 Forest Plan Revision Final EIS analysis (see USDA Forest Service 1997a, p. 3-460).

[5] Nonresident use is estimated to be 44 percent of total forest use. This analysis focuses upon nonresident visitors because jobs generated by nonresident expenditures on goods and services are considered comparable to an export industry that brings new money into the region, creating new wealth and development opportunities. Resident recreational activity, on the other hand, brings no new money into the region, and thereby does not expand the local job base.

[6] Total employment generated by nonresident activities is estimated using a multiplier of 1.21.

Source: USDA Forest Service 1997a (Table 3-136)

Commercial Fishing and Seafood Processing

While commercial salmon fishing represents the largest share of Southeast Alaska's fishing industry (42 percent based on ex-vessel value in 2005), halibut, crab and herring fishing combined make up a substantial proportion of the region's total catch (approximately 31 percent in 2005 on a value basis) (Alaska DOL 2007e). There is an important connection between salmon and other wildlife and fish species on the Tongass National Forest. Crab, halibut, herring, bears, eagles, and other species depend on the annual return of millions of salmon and juvenile salmon produced in the streams and lakes of these public lands. As a result, management decisions that affect salmon are known to indirectly affect other species that are commercially fished. These relationships are, however, poorly understood and difficult to quantify. The commercial fishing discussion presented in this section, therefore, focuses on the salmon fishery. Data available for the seafood processing industry, however, do not allow for an easy distinction between salmon processors and other firms. Data presented for the seafood processing sector, therefore, include the entire seafood processing industry.

Although the profitability of the seafood industry in Southeast Alaska continuously changes, it remains a major component of the regional economy. Together, the fish harvesting and seafood processing sectors accounted for approximately 3,781 direct jobs in 2005, and approximately 10 percent of regional employment (Table 3.22-3). Indirect and induced employment for the fish harvesting sector is estimated to be 525 jobs, resulting in a total of 2,806 jobs supported by this sector in 2005. The seafood processing sector in Southeast Alaska had estimated indirect and induced employment of 960 jobs and supported a total of 2,460 jobs (Table 3.22-3). [2]

Employment data compiled by the Alaska DOL indicate that the salmon fishery accounted for approximately 45 percent of commercial fishing employment (1,026 jobs) in 2005, with the other fisheries combined supporting 1,255 jobs (Alaska DOL 2007d). Other important fisheries in 2005 included halibut (567 jobs), sablefish (226 jobs), and crab (176 jobs) (Alaska DOL 2007d).

Unlike other basic sectors of Southeast Alaska's economy, components of the seafood industry are spread throughout the region with an important presence in virtually every community. Alaska's market share of the global salmon supply (estimated at 31 percent in 1990) has, however, been falling. The loss of market share is not a function of poor stocks or low supply, but a consequence of the growing acceptability of farmed fish as a source of fresh salmon and other seafoods. Southeast Alaskan fishermen have also been negatively affected by weaker Asian markets and competition from fish from eastern Russia (Schroeder et al. 2005). Seafood processing has also undergone fundamental changes in recent years with the increased use of floating fish processing facilities and a trend toward frozen rather than canned salmon. The seafood industry is discussed in more detail in the 1997 Tongass Land Management Plan Revision Final EIS (USDA Forest Service 1997a, p. 3-452 to 3-456).

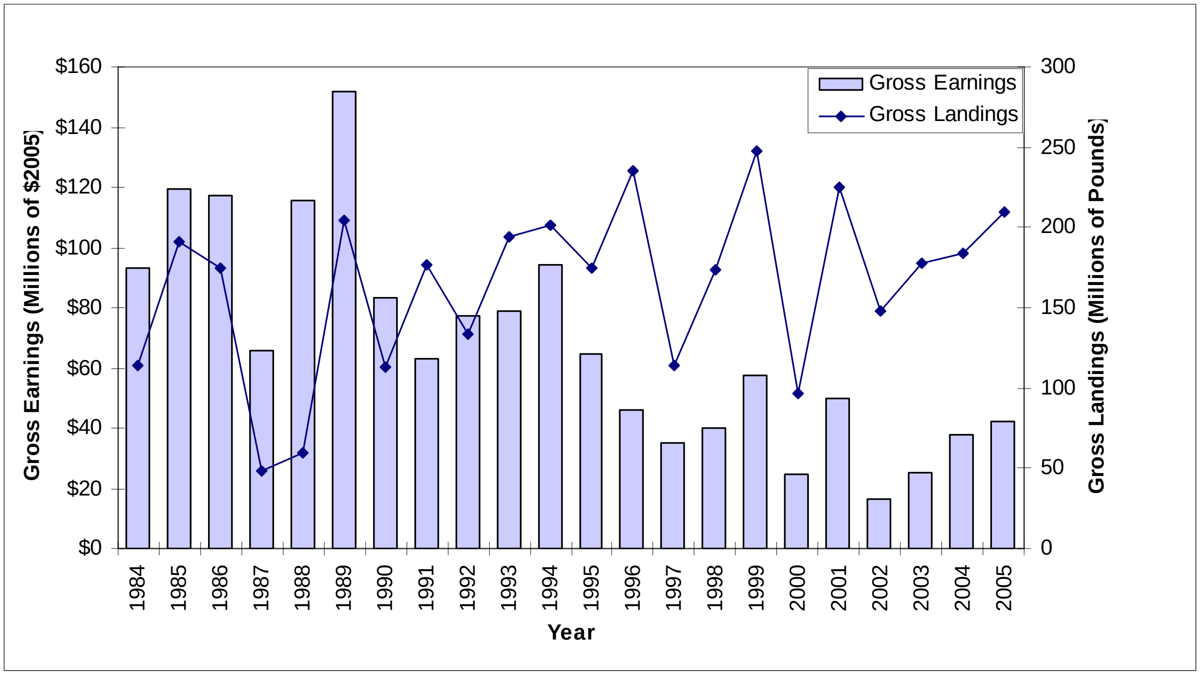
Value and volume measures of salmon harvest for Southeast Alaska are shown in Figure 3.22-8. Both measures show considerable variation from year-to-year. In contrast to revenue and catch figures, employment has remained relatively stable, but has exhibited an overall downward trend (Figure 3.22-9). Statewide, fleet participation in the Alaska salmon fisheries dropped in 2002, partly as a result of low ex-vessel prices (the prices fishermen receive for their catch), but also due to processor limitations on the number of vessels they would serve. Low prices and loss of market

[2] Note that indirect employment for the seafood processing sector includes fish harvesting. As a result, the total (direct and indirect) employment estimates for these sectors should not be added together because this would result in some salmon harvesting employment being double counted.

opportunities resulted in a notable decline in the value of limited entry permits in the salmon fisheries, declining in total value from approximately $1.25 billion in 1990 to $226 million in 2002. Wards Cove Packing Company, the eighth largest processor in Alaska, announced in December 2002 that it was terminating its Alaska salmon operations.

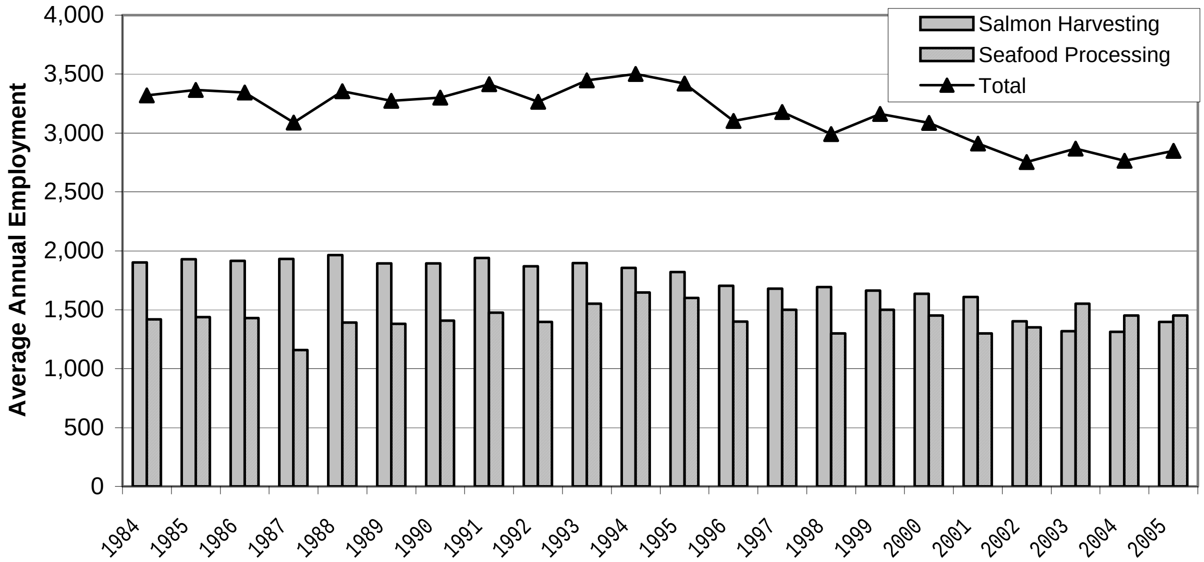
Southeast Alaska accounted for approximately 29 percent of employment in Alaska fisheries in 2004 (Patton and Robinson 2006). Fisheries employment in Southeast declined by about 9 percent from 2000 to 2003, but recovered slightly in 2004, increasing by 2.4 percent. Most of these changes were due to the decline and partial recovery in the salmon fishery, which accounted for approximately 45 percent of all Southeast harvesting employment in 2005 (Patton and Robinson 2006) (see Figure 3.22-9). The commercial fishing and seafood processing industries are generally characterized by high degrees of nonresident participation. Nonresidents accounted for approximately 34 percent of gross earnings in the fish harvesting industry in Southeast Alaska in 2005 (Alaska DOL 2007f). Nonresidents made up a higher share of the fish processing industry, accounting for approximately 67 percent of employment in this sector in Southeast Alaska in 2005 (Alaska DOL 2007g).

Figure 3.22-8
Southeast Alaska Salmon Harvest: Gross Landings and Gross Revenue, 1984 to 2005



Sources: Martin 2006; Bachman et al. 2005; ADF&G 2004; Alaska Commercial Fisheries Entry Commission 2006.

Figure 3.22-9
Direct Salmon Harvesting and Fish Processing Employment in Southeast Alaska, 1984 to 2005



1. Salmon harvesting employment totals presented in this figure were estimated based on data by Fishery and average crew sizes, time spent fishing, and preparation time for different fisheries. The employment coefficients used in this analysis are presented in Table 3-135 of the 1997 Forest Plan Revision Final EIS (USDA Forest Service 1997a).
2. Seafood processing employment for 1995 through 2005 was obtained from the Alaska DOL, who provided these data rounded to the nearest 50 employees.

Source: Alaska CFEC 2002, 2006; Alaska DOL 2001, 2006a; and USDA Forest Service 1997a (Table 3-135).

Mining and Mineral Development

Mineral exploration and mining have been a part of life in Southeast Alaska for over 120 years. Today, the mining industry is exploring new areas for potential mineral deposits and is revisiting historic mining areas using modern exploration techniques. The 1997 Forest Plan Revision Final EIS analysis noted that there are 13 identified mineral deposits on the Tongass National Forest that appeared economically viable under certain conditions. The Present Net Value of these 13 deposits was estimated at $25.6 billion (USDA Forest Service 1997a, p. 3-464). Existing and potential mining development activities identified in the 1997 Final EIS analysis included the Quartz Hill molybdenum site in Misty Fiords, the Greens Creek zinc, lead, and silver mine on Admiralty Island, and the Kensington mine north of Juneau.

In 2005, 312 workers were directly employed by the mining industry. Mining-related indirect and induced employment is estimated at 150 jobs, resulting in a total of 462 jobs supported by the mining industry in that year (Table 3.22-3). Estimated annual average employee earnings of $60,971 per year in 1995 were twice the regional average. This annual average estimate is equal to $78,043 in 2005 dollars. Based on this estimate, direct and total employee earnings in the mining sector were approximately $24.3 million and $30.4 million in 2005. Approximately 93 percent of direct mining employment was located in Juneau Borough and mainly associated with the Greens Creek Mine on Admiralty Island.

The Forest Service approved a plan of operations for the Kensington Gold Mine north of Juneau in 2005 and Coeur Alaska, Inc. subsequently began construction activities on the site. However, a lawsuit was filed against the United States Army Corps of

Engineers and the Forest Service challenging the permitted tailings disposal facility, citing violations to the Clean Water Act. The plaintiffs failed in District Court but were upheld on appeal by the 9th Circuit Court in 2007. The Forest Service anticipates the submittal of a revised plan of operations in 2008.

Natural Amenities and Quality of Life

Natural amenities and local quality of life have increasingly been recognized as important factors determining the economic prospects of many rural communities in the American West and elsewhere (Rudzitis and Johnson 2000). While local amenities and life quality do not directly generate income in the same sense as, say, a sawmill or tourist lodge, they do act to attract and keep residents. This, in turn, supports communities and their economies in several ways. First, many of these residents may earn a substantial proportion of their income from non-job related sources that are independent of local economic activity. Much of this income will then be spent locally, resulting in additional employment and income in the community. Second, residents bring with them important skills and energy that constitute valuable assets for the community. Broadly termed “human capital” by economists, these skills (and the energy with which residents apply them) can earn additional outside income as well as provide essential social resources to the community. These residents may also help attract and retain businesses that are dependent on a skilled labor force, but otherwise relatively footloose from a location standpoint.

Since it is tracked as a separate category in standard income statistics, non-wage income and its contribution to local economies is directly measurable. Investment income (dividends, interest, and rent) and transfer payments from government represent the two major categories of non-wage income. As shown in Table 3.22-10, non-job related income (i.e., transfer payments and dividends, interest, and rent) accounted for 35 percent of total income in Southeast Alaska in 2000, compared to 17 percent in 1980. Non-job related income in the state of Alaska as a whole exhibited a similar change over this period, increasing from 16 percent to 33 percent of total income. Non-job related income accounted for 31 percent of total income for the United States as a whole, but showed relatively little change over the past two decades increasing from 28 percent of total income in 1980 (Table 3.22-10).

Data compiled for 2005 indicate that the non-wage income as a share of total income has decreased from 2000 to 2005 in Southeast Alaska, Alaska as a whole and in the U.S. (Table 3.22-11). In Southeast Alaska this decrease is entirely in dividends, interest, and rent, with transfer payments increasing as a share of total income over this period. This was also the case for the U.S. as a whole. Both non-wage categories decreased in Alaska.

Table 3.22-10
Components of Per Capita Income, 2000

	Southeast Alaska			Alaska			United States		
	2000		% Change	2000		% Change	2000		% Change
	Total ($)	Percent of Total	1980-2000	Total ($)	Percent of Total	1980-2000	Total ($)	Percent of Total	1980-2000
Personal income	31,243	100	0	29,642	100	0	29,469	100	0
Earnings	20,270	65	-18	19,861	67	-18	20,287	69	-3
Transfer payments	4,793	15	9	4,801	16	10	3,793	13	1
Dividends, interest, and rent	6,180	20	9	4,980	17	7	5,389	18	2

Notes:
1. Earnings includes wages and salaries, other labor income, and proprietors' income.
2. Transfer payments consist mainly of government payments to individuals, including retirement, disability, and unemployment insurance benefit payments, income maintenance payments, and veterans benefit payments. Government payments to individuals in Alaska include Alaska Permanent Fund benefits, which are derived from oil revenues and paid to every resident.
3. 1980-2000 Change is the change in percentage share of total per capita income (e.g., earnings in Southeast Alaska in 1980 comprised 83 percent of total per capita income compared to 65 percent in 2000, a difference of 18 percent). In inflation-adjusted dollars this represented a 14 percent decrease from $23,597 to $20,270.

Sources: U.S. Department of Commerce, Bureau of Economic Analysis 2002.

Table 3.22-11
Components of Per Capita Income 2005

	Southeast Alaska		Alaska		United States	
Per Capita Income	Total ($)	Percent of Total	Total ($)	Percent of Total	Total ($)	Percent of Total
Total	36,411	100	35,564	100	34,471	100
Earnings	25,240	69	25,630	72	23,956	69
Transfer payments	5,893	16	4,762	13	5,366	16
Dividends, interest, and rent	5,278	14	5,172	15	5,149	15

See notes 1 and 2 to Table 3.22-10.

Sources: U.S. Department of Commerce, Bureau of Economic Analysis 2007a.

Transfer payments can be further broken out into various categories with social security payments and medical benefits being among the most important. Transfer payments per capita in 2005 in Southeast Alaska were slightly higher than the U.S and Alaska averages (Table 3.22-11).

"Other payments" comprised approximately 40 percent of per capita transfer payments in Southeast Alaska and Alaska in 2000, compared to less than 1 percent nationwide (Table 3.22-12). This category includes certain income categories that are directly linked to birthrights or residence in Alaska, notably annual payments from the Alaska permanent fund, which have averaged between $1,000 and $2,000 per resident in recent years, and dividends from various Alaska native corporations, which are variable but often quite substantial. Much of the growth in transfer payments in Southeast Alaska and Alaska between 1980 and 2000 was due to increases in the other payments category, which exhibited a more than five-fold increase over this period. Other payments comprised a smaller share of total Southeast Alaska transfer payments in 2005 (Table 3.22-13).

Table 3.22-12
Components of Per Capita Transfer Payments, 1980 and 2000

	Southeast Alaska			Alaska			United States		
	2000 Total ($)	2000 Percent of Total	Change 1980-2000	2000 Total ($)	2000 Percent of Total	Change 1980-2000	2000 Total ($)	2000 Percent of Total	Change 1980-2000
Retirement and disability	950	20	-8	769	16	-6	1,508	40	-6
Medical payments	1,028	21	6	1,156	24	4	1,500	40	17
Income maintenance benefits	382	8	-4	466	10	-10	377	10	-2
Unemployment insurance	200	4	-10	178	4	-11	73	2	-5
Other payments[1]	1,966	41	24	1,909	40	30	7	0	0
Miscellaneous other[2]	266	6	-7	325	7	-6	328	9	-4
Total transfer payments	**4,793**	**100**	**0**	**4,801**	**100**	**0**	**3,793**	**100**	**0**

[1] Consists largely of Bureau of Indian Affairs payments, education exchange payments, Alaska Permanent Fund dividend payments, compensation of survivors of public safety officers, compensation of victims of crime, disaster relief payments, compensation for Japanese internment, and other special payments to individuals.
[2] Miscellaneous other includes veterans benefit payments, federal education and training assistant payments (excluding veterans), payments to nonprofit institutions, and business payments to individuals.
[3] 1980-2000 Change is the change in percentage share of total per capita income (e.g., “other payments” in Southeast Alaska in 1980 comprised 17 percent of total per capita income compared to 41 percent in 2000, a difference of 24 percent). In inflation-adjusted dollars this represented a more than five-fold increase, as other payments increased from $300 per capita to $1,966.
Source: U.S. Department of Commerce, Bureau of Economic Analysis 2002.

Table 3.22-13
Components of Per Capita Transfer Payments, 2005

	Southeast Alaska		Alaska		USA	
	Total ($)	Percent of Total	Total ($)	Percent of Total	Total ($)	Percent of Total
Retirement and disability	1,280	24	1,026	20	1,839	36
Medical payments	2,107	40	2,171	42	2,205	43
Income maintenance benefits	509	10	548	11	532	10
Unemployment insurance	185	4	162	3	109	2
Other payments[1]	886	17	866	17	16	0
Miscellaneous other[2]	309	6	399	8	447	9
Total transfer payments	5,275	100	5,172	100	5,149	100

See Table 3.22-12, notes 1 and 2
Source: U.S. Department of Commerce, Bureau of Economic Analysis 2007c.

Retirees comprise the most common (but by no means the only) source of non-wage income in many rural communities (Colt 2001). In fact, this has given rise in some places to local marketing strategies specifically aimed at attracting retirees and thereby developing the local “retirement industry.” The growing economic importance of retirees was not readily apparent in Southeast Alaska in Table 3.22-12 because the increase in the “other payments” category tends to overshadow other changes. However, although retirement and disability payments comprise a relatively small share of total income by national standards, they almost doubled over this period, while medical payments increased by approximately 300 percent. This is partially the result of natural aging processes, but the mean age in the study area, and Alaska as a whole, has been rising at a much faster rate than elsewhere in the United States. This, in turn, may serve as a partial indication that Alaska is becoming more attractive for people as a place to live and not merely as a place to earn money.

Retirement and disability payments and medical payments increased in Southeast Alaska in absolute terms and as a share of transfer payments between 2000 and 2005 accounting for 64 percent of Southeast Alaska transfer payments in 2004, compared to 79 percent nationwide (Table 3.22-13).

The role of "human capital" in local economies is not directly measurable, but it is undoubtedly substantial. The skills possessed by a community's population can be essential in determining its adaptability to negative changes and its ability to take advantage of new economic opportunities. Skilled employees, for example, constitute a key resource for existing or potential employers, and local entrepreneurs can help identify and grow new business opportunities if they exist. Owing to improvements in transportation and telecommunications, other residents may be able to sell their skills in distant or "virtual" labor markets without leaving home. Equally important is the skills and energy residents can bring to local government and other community organizations. Research has indicated that effective and energetic local government supported by strong community involvement is an important ingredient in community resiliency and the ability to weather adverse economic events.

Although it is difficult to directly measure the importance of natural amenities in attracting and keeping residents, proximity to natural environments and the recreational activities they support are undeniably a benefit enjoyed by residents, especially in the more rural communities of Southeast Alaska. At the same time, the atmosphere of a community also constitutes an important amenity, and this may often be linked to more traditional forms of economic activity, such as fishing or timber. In other words, changes in the local economy such as a shift to tourism may impact local atmosphere and amenities even if the surrounding natural environment remains essentially unchanged. These impacts are often assumed to be negative as tourism leads to crowding and the loss of traditional charm, but this need not always be the case. Certain tourism establishments, such as restaurants, meeting centers or entertainment facilities, often serve local residents as well, and thus add to the amenities available to them. Finally, the size of a community has important effects on the local amenities available. If a community is too small, or too poor, for example, it may not be able to provide many of the basic social and economic amenities many residents require, local natural amenities notwithstanding.

Payments to the State

Prior to 2000, in states with national forests, 25 percent of the returns to the US Treasury from revenue producing Forest Service activities such as timber sales, were returned to each state for distribution back to counties (or in Alaska, boroughs) having acreage within a national forest. Those payments were called the "25 percent fund payments" and were dedicated by law to be used for roads and schools. In October 2000, the *Secure Rural Schools and Community Self Determination Act of 2000* was enacted to stabilize federal payments to states in response to declining federal receipts.

The legislation was authorized for implementation for fiscal years 2001 through 2007 and allowed counties and/or boroughs to choose between 25 percent of current receipts or a full payment amount based on the average of the highest three payments made to the state during the 14-year period between 1986 and 1999. Alaska boroughs and communities have elected to receive a full payment amount rather than 25 percent of receipts since enactment of this legislation. Those annual full payment amounts are primarily dedicated to roads and schools, with provisions for special project funding under certain conditions. Under the full payment approach, Forest Service payments to the State of Alaska have been based on the high 3-year historic average, rather than linked to annual Forest Service revenue, and, as a result, Alaska has received payments of approximately $9 million per year. Payments made to the state of Alaska from 1986 through 2007 are shown in Table 3.22-14.

Table 3.22-14
Federal Payments to Alaska from NFS Receipts 1986 to 2006 (Amounts in $1,000s)

Year	Payment ($000s)[1]
1986	820.2
1987[2]	0.0
1988	581.4
1989	6,892.6
1990	11,703.0
1991	11,870.3
1992	4,216.7
1993	4,847.0
1994	10,764.7
1995	9,053.9
1996	6,874.2
1997	1,377.3
1998	2,133.8
1999	2,295.3
2000	2,553.1
2001-2007[3]	9,921.7

[1] Data are adjusted for inflation using the U.S. producer price index and presented in 2004 dollars and 1,000s.
[2] Tongass receipts in Fiscal Year (FY) 1987 were negative due to Comptroller General Decision B-224730 of March 31, 1987, to retroactively implement the emergency rate redeterminations for short-term sales. Without this reduction, Tongass receipts would have been positive by $2.1 million (unadjusted for inflation). As a result of the negative receipt, no payments were made to the State of Alaska that year.
[3] Represents legislated annual payment for FY 2001 to FY 2007
Source: USDA Forest Service 1997a, 2002b.

Environmental Consequences

This section describes the potential direct, indirect, and cumulative economic effects of the seven alternatives examined in detail in the EIS. The analysis is divided into two main sections: 1) economic impact analysis, and 2) economic efficiency analysis. The Tongass National Forest budget and payments to the State are addressed in two short sections at the end. In addition, a fifth and final section summarizes the cumulative effects which are included in the overall analysis.

The impact analysis section addresses the effects of the proposed alternatives on regional employment and income. The efficiency analysis attempts to measure all of the costs and benefits to society, both future and present, of each alternative. The costs and benefits assessed in an economic efficiency analysis are not restricted to cash transactions, but also include non-market benefits such as consumer surplus. The concepts and methodologies used in each of these analyses are described in detail in the following sections. In general, it should be remembered that impact and efficiency analyses measure different things and are not directly comparable. Alternatives with positive impacts on jobs and income will not necessarily have high benefits under efficiency analysis.

The cumulative effects of the alternatives are assessed as part of the impact and efficiency analyses in the following sections. These effects are addressed in a number of ways including the following: The regional economic overview in the Affected Environment portion of this section addresses the regional economy as a whole to establish context for this analysis. Potential changes in the wood products industry are viewed in the context of ongoing changes in other sectors of this industry, particularly past and projected future trends in logging on Native corporation lands.

Effects on the recreation and tourism industry are viewed in the broader context of ongoing and possible future trends in visitation to Southeast Alaska. The effects analysis also considers the economic implications of the potential effects of the alternatives on possible future transportation and public utility projects.

Economic Impact Analysis

The Economic Impact Analysis addresses the effects of the alternatives on regional employment and income.

This section addresses the potential effects of the proposed alternatives on regional employment and income and is divided into seven main parts. The first six parts address the effects of the alternatives on the wood products industry, recreation and tourism, mining, transportation and utilities, salmon harvesting and processing, and quality of life, respectively. The final part provides a summary of the effects discussed in the preceding sections.

Wood Products and Timber Demand—Long-Term Effects

The economic impact analysis addresses the potential effects of the alternatives on the wood products sector in two ways. This section evaluates the long-term impacts of the proposed alternatives based on the four projected demand scenarios developed by Brackley et al. (2006a). The following section (Wood products—Short-Term Effects) discusses the short-term implications of the alternatives by addressing their potential effects on national forest timber sale volume under contract, as well as NEPA-cleared volume and timber volume in preparation.

The potential effects of the alternatives on the future supply of national forest timber may be evaluated based on the amount of timber available under each alternative. The ASQ is the maximum quantity of timber that may be harvested from suitable lands on the entire Forest for a 10-year period (36 CFR 219.3). It is usually expressed as an annual average. In addition to the volume harvested from suitable lands, timber harvested from unsuitable lands can also contribute to market demand needs. The Forest contains extensive areas of young-growth forest that are in the stem exclusion phase (see the *Timber* section of this EIS). Thinning these dense stands to improve wildlife habitat may result in merchantable volume. Other examples include timber that may be salvaged from unsuitable land following windthrow if these trees are in excess to dead and down wood habitat needs and timber from harvest on oversteepened slopes that is incidental to other harvest operations.

As discussed earlier, the ASQ is a ceiling and does not represent a future sale level projection or target, nor does it reflect all of the factors that may influence future sale levels. This is discussed further in the *Timber* section of this document. As noted in the Affected Environment portion of this section, the ASQ consists of two non-interchangeable components (NICs): NIC I, which includes lands that can be harvested with normal logging systems, and NIC II, which includes lands with especially high logging costs usually due to isolation or special harvesting equipment requirements. Acres included in the ASQ but not in NIC I are more costly to harvest and not likely to be cut under current market conditions with the current industry structure.

Estimated annual average ASQ and NIC I volumes are presented by alternative for the second decade following implementation in Table 3.22-15. These volumes are divided into general log class and species type based on recent estimates of the net standing volume by species and grade for the Tongass National Forest (Alexander 2006). This table also includes projected non-national forest annual harvests for Southeast Alaska, which are assumed to be 109 MMBF based on Brackley et al. (2006a). Harvest from private lands accounts for the largest share (102 MMBF) of the non-national forest harvest, with harvest from other public lands accounting for the remaining 7 MMBF. This overall estimate is lower than the volume harvested from non-national forest lands in 2004 (123 MMBF) and 2005 (147 MMBF) and lower than estimates of future non-national forest harvest developed by the McDowell Group et al. (118 MMBF) (McDowell

Group et al. 2004)[3]. Non-national forest harvest decreased from 221 MMBF in 2000 to 123 MMBF in 2005 (Figure 3.22-5). As previously noted, harvests from private lands are typically exported as logs and are not processed locally.

Table 3.22-15
Estimated Timber Supply (second decade annual average)

Alternative	1	2	3	4	5	6	7
Entire ASQ Harvested (MMBF Log Scale)							
No.1 Spruce/Hemlock[1/]	4	14	18	33	24	24	38
No. 2 Spruce/Hemlock	20	62	84	148	110	110	173
Alaska yellow-cedar	5	15	21	36	27	27	42
Western red-cedar	3	9	13	22	17	17	26
No. 3 Spruce/Hemlock	9	29	39	69	51	51	81
Utility Spruce/Hemlock	7	22	30	52	39	39	61
Total Tongass	**49**	**151**	**205**	**360**	**267**	**267**	**421**
Non-Tongass National Forest[3]	109	109	109	109	109	109	109
Total Southeast Alaska	**158**	**260**	**314**	**469**	**376**	**376**	**530**
NIC 1 Only Harvested (MMBF Log Scale)							
No.1 Spruce/Hemlock[1/]	4	13	17	28	22	21	33
No. 2 Spruce/Hemlock	20	59	77	129	98	97	152
Alaska yellow-cedar	5	14	19	31	24	24	37
Western red-cedar	3	9	12	19	15	15	23
No. 3 Spruce/Hemlock	9	27	36	60	46	45	71
Utility Spruce/Hemlock	7	21	27	46	35	34	54
Total Tongass (NIC I only)	**49**	**143**	**187**	**314**	**239**	**236**	**370**
Non-Tongass National Forest[2]	109	109	109	109	109	109	109
Total Southeast Alaska	**158**	**252**	**296**	**423**	**348**	**345**	**479**

[1] The No.1 Spruce/Hemlock category also includes peeler and select logs.
[2] The 109 MMBF consists of 102 MMBF from private lands and 7 MMBF from other public lands. Harvest from private lands is assumed to be exported in log form and not processed in Southeast Alaska. Non-Tongass harvest levels are assumed constant across alternatives and time periods.
NIC I=Non-Interchangeable Component I. NIC I includes lands that can be harvested with normal logging systems.

The following discussion is divided into two main sections. The first section addresses the potential effects of the alternatives on the timber industry. The second section discusses the potential effects the alternatives would have on timber-related employment and income in Southeast Alaska.

Effects on the Timber Industry

The following sections evaluate the alternatives with respect to: a) the Pacific Northwest Research Station demand projections (Brackley et al. 2006a), and b) current production levels, installed capacity, and the minimum volumes required by various processing facilities.

Demand Indicators

Pacific Northwest Research Station Projections

The Affected Environment part of this section provides an overview of current conditions for the Southeast Alaska wood products industry, outlines the current status of the industry, and discusses projected demand, as identified by Brackley et al. (2006a) (see Table 3.22-6). One key difference between the demand projections prepared by Brackley et al. and those used in past Tongass National Forest planning efforts (Brooks and Haynes 1990, 1994, 1997) is that the Brackley et al. (2006a) publication presents four specifically designed scenarios, as opposed to three general

[3] McDowell Group (2006b) clarified and provided some updated information on their 2004 study and noted that they now understand that respective annual harvests from private and state lands are likely to be closer to 50 MMBF and 10 to 13 MMBF into the future, respectively.

assumptions of long-term demand. In addition, Brackley et al. (2006a) estimated demand in two scenarios for decked logs and a portion of cedar exports only, not total harvest, as done in previous projections (see the Affected Environment part of this discussion).

The four scenarios are generally described as limited lumber, expanded lumber, medium integrated industry, and high integrated industry. A key issue in these scenarios is the use of low-quality material (low-grade and utility logs). The limited and expanded lumber scenarios both assume that this material will be left in the Forest, sent directly to sawmill chippers, shipped to the lower 48 states, or exported. The local wood products industry is assumed to consist primarily of sawmills that process higher value material and it is assumed that the economic disposition of lower value material (No. 3 sawlogs and utility logs) will continue to be a challenge. The two integrated industry scenarios, in contrast, assume the addition of one or more facilities that will process this low-quality material. Facilities that could be developed to process lower quality material include veneer, medium density fiberboard (MDF), and bioenergy facilities among others. The four different scenarios result in total derived demand projections that range for the year 2022 from 68 MMBF under Scenario 1 (Limited Lumber Production) to 342 MMBF under Scenario 4 (High Integrated Industry) (Table 3.22-7).

These scenarios provide a good basis for discussion of where the industry currently is, and provide insight into what that industry could look like in the future given various assumptions about industry investment and end markets. Of course many factors would be involved to shape what the actual industry looks like in the future. The "seek to provide a supply of timber from the Tongass National Forest" language of the TTRA indicates the Forest should consider a full range of possibilities. The four scenarios evaluated by Brackley et al. are useful in this context, especially as the Deciding Official works to balance the land base available to provide timber along with all other resource values and needs. These four scenarios are hypothetical and presented here to illustrate the type of developments that might take place in cases where different volumes are made available for harvest. An implicit assumption of all four scenarios is that an economically viable and stable timber supply is available from multiple sources in Southeast Alaska, including the Tongass National Forest. The transition from one scenario to the next involves new private investment and market development. A key factor in attracting new investment is whether or not a supply of timber "shelf volume" is available for purchase.

The four scenarios provide one series of benchmarks that the proposed alternatives may be measured against. Recognizing that the Southeast Alaska wood products industry has essentially been in a period of transition since the APC and KPC pulp mills closed in the 1990s, the alternatives evaluated in this document also consider alternate futures for the industry, with Alternatives 1 through 4 designed to correspond with Brackley et al.'s Scenarios 1 through 4, while also responding to other concerns. Alternative 5, No Action, is the current Forest Plan (1997 ROD, as amended). Alternative 6, Proposed Action, is also based on the existing plan, but includes adjustments based on information generated during the recent 5 Year Plan Review and other minor clarifications and updates. Alternative 7 assumes that all wood processed in Southeast Alaska would come from the Tongass National Forest.

Scenario 1 – Limited Lumber Production. This scenario approximates the status of the timber industry in Southeast Alaska at the time that the Brackley et al. study was completed. Transition of the industry from the pulp mill era, which involved a much more integrated industry, toward an industry that is centered around the manufacture and supply of a different suite of products has been slow. Uncertainty about a stable supply of timber from the Tongass is believed to have contributed to the timeframe of this transition.

Total derived demand is projected to be 68 MMBF in 2022 under this scenario (Table 3.22-7). It is likely that this volume would be primarily logs from more economical (NIC I) lands. Existing mills would continue to have insufficient timber to operate efficiently. The lower value logs sold in federal, state, and private timber harvest projects would continue to be left in the woods, exported, or chipped and sold when favorable markets conditions exist.

Alternative 1 with a maximum annual average harvest level of 49 MMBF could not provide sufficient volume to meet this scenario as currently modeled.

Alternatives 2, 3, 4, 5, 6, and 7 could all provide sufficient volume to meet this scenario during the next 10 to 15 years.

Scenario 2 – Expanded Lumber Production. This scenario also projects only higher value logs are processed, with limited new investments in the existing mills in Southeast Alaska. The scenario assumes that there will be sufficient sawlog wood supply, primarily from federal and state timber lands, to efficiently operate the existing mills in Southeast Alaska. No new mills will be installed to utilize the lower value logs from any lands in Southeast and this material could be left in the woods, exported, or chipped and sold when favorable market conditions exist..

Total derived demand is projected to be 187 MMBF in 2022 under this scenario (Table 3.22-7). As in Scenario 1, it is likely that this volume would be primarily higher value logs from the more economical (NIC I) lands.

Alternatives 1 and 2 with maximum annual average harvest levels of 49 MMBF and 151 MMBF, respectively, could not provide sufficient volume to meet this scenario.

Alternatives 3, 4, 5, 6, and 7 could all provide sufficient NIC I volume to meet this scenario.

Scenario 3 – Medium Integrated Industry. This scenario builds on Scenario 2 and would establish processing capacity to fully utilize sawlogs and low grade and utility logs from federal and state timber sales. Under this scenario the current sawlog milling capacity would operate efficiently and new processing capacity would be developed to utilize the material that has been left in the woods or exported. Some material from other land ownerships has the potential to be used by local mills. Low-grade logs would be used to produce chemicals, energy, or engineered wood products.

Total derived demand is projected to be 204 MMBF in 2022 under this scenario (Table 3.22-7). It is likely that this volume would come from both the more economical (NIC I) lands and the less economical (NIC II) lands.

Alternatives 1 and 2 with maximum annual average harvest levels of 49 MMBF and 151 MMBF, respectively, could not provide sufficient volume to meet this scenario.

Alternatives 3, 4, 5, 6, and 7 could provide sufficient volume to meet this scenario.

Scenario 4 – High Integrated Industry. This scenario builds on Scenario 3 and provides an estimate of the upper market level for the foreseeable future. In order for this situation to be realized, new investments in processing capacity would need to be made and additional market shares established.

Total derived demand is projected to be 342 MMBF in 2022 under this scenario (Table 3.22-7). It is likely that this volume would come from both the more economical (NIC I) lands and the less economical (NIC II) lands. Note that Brackley et al. (2006a) indicate that it would likely take several years to fully achieve Scenario 4.

Alternatives 1, 2, 3, 5 and 6 with maximum annual average harvest levels of 49 MMBF, 151 MMBF, 205 MMBF, 267 MMBF, and 267 MMBF respectively, could not provide sufficient volume to meet this scenario.

Alternatives 4 and 7 could provide sufficient volume to meet this scenario.

The ability of the seven alternatives to supply enough timber to satisfy the projected demand for timber under each scenario is summarized in Table 3.22-16.

Table 3.22-16
Ability of the Alternatives to meet the Timber Demand Scenarios in 2022

	Alternative[1]						
	1	**2**	**3**	**4**	**5**	**6**	**7**
Scenario 1	No	Yes	Yes	Yes	Yes	Yes	Yes
Scenario 2	No	No	Yes	Yes	Yes	Yes	Yes
Scenario 3	No	No	Yes	Yes	Yes	Yes	Yes
Scenario 4	No	No	No	Yes	No	No	Yes

1. While an alternative may be technically able to meet a given demand scenario, the ability to do so in the short-term is highly dependant on budgets, resolution of current litigation and success in implementing new projects. It takes several years to initiate and complete a new analysis and implement the decision through sale layout and contract award.

Current Production Levels, Installed Capacity, and Minimum Volumes Required by Various Processing Facilities

The following sections evaluate the potential effects of the alternatives using three sets of evaluation criteria: current production levels, installed capacity, and the minimum volumes required to operate by various processing facilities. Current (2005) production levels and active and total installed capacity are shown by facility in Table 3.22-5.

The minimum timber volumes required by various processing facilities are identified in Table 3.22-17. These minimum estimated volumes are compared with the estimated annual ASQ for the second decade following Plan implementation for each alternative in Figure 3.22-11. As shown in Table 3.22-18, the different types of potential facilities would use different types of logs, although in most cases different types of logs may be used by more than one type of facility. Both sawmills and a veneer plant would, for example, be able to process No. 2 spruce and hemlock sawlogs (Table 3.22-18). In addition, different facilities would be able to process more than one type of log. A veneer plant may, for example, process No. 2 spruce and hemlock sawlogs, No. 3 spruce and hemlock sawlogs, and cedar (Table 3.22-18). These points should be kept in mind when viewing the simplified comparison presented in Figure 3.22-11.

Table 3.22-17
Minimum Timber Volumes Required by Various Processing Facilities

Facility	Volume (MMBF)
Sawmills[1]	138
Veneer Plant[2]	30
MDF or Bioenergy[2]	80 to 100

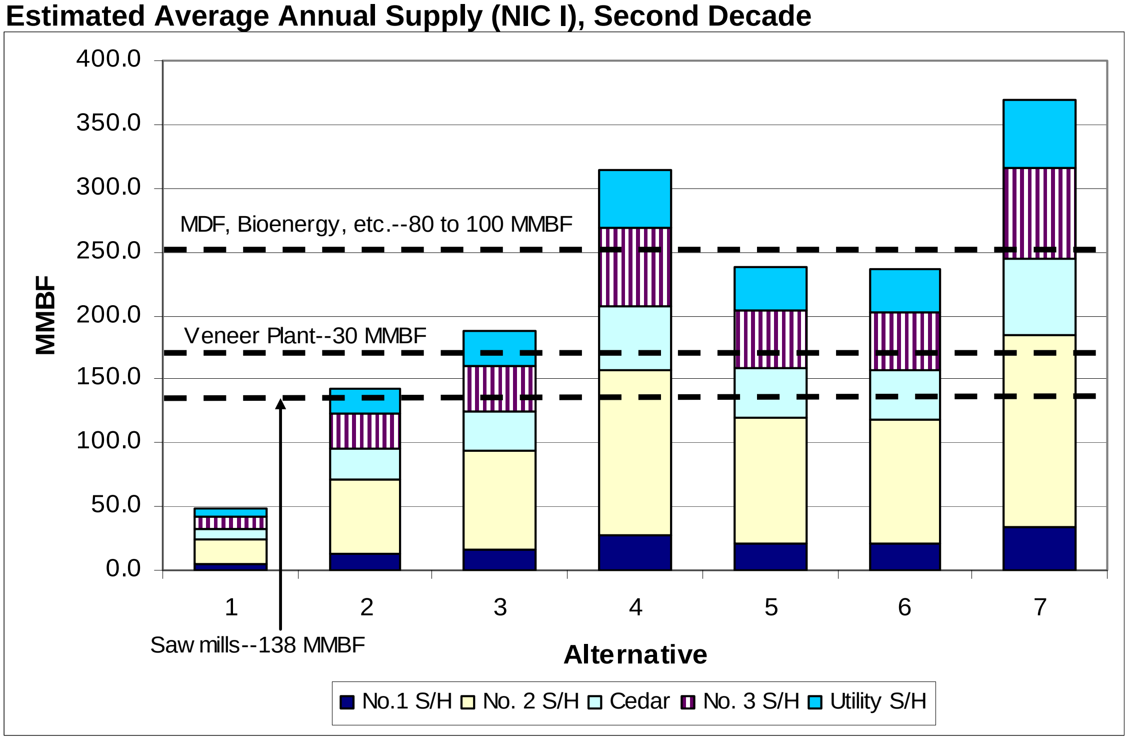
[1] The estimated sawmill volume is approximately 66 percent of existing mill capacity based on the four largest existing sawmills, with some allowance for smaller sales. It is not 66 percent of the estimated mill capacity shown in Table 3.22-5.
[2] These volumes are the minimum required to operate the identified types of facilities.
Source: Estimates developed by the Forest Service based on McDowell Group et al (2004), Brackley et al. (2006b), and the Juneau Economic Development Council (2006) with updates by Southeast Alaska sawmills.

Table 3.22-18
Log Utilization by Facility

Log Grade/Species	Percent of Average Harvest	Facility Type
Peeler/Select/No.1 Spruce/Hemlock	9	Sawmill
No. 2 Spruce/Hemlock	41	Sawmill, veneer
Alaska yellow-cedar	10	Sawmill, veneer
Western red-cedar	6	Sawmill, veneer
No. 3 Spruce/Hemlock	19	Veneer, MDF, Bioenergy
Utility Spruce/Hemlock	15	MDF, Bioenergy
Total	**100**	**NA**

Source: Alexander 2006

Figure 3.22-11
Minimum Timber Volumes Required by Various Processing Facilities and Estimated Average Annual Supply (NIC I), Second Decade



Notes:
S/H = Spruce/Hemlock
1. No. 1 S/H includes Peeler, Select, and No.1 spruce and hemlock sawlogs.
2. The minimum timber volumes required by various processing facilities are shown in Table 3.22-17. Log utilization by facility is shown in Table 3.22-18.
3. Estimated supply by alternative is based on the projected ASQ and average timber sale composition in terms of species and log grades (see Table 3.22-15).

Table 3.22-19
Projected Second Decade NIC I Volumes and Active and Total Installed Capacity

	Alternative						
	1	2	3	4	5	6	7
Log Grade/Species	**Projected NIC I (MMBF Log Scale)**						
Higher Value[1]	24	72	94	157	119	118	185
Cedar[2]	8	23	30	51	39	38	60
Lower Value[3]	9	27	36	60	46	45	71
Utility	7	21	27	46	35	34	54
Total	**49**	**143**	**187**	**314**	**239**	**236**	**370**
Capacity	**Percent of 2006 Active and Total Installed Capacity**						
Active Installed Capacity[4]	9%	27%	36%	60%	46%	45%	71%
Total Installed Capacity[5]	7%	20%	26%	43%	33%	33%	51%

Notes:
1/Higher value consists of No.1 and No.2 Spruce/Hemlock (see Table 3.22-15)
2/Cedar includes Alaska yellow-cedar and Western red-cedar (see Table 3.22-15)
3/Lower value includes No. 3 Spruce/Hemlock (Table 3.22-15)
4/Active installed capacity was 261 MMBF in 2005 (Table 3.22-5)
5/Total installed capacity was estimated at 361 MMBF in 2006 (see Table 3.22-5, Note 1)

Alternative 1—The maximum annual average timber harvest under Alternative 1 would be approximately 49.3 MMBF per year in the second decade, with a NIC I component of approximately 48.8 MMBF. This harvest level could be met in the first year if this alternative was selected and the timber volume presently under litigation was made available for harvest. As of September 2007, there was 43.5 MMBF under active litigation, with an additional 165 MMBF withdrawn under the 2007 Natural Resources Defense Council settlement until completion of this forest planning process.

Based on the typical log mix for the Tongass National Forest, the NIC I volume would include approximately 24 MMBF of higher-value spruce and hemlock logs (peeler/select, No. 1, and No. 2), 8 MMBF of cedar logs, and 16 MMBF of lower-value spruce and hemlock sawlogs (No. 3 and utility) (Table 3.22-19). This volume would not be sufficient to support the existing Southeast Alaska sawmills operating at their recent production levels (32.1 MMBF in 2006). Further, the Southeast Alaska sawmill industry is currently operating at less than 14 percent of the active mill capacity and less than 10 percent of total installed capacity (Table 3.22-19).

Viewed in terms of the minimum timber volumes required by various processing facilities, this volume would be insufficient to meet the estimated sawmill requirement of 138 MMBF of high value timber (Table 3.22-17). The available supply of higher-quality material (including cedar) would account for about 32 MMBF of the total harvest under this alternative (Table 3.22-15). There would be sufficient volume to support a veneer plant (30 MMBF) if 14 MMBF or more of No. 2 spruce/hemlock sawlogs were processed by this type of plant, rather than the existing sawmills. The projected supply of No. 3 spruce/hemlock sawlogs (9 MMBF) and utility logs (7 MMBF) would not be sufficient to support a chip related facility, such as a MDF plant.

This alternative would not meet the potential upper planning cycle demand of 360 MMBF.

Alternative 2—The maximum annual average harvest level under Alternative 2 would be approximately 151 MMBF per year in the second decade, with a NIC I component of approximately 143 MMBF. Based on the typical log mix for the Tongass, the NIC I volume would consist of approximately 72 MMBF of higher-value logs, 23 MMBF of cedar logs, and 48 MMBF of lower-value sawlogs and utility logs (Table 3.22-19).

This volume would be sufficient to support the existing Southeast Alaska sawmills operating at their current production levels (32.1 MMBF in 2006). The estimated higher-value component under this alternative (72 MMBF) would allow regional sawmills to operate at approximately 27 percent of the active installed processing capacity and 20 percent of total installed production capacity in 2006 (Table 3.22-19).

Viewed in terms of the minimum timber volumes required by various processing facilities, this volume would be insufficient to meet the estimated sawmill requirement of 138 MMBF of high value timber. However, if all the sawlogs were to go to existing sawmills, these mills would operate at a higher rate than they are at present, and assuming their ability to use the lower grade sawlogs more efficiently, approximately 100 MMBF would be available for processing under this alternative. Improved efficiency could result from investments in existing equipment or new capacity. If the existing sawmills were not to operate at this level and processed only higher grade sawlogs, there would be sufficient volume to support a veneer plant.

This alternative would not meet the potential upper planning cycle demand of 360 MMBF.

Alternative 3—The maximum annual average harvest level under Alternative 3 would be approximately 205 MMBF per year in the second decade, with a NIC I component of approximately 187 MMBF

Based on the typical log mix for the Tongass, the NIC I volume would consist of approximately 94 MMBF of higher-value logs, 30 MMBF of cedar logs, and 63 MMBF of lower-value sawlogs and utility logs (Table 3.22-19). This volume would be sufficient to support the existing Southeast Alaska sawmills operating at their current production levels (32.1 MMBF in 2005). The estimated higher-value component of the ASQ under this alternative (94 MMBF) would allow regional sawmills to operate at approximately 36 percent of the active installed processing capacity and 26 percent of total installed production capacity calculated in 2006 (Table 3.22-19).

Viewed in terms of the minimum timber volumes required by various processing facilities, this volume would not have enough high grade sawlogs to meet the estimated sawmill requirement of 138 MMBF of high value timber. However, similar to Alternative 2, if all sawlogs were to go to the existing sawmills they would operate at a higher rate and use lower grade sawlogs more efficiently. There would also be enough volume to support a veneer plant and export the remainder; support two veneer mills; or operate an MDF or similar facility. Over the long-term, a relatively stable level of harvest around the 185 MMBF range would be expected to encourage the development of a moderate level of integration for the local industry.

This alternative would not meet the potential upper planning cycle demand of 360 MMBF.

Alternative 4—The maximum annual average harvest level under Alternative 4 would be approximately 360 MMBF per year in the second decade, with a NIC I component of approximately 294 MMBF. This is the second highest projected volume in any of the alternatives. Alternative 7 has the highest.

Based on the typical log mix for the Tongass, the NIC I volume would consist of approximately 157 MMBF of higher-value logs, 51 MMBF of cedar logs, and 106 MMBF of lower-value sawlogs and utility logs (Table 3.22-19). The estimated higher-value component would allow regional sawmills to operate at approximately 60 percent of active installed processing capacity and 43 percent of total installed production capacity calculated in 2006 (Table 3.22-19).

Viewed in terms of the minimum timber volumes required by various processing facilities, this volume would be sufficient to meet the estimated sawmill requirement of 138 MMBF of high value timber and the estimated veneer plant requirement of 30

MMBF. There would also be available cedar to either run through the existing sawmills or support a new mill that specializes in cedar. In addition, the available supply of low grade sawlogs and utility logs would be sufficient to support a chip related facility, such as an MDF plant.

As industry becomes more integrated, it is possible that the veneer plant and chip related operations would expand operations to efficiently take advantage of this excess material. There could also be additional new investment in sawmills in the region, with, for example, investment in new facilities closer to sources of raw materials, which would reduce transportation costs. The amount of cedar harvested may continue to exceed the local capacity to process it, but investments in production of high end wood products may reduce the amount that is surplus.

This alternative would not meet the potential upper planning cycle demand of 360 MMBF.

Alternative 5, No Action and Alternative 6, Proposed Action—The maximum annual average harvest levels under Alternative 5 and 6 would be approximately 267 MMBF under either alternative, with respective NIC I components of approximately 239 MMBF and 236 MMBF, respectively. These alternatives are midway between Alternatives 3 and 4 in terms of projected volume.

Based on the typical log mix for the Tongass, the volume for these alternatives would be comprised of approximately 119 MMBF of higher-value logs, 39 MMBF of cedar logs, and 81 MMBF of lower-value sawlogs and utility logs (Table 3.22-19). The estimated higher-value component would allow regional sawmills to operate at approximately 45 percent of the active installed processing capacity and 33 percent of total installed production capacity calculated in 2006 (Table 3.22-19).

Based on the existing active installed sawmill processing capacity, these alternatives would almost provide sufficient higher-value timber supply for existing sawmills to operate at or near full capacity. There would be sufficient timber to operate the existing sawmills at or near full capacity if they were also able to process cedar. The total projected NIC I volume under these alternatives would not be quite sufficient to support a fully integrated industry. There would be sufficient volume to support one or more veneer plants or an MDF or other chip-related operation, but not both.

These alternatives would not meet the potential upper planning cycle demand of 360 MMBF.

Alternative 7—The maximum annual average harvest level under Alternative 7 would be approximately 421 MMBF per year in the second decade, with a NIC I component of approximately 370 MMBF. This is the highest projected volume under any of the alternatives.

Based on the typical log mix for the Tongass, the NIC I volume would be comprised of approximately 185 MMBF of higher-value logs, 60 MMBF of cedar logs, and 125 MMBF of lower-value sawlogs and utility logs (Table 3.22-19). The estimated higher-value component represents approximately 71 percent of the active installed processing capacity and 51 percent of total installed production capacity in 2006 (Table 3.22-19).

Viewed in terms of the minimum timber volumes required by various processing facilities, Alternative 7 would be sufficient to meet the estimated sawmill requirement of 138 MMBF of high value timber and the estimated veneer plant requirement of 30 MMBF. There would also be cedar available to run through the existing sawmills or support a new mill that specializes in cedar. In addition, the available supply of low grade sawlogs and utility logs would be sufficient to support one or more chip related facilities, such as an MDF plant.

The potential effects under this alternative would be similar to those described for Alternative 4 above. Although there would be more volume available under Alternative 7 than under Alternative 4, the general trend would be expected to be the same and is based on the assumption that a reliable supply of timber would allow the development of an integrated industry and encourage the development of new facilities and the utilization of existing facilities. This alternative also assumes that all wood processed in Southeast Alaska would come from the Tongass National Forest. As with Alternative 4, the highly integrated nature of the timber industry that could be supported by this level of projected harvest could involve the entry of more businesses and/or facilities in Southeast Alaska. As industry becomes more integrated, it is possible that the veneer plant and chip related operations would expand operations to efficiently take advantage of this excess material. There could also be additional new investment in sawmills in the region, as discussed with respect to Alternative 4.

This alternative would meet the potential upper planning cycle demand of 360 MMBF.

Discussion

How the timber industry would respond to a stable supply of timber under any of the alternatives described above is speculative. The projected scenarios are based on the assumption that as stable volumes increase, the industry will develop in an integrated fashion, with operations and production that utilize materials that are inefficient or excess to one another's production needs. An integrated industry could also promote the establishment of other businesses that provide both direct and indirect support services, such as lumber and/or specialty wood product grading and certification. Coordinated or consolidated marketing of Alaskan wood products could be another example of integrated operations.

Several developments hold promise for the timber industry in Southeast Alaska regardless of which harvest level stabilizes. A wood-burning boiler is being installed by the community of Craig to heat school buildings and a recreation facility, reducing energy costs by utilizing waste wood. Several other communities have shown interest in this type of system. Investments in dry kilns and planers in several facilities suggest an increase in production of high value wood products. Wood technology and testing has helped secure a set of Alaska lumber grades for Alaska species. Hemlock, for example, with the Alaska lumber grade can now compete directly with Douglas fir construction grade lumber. To take best advantage of this, the lumber needs to be dried, planed and graded. In Alaska alone, the construction lumber market consumes approximately 120 MMBF per year.

Once positioned, Southeast Alaskan facilities could tap into that high end market, which is currently supplied by material imported from the lower 48 states. Other examples include development of specialty and finished wood products from hemlock and development of dried, sawn, and finished house kits. Products such as glue laminated materials are being tested and show promise. Specialty products made of yellow-cedar are currently marketed internationally. Collective marketing of local wood products could have a positive impact on sales of locally produced material. With a stable supply of material, it might be possible for the local wood industry to regain market share in world wide wood product markets, as well as continue to develop niche markets that take advantage of the high quality and uniqueness of Alaska woods.

Employment and Income

Projected levels of employment and income are presented by alternative in Table 3.22-20. These estimates are based on the annual average NIC I component of the ASQ. Direct employment is calculated using a coefficient of 3.31 jobs/MMBF for sawmill employment and 2.31 jobs/MMBF for logging employment (Alexander 2007). These coefficients are based on average levels of forest-related employment per unit of net sawlogs harvested on the Tongass for the 2000 to 2005 period. This time period excludes volume from long-term contracts and the employment volatility of the late 1990s, and is, therefore, representative of current conditions. Total employment is calculated using regional multipliers estimated using IMPLAN. (See note 6 in Table 3.22-20 for an explanation of the difference between the various multipliers).

The estimates presented in Table 3.22-20 assume the entire NIC I component for the first decade would be harvested. They also assume a linear relationship between harvest and employment levels, with a one percent change in harvest resulting in a one percent change in employment. In reality, changes in volume will have a lagged response in employment, but this assumed linear relationship is an approximation that can be used to compare alternatives. Estimated changes in sawmill and logging employment are presented in job-years, which represent the equivalent of one year's employment. This potential employment would not necessarily occur all in one year and estimated job totals do not directly translate into estimated numbers of affected workers.

The logging employment totals identified in Table 3.22-20 also include jobs associated with non-Tongass National Forest harvest activities. Non-Tongass harvest in Southeast Alaska is assumed to be 109 MMBF for all alternatives and, with the exception of the approximate 7 MMBF harvested from state lands, is assumed for the purposes of this analysis to be exported in unprocessed form (Brackley et al. 2006a). As noted in a preceding section, this estimate is lower than the volume harvested from non-national forest lands in 2004 (123 MMBF) and 2005 (147 MMBF), and lower than estimates of future non-national forest harvest developed by the McDowell Group et al. (118 MMBF) (McDowell Group et al. 2004).[4]

Assuming the entire NIC I component were harvested over the next decade, average annual direct wood products employment would range from 494 annualized jobs under Alternative 1 to 1,922 jobs under Alternative 7. Approximately 226 of these annualized jobs would be associated with non-Tongass harvest under each alternative. Average annual total employment (direct, indirect, and induced) would range from 970 jobs under Alternative 1 to 3,829 jobs under Alternative 7. The potential effects on direct and total income are also summarized by alternative in Table 3.22-20.

The impact of the recent policy change (March 2007), referred to as the Limited Interstate Shipment Policy, on wood products-related employment at the Forest level will most likely be positive. The policy is expected to increase the likelihood that timber sales on the Tongass will have a positive appraisal and is expected to increase the utilization of timber harvested on the Tongass and improve the economics of timber sales by providing a market for smaller diameter and low grade material that cannot be processed profitably by sawmills in Southeast Alaska at present (Alexander et al. 2007).

Under Alternatives 1 and 2, only a portion of the NFS timber harvested would be processed in Southeast Alaska sawmills because there is a limited market for utility

[4]As noted above, the McDowell Group (2006b) have since adjusted their annual estimate for private and state lands to 60 to 63 MMBF.

logs and lower value sawlogs. The higher volume alternatives are, however, based on the assumption that as sale volumes increase and perceptions of risk decrease, the industry will develop in an integrated fashion, with different operations using materials that are inefficient or excess to one another's production needs. If this were to occur the percent of the harvest that would be processed locally would likely be higher than current levels (66 percent). As a result, the employment estimates presented in Table 3.22-20 should be viewed as minimum employment levels that likely underestimate the amount of sawmill (or other processing facility) employment that would occur at higher harvest levels.

Table 3.22-20
Projected Timber Industry Employment at Maximum Allowable Timber Harvest Levels (First Decade, Annual Average)

		Alternative						
	2005	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Actual (2005) and Projected NIC I Volume (MMBF)[1]								
Tongass National Forest	43	49	144	186	272	239	238	367
Total Southeast Alaska Harvest[2]	197	158	253	295	381	348	347	476
Employment (Average Annual)								
Direct Employment[3]								
Logging[4]	351	365	583	680	880	803	801	1,098
Sawmills[5]	148	129	336	428	616	544	542	823
Total	**499**	**494**	**919**	**1,108**	**1,496**	**1,346**	**1,343**	**1,922**
Total Employment (Direct, Indirect, Induced)[6]								
Logging	674	700	1,120	1,306	1,689	1,541	1,538	2,109
Sawmills	309	270	702	894	1,288	1,136	1,132	1,720
Total	**983**	**970**	**1,822**	**2,200**	**2,977**	**2,677**	**2,670**	**3,829**
Income (million 2005 $)								
Direct Income[7]								
Logging	14.8	15.4	24.6	28.7	37.2	33.9	33.8	46.4
Sawmills	4.7	4.1	10.6	13.6	19.5	17.2	17.2	26.1
Total	**19.5**	**19.5**	**35.3**	**42.3**	**56.7**	**51.1**	**51.0**	**72.5**
Total Income (Direct, Indirect, Induced)[6]								
Logging	20.6	21.4	34.3	40.0	51.7	47.1	47.0	64.5
Sawmills	7.1	6.2	16.1	20.5	29.5	26.0	25.9	39.4
Total	**27.7**	**27.6**	**50.3**	**60.4**	**81.2**	**73.2**	**73.0**	**103.9**

[1] It is important to note that the NIC I levels by alternative that form the basis of these employment and income estimates are not projected harvest levels. Rather, they represent the maximum NIC I volumes that could be harvested under each alternative.
[2] Total Southeast Alaska harvest includes Tongass, private (Native corporation), and state harvests. Private and State harvests are assumed to remain constant at 109 MMBF under all alternatives (Brackley et al. 2006a).
[3] Logging and sawmill job/MMBF ratios, 2.31 jobs/MMBF and 3.31 jobs/MMBF, respectively, are based on 2000 to 2005 average levels of employment per MMBF of net sawlog volume harvested (Alexander 2007).
[4] Logging employment is calculated by multiplying total Southeast Alaska harvest (including non-Tongass harvest) by 2.31 jobs/MMBF. Note: these estimates are based on current industry structure and assumed behavior.
[5] Sawmill employment is calculated based on the estimated sawlog share of harvest on the Tongass (66 percent) (Alexander 2006). Non-Tongass harvest, with the exception of about 7 MMBF harvested from state lands, is assumed to be exported in unprocessed form. Note: these estimates are based on current industry structure and assumed behavior.
[6] Total employment and income multipliers are from the 1998 IMPLAN model (see Table 3.22-4). Note that the estimate of direct employment embedded in the IMPLAN number will not be the same as direct employment calculated using actual Southeast Alaska logging and sawmilling data. You cannot subtract the direct employment estimates from the total employment numbers to get indirect and induced employment.
[7] Direct income is estimated using the annual average wage for the Alaska Forestry and Logging ($42,257) and Wood Products Manufacturing ($31,690) sectors from 2001 to 2005 (Alexander 2007).

Wood Products and Timber Demand—Short-Term Effects

In order to provide a stable timber sale program and provide a continued flow of timber to regional timber processors, the Forest Service employs a "buffer stock" approach to timber sale planning. The resulting timber sale program is complex and requires that the Forest Service manage four "pools" of timber volume, commonly referred to as the "timber pipeline." These pools of timber volume include: volume under contract, NEPA-cleared volume, timber volume in preparation, and timber volume identified in the Forest Service's 5-year Plan. The "timber pipeline" and its constituent parts are discussed in more detail in the *Timber* section of this EIS.

Timber sales can take from 3 to 5 years to complete. Sales offered by the Forest Service vary in size to meet the needs of different purchasers and in preparation time as a function of the sale offering size. Uncertainty and delays may be introduced through appeals and litigation. The buffer stock approach and the variable length of the timber sale process generally make it difficult to draw a direct relationship between particular sales and regional timber demand. It is, however, apparent that under current conditions a reduction in the timber volume under contract (i.e., the volume included in timber sales that have been purchased, but not logged or only partially logged) would affect regional timber operators, with related effects to regional employment and income. The affected volumes could be replaced or substituted in part or fully, but this would take time and reductions in the volume under contract would have direct and relatively immediate effects upon the affected operators.

The following discussion addresses the potential effects of the alternatives on three key components of the "timber pipeline": volume under contract, NEPA-cleared volume (i.e., sales that have approved NEPA documents but have not yet been sold), and timber volume in preparation (i.e., proposed sales that are currently being evaluated under the NEPA process).

Volume Under Contract

As noted above, volume under contract refers to the volume included in timber sales that have been purchased, but not logged or only partially logged. Volume under contract is, therefore, essentially a measure of inventory that changes on a regular basis, increasing as timber is sold and added to the total and decreasing when sales are actually harvested. The following discussion illustrates the potential effects of the alternatives on volume under contract with reference to data from August 2006. It should be noted that while these data provide an indication of potential impacts, the actual impacts would depend on the volume that is under contract when the decision is implemented and whether potentially affected existing sales were cancelled as part of the decision.

The Forest Service had approximately 104 MMBF in uncut volume under contract in August 2006. The majority of this volume (92 percent) was located in Ranger Districts on the south end of the Forest, with the Ketchikan and Wrangell ranger districts accounting for 41 percent and 25 percent of the total, respectively. This volume was under contract with five purchasers, including Pacific Log and Lumber (41 percent of the total), Viking Lumber Company (25 percent), and Alcan Forest Products (23 percent). Note that the corresponding volume in July 2007 was 102 MMBF (USDA Forest Service 2007e).

Review of the proposed alternatives indicated that 52 percent of the volume under contract in August 2006 could be affected under Alternative 1, which would maintain all Inventoried Roadless Areas on the Tongass in a natural condition and not permit timber harvest in these areas. The volume currently under contract would not be affected under any of the other alternatives.

Existing volumes under contract likely represent the majority of the short-term timber supply for the affected purchasers and reductions in the existing volume under contract would be difficult to make up from other areas in the near future. Reductions in the volume under contract could, therefore, potentially affect both sawmill and logging employment. Using the logging and sawmill job/MMBF ratios employed for the preceding long-term effects analysis (2.31 jobs/MMBF and 3.31 jobs/MMBF, respectively) and assuming the entire volume would be harvested and approximately

50 percent of the total would be processed locally, the potentially affected volume of 54 MMBF would support approximately 214 job-years.

NEPA-Cleared Volume

The Forest Service had approximately 454 MMBF in the NEPA-cleared volume pool in August 2006. It should be noted that not all this volume is considered economic under current market conditions. Review of the proposed alternatives indicated that approximately 56 percent and 44 percent of this volume could be affected under Alternatives 1 and 2, respectively. These data are intended to illustrate the potential effects. As noted with respect to the volume under contract, actual impacts would depend on the NEPA-cleared volume when the decision is implemented. The NEPA-cleared volume in September 2007 was 309 MMBF (USDA Forest Service 2007f).

Timber Volume in Preparation

The third component of the timber supply is the timber volume in preparation. The Forest Service had approximately 536 MMBF in preparation in September 2006 spread across 17 separate projects. Under Alternative 1 approximately 56 percent of the proposed total would not be available for harvest. Alternatives 2 and 3 would each affect 7 percent of the proposed total. As noted above, these data are intended to illustrate the potential effects. Actual impacts would depend on the timber volume in preparation when the decision is implemented. The Forest Service had approximately 384 MMBF in preparation in September 2007 (USDA Forest Service 2007f).

Recreation and Tourism

The following analysis addresses recreation and tourism over the decade following implementation. Recreation supply is subject to cumulative impacts with the effects of timber harvest activities on recreation places accumulating over time and increasing impacts felt in later decades.

Supply

The general methodology for deriving projected levels of recreation and tourism employment is described in detail in the Affected Environment part of this section. Three types of recreation opportunity settings (ROS 1, ROS 2, and ROS 3) are used in the economic analysis. Timber harvest and other activities result in a reclassification of certain acres from one ROS group to another. Road construction, for example, will generally cause a given area to be reclassified as ROS 3 (Roaded Natural, Roaded Modified, and Rural). The availability for use of ROS 3 designations also depends on the connection between proposed road networks and ferry landings or local communities. Had these acres been classified as ROS 1 (or ROS 2) previously, the result would be a net reduction of ROS 1 (or ROS 2) and an increase in ROS 3. Depending on the relative demand for different ROS groups, the result could be an increase, a decrease, or no change in recreation and tourism activity. If, in the current example, demand for ROS 1 exceeds supply and ROS 3 settings are in surplus, then the net result would be a decrease in recreational activity. If, however, supply exceeds demand for both ROS classes, the net impact on recreation and tourism activity is assumed for the purposes of this analysis to be zero.

Each ROS group has a maximum capacity based on the type of experience expected within the setting. ROS 1 has the lowest capacity per acre because it provides primitive recreation opportunities that require that users not be within sight or sound of other parties. While ROS 2 has a higher capacity per acre than ROS 1, users in this setting expect to see only a few other parties during their experience. ROS 3 has the highest capacity and users in this setting may expect to interact frequently with others. Timber harvest activity could, therefore, result in an increase in recreation capacity measured in terms of RVDs, because areas classified as ROS 1 or ROS 2 would be converted to ROS 3.

Demand

Future demand for recreational activity on the Tongass National Forest was predicted using a linear projection of total RVDs (see Figure 3.22-7). Historical patterns of RVD use by ROS class were then used to predict future recreation and tourism demand by ROS class. Using this methodology, estimated demand for ROS 2 class RVDs (Semi-Primitive Motorized) exceeded estimated supply of ROS 2 settings in 1998. Differences in projected levels of recreation use between alternatives are small because ROS 2 is the only setting where demand exceeds supply in the first decade of this analysis and effects related to harvest activity have had little time to accumulate. As discussed in the Affected Environment section, the finding that demand exceeds supply is based on the supply of ROS 2 opportunities in specifically identified recreation places only and assumes there would be no change in the current availability of recreational settings. These assumptions do not accurately reflect underlying supply realities but are necessary to allow a quantitative comparison of the alternatives.

Consumption

Projected supply and consumption are presented in RVDs by alternative for the next decade in Table 3.22-21.

Table 3.22-21
Recreation/Tourism Supply, Demand, and Consumption (First Decade, Annual Average)

		Alternative						
	2015	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Supply (1,000 RVDs)								
ROS1	1,245	1,289	1,282	1,269	1,227	1,245	1,252	1,223
ROS2	1,995	2,018	2,007	2,000	1,972	1,995	1,994	1,966
ROS3	2,616	2,262	2,335	2,435	2,779	2,616	2,566	2,819
Total	**5,856**	**5,569**	**5,623**	**5,705**	**5,978**	**5,856**	**5,812**	**6,009**
Demand (1,000 RVDs)								
ROS1	1,104							
ROS2	3,422							
ROS3	993							
Total	**5,519**							
Projected Consumption (1,000 RVDs)								
ROS1	1,104	1,104	1,104	1,104	1,104	1,104	1,104	1,104
ROS2	1,995	2,018	2,007	2,000	1,972	1,995	1,994	1,966
ROS3	993	993	993	993	993	993	993	993
Total	**4,092**	**4,115**	**4,104**	**4,097**	**4,069**	**4,092**	**4,091**	**4,064**

Employment and Income

Projected average annual recreation and tourism-related employment and income is presented by alternative in Table 3.22-22. Direct employment was calculated using a job/RVD ratio of 0.00074, which was developed for the 1997 Forest Plan Revision Final EIS (see the Affected Environment subsection of this section). The direct and total employment rows, and the corresponding rows under income, include both resident and nonresident Tongass-related recreation.

The rows that address nonresident recreation include nonresident Tongass-related employment, as well as an estimate for non-Tongass-related, nonresident recreation and tourism in Southeast Alaska. Nonresident recreational activities were assumed to account for 44 percent of direct employment. Direct nonresident employment also

Table 3.22-22
Recreation/Tourism Related Employment and Income (First Decade, Annual Average)

	Alternative							
	2015	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Employment (Jobs)								
Resident and Nonresident Tongass-Related Recreation Employment								
Direct Employment[1]	3,028	3,045	3,037	3,032	3,011	3,028	3,027	3,007
Total Employment[2]	3,664	3,685	3,675	3,669	3,643	3,664	3,663	3,639
Nonresident Tongass-Related and Non-Tongass-Related Employment								
Nonresident Recreation-Related Direct Employment[3]	4,319	4,327	4,323	4,321	4,312	4,319	4,319	4,310
Total Nonresident Recreation-Related Employment	5,226	5,235	5,231	5,228	5,217	5,226	5,226	5,215
Income (Million 2005)								
Resident and Nonresident Tongass-Related Recreation Income								
Direct Income[4]	53.9	54.2	54.1	54.0	53.6	53.9	53.9	53.5
Total Income[5]	71.2	71.6	71.4	71.3	70.8	71.2	71.1	70.7
Nonresident Tongass-Related and Non-Tongass-Related Income								
Nonresident Recreation-Related Direct Income	76.9	77.0	77.0	76.9	76.8	76.9	76.9	76.7
Total Nonresident Recreation-Related Income	101.5	101.7	101.6	101.5	101.3	101.5	101.5	101.3

[1] Direct employment was estimated using a job/RVD ratio of 0.00074 (average annual) and includes both resident and nonresident Tongass-related employment.
[2] Total (direct, indirect, and induced) employment estimates were calculated using a 1.21 employment multiplier (see Table 3.22-4).
[3] Nonresident recreation-related employment was calculated using the assumption that 44 percent of ROS 1, 2, and 3 RVDs are consumed by nonresidents. This estimate also includes non-Tongass-related recreation and tourism employment, which is assumed to remain constant across all of the alternatives. The non-Tongass employment was estimated based on total direct employment in the leisure and hospitality sector in 2005. This component was estimated to increase by 20 percent between 2005 and 2015, which is equivalent to less than half the increase in growth of Juneau cruise ship passenger volumes between 2000 and 2005.
[4] Direct income is estimated based on the 2004 statewide average annual salary for the Leisure and Hospitality sector ($17,220) adjusted for inflation to $17,803 in 2005 dollars and includes both resident and nonresident Tongass-related incomet.
[5] Total (direct, indirect, and induced) income estimates were calculated using a 1.32 income multiplier (see Table 3.22-4).

includes an estimate of the jobs associated with non-Tongass recreation and tourism activities pursued by nonresidents. This category is intended to represent the jobs associated with recreation and tourism activities that do not physically take place on the Tongass National Forest. These types of activities include viewing scenery from cruise ships (see Table 3.22-22, note 3).

The distinction between resident- and nonresident-related employment is important because jobs generated by nonresident expenditures on goods and services are considered comparable to an export industry that brings new money into the region. Expenditures by local residents, on the other hand, represent a recirculation of money that is already present in the regional economy and are, therefore, not typically identified as “new” money. However, if residents are substituting local recreation for non-local recreation then their money can be considered to be money that would otherwise not be present in the local economy. The extent to which this is the case can only be identified by surveying local residents and asking detailed questions about their substitution decisions with respect to Tongass-based recreation (Rudzitis and Johnson 2000). This type of information is not available for the Tongass and, more importantly, inclusion of resident recreation-related employment in the final summary table would have little effect on these results, which show very little difference across the alternatives under either scenario.

Mining

While it is not possible to project the potential effects of the proposed alternatives on mining employment or income, allocating areas to non-development or development LUDs could affect mining activities in the future. None of the alternatives would allocate areas to Recommended Wilderness or LUD II. However, alternatives that would increase the roaded portion of the Forest, such as Alternatives 7 and 4, may facilitate mining exploration and development more that those that retain Roadless areas (especially Alternatives 1, 2, and 3). Alternatives 5 and 6 would be intermediate, representing little or no change from allocations under the current Forest Plan. The effect on future mining employment and income would depend on whether the potentially affected locatable deposits are economically viable in the future.

Transportation and Utilities

Residents of Southeast Alaska are dependent on air and water transportation for travel between most communities, rather than roads or rail. There are limited road connections between the region and the continental road system and between communities. Several possibilities exist for State Highways that could connect some Southeast Alaska communities to the continental road system, as well as possibilities for new internal corridors.

The State of Alaska has proposed corridors for transmission lines and/or undersea cables to link many Southeast Alaska communities to British Columbia. An intertie corridor, connecting the Swan Lake project (near Carroll Inlet) with the Tyee project (on the Bradfield Canal) has been permitted and with construction initiated in 2002. A number of other potential interties could include powerlines between a number of different communities, including some of the smaller and more remote communities, such as Kake and Meyers Chuck.

None of the alternatives would affect regional transportation opportunities or power transmission line opportunities. This is discussed in further detail in the *Transportation and Utilities* section of this document.

Salmon Harvesting and Processing

There is not expected to be any significant change to the commercial fishing or fish processing industries over the next decade as a result of national forest activities. As noted in the Affected Environment discussion, much of the future of the fishing industry in Southeast Alaska is expected to depend on occurrences outside of the Tongass National Forest such as hatchery production, off-shore harvest levels and changes in ocean conditions. In addition, a large segment of the commercial fishing industry operates under a limited entry harvest system. New permit holders are not usually added to the market during high fish harvest years, nor are they removed during periods of low harvest. The result in either case is the same number of commercial fishers catching either more or less fish.

The 1997 Final EIS noted that the amount of acreage of timber harvest was at most less than 20,000 acres per year, representing approximately 0.5 percent of the total remaining productive old growth (or 5 percent over the next decade) and less than 0.02 percent of the entire Forest. That EIS concluded that this was not expected to result in a significant change to commercial fishing employment. Under the proposed alternatives, the estimated harvest would range from less than 2,000 to approximately 16,000 acres per year (see Table 3.13-9 in the *Timber* section). This level of harvest, which is under the maximum proposed in the 1997 EIS, in conjunction with the Riparian Management Standards and Guidelines established in the current Forest Plan and included in the updated Forest Plan prepared for the action alternatives (Volume II in this EIS), is not expected to have a significant effect on commercial fisheries employment over the next 10 years.

Natural Amenities and Quality of Life

As discussed in the Affected Environment portion of this section, natural amenities and local quality of life have increasingly been recognized as important factors that serve to attract and retain residents. It is, however, very difficult to determine the effect of the different alternatives on local amenities and, further, on the economic activity that these amenities are believed to indirectly generate. In most cases and localities the impacts of the action alternatives relative to the No-Action Alternative on amenities are not expected to be significant enough in themselves to result in measurable changes in economic activity.

This conclusion is based on the Forest Plan standards and guidelines that are designed to protect and/or mitigate negative effects to natural resources on the Tongass, as well as the relatively small proportion of the Forest that would be disturbed under any of the proposed alternatives. The importance of the standards and guidelines are discussed with respect to quality of life and other difficult to quantify values below in the part of this Economic Efficiency analysis that discusses Ecosystem Services. Potential harvest activities under the proposed alternatives would affect a relatively small proportion of the Tongass and would be unlikely to affect the predominantly wild and undeveloped nature of the region and the role it presently plays in attracting visitors and residents.

Summary of Impacts

Projected annual average employment and income levels are summarized for the next 10 years in Table 3.22-23. In terms of direct employment in the wood products and recreation and tourism industries, the alternatives range from 4,820 jobs under Alternative 1 to 6,231 jobs under Alternative 7 (Table 3.22-23). Most of the difference between these two values (1,411 jobs) is caused by differences in timber-related employment. Recreation and tourism employment shows much less variation across the alternatives, with a difference between high and low employment levels of less than 20 direct jobs. Direct earnings follow a similar pattern, as do total employment and earnings.

The employment and income estimates for the wood products sector assume the entire NIC I volume projected for each alternative for the first decade following implementation would be harvested. This outcome is dependent on the scenarios developed for each alternative, which assume for the more timber-intensive alternatives that as stable volumes get higher, the industry will develop in an integrated fashion. Recreation and tourism employment and income estimates are for nonresident, recreation and tourism activity only.

Potential direct employment effects are displayed in Table 3.22-24, which shows the projected change in employment by sector as a percent of current totals. Projected recreation and tourism employment is expected to increase by approximately 20 percent from 2005 levels under all of the alternatives. The majority of this projected increase is due to the projected change in non-Tongass, recreation and tourism-related employment, which does not vary by alternative in this analysis. Projected changes in wood products employment from 2005 levels range from a decrease of approximately 1 percent under Alternative 1 to a 285 percent increase under Alternative 7. These increases are relatively large because they assume that the entire NIC I component of the projected ASQ would be harvested under each alternative. This outcome is dependent on multiple factors beyond the Forest Service's control, as discussed in the Wood Products, Long-Term Effects section.

None of the alternatives are expected to affect regional transportation or power transmission line development opportunities.

Table 3.22-23
Projected Annual Average Employment and Income Effects by Alternative (First Decade, Annual Average)

	2005	Alternative 1	2	3	4	5	6	7
Direct Employment and Income								
Employment (Jobs)								
Wood Products	499	494	919	1,108	1,496	1,346	1,343	1,922
Recreation/Tourism	3,586	4,327	4,323	4,321	4,312	4,319	4,319	4,310
Total	**4,085**	**4,820**	**5,242**	**5,429**	**5,808**	**5,665**	**5,661**	**6,231**
Earnings (Million 2000$)								
Wood Products	19.5	19.5	35.3	42.3	56.7	51.1	51.0	72.5
Recreation/Tourism	63.8	77.0	77.0	76.9	76.8	76.9	76.9	76.7
Total	**83.4**	**96.5**	**112.3**	**119.2**	**133.5**	**128.0**	**127.9**	**149.2**
Total Employment and Income								
Employment (Jobs)								
Wood Products	983	970	1,822	2,200	2,977	2,677	2,670	3,829
Recreation/Tourism	4,339	5,235	5,231	5,228	5,217	5,226	5,226	5,215
Total	**5,322**	**6,205**	**7,053**	**7,429**	**8,194**	**7,903**	**7,896**	**9,044**
Earnings (Million 2000$)								
Wood Products	27.7	27.6	50.3	60.4	81.2	73.2	73.0	103.9
Recreation/Tourism	84.3	101.7	101.6	101.5	101.3	101.5	101.5	101.3
Total	**112.0**	**129.3**	**151.9**	**162.0**	**182.5**	**174.7**	**174.5**	**205.2**

Notes:
1. Recreation/tourism employment and income estimates are for nonresident, recreation and tourism-related employment only.
Sources: Tables 3.22-20 and 3.22-22.

Table 3.22-24
Projected Change in Direct Employment by Sector as a Percent of Current Totals

Sector	2004	Alternative 1	2	3	4	5	6	7
Wood Products	499	-1	84	122	200	170	169	285
Recreation/Tourism	3,586	21	21	20	20	20	20	20

Source: Table 3.22-23.

Economic Efficiency Analysis

Introduction

The Present Net Value of a given alternative is the discounted sum of all benefits minus the discounted sum of all costs associated with that

The 1982 planning regulations (36 CFR 219) require that land and resource management plans for National Forest System (NFS) lands "provide for multiple use and sustained yield of goods and services from the NFS in a way that maximizes long term net public benefits in an environmentally sound manner" [36 CFR 219.1 (a)]. These regulations define the term net public benefits as "the overall long-term value to the nation of all outputs and positive effects (benefits) less all associated inputs and negative effects (costs) whether they can be quantitatively valued or not." The definition continues: "(n)et public benefits are measured by both quantitative and qualitative criteria rather than a single measure or index" (36 CFR 219.3).

Net public benefits are evaluated in this EIS through an economic efficiency analysis, which is one type of measure the Forest Service Manual (FSM) encourages the economic and social analyses for Forest Service resource plans to provide (FSM 1970.61). Economic efficiency analysis seeks to measure the costs and benefits to society associated with each alternative and summarize them in the form of a present net value (PNV). PNV figures are calculated by subtracting costs from benefits to yield a net value. Future values (i.e., costs and benefits incurred and received in the future) are discounted using an appropriate discount rate to obtain a present value. The PNV of a given alternative is the discounted sum of all benefits minus the discounted sum of all costs associated with that alternative. Following Forest Service standard procedures, a 4 percent real discount rate is used in the following analysis.

The 1982 planning regulations direct that analysis of the estimated effects of alternatives include, among other things "the expected real-dollar value (discounted when appropriate) of all outputs attributable to each alternative to the extent that monetary values can be assigned to nonmarket goods and services, using quantitative and qualitative criteria when monetary values may not reasonably be assigned" [36 CFR 219.12 (g) (3) (ii)]. Potential forest management outputs that could be affected by the various Forest Plan alternatives include those generated from commodity production, the value experienced by recreationists and other users of the Forest, the "non-use" values held by those who value the existence of the Forest resource even if they do not use it, and the value of various services (ecosystem services) provided by the Forest, such as water resource enhancement, that are not directly traded in any economic market place.

Economists face several challenges when they attempt to summarize the values of various goods and services produced by Forest management. First, while economists generally follow a typology of values that includes both use and non-use values there are concerns about the tendency of many economists to use monetary values for both types. Most economists acknowledge that monetary measures while convenient and easily communicated, are weak approximations of social values. Difficulties exist in trying to assign values to beliefs (sometimes called held values) and other forms of social values. Second, since no markets exist for many ecosystem goods and services economists have to rely on non market valuation techniques such as willingness-to-pay (WTP) approaches. The mix of market and non-market values poses theoretical problems by mixing both marginal and average values depending on the processes used to establish the values. Third, any estimate of value is temporally specific, and this complicates summation processes and relative comparisons.

Comments on the Draft EIS

Comments on the economic efficiency analysis presented in the Draft EIS were concerned with two main aspects of the analysis: 1) the absence of non-market values, other than recreation and tourism, and 2) the misleading comparison of actual timber costs and revenues with estimated recreation and tourism consumer surplus values, which were estimated using WTP values. These issues are briefly summarized below and discussed in more detail in Appendix H, Comments and Responses.

Non-Market Values

The Draft EIS provided a brief overview of comments received on the 2002 Draft SEIS that expressed concern that the economic efficiency analysis presented in that document did not assign monetary values to all the goods and services provided by the Tongass National Forest. Several organizations commenting on the 2006 Draft EIS made the same or very similar comments on the Draft EIS analysis. Concerns were expressed that the analysis presented in the Draft EIS did not assign monetary values to uses, such as commercial fishing and subsistence, or quantify potential effects to non-use values, ecosystem services, and quality of life or off-site benefits in monetary terms. Several comments argued that by failing to assign monetary values to non-market goods and services—such as fish and wildlife habitat, water purification and regulation, carbon sequestration, genetic material, long-term forest productivity, and quality of life—the Forest Service has essentially assigned these goods and services a value of zero and discounted them relative to commodity production.

Given the complexity of forest ecosystems and the elusive nature of many of the values associated with them, accurately accounting for all of these values in a single PNV measure is not feasible at this time. This, as explained in the Draft EIS, is by no means intended to imply that the Forest Service believes the other types of values mentioned above are unimportant. Many of the other sections in this document, in fact, present substantial amounts of information and analysis relative to the resources supporting these other values. Decision-makers will consider the economic values presented in this section within the context of the information presented elsewhere in this document, much of which cannot readily be translated into economic terms.

Misleading Comparison

Others providing comments on the Draft EIS expressed concern about the analysis summarized in Table 3.22-29 of the Draft EIS, which they believed provided a misleading comparison between timber and recreation and tourism. The table presented a PNV that consisted of projected timber revenues and costs to the Forest Service and recreation and tourism consumer surplus benefits that were estimated based on WTP estimates. Concerns were expressed about the overall validity of WTP methodologies and comments suggested that including consumer surplus estimates to value recreation and projected revenues and costs for timber resulted in a misleading comparison between these sectors. Others were concerned that the analysis was unbalanced because it did not include Forest Service costs for recreation, only user benefits.

Revised Economic Efficiency Analysis

The following analysis has been revised to include estimated Tongass National Forest costs and revenues for the NFS budget items based on costs and revenues from 2005 and 2006. In addition, we have separated the estimated costs and revenues from the recreation and tourism consumer surplus to emphasize the difference between these types of measures.

The following analysis assumes that any alternative would be fully implemented in the first year of the planning period, and future values were discounted at four percent. Table 3.22-25 displays these cost and benefits followed by more detailed explanations of their derivation. The potential effects of the proposed alternatives on salmon harvesting and processing, subsistence, and non-use and ecosystem service values are assessed qualitatively.

Timber

The timber benefits presented in Table 3.22-25 are the present value of expected Forest Service revenues from the timber sale program. Future timber sale revenues were estimated for the 160-year planning period using projected harvest volumes for each alternative. These volumes were calculated based on the estimated NIC I volumes by alternative. The analysis in the Draft EIS used an average rate of $11.69/MBF, which was the average value per MBF harvested on the Tongass in 2005/2006. We have revised this analysis and the estimated timber benefits identified in Table 3.22-25 are instead based on the minimum prices or "base rates" established for timber species on the Tongass National Forest. The base rate is the minimum value that must be bid for timber to be sold or cut.

The timber benefit estimates presented in Table 3.22-25 were calculated by developing an average base rate value per MBF based on the average timber sale composition (by species) and current base rates (see Table 3.22-25, note 1). The resulting estimates are, therefore, the minimum revenues or benefits that would be generated over the period of analysis (160 years). These estimates are also based on the assumption that all the NIC I volume identified under each alternative would sell and this may not necessarily be the case.

Table 3.22-25
Economic Efficiency Analysis (million 2006$)

	Alternative						
	1	**2**	**3**	**4**	**5**	**6**	**7**
Benefits							
Revenues							
Timber Revenue[1]	9	26	34	55	44	44	68
Recreation Revenue[2]	54	54	54	54	54	54	54
Land Use Revenue[3]	7	7	7	7	7	7	7
Power[3]	1	1	1	1	1	1	1
Minerals[3]	1	1	1	1	1	1	1
Consumer Surplus							
Recreation/Tourism Consumer Surplus[4]	7,637	7,640	7,643	7,610	7,645	7,645	7,599
Costs[5]							
Timber Variable Costs[6]	128	376	489	787	625	620	967
Inventory & Monitoring[7]	67	67	67	67	67	67	67
Land Management[8]	75	75	75	75	75	75	75
Minerals and Geology[7]	32	32	32	32	32	32	32
Recreation/ Heritage/ Wilderness Mgmt[7]	111	111	111	111	111	111	111
Vegetation, Watershed, Wildlife & Fisheries Habitat[8]	184	184	184	184	184	184	184
Present Net Value	**7,112**	**6,884**	**6,782**	**6,472**	**6,657**	**6,662**	**6,294**

Note: Cost and benefit streams extended over a 160-year analysis period and discounted at 4% per year.

[1] Based on the average base rate per MBF using the average timber sale composition and the following current base rates: Sitka Spruce—$12, Western Hemlock—$2, Western Red Cedar—$12, Alaskan Yellow Cedar—$20.

[2] Recreation revenue was estimated based on the average recreation revenues received in 2005 and 2006. Revenue categories included in this total are: Recreation, Recreation User Fees, Recreation Fee Collection, and Recreation Site Fees (USDA Forest Service 2006d, 2007g). These revenues are assumed for the purposes of this analysis to remain at current levels and constant across all alternatives.

[3] Land use, power, and minerals revenues were estimated based on average revenues received in 2005 and 2006. These revenues are assumed for the purposes of this analysis to remain at current levels and constant across all alternatives.

[4] Unlike timber or minerals, recreation and tourism is not directly traded in the market place and recreationists on the Tongass generally pay for only a small portion of the total benefits they receive from the Forest. In other words, the recreation revenue category above does not capture the full value of the experience to recreationists. Economists have developed techniques to try and estimate the amount that recreationists would be willing-to-pay for a Recreation experience above and beyond what they actually pay. This is discussed further in the following section under recreation. It is important to understand that the recreation/tourism consumer surplus values shown here assign a monetary value to the share of the recreation good that is not traded in the market place and, as a result, are not directly comparable with actual revenues paid to the Forest Service.

[5] The following cost items include the major NFS cost items based on actual costs for 2005 and 2006 (USDA Forest Service 2006d, 2007g). They do not include other costs that are classified under Capital Improvement, Fire, Miscellaneous Funds, or Other. The cost categories included in this summary were approximately $31,000 in 2005 and 2006, accounting for approximately 37 percent and 44 percent of total costs in 2005 and 2006, respectively. This is discussed further in the following section under Management Costs.

[6] Based on per MBF planning and support charges: $41 for NEPA preparation; $23 for sale preparation; $9 for sale administration; and $28 for engineering support.

[7] Inventory & Monitoring, Minerals and Geology, and Recreation/ Heritage/ Wilderness Mgmt costs were estimated based on average costs in 2005 and 2006. These costs are assumed for the purposes of this analysis to remain at current levels and constant across all alternatives.

[8] Land Management and Vegetation, Watershed, Wildlife & Fisheries Habitat costs were estimated based on average costs in 2005 and 2006. Cost categories included in these totals are Land Management Planning and Land Ownership Management (Land Management) and Vegetation & Watershed Management and Wildlife & Fisheries Habitat Mgmt (Vegetation, Watershed, Wildlife & Fisheries Habitat). These costs are assumed for the purposes of this analysis to remain at current levels and constant across all alternatives.

The Spectrum model analysis—used to identify the ASQ for each alternative—suggests that under current market conditions stumpage values for some stands would be negative (see Appendix B for more detail on this model). In other words, the estimated costs of harvesting and transporting the timber exceed the current value of the timber at the mill (the pond log value) and, as a result, volume from these stands would be unlikely to sell. While the Spectrum model analysis suggests that there would be sufficient economic timber to provide projected NIC I volumes (should there be demand) in the short-term under current market conditions, market prices would need to improve over the long-term for stands that would be potentially harvested in later decades to sell.

Timber variable costs are also presented for each alternative in Table 3.22-25. These costs are estimated based on a flat rate of $101/MBF and assume the identified NIC I volumes for each alternative would be sold. This flat rate includes NEPA preparation ($41/MBF), sale preparation ($23/MBF), sale administration ($9/MBF), and engineering support ($28/MBF), and includes timber sale-related road construction costs, among others. This average cost per MBF ($101/MBF) exceeds the average base rate value per MBF ($7.12/MBF) used to estimate timber benefits to the government for this analysis. As noted above, the average base rate is the minimum value that must be bid for a timber sale to go forward. The average value for 2005/2006 was $11.69 per MBF. The 2003 SEIS identified an average value of $36.17 per MBF harvested on the Tongass from 1997 to 2001 (USDA Forest Service 2003b). Recent sales on Alaska State lands have generated an average return of $49.54 per MBF for sales totaling 54 MMBF (Slenkamp 2007).

Industry revenues and profits are omitted from the calculation. This is because efficiency analysis commonly assumes perfect competition in the private sector. This implies, in turn, that competing purchasers of federal timber will bid up the price of stumpage to the point where all economic profits (i.e., profits over and above a competitive rate of return to capital) are dissipated.

It is important to note that the PNV calculation for timber does not assign monetary values to perceived local benefits associated with timber-related employment and salaries and related economic activity, as well as other perceived benefits associated with capital investment in roads and log transfer facilities. Employment and income are addressed in the preceding economic impact assessment.

As previously noted, it is also important to recognize that the NIC I component is not a future sale level projection or target. Rather, it represents the maximum volume that could be harvested with normal logging systems.

Recreation and Tourism

The analysis presented in Table 3.22-25 provides two sets of values for recreation benefits: 1) recreation revenues and costs paid to the Forest Service, and 2) recreation and tourism benefits to the consumer, identified in Table 3.22-25 as recreation and tourism consumer surplus.

Recreation Revenues and Costs

Recreation revenues and costs were estimated based on the average receipts paid to the Forest Service in 2005 and 2006. The values used for the analysis were based on the average values for those two years. Forest Service revenue categories included in this total are the general recreation category, recreation user fees, recreation fee collection, and recreation site fees. Recreation cost categories are shown in Table 3.22-25 as part of the Recreation/Heritage/Wilderness budget line item. This budget item was about $4.3 million in 2005 and $4.6 million in 2006. In addition to these budget item costs, other recreation-related costs incurred in 2005 and/or 2006 and not included in this cost category are trail improvement and maintenance costs, outfitter/guide program management costs, recreation site maintenance and operation, and recreation fee collection costs. These costs are included elsewhere in the Forest Service's accounting system (e.g., capital improvement, miscellaneous funds, and other) and varied substantially between 2005 and 2006, the years used to establish the baseline used here.

Recreation revenues and costs are included in this analysis to address concerns about misleading comparisons and also provide an indication of the relative management costs and revenues associated with different Forest resources. Budget figures from 2006 are also summarized in Table 3.22-28.

Recreation and Tourism Consumer Surplus

Unlike timber, recreation and tourism is, for the most part, not directly traded in the market place. Recreational users of the Tongass National Forest generally pay for only a small proportion of the total benefits they receive from the Forest. Consumer surplus, or willingness-to-pay, is the value of a recreation activity beyond what must be paid to enjoy it. Total economic use value is the cost to participate plus consumer surplus. This type of approach is very different to those used to estimate the other benefits and costs summarized in Table 3.22-25.

The consumer surplus estimates presented in Table 3.22-25 are derived from 1988 survey data. For general recreational activity, this figure is estimated at $33.00 (2005$) per RVD, and for recreational fishing the estimate is approximately $1,025.27 per RVD (2005$). Using the proportion of 1994 total RVDs comprised by recreational fishing use, a weighted average of $69.13 per RVD was derived. This figure represents the average amount a Tongass National Forest recreational user would be willing to pay for a day's recreation over and above expenses already incurred. These net willingness-to-pay figures are from the 1997 Forest Plan Revision Final EIS adjusted for inflation (USDA Forest Service 1997a, p. 3-503).

Future recreation and tourism use on the Tongass was estimated using techniques described in the Affected Environment portion of this section and further detailed in the recreation and tourism impact analysis presented above. Projected future value was derived by multiplying total RVD use by the average net WTP estimate of $69.13. These values were then discounted using the standard 4 percent rate, and the resulting estimates are shown in the second row of Table 3.22-25. Recreation and tourism consumer surplus estimates are much higher than the other benefits and costs addressed in Table 3.22-25, but are relatively constant across the alternatives. The finding that these values are relatively constant across alternatives is consistent with the expected outcome of the Forest Plan, which seeks to protect high value and high use recreation areas under all alternatives, while the high values reflect the wide range of unique recreation opportunities on the Tongass National Forest.

There is the potential for substantial error in these value estimates, and decision makers and the public should avoid a mistaken sense of precision when considering them. Various aspects of recreation and tourism-related value, for example, were impossible to measure or estimate for this analysis. All RVDs have been treated as equivalent, but it is likely that net WTP varies for different recreation experiences and associated ROS classes. Likewise, the net WTP value for a given recreation experience will vary according to a host of factors which may be impacted differently under the different alternatives. By using a constant dollar per RVD estimate, this takes only quantity into account and ignores quality. This quality can take many forms, but must include aesthetic considerations, personal attachments (in the case of local residents who habitually frequent the same "favorite places"), availability of fish and game, the effects of crowding, and ease of access. Moreover, these quality considerations will extend beyond recreational use directly occurring on the Tongass National Forest to include cruise ship passengers and others who have come to the region to mainly experience its beauty and wild character.

Management Costs

The Forest Service incurs various costs in the management of the national forests. Some of these can be directly attributed to a specific management activity or objective, but many others cannot. Likewise, some costs will vary depending upon specific activities stipulated in the Forest Plan. Others, however, are essentially fixed operating costs that will likely not vary for different alternatives.

The timber variable costs presented in Table 3.22-25 are based on average costs (dollars per MBF) resulting from planning and administration activities in conjunction with recent timber sale projects on the Tongass National Forest. Costs are also presented for the following NFS program costs: Inventory and Monitoring; Minerals and Geology; Recreation, Heritage, and Wilderness Management; Land Management Planning and Land Ownership Management; Vegetation and Watershed Management; and Wildlife and Fisheries Habitat Management. The costs assigned to these categories are estimated based on the average 2005/2006 costs for these cost categories and are assumed to remain constant across all alternatives. The choice of alternatives would undoubtedly affect these fixed operating costs, but we are unable to predict how they would be affected.

Additional costs may be imposed on organizations or individuals outside of the Forest Service. These costs are commonly termed "negative externalities" by economists. The current analysis makes no attempt to assign dollar values for the negative externalities that may be associated with the alternatives. Instead, the Forest Service addresses these by providing as much information as possible about the physical and ecological impacts of the alternatives, and using this information in the public participation process associated with the Plan.

Salmon Harvesting and Processing

With the exception of Alternatives 4 and 7, the effects of the alternatives on fish resources are expected to be at or below the level predicted for Alternative 11 in the 1997 Forest Plan Revision Final EIS (USDA Forest Service 1997a, pages 3-46 through 3-73). Alternative 4 is expected to have similar effects to Alternative 6 in the 1997 Forest Plan Final EIS. The effects of Alternative 7 are expected to be similar but less than those projected under Alternative 2 in the 1997 Forest Plan Final EIS. Effects are expected to be lower than those projected under the 1997 Alternative 2 because Alternative 7 includes improved riparian protections. The analysis of effects on fish habitat included in the 1997 Forest Plan Final EIS is incorporated into this EIS by reference. This is also the case with the commercial fishing portion of the economic efficiency analysis presented in the 1997 Final EIS (page 3-504). This section of the 1997 Final EIS explains why PNV estimates were not prepared for the economic efficiency analysis presented in the Final EIS and these reasons also apply here. In addition, there has been a reduction in commercial harvest dependence on natural fish production from the Tongass in recent years.

The absence of quantified salmon harvesting and processing benefits in Table 3.22-25 should not be taken as an indication that this resource is not valued or that current and future management decisions are made without careful consideration of the potential impacts to these values. Potential impacts to fish are discussed in the *Fish* section of this EIS.

Mining

Estimates of mining PNV are also omitted from this analysis because it is not possible to quantify the potential effects of the alternatives on future mining activities.

Subsistence

Subsistence activities have significant economic, as well as cultural and spiritual value for many Southeast Alaska residents. However, there are a number of difficulties involved in trying to quantify these values in monetary terms. A 2001 study that attempted to quantify the economic importance of Alaska's ecosystems used three different standard methods to estimate the statewide net economic benefits associated with subsistence (Colt 2001). This study concluded: "(i)n summary, it remains quite difficult to measure the net economic value of subsistence in economic terms. Using standard techniques, one can come up with estimates that range from zero (using a $4.00/lb replacement value less the cost of cash and labor input) to more than $1.7 billion (upper bound on net willingness to accept compensation for lost subsistence opportunities)" (Colt 2001; 37). Assigning an accurate economic value to subsistence is one significant problem in trying to calculate a PNV for subsistence. A second major problem involves quantifying the potential effects of the alternatives in terms of pounds of subsistence harvest foregone. This type of information is not available, as discussed in the *Subsistence* section of this document.

It is important to recognize that while it is not possible to assign subsistence a net economic value for the economic efficiency analysis, this does not mean that the potential effects of the alternatives on subsistence are not important. These potential effects are addressed programmatically in the *Subsistence* section of this document. They are also discussed on a community basis in the *Subregional Overview and Communities* section. The analysis presented in the *Subsistence* section assesses the potential effects of the alternatives in terms of abundance and distribution, access, and competition.

Non-use Values and Ecosystem Services

This section discusses non-use and ecosystem service values. Definitions of ecosystem services can be broad, including both use and non-use values. The following discussion uses a more narrow definition that applies to the group of services that is sometimes referred to as "life-support services." This definition excludes non-use and quality of life values, which are discussed separately below, as well as recreation use.

Non-use Values

Non-use values represent the value that individuals assign to a resource independent of their use of that resource. Non-use values include existence, option, and bequest values.

Economists have argued that recreation use represents only a portion of the economic value of natural areas. There are also non-use values associated with natural areas. Non-use values represent the value that individuals assign to a resource independent of their use of that resource. These types of values, which include existence, option, and bequest values, are usually measured via surveys that ask people how much they would be willing to pay to preserve a particular area. These values represent the value that individuals obtain from knowing that an area or resource exists, knowing that it would be available to visit in the future should they choose to do so, and knowing that it would be left for future generations to inherit.

While the non-use values associated with the Tongass National Forest as a whole are no doubt considerable, they are extremely difficult to accurately measure, particularly on a per acre basis. The results from surveys in other areas do provide some insight to potential non-use values that might be associated with the proposed alternatives. The findings of a number of recent studies are summarized in Table 3.22-26. These studies attempt to quantify the non-use values associated with wilderness and other types of natural areas in Alaska and other areas. WTP values are typically calculated on a per household basis and then expanded to a broader population. A critical issue here becomes identifying the extent of the survey area. Summing these types of values per household across large areas generates very high values. This issue is evident in the different geographical extent of the areas surveyed in the studies summarized in Table 3.22-26.

Examining the results of two of the studies summarized in Table 3.22-26 (Walsh et al. 1984 and Pope and Jones 1990), Loomis (2000) noted two trends that are relevant to this discussion. First, WTP per household increases with an increase in the number of acres proposed for wilderness protection, but at a decreasing rate. Second, existence, option, and bequest values in both cases represented about half the total value of wilderness. There are no new wilderness areas proposed under any of the alternatives, but these findings may also apply to areas preserved in a natural condition.

The results of the studies summarized in Table 3.22-26 suggest that the non-use values associated with maintaining areas on the Tongass in a natural condition are likely to be high, especially given the national importance of the Tongass. These values would likely increase with the number of acres, but at a lower rate. In terms of the proposed alternatives, the value per household is likely to be highest for Alternatives 1, 2, 3, 5 and 6, 4, and 7 in that order.

Table 3.22-26
Summary of Willingness-to-Pay Estimates of Existence Values

Author (Date)	Study Location	Description of Resource	Description of Commodity	Annual Willingness-to-Pay (2000$)[1]
Carson et al. 1992	Alaska: Prince William Sound	Prince William Sound coast and waters	WTP for spill prevention plan	$3.13 per U.S. household per year ($32.31 one-time)
Goldsmith and Hill 1998	Alaska: Bristol Bay Wildlife Refuges	13.2-million-acre wildlife refuges made up of three separate refuges	WTP for preserving wildlife habitat in Bristol Bay.	$26.05 to $52.11 per household U.S.
Walsh, et al. 1984	Colorado	1.2-million-acre designated wilderness area (2% of total state acreage) made up of 13 separate areas.	WTP to preserve existing wilderness areas in Colorado -- 1.2 million acres -- 10 million acres	 $23.07 per Colorado household $52.75 (1984$) per Colorado household
Reid et al. 1993	British Columbia	Current Wilderness in British Columbia.	WTP for doubling wilderness in British Columbia WTP for tripling wilderness in British Columbia	$11.80 per B.C. household ($118.02 one-time) $15.02 per B.C. household ($150.21 one-time)
Pope and Jones 1990	Utah	Bureau of Land Management land (BLM)	WTP for designation of BLM land in Utah million acres as wilderness. --2.7 million acres --16.2 million acres	 $69.50 per household $121.49 per household
Loomis 2000[2]	Western U.S outside Alaska	National Forest Roadless areas in Western U.S.	WTP to preserve roadless lands in the west	$6.72 per acre

[1] Values were adjusted to 2000 dollars using the Anchorage CPI for Alaska values and the U.S. CPI for all other areas.
[2] Estimated by Loomis using benefit-transfer approach from Walsh et al. (1984) and Pope and Jones (1990).
Sources: Colt 2001; Loomis 2000.

The summary of recent studies presented in Table 3.22-26 is meant to provide some indication of the results of other studies, only. While there is a general consensus that non-use values of this type exist and federal policy includes approval of such techniques, the methodologies for measuring the size of these values are both controversial and difficult to apply in a consistent fashion.

A recent study prepared by The Wilderness Society (Phillips and Silverman 2007), for example, used the values from the three of the studies shown in Table 3.22-25 (Carson et al., Goldsmith and Hill, and Loomis) to estimate annual passive use values of “wildlands” on the Tongass and Chugach National Forests that ranged from $6.8 million to $387.9 million. They then divided the difference to get an average annual passive value of $196.2 million. This analysis suggests that there is a passive use value associated with the Tongass National Forest, but the wide possible range identified for this value (with the high estimate [$387.9 million] 57 times as large as the low estimate [$6.8 million]) underlines the difficulty in estimating this type of value using a benefit transfer approach. This study is discussed in more detail in Appendix H.

Ecosystem Services

Ecosystem services are those services and benefits provided by healthy ecosystems. Definitions of ecosystem services can be broad, including both use and non-use values. A number of different definitions and groupings have been identified (Colt 2001; Costanza et al. 1997; Krieger 2001; Morton 2000). These include the typology developed by the Millennium Ecosystem Assessment (2005), which is featured on the Forest Service's Ecosystem Services web site (http://www.fs.fed.us/ecosystemservices/) and identifies four general categories of ecosystem services: provisioning, regulating, cultural, and supporting. This typology is also highlighted in Chapter 2 of this EIS. The Forest Service's Pacific Northwest Research Station recently issued a technical report that attempts to define an economics research program to describe and evaluate ecosystem services (Kline 2006).

Some definitions of ecosystem services include consumptive uses—such as logging, fishing, and hunting—that can be considered market goods, as well as non-use or passive use values. The values associated with these types of market goods and non-use values are discussed in the preceding sections. Other types of ecosystem services provide what might be considered long-term life support benefits to society as a whole. Examples of these types of benefits that pertain to forests include watershed services, soil stabilization and erosion control, improved air quality, climate regulation and carbon sequestration, and biological diversity (Krieger 2001).

Some economists have expressed concerns that ecosystem service values are not adequately considered in decision-making processes because they are not valued on a par with goods and services that are traded in commercial markets. A number of methods have been used to assign monetary values to these types of services. These methods include travel cost, hedonic pricing, and defensive expenditure approaches that use observed behavior to estimate values, as well as contingent valuation approaches that ask people what they would be willing to pay for an ecosystem service.

Costanza et al. (1997) estimated the total value of the services provided by the world's ecosystems ranges from $16 trillion to $54 trillion per year, with an average value of $33 trillion. Costanza et al.'s estimate involved the review and synthesis of a wide variety of existing studies and included estimates of recreation and cultural values, as well as more life-support-related services. Many of the studies used in their synthesis were based directly or indirectly on estimates of WTP. Colt (2001) applied Costanza et al.'s values to Alaska and estimated that the ecosystem values associated with the state's lands and waters ranged from $1.2 billion to $1.6 billion. Colt's estimate only included the components of Costanza et al.'s analysis that he considered to relate directly to life support services.

Phillips and Silverman (2007) applied the global values adopted by Colt (2001) to the Tongass National Forest and estimated that the annual ecosystem value of 15.7 million acres of the Tongass is $293.7 million. This analysis involved applying dollar per acre values for various ecosystem services, such as gas regulation, climate regulation, disturbance regulation, soil formation, and nutrient cycling, to five different forest biomes. Colt (2001, 42) notes that while the Costanza et al. estimates that form the basis of this analysis represent an important first step, they are "extremely primitive." Colt (2001, 43-44) also noted two obvious sources of bias with his analysis, which also apply to Phillips and Silverman's (2007) analysis. First, the average values per acre estimated by Costanza et al. and applied here are global averages derived from studies of population places and may have limited applicability to Alaska. Second, the data Colt adopted from Costanza et al., which Phillips and Silverman also use, does not address all "life support system" services and in this respect excludes categories of ecosystem services, such as wildlife habitat.

The results of Phillips and Silverman's (2007) analysis suggests there are ecosystem service values associated with the Tongass National Forest and these values are, as the resource-by-resource analyses presented in the other sections of this EIS suggest, undoubtedly high. These estimates are not, however, suitable for a detailed comparison of alternatives at the Forest level.

The uncertainty surrounding the accuracy of these estimates is compounded by the difficulty involved in accurately quantifying the effects of the alternatives on physical and biological resources in unit values. As Kline (2006, 15) notes, even if we were to accept this overall estimate as a reasonable benchmark for the total existing value of Tongass-related ecosystem services, "total ecosystem values provide little guidance to policy or management decisions unless these decisions can be expressed as marginal or incremental changes in ecosystem services." With respect to wetlands, which make up 91 percent of the annual ecosystems services value estimated by Phillips and Silverman, for example, the impacts are evaluated in this EIS in terms of potential risk based on projected road building and acres identified as suitable for harvest. Impacts are not quantified in terms of acres lost or acres of wetland function impaired.

However, as noted earlier, the fact that no monetary value is assigned to ecosystem services in this document does not lessen their importance in the decision making process. A large proportion of this document is devoted to assessing impacts to the Forest resource that cannot be readily expressed in monetary terms.

It should also be noted that ongoing initiatives in Southeast Alaska to develop ecosystem services markets such as the Fuels for Schools program, thinning of second growth for wildlife habitat improvement, and implementation of practices and technologies to reduce the carbon 'footprint' of Forest Service operations will con tinue under all of the alternatives.

It is important to recognize when evaluating the potential effects of the alternatives on non-commodity forest values, such as non-use values, ecosystem services, and quality of life issues, that there are a number of options available and in place to protect these values and resources. Under the current Forest Plan, LUDs specify ways of managing an area of land and the resources it contains. LUDs may emphasize certain resources, such as remote recreation or old-growth wildlife habitat, or combinations of resources, such as providing scenic quality in combination with timber harvesting. Each LUD has a detailed management prescription, which includes standards and guidelines.

Under the current Forest Plan, there are 19 LUDs that range from Wilderness to Timber Production, in terms of the level of development permitted. While each LUD has a different purpose and management emphasis, they may be generally grouped into four categories based on the kind of effects they potentially create. These four categories are wilderness, natural setting, moderate development, and intensive development. Timber management and other types of development are only allowed in the moderate and intensive development LUDs. Not all lands allocated to development LUDs are available for timber production. Under the current Forest Plan (Alternative 5), 3.6 million acres or 21 percent of the Forest is allocated to development LUDs. Approximately 687,000 acres of this area, or 4 percent of the Forest, suitable and scheduled for timber production (Table 3.22-27). This total includes both productive old growth and young-growth acreage. Under Alternative 1, the most restrictive alternative from a development perspective, 5 percent of the Forest would be allocated to development LUDs, with approximately 144,000 acres estimated to be suitable for timber production.

Table 3.22-27
Land Use Designations and Mapped Suitable Lands by Alternative (1,000s Acres)

LUD Group/Alternative	1	2	3	4	5	6	7
Wilderness and Natural Monument	5,916	5,916	5,916	5,916	5,916	5,916	5,916
Mostly Natural Setting	10,019	8,928	8,054	6,130	7,252	7,400	5,808
Moderate Development	279	577	830	1,503	1,096	1,064	1,653
Intensive Development	560	1,353	1,974	3,225	2,510	2,394	3,396
Total	**16,774**	**16,774**	**16,774**	**16,774**	**16,774**	**16,774**	**16,774**
Percent of Forest in Development LUDs	7	12	18	28	22	21	30
Scheduled Suitable Lands[1]							
Thousands of Acres	144	394	514	892	687	664	1,070
Percent of Total	1	2	3	5	4	4	6

[1] Scheduled suitable acres appropriate for harvest occur in moderate and intensive development LUDs only.

Under the current Forest Plan, timber management activities are governed by a large number of rules and regulations designed to protect or mitigate negative impacts to resources. These standards and guidelines, presented in Chapter 4 of the current Forest Plan, address the following resource areas and apply to Alternative 5, the No-Action Alternative, in this EIS:

- Air
- Beach and Estuary Fringe
- Facilities
- Fire
- Fish
- Forest Health
- Heritage Resources
- Karst and Caves
- Lands
- Minerals and Geology
- Recreation and Tourism
- Riparian
- Rural Community Assistance
- Scenery
- Soil and Water
- Subsistence
- Threatened, Endangered, & Sensitive Species
- Timber
- Trails
- Transportation
- Wetlands
- Wildlife

A number of changes to the Forest Plan text are being proposed under the action alternatives, based on the Forest Plan 5-Year Plan Review and Forest Service staff recommendations. Most changes were incorporated into the Proposed Forest Plan (Land and Resource Management Plan), which accompanied the Draft EIS. These changes were modified and updated for the Final EIS and the major changes being proposed are summarized in Chapter 2. The Final Proposed Forest Plan forms the basis for Alternatives 1, 2, 3, and 6. A summary of the major differences between the Final Proposed Forest Plan and the current Forest Plan are summarized below.

Management Prescriptions

- Edits and clarifications were made regarding karst management programs, sacred site protection, minerals and geology, off-highway vehicle use, scenery management, and other areas for most LUD prescriptions

- Substantial edits and clarifications were made to the Wilderness and Wilderness National Monument LUD prescriptions

Forest-wide Standards and Guidelines

- Clarifications and edits were made to the standards and guidelines regarding steep slopes and soil stability, Class III and IV streams, karst and cave resources, minerals and geology, recreation and tourism, scenery, off-highway vehicle use, road storage and decommissioning, and other resources.

- ♦ New sections were added to Chapter 4 on Invasive Species and Plants, and new standards and guidelines on sacred site protection.
- ♦ Conversion of the goshawk foraging habitat and the marten habitat standards and guidelines in the Wildlife section to a Forest-wide legacy standard and guideline in the *Wildlife* section.
- ♦ Revision of the goshawk nesting habitat standard and guideline in the *Wildlife* section.
- ♦ The requirement to conduct inventories to determine the presence of nesting goshawks for proposed goshawks that affect goshawk habitat is included in the Final Proposed Forest Plan.

Alternatives 4 and 7 also follow the Final Proposed Forest Plan, with some exceptions including the following:

- The Beach and Estuary Fringe buffer is changed to 500 feet along the beach fringe and 1,000 feet around estuaries under Alternative 7
- Neither the goshawk foraging habitat, the marten habitat, nor the new Legacy Standards and Guidelines would be implemented
- The goshawk nesting standard and guideline would not be implemented

As a result, the levels of resource protection are expected to be lower in these areas under Alternatives 4 and 7. In addition, the Old-Growth Habitat LUD and its management prescription is not used under Alternative 7, resulting in a reduction in protection for old-growth habitat.

Although data availability and specificity continue to be a challenge to refining the scale at which ecosystem service provision is assessed and valued, measurement, modeling, and valuation of ecosystem service efforts are increasing rapidly in scope, resolution, and ability to reflect system complexities. In addition, markets for ecosystem services are a topic of growing interest within the Forest Service, its partners and stakeholder groups. A prominent challenge to establishment of ecosystem service markets is the understanding of the current provision of ecosystem services as a baseline, against which progress (termed by economists as additionality) can be measured. A second challenge is to understand in a forward-looking manner the potential direct and indirect benefits of emerging market opportunities related to ecosystem services. Ongoing initiatives in Southeast Alaska illustrate some of the potential in this regard and include the Fuels for Schools programs, thinning of second growth for habitat, and implementation of practice and technologies to reduce the carbon ‘footprint’ of Forest Service operations, among other examples.

Natural Amenities and Quality of Life

As discussed in the Affected Environment portion of this section, natural amenities and local quality of life have increasingly been recognized as important factors that serve to attract and retain residents. It is, however, very difficult to determine the effect of the different alternatives on local amenities and, further, on the economic activity that these amenities are believed to indirectly generate. In most cases and localities the impacts of the action alternatives relative to the no-action alternative on amenities are not expected to be significant enough in themselves to result in measurable changes in economic activity.

Tongass National Forest Budget

The Forest Service budget is appropriated through Congress on a yearly basis. National forest budget requests are considered as part of total budget requests submitted to the United States Congress by the executive branch each year, with Congress having final say. The relevant portions of the Tongass National Forest budget are summarized for 2007 in Table 3.22-28. In general, funding for the Tongass National Forest has followed a downward trend in recent years. The Fiscal Year (FY) 2007 budget allocation was, for example, approximately $46 million (Table 3.22-28) compared to approximately $72 million in 2001 (see Table 3.22-26 in the 2003 SEIS [USDA Forest Service 2003b]). This overall decline in funding means that an increase in overall funding would be required relative to 2007 levels to fully implement the Forest Plan under all of the alternatives, including Alternative 5, No Action.

Variations in the level of timber harvest would affect the cost of operating the related programs including the following budget items, which include all the resource support, like wildlife biologists, necessary for timber harvesting.

The budget items that would be affected by variations in timber harvest volumes are as follows:

NFPN – Land Management Planning
NFIM – Inventory and Monitoring
CMRD – Roads Capital Improvements & Maintenance
NFTM – Timber Management
NFVW – Vegetation and Watershed Management

The amounts required to adequately fund these budget items would vary by alternative based on the estimated level of timber harvest. Projected budget requirements would be higher for these items under Alternatives 4, 5, 6, and 7, with Alternative 1 requiring the lowest amount of funding for timber management related activities. As the preceding discussion suggests, budget shortfalls are likely in the future, especially for the more timber-intensive alternatives.

Table 3.22-28
Fiscal Year 2007 Budget Allocation by Resource Item

Fund Code	Budget Line Item	Allocation
	National Forest System	
NFPN	Land Management Planning	$ 1,306,700
NFIM	Inventory and Monitoring	1,945,500
NFRW	Recreation/Heritage/Wilderness	4,240,600
NFWF	Wildlife and Fish Habitat Management	3,570,100
NFTM	Timber Management	12,699,300
NFVW	Vegetation and Watershed Management	2,430,400
NFMG	Minerals	1,017,800
NFLM	Landownership Management	1,625,700
NFLE	Law Enforcement	
	Total	$ 28,836,100
	Wildland Fire Management	
WFPR	Fire Preparedness	$ 890,700
WFHF	Hazardous Fuels	
WFSU	Fire Operations	
	Total	$ 890,700
	Capital Improvement & Misc.	
CMFC	Facilities Capital Improvements and Maintenance	$ 2,752,600
CMRD	Roads Capital Improvements and Maintenance	12,179,400
CMTL	Trails, Capital Improvements and Maintenance	1,412,200
	Total	16,344,200
Total		**$ 46,071,000**

Note: This table only summarizes those portions of the 2007 Tongass National Forest allocation that pertain to this analysis.
Source: USDA Forest Service 2007h.

Payments to the State

As noted in the Affected Environment discussion, the *Secure Rural Schools* legislation expired in 2006 with the last payments under this authorization made in December 2006. However, payments under this legislation were extended for 2007 as part of the Iraq Accountability Appropriations Act of 2007, which was signed into law on May 25, 2007 (USDA Forest Service 2007i).

Cumulative Effects

This section considers the incremental effects of the alternatives when added to other past, present, and reasonably foreseeable actions. The effects of past and present actions on the economic and social environment are included in the Affected Environment portion of this section, which discusses the regional economy, as well as providing a subregional overview, and assessing potential impacts at the community level. These sections summarize current employment levels and other key aspects of natural resource-based industries, and also assess recent trends.

The effects analyses presented in the preceding sections also take into consideration reasonably foreseeable actions. The impact analyses that address the wood products industry include, for example, projected future harvest levels for other land ownerships in Southeast Alaska. The effects of past and present harvest actions on other land ownerships are also implicitly incorporated into this analysis because they influence projected future levels of timber harvest. The influence of other factors not directly related to the Tongass, such as the major shifts in the markets served by Alaskan sawmills over the past decade, are also considered as part of the analysis.

The continued growth in the number of cruise ship passengers visiting the region is one of the major trends in recreation in Southeast Alaska. The effects of the alternatives are considered in conjunction with this trend because it underpins current and future recreation demand on the Tongass. In addition, the recreation and tourism economic impact analysis includes estimated non-Tongass-related recreation employment, as well as the potential effects of the alternatives on the supply of recreation opportunities on the Tongass.

Other reasonably foreseeable future actions include an expected growth in recreation and tourism businesses based on the continued growth in the cruise ship industry, as well as the development of additional fishing and other lodges. This type of development would facilitate additional recreation and tourism in the region and on the Forest. Human settlement expansion is expected to occur around the region's larger cities, such as Juneau and Ketchikan, with residential expansion also expected as a result of state land auctions. These developments would likely result in increased demand for a range of recreation activities, with some developments favoring developed recreation opportunities, and others more dependent on undeveloped lands.

Reasonably foreseeable actions on NFS lands include the projected levels of future timber harvest and development that are used in the preceding analysis to assess the potential impacts of the alternatives on the regional and local economies. These projected activities were also used to assess the potential impacts of the alternatives on the supply of recreation opportunities and recreation use and demand.

Other reasonably foreseeable actions include transportation and utility developments proposed by the State of Alaska. These proposals are summarized in the *Transportation and Utilities* section of this document. A total of 1,523 miles of roads are projected to be constructed on non-NFS lands in Southeast Alaska over the life of the Plan (100+ years) under each of the alternatives (see Table 3.12-3 in the *Transportation and Utilities* section). Most of the projected non-NFS roads are forest roads that would be developed for timber harvest, but the total miles also include roads likely to be built to serve communities, such as the Juneau access road on the east side of Lynn Canal. This road, and other road corridors covered by Public Law 109-59, would, if approved under NEPA and funded, connect additional areas in Southeast Alaska to the continental highway system and improve transportation between communities. They would also improve access for recreation use and in some cases would likely facilitate new types of use.

It is not possible at this time to predict exactly which roads would be developed or their likely impact on future recreation patterns and associated employment. None of the alternatives are expected to affect this type of future road development, which would be expected to go forward regardless of the selected alternative. The overall cumulative effect of new regional road corridors viewed in conjunction with the proposed Forest Plan alternatives would be a trend toward more developed recreation opportunities that would be relatively high under Alternative 7 and relatively low under Alternative 1. Planned timber harvest activities on adjacent private and Native Corporation lands would also result in a cumulative trend toward more developed recreation opportunities that would be most pronounced under Alternative 7 and least pronounced under Alternative 1.

Mining activities are expected to expand at existing sites, including Greens Creek on Admiralty Island and Berners Bay north of Juneau, with an increase in mining exploration and new development anticipated. Continued mining at existing sites and ongoing exploration efforts would likely support existing levels of mining employment and income. This employment and income would increase if there were an increase in exploration and development.

Regional energy and transmission projects are also expected to occur, including the Swan-Tyee transmission line and the Juneau-Hoonah transmission line. These projects are expected to improve and expand local and regional electrical service and reliability.

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Introduction

The preceding section of this document addressed the potential impacts of the proposed alternatives upon the regional economy as a whole. Potential impacts would not, however, be viewed similarly by all boroughs or communities in Southeast Alaska or distributed equally among them. It is, therefore, important to consider the potential effects at a more detailed geographic scale. The following section is divided into two parts. The first part, entitled Subregional Overview, addresses the economic and social composition of the boroughs and census areas (CAs) that comprise Southeast Alaska, as well as providing summary data at the community group level. This discussion provides an important perspective on the likely distribution of the potential effects identified in the regional economy analysis, as well as setting the stage for the second part of this section, which discusses the potential effects of the alternatives on each of Southeast Alaska's 32 communities.

Subregional Overview

Addressing potential effects at the subregional level can be difficult because the types of data available at the state or regional level are often not available for smaller localities. In addition to problems arising from inadequate data, the lack of detailed information on the exact location of expected harvests and on the competitive position of individual firms makes it impossible to know which jobs or firms may be affected under a given alternative. Any attempt to provide numerical estimates of long-term impacts at the community level would be prone to error, and give a false sense of accuracy and certainty. As a result, the following analysis presents a more detailed picture of the current situation and past trends at the Borough/CA and community group levels, but does not attempt to quantify potential impacts by alternative.

Economic developments are discussed in the following sections using data compiled at the borough/CA level, as well as employment data compiled by the Alaska Department of Labor (Alaska DOL) at the community group level. Community groups are sub-areas of boroughs and CAs developed by the Alaska DOL. Some of the community groups consist of one community; others include several communities (see Table 3.23-6). Information at the community group level provides a more detailed picture of local employment patterns than is usually available.

Southeast Alaska Boroughs and Census Areas

There are large differences in the economic structure and development of the boroughs and CAs (referred to as the "boroughs" in the following discussion) that comprise Southeast Alaska. A common problem encountered in the analysis of the Southeast Alaska economy is that, owing to its relative size, Juneau dominates statistics at the regional level. As a result, regional trends in population, employment, or income tend to closely represent developments in Juneau and often do not reflect changes in other boroughs. By analyzing certain economic statistics at the borough level, differences in economic structure and trends that are obscured at the regional level, are more apparent. The following sections discuss population, employment, and income trends at the borough level.

Population

The population of Alaska grew during the 1980s and 1990s increasing from about 402,000 in 1980 to approximately 627,000 in 2000, an increase of 56 percent. Southeast Alaska's population increased by 36 percent over the same time period. Increases at the borough level ranged from 8 percent for Wrangell-Petersburg to

57 percent and 61 percent for Juneau and Prince of Wales-Outer Ketchikan, respectively, with Juneau accounting for about 55 percent of Southeast Alaska's population growth over this period. Population increases were larger in the 1980s than in the 1990s in all cases, and population in the Northern Complex, Wrangell-Petersburg, and Prince of Wales-Outer Ketchikan actually declined between 1990 and 2000 (Table 3.23-1).

Table 3.23-1
Borough/Census Area Population, 1990, 2000, and 2006

Borough/Census Area/ Region	1990	2000	2006	1990 to 2000 Absolute Change	1990 to 2000 Percent Change	2000 to 2006 Absolute Change	2000 to 2006 Percent Change
Northern Boroughs							
Haines Borough	2,117	2,392	2,241	275	13	-151	-6
Juneau Borough	26,751	30,711	30,650	3,960	15	-61	0
Sitka Borough	8,588	8,835	8,833	247	3	-2	0
Northern Complex[1]	4,404	4,244	3,654	-160	-4	-590	-14
Southern Boroughs							
Ketchikan Gateway Borough	13,828	14,059	13,174	242	2	-885	-6
Prince of Wales-Outer Ketchikan CA	6,278	6,157	5,477	-132	-2	-680	-11
Wrangell-Petersburg CA	7,042	6,684	6,024	-358	-5	-660	-10
Southeast Alaska	**69,009**	**73,082**	**70,053**	**4,073**	**7**	-3,029	-4
Alaska	550,043	626,931	670,053	76,889	14	43,122	7

CA=Census Area
[1] 1990 data are for the Skagway-Yakutat-Angoon Census Area. 2000 data combine the Skagway-Hoonah-Angoon Census Area and Yakutat Borough. Yakutat Borough was incorporated in 1992.
Source: Alaska DOL 2001a, 2007a; U.S. Census Bureau 1995.

Alaska has continued to grow since 2000 with total population increasing by 7 percent between 2000 and 2006. Southeast Alaska, in contrast, lost population over this period, with the total population decreasing by an estimated 3,029 people or about 4 percent. All of the boroughs have lost population since 2000, with the largest absolute decrease (-885 people) occurring in Ketchikan Gateway Borough. Juneau and Sitka experienced relatively modest decreases in population from 2000 to 2006, less than 0.5 percent in both cases (Table 3.23-1).

Components of regional population change for 2000 through 2006 indicate that all of the boroughs in Southeast Alaska experienced natural increase (more births than deaths) over this period (U.S. Census Bureau 2006). All of the boroughs also experienced net out-migration (more people leaving than moving in) and in all cases the net loss of population through out-migration exceeded the net gain through natural increase. Juneau City and Borough experienced the largest absolute net out-migration over this period.

Alaska DOL released new statewide population projections in 2007 (Alaska DOL 2007h). These projections extend from 2010 through 2030, with low, middle, and high estimates available at the borough level at 5 year intervals. The general trend from 2006 to 2030 is for some degree of population growth for all Alaska regions, with the exception of Southeast Alaska. The boroughs with the greatest levels of annualized projected population decrease from 2006 to 2030 are both located in Southeast Alaska. Skagway-Hoonah-Angoon CA and Haines borough are projected to see annual decreases in population of 1.8 percent and 1.5 percent over this period, respectively (Alaska DOL 2007h).

Population in Alaska as a whole is projected to increase between 2006 and 2030 under all three sets of estimates, with anticipated increases ranging from 9 percent to 42 percent. Population estimates for Southeast Alaska anticipate a 19 percent decrease (low), a 7 percent decrease (middle), or a 5 percent increase (high) over the same time period. Population is expected to decrease in all Southeast Alaskan boroughs under the low set of projections, for all the boroughs except Juneau (+5 percent) under the middle set, and all boroughs except Juneau (+19 percent), Sitka (+11 percent), and Yakutat (+3 percent) under the high set (Alaska DOL 2007h).

Employment

Total full- and part-time employment is presented by borough for 1990 and 2000 in Table 3.23-2. These data compiled by the U.S. Department of Commerce, Bureau of Economic Analysis include proprietors and self-employed workers. These data indicate that overall employment in Southeast Alaska increased by approximately 11 percent during the 1990s, with population increasing by 6 percent over the same period (Table 3.23-1). Employment increased in all boroughs with the exception of Ketchikan Gateway, which experienced a net loss of 529 jobs or 4.9 percent of total employment over this period. Total employment in Juneau increased by 4,036 jobs or 22 percent. Employment in Haines also saw a relatively large gain, increasing by 31 percent or 520 jobs.

Table 3.23-2
Borough/Census Area Employment, 1990 and 2000

	Total Employment[1]		Wood Products[2,3]			Lodging, Rest. & Rec[2,3,4]		
	2000	1990-2000 Change (%)	2000	1990-2000 Change (%)	% Local Total	2000	1990-2000 Change (%)	% Local Total
Northern Boroughs								
Haines Borough	2,174	31.4	0	-100.0	0.0	214	112.4	21.6
Juneau Borough	22,046	22.4	68	NA	0.4	1,873	60.5	11.0
Sitka Borough	6,385	3.0	1	-100.0	0.0	371	2.7	5.2
Northern Complex[5]	3,093	4.4	183	-43.7	9.0	319	52.3	15.7
Southern Boroughs								
Ketchikan Gateway Borough	10,239	-4.9	383	-73.2	9.4	698	3.6	17.1
Prince of Wales-Outer Ketchikan CA	2,951	5.3	281	-59.9	15.1	226	57.2	12.1
Wrangell-Petersburg CA	4,734	9.3	158	-64.3	6.0	161	-22.3	6.1
Southeast Alaska	**51,622**	**10.5**	**1,074**	**-69.3**	**3.0**	**3,862**	**35.0**	**10.8**

1 These data, compiled from U.S. Department of Commerce, Bureau of Economic Analysis (BEA) data and are for full and part-time employment, including proprietors and self-employed.
2 These data, compiled from Alaska DOL (NAWS) data (Alaska DOL 2006c) and the 1997 Forest Plan Revision Final EIS, do not include proprietors and self-employed workers. Bureau of Economic Analysis data, the source for the total employment column, is not available at this level of disaggregation.
3 The percent of local total is benchmarked against total NAWS employment, which excludes proprietors and self-employed, not the Bureau of Economic Analysis numbers shown in the left column.
4 Lodging, Restaurants, and Recreational and Entertainment Services. This measure does not directly reflect recreation and tourism-related employment but is included as an indicator of trends and relative concentration of recreation and tourism-dependent jobs. The numbers presented here do not include proprietors or the self-employed and, therefore, are likely underestimates as proprietors and self-employed workers tend to comprise a large share of total employment in these sectors.
5 Aggregate of Skagway-Hoonah-Angoon Census Area and Yakutat Borough.
Source: Alaska DOL 2006c; U.S. Department of Commerce, Bureau of Economic Analysis 2002; USDA Forest Service 1997a (Table 3-154).

Employment in wood products and lodging, restaurants, and recreational and entertainment services is also summarized by borough in Table 3.23-2. These data compiled by the Alaska DOL are for covered employment only. Covered employment data include workers covered by State or federal unemployment insurance laws programs. Covered employment does not include proprietors or self-employed workers. As a result, the numbers presented in Table 3.23-2 are likely underestimates. This is particularly the case with lodging, restaurants, and recreational and entertainment services because proprietors and self-employed workers tend to comprise a large share of total employment in these sectors. U.S. Department of Commerce, Bureau of Economic Analysis data, which include proprietors and self-employed workers, are not available at this level of disaggregation.

Employment in the wood products sector declined in all boroughs during the 1990s, with the largest absolute loss (1,046 jobs) occurring in Ketchikan Gateway. Losses ranged from a low of 44 percent of 1990 wood products employment in Northern Complex to 100 percent in Sitka and Haines. The wood products sector accounted for 433 and 141 jobs in Sitka and Haines in 1990, respectively. These sharp declines in employment in part reflect the years selected for comparison. Wood products employment, which has followed cyclical trends over the past two decades, peaked in 1990 (see Figure 3.22-6 in the *Economic and Social Environment* section). A comparison between 1985 and 1999, for example, would show a less dramatic decline. Comparing two points in time also has the effect of suggesting a linear trend that may not be the case. Wood products employment in Wrangell-Petersburg CA, for example, declined by 64 percent between 1990 and 2000, but actually increased by about 88 percent between 1995 and 2000.

That said, APC and KPC ceased their Southeast Alaska operations in the 1990s and mill closures in Ketchikan, Sitka, and Wrangell had dramatic effects on these communities because they eliminated their main source of private sector year round employment. In addition, the seasonal but well-paid logging activities in Prince of Wales-Outer Ketchikan, Wrangell-Petersburg, and Skagway-Hoonah-Angoon were reduced over this period (Gilbertson 2004). As a result, by 2000 wood products accounted for a relatively small share of total employment in most boroughs. Wood products did, however, continue to comprise a relatively large share of employment in Prince of Wales-Outer Ketchikan (15.1 percent), Ketchikan Gateway (9.4 percent), and Northern Complex (9.0 percent) (Table 3.23-2).

In contrast to wood products employment, employment in lodging, restaurants and recreation-related services demonstrated strong gains between 1990 and 2000. The contrast between losses in wood products employment and gains in lodging, restaurants and recreation-related employment is consistent with overall trends discussed in the *Economic and Social Environment* section, but there is considerable variation across boroughs. Employment in this category in Haines, for example, more than doubled, with lodging, restaurants and recreation-related services accounting for 22 percent of total employment in 2000. The Wrangell-Petersburg CA, on the other hand, saw a substantial decrease (22 percent) in employment in this category, which represented just 6 percent of total employment in 2000. Certain boroughs (and, by extension, the communities that they encompass) have benefited more from the expansion of the tourist-related economy than others.

Employment data for 2000 and 2005 are summarized in Table 3.23-3 and indicate that while statewide employment increased by 9.8 percent over this period, employment in Southeast Alaska stayed relatively constant increasing by just 0.7 percent or 333 jobs. Employment in Juneau declined over this period, with 1,041 fewer jobs in 2005 than in 2000. Employment stayed relatively constant in Haines (-19 jobs) and increased in all the other boroughs, with the largest absolute increase occurring in Sitka (777 jobs) (Table 3.23-3).

Covered employment data compiled by Alaska DOL for 2005 are also presented in Table 3.23-3 and shown graphically in Figure 3.23-1. These data are not directly comparable with those presented in Table 3.23-2 because of the change from the SIC to NAICS measurement systems employed by federal and state agencies in 2001. Comparison of these data does, however, suggest that wood products has continued to decline as a share of total employment in all Southeast Alaska boroughs since 2000 (see Tables 3.23-2 and 3.23-3). Employment in the leisure and hospitality sector accounted for about 10 percent of total Southeast Alaska covered employment in 2005, ranging from 6.6 percent of total employment in Wrangell-Petersburg to 18.9 percent in Yakutat (Table 3.23-3).

Table 3.23-3 and Figure 3.23-1 highlight the distinction between northern and southern boroughs. With the exception of Skagway-Hoonah-Angoon, there was no wood products employment in the northern boroughs in 2005. Nearly all of the covered forestry and logging and wood products manufacturing employment in Southeast Alaska (96 percent) is concentrated in the southern boroughs. Leisure and hospitality employment, by contrast, generally shows higher concentrations in the north, with northern boroughs accounting for 70 percent of total regional employment in this category.

Table 3.23-3
Borough/Census Area Employment, 2000 and 2005

	Total Employment[1]		2005 Employment by Sector: Forestry and Logging[2,3]		Wood Products[2,3]		Leisure and Hospitality[2,3,4]	
	2005 Employ-ment	2000-2005 Change (%)	Employ-ment	Percent of Total	Employ-ment	Percent of Total	Employ-ment	Percent of Total
Northern Boroughs								
Haines Borough	2,469	-0.9	0	0.0	0	0.0	168	16.0
Juneau Borough	20,536	-5.2	0	0.0	0	0.0	1,545	8.8
Sitka Borough	6,928	11.8	0	0.0	0	0.0	503	11.4
Skagway-Hoonah-Angoon CA	2,552	1.0	13	0.8	7	0.4	241	15.4
Yakutat Borough	712	22.5	0	0.0	0	0.0	63	18.9
Southern Boroughs								
Ketchikan Gateway Borough	10,370	1.8	95	1.4	55	0.8	741	10.7
Prince of Wales-Outer Ketchikan CA	2,984	4.5	161	7.9	43	2.1	155	7.6
Wrangell-Petersburg CA	4,637	2.8	82	3.2	0	0	170	6.6
Southeast Alaska	**51,188**	**0.7**	**351**	**1.0**	**105**	**0.3**	**3,586**	**9.8**
Alaska	437,010	9.8	486	0.2	364	0.1	31,000	10.1

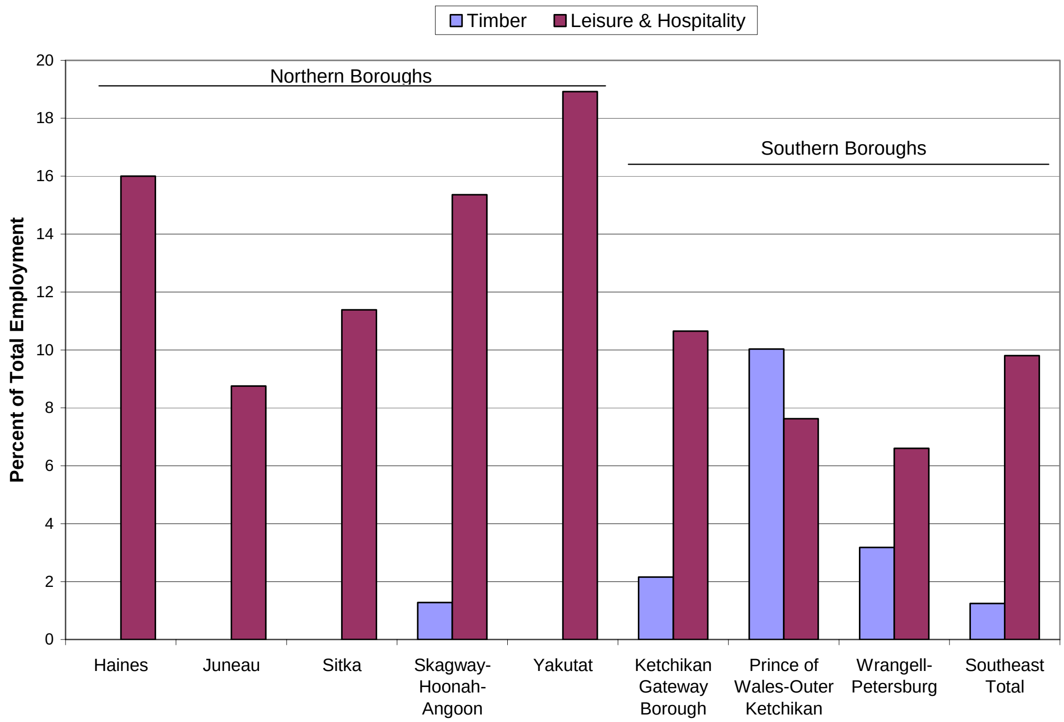
[1] These data, compiled from U.S. Department of Commerce, Bureau of Economic Analysis (BEA) data and are for full and part-time employment, including proprietors and self-employed.
[2] These data, compiled from Alaska DOL (NAWS) data (Alaska DOL 2006b), do not include proprietors and self-employed workers. Bureau of Economic Analysis data, the source for the total employment column, is not available at this level of disaggregation.
[3] The percent of local total is benchmarked against total NAWS employment, which excludes proprietors and self-employed, not the Bureau of Economic Analysis numbers shown in the left column.
[4] Leisure and hospitality does not directly reflect recreation and tourism-related employment but is included as an indicator of the relative concentration of recreation and tourism-dependent jobs. This sector includes the Arts, Entertainment, and Recreation and Accommodation and Food Services sectors. The numbers presented here do not include proprietors and self-employed and, therefore, are likely underestimates as proprietors and self-employed workers tend to comprise a large share of total employment in these sectors.
Source: Alaska DOL 2006b; U.S. Department of Commerce, Bureau of Economic Analysis 2006b

Income

Average real per capita income in Southeast Alaska (expressed in constant 2005 dollars) increased by 4 percent between 1996 and 2005. The change from 1996 to 2005 varied by borough, ranging from a decrease of 1 percent in Juneau to relatively large increases in the smaller northern boroughs (Haines [16 percent], Skagway-Hoonah-Angoon [20 percent], Yakutat [18 percent]). Average real per capita income increased in Alaska (11 percent) and nationwide (15 percent) over this period

The absolute level of per capita income is considerably lower for Prince of Wales-Outer Ketchikan, indicating that in 2005, on average, residents at this area received 36 percent less income than the regional average. Per capita incomes are above the regional average in Ketchikan (111 percent), Haines (110 percent), and Juneau (106 percent) (Table 3.23-4).

Figure 3.23-1
Wood Products and Lodging, Restaurant, and Recreation Services Share of Total Employment by Borough, 2005 (Percent)



Notes:
NAWS=Non-agricultural wage and salary employment. Excludes proprietors and self-employed.
See notes to Table 3.23-3.
1. Timber includes both forestry and logging and wood products manufacturing employment.
Source: Alaska DOL 2006b (see Table 3.23-3)

Table 3.23-4
Per Capita Income, 1996 to 2005

	1996	2005	1996 to 2005 Absolute Change	1996 to 2005 Percent Change	Share of Regional Average (2005)
Northern Boroughs					
Haines Borough	34,725	40,185	5,460	16%	110%
Juneau Borough	39,122	38,702	-420	-1%	106%
Sitka Borough	31,124	33,115	1,991	6%	91%
Skagway-Hoonah-Angoon CA	28,459	34,265	5,806	20%	94%
Yakutat Borough	28,467	33,716	5,249	18%	93%
Southern Boroughs					
Ketchikan Gateway Borough	38,678	40,291	1,613	4%	111%
Prince of Wales-OK CA	22,053	23,305	1,252	6%	64%
Wrangell-Petersburg CA	29,269	33,446	4,177	14%	92%
Southeast Alaska	34,848	36,411	1,563	4%	100%
Alaska	31,998	35,564	3,566	11%	98%
USA	29,977	34,471	4,494	15%	95%

Note:
1. Per capita income figures for 1996 are adjusted for inflation and presented here in 2005 dollars.
Source: U.S. Department of Commerce, Bureau of Economic Analysis 2007a.

Dividends, interest, and rent decreased as a share of total income from 1996 to 2005 in Alaska, the U.S as a whole, and all Southeast Alaska boroughs (Table 3.23-5). Transfer payments increased as a relative share of employment over the same period in all Southeast Alaska boroughs, as well as in Alaska as a whole and nationwide. Increases in Southeast Alaska ranged from 1.4 percent in Sitka to 6.8 percent in Yakutat Borough.

Table 3.23-5
Components of Personal Income, 1996 to 2005 (percent of total)

	Earnings		Dividends, Interest, and Rent		Transfer Payments	
	2005	1996-2005 Change	2005	1996-2005 Change	2005	1996-2005 Change
Northern Boroughs						
Haines Borough	64.6	2.4	18.0	-4.6	17.5	2.2
Juneau Borough	72.0	2.5	16.3	-4.3	11.7	1.8
Sitka Borough	67.7	4.8	17.9	-6.2	14.5	1.4
Skagway-Hoonah-Angoon CA	64.9	-0.3	16.0	-3.6	19.2	3.9
Yakutat Borough	61.8	-2.4	16.3	-4.4	21.9	6.8
Southern Boroughs						
Ketchikan Gateway Borough	69.3	-1.3	15.6	-1.6	15.0	2.9
Prince of Wales-OK CA	64.0	-3.9	13.1	-2.0	22.9	5.9
Wrangell-Petersburg CA	64.9	1.8	15.8	-4.2	19.3	2.4
Southeast Alaska	69.3	1.3	16.2	-3.7	14.5	2.4
Alaska	72.1	2.7	13.4	-4.0	14.5	1.3
USA	69.5	2.4	15.6	-3.2	14.9	0.7

Notes:
1. Earnings includes wages and salaries, other labor income, and proprietors' income.
2. Transfer payments consist mainly of government payments to individuals, including retirement, disability, and unemployment insurance benefit payments, income maintenance payments, and veterans benefit payments. Government payments to individuals in Alaska include Alaska Permanent Fund benefits, which are derived from oil revenues and paid to every resident.
3. Percent of total income.

Source: U.S. Department of Commerce, Bureau of Economic Analysis 2007a.

Earnings as a share of personal income increased from 1995 to 2004 in Southeast Alaska (0.5 percent), Alaska (1.7 percent), and the U.S as a whole (2.3 percent) (Table 3.23-5). Earnings decreased as a share of total income in all the southern boroughs, with the largest decrease (-7.7 percent) occurring in Prince of Wales-Outer Ketchikan, as well as Skagway-Hoonah-Angoon and Yakutat. Earnings increased as a share of total income in Haines, Juneau, and Sitka.

Alaska DOL Community Groups

In this portion of the document, the employment data provided by Alaska DOL is analyzed using the community groups defined by that agency—the most detailed level available for this data. At this level of disaggregation there is a much greater potential for substantial errors in the data. Changes in reporting jurisdictions or industry definitions, for example, may result in large and abrupt changes in reported employment for a given community or industry with no underlying change in actual employment patterns. It is also important to remember that Alaska DOL community groups are not necessarily synonymous with actual communities. The individual communities included in each community group are identified in Table 3.23-6. The following discussion focuses on the wood products and recreation and tourism industries. Data are presented for 1990 and 1999, which is the most recent year that data are available in this format.

Table 3.23-6
Alaska DOL Community Groups Defined

Boroughs and Census Areas	Community Groups	Communities/Places
City & Borough of Juneau	Juneau	Auke Bay, Berners Bay, Douglas, Dupont, Fritz Cove, Hawk Inlet, **Juneau**, Lemon Creek, Lena Cove, Lynn Canal, Mendenhall Valley, North Douglas, Salmon Creek, Snettisham, Switzer Creek, Taku Harbor, Taku Lodge, Tee Harbor, Thane, and West Juneau.
Ketchikan Gateway Borough	Ketchikan	Carlanna, Charcoal Point, Clover Pass, Herring Cove, **Ketchikan**, Mountain Point, Mud Bay, North Tongass Highway, Peninsula Point, Pennock Island, Point Higgins, Refuge Cove, **Saxman**, Shoreline Drive, Thomas Basin, Totem Bight, Upper Nickeyville, Wacker, and Ward Cove.
	Revillagigedo	Fire Cove, Gedney Pass, George Inlet, Gravina Island, Guard Island, Hassler Pass, Loring, Neets Bay, Princess Bay, Shoal Cove, and Twin Peaks.
Haines Borough	Haines	Eldred Rock, Excursion Inlet, **Haines**, Letnikof Cove, Moose Valley, Mosquito Lake, Pleasant Camp, Porcupine, Port Chilkoot, and Saint James Bay.
Sitka Borough	Baranof	Baranof, Big Port Walker, Chatham, Corner Bay, False Island, Lake Eva, Little Port Walter, Port Armstrong, Port Conclusion, Rodman Bay, Saook Bay, Todd, and Warm Spring Bay.
	Sitka	Biorka Island, Chichagof, Cobol, Deep Bay, Goddard, Halibut Point, Jamestown Bay, Japonski Island (Mt. Edgecumbe), Katlian Bay, Klag Bay, Nakwasina Cove, Redfish Cape, Saint John Baptist Bay, Schulze Cove, **Sitka**, and Sitka Logging Camp.
Yakutat Borough	Yakutat	Situk and **Yakutat**
Angoon-Hoonah-Skagway Census Area	Chatham Strait	**Angoon**, Catherine Island, Cube Cove, Hanus Bay, **Tenakee Springs**, Tyee, and Whitewater Bay.
	Gustavus	Bartlett Cove, Cape Spencer, and **Gustavus** (Strawberry Point).
	North Chichagof	**Elfin Cove**, Gull Cove, **Hoonah**, Idaho Inlet, Lisianski, **Pelican**, Port Althorp, Port Frederick, and Yakobi Island.
	Stephens Passage	Cape Fanshaw, Five Fingers, Freshwater, Bay, Funter Bay, Hobart Bay, Point Retreat, Port Houghton, Sawyers Landing, Sumdum, and Windham Bay.
	Skagway	Clifton, and **Skagway**.
Prince of Wales-Outer Ketchikan	Central Prince of Wales	**Craig**, **Hollis**, and **Klawock**.
	Southeast Prince of Wales	Bokan Mountain, Campbell, Dall Island, Dora Bay, Kendrick Bay, Klakas Inlet, Rose Inlet, Twelvemile Arm, View Cove and Waterfall.
	Hydaburg	**Hydaburg**
	North Prince of Wales	Cape Pole, Coal Bay, **Coffman Cove**, **Edna Bay**, El Capitan, **Kasaan**, Labouchere Bay, Little Naukati Bay, **Naukati Bay**, Noyes Island, **Point Baker**, Port Alice, **Port Protection**, Ratz Harbor, Red Bay, Salt Chuck, Shakan, Steamboat Bay, **Thorne Bay**, Thorne Island, Tokeen, Warren Cove, and **Whale Pass**.
	Metlakatla	Annette, Mary Island, and **Metlakatla**.
	Hyder	Hidden Inlet, **Hyder**, Smeaton Bay, Tongass, and Tree Point
	Cleveland Pen.	Bell Island, **Meyers Chuck**, Union Bay and Yes Bay.
Wrangell Petersburg Census Area	Kake	**Kake**.
	Kuiu Island	Alvin Bay, Cape Decision, Coronation Island, Duncan Canal, Fairway Island, Hamilton Bay, Kah Sheets Bay, **Port Alexander**, Rowan Bay, Saginaw Bay, Security Bay, Tebenkof Bay, and Washington Bay.
	Petersburg	Kupreanof, Mitkof Island, **Petersburg**, Scow Bay, and Vank Island.
	Thomas Bay	Thomas Bay.
	Wrangell City	**Wrangell**.
	Wrangell Island	Bradfield River, Burnette Inlet, Deer Island, Ernest Sound, Etolin Island, Kakwan Point, Roosevelt Harbor, Saint John Harbor, Tyler Logging Camp, and Zarembo Island.

Notes:
1. Some of these community groups have been renamed to more clearly represent the communities/places included.
2. The listing of communities/places included in each community group identifies named places in these areas. Some of these places are presently uninhabited.
3. Communities identified in bold are discussed in the Communities section of this document.

Source: USDA Forest Service 1997a (Table 3-155).

The following tables and figures provide some insight into which areas are more likely to be affected by the alternatives, as well as those that are likely to have been affected by changes in the economy since 1990.

Employment information, presented by community group in Table 3.23-7, shows an extremely high variation in the rate of job creation (or loss) experienced by the different community groups. The highest positive or negative changes are, not surprisingly, concentrated in those groups with the smallest total employment numbers. This highlights an important aspect of community level impacts—the most severe impacts (relative to total local employment) are often experienced in smaller communities, where even small job losses may be large relative to total employment.

Smaller communities also often exhibit higher concentrations of employment in a single industry, such as logging camps or resorts and fishing lodges.

Table 3.23-7
Employment by Community Group, 1990 to 1999

	Wage & Salary[1]		Wood Products[2]			Lodging, Rest., & Rec.[3]		
Community Group	1999 Jobs	1990-1999 Change (%)	1999 Jobs	1990-1999 Change (%)	% of Local Total	1999 Jobs	1990-1999 Change (%)	% of Local Total
Borough								
Haines	865	- 3	0	- 100	0	192	+ 90	22
City and Borough of Juneau								
Juneau	16,284	15	55	--	0	1,783	52	11
Ketchikan Gateway Borough								
Ketchikan City	7,014	- 10	404	- 72	6	682	1	10
Revillagigedo	31	--	0	--	0	0	--	0
Subtotal	**7,045**	**- 11**	**404**	**- 72**	**6**	**682**	**1**	**10**
Northern Complex								
Chatham Strait	223	- 33	40	- 55	18	22	17	10
Gustavus Island	189	53	0	--	0	75	27	40
North Chichagof	411	- 31	99	- 29	24	33	11	8
Skagway	578	14	0	--	0	147	101	25
Stephens Passage	14	- 96	0	- 100	0	0	--	0
Yakutat	381	92	13	- 65	3	74	164	19
Subtotal	**1,795**	**- 16**	**152**	**- 53**	**8**	**352**	**68**	**20**
Prince of Wales/Outer Ketchikan								
Central Prince of Wales	1,051	8	116	- 63	11	140	--	13
Cleveland Peninsula	195	786	180	--	92	14	- 37	7
Hydaburg	75	- 3	1	--	1	0	--	0
Hyder	54	73	0	--	0	4	- 61	7
Metlakatla	472	- 20	40	- 65	9	0	- 100	0
North Prince of Wales	361	- 29	83	- 69	23	28	368	8
Southeast Prince of Wales	50	528	0	--	0	42	--	84
Subtotal	**2,258**	**2**	**420**	**- 40**	**19**	**228**	**406**	**10**
Sitka Borough								
Baranof	13	- 75	1	- 98	8	0	--	0
Sitka	4,000	- 1	0	- 100	0	415	15	10
Subtotal	**4,014**	**- 2**	**1**	**- 100**	**0**	**415**	**15**	**10**
Wrangell-Petersburg Census Area								
Kake	257	- 10	53	- 57	21	0	--	0
Kuiu Island	13	- 85	0	- 100	0	0	--	0
Petersburg	1,395	0	5	- 93	0	109	- 16	8
Wrangell City	823	- 7	70	- 57	9	70	- 9	9
Subtotal	**2,488**	**- 6**	**128**	**- 70**	**5**	**179**	**- 14**	**7**
Southeast Alaska Total	**34,748**	**2**	**1,160**	**- 67**	**3**	**3,830**	**38**	**11**

[1] Full and part-time average annual employment. Self-employed people and proprietors are not included in this data-set.
[2] Wood products includes both mill and logging employment.
[3] Lodging, Restaurants and Recreational and Entertainment Services. This measure does not directly reflect recreation and tourism-related employment, but is included as an indicator of trends and relative concentration of recreation and tourism-dependent employment.
Source: Alaska DOL 2002.

Communities

Community is a concept with multiple dimensions and definitions. Basic definitions of community include: 1) a geographic/political entity, such as a town or village; 2) a network of people with shared values, world views, or identities (sometimes called a community of meaning), such as an ethnic or racial group (e.g., Native Alaskans) or an occupational group (e.g., loggers); 3) a working social system; 4) a rural social landscape, which would include the first three definitions in a rural setting; 5) a community of interest, or people with a common stake, profession, interest, activity, or set of values, who may live far apart (e.g., anglers, environmentalists, off-road-vehicle operators).

This section uses the geographic/political community—towns and villages—as its basis for several reasons. There are relatively few communities in Southeast Alaska, they are typically isolated geographically, most are recognized as being unique, and data are more commonly available at this level (although some local economic data is compiled by the State for groups of communities). Geographic/political communities represent an aggregate of individuals and it is important to remember that residents within the same community may be affected differently by the same action. Potential effects that do not appear that significant when viewed at a community level may be very significant for the individuals that are directly affected.

Community Assessments

The 1997 Forest Plan EIS included discussions of 32 Southeast Alaska communities with a state land selection base. These discussions provided brief descriptions of each community, including aspects of their histories, population trends, economic bases, and the subsistence resources used by each community. Each community discussion also included a summary of the public comments and testimony received by the Forest Service on the 1990 Draft EIS, 1991 SDEIS, and the 1996 Revised Supplement. Much of the baseline community information provided in those discussions was taken from the Alaska Department of Community and Regional Affairs (Alaska DCRA) *Community Profiles* (1996) and 1990 U.S. Census data. Subsistence information was mainly based on the findings of the 1989 Tongass Resource Use Cooperative Survey (TRUCS). Updated summary data are presented by community in Table 3.23-8. These data suggest that these communities are diverse in terms of population, income, and subsistence use. There is also a good deal of variation within many of the communities, as reflected by the range of public comments received during preparation of the 1997 Forest Plan EIS and the 2003 SEIS (USDA Forest Service 1997a; 2003b).

This document provides brief updates of the affected environment sections of the community discussions, where applicable. The reader is referred to the 1997 Tongass Forest Plan EIS for more detailed information on community history, economic base, and subsistence resources. The 1987 TRUCS data used in the 1997 Forest Plan EIS discussions is still the most current consistent source of subsistence information available. Updated information from the ADF&G, Subsistence Community Profile Database is provided in the following discussions, where available.

Data from the 2000 Census has been incorporated in the community discussions, as appropriate. This includes estimates of the number of people who work in differrent industries. These estimates are generally extrapolated from a sample of each community's population with the sample size varying by community. In cases where the community is small, the extrapolation may not be exact but should in most cases provide a general indication of distribution of employment. Employment data are available by community group for 1990, 1995, and 1999 in the planning record for this EIS.

The effects of the alternatives considered in the 1997 Forest Plan EIS were evaluated in terms of community use area effects. Community use areas depict the approximate extent of each community's day-to-day use area. Potential community effects were also estimated with the help of a Socioeconomic Panel and Subsistence Workshop, which were convened to assess the potential effects of the planning alternatives for the 1997 Forest Plan EIS. The Socioeconomic Panel assessed these potential effects in terms of timber employment, tourism/recreation employment, mining employment, economic structure/diversity, community stability, quality of life, recreation opportunities, and access to traditional lifestyles. The Subsistence Workshop involved a group of subsistence specialists who met to offer professional judgement regarding the potential effects of planning alternatives on 30 selected subsistence communities (Juneau and Ketchikan do not meet the federal definition of subsistence community). In addition, the Sitka black-tailed deer habitat capability model output was analyzed for the Wildlife Analysis Areas (WAAs) where each community obtained approximately 75 percent of their average annual deer harvest. This analysis is discussed further in the 1997 Forest Plan EIS. An updated deer habitat capability model-based analysis is used here and is presented in the Wildlife section.

The analysis presented here draws upon these information sources to assess the effects of the seven alternatives under consideration by community. Each community discussion includes a map of that community's use area, as defined by the 1997 Forest Plan EIS. These maps are accompanied by tables that provide summary information on the LUDs and suitable acres in each community use area by alternative. The community use area maps and tables are intended to help community residents (and other readers) gain a better understanding of what management direction is proposed for their immediate surroundings under each alternative.

The summary tables for each alternative compare the acres allocated to types of LUD group by alternative. Variations in the amount of National Forest System land allocated to the different LUD groups under each alternative show what land use opportunities would be available during the next 10 to 15 years within each community use area. The variations in how many suitable acres are programmed for timber management under each alternative provide additional information indicating how much of the local forest environment (that is allocated to LUDs in the Moderate and Intensive Development LUD groups) could potentially be harvested over rotation-length time frames. The tables also present summary information on total suitable acres by alternative, which indicate how much of the community use area's forest land remains available for possible future harvesting. Whether any timber harvesting would actually take place on the suitable lands within the community use area over the next decade would depend on the timber sales that are actually carried out during plan implementation. All proposed timber sales would be evaluated on a project-specific basis in accordance with NEPA.

Table 3.23-8
Southeast Alaska Community Statistics

	Population			2000 Median Household Income	Percent of Households Below Poverty Line in 2000	Percent of Labor Force Unemployed in 2000	Subsistence Use (lbs per capita)[1]
	2006	Percent Change 2000 to 2006	Percent Native in 2000				
Angoon	482	-16	82	29,861	27	13	349
Coffman Cove	162	-19	3	43,750	7	10	276
Craig	1,105	-21	22	45,298	8	9	232
Edna Bay	41	-16	0	44,583	15	0	373
Elfin Cove	25	-22	0	33,750	0	23	263
Gustavus	441	3	44	34,766	10	14	241
Haines	1,492	-18	15	39,926	6	14	196
Hollis	156	12	5	43,750	6	3	169
Hoonah	829	-4	61	39,028	14	21	518
Hydaburg	352	-8	85	31,625	21	31	384
Hyder	92	-5	0	11,719	44	47	345
Juneau	30,650	0	11	62,034	4	5	NA
Kake	536	-25	67	39,643	13	25	179
Kasaan	59	51	38	43,500	0	20	452
Ketchikan	7,662	-3	18	45,802	5	8	NA
Klawock	776	-9	51	35,000	14	16	320
Metlakatla	1,377	-5	82	43,516	8	21	70
Meyers Chuck	11	-48	0	64,375	0	0	414
Naukati Bay	129	-4	10	NA	NA	NA	241
Pelican	106	-35	21	48,750	0	0	355
Petersburg	3,129	-3	7	49,028	3	3	198
Point Baker	16	-54	3	28,000	0	0	289
Port Alexander	64	-21	5	31,563	25	25	312
Port Protection	59	-6	0	10,938	44	44	451
Saxman	422	-2	66	44,375	7	7	94
Sitka	8,833	0	19	51,901	4	4	205
Skagway	854	-1	3	49,375	1	1	48
Tenakee Springs	109	5	3	33,125	9	9	330
Thorne Bay	482	-13	3	45,625	6	6	118
Whale Pass	61	5	2	62,083	0	0	185
Wrangell	1,911	-17	16	43,250	7	7	132
Yakutat	609	-10	47	47,054	12	12	385

Notes:
NA = not available
[1] The year these data were collected varies by community, as follows:
1987: Elfin Cove, Gustavus, Hyder, Metlakatla, Meyers Chuck, Pelican, Petersburg, Port Alexander, Saxman, Skagway, Tenakee Springs, and Wrangell;
1996: Angoon, Haines, Hoonah, Kake, Point Baker, Port Protection, Sitka, and Whitestone Logging Camp.
1997: Craig, Hydaburg, and Klawock
1998: Coffman Cove, Edna Bay, Hollis, Kasaan, Naukati Bay, Thorne Bay, and Whale Pass.
2000: Yakutat
Source: USDA Forest Service 2003b (Table 3.4-35); ADF&G 2006; Alaska DOL 2007a

Analyzing Impacts to Communities

Small, rural communities are seldom self-contained economic units. Although it is possible to describe a community's economic structure, complex social and economic forces, many of which are outside the control of community residents, have great influence on community economics. This makes it difficult to precisely predict the effects of forest-wide management alternatives on individual communities. Forest Service activities provide economic opportunities to the private sector. How that sector and the various industries that comprise it respond depends on many variables in addition to Forest Service management.

Forest plans are programmatic, meaning that they establish direction and allowable activities for broad land areas, rather than schedule specific activities on specific patches of land. This also makes it difficult to predict effects on individual communities. This is a common source of frustration to local residents, who want to know exactly how they and the places they care about could be affected. While many outputs of forest management, such as scheduled timber harvest, generally translate into social and economic activity, such as employment in the timber industry, it is difficult to predict which communities would benefit the most from that activity. Communities may even compete with each other in many instances. Communities that rely on a given resource-related industry would, however, be expected to be the first to benefit or lose from significant changes in planned output levels affecting that industry.

Another factor affecting the accuracy of predicting specific impacts at the community scale is that people and businesses have proven themselves highly adaptable. Researchers have used the term community resiliency (Harris 1996) or community capacity (FEMAT 1993) to describe a community's ability to weather significant changes. Some of the factors judged important for small, rural communities in the Pacific Northwest include community infrastructure, the presence of amenities, social cohesion and effective community leadership, and economic diversity. Some communities will be more effective than others in coping with changes that do result. While information such as population size can be used as a rough proxy for resiliency (generally, larger communities tend to be more resilient than smaller ones), this is not always the case. However, analyses have not been conducted regarding the resiliency of Southeast Alaska communities, and we do not know how well information gained elsewhere applies to understanding Southeast communities. It is also worth noting that while a community as a whole may be resilient to change, individuals within that community will still be negatively affected.

Given these considerations, it is more accurate to identify areas of concern for which the risks of effects from a given alternative are higher or lower, rather than say, "Here is what we know will happen to each and every community." One of the hazards associated with such attempts to assess impacts is that analyses tend to view social and economic conditions as static, failing to consider that economies are dynamic, and adjust to different impacts in different ways.

Potential Effects by Resource Area

The alternatives have implications for specific places on the Forest and particular parts of the community use areas of various communities. They also have potential implications in terms of employment in resource dependent industries and the availability of subsistence resources. The following paragraphs discuss the potential implications for wood products, recreation and tourism, and subsistence in general terms to provide some background to the reasoning employed in the community effects discussions presented in the following sections.

Wood Products

Based on the analysis presented in the preceding section, projected direct wood products employment would be higher than current (2005) levels (499 jobs) under all of the alternatives, except Alternative 1 (Table 3.22-20). These projections assume in all cases that the timber supply would be stable and that the entire NIC I component of the projected ASQ would be harvested under each alternative. These projected increases range from 1.8 times the 2005 harvest level under Alternative 2 to 3.9 times under Alternative 7.

As noted in the preceding section, while forest management activities can generally translate into social and economic activity, it is difficult to predict where this activity will actually occur. It is, however, reasonable to assume that increased harvest levels would likely benefit those communities that have historically been dependent on the wood products industry, including the communities where the existing mills are located. The more timber intensive alternatives, especially Allternatives 4 and 7, assume that an integrated industry would develop over time in response to stable supplies of timber. If this were to occur, much of the associated employment would be in the communities where new facilities would be located.

Recreation and Tourism

The mix of primitive and roaded recreation opportunities would vary by alternative based on the allocation of the Forest to different LUD groups and range from maintaining almost all the existing Inventoried Roadless Areas in a natural condition (Alternative 1) to intensive timber management (Alternatives 4 and 7). Viewed in terms of projected recreation and tourism employment over the next decade, there would be very little difference between the alternatives.

Subsistence

Among the subsistence resources of greatest importance (salmon, other finfish, marine invertebrates, and deer), deer is the only one that is potentially significantly affected by the alternatives. Therefore, the subsistence analysis presented here uses deer as a key indicator for potential subsistence resource consequences concerning the abundance and distribution of the resources. Timber harvest tends to affect deer-related subsistence activities in two ways. In the short run, approximately 20 to 30 years following harvest, deer populations tend to increase in harvested areas. In the long-run, populations tend to decline as the canopy in even-aged forest stands closes, resulting in lower habitat quality. Reductions in habitat quality can be reduced through management (e.g., thinning) of young-growth stands. Deer populations in unharvested areas are likely to remain at fairly constant levels that are typically lower than a comparable harvested area in the short run, but higher in the long run. Road construction also affects subsistence by providing subsistence hunters with ready access to areas that may have been previously inaccessible. This effect may be perceived as either positive or negative depending on the parties involved, as increased access may lead to increased competition for resources. Potential effects are likely to vary by community and may be perceived differently by members of the same or neighboring communities.

While there would be some new road access under all alternatives in the long run, nearly all new roads constructed under the alternatives would be closed following harvest. These roads would, therefore, not be available for use by highway vehicles or high-clearance vehicles. They would, however, be available for access by other methods and would, as a result, have the potential to affect existing subsistence patterns.

The subsistence analysis for deer presented for each community is based on several pieces of information. First, it analyzes recent harvest and harvest trends for the WAAs that comprise each community's community use area. For this analysis, hunters are divided into three groups: residents of the community in question, all rural hunters, and all hunters. Next, it considers the results of deer habitat capability modeling presented in the *Wildlife* section, which addresses current and future habitat capability under each alternative relative to the habitat capability available in 1954. Finally, it draws upon the findings of the 1997 Forest Plan EIS (USDA Forest Service 1997a) because four of the current alternatives are very similar to three alternatives in the 1997 EIS. Alternatives 5 and 6 in this analysis are similar to the selected alternative in the 1997 analysis (Alternative 11) and Alternatives 4 and 7 in this analysis are similar to Alternatives 6 and 2 in the 1997 analysis, respectively. For the 1997 EIS, projected harvest levels were compared with estimated deer habitat capability, which was converted into long-term deer carrying capacities, by alternative in the short term (2005) and long term (2095). This analysis assumed that a deer population at carrying capacity should be able to support a hunter harvest of approximately 10 percent that is both sustainable and provides a reasonably high level of hunter success for their effort. At 20 percent it was assumed that the hunter success for their effort may decrease, and, if the population is at carrying capacity, 20 percent may approach a rate that is not sustainable.

Individual Community Assessments

The following sections present socioeconomic descriptions and assessments of impact for 32 Southeast Alaska communities with a state land selection base. These are presented in alphabetical order.

Angoon

Angoon, located on the west coast of Admiralty Island at the mouth of Kootznoowoo Inlet, has been there so long that no precise date can be established for its original occupation. As the only permanent community on Admiralty Island, Angoon had a population of about 572 in 2000. It remains a traditional Tlingit Alaska Native village with 82 percent of its population identified as Alaska Native in the 2000 Census (U.S. Census Bureau, 2001).

The lands immediately adjacent to Angoon are part of Admiralty Island National Monument-Kootznoowoo Wilderness and would not be affected by any of the proposed alternatives. Other areas within Angoon's community use area would, however, be affected. Angoon's population increased 37 percent between the 1970 and 1990 census. Population was, however, approximately 13 percent below the 1990 level in 2000 and continued to decline in the first part of this decade, with an estimated total population of 497 in 2005. Total estimated population was 482 in Angoon in 2006 (Alaska DOL 2007a).

Year	1970	1980	1990	2000	2005	2006
Population	400	465	638	572	497	482

Source: USDA Forest Service 1997a; U.S. Census Bureau 2001; Alaska DOL 2007a

The Chatham School District and commercial fishing provide the majority of employment for Angoon. Approximately 10 percent of Angoon (72 residents) held commercial fishing permits (94 permits) in 2005. These permits were primarily used for hand-trolling for king and coho salmon. State and Federal grants recently funded a new shellfish farm in the area. Logging on Prince of Wales Island provides occasional jobs (Alaska DCED 2002).

Employment by industry data compiled by the Alaska DCED from the 2000 Census are summarized in the table below. Approximately 13 percent of the labor force in Angoon was identified as unemployed and seeking work in 2000, compared to 7 percent for Southeast Alaska as a whole. Median household income was $29,861, compared to a regional median of $44,118 (Alaska DCED 2002).

Employment by Industry	Number	Percent of Total
Agriculture, Forestry, Fishing & Hunting, Mining	10	5
Construction	14	7
Manufacturing	3	2
Wholesale Trade	0	0
Retail Trade	22	11
Transportation, Warehousing & Utilities	10	5
Information	0	0
Finance, Insurance, Real Estate, Rental & Leasing	10	5
Professional, Scientific, Management, Administrative & Waste Mgmt	2	1
Education, Health & Social Services	77	39
Arts, Entertainment, Recreation, Accommodation & Food Services	30	15
Other Services (Except Public Admin)	1	1
Public Administration	16	8
Total Employment	**195**	**100**

Source: Alaska DCED 2002

Please refer to the 1997 Forest Plan EIS for further details on the history, economy, and subsistence use of this community. Angoon is part of the Chatham Strait community group (see Table 3.23-6). Detailed employment data are available for this community group by economic sector for 1990, 1995, and 2000 in of the planning record for this EIS. The non-federal government, wood products, and service sectors were the major employers in the Chatham Strait community group in 1999, accounting for 49, 18, and 17 percent of total employment, respectively. The wood products employment was entirely in the logging sector.

Potential Effects

Community Use Area

The general area commonly used or related to by many of the residents of Angoon in their local day-to-day work, recreational, and subsistence activities is shown in Figure 3.23-2. This area contains 1,083,231 acres of National Forest System land (among other land ownerships). Table 3.23-9 shows how the lands within this community use area would be distributed among the LUD groups by alternative. The LUD groups are explained in the introduction to Chapter 3 of this document.

Development LUDs presently account for 32 percent of the total acreage within the Angoon community use area. Alternatives 5 and 6 would not have a significant effect on existing LUD allocations in the community use area because the acreage by LUD group would remain the same as under the existing Forest Plan. The acreage allocated to Wilderness/National Monument LUDs would remain constant under all alternatives. The amount of acreage allocated to Mostly Natural LUDs would increase under Alternatives 1 through 3. The largest increase would occur under Alternative 1, with the acreage allocated to Mostly Natural LUDs increasing from 27 percent under Alternative 5 (No Action) to 55 percent under Alternative 1, with a commensurate reduction in development LUDs (Table 3.23-9). Alternatives 4 and 7 would increase the acreage in development LUDs. Development LUDs would account for 40 percent and 42 percent under Alternatives 4 and 7, respectively, compared to 32 percent under Alternative 5.

Figure 3.23-2
Angoon's Community Use Area

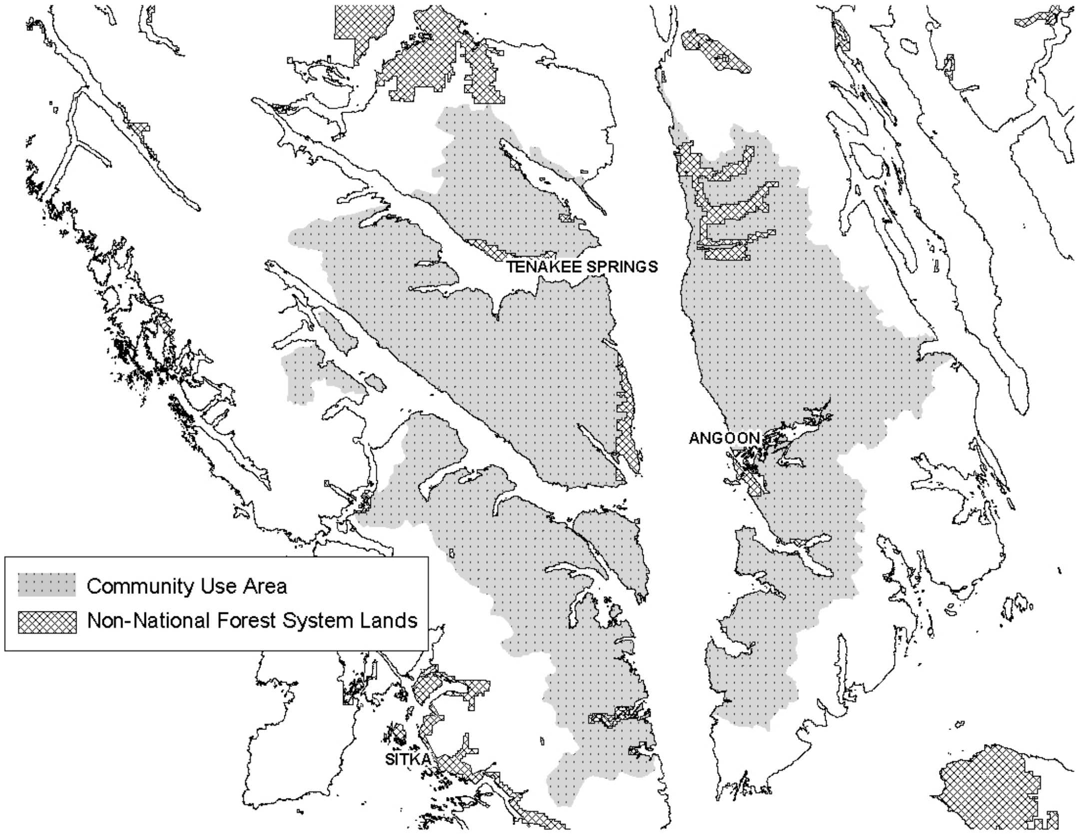


Table 3.23-9
LUD Groups in Angoon's Community Use Area by Alternative

	Alternative						
	1	**2**	**3**	**4**	**5**	**6**	**7**
	Suitable National Forest System Acres for Timber Management						
Suitable Acres	17,334	61,675	74,138	113,750	91,130	85,871	129,236
LUD Groups	**Acres of National Forest System Land per LUD Group**						
Wilderness/National Monument	440,588	440,588	440,588	440,588	440,588	440,588	440,588
Mostly Natural	599,119	447,753	381,812	207,876	296,339	319,769	192,331
Moderate Development	5,817	25,449	27,846	62,047	33,487	31,131	67,920
Intensive Development	37,707	169,440	232,985	372,720	312,817	291,743	382,392
Total	**1,083,231**	**1,083,231**	**1,083,231**	**1,083,231**	**1,083,231**	**1,083,231**	**1,083,231**

[1] See the accompanying large LUD map for the distribution of existing LUDs and the Alternative Maps for the distribution of LUDs by alternative.

Total suitable acres would range from 2 percent of the Angoon community use area under Alternative 1 to 12 percent under Alternative 7, compared to 8 percent under Alternative 5 (No Action) and Alternative 6 (Proposed Action).

Economy

Angoon is a traditional native community. Commercial fishing and subsistence use are the primary factors influencing Angoon. For subsistence use, Admiralty and Catherine Islands are especially important to Angoon. All of the National Forest System land within the Angoon community use area on Admiralty Island would be maintained in their current condition under all alternatives. Commercial fishing would not be affected under any of the alternatives.

Subsistence

No significant effect on salmon, other finfish, or invertebrate habitat capability is expected from implementation of any alternative. These resources account for 52 percent of the total edible pounds of subsistence resources harvested by Angoon households (Kruse and Frazier 1988). Marine resources (fish and marine invertebrates), primarily salmon, accounted for the majority (81 percent) of per capita subsistence harvest in Angoon in 1996 (ADF&G 2006).

The 1988 TRUCS study found that deer accounted for 30 percent of the total edible pounds of subsistence resources harvested by Angoon households (Kruse and Frazier 1988). Deer accounted for 15 percent of per capita subsistence harvest by Angoon residents in 1996 (ADF&G 2006).

The WAAs used by Angoon residents for hunting deer lie within Game Management Unit (GMU) 4. Deer harvest in GMU 4 is considered very high relative to other areas of Southeast Alaska, which is indicative of relatively high deer populations (ADF&G 2005). Over 1997-2004, there has been no significant trend in the number of deer harvested or in the number of hunters (ADF&G 2005). However, as shown above, from 1990 to 2005 Angoon's human population has been on a declining trend and is currently 22 percent below 1990 levels.

Angoon residents take the majority (59 percent) of their deer from three WAAs on Admiralty Island (4042, 4054, and 4055). As shown in Table 3.23-10, these three WAAs will not be affected by any of the alternatives. The next two WAAs in importance contribute 20 percent of Angoon's deer harvest and would each be affected under the alternatives, with the greatest effects occurring under Alternatives 4 and 7.

The Deer Availability and Anticipated Demand analysis completed for the 1997 Forest Plan EIS determined that all of the alternatives should be able to provide habitat capability for deer hunted by Angoon residents, all rural hunters, and all hunters within the WAAs where Angoon hunters derive most of their deer harvest. Because Alternative 7, the most timber-intensive alternative in this EIS, is similar to Alternative 2 in the 1997 Forest Plan EIS, all alternatives in this EIS should be able to provide habitat capability for deer hunted by Angoon residents, as well as for all deer hunted within the WAAs.

Table 3.23-10
Deer Harvest (1996 to 2002) and Deer Habitat Capability on NFS Lands in 2005 and After 100+ Years of Full Implementation under Each Alternative, Expressed as a Percent of 1954 Habitat Capability, for the WAAs where Angoon Residents Obtain Approximately 75% of their Average Annual Deer Harvest*

	Average Deer Harvest from 1996 to 2002			Deer Habitat Capability in 2005 and after 100+ Years of Full Implementation Under Each Alternative, Expressed as a Percent of the 1954 Habitat Capability							
WAA	Angoon Residents	All Rural Hunters	All Hunters	2005	Alt 1	Alt 2	Alt 3	Alt 4	Alt 5	Alt 6	Alt 7
4042	47	49	53	100	100	100	100	100	100	100	100
4055	34	36	50	96	96	96	96	96	96	96	96
4054	24	25	30	100	100	100	100	100	100	100	100
3315	20	85	107	83	82	75	75	71	74	74	69
3308	16	98	158	66	64	59	57	53	56	57	51

*Calculated based on harvest where location is known.

In summary, use of most subsistence resources (fish and marine invertebrates) by Angoon residents is not expected to be affected under any of the alternatives. In addition, subsistence use of deer by Angoon households is unlikely to be directly affected by any of the alternatives as the areas most heavily used by Angoon residents (on Admiralty Island) will be essentially unmodified under all alternatives. It is possible, however, that the more timber-intensive alternatives, especially Alternatives 4 and 7, would create increased competition for deer within Angoon's subsistence use areas if hunters from other communities are displaced due to timber harvest activity. These impacts are estimated to be minor based on the limited accessibility of these areas to non-local hunters. The three WAAs of highest importance to Angoon hunters, which occur on Admiralty Island, have very low road densities. Open and total road densities range from 0 to 0.1 mile per square mile (for all ownerships combined).and road densities in these WAAs are expected to increase insiginificantly in the future under any of the alternatives. Although the WAAs of importance to Angoon across Chatham Strait on Chichagof, Baranof, and Catherine Islands have considerably higher road densities, these roads are generally isolated and not connected to a community road system.

Coffman Cove

Coffman Cove is located on northeast Prince of Wales Island. Settlement of Coffman Cove began in 1956 with development of a logging camp. A road connecting Coffman Cove to the larger community of Craig was built in the 1980s. Two scheduled airlines serve the community from Ketchikan. The population of Coffman Cove shows little change between 1980 and 2000. According to the 2000 Census, Coffman Cove had a 2000 population of 199, with Alaska Natives comprising 3 percent of the total (U.S. Census Bureau 2001). The population decreased by 22 percent between 2000 and 2005, with an estimated population of 156 in 2005. Total estimated population was 162 in Coffman Cove in 2006 (Alaska DOL 2007a).

Year	1980	1990	2000	2005	2006
Population	193	186	199	156	162

Source: USDA Forest Service 1997a; U.S. Census Bureau 2001; Alaska DOL 2007a

The logging industry and the local school system provide the majority of employment for Coffman Cove. One of the major log transfer sites on Prince of Wales Island is located at Coffman Cove. Oyster farming and commercial fishing also occur in the area. The city is conducting a study of the feasibility of creating a commercial/ industrial complex (Alaska DCED 2006). Roundtrip service is currently (summer 2006) provided to Coffman Cove from Wrangell and Petersburg by the Inter-Island Ferry Authority.

Employment by industry data compiled by the Alaska DCED from the 2000 Census are summarized in the table below. Approximately 11 percent of the labor force in Coffman Cove was identified as unemployed and seeking work in 2000, compared to 7 percent for Southeast Alaska as a whole. Median household income was $43,750, compared to a regional median of $44,118 (Alaska DCED 2002).

Employment by Industry	Number	Percent of Total
Agriculture, Forestry, Fishing & Hunting, Mining	56	50
Construction	19	17
Manufacturing	0	0
Wholesale Trade	2	2
Retail Trade	4	4
Transportation, Warehousing & Utilities	0	0
Information	7	6
Finance, Insurance, Real Estate, Rental & Leasing	0	0
Professional, Scientific, Management, Administrative & Waste Mgmt	5	5
Education, Health & Social Services	7	6
Arts, Entertainment, Recreation, Accommodation & Food Services	0	0
Other Services (Except Public Admin)	3	3
Public Administration	8	7
Total Employment	**111**	**100**

Source: Alaska DCED 2002

Please refer to the 1997 Forest Plan EIS for further details on the history, economy, and subsistence use of this community.

Coffman Cove is located in the Thorne Bay Ranger District and is part of the North Prince of Wales community group (see Table 3.23-6). Detailed employment data are available for this community group by economic sector for 1990, 1995, and 2000 in the planning record for this EIS. Wood products employment in the North Prince of Wales community group declined by 186 jobs or 69 percent between 1990 and 1999. Wood products employment accounted for 83 jobs or 23 percent of total employment in this community group in 1999.

Potential Effects

Community Use Area

The general area commonly used or related to by many of the residents of Coffman Cove in their local day-to-day work, recreational, and subsistence activities is shown on Figure 3.23-3. This area contains 1,228,787 acres of National Forest System land (among other land ownerships). Table 3.23-11 shows how the lands within this community use area would be distributed among the LUD groups by alternative. The LUD groups are explained in the introduction to Chapter 3.

Development LUDs presently account for 50 percent of the total acreage within the Coffman Cove community use area. Alternatives 5 and 6 would not have a significant effect on existing LUD allocations in the community use area because the acreage by LUD group would remain the same as under the existing Forest Plan. The acreage allocated to Wilderness/National Monument LUDs would remain constant under all alternatives. The amount of acreage allocated to Mostly Natural LUDs would increase under Alternatives 1 through 3. The largest increase would occur under Alternative 1, with the acreage allocated to Mostly Natural LUDs increasing from 40

Figure 3.23-3
Coffman Cove's Community Use Area

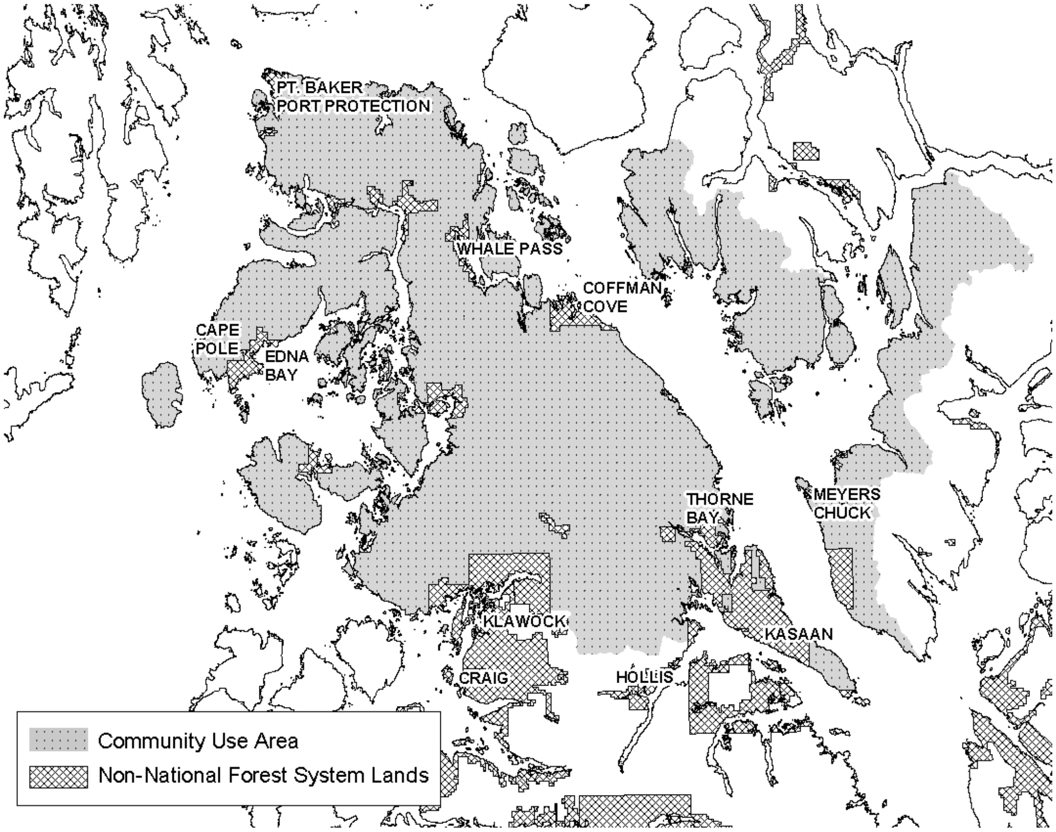


Table 3.23-11
LUD Groups in Coffman Cove's Community Use Area by Alternative

	Alternative						
	1	2	3	4	5	6	7
	Suitable National Forest System Acres for Timber Management						
Suitable Acres	171,404	198,276	213,748	258,716	231,727	224,744	342,754
LUD Groups	**Acres of National Forest System Land per LUD Group**						
Wilderness/National Monument	122,719	122,719	122,719	122,719	122,719	122,719	122,719
Mostly Natural	758,086	631,548	546,866	370,813	489,516	499,352	218,709
Moderate Development	98,294	144,517	184,157	247,719	208,000	204,089	340,708
Intensive Development	249,686	330,004	375,047	487,558	408,556	402,628	546,652
Total	**1,228,786**	**1,228,787**	**1,228,789**	**1,228,809**	**1,228,790**	**1,228,787**	**1,228,788**

[1] See the accompanying large LUD map for the distribution of existing LUDs and the Alternative Maps for the distribution of LUDs by alternative.

percent under Alternative 5 (No Action) to 62 percent under Alternative 1, with a commensurate reduction in development LUDs (Table 3.23-11). Alternatives 4 and would increase the acreage in development LUDs. Development LUDs would account for 60 percent and 72 percent under Alternatives 4 and 7, respectively, compared to 50 percent under Alternative 5.

Total suitable acres would range from 14 percent of the Coffman Cove community use area under Alternative 1 to 28 percent under Alternative 7, compared to 19 percent of the total community use area under Alternative 5 (No Action) and Alternative 6 (Proposed Action).

Economy

Coffman Cove is primarily a logging community and would, therefore, be directly affected by the amount of logging opportunities on northern Prince of Wales Island and elsewhere on the Tongass. Approximately 6.5 MMBF was under contract in the Thorne Bay Ranger District in August 2006. This volume would not be affected under any of the alternatives. These data provide an indication of potential impacts, actual impacts would depend on the volume that is under contract when the decision is implemented and whether potentially affected existing sales were cancelled as part of the decision.

Subsistence

No significant effect on salmon, other finfish, or invertebrate habitat capability is expected from implementation of any alternative. These resources account for 65 percent of the total edible pounds of subsistence resources harvested by Coffman Cove households (Kruse and Frazier 1988). Marine resources (fish and marine invertebrates) accounted for the majority (71 percent) of per capita subsistence harvest in the community in 1998 (ADF&G 2006).

The 1998 TRUCS study found that deer accounted for 32 percent of the total edible pounds of subsistence resources harvested by Coffman Cove households (Kruse and Frazier 1988). Deer accounted for 20 percent of per capita subsistence harvest by Coffman Cove residents in 1998 (ADF&G 2006).

Coffman Cove residents harvest deer almost entirely on Prince of Wales Island, which is included in GMU 2. Deer harvest and hunter effort in GMU 2 generally increased during 1997-2000 and subsequently declined during 2000-2004; however, no change has been noted in the average number of hunter-days required to harvest a deer (ADF&G 2005). As noted above, Coffman Cove's human population was relatively stable between 1980 and 2000, but has recently declined 22 percent below 2000 levels.

Residents of Coffman Cove harvest the majority (81 percent) of their deer from two WAAs in the eastern half of north-central Prince of Wales Island (1420 and 1421). As shown in Table 3.23-12, the Coffman Cove portion represents about one-third of the total harvest and about one-half of the rural hunter harvest in these WAAs. About 36 percent of the combined harvest in these WAAs is by non-rural hunters, suggesting that there is a harvest buffer that could be restricted, if necessary, before restrictions are placed on rural harvests.

WAAs 1420 and 1421 occur in an area with substantial past harvest and, therefore, deer habitat capabilities are currently estimated to be considerably below 1954 levels (Table 3.23-12). Under each of the alternatives, additional harvest would occur that would reduce habitat capabilities after 100+ years to 36 to 43 percent of 1954 levels in WAA 1420 and 55-66 percent in WAA 1421.

Table 3.23-12
Deer Harvest (1996 to 2002) and Deer Habitat Capability on NFS Lands in 2005 and After 100+ Years of Full Implementation under Each Alternative, Expressed as a Percent of 1954 Habitat Capability, for the WAAs where Coffman Cove Residents Obtain Approximately 75% of their Average Annual Deer Harvest*

	Average Deer Harvest from 1996 to 2002			Deer Habitat Capability in 2005 and after 100+ Years of Full Implementation Under Each Alternative, Expressed as a Percent of the 1954 Habitat Capability							
WAA	**Coffman Cove Residents**	**All Rural Hunters**	**All Hunters**	**2005**	**Alt 1**	**Alt 2**	**Alt 3**	**Alt 4**	**Alt 5**	**Alt 6**	**Alt 7**
1420	87	151	231	52	43	42	40	39	40	40	36
1421	22	47	76	74	66	64	64	64	63	63	55

*Calculated based on harvest where location is known.

The Deer Availability and Anticipated Demand analysis completed for the 1997 Forest Plan EIS determined that 1997 Alternatives 2, 6, and 11, which are similar to the four highest harvest alternatives in this EIS, should be able to provide sufficient habitat capability over the long term for deer hunted by Coffman Cove residents. However, it concluded that demand would exceed the capability of the habitat to produce deer populations sufficient to avoid effects on hunter success for all rural hunters in the long term and for all hunters in both the short and long terms.

In summary, use of most subsistence resources by Coffman Cove residents (fish and marine invertebrates) is not expected to be affected by any of the alternatives. However, subsistence use of deer may be affected to the point that some restriction in hunting might be necessary over the long term, even under Alternative 1. The risks of this occurring are greatest under Alternative 7 because of its general lack of Non-development LUDs within the Coffman Cove use area, and lower under the other six alternatives. The risk of hunting restrictions would be reduced somewhat, through more intensive management (e.g., thinning) of the existing and future closed-canopy, young-growth forests in this area. Indirect effects associated with increased competition for deer within Coffman Cove's subsistence use areas could also occur under all alternatives due to displacement of hunters from other communities due to timber harvest activity. Additional road development under the alternatives would improve access but may increase competition with other non-local hunters. The level of road development is already relatively high in these WAAs. Existing open road densities are 1.1 and 0.7 miles per square mile and existing total road densities are 1.8 and 1.3 miles per square mile in WAAs 1420 and 1421, respectively (for all ownerships combined). Long-term (100+ years) road development would vary by alternative and would result in estimated maximum total road densities ranging from 1.6 to 2.0 miles per square mile in these WAAs under Alternative 1, to 2.0 to 2.2 miles per square mile in these WAAs under Alternative 7 (for all ownerships combined).

Craig

Craig is situated on a small island connected to the west coast of Prince of Wales Island by a causeway. Craig is located approximately 56 air miles northwest of Ketchikan and 6 and 23 road miles from Klawock and Hydaburg, respectively. A floatplane dock and heliport are maintained in Craig, and the State ferry serves Hollis 30 miles away enabling transportation of passengers, cargo, and vehicles.

Tlingit fish camps and seasonal villages originally occupied the present location of Craig. It was named for its contemporary founder, Craig Miller, who in 1907, with the help of local Haidas, established a saltery at Fish Egg Island.

The Forest Service established a permanent ranger station here around 1919. The city of Craig was incorporated in 1922 as a second-class city under the laws of the territory of Alaska and became a first-class city in 1973. Shaan-Seet Inc. (the village corporation established under the Alaska Native Claims Settlement Act of 1971) received an interim conveyance of 20,852 acres in 1979 (ADF&G 1994).

The population of Craig more than tripled between 1970 and 1990. According to the 2000 Census, Craig had a 2000 population of 1,397, with Alaska Natives comprising 22 percent of the total (U.S. Census Bureau 2001). The total population was 10 percent higher in 2000 than in 1990. The population decreased by an estimated 301 residents or 22 percent from 2000 to 2005. Total estimated population was 1,105 in Craig in 2006 (Alaska DOL 2007a).

Year	**1970**	**1980**	**1990**	**2000**	**2005**	**2006**
Population	272	527	1,260	1,397	1,096	1,105

Source: USDA Forest Service 1997a; U.S. Census Bureau 2001; Alaska DOL 2007a

The Craig economy is primarily based on the fishing and timber industry with commercial fishing, fish processing, logging, sawmill operations, government and commercial services providing the majority of employment. Estimated gross fishing earnings of local residents exceeded $2.6 million in 2000. Columbia Ward Fisheries, a fish buying station, and a major cold storage plant are located in Craig and 200 residents hold commercial fishing permits. Shan-Seet Village Corporation timber operations is a major employer of local residents. Craig's increased role as a service and transportation center for the Prince of Wales Island communities has largely been responsible for its growth (Alaska DCED 2002). The Viking Lumber sawmill is located near Craig. According to the 2006 mill survey conducted for the USDA Forest Service, this mill, which has an installed production capacity of 80 MMBF, processed approximately 19 MMBF in 2006 and employed 42 people (Juneau Economic Development Council 2007).

W.R. Jones and Son Lumber Company is also located in Craig. This mill with an installed production capacity of 1 MMBF, processed approximately 600 MBF in 2006 and employed 4 people (Juneau Economic Development Council 2007).

Employment by industry data compiled by the Alaska DCED from the 2000 Census are summarized in the table below. Approximately 9 percent of the labor force in Craig was identified as unemployed and seeking work in 2000, compared to 7 percent for Southeast Alaska as a whole. Median household income was $45,298, compared to a regional median of $44,118 (Alaska DCED 2002).

Employment by Industry	**Number**	**Percent of Total**
Agriculture, Forestry, Fishing & Hunting, Mining	174	24
Construction	57	8
Manufacturing	34	5
Wholesale Trade	18	3
Retail Trade	90	13
Transportation, Warehousing & Utilities	41	6
Information	12	2
Finance, Insurance, Real Estate, Rental & Leasing	11	2
Professional, Scientific, Management, Administrative & Waste Mgmt	7	1
Education, Health & Social Services	127	18
Arts, Entertainment, Recreation, Accommodation & Food Services	65	9
Other Services (Except Public Admin)	46	6
Public Administration	37	5
Total Employment	**719**	**100**

Source: Alaska DCED 2002

Please refer to the 1997 Forest Plan EIS for further details on the history, economy, and subsistence use of this community.

Craig is part of the Central Prince of Wales community group (see Table 3.23-6). Detailed employment data are available for this community group by economic sector for 1990, 1995, and 2000 in the planning record for this EIS.

Potential Effects

Community Use Area

The general area commonly used or related to by many of the residents of Craig in their local day-to-day work, recreational, and subsistence activities is shown on Figure 3.23-4. This area contains 766,935 acres of National Forest System land (among other land ownerships). Table 3.23-13 shows how the land within this community use area would be distributed among the LUD groups by alternative. The LUD groups are explained in the introduction to Chapter 3.

Development LUDs presently account for 55 percent of the total acreage within the Craig community use area. Alternatives 5 and 6 would not have a significant effect on LUD allocations in the Craig community use area because the acreage in development LUD groups would remain virtually the same as under the current Forest Plan. The acreage allocated to Wilderness/National Monument LUDs would remain constant under all alternatives. The amount of acreage allocated to Mostly Natural LUDs would increase under Alternatives 1 through 3. The largest increase would occur under Alternative 1, with the acreage allocated to Mostly Natural LUDs increasing from 39 percent under Alternative 5 (No Action) to 63 percent under Alternative 1, with a commensurate reduction in development LUDs (Table 3.23-13). Alternatives 4 and 7 would increase the acreage in development LUDs. Development LUDs would account for 64 percent and 72 percent under Aternatives 4 and 7, respectively, compared to 55 percent under Alternative 5.

Total suitable acres would range from 15 percent under Alternative 1 to 28 percent under Alternative 7, compared to 20 percent of the total community use area under Alternative 5 (No Action).

Economy

Craig is primarily a commercial fishing, retail trade, and timber community. It is most likely to be affected by changes in timber employment, commercial fishing, and retail services. Viking Lumber, one of the larger remaining sawmills in the region, is located between Craig and Klawock.

Viking Lumber had 27 MMBF under contract in August 2006. Approximately 17 percent (4.6 MMBF) of this volume could be potentially affected under Alternative 1, which would maintain all Inventoried Roadless Areas on the Tongass in a natural condition and not permit timber harvest in these areas. None of the other alternatives would affect this volume. These data provide an indication of potential impacts, actual impacts would depend on the volume that is under contract when the decision is implemented and whether potentially affected existing sales were cancelled as part of the decision.

Several small timber operators produce value-added products in Craig. These value added products include music wood, cabinets, and other products. These operators process relatively low volumes of timber, but require specific species and grades to meet their needs. All alternatives should meet their needs.

Commercial fisheries employment is not likely to be affected any of the alternatives.

Figure 3.23-4
Craig's Community Use Area

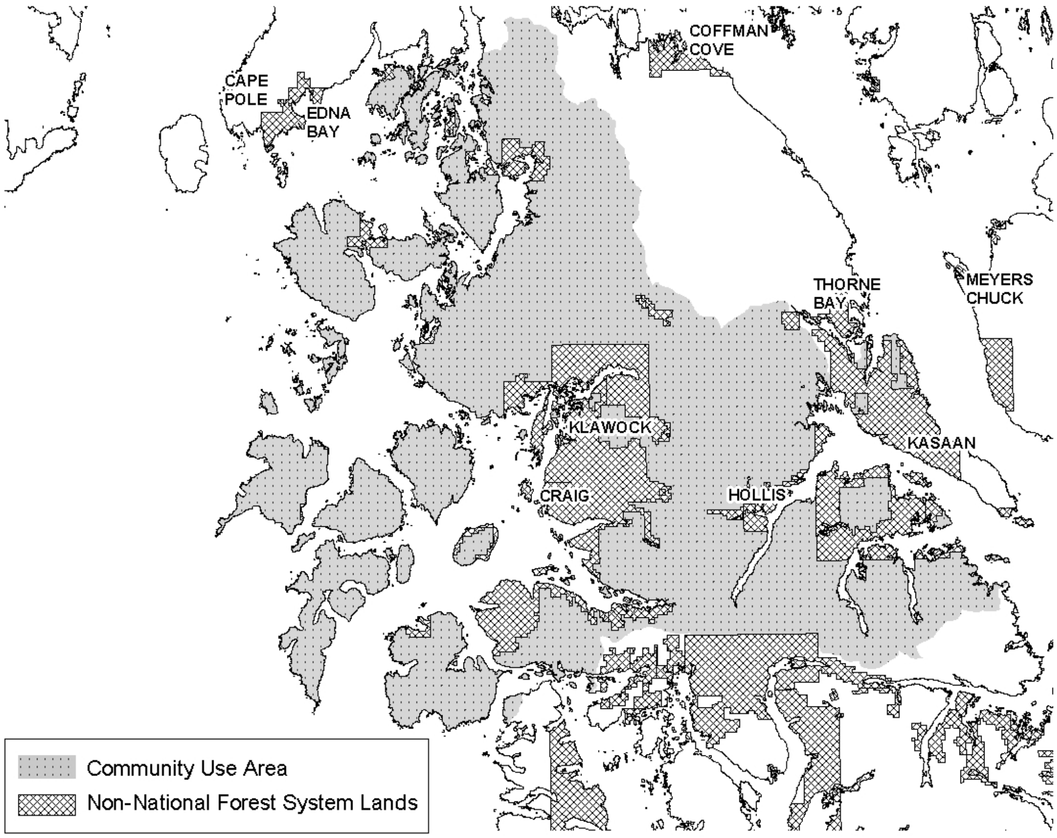


Table 3.23-13
LUD Groups in Craig's Community Use Area by Alternative

	Alternative						
	1	**2**	**3**	**4**	**5**	**6**	**7**
	Suitable National Forest System Acres for Timber Management						
Suitable Acres	113,371	132,673	147,957	170,424	153,413	149,162	212,194
LUD Groups	**Acres of National Forest System Land per LUD Group**						
Wilderness/National Monument	45,518	45,518	45,518	45,518	45,518	45,518	45,518
Mostly Natural	479,982	386,022	314,182	229,123	302,146	308,274	166,626
Moderate Development	42,759	59,597	71,035	86,288	76,686	74,907	100,174
Intensive Development	198,674	275,797	336,201	406,006	342,585	338,235	454,615
Total	**766,933**	**766,933**	**766,935**	**766,935**	**766,934**	**766,933**	**766,934**

[1] See the accompanying large LUD map for the distribution of existing LUDs and the Alternative Maps for the distribution of LUDs by alternative.

Subsistence

No significant effect on salmon, other finfish, or invertebrate habitat capability is expected from implementation of any alternative. These resources account for 70 percent of the total edible pounds of subsistence resources harvested by Craig households (Kruse and Frazier 1988). Marine resources (fish and marine invertebrates) accounted for 67 percent of per capita subsistence harvest in Craig in 1997 (ADF&G 2006).

The 1988 TRUCS study found that deer accounted for 22 percent of the total edible pounds of subsistence resources harvested by Craig households (Kruse and Frazier 1988). Deer accounted for 19 percent of per capita subsistence harvest by Craig residents in 1997 (ADF&G 2006).

Craig residents harvest deer almost entirely on Prince of Wales and adjacent islands, which are included in GMU 2. Deer harvest and hunter effort in GMU 2 generally increased during 1997-2000 and subsequently declined during 2000-2004; however, no change has been noted in the average number of hunter-days required to harvest a deer (ADF&G 2005). As noted above, the human population of Craig more than tripled between 1970 and 1990, continued to grow and peaked around 2000, and then declined by 21 percent as of 2005.

Deer harvest by Craig residents is spread over many WAAs, but the majority (55 percent) of their deer are harvested from five WAAs in central and northern Prince of Wales Island (top five WAAs in Table 3.23-14). The Craig portion of the harvest in these five WAAs represents about one-quarter of the total harvest and about 40 percent of the rural hunter harvest (Table 3.23-14). About 30 percent of the combined harvest in these WAAs is by non-rural hunters, indicating that there is a harvest buffer that could be restricted, if necessary, before restrictions are placed on rural harvests.

Table 3.23-14
Deer Harvest (1996 to 2002) and Deer Habitat Capability on NFS Lands in 2005 and After 100+ Years of Full Implementation under Each Alternative, Expressed as a Percent of 1954 Habitat Capability, for the WAAs where Craig Residents Obtain Approximately 75% of their Average Annual Deer Harvest*

	Average Deer Harvest from 1996 to 2002			Deer Habitat Capability in 2005 and after 100+ Years of Full Implementation Under Each Alternative, Expressed as a Percent of the 1954 Habitat Capability							
WAA	Craig Residents	All Rural Hunters	All Hunters	2005	Alt 1	Alt 2	Alt 3	Alt 4	Alt 5	Alt 6	Alt 7
1318	115	198	234	92	85	78	76	66	72	75	64
1422	66	209	300	60	50	48	47	46	47	47	43
1317	43	53	93	54	51	49	47	45	47	47	38
1319	37	177	220	74	69	67	66	59	64	64	54
1529	35	110	226	73	63	61	60	56	59	59	50
1214	34	49	91	79	70	66	65	62	64	64	53
1315	34	171	270	55	50	49	47	44	47	47	41
1332	25	31	37	85	83	82	78	75	77	78	70
1420	25	151	231	52	43	42	40	39	40	40	36

*Calculated based on harvest where location is known.

The majority of the WAAs used heavily by Craig residents are in areas with substantial past harvest and deer habitat capabilities are currently estimated to be considerably below 1954 levels (Table 3.23-14). Under each of the alternatives, additional harvest would further reduce habitat capabilities after 100+ years. Reductions would be smallest under Alternative 1 and highest under Alternative 7.

The Deer Availability and Anticipated Demand analysis completed for the 1997 Forest Plan EIS determined that 1997 Alternatives 2, 6, and 11, which are similar to the four highest harvest alternatives in this EIS, should be able to provide sufficient habitat capability over the long term for deer hunted by Craig residents. However, it concluded that demand would exceed the capability of the habitat to produce deer populations sufficient to avoid effects on hunter success for all rural hunters in the long term and for all hunters in both the short and long terms.

In summary, use of most subsistence resources by Craig residents (fish and marine invertebrates) is not expected to be affected by any of the alternatives. However, subsistence use of deer may be affected to the point that some restriction in hunting might be necessary over the long term, even under Alternative 1. The risks of this occurring are greatest under Alternative 7 because of its general lack of non-development LUDs throughout most of Prince of Wales Island, and second highest under Alternative 4 because of its lower use of non-development LUDs than the other alternatives. Alternatives 1, 2, and 3 would have the lowest risk and Alternatives 5 and 6 would be intermediate. The risk of hunting restrictions would be reduced somewhat, through more intensive management (e.g., thinning) of the existing and future closed-canopy, young-growth forests in this area. Indirect effects associated with increased competition for deer within Craig's subsistence use areas could also occur under all alternatives due to displacement of hunters from other communities due to timber harvest activity. Additional road development under the alternatives would improve access but may increase competition with other non-local hunters. The level of road development is already relatively high in these WAAs. Existing open road densities range from 0.6 to 1.9 miles per square mile and existing total road densities range from 1.2 to 1.9 miles per square mile in the five most important WAAs for Craig deer harvest (for all ownerships combined). Long-term (100+ years) road development would vary by alternative and would result in estimated maximum total road densities ranging from 1.3 to 2.8 miles per square mile in these WAAs under Alternative 1, to 1.6 to 3.0 miles per square mile in these WAAs under Alternative 7 (for all ownerships combined).

Edna Bay

Edna Bay is located on southeast Kosciusko Island, west of Prince of Wales Island, and north of Sea Otter Sound. Originally, Tlingit Indians from west Prince of Wales Island used Edna Bay on a seasonal basis. In 1943, a logging camp was established when the demand for aircraft-quality spruce was high. The camp closed in the late 1960s and the buildings were burned and the site cleaned. In 1977, the State selected part of the Tongass National Forest at Edna Bay, with the U.S. Forest Service reserving two administrative sites. In 1982, the State sold several lots around Edna Bay to private landowners. A small community developed as families, mainly those involved in commercial fishing, moved to Edna Bay. A school was constructed and a road connecting dispersed segments of the community was completed (ADF&G 1994).

Edna Bay remains an unincorporated city. The community has a local Fish and Game Advisory Committee and has shown a strong commitment to protecting local commercial fishing and subsistence resources (ADF&G 1994). Edna Bay is accessible by water or by float plane from Ketchikan. Most households own skiffs for transportation around the bay and to other near shore areas not accessible by road (ADF&G 1994).

Edna Bay's population fluctuated a great deal between 1970 and 1990. The population in 2000 was very similar to that identified in 1990. According to the 2000 Census, Edna Bay had a 2000 population of 49, with no Alaska Native population (U.S. Census Bureau 2001). The population declined by 16 percent—an estimated eight people—between 2000 and 2005, with an estimated population of 41 in 2005. Total estimated population was also 41 in Edna Bay in 2006 (Alaska DOL 2007a).

Year	1970	1980	1990	2000	2005	2006
Population	112	6	86	49	41	41

Source: USDA Forest Service 1997a; U.S. Census Bureau 2001; Alaska DOL 2007a

The majority of employment in Edna Bay is provided by a local sawmill, commercial fishing, and the local school district. Thirteen residents hold commercial fishing licences, primarily used for power trolling. During the summer, a fish buyer is also located in the bay (Alaska DCED 2002).

Employment by industry data compiled by the Alaska DCED from the 2000 Census are summarized in the table below. This data is an extrapolation based on information from a sample of residents. Because the sample size was small, the extrapolation may not be exact, but it should provide a general indication of distribution of employment. The potential work force was estimated to be 35 people and total employment estimated to be 18. While no adults in Edna Bay were identified as unemployed and seeking work in 2000, 49 percent of the population was identified as not employed and not seeking work. Median household income was $44,583, compared to a regional median of $44,118 (Alaska DCED 2002).

Employment by Industry	Number	Percent of Total
Agriculture, Forestry, Fishing & Hunting, Mining	4	22
Construction	0	0
Manufacturing	0	0
Wholesale Trade	0	0
Retail Trade	2	11
Transportation, Warehousing & Utilities	4	22
Information	0	0
Finance, Insurance, Real Estate, Rental & Leasing	0	0
Professional, Scientific, Management, Administrative & Waste Mgmt	0	0
Education, Health & Social Services	8	44
Arts, Entertainment, Recreation, Accommodation & Food Services	0	0
Other Services (Except Public Admin)	0	0
Public Administration	0	0
Total Employment	**18**	**100**

Source: Alaska DCED 2002

Please refer to the 1997 Forest Plan EIS for further details on the history, economy, and subsistence use of this community. Edna Bay is part of the North Prince of Wales community group (see Table 3.23-6). Detailed employment data are available for this community group for 1990, 1995, and 2000 in the planning record for this EIS. Wood products employment in the North Prince of Wales community group declined by 186 jobs or 69 percent between 1990 and 1999. Wood products employment accounted for 83 jobs or 23 percent of total employment in this community group in 1999.

Potential Effects

Community Use Area

The general area commonly used or related to by many of the residents of Edna Bay in their local day-to-day work, recreational, and subsistence activities is shown on Figure 3.23-5. This area contains 665,386 acres of National Forest System land (among other land ownerships).

Development LUDs presently account for 49 percent of the total acreage within the Edna Bay community use area. Table 3.23-15 shows how the lands within this community use area would be distributed among the LUD groups by alternative. The LUD groups are explained in the introduction to Chapter 3. Alternatives 5 and 6 would not have a significant effect on existing LUD allocations in the community use area because the acreage by LUD group would remain the same as under the existing Forest Plan. The acreage allocated to Wilderness/National Monument LUDs would remain constant under all alternatives. The amount of acreage allocated to Mostly

Natural LUDs would increase under Alternatives 1 through 3. The largest increase would occur under Alternative 1, with the acreage allocated to Mostly Natural LUDs increasing from 46 percent under Alternative 5 (No Action) to 67 percent under Alternative 1, with a commensurate reduction in development LUDs (Table 3.23-15). Alternatives 4 and 7 would increase the acreage in development LUDs. Development LUDs would account for 54 percent and 62 percent under Alternatives 4 and 7, respectively, compared to 49 percent under Alternative 5.

Total suitable acres would range from 16 percent under Alternative 1 to 25 percent under Alternative 7, compared to 19 percent of the total community use area under Alternative 5 (No Action).

Economy

Edna Bay is primarily a commercial fishing and subsistence community. Commercial fishing is not expected to be significantly affected under any of the alternatives.

Subsistence

No significant effect on salmon, other finfish, or invertebrate habitat capability is expected from implementation of any alternative. These resources accounted for 59 percent of the total edible pounds of subsistence resources harvested by Edna Bay households based on the 1998 TRUCS study (Kruse and Frazier 1988). Marine resources (fish and marine invertebrates) accounted for 69 percent of per capita subsistence harvest in Edna Bay in 1998 (ADF&G 2006).

The 1988 TRUCS study found that deer accounted for 21 percent of the total edible pounds of subsistence resources harvested by Edna Bay households (Kruse and Frazier 1988). Deer accounted for 23 percent of per capita subsistence harvest by Edna Bay residents in 1998 (ADF&G 2006).

Three WAAs have been identified as most important to Edna Bay residents for deer harvest: WAA 1525, covering Kosciusko Island; WAA 1003, covering Heceta Island; and WAA 3315, covering Catherine Island and adjacent parts of Baranof Island. Over 75 percent of Edna Bay's harvest is derived from the first two WAAs, which are included in GMU 2. Deer harvest and hunter effort in GMU 2 generally increased during 1997-2000 and subsequently declined during 2000-2004; however, no change has been noted in the average number of hunter-days required to harvest a deer (ADF&G 2005). As noted above, Edna Bay's human population has fluctuated considerably from 1970 to 1990 and has declined since then, with the 2005 population at less than half the 1990 level.

Residents of Edna Bay are responsible for the majority (62 percent) of the deer harvested on Kosciusko Island (WAA 1525), but only a small portion of the deer harvested on Heceta Island and in other WAAs. As shown in Table 3.23-16, the Edna Bay portion represents about 14 percent of the total harvest and about 29 percent of the rural hunter harvest in these WAAs. About 43 percent of the combined harvest in these WAAs is by non-rural hunters, suggesting that there is a harvest buffer that could be restricted, if necessary, before restrictions are placed on rural harvests.

Figure 3.23-5
Edna Bay's Community Use Area

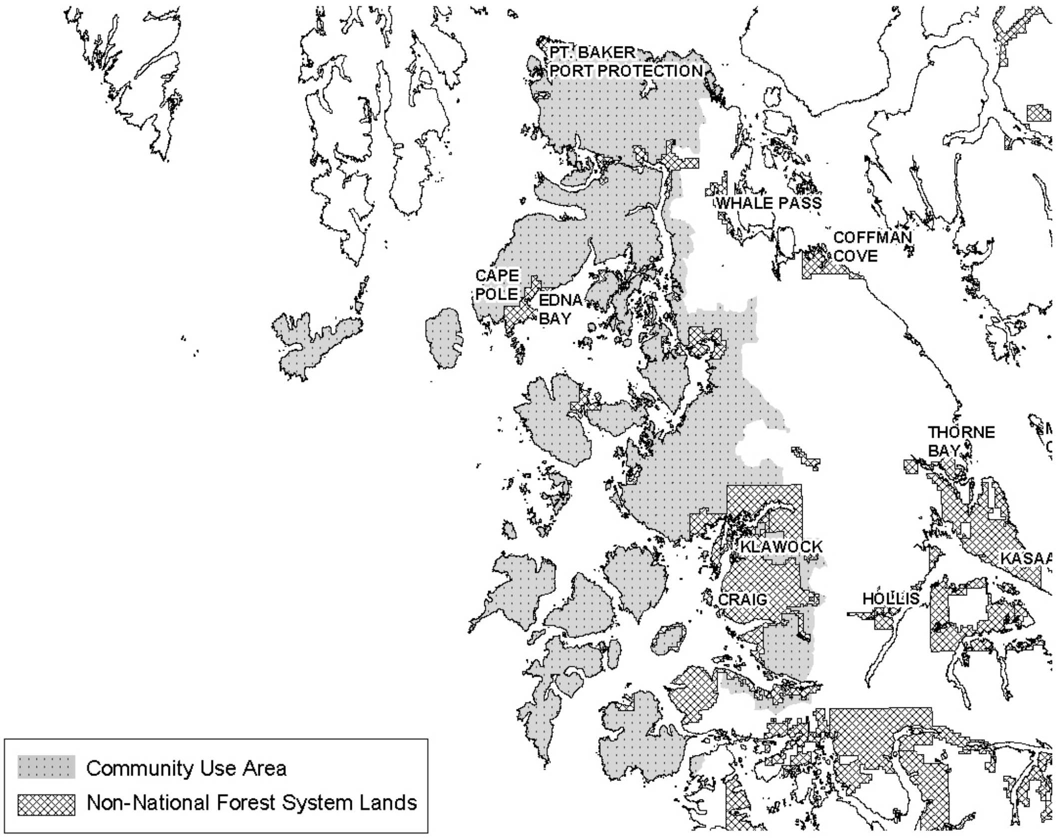


Table 3.23-15
LUD Groups in Edna Bay's Community Use Area by Alternative

	Alternative						
	1	**2**	**3**	**4**	**5**	**6**	**7**
	Suitable National Forest System Acres for Timber Management						
Suitable Acres	93,739	109,869	118,889	130,966	125,071	121,641	169,454
LUD Groups	**Acres of National Forest System Land per LUD Group**						
Wilderness/National Monument	36,103	36,103	36,103	36,103	36,103	36,103	36,103
Mostly Natural	442,587	364,760	325,637	269,822	305,207	309,110	218,426
Moderate Development	36,975	51,326	63,788	75,899	66,066	68,935	94,381
Intensive Development	149,720	213,197	239,859	283,563	258,011	251,238	316,476
Total	**665,385**	**665,386**	**665,387**	**665,388**	**665,387**	**665,386**	**665,386**

[1] See the accompanying large LUD map for the distribution of existing LUDs and the Alternative Maps for the distribution of LUDs by alternative.

Table 3.23-16
Deer Harvest (1996 to 2002) and Deer Habitat Capability on NFS Lands in 2005 and After 100+ Years of Full Implementation under Each Alternative, Expressed as a Percent of 1954 Habitat Capability, for the WAAs where Edna Bay Residents Obtain Approximately 75% of their Average Annual Deer Harvest*

	Average Deer Harvest from 1996 to 2002			Deer Habitat Capability in 2005 and after 100+ Years of Full Implementation Under Each Alternative, Expressed as a Percent of the 1954 Habitat Capability							
WAA	Edna Bay Residents	All Rural Hunters	All Hunters	2005	Alt 1	Alt 2	Alt 3	Alt 4	Alt 5	Alt 6	Alt 7
1525	8	11	13	51	48	47	46	46	46	46	43
1003	4	31	61	66	54	53	53	49	51	52	47

*Calculated based on harvest where location is known.

The two WAAs used heavily by Edna Bay residents are in areas with substantial past harvest and deer habitat capabilities are currently estimated to be considerably below 1954 levels (Table 3.23-16). Under each of the alternatives, additional harvest would further reduce habitat capabilities. Reductions would be smallest under Alternatives 1 and 2 and greatest under Alternative 7.

The Deer Availability and Anticipated Demand analysis completed for the 1997 Forest Plan EIS determined that all of the alternatives should be able to provide habitat capability for deer hunted by Edna Bay residents, all rural hunters, and all hunters, within the WAAs where Edna Bay hunters derive most of their deer harvest. Because Alternative 7, the most timber-intensive alternative in this EIS, is similar to Alternative 2 in the 1997 Forest Plan EIS, the 1997 analysis indicates that all alternatives in this EIS should be able to provide habitat capability for deer hunted by Edna Bay residents, as well as for all deer hunted within the WAA's.

In summary, use of most subsistence resources by Edna Bay residents (fish and marine resources) is not expected to be affected under any of the alternatives. In addition, subsistence use of deer by Edna Bay households is unlikely to be directly affected by any of the alternatives, as the area most heavily used by Edna Bay residents appears to have a low current rate of harvest by local hunters and all hunters combined and it is unlikely that demand will increase sufficiently in the future to result in a direct effect. Future young-growth management (e.g., thinning) would further reduce the potential for effects on local hunters. It is possible, however, that additional timber harvest throughout Prince of Wales and adjacent islands would create increased competition for deer within Edna Bay's subsistence use areas if hunters from other communities are displaced due to timber harvest activity. These impacts are estimated to be relatively minor based on the limited accessibility of these island areas to non-local hunters. The two WAAs of highest importance to Edna Bay hunters have relatively high existing road densities. Existing open road densities range from 1.1 to 1.5 miles per square mile and total road densities range from 2.0 to 2.3 miles per square mile (for all ownerships combined). However, these road systems are not connected to any community road systems outside of Edna Bay. Long-term (100+ years) road development would vary by alternative and would result in estimated maximum total road densities ranging from 2.4 to 2.5 miles per square mile in these WAAs under Alternative 1, to 2.7 to 2.8 miles per square mile in these WAAs under Alternative 7 (for all ownerships combined).

Elfin Cove

Elfin Cove is a small fishing town located on northwest Chichagof Island. Prior to its development as a community, Native Tlingit groups, now based largely in Hoonah, used the Elfin Cove area for hunting, fishing, and gathering, as well as a safe harbor. According to the 2000 Census, Elfin Cove had a 2000 population of 32, none of whom were Alaska Natives (U.S. Census Bureau 2001).

A fish buyer established a business here in 1927. The opening of a cold storage plant at Pelican, less than 20 miles from Elfin Cove in Lisianski Inlet, meant that fish no longer had to be hauled all the way to Juneau. Today, the cove still serves as a key stopover and supply center for fishermen and the year-round community is made up largely of fishing households. In the 1980s, a school was completed that also functions as a community center.

Elfin Cove is an unincorporated community. The community has a local Fish and Game Advisory Committee and is accessible by floatplane from Juneau. Elfin Cove's population, which fluctuated between 1970 and 1990, was 25 people or 44 percent lower than it was in 1990. The population remained fairly stable between 2000 and 2005, with an estimated decrease in total population of three people. Total estimated population was 25 in Elfin Cove in 2006 (Alaska DOL 2007a).

Year	1970	1980	1990	2000	2005	2006
Population	49	28	57	32	29	25

Source: USDA Forest Service 1997a; U.S. Census Bureau 2001; Alaska DOL 2007a

The economy of Elfin Cove is highly seasonal and primarily based on the fishing industry. It is a fish buying and supply center for fishermen and residents participate in commercial fishing, sport fishing and charter services. Eighty percent of the population (26 residents) holds commercial fishing permits. Seasonal employment is also provided by summer lodges and local retail businesses (Alaska DCED 2006).

A recent study of nature-based tourism in Southeast Alaska found that although Elfin Cove had been dependent on the commercial fishing industry for decades, the focus of the town's economy had shifted toward tourism and sportfishing (Dugan et al. 2006). This study also found that the community's population ranged from 12 in the winter to 200 in the summer, with much of the summer increase associated with employment in nine sport fishing lodges. The study estimated that 54 people, mostly non-residents, were employed by these lodges during the summer. Small cruise ships, mostly carrying 60 to 70 passengers, dock at Elfin Cove, with 30 dockings in 2005 (Dugan et al. 2006).

Employment by industry data compiled by the Alaska DCED from the 2000 Census are summarized in the table below. This data is an extrapolation based on information from a sample of residents. Because the sample size was small, the extrapolation may not be exact, but it should provide a general indication of distribution of employment. Approximately 23 percent of the labor force in Elfin Cove was identified as unemployed and seeking work in 2000, compared to 7 percent for Southeast Alaska as a whole. Median household income was $33,750, compared to a regional median of $44,118 (Alaska DCED 2002).

Please refer to the 1997 Forest Plan EIS for further details on the history, economy, and subsistence use of this community.

Elfin Cove is part of the North Chichagof community group (see Table 3.23-6). Detailed employment data are available for this community group by economic sector for 1990, 1995, and 2000 in the planning record for this EIS. Manufacturing and non-federal government were the major employers in the North Chichagof community group in 1999, accounting for 34 and 30 percent of total employment, respectively. Logging and seafood processing accounted for 24 and 10 percent of total employment, respectively.

Employment by Industry	Number	Percent of Total
Agriculture, Forestry, Fishing & Hunting, Mining	3	30
Construction	0	0
Manufacturing	0	0
Wholesale Trade	0	0
Retail Trade	0	0
Transportation, Warehousing & Utilities	5	50
Information	0	0
Finance, Insurance, Real Estate, Rental & Leasing	0	0
Professional, Scientific, Management, Administrative & Waste Mgmt	0	0
Education, Health & Social Services	0	0
Arts, Entertainment, Recreation, Accommodation & Food Services	2	20
Other Services (Except Public Admin)	0	0
Public Administration	0	0
Total Employment	**10**	**100**

Source: Alaska DCED 2002

Potential Effects

Community Use Area

The general area commonly used or related to by many of the residents of Elfin Cove in their local day-to-day work, recreational, and subsistence activities is shown on Figure 3.23-6. This area contains 357,385 acres of National Forest System land (among other land ownerships). Table 3.23-17 shows how the land within this community use area would be distributed among the LUD groups by alternative. The LUD groups are explained in the introduction to Chapter 3.

The proposed alternatives would not have a significant effect on existing LUD allocations in the Elfin Cove community use area because the acreage in development LUDs would remain essentially the same as under the existing Forest Plan under all of the alternatives, with a very slight increase in development LUDs and suitable acres under Alternatives 4 and 7.

Economy

Commercial fishing, recreation and tourism, and subsistence use are important to Elfin Cove. The acreage in the Elfin Cove community use area is either Wilderness or Mostly Natural LUD allocations. Local timber production is not a significant part of the local economy. Commercial fishing is not expected to be significantly affected under any of the alternatives. Tourism, especially sportfishing, has recently become more important to Elfin Cove. A number of lodges operate out of the community. Recreation and tourism based on sportfishing is expected to increase by the same amount under all of the alternatives.

Icy Strait, northwest Chichagof Island, and Yakobi Island are the most important areas in terms of subsistence use to Elfin Cove. Portions of these areas are legislatively withdrawn from timber harvest as either Wilderness or LUD II and would be maintained in their current condition under all alternatives. The remaining area is allocated to Mostly Natural LUDs and would continue to be either mostly natural or further restricted by re-allocation as Recommended Wilderness or LUD II.

Figure 3.23-6
Elfin Cove's Community Use Area

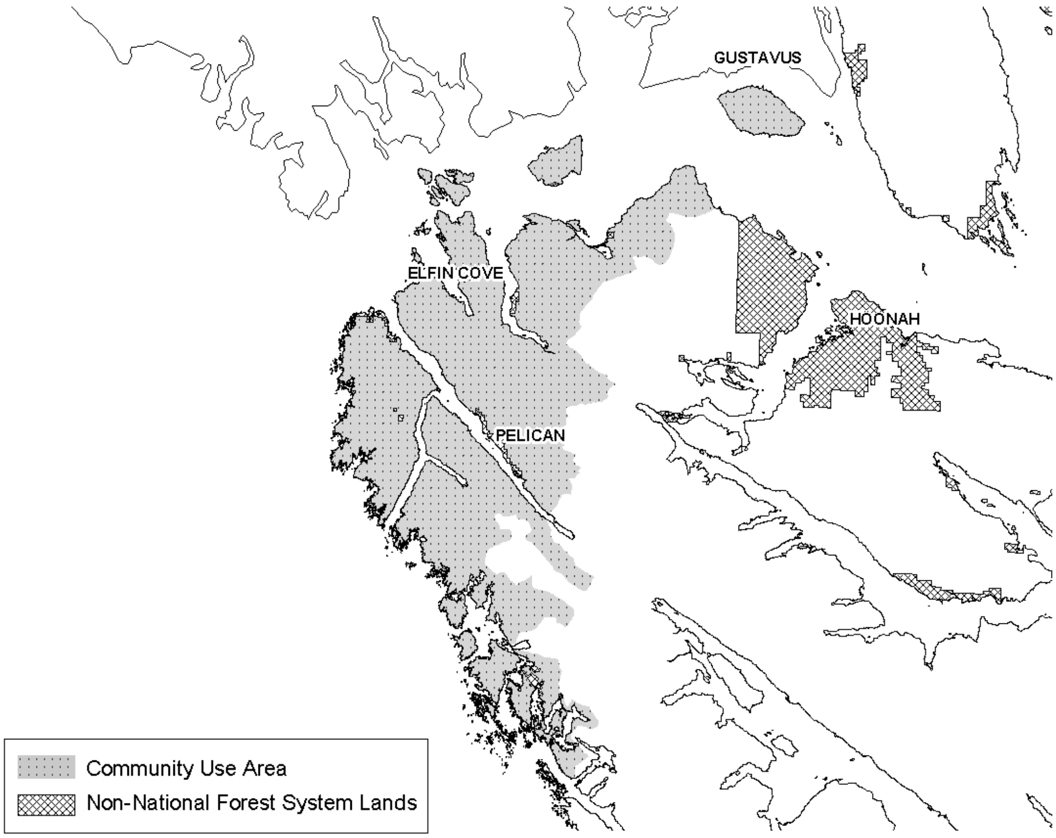


Table 3.23-17
LUD Groups in Elfin Cove's Community Use Area by Alternative

	Alternative						
	1	**2**	**3**	**4**	**5**	**6**	**7**
	Suitable National Forest System Acres for Timber Management						
Suitable Acres	0	0	0	1,928	0	0	1,943
LUD Groups	**Acres of National Forest System Land per LUD Group**						
Wilderness/National Monument	161,929	161,929	161,929	161,929	161,929	161,929	161,929
Mostly Natural	195,456	195,455	195,451	190,078	195,438	195,451	190,078
Moderate Development	0	0	0	363	0	0	363
Intensive Development	0	1	5	5,015	18	5	5,015
Total	**357,385**	**357,385**	**357,385**	**357,385**	**357,385**	**357,385**	**357,385**

[1] See the accompanying large LUD map for the distribution of existing LUDs and the Alternative Maps for the distribution of LUDs by alternative.

Subsistence

No significant effect on salmon, other finfish, or invertebrate habitat capability is expected from implementation of any alternative. These resources accounted for 63 percent of the total edible pounds of subsistence resources harvested by Elfin Cove households based on the 1988 TRUCS study (Kruse and Frazier 1988). Marine resources (fish and marine invertebrates) accounted for 62 percent of per capita subsistence harvest in Elfin Cove in 1987 (ADF&G 2006).

The 1988 TRUCS study found that deer accounted for 27 percent of the total edible pounds of subsistence resources harvested by Elfin Cove households (Kruse and Frazier 1988). Deer accounted for 28 percent of per capita subsistence harvest by Elfin Cove residents in 1987 (ADF&G 2006).

The WAAs used by Elfin Cove residents for hunting deer lie within Game Management Unit (GMU) 4. Deer harvest in GMU 4 is considered very high relative to other areas of Southeast Alaska, which is indicative of relatively high deer populations (ADF&G 2005). Over 1997-2004, there has been no significant trend in the number of deer harvested or in the number of hunters (ADF&G 2005). However, as shown above, although from 1970 to 2005 the number of residents in Elfin Cove has fluctuated, the number in 2005 is 51 percent of the peak in 1990.

Elfin Cove residents take the majority (74 percent) of their deer from two WAAs on northwestern Chichagof Island (3417 and 3421). As shown in Table 3.23-18, these WAAs would not be affected by any of the alternatives because they are in wilderness, LUD II areas, or are in other Non-development LUDs. The next two WAAs in importance are also in the same area and also would not be affected by any of the alternatives because of their LUDs.

Table 3.23-18
Deer Harvest (1996 to 2002) and Deer Habitat Capability on NFS Lands in 2005 and After 100+ Years of Full Implementation under Each Alternative, Expressed as a Percent of 1954 Habitat Capability, for the WAAs where Elfin Cove Residents Obtain Approximately 75% of their Average Annual Deer Harvest*

	Average Deer Harvest from 1996 to 2002			Deer Habitat Capability in 2005 and after 100+ Years of Full Implementation Under Each Alternative, Expressed as a Percent of the 1954 Habitat Capability							
WAA	Elfin Cove Residents	All Rural Hunters	All Hunters	2005	Alt 1	Alt 2	Alt 3	Alt 4	Alt 5	Alt 6	Alt 7
3421	14	29	36	100	100	100	100	100	100	100	100
3417	7	100	159	100	100	100	100	100	100	100	100

*Calculated based on harvest where location is known.

The Deer Availability and Anticipated Demand analysis completed for the 1997 Forest Plan EIS determined that all of the alternatives should be able to provide habitat capability for deer hunted by Elfin Cove residents, all rural hunters, and all hunters within the WAAs where Elfin Cove hunters derive most of their deer harvest in the short term. In the long term, sufficient habitat would be provided for Elfin Cove residents and all rural hunters, but not for all hunters. However, the predicted deficit for all hunters in the long term would be a natural condition and not due to timber harvest.

In summary, use of most subsistence resources (fish and marine invertebrates) by Elfin Cove residents is not expected to be affected under any of the alternatives. In addition, subsistence use of deer by Elfin Cove households would not be directly affected by any of the alternatives as the areas most heavily used by Elfin Cove residents are in Non-development LUDs. It is also unlikely that Elfin Cove residents would be affected by increased competition or access because of the limited access and the lack of activities under the alternatives in this area.

Gustavus

Gustavus is located in northern Southeast Alaska on the north shore of Icy Straits, east of the entrance to Glacier Bay. Prior to the founding of the present community, Huna Tlingit used the land and resources in the immediate vicinity of the community site. Use of a salmon camp near the mouth of the Salmon River was noted by early Gustavus settlers; however, after a short period of settlement by the new community, the Huna Tlingit generally discontinued use of the camp (ADF&G 1994). According to the 2000 Census, Gustavus had a 2000 population of 429, with Alaska Natives comprising 44 percent of the total (U.S. Census Bureau 2001).

Gustavus was settled and named “Strawberry Point” in 1914 by a small group of immigrants from the lower 48 planning to develop the land as agricultural homesteads. World War II brought development to Gustavus in the form of an airstrip and Federal Aviation Administration communications facilities. Nearby Glacier Bay National Monument was established in 1925 (ADF&G 1994).

The population of Gustavus, which increased considerably between 1970 and 1990, increased by 66 percent between 1990 and 2000 and continued to increase in the first part of this decade, although at a much slower rate with an estimated total population of 459 in 2005. Total estimated population was 441 in Gustavus in 2006 (Alaska DOL 2007a).

Year	1970	1980	1990	2000	2005	2006
Population	64	98	258	429	459	441

Source: USDA Forest Service 1997a, U.S. Census Bureau 2001; Alaska DOL 2007a

The economy of Gustavus is seasonal, at least partly due to its proximity to Glacier Bay National Park. The park and its lodge attract tourists and recreation enthusiasts during the summer months and there is also a commercial fishing industry. The lodge, airport, school, small businesses, and the Park Service are primary employers of local residents (Alaska DCED 2002).

Employment by industry data compiled by the Alaska DCED from the 2000 Census are summarized in the table below. Approximately 14 percent of the labor force in Gustavus was identified as unemployed and seeking work in 2000, compared to 7 percent for Southeast Alaska as a whole. Median household income was $34,766, compared to a regional median of $44,118 (Alaska DCED 2002).

Employment by Industry	Number	Percent of Total
Agriculture, Forestry, Fishing & Hunting, Mining	7	4
Construction	23	12
Manufacturing	7	4
Wholesale Trade	0	0
Retail Trade	7	4
Transportation, Warehousing & Utilities	19	10
Information	2	1
Finance, Insurance, Real Estate, Rental & Leasing	2	1
Professional, Scientific, Management, Administrative & Waste Mgmt	10	5
Education, Health & Social Services	26	14
Arts, Entertainment, Recreation, Accommodation & Food Services	60	32
Other Services (Except Public Admin)	10	5
Public Administration	17	9
Total Employment	**190**	**100**

Source: Alaska DCED 2002

Please refer to the 1997 Forest Plan EIS for further details on the history, economy, and subsistence use of this community.

Gustavus is part of the Gustavus community group (see Table 3.23-6). Detailed employment data are available for this community group by economic sector for 1990, 1995, and 2000 in the planning record for this EIS.

The services and Federal government sectors were the largest employers in the Gustavus community group in 1999, accounting for 40 and 36 percent of total employment, respectively. There is no wood products employment in this community. Recreation and tourism-related activities (lodging, restaurants, and recreation services) accounted for 40 percent of total employment in 1999.

Potential Effects

Community Use Area

The general area commonly used or related to by many of the residents of Gustavus in their local day-to-day work, recreational, and subsistence activities is shown on Figure 3.23-7. This area contains 480,541 acres of National Forest System land (among other land ownerships). Table 3.23-19 shows how the land within this community use area would be distributed among the LUD groups by alternative. The LUD groups are explained in the introduction to Chapter 3.

Development LUDs presently account for 35 percent of the total acreage within the Gustavus community use area. Alternatives 5 and 6 would not have a significant effect on existing LUD allocations in the community use area because the acreage by LUD group would remain the same as under the existing Forest Plan. The acreage allocated to Wilderness/National Monument LUDs would remain constant under all alternatives. The amount of acreage allocated to Mostly Natural LUDs would increase under Alternatives 1 through 3. The largest increase would occur under Alternative 1, with the acreage allocated to Mostly Natural LUDs increasing from 59 percent under Alternative 5 (No Action) to 89 percent under Alternative 1, with a commensurate reduction in development LUDs (Table 3.23-19). Alternatives 4 and 7 would increase the acreage in development LUDs. Development LUDs would account for 46 percent and 56 percent under Alternatives 4 and 7, respectively, compared to 35 percent under Alternative 5.

Total suitable acres would range from 2 percent under Alternative 1 to 16 percent under Alternative 7, compared to 7 percent of the total community use area under Alternative 5 (No Action) and Alternative 6 (Proposed Action).

Economy

Gustavus is a small community located near Glacier Bay National Park. Recreation and tourism are important to Gustavus, especially in relation to use of the National Park. Commercial fishing and subsistence use are also important to the community.

Commercial fishing is not expected to be significantly affected by Forest Service activities under any of the alternatives.

Figure 3.23-7
Gustavus' Community Use Area

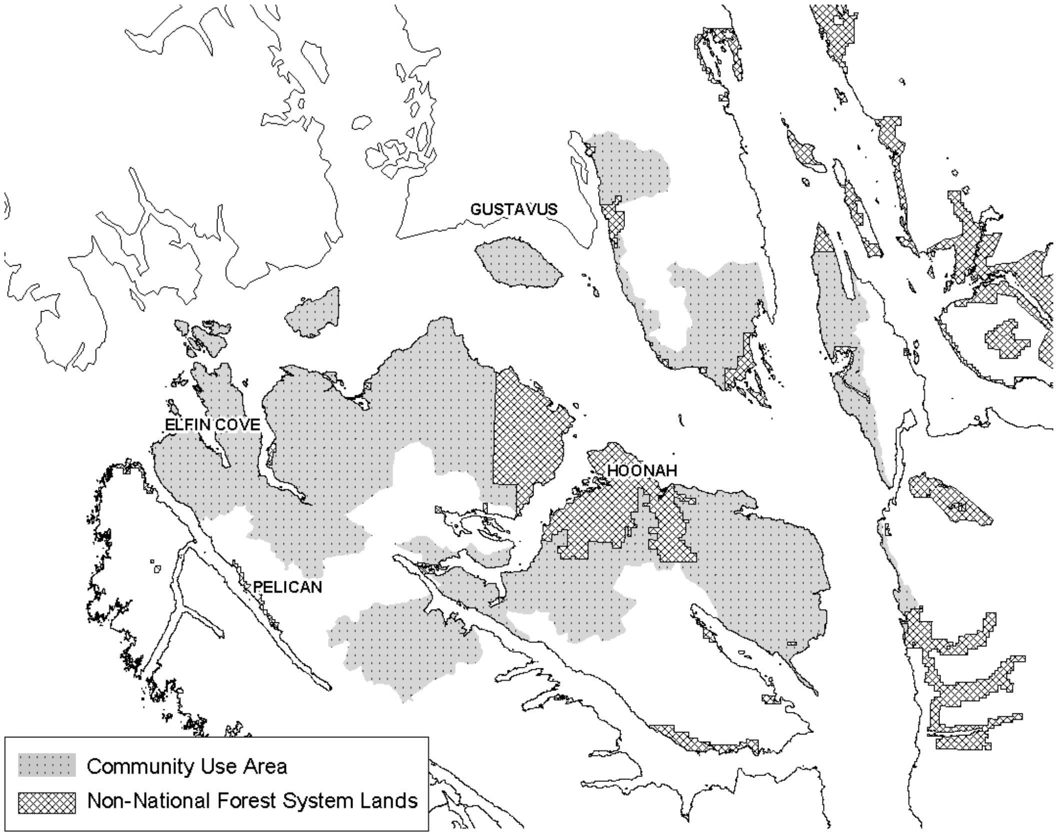


Table 3.23-19
LUD Groups in Gustavus' Community Use Area by Alternative

	Alternative						
	1	**2**	**3**	**4**	**5**	**6**	**7**
	Suitable National Forest System Acres for Timber Management						
Suitable Acres	9,588	31,446	32,587	57,039	35,168	34,056	74,892
LUD Groups	**Acres of National Forest System Land per LUD Group**						
Wilderness/National Monument	26,740	26,740	26,740	26,740	26,740	26,740	26,740
Mostly Natural	429,439	343,865	327,090	232,949	283,366	309,137	182,377
Moderate Development	447	11,468	11,467	31,122	13,169	12,479	40,146
Intensive Development	23,915	98,468	115,244	189,726	157,266	132,184	231,278
Total	**480,541**	**480,541**	**480,541**	**480,537**	**480,541**	**480,541**	**480,541**

[1] See the accompanying large LUD map for the distribution of existing LUDs and the Alternative Maps for the distribution of LUDs by alternative.

Subsistence

No significant effect on salmon, other finfish, or invertebrate habitat capability is expected from implementation of any alternative. Marine resources (fish and marine invertebrates) accounted for 69 percent of per capita subsistence harvest in Gustavus in 1987.

The 1988 TRUCS study found that deer accounted for 70 percent of the total edible pounds of subsistence resources harvested by Gustavus households (Kruse and Frazier 1988). Deer accounted for 27 percent of per capita subsistence harvest by Gustavus residents in 1987 (ADF&G 2006).

The primary WAAs used by Gustavus residents for hunting deer lie within Game Management Unit (GMU) 4. Deer harvest in GMU 4 is considered very high relative to other areas of Southeast Alaska, which is indicative of relatively high deer populations (ADF&G 2005). Over 1997-2004, there has been no significant trend in the number of deer harvested or in the number of hunters (ADF&G 2005). However, as shown above, the number of residents in Gustavus has increased steadily from 1970 to 2005, and the 2005 population is seven times the size it was in 1970.

Gustavus residents take the majority (80 percent) of their deer from two WAAs on northern Chichagof Island and Pleasant, Lemesurier, and Inian Islands (4256 and 4222). As shown in Table 3.23-20, WAA 4256, which provides over half of Gustavus' harvest, would not be affected by any of the alternatives because it is in wilderness. WAA 4222 would be affected by timber harvest, especially by Alternatives 4 and 7.

Table 3.23-20
Deer Harvest (1996 to 2002) and Deer Habitat Capability on NFS Lands in 2005 and After 100+ Years of Full Implementation under Each Alternative, Expressed as a Percent of 1954 Habitat Capability, for the WAAs where Gustavus Residents Obtain Approximately 75% of their Average Annual Deer Harvest*

	Average Deer Harvest from 1996 to 2002			Deer Habitat Capability in 2005 and after 100+ Years of Full Implementation Under Each Alternative, Expressed as a Percent of the 1954 Habitat Capability							
WAA	**Gustavus Residents**	**All Rural Hunters**	**All Hunters**	**2005**	**Alt 1**	**Alt 2**	**Alt 3**	**Alt 4**	**Alt 5**	**Alt 6**	**Alt 7**
4256	26	30	45	100	100	100	100	100	100	100	100
4222	12	45	64	97	96	95	94	86	94	94	86

*Calculated based on harvest where location is known.

The Deer Availability and Anticipated Demand analysis completed for the 1997 Forest Plan EIS determined that all of the alternatives should be able to provide habitat capability for deer hunted by Gustavus residents, all rural hunters, and all hunters within the WAAs where Gustavus hunters derive most of their deer harvest in the short term. In the long term, sufficient habitat would be provided for Gustavus residents and all rural hunters, but not for all hunters. The predicted deficit for all hunters in the long term would be a natural condition, but would occur earlier with timber harvest in the area.

In summary, use of most subsistence resources (fish and marine invertebrates) by Gustavus residents is not expected to be affected under any of the alternatives. In addition, subsistence use of deer by Gustavus households may be slightly affected to the point that some restriction in hunting by non-rural hunters might be necessary over the long term. It is also unlikely that Gustavus residents would be affected by increased competition or access because of the limited access and the lack of activities under the alternatives in this area.

Haines

Haines is located in the northern portion of Southeast Alaska, near the north end of Lynn Canal on the Chilkat Peninsula. Haines is one of three Southeast communities connected by road to Canada. According to the 2000 Census, Haines had a 2000 population of 2,292, with Alaska Natives comprising 11 percent of the total (U.S. Census Bureau 2001). Haines Borough includes the city of Haines, which had a 2000 population of 1,811, and several surrounding communities. These communities include Lutak, just north of Haines, which had a population of 39 in 2000 and Mosquito Lake, historically Chilkat Tlingit territory, which was home to 221 residents in 2000, 5 percent identified as Alaska Natives. Covenant Life, a religious community, had 102 residents in 2000.

The Haines area was originally settled by the Chilkat Tlingits. The Chilkat Tlingits are now considered as two groups: the Chilkats of the Chilkat River, with Klukwan being the major population center, and the Chilkoots living in and near Haines. Haines itself was a trade center and mission site (ADF&G 1994). Klukwan, a Chilkat Indian Village near the Chilkat River and 22 miles north of Haines, had a population of 139 in 2000. The village is known for its woven artwork of cedar bark and mountain goat hair. The area is host to the largest concentration of bald eagles in the world during the fall and winter at the nearby Chilkat Bald Eagle Reserve.

Settlement did not concentrate in Haines until the late 1800s. The commercial fishing industry located several canneries in the Chilkat Inlet area near Haines beginning in 1882; the Klondike gold rush brought thousands of prospectors to the town in the late 1890s; and the Dalton Trail was established as an open access route into the interior in the 1890s. Haines incorporated as a city in 1910 and as a third class borough in 1968 (ADF&G 1994).

Haines is a major trans-shipment point because of its ice-free, deep-water port and dock, and year-round road access to Canada and Interior Alaska on the Alaska Highway. It is a northern terminus of the Alaska Marine Highway System and a hub for transportation to and from Southeast Alaska (Alaska DCED 2006).

The population of Haines has increased steadily since 1970. In the last decade, between 1990 and 2000, it increased 46 percent (U.S. Census Bureau 2001). The estimated total population decreased by about 16 percent between 2000 and 2005. Total estimated population was 1,492 in Haines in 2006 (Alaska DOL 2007a).

Year	1970	1980	1990	2000	2005	2006
Population	463	993	1,238	1,811	1,525	1,492

Source: USDA Forest Service 1997a; U.S. Census Bureau 2001; Alaska DOL 2007a

The economy of Haines is highly seasonal. Commercial fishing, tourism, government, and transportation are the primary employers. Estimated gross fishing earnings of local residents neared $3 million in 2000 and 128 residents hold commercial fishing permits. Haines' road connection to the State Ferry has become increasingly important to the tourism businesses. In 2001, Royal Caribbean Cruise Lines ceased serving Haines as a port of call. Today, around 45,000 cruise ship passengers visit each year (Alaska DCED 2006). Approximately 38,000 visitors arrived by land in 2005.

Employment by industry data, as compiled by the Alaska DCED from the 2000 Census, are summarized in the table below. Approximately 14 percent of the labor force in Haines was identified as unemployed and seeking work in 2000, compared to 7 percent for Southeast Alaska as a whole. Median household income was $39,926, compared to a regional median of $44,118 (Alaska DCED 2002).

Employment by Industry	Number	Percent of Total
Agriculture, Forestry, Fishing & Hunting, Mining	46	6
Construction	92	12
Manufacturing	19	2
Wholesale Trade	7	1
Retail Trade	96	12
Transportation, Warehousing & Utilities	54	7
Information	20	3
Finance, Insurance, Real Estate, Rental & Leasing	28	4
Professional, Scientific, Management, Administrative & Waste Mgmt	52	7
Education, Health & Social Services	125	16
Arts, Entertainment, Recreation, Accommodation & Food Services	108	14
Other Services (Except Public Admin)	72	9
Public Administration	53	7
Total Employment	**772**	**100**

Source: Alaska DCED 2002

Please refer to the 1997 Forest Plan EIS for further details on the history, economy, and subsistence use of this community.

Haines is part of the Haines community group (see Table 3.23-6). Detailed employment data are available for this community group by economic sector for 1990, 1995, and 2000 in the planning record for this EIS.

Retail trade, services, and non-federal government were the main employers in the Haines community group in 1999, accounting for 26, 26, and 20 percent of total employment, respectively. Recreation and tourism-related activities (lodging, restaurants, and recreation services) accounted for 22 percent of total employment in 1999. Approximately 140 sawmill jobs were lost with the closure of the Chilkoot Lumber Mill in 1991. There was no wood products employment identified in the Haines community group in 1999.

Potential Effects

Community Use Area

The general area commonly used or related to by many of the residents of the Haines Borough in their local day-to-day work, recreational, and subsistence activities is shown on Figure 3.23-8. This area contains 232,496 acres of National Forest System land (among other land ownerships). Table 3.23-21 shows how the land within this community use area would be distributed among the LUD groups by alternative. The LUD groups are explained in the introduction to Chapter 3.

Figure 3.23-8
Haines' Community Use Area

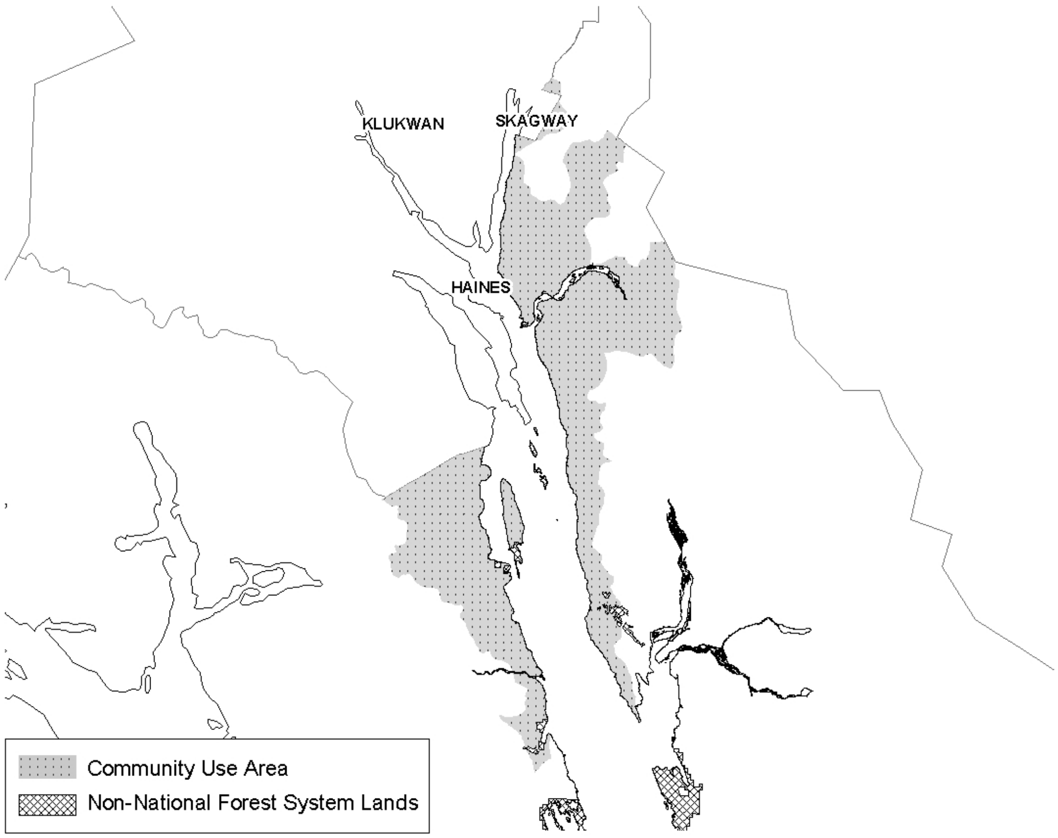


Table 3.23-21
LUD Groups in Haines' Community Use Area by Alternative

	Alternative						
	1	2	3	4	5	6	7
	Suitable National Forest System Acres for Timber Management						
Suitable Acres	233	326	2,208	8,732	6,066	5,694	9,733
LUD Groups	**Acres of National Forest System Land per LUD Group**						
Wilderness/National Monument	253	253	253	253	253	253	253
Mostly Natural	231,717	231,393	216,585	180,501	195,999	199,757	180,501
Moderate Development	527	850	15,659	51,424	36,244	32,487	51,423
Intensive Development	0	0	0	318	0	0	319
Total	**232,496**	**232,496**	**232,496**	**232,496**	**232,496**	**232,496**	**232,496**

[1] See the accompanying large LUD map for the distribution of existing LUDs and the Alternative Maps for the distribution of LUDs by alternative.

Development LUDs presently account for 16 percent of the total acreage within the Haines community use area. Alternatives 5 and 6 would not have a significant effect on existing LUD allocations in the community use area because the acreage by LUD group would remain the same as under the existing Forest Plan. The acreage allocated to Wilderness/National Monument LUDs would remain constant under all alternatives. The amount of acreage allocated to Mostly Natural LUDs would increase under Alternatives 1 through 3. The largest increase would occur under Alternative 1, with the acreage allocated to Mostly Natural LUDs increasing from 84 percent under Alternative 5 (No Action) to 100 percent under Alternative 1, with a commensurate reduction in development LUDs (Table 3.23-21). Alternatives 4 and 7 would increase the acreage in development LUDs. Development LUDs would account for 22 percent under both of these alternatives compared to 16 percent under Alternative 5.

Total suitable acres would range from 0 under Alternatives 1 and 4 percent under Alternatives 4 and 7, compared to 3 percent of the total community use area under Alternative 5 (No Action).

Economy

Commercial fishing, recreation and tourism, and subsistence use are important to Haines. Haines has an Alaska Marine Highway System ferry terminal and provides road access into Interior Alaska. Timber harvest on State land and wood processing were historically a major sector of the Haines economy, but there was no wood products employment in Haines in 2004 (see Table 3.23-3). Mining at the Kensington Mine southeast of Haines may become a more significant employer in the future. Construction activities initiated on the mine site were halted by legal challenges and the Forest Service now anticipates the submittal of a revised plan of operations in 2008. Although the major mine support is anticipated to be located in Juneau, it is likely that some benefits would accrue to Haines.

Commercial fishing is not expected to be significantly affected under any of the alternatives. Mining, and the potential opening of the Kensington Mine, is not anticipated to be affected differently by any alternative.

Subsistence

No significant effect on salmon, other finfish, or invertebrate habitat capability is expected from implementation of any alternative. These resources account for 68 percent of the total edible pounds of subsistence resources harvested by Haines' households (Kruse and Frazier 1988). Marine resources (fish and marine invertebrates) accounted for 76 percent of per capita subsistence harvest in Haines in 1996.

The 1988 TRUCS study found that deer accounted for 15 percent of the total edible pounds of subsistence resources harvested by Haines households (Kruse and Frazier 1988). Deer accounted for 4 percent of per capita subsistence harvest by Haines residents in 1996 (ADF&G 2006).

Haines residents mainly harvest deer in GMU 4. Deer harvest in GMU 4 is considered very high relative to other areas of Southeast Alaska, which is indicative of relatively high deer populations (ADF&G 2005). Over 1997-2004, there has been no significant trend in the number of deer harvested or in the number of hunters (ADF&G 2005). As noted above, the human population of Haines increased steadily from 1970 through 2000, but experienced an estimated decrease of 16 percent between 2000 and 2005. Haines had an estimated population of 1,525 in 2005.

Nineteen WAAs account for about 75 percent of deer harvest by Haines residents. The two most heavily used WAAs—3418 and 3104—accounted for 12 percent and

7 percent of total deer harvest by Haines residents, respectively. As these numbers suggest, deer harvest by Haines residents is spread over a fairly wide area in GMU 4 (Table 3.23-22). As a result, Haines residents tend to comprise a relatively small share of total harvest by WAA, with two main exceptions—WAAs 1106 and 4146, which are located on Chichagof Island and Admiralty Island, respectively, and have very low levels of deer harvest. About 38 percent of the combined harvest in the 19 WAAs used by Haines residents is by non-rural hunters, suggesting that there is a harvest buffer that could be restricted, if necessary, before restrictions are placed on rural harvests.

Table 3.23-22
Deer Harvest (1996 to 2002) and Deer Habitat Capability on NFS Lands in 2005 and After 100+ Years of Full Implementation under Each Alternative, Expressed as a Percent of 1954 Habitat Capability, for the WAAs where Haines Residents Obtain Approximately 75% of their Average Annual Deer Harvest*

WAA	Average Deer Harvest from 1996 to 2002			Deer Habitat Capability in 2005 and after 100+ Years of Full Implementation Under Each Alternative, Expressed as a Percent of the 1954 Habitat Capability							
	Haines Residents	All Rural Hunters	All Hunters	2005	Alt 1	Alt 2	Alt 3	Alt 4	Alt 5	Alt 6	Alt 7
3418	19	62	70	100	100	100	100	100	100	100	100
3104	11	177	193	73	73	69	68	65	68	68	64
3731	9	54	87	92	92	91	91	86	90	91	83
3421	9	28	36	100	100	100	100	100	100	100	100
3525	8	107	171	78	71	67	67	62	65	66	58
4044	7	16	228	100	99	99	99	99	99	99	99
4252	7	75	99	92	92	78	78	70	77	76	69
3524	6	71	90	100	100	86	85	79	83	84	78
3523	6	99	164	81	76	74	74	72	73	73	63
3551	5	146	226	83	77	73	72	68	71	72	62
3627	5	35	72	76	70	67	65	62	64	65	61
3630	5	7	15	99	99	99	99	87	91	94	86
1106	5	6	20	99	99	99	99	99	99	99	99
4222	4	45	64	97	96	95	94	86	94	94	86
3310	4	127	140	93	93	93	93	93	93	93	93
4043	4	7	62	100	100	100	100	100	100	100	100
4146	4	5	35	100	100	100	100	100	100	100	100
3836	3	4	196	100	100	100	100	100	100	100	100
3001	3	422	431	81	81	79	79	72	78	79	71

*Calculated based on harvest where location is known.

The Deer Availability and Anticipated Demand analysis completed for the 1997 Forest Plan EIS determined that the the 1997 Alternatives 2, 6, and 11, which are similar to the four highest harvest alternatives in this EIS, should be able to provide sufficient habitat capability for deer hunted in the Haines community use area by Haines residents, all rural hunters, and all hunters in the short term. The selected alternative should also provide sufficient habitat capability for Haines residents in the long term. Projected harvest for all rural hunters and all hunters in the Haines community use area would exceed 10 percent habitat capability, the level that the analysis assumed would provide a reasonably high level of hunter success for their effort. The Final EIS analysis concluded that at some point a restriction in hunting might be necessary.

In summary, use of most subsistence resources by Haines residents (fish and marine invertebrates) is not expected to be affected by any of the alternatives. However, subsistence use of deer in some of the WAAs hunted by Haines residents may be affected to the point that some restriction in hunting might be necessary over the long term, even under Alternative 1. The risks of this occurring are greatest under Alternative 7 because of its general lack of Non-Development LUDs under this alternative, and lower under the other six alternatives. The risk of hunting restrictions would be reduced somewhat, through more intensive management (e.g., thinning) of the existing and future closed-canopy, young-growth forests in this area. Indirect effects associated with increased competition for deer within Haine's subsistence use areas could also occur under all alternatives due to displacement of hunters from other communities due to timber harvest activity. Additional road development under the alternatives would improve access but may increase competition with other non-local hunters.

Hollis

Hollis is located on east Prince of Wales Island, 19 miles east of Craig. According to the 2000 Census, Hollis had a 2000 population of 139, with Alaska Natives comprising 5 percent of the total (U.S. Census Bureau 2001).

Hollis, initially settled as a mining camp at the turn of the century, developed into a logging camp in the mid-1950s. In 1960, when Thorne Bay became center of the logging industry on central Prince of Wales Island, most Hollis residents moved to Thorne Bay. In recent years, Hollis has grown as a community, due in part to an Alaska Marine Highway terminal there. Roads now connect Hollis with most other communities on Prince of Wales Island. A State land sale at Hollis in 1980 led to its present status as a permanent community (ADF&G 1994).

Viking Lumber, one of the larger sawmills presently operating in the region, is located nearby between Craig and Klawock. According to the 2006 mill survey conducted for the USDA Forest Service, this mill, which has an installed production capacity of 80 MMBF, processed approximately 19 MMBF in 2006 and employed 42 people (Juneau Economic Development Council 2007).

The population of Hollis increased by 28 people or 25 percent between 1990 and 2000. The estimated total population stayed essentially constant between 2000 and 2005, with an estimated 2 fewer people in 2005 than in 2000. Total estimated population was 156 in Hollis in 2006 (Alaska DOL 2007a).

Year	1990	2000	2005	2006
Population	111	139	137	156

Source: USDA Forest Service 1997a; U.S. Census Bureau 2001; Alaska DOL 2007a

Support services for the timber industry, the State Ferry, and the U.S. Forest Service provide the majority of employment to the residents of Hollis. While the timber industry is prevalent on the Prince of Wales Island, it does not occur directly in the Hollis Community (Alaska DCED 2002).

Employment by industry data compiled by the Alaska DCED from the 2000 Census are summarized in the table below. Approximately 3 percent of the labor force in Hollis was identified as unemployed and seeking work in 2000, compared to 7 percent for Southeast Alaska as a whole. Median household income was $43,750, compared to a regional median of $44,118 (Alaska DCED 2002).

Employment by Industry	Number	Percent of Total
Agriculture, Forestry, Fishing & Hunting, Mining	12	19
Construction	4	6
Manufacturing	2	3
Wholesale Trade	4	6
Retail Trade	6	10
Transportation, Warehousing & Utilities	11	17
Information	0	0
Finance, Insurance, Real Estate, Rental & Leasing	3	5
Professional, Scientific, Management, Administrative & Waste Mgmt	2	3
Education, Health & Social Services	13	21
Arts, Entertainment, Recreation, Accommodation & Food Services	0	0
Other Services (Except Public Admin)	0	0
Public Administration	6	10
Total Employment	**63**	**100**

Source: Alaska DCED 2002

Please refer to the 1997 Forest Plan EIS for further details on the history, economy, and subsistence use of this community.

Hollis is part of the Central Prince of Wales community group (see Table 3.23-6). Detailed employment data are available for this community group by economic sector for 1990, 1995, and 2000 in the planning record for this EIS.

Potential Effects

Community Use Area

The general area commonly used or related to by many of the residents of Hollis in their local day-to-day work, recreational, and subsistence activities is shown on Figure 3.23-9. This area contains 289,873 acres of National Forest System land (among other land ownerships). Table 3.23-23 shows how the land within this community use area would be distributed among the LUD groups by alternative. The LUD groups are explained in the introduction to Chapter 3.

Development LUDs presently account for 53 percent of the total acreage within the Hollis community use area. Alternatives 5 and 6 would not have a significant effect on existing LUD allocations in the community use area because the acreage by LUD group would remain the same as under the existing Forest Plan. The acreage allocated to Wilderness/National Monument LUDs would remain constant under all alternatives. The amount of acreage allocated to Mostly Natural LUDs would increase under Alternatives 1 through 3. The largest increase would occur under Alternative 1, with the acreage allocated to Mostly Natural LUDs increasing from 35 percent under Alternative 5 (No Action) to 63 percent under Alternative 1, with a commensurate reduction in development LUDs (Table 3.23-23). Alternatives 4 and 7 would increase the acreage in development LUDs. Development LUDs would account for 62 percent and 83 percent under Alternatives 4 and 7, respectively, compared to 53 percent under Alternative 5.

Figure 3.23-9
Hollis' Community Use Area

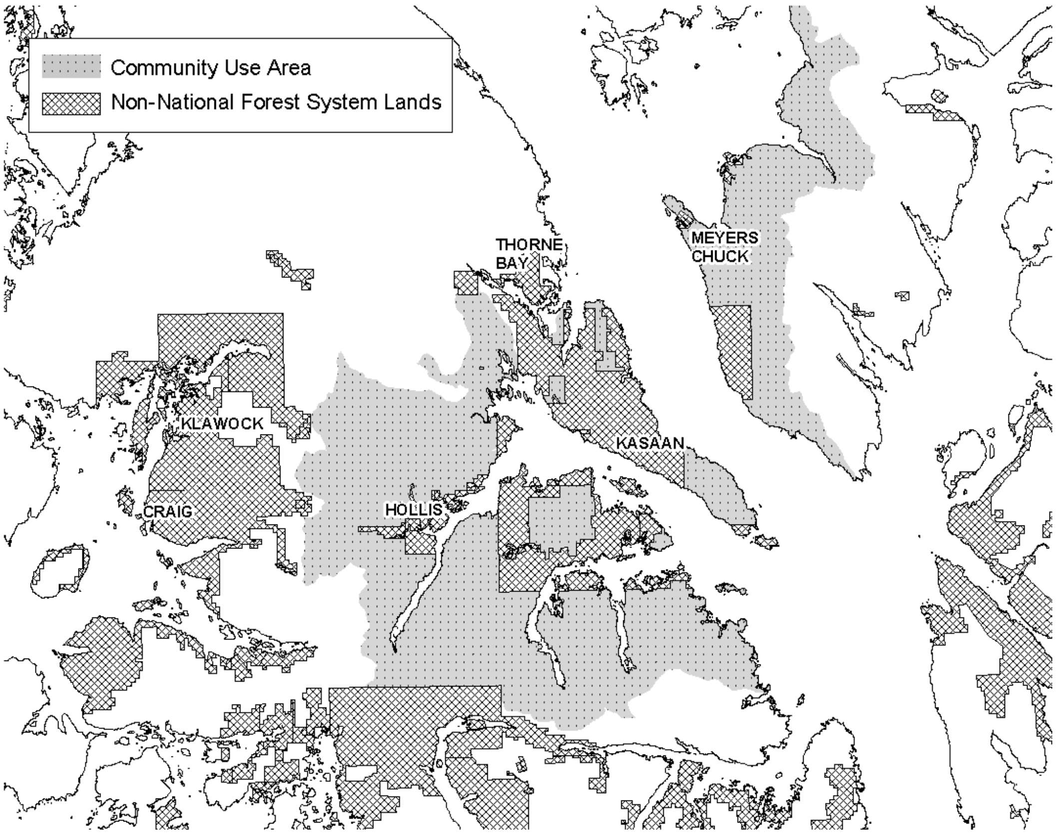


Table 3.23-23
LUD Groups in Hollis' Community Use Area by Alternative

	Alternative						
	1	**2**	**3**	**4**	**5**	**6**	**7**
	Suitable National Forest System Acres for Timber Management						
Suitable Acres	29,180	33,571	40,718	57,431	46,863	46,893	85,742
LUD Groups	**Acres of National Forest System Land per LUD Group**						
Wilderness/National Monument	34,253	34,253	34,253	34,253	34,253	34,253	34,253
Mostly Natural	181,869	155,362	122,186	74,504	101,416	100,486	15,833
Moderate Development	21,518	26,338	29,168	41,408	35,301	35,467	62,373
Intensive Development	52,233	73,920	104,265	139,708	118,903	119,667	177,413
Total	**289,872**	**289,873**	**289,873**	**289,873**	**289,873**	**289,872**	**289,872**

[1] See the accompanying large LUD map for the distribution of existing LUDs and the Alternative Maps for the distribution of LUDs by alternative.

Total suitable acres would range from 10 percent under Alternative 1 to 30 percent under Alternative 7, compared to 16 percent of the total community use area under Alternative 5 (No Action) and Alternative 6 (Proposed Action).

Economy

Hollis is the site of the Alaska Marine Highway ferry terminal that provides access to the rest of Prince of Wales Island. As such, transportation is a major component of the community's economy. Subsistence and timber also play important roles.

Viking Lumber had 27 MMBF under contract in August 2006. Approximately 17 percent (4.6 MMBF) of this volume could be potentially affected under Alternative 1, which would maintain all Inventoried Roadless Areas on the Tongass in a natural condition and not permit timber harvest in these areas. None of the other alternatives would affect this volume. These data provide an indication of potential impacts, actual impacts would depend on the volume that is under contract when the decision is implemented and whether potentially affected existing sales were cancelled as part of the decision.

The ferry terminal would continue to provide important access to Prince of Wales Island under all alternatives. Ferry access has become increasingly important to Prince of Wales Island as its population continues to grow.

Subsistence

No significant effect on salmon, other finfish, or invertebrate habitat capability is expected from implementation of any alternative. These resources account for 65 percent of the total edible pounds of subsistence resources harvested by Hollis households (Kruse and Frazier 1988). Marine resources (fish and marine invertebrates) accounted for 73 percent of per capita subsistence harvest in Hollis in 1998.

The 1988 TRUCS study found that deer account for 23 percent of the total edible pounds of subsistence resources harvested by Hollis households (Kruse and Frazier 1988). Deer accounted for 18 percent of the per capita subsistence harvest by Hollis residents in 1998 (ADF&G 2006).

Data were not provided for Hollis in the ADF&G deer harvest reports for 1996 to 2002. The majority of deer harvest by Hollis residents likely takes place in GMU 2—Prince of Wales Island. Deer harvest and hunter effort in GMU 2 generally increased during 1997-2000 and subsequently declined during 2000-2004; however, no change has been noted in the average number of hunter-days required to harvest a deer (ADF&G 2005). As noted above, the human population of Hollis has been relatively constant since 1990. Hollis had an estimated population of 137 residents in 2005.

The Deer Availability and Anticipated Demand analysis completed for the 1997 Forest Plan EIS determined that the 1997 Alternatives 2, 6, and 11, which are similar to the four highest harvest alternatives in this EIS, should be able to provide habitat capability for deer hunted in the Hollis community use area by Hollis residents and all rural hunters in both the short term and long term. Projected harvest by all hunters in the Hollis community use area would exceed 10 percent habitat capability; the level that the analysis assumed would provide a reasonably high level of hunter success for their effort, in both the short term and long term. The Final EIS analysis concluded that at some point a restriction in hunting might be necessary.

In summary, use of most subsistence resources by Hollis residents (fish and marine invertebrates) is not expected to be affected by any of the alternatives. However, subsistence use of deer may be affected to the point that some restriction in hunting might be necessary over the long term, even under Alternative 1. The risks of this occurring are greatest under Alternative 7, and second highest under Alternative 4 because of its lower use of Non-Development LUDs than the other alternatives. Alternatives 1, 2, and 3 would have the lowest risk and Alternatives 5 and 6 would be intermediate.

Hoonah

Hoonah is located on Port Frederick, along Icy Strait on the northeast shore of Chichagof Island, 40 air miles west of Juneau. Hoonah is predominantly a Native community and has been the principal village for the Hoonah Tlingit Clans since the late 1800s. According to the 2000 Census, Hoonah had a 2000 population of 501, with Alaska Natives comprising 61 percent of the total (U.S. Census Bureau 2001). Whitestone Logging Camp, with a population of 116 (U.S. Census Bureau 2001), is adjacent to Hoonah. The community of Game Creek, a religious ministry, is located 2.6 miles southwest of Hoonah.

The village of Hoonah has been occupied since prehistoric times by the Tlingit people. Groups of Huna Tlingit lived all or part of the year at seasonal camps and small winter settlements throughout the Huna territory. Dozens of camps and settlements have been documented through archaeological surveys. The Hoonah Tlingit have very close ties to the Glacier Bay area across Icy Strait.

In 1880, the Northwest Trading Company built a store in Hoonah. The following year, missionaries settled in the town and established the Presbyterian Home Mission church and school. By 1887, about 500 people were wintering in the village. When the post office was established in 1901, the village was officially named Hoonah, which means “village by the cliff” in Tlingit. In 1944, fire burned many homes in Hoonah and destroyed the traditional ceremonial costumes and keepsakes of the villagers. The town has since been rebuilt and has become a center for logging operations on northern Chichagof Island (ADF&G 1994). A sort yard and log transfer facility are located at Long Island. The community has a local Fish and Game Advisory Committee (ADF&G 1994).

Icy Strait Point, an old cannery located approximately 1.5 miles from in Hoonah opened in 2004 as Alaska’s first cruise destination built specifically for tourists. Owned by the Hoonah Totem Corporation and operated by Pt. Sophia Development Corporation. A total of 67,620 cruise passengers visited Hoonah in 2004, 77,498 visited in 2005, and 135,519 cruise visitors were projected for 2006 (Cruise Line Agencies of Alaska 2006).

The Icy Straits Lumber Company and D&L Woodworks are both located in Hoonah. According to the 2006 mill survey conducted for the USDA Forest Service, the Icy Straits mill, which had an installed production capacity of 20 MMBF, processed approximately 0.7 MMBF in 2006 and employed 15 people (Juneau Economic Development Council 2007). D&L Woodworks had an installed production capacity of 1.8 MMBF and processed 0.1 MMBF in 2007, supporting approximately 1.5 years of full-time employment (Juneau Economic Development Council 2007). This processing total represented 3 percent and 6 percent of the existing capacity at the Icy Straits and D&L Woodworks facilities, respectively.

The population of Hoonah increased by 65 people or 8 percent between 1990 and 2000 and stayed essentially constant between 2000 and 2005. Total estimated population was 829 in Hoonah in 2006 (Alaska DOL 2007a).

Year	1970	1980	1990	2000	2005	2006
Population	748	680	795	860	861	829

Source: USDA Forest Service 1997a; U.S. Census Bureau 2001; Alaska DOL 2007a

Hoonah has a diverse economy with nearly full employment during the summer season. A total of 117 residents hold commercial fishing permits. Fishing, logging, and local government are the main employers. Estimated gross fishing earnings of local residents exceeded $1.5 million in 2000. Fish processing occurs at plants in Hoonah and nearby Excursion Inlet. Sealaska Timber Corporation employs a number of local residents through contracts with Whitestone Logging, Inc. and Southeast Stevedoring. The Huna Totem Corporation owns and operates a sort yard and timber transfer facility. The City of Hoonah and the school district are the major public sector employers (Alaska DCED 2002). Residents are also employed by the recently opened Icy Strait Point development. A total of 67,620 cruise passengers visited Hoonah in 2004, 77,498 visited in 2005, and 135,519 cruise visitors are projected for 2006 (Cruise Line Agencies of Alaska 2006).

The economy of Hoonah has undergone a major transformation in recent years with the completion of Icy Strait Point (Dugan et al. 2006). Icy Strait Point is the largest single employer in Hoonah, with 124 employees, mostly Hoonah residents, working there three to four days a week. Icy Strait Point includes a museum and serves as a base for tours, including forest tours, whale watching, and fishing charters. These tours served an estimated 30,000 people in 2005 (Dugan et al. 2006).

Employment by industry data compiled by the Alaska DCED from the 2000 Census are summarized in the table below. Approximately 21 percent of the labor force in Hoonah was identified as unemployed and seeking work in 2000, compared to 7 percent for Southeast Alaska as a whole. Median household income was $39,028, compared to a regional median of $44,118 (Alaska DCED 2002).

Employment by Industry	Number	Percent of Total
Agriculture, Forestry, Fishing & Hunting, Mining	75	24
Construction	10	3
Manufacturing	36	11
Wholesale Trade	2	1
Retail Trade	20	6
Transportation, Warehousing & Utilities	42	13
Information	0	0
Finance, Insurance, Real Estate, Rental & Leasing	6	2
Professional, Scientific, Management, Administrative & Waste Mgmt	6	2
Education, Health & Social Services	74	23
Arts, Entertainment, Recreation, Accommodation & Food Services	15	5
Other Services (Except Public Admin)	2	1
Public Administration	29	9
Total Employment	**317**	**100**

Source: Alaska DCED 2002

Please refer to the 1997 Forest Plan EIS for further details on the history, economy, and subsistence use of this community.

Hoonah is part of the North Chichagof community group (see Table 3.23-6). Detailed employment data are available for this community group by economic sector for 1990, 1995, and 2000 in the planning record for this EIS. Manufacturing and non-federal government were the major employers in the North Chichagof community group in 1999, accounting for 34 and 30 percent of total employment, respectively. Logging and seafood processing accounted for 24 and 10 percent of total employment, respectively.

Potential Effects

Community Use Area

The general area commonly used or related to by many of the residents of Hoonah in their local day-to-day work, recreational, and subsistence activities is shown on Figure 3.23-10. This area contains 583,825 acres of National Forest System land (among other land ownerships). Table 3.23-24 shows how the land within this community use area would be distributed among the LUD groups by alternative. The LUD groups are explained in the introduction to Chapter 3.

Development LUDs presently account for 46 percent of the total acreage within the Hoonah community use area. Alternatives 5 and 6 would not have a significant effect on existing LUD allocations in the community use area because the acreage by LUD group would remain the same as under the existing Forest Plan. The acreage allocated to Wilderness/National Monument LUDs would remain constant under all alternatives. The amount of acreage allocated to Mostly Natural LUDs would increase under Alternatives 1 through 3. The largest increase would occur under Alternative 1, with the acreage allocated to Mostly Natural LUDs increasing from 51 percent under Alternative 5 (No Action) to 87 percent under Alternative 1, with a commensurate reduction in development LUDs (Table 3.23-24). Alternatives 4 and 7 would increase the acreage in development LUDs. Development LUDs would account for 58 percent and 69 percent under Alternatives 4 and 7, respectively, compared to 46 percent under Alternative 5.

Total suitable acres would range from 3 percent under Alternative 1 to 19 percent under Alternative 7, compared to 10 percent of the total community use area under Alternative 5 (No Action).

Economy

Commercial fishing, logging, and subsistence use are important to Hoonah. The Icy Straits sawmill, which is located in Hoonah, employed 15 people in 2006. Hoonah residents are also employed by the recently opened Icy Strait Point development. Commercial fishing is not expected to be significantly affected under any of the alternatives.

The Icy Straits sawmill had approximately 8 MMBF under contract in August 2006. Approximately 30 percent (2.5 MMBF) of this volume could be potentially affected under Alternative 1. None of the other alternatives would affect this volume. These data provide an indication of potential impacts, actual impacts would depend on the volume that is under contract when the decision is implemented and whether potentially affected existing sales were cancelled as part of the decision.

Subsistence

No significant effect on salmon, other finfish, or invertebrate habitat capability is expected from implementation of any alternative. These resources account for 59 percent of the total edible pounds of subsistence resources harvested by Hoonah households (Kruse and Frazier 1988). Marine resources (fish and marine invertebrates) accounted for 74 percent of per capita subsistence harvest in Hoonah in 1996.

The 1988 TRUCS study found that deer accounted for 23 percent of the total edible pounds of subsistence resources harvested by Hoonah households (Kruse and Frazier 1988). Deer accounted for 14 percent of per capita subsistence harvest by Hoonah residents (ADF&G 2006).

Figure 3.23-10
Hoonah's Community Use Area

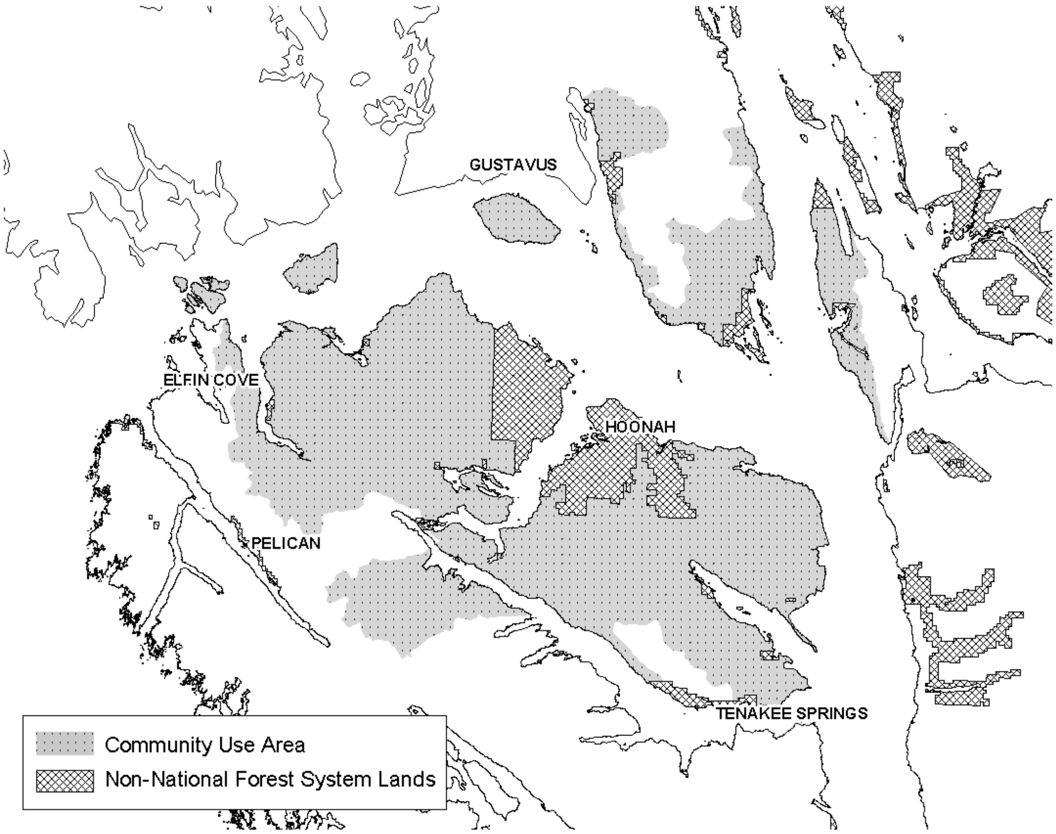


Table 3.23-24
LUD Groups in Hoonah's Community Use Area by Alternative

	Alternative						
	1	**2**	**3**	**4**	**5**	**6**	**7**
	Suitable National Forest System Acres for Timber Management						
Suitable Acres	20,211	51,358	53,071	86,596	56,811	54,540	109,951
LUD Groups	**Acres of National Forest System Land per LUD Group**						
Wilderness/National Monument	23,113	23,113	23,113	23,113	23,113	23,113	23,113
Mostly Natural	508,614	381,703	347,870	219,502	294,907	329,917	159,977
Moderate Development	4,153	16,568	15,958	53,154	19,250	17,580	64,254
Intensive Development	47,945	162,441	196,884	288,053	246,555	213,215	336,482
Total	**583,825**	**583,825**	**583,825**	**583,821**	**583,825**	**583,825**	**583,825**

[1] See the accompanying large LUD map for the distribution of existing LUDs and the Alternative Maps for the distribution of LUDs by alternative.

Hoonah residents mainly harvest deer on Chichagof Island, which is included in GMU 4. Deer harvest in GMU 4 is considered very high relative to other areas of Southeast Alaska, which is indicative of relatively high deer populations (ADF&G 2005). Over 1997-2004, there has been no significant trend in the number of deer harvested or in the number of hunters (ADF&G 2005). As noted above, the human population of Hoonah increased steadily from 1970 through 2000 and remained relatively constant from 2000 to 2005. Hoonah had an estimated population of 861 in 2005.

Four WAAs account for the majority (74 percent) of deer harvest by Hoonah residents (Table 3.23-25). The Hoonah portion represents from 78 percent to 93 percent of the rural hunter harvest and from 49 percent to 70 percent of the total harvest in these WAAs. About 35 percent of the combined harvest in these WAAs is by non-rural hunters, suggesting that there is a harvest buffer that could be restricted, if necessary, before restrictions are placed on rural harvests.

Table 3.23-25
Deer Harvest (1996 to 2002) and Deer Habitat Capability on NFS Lands in 2005 and After 100+ Years of Full Implementation under Each Alternative, Expressed as a Percent of 1954 Habitat Capability, for the WAAs where Hoonah Residents Obtain Approximately 75% of their Average Annual Deer Harvest*

	Average Deer Harvest from 1996 to 2002			Deer Habitat Capability in 2005 and after 100+ Years of Full Implementation Under Each Alternative, Expressed as a Percent of the 1954 Habitat Capability							
WAA	Hoonah Residents	All Rural Hunters	All Hunters	2005	Alt 1	Alt 2	Alt 3	Alt 4	Alt 5	Alt 6	Alt 7
3551	132	146	226	83	77	73	72	68	71	72	62
3523	92	99	164	81	76	74	74	72	73	73	63
3525	83	107	171	78	71	67	67	62	65	66	58
3524	63	71	90	100	100	86	85	79	83	84	78

*Calculated based on harvest where location is known

Three of the WAAs identified in Table 3.23-26 are in areas with substantial past harvest and deer habitat capabilities are currently estimated to be considerably below 1954 levels. Under each of the alternatives, additional harvest would further reduce habitat capabilities. Reductions would be smallest under Alternatives 1 and 2 and greatest under Alternative 7.

The Deer Availability and Anticipated Demand analysis completed for the 1997 Forest Plan EIS determined that the 1997 Alternatives 2, 6, and 11, which are similar to the four highest harvest alternatives in this EIS, should be able to provide sufficient habitat capability for deer hunted by Hoonah residents in the short term. Projected deer harvest in the Hoonah community use area for all rural hunters and all hunters would exceed 10 percent habitat capability, the level that the analysis assumed would provide a reasonably high level of hunter success for their effort, in the short term. Projected harvest for Hoonah residents was estimated to exceed this level in the long term. The Final EIS analysis concluded that at some point a restriction in hunting might be necessary.

In summary, use of most subsistence resources by Hoonah residents (fish and marine invertebrates) is not expected to be affected by any of the alternatives. However, subsistence use of deer may be affected to the point that some restriction in hunting might be necessary over the long term, even under Alternative 1. The risks of this occurring are greatest under Alternative 7 because of its general lack of Non-Development LUDs in Hoonah's community use area, and second highest under Alternative 4 because of its lower use of Non-Development LUDs than the other alternatives (Table 3.23-25). Alternatives 1, 2, and 3 would have the lowest risk and Alternatives 5 and 6 would be intermediate. The risk of hunting restrictions would be reduced somewhat, through more intensive management (e.g., thinning) of the existing and future closed-canopy, young-growth forests in this area. Indirect effects associated with increased competition for deer within Hoonah's subsistence use areas could also occur under all alternatives due to displacement of hunters from other communities due to timber harvest activity. Additional road development under the alternatives would improve access but may increase competition with other non-local hunters. The level of road development is already relatively high in these WAAs. Existing open road densities range from 0.4 to 2.1 miles per square mile and existing total road densities range from 0.8 to 2.1 miles per square mile (for all ownerships combined). Long-term (100+ years) road development would vary by alternative and would result in estimated maximum total road densities ranging from 1.1 to 3.1 miles per square mile in these WAAs under Alternative 1, to 1.5 to 3.4 miles per square mile in these WAAs under Alternative 7 (for all ownerships combined).

Hydaburg

Hydaburg is located on the southwest side of Prince of Wales Island, 45 air miles northwest of Ketchikan. According to the 2000 Census, Hydaburg had a 2000 population of 382, with Alaska Natives comprising 85 percent of the total (U.S. Census Bureau 2001).

The Haida Indians migrated to Prince of Wales Island, a predominantly Tlingit area, from Graham Island, Canada. After combining three villages, the present site was chosen initially as the Hydaburg Indian Reservation in 1912. It became a fishing village with the first fish processing plant opening in 1927, and three other canneries operating through the 1930s. Seafood processing was active until 1984 when a fire destroyed the cannery (ADF&G 1994). Hydaburg is connected by road to Craig, Klawock, Hollis, and northern parts of the Island.

In 1936, Hydaburg became the first Alaskan Native village to form an Indian Reorganization Act Council. In 1972, Hydaburg incorporated as a first class city. The community has a local Fish and Game Advisory Committee (ADF&G 1994).

Hydaburg's population increased by 79 percent between 1970 and 1990, but remained fairly constant between 1990 and 2000, and decreased slightly (3 percent) between 2000 and 2005. Total estimated population was 352 in Hydaburg in 2006 (Alaska DOL 2007a).

Year	1970	1980	1990	2000	2005	2006
Population	214	298	384	382	369	352

Source: USDA Forest Service 1997a; U.S. Census Bureau 2001; Alaska DOL 2007a

Hydaburg's economy is based primarily on the timber and fishing industries. A total of 39 residents hold commercial fishing permits. The Haida Corporation has a substantial timber holding, a log storage facility, and a sort yard. It suspended logging in 1985 due to a decline in the timber market and leases the storage facility and sort yard to Sealaska Corporation. The city of Hydaburg, Sealaska Corporation, Haida Corporation, and SEARHC are the leading employers. Potential development ideas for the community include a fish processing facility, a U.S. Forest Service Visitor Center, specialty woodworking, and some type of retail center (Alaska DCED 2002).

Employment by industry data compiled by the Alaska DCED from the 2000 Census are summarized in the table below. Approximately 31 percent of the labor force in Hydaburg was identified as unemployed and seeking work in 2000, compared to 7 percent for Southeast Alaska as a whole. Median household income was $31,625, compared to a regional median of $44,118 (Alaska DCED 2002).

Employment by Industry	Number	Percent of Total
Agriculture, Forestry, Fishing & Hunting, Mining	5	6
Construction	11	12
Manufacturing	0	0
Wholesale Trade	0	0
Retail Trade	8	9
Transportation, Warehousing & Utilities	7	8
Information	0	0
Finance, Insurance, Real Estate, Rental & Leasing	3	3
Professional, Scientific, Management, Administrative & Waste Mgmt	4	4
Education, Health & Social Services	40	44
Arts, Entertainment, Recreation, Accommodation & Food Services	2	2
Other Services (Except Public Admin)	3	3
Public Administration	7	8
Total Employment	**90**	**100**

Source: Alaska DCED 2002

Please refer to the 1997 Forest Plan EIS for further details on the history, economy, and subsistence use of this community.

Hydaburg is part of the Hydaburg community group (see Table 3.23-6). Detailed employment data are available for this community group by economic sector for 1990, 1995, and 2000 in the planning record for this EIS. Non-federal government and services were the main employers in the Hydaburg community group in 1999, accounting for 48 and 19 percent of total employment, respectively.

Potential Effects

Community Use Area

The general area commonly used or related to by many of the residents of Hydaburg in their local day-to-day work, recreational, and subsistence activities is shown on Figure 3.23-11. This area contains 764,430 acres of National Forest System land (among other land ownerships). Table 3.23-26 shows how the land within this community use area would be distributed among the LUD groups by alternative. The LUD groups are explained in the introduction to Chapter 3.

Development LUDs presently account for 44 percent of the total acreage within the Hydaburg community use area. Alternatives 5 and 6 would not have a significant effect on existing LUD allocations in the community use area because the acreage by LUD group would remain the same as under the existing Forest Plan. The acreage allocated to Wilderness/National Monument LUDs would remain constant under all alternatives. The amount of acreage allocated to Mostly Natural LUDs would increase under Alternatives 1 through 3. The largest increase would occur under Alternative 1, with the acreage allocated to Mostly Natural LUDs increasing from 44 percent under Alternative 5 (No Action) to 77 percent under Alternative 1, with a commensurate reduction in development LUDs (Table 3.23-26). Alternatives 4 and 7 would increase the acreage in development LUDs. Development LUDs would account for 54 percent and 59 percent under Alternatives 4 and 7, respectively, compared to 44 percent under Alternative 5.

Total suitable acres would range from 5 percent under Alternative 5 to 19 percent under Alternative 7, compared to 12 percent of the total community use area under Alternative 5 (No Action) and Alternative 6 (Proposed Action).

Figure 3.23-11
Hydaburg's Community Use Area

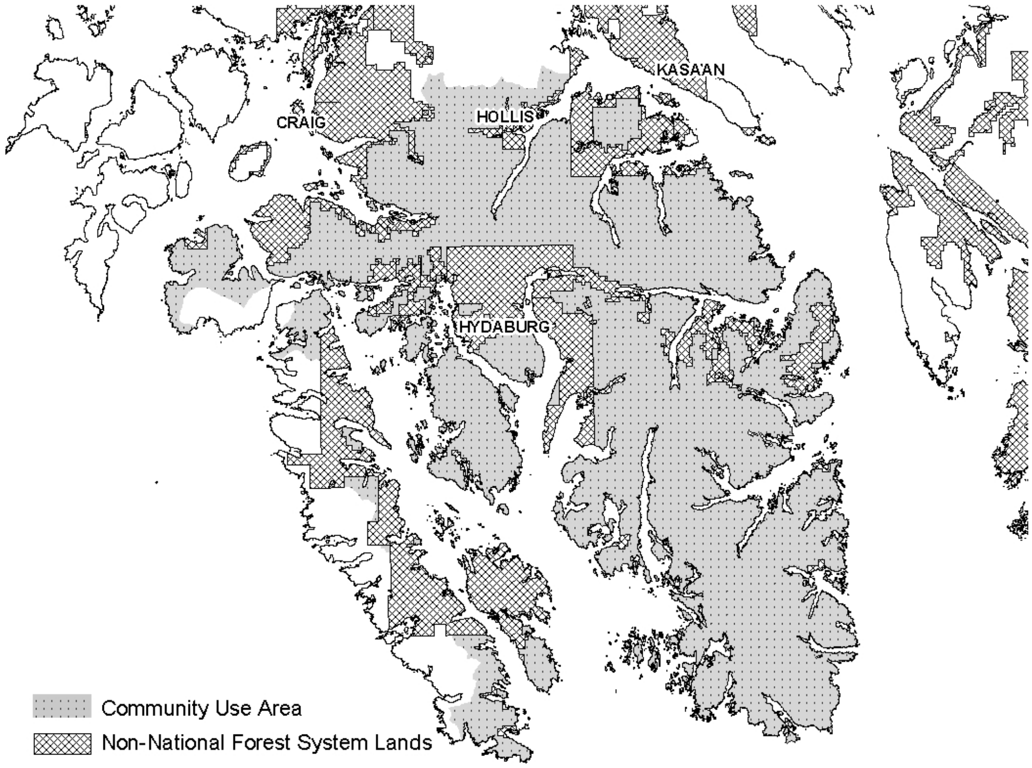


Table 3.23-26
LUD Groups in Hydaburg's Community Use Area by Alternative

	Alternative						
	1	**2**	**3**	**4**	**5**	**6**	**7**
	Suitable National Forest System Acres for Timber Management						
Suitable Acres	35,885	54,380	77,736	113,772	94,397	91,860	142,789
LUD Groups	**Acres of National Forest System Land per LUD Group**						
Wilderness/National Monument	87,503	87,503	87,503	87,503	87,503	87,503	87,503
Mostly Natural	589,020	505,340	390,557	267,725	338,976	341,121	227,616
Moderate Development	27,692	49,387	54,131	109,515	68,704	62,074	114,791
Intensive Development	60,214	122,201	232,239	299,688	269,248	273,733	334,521
Total	**764,430**	**764,430**	**764,430**	**764,431**	**764,431**	**764,430**	**764,431**

[1] See the accompanying large LUD map for the distribution of existing LUDs and the Alternative Maps for the distribution of LUDs by alternative.

Economy

Subsistence use and commercial fishing are the primary elements of Hydaburg's economy. Commercial fisheries employment is not likely to be affected under any of the alternatives.

Subsistence

No significant effect on salmon, other finfish, or invertebrate habitat capability is expected from implementation of any alternative. These resources account for 80 percent of the total edible pounds of subsistence resources harvested by Hydaburg households (Kruse and Frazier 1988). Marine resources (fish and marine invertebrates) accounted for the majority (85 percent) of per capita subsistence harvest in Hydaburg in 1997.

The 1988 TRUCS study found that deer accounted for 13 percent of the total edible pounds of subsistence resources harvested by Hydaburg households (Kruse and Frazier 1988). Deer accounted for 9 percent of per capita subsistence harvest by Hydaburg residents in 1997 (ADF&G 2006).

Hydaburg residents primarily harvest deer on south Prince of Wales Island, which is included in GMU 2. Deer harvest and hunter effort in GMU 2 generally increased during 1997-2000 and subsequently declined during 2000-2004; however, no changehas been noted in the average number of hunter-days required to harvest a deer (ADF&G 2005). As noted above, Hydaburg's human population increased steadily from 1970 through 1990 and decreased slightly from 2000 to 2005. Hydaburg had an estimated 2005 population of 861.

Residents of Hydaburg harvest the majority (75 percent) of their deer from two WAAs in central Prince of Wales Island (1107 and 1214) (Table 3.23-27). The Hydaburg portion represents about 47 percent of the total harvest and 53 percent of rural hunter harvest in WAA 1107 and less than 10 percent of total and rural harvest in WAA 1214. Non-rural harvest comprises 10 percent of total harvest in WAA 1107 and 42 percent in WAA 1214. This suggests that there is a limited harvest buffer that could be restricted, if necessary, before restrictions are placed on rural harvests.

Table 3.23-27
Deer Harvest (1996 to 2002) and Deer Habitat Capability on NFS Lands in 2005 and After 100+ Years of Full Implementation under Each Alternative, Expressed as a Percent of 1954 Habitat Capability, for the WAAs where Hydaburg Residents Obtain Approximately 75% of their Average Annual Deer Harvest*

	Average Deer Harvest from 1996 to 2002			Deer Habitat Capability in 2005 and after 100+ Years of Full Implementation Under Each Alternative, Expressed as a Percent of the 1954 Habitat Capability							
WAA	Hydaburg Residents	All Rural Hunters	All Hunters	2005	Alt 1	Alt 2	Alt 3	Alt 4	Alt 5	Alt 6	Alt 7
1107	19	37	41	98	97	97	97	88	90	90	86
1214	3	53	91	79	70	66	65	62	64	64	53

*Calculated based on harvest where location is known

The Deer Availability and Anticipated Demand analysis completed for the 1997 Forest Plan EIS determined that the 1997 Alternatives 2, 6, and 11, which are similar to the four highest harvest alternatives in this EIS, should be able to provide sufficient habitat capability for deer hunted by Hydaburg residents, as well as for all deer hunted within the WAAs of the Hydaburg community use area in the long term.

In summary, use of most subsistence resources by Hydaburg residents (fish and marine invertebrates) is not expected to be affected by any of the alternatives.

However, subsistence use of deer may be affected to the point that some restriction in hunting might be necessary over the long term, even under Alternative 1. The risks of this occurring are greatest under Alternative 7 because of its general lack of Non-Development LUDs throughout most of Prince of Wales Island, and second highest under Alternative 4 because of its lower use of Non-Development LUDs than the other alternatives. Alternatives 1, 2, and 3 would have the lowest risk and Alternatives 5 and 6 would be intermediate. The risk of hunting restrictions would be reduced somewhat, through more intensive management (e.g., thinning) of the existing and future closed-canopy, young-growth forests in this area. Indirect effects associated with increased competition for deer within Hydaburg's subsistence use areas could also occur under all alternatives due to displacement of hunters from other communities due to timber harvest activity. Additional road development under the alternatives would improve access but may increase competition with other non-local hunters. The level of road development is already relatively high in these WAAs. Existing open road densities are 0.9 and 1.5 miles per square mile and existing total road densities are 0.9 and 1.6 miles per square mile in WAAs 1107 and 1214, respectively (for all ownerships comined). Long-term (100+ years) road development would vary by alternative and would result in estimated maximum total road densities ranging from 1.5 to 2.3 miles per square mile in these WAAs under Alternative 1, to 1.5 to 2.7 miles per square mile in these WAAs under Alternative 7 (for all ownerships combined).

Hyder

Hyder is a small community located at the head of Portland Canal, a 70-mile-long fjord that forms part of the United States/Canadian border. Hyder is just 2 miles from Stewart, British Columbia, and 75 air miles from Ketchikan. Hyder is one of three Alaskan communities connected by road to Canada. According to the 2000 Census, Hyder had a 2000 population of 97, with no Alaska Native population (U.S. Census Bureau 2001).

Nass River Tsimshians inhabited the area, which they called Skam-a-Kounst, "a safe place," prior to the coming of white prospectors in the late 1890s. The first official exploration and building at the town site occurred in 1896 by the U.S. Army Corps of Engineers. Stewart also became settled at this time, as gold, silver, and other mineral mining operations developed. The two towns grew together with an initial economic base in mining (ADF&G 1994).

The population of Hyder, which slightly more than doubled between 1970 and 1990, remained fairly constant between 1990 and 2005, decreasing by an estimated 6 persons. Total estimated population was 92 in Hyder in 2006 (Alaska DOL 2007a).

Year	1970	1980	1990	2000	2005	2006
Population	49	77	99	97	91	92

Source: USDA Forest Service 1997a; U.S. Census Bureau 2001; Alaska DOL 2007a

Hyder's economy is primarily based on tourism and, as such, is seasonal. Four of the five largest employers are tourist related. Four residents hold commercial fishing permits. Many tourists enter Hyder from Canada. Stewart, British Columbia and Hyder are only 2 miles apart and share visitor services. A bottled water business opened in 1998 and employs several local residents (Alaska DCED 2002).

Employment by industry data compiled by the Alaska DCED from the 2000 Census are summarized in the table below. Approximately 47 percent of the labor force in Hyder was identified as unemployed and seeking work in 2000, compared to 7 percent for Southeast Alaska as a whole. Median household income was $11,719 compared to a regional median of $44,118 (Alaska DCED 2002).

Employment by Industry	Number	Percent of Total
Agriculture, Forestry, Fishing & Hunting, Mining	0	0
Construction	10	42
Manufacturing	0	0
Wholesale Trade	0	0
Retail Trade	2	8
Transportation, Warehousing & Utilities	4	17
Information	0	0
Finance, Insurance, Real Estate, Rental & Leasing	0	0
Professional, Scientific, Management, Administrative & Waste Mgmt	0	0
Education, Health & Social Services	4	17
Arts, Entertainment, Recreation, Accommodation & Food Services	4	17
Other Services (Except Public Admin)	0	0
Public Administration	0	0
Total Employment	**24**	**100**

Source: Alaska DCED 2002

Please refer to the 1997 Forest Plan EIS for further details on the history, economy, and subsistence use of this community.

Hyder is part of the Hyder community group (see Table 3.23-6). Detailed employment data are available for this community group by economic sector for 1990, 1995, and 2000 in the planning record for this EIS. The Federal government and services sectors were the main employers in the Hyder community group in 1999, accounting for 69 and 25 percent of total employment, respectively.

Potential Effects

Community Use Area

The general area commonly used or related to by many of the residents of Hyder in their local day-to-day work, recreational, and subsistence activities is shown on Figure 3.23-12. This area contains 108,809 acres of National Forest System land (among other land ownerships). Table 3.23-28 shows how the land within this community use area would be distributed among the LUD groups by alternative. The LUD groups are explained in the introduction to Chapter 3.

Development LUDs presently account for 10 percent of the total acreage within the Hyder community use area. Alternatives 5 and 6 would not have a significant effect on existing LUD allocations in the community use area because the acreage by LUD group would remain the same as under the existing Forest Plan. The acreage allocated to Wilderness/National Monument LUDs would remain constant under all alternatives. The amount of acreage allocated to Mostly Natural LUDs would increase under Alternatives 1 through 3. The largest increase would occur under Alternative 1, with the acreage allocated to Mostly Natural LUDs increasing from 90 percent under Alternative 5 (No Action) to 100 percent under Alternative 1, with a commensurate reduction in development LUDs (Table 3.23-28). Alternatives 4 and 7 would increase the acreage in development LUDs. Development LUDs would account for 31 percent under Alternatives 4 and 7 compared to 10 percent under Alternatives 5 and 6.

Total suitable acres would range from 0 under Alternative 1 to 5 percent under Alternatives 4 and 7, compared to 3 percent of the total community use area under Alternative 5 (No Action) and Alternative 6 (Proposed Action).

Figure 3.23-12
Hyder's Community Use Area

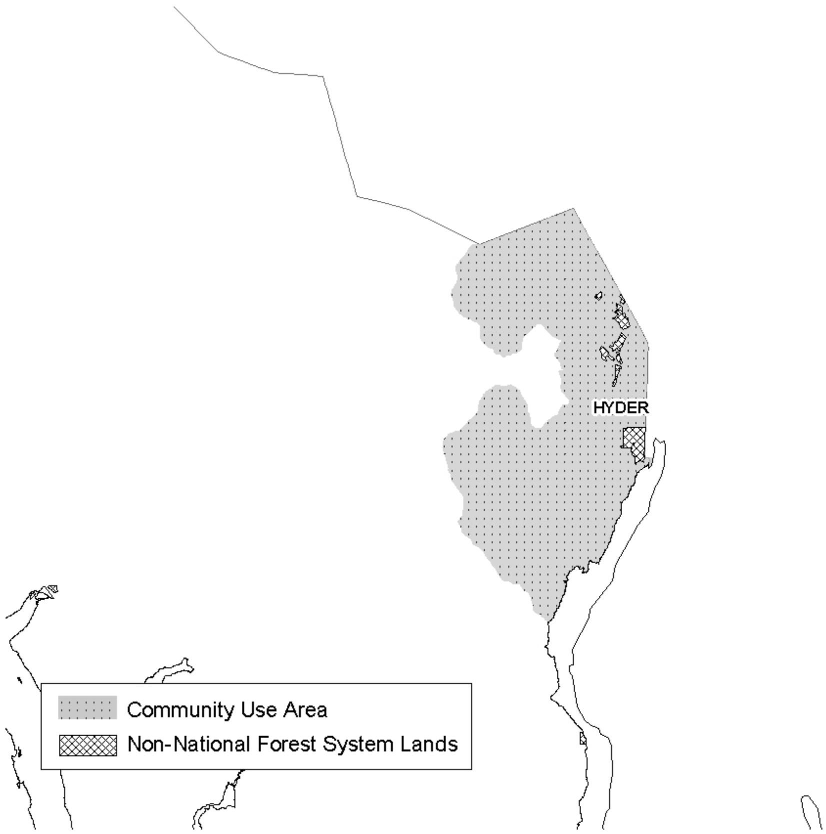


Table 3.23-28
LUD Groups in Hyder's Community Use Area by Alternative

	Alternative						
	1	**2**	**3**	**4**	**5**	**6**	**7**
	Suitable National Forest System Acres for Timber Management						
Suitable Acres	0	3,011	3,011	5,543	3,054	3,054	5,788
LUD Groups	**Acres of National Forest System Land per LUD Group**						
Wilderness/National Monument	71	71	71	71	71	71	71
Mostly Natural	108,738	99,539	99,539	75,530	98,275	98,275	75,530
Moderate Development	0	9,199	9,199	33,110	10,463	10,463	33,110
Intensive Development	0	0	0	98	0	0	98
Total	**108,809**	**108,809**	**108,809**	**108,809**	**108,809**	**108,809**	**108,809**

[1] See the accompanying large LUD map for the distribution of existing LUDs and the Alternative Maps for the distribution of LUDs by alternative.

Economy

Hyder is a small former mining town that now relies upon tourism and commercial fishing for the majority of its income. Tourism (especially bear viewing) has become increasingly important to the economy of Hyder. A number of organizations commenting on the Draft EIS pointed out that the area around Hyder is a well-known mining area (as noted above) and stated that several old mines in the area are being evaluated for further development and a number of new projects have been identified and are in various stages of development. These organizations requested that the LUD classification in this area be changed from Semi-remote Recreation to a Moderate Development LUD with a Minerals overlay. A Minerals overlay has been added to this area in the Final Proposed Plan under all of the action alternatives. The Minerals LUD overlay may have the effect of changing potential exploration and development costs from high to moderate in the affected area. This is discussed further in the *Minerals* section of this EIS.

Subsistence

No significant effect on salmon, other finfish, or invertebrate habitat capability is expected from implementation of any alternative. These resources account for 80 percent of the total edible pounds of subsistence resources harvested by Hyder households (Kruse and Frazier 1988). Marine resources (fish and marine invertebrates) accounted for the majority (85 percent) of per capita subsistence in Hyder in 1987.

The 1988 TRUCS study found that deer accounted for only a fraction of the total edible pounds of subsistence resources harvested by Hyder households (Kruse and Frazier 1988). Deer accounted for a very small amount of per capita subsistence harvest by Hyder residents in 1987.

Data were not provided for Hyder in the ADF&G deer harvest reports for 1996 to 2002. The majority of deer harvest by Hyder residents likely takes place in GMU 1A. Deer harvest in GMU 1A generally declined from 1997 to 2004, with the number of hunters and hunter effort also decreasing over this period (ADF&G 2005). As noted above, the population of Hyder increased from 1970 through 1990 and has remained fairly constant since. Hyder had an estimated population of 91 residents in 2005.

The Deer Availability and Anticipated Demand analysis completed for the 1997 Forest Plan EIS determined that 1997 Alternatives 2, 6, and 11, which are similar to the four highest harvest alternatives in this EIS, should be able to provide sufficient habitat capability for deer hunted in Hyder's community use area by Hyder residents, all rural hunters, and all hunters in the short term. In the long term projected harvest for all rural hunters and all hunters in the Hyder community use area would exceed 10 percent habitat capability, the level that the analysis assumed would provide a reasonably high level of hunter success for their effort.

In summary, use of most subsistence resources by Hyder residents (fish and marine invertebrates) is not expected to be affected by any of the alternatives. However, subsistence use of deer may be affected to the point that some restriction in hunting might be necessary over the long term, even under Alternative 1. The risks of this occurring are greatest under Alternative 7 and second highest under Alternative 4, because of their lower use of Non-Development LUDs compared with the other alternatives. Alternatives 1, 2, and 3 would have the lowest risk and Alternatives 5 and 6 would be intermediate. It is unlikely that Hyder residents would be affected by increased competition or access in WAA 826, which surrounds their community, because of the limited access to this area. Existing road densities are also relatively low and total road density is not expected to increase to more than 0.6 mile per square mile even under Alternative 7 (for all lands combined).

Juneau and Vicinity

The city and Borough of Juneau surrounds the Gastineau Channel in Southeast Alaska. Juneau lies approximately 900 air miles northwest of Seattle and 600 air miles southeast of Anchorage. The City and Borough is comprised of three communities: Juneau, Auke Bay, and Douglas. According to the 2000 Census, the City and Borough of Juneau had a 2000 population of 30,711, accounting for 42 percent of the population in Southeast Alaska. Alaska Natives comprised almost 11 percent of the total population (U.S. Census Bureau 2001).

Originally, Tlingit Indians made seasonal and permanent villages along the north and south coast near the present site of Juneau. Gold discovered in the Juneau area started the mining town in 1880 and the settlement grew rapidly. Two of the world's largest lode gold mines produced over $180 million in gold before finally closing in 1944. The state capital was moved from Sitka to Juneau in 1906 while Alaska was still a territory. Alaska became the 49th State in 1959. Juneau has developed as a government and regional services center, with added economic contributions from fishing and tourism.

The population of Juneau has grown steadily since 1970, almost doubling between 1970 and 1990 and increasing a further 15 percent between 1990 and 2000. The population in Juneau has continued to growth, increasing by approximately 2 percent (482 residents) between 2000 and 2005. Total estimated population was 30,650 in Juneau in 2006 (Alaska DOL 2007a).

Year	1970	1980	1990	2000	2005	2006
Population	13,556	19,528	26,751	30,711	31,193	30,650

Source: USDA Forest Service 1997a; U.S. Census Bureau 2001; Alaska DOL 2007a

The Juneau economy is primarily based on government, tourism, support services for logging, fish processing and mining. The State, city and Borough of Juneau, and federal agencies provide nearly 45% of the employment in the community. Juneau is the State capital and is the home of the State legislators and their staff during the legislative season (January to May). Tourism is a significant part of the economy during the summer months providing an estimated $130 million in income. Juneau is an important cruise ship docking location due to the local attractions: Mendenhall Glacier, Juneau Icefield, Tracy Arm Fjord Glacier, and the new Mount Roberts Tram. Estimated gross fishing earnings of local residents exceeded $10.4 million in 2000. Cold storage facilities in Juneau process over 2 million pounds of seafood annually and DIPAC, a private non-profit organization, operates a salmon hatchery. The Kennecott Green's Creek Mine, the largest silver mine in North America, produces gold, silver, lead and zinc (Alaska DCED 2002). In addition, the Forest Service approved a plan of operations for the Kensington Gold Mine north of Juneau in 2005 and Coeur Alaska, Inc. subsequently began construction activities on the site. Construction and development was, however, halted by legal challenges and the Forest Service now anticipates the submittal of a revised plan of operations in 2008.

Tourism in Juneau is dominated by cruise ships, but a recent study noted that a substantial number of independent unguided travelers also make their way through Juneau in pursuit of hiking, kayaking, boating, hunting, and other outdoor activities (Dugan et al. 2006). The six major cruise lines who dock at Juneau each offer 34 to 37 shore excursions for purchase on the ship or before the cruise begins.

Employment by industry data compiled by the Alaska DCED from the 2000 Census are summarized in the table below. Approximately 5 percent of the labor force in Juneau was identified as unemployed and seeking work in 2000, compared to 7 percent for Southeast Alaska as a whole. Median household income was $62,034, compared to a regional median of $44,118 (Alaska DCED 2002).

Employment by Industry	Number	Percent of Total
Agriculture, Forestry, Fishing & Hunting, Mining	854	5
Construction	1,035	6
Manufacturing	199	1
Wholesale Trade	174	1
Retail Trade	1,689	10
Transportation, Warehousing & Utilities	1,072	6
Information	417	3
Finance, Insurance, Real Estate, Rental & Leasing	723	4
Professional, Scientific, Management, Administrative & Waste Mgmt	1,339	8
Education, Health & Social Services	3,383	20
Arts, Entertainment, Recreation, Accommodation & Food Services	1,162	7
Other Services (Except Public Admin)	755	5
Public Administration	3,735	23
Total Employment	**16,537**	**100**

Source: Alaska DCED 2002

Please refer to the 1997 Forest Plan EIS for further details on the history, economy, and subsistence use of this community.

Juneau is part of the Juneau community group (see Table 3.23-6). Detailed employment data are available for this community group by economic sector for 1990, 1995, and 2000 in the planning record for this EIS. Non-federal government, services, and retail trade were the main employers in the Juneau community group in 1999, accounting for 37, 21, and 15 percent of total employment, respectively. Recreation-related activities (lodging, restaurants, and recreation services) accounted for 11 percent of total employment.

Potential Effects

Community Use Area

The general area commonly used or related to by many of the residents of Juneau in their local day-to-day work, recreational, and subsistence activities is shown on Figure 3.23-13. This area contains 2,013,397 acres of National Forest System land (among other land ownerships). Table 3.23-29 shows how the land within this community use area would be distributed among the LUD groups by alternative. The LUD groups are explained in the introduction to Chapter 3.

Development LUDs presently account for 8 percent of the total acreage within the Juneau community use area. Alternatives 5 and 6 would not have a significant effect on existing LUD allocations in the community use area because the acreage by LUD group would remain the same as under the existing Forest Plan. The acreage allocated to Wilderness/National Monument LUDs would remain constant under all alternatives. The amount of acreage allocated to Mostly Natural LUDs would increase under Alternatives 1 through 3. The largest increase would occur under Alternative 1, with the acreage allocated to Mostly Natural LUDs increasing from 73 percent under Alternative 5 (No Action) to 80 percent under Alternative 1, with a commensurate reduction in development LUDs (Table 3.23-29). Alternatives 4 and 7 would increase the acreage in development LUDs. Development LUDs would account for 10 and 11 percent under alternatives 4 and 7, respectively, compared to 8 percent under Alternative 5.

Total suitable acres would range from no acreage under Alternatives 1 through 3 to 2.4 percent under Alternative 7, compared to 1.6 percent of the total community use area under Alternative 5 (No Action).

Figure 3.23-13
Juneau's Community Use Area

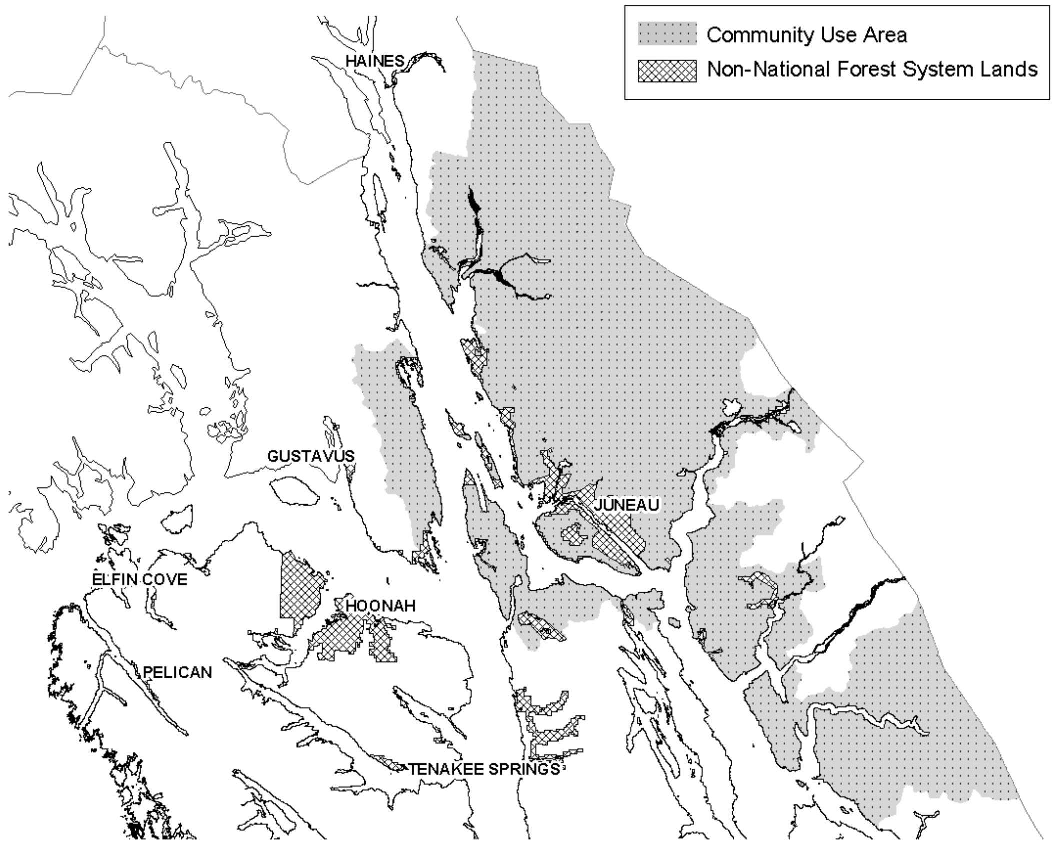


Table 3.23-29
LUD Groups in Juneau's Community Use Area by Alternative

	Alternative						
	1	**2**	**3**	**4**	**5**	**6**	**7**
	Suitable National Forest System Acres for Timber Management						
Suitable Acres	621	2,986	8,514	45,408	31,439	25,123	47,865
LUD Groups	**Acres of National Forest System Land per LUD Group**						
Wilderness/National Monument	388,994	388,994	388,994	388,994	388,994	388,994	388,994
Mostly Natural	1,602,469	1,596,636	1,580,021	1,413,085	1,470,366	1,479,129	1,412,235
Moderate Development	21,934	24,203	40,818	175,434	131,124	122,472	176,382
Intensive Development	0	3,564	3,564	35,884	22,913	22,802	35,869
Total	**2,013,397**	**2,013,397**	**2,013,397**	**2,013,398**	**2,013,397**	**2,013,397**	**2,013,480**

[1] See the accompanying large LUD map for the distribution of existing LUDs and the Alternative Maps for the distribution of LUDs by alternative.

Economy

As the State capital, government is important to Juneau. Besides changes in government employment, Juneau is most likely to be affected by changes in mining, recreation and tourism, and commercial fishing. None of the alternatives are expected to affect these aspects of the local economy.

Subsistence

Juneau is not classified as a subsistence community; however, many residents use the surrounding Tongass for sport hunting and fishing. Juneau is the largest community in Southeast Alaska and accounted for 44 percent of the region's population in 2005, with an estimated total of 31,193 residents. Given the non-subsistence status of the community and its large size, no attempt is made here to summarize the WAAs that community residents use to hunt deer. The following paragraphs do, however, summarize the findings of the 1997 EIS and provide a general overview of the likely impacts of the current alternatives.

The majority of deer harvest by Juneau residents likely takes place within the community's identified use area (Figure 3.23-13), which is mainly located within GMU 1C. GMU 1C has been characterized from 1997-2004 by substantial annual variation in deer harvest, with no evident long-term trend in harvest levels (ADF&G 2005).

The Deer Availability and Anticipated Demand analysis completed for the 1997 Forest Plan EIS determined that 1997 Alternatives 2, 6, and 11, which are similar to the four highest harvest alternatives in this EIS, should be able to provide sufficient habitat capability for deer hunted by all rural hunters in the long term. Projected deer harvest in the Juneau community use area by all rural hunters and Juneau residents and all hunters was estimated to exceed 10 percent habitat capability; the level that the analysis assumed would provide a reasonably high level of hunter success for their effort in the short term and long term. The Final EIS analysis concluded that at some point a restriction in hunting might be necessary.

In summary, use of most subsistence resources by Juneau residents (fish and marine invertebrates) is not expected to be affected by any of the alternatives. However, subsistence use of deer may be affected to the point that some restriction in hunting might be necessary over the long term, even under Alternative 1. The risks of this occurring are greatest under Alternative 7, and second highest under Alternative 4 because of its lower use of Non-Development LUDs than the other alternatives. Alternatives 1, 2, and 3 would have the lowest risk and Alternatives 5 and 6 would be intermediate.

Kake

Kake is located on west Kupreanof Island, along Keku Strait, 38 air miles northwest of Petersburg. According to the 2000 Census, Kake had a 2000 population of 710, with Alaska Natives comprising 67 percent of the total (U.S. Census Bureau 2001).

Tlingit Alaska Natives villages and fishing camps in the Kake area pre-date non-Alaska Native explorations of Southeast Alaska. During the 1800s these villages were consolidated at the present site of Kake. In the years following the American purchase of Alaska from Russia in 1867, there were several confrontations between the *Keex'* Tlingit and the Russian and American military administrations culminating in the destruction of three Kake villages. For many years, the *Keex'* people did not rebuild their villages. Eventually, they concentrated on Kupreanof Island at the present townsite along Keku Strait (ADF&G 1994).

The period of 1880 through 1915 brought a territorial government, missionary activity, economic innovations, and a larger white population into *Keex'* Tlingit territory. By the 1920s, Kake had become self-governing, with a mayor and police chief. In 1949, Kake formed an IRA Council under the Indian Reorganization Act of

1936. In 1952, Kake became incorporated as a first class city. In 1971, the passage of ANCSA resulted in the incorporation of the village and the selection of corporation lands (ADF&G 1994).

The population of Kake, which increased by 56 percent between 1970 and 1990, remained fairly constant between 1990 and 2000, and decreased by an estimated 112 people or 16 percent between 2000 and 2005. Total estimated population was 536 in Kake in 2006 (Alaska DOL 2007a).

Year	1970	1980	1990	2000	2005	2006
Population	448	555	700	710	598	536

Source: USDA Forest Service 1997a; U.S. Census Bureau 2001; Alaska DOL 2007a

The Kake economy is primarily based on timber and fishing industries. Sixty-seven residents hold commercial fishing permits. The city, including the school district, and the timber industry are the largest employers. Turn Mountain Timber, a joint venture between Whitestone logging and Kake Tribal Logging, and the log sort yard and transfer facility at Point McCarny employ a number of local residents. Kake Tribal Corporation, which owns a local cold storage plant and Ocean Fresh Seafoods, is the largest individual employer. The Gunnock Creek Hatchery, a non-profit organization, operates a salmon hatchery to assist in sustaining the salmon fishery in the area (Alaska DCED 2002).

Employment by industry data compiled by the Alaska DCED from the 2000 Census are summarized in the table below. Approximately 25 percent of the labor force in Kake was identified as unemployed and seeking work in 2000, compared to 7 percent for Southeast Alaska as a whole. Median household income was $39,643, compared to a regional median of $44,118 (Alaska DCED 2002).

Employment by Industry	Number	Percent of Total
Agriculture, Forestry, Fishing & Hunting, Mining	34	14
Construction	34	14
Manufacturing	10	4
Wholesale Trade	0	0
Retail Trade	22	9
Transportation, Warehousing & Utilities	19	8
Information	0	0
Finance, Insurance, Real Estate, Rental & Leasing	3	1
Professional, Scientific, Management, Administrative & Waste Mgmt	0	0
Education, Health & Social Services	57	23
Arts, Entertainment, Recreation, Accommodation & Food Services	17	7
Other Services (Except Public Admin)	20	8
Public Administration	32	13
Total Employment	**248**	**100**

Source: Alaska DCED 2002

Please refer to the 1997 Forest Plan EIS for further details on the history, economy, and subsistence use of this community.

Kake is located in the Petersburg Ranger District and part of the Kake community group (see Table 3.23-6). Detailed employment data are available for this community group by economic sector for 1990, 1995, and 2000 in the planning record for this EIS.

The non-federal government, finance, insurance, and real estate (F.I.R.E), and manufacturing sector were the major employers in the Kake community group in 1999, accounting for 28, 22, and 21 percent of total employment, respectively. Wood products (logging) employment decreased by 57 percent between 1990 and 1999, declining from 123 to 53 jobs. Wood products employment accounted for 21 percent of total employment in the Kake community group in 1999.

Potential Effects

Community Use Area

The general area commonly used or related to by many of the residents of Kake in their local day-to-day work, recreational, and subsistence activities is shown on Figure 3.23-14. This area contains 454,186 acres of National Forest System land (among other land ownerships). Table 3.23-30 shows how the land within this community use area would be distributed among the LUD groups by alternative. The LUD groups are explained in the introduction to Chapter 3.

Figure 3.23-14
Kake's Community Use Area

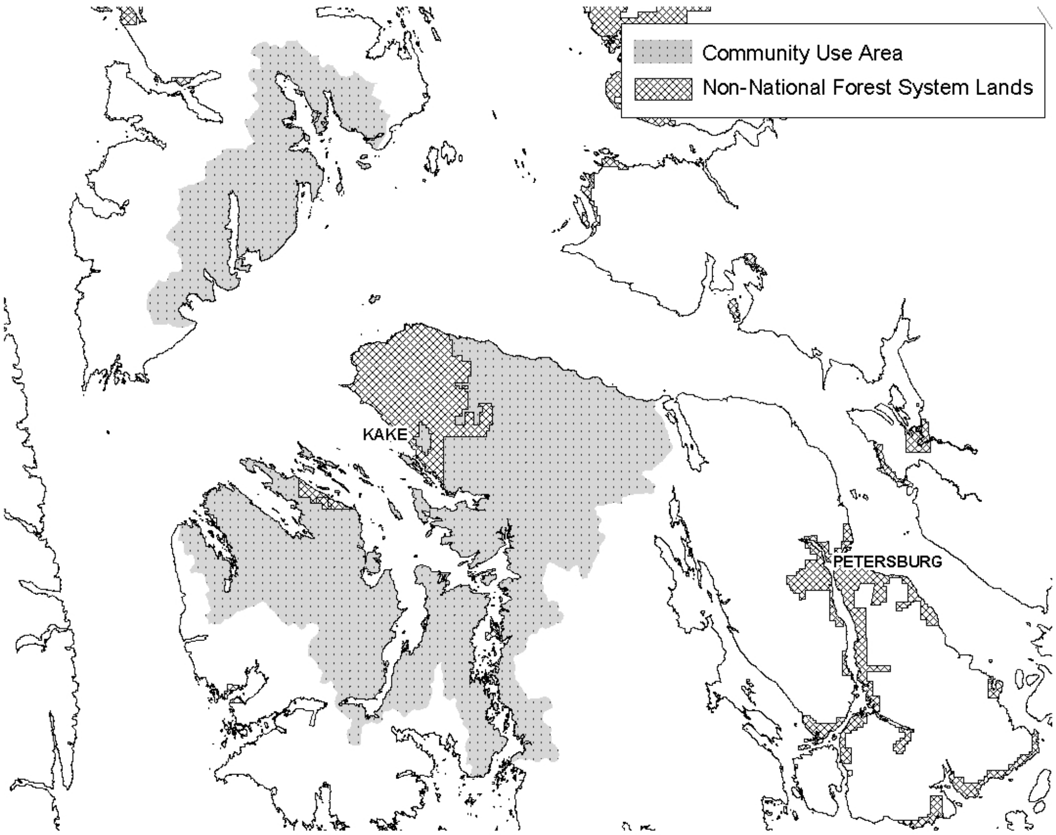


Table 3.23-30
LUD Groups in Kake's Community Use Area by Alternative

	Alternative						
	1	**2**	**3**	**4**	**5**	**6**	**7**
	Suitable National Forest System Acres for Timber Management						
Suitable Acres	16,662	62,758	65,251	78,711	73,014	70,998	87,801
LUD Groups	**Acres of National Forest System Land per LUD Group**						
Wilderness/National Monument	105,149	105,149	105,149	105,149	105,149	105,149	105,149
Mostly Natural	313,278	203,252	191,676	110,747	151,246	170,011	91,839
Moderate Development	5,806	8,035	10,242	18,292	13,885	15,480	23,345
Intensive Development	29,953	137,749	147,144	220,001	183,905	163,545	233,853
Total	**454,187**	**454,185**	**454,210**	**454,188**	**454,186**	**454,185**	**454,186**

[1] See the accompanying large LUD map for the distribution of existing LUDs and the Alternative Maps for the distribution of LUDs by alternative.

Development LUDs presently account for 44 percent of the total acreage within the Kake community use area. Alternatives 5 and 6 would not have a significant effect on existing LUD allocations in the community use area because the acreage by LUD group would remain the same as under the existing Forest Plan. The acreage allocated to Wilderness/National Monument LUDs would remain constant under all alternatives. The amount of acreage allocated to Mostly Natural LUDs would increase under Alternatives 1 through 3. The largest increase would occur under Alternative 1, with the acreage allocated to Mostly Natural LUDs increasing from 33 percent under Alternative 5 (No Action) to 69 percent under Alternative 1, with a commensurate reduction in development LUDs (Table 3.23-30). Alternatives 4 and 7 would increase the acreage in development LUDs. Development LUDs would account for 52 percent and 57 percent under Alternatives 4 and 7, respectively, compared to 44 percent under Alternatives 5.

Total suitable acres would range from 4 percent under Alternative 1 to 19 percent under Alternative 7, compared to 16 percent of the total community use area under Alternative 5 (No Action).

Economy

Kake is a traditional native community where commercial fishing, timber harvesting, and subsistence use are important. For subsistence use, west Kupreanof and north Kuiu Islands are some of the most important areas.

Timber harvest has been an important contributor to the Kake economy for approximately 20 years. During that period, both private and National Forest System lands have been harvested. Recently, timber harvest has diminished on both ownerships. Logging employment in the Kake community group declined by 70 jobs or 57 percent between 1990 and 1999, but still comprised 21 percent of total employment in 1999 (Table 3.23-7).

A total of 20.6 MMBF is presently under contract in the Petersburg Ranger District. Approximately 22 percent or 4.6 MMBF of this volume would be affected under Alternative 1, which would maintain all Inventoried Roadless Areas on the Tongass in a natural condition and not permit timber harvest in these areas. None of the other alternatives would affect this volume. These data provide an indication of potential impacts, actual impacts would depend on the volume that is under contract when the decision is implemented and whether potentially affected existing sales were cancelled as part of the decision.

Commercial fishing is not expected to be significantly affected under any of the alternatives.

Subsistence

No significant effect on salmon, other finfish, or invertebrate habitat capability is expected from implementation of any alternative. These resources account for 52 percent of the total edible pounds of subsistence resources harvested by Kake households (Kruse and Frazier 1988). Marine resources (fish and marine invertebrates) accounted for 60 percent of per capita subsistence harvest in Kake in 1996.

The 1988 TRUCS study found that deer accounted for 24 percent of the total edible pounds of subsistence resources harvested by Kake households (Kruse and Frazier 1988). Deer accounted for 28 percent of per capita subsistence harvest by Kake residents in 1996 (ADF&G 2006).

Kake residents harvest deer on Admiralty Island and Kupreanof Island, which are included in GMU 4 and GMU 3, respectively. Deer harvest in GMU 4 is considered very high relative to other areas of Southeast Alaska, which is indicative of relatively high deer populations. Over 1997-2004, there has been no significant trend in the number of deer harvested or in the number of hunters (ADF&G 2005). Deer harvest in GMU 3 declined between 1998-2002 and increased between 2002-2004. The number of deer hunters declined between 2000-2002 and slightly increased between 2002-2004 (ADF&G 2005). As noted above, Kake's human population increased from 1970 to 1990, stayed relatively constant between 1990 and 2000, and decreased from 2000 to 2005. Kake had an estimated 2005 population of 598.

Five WAAs account for the majority (76 percent) of deer harvest by Kake Residents (Table 3.23-31). The Kake portion ranges from about 19 percent (WAA 3939) to 91 percent (WAA 5131) of the total harvest and from 21 percent to 100 percent of the rural hunter harvest in these WAAs. About 7 percent of the combined harvest in these WAAs is by non-rural hunters, suggesting that there is a small harvest buffer that could be restricted, if necessary, before restrictions are placed on rural harvests.

Table 3.23-31
Deer Harvest (1996 to 2002) and Deer Habitat Capability on NFS Lands in 2005 and After 100+ Years of Full Implementation under Each Alternative, Expressed as a Percent of 1954 Habitat Capability, for the WAAs where Kake Residents Obtain Approximately 75% of their Average Annual Deer Harvest*

	Average Deer Harvest from 1996 to 2002			Deer Habitat Capability in 2005 and after 100+ Years of Full Implementation Under Each Alternative, Expressed as a Percent of the 1954 Habitat Capability							
WAA	Kake Residents	All Rural Hunters	All Hunters	2005	Alt 1	Alt 2	Alt 3	Alt 4	Alt 5	Alt 6	Alt 7
3940	35	75	77	92	92	92	92	92	92	92	92
3939	24	114	125	100	100	100	100	100	100	100	100
5132	18	21	21	73	71	68	67	64	65	67	62
5131	15	15	17	90	86	83	83	80	81	82	79
4041	14	24	29	90	90	90	90	90	90	90	90

*Calculated based on harvest where location is known

The Deer Availability and Anticipated Demand analysis completed for the 1997 Forest Plan EIS determined that the 1997 Alternatives 2, 6, and 11, which are similar to the four highest harvest alternatives in this EIS, should be able to provide sufficient habitat capability for deer hunted in the Kake community use area by Kake residents, all rural hunters, and all hunters in the short term. In the long term, the selected alternative (Alternative 11 in the 1997 Forest Plan EIS) should be able to provide sufficient habitat capability for deer hunted in the Kake community use area by Kake residents and all rural hunters. Projected harvest for all hunters in the Kake community use area would, however, exceed 10 percent habitat capability; the level that the analysis assumed would provide a reasonably high level of hunter success for their effort.

In summary, use of most subsistence resources by Kake residents (fish and marine invertebrates) is not expected to be affected by any of the alternatives. However, subsistence use of deer in some of the WAAs hunted by Kake residents may be affected to the point that some restriction in hunting might be necessary over the long term, even under Alternative 1. The risks of this occurring are greatest under Alternative 7 because of its general lack of Non-Development LUDs within the Kake use area, and lower under the other six alternatives. The risk of hunting restrictions would be reduced somewhat, through more intensive management (e.g., thinning) of the existing and future closed-canopy, young-growth forests in this area. Indirect effects associated with increased competition for deer within Kake's subsistence use areas could also occur under all alternatives due to displacement of hunters from other communities due to timber harvest activity. The impacts are estimated to be relatively low based on the limited accessibility of these areas to non-local hunters. Three of the five WAAs of highest importance to Kake hunters (WAAs 3939, 3940, and 4041) occur at the south end of Admiralty Island. They are currently unroaded and there are no plans for future road development in these areas. This is not the case for the other two WAAs of importance to Kake hunters (WAAs 5131 and 5132), which are located surrounding or adjacent to the community of Kake on Kupreanof Island. These WAAs, which currently have total road densities of 0.4 and 2.2 miles per square mile, respectively, are projected to have long-term maximum total road densities ranging from 0.6 and 3.2 miles per square mile under Alternative 1 to 1.0 and 3.3 miles per square mile under Alternative 7, respectively (all ownerships combined).

Kasaan

Kasaan is a small village located on the eastern side of Prince of Wales Island 30 miles northwest of Ketchikan. According to the 2000 Census, Kasaan had a 2000 population of 39, with Alaska Natives comprising 38 percent of the total (U.S. Census Bureau 2001).

Originally Tlingit territory, Kasaan gets its name from the Tlingit word meaning "pretty town." Haidas migrated north from the Queen Charlotte Islands in the early 1700s to the Island and established the village known as "Old Kasaan." Between 1892 and 1900, the Copper Queen mine, camp, sawmill, post office, and store were built on Kasaan Bay, and the Haida people relocated to this new village (Alaska DCED 2006). The Haida village of Kasaan was settled at its present site in 1904 (ADF&G 1994).

Kasaan's population grew by 80 percent between 1970 and 1990. The population declined between 1990 and 2000, decreasing by 15 people or 28 percent. The population has increased since 2000, with an estimated 61 people living in Kasaan in 2005. Total estimated population was 59 in Kasaan in 2006 (Alaska DOL 2007a).

Year	1970	1980	1990	2000	2005	2006
Population	30	25	54	39	61	59

Source: USDA Forest Service 1997a; U.S. Census Bureau 2001; Alaska DOL 2007a

Most villagers participate in subsistence for supplemental food sources (Alaska DCED 2002).

Employment by industry data compiled by the Alaska DCED from the 2000 Census are summarized in the table below. This data is an extrapolation based on information from a sample of residents. Extrapolation of a small sample may have inaccuracies but should provide a general indication of distribution of employment. Approximately 20 percent of the labor force in Kasaan was identified as unemployed and seeking work in 2000, compared to 7 percent for Southeast Alaska as a whole. Median household income was $43,500, compared to a regional median of $44,118 (Alaska DCED 2002).

Employment by Industry	Number	Percent of Total
Agriculture, Forestry, Fishing & Hunting, Mining	2	13
Construction	2	13
Manufacturing	3	19
Wholesale Trade	0	0
Retail Trade	0	0
Transportation, Warehousing & Utilities	2	13
Information	0	0
Finance, Insurance, Real Estate, Rental & Leasing	0	0
Professional, Scientific, Management, Administrative & Waste Mgmt	0	0
Education, Health & Social Services	2	13
Arts, Entertainment, Recreation, Accommodation & Food Services	0	0
Other Services (Except Public Admin)	0	0
Public Administration	5	31
Total Employment	**16**	**100**

Source: Alaska DCED 2002

Please refer to the 1997 Forest Plan EIS for further details on the history, economy, and subsistence use of this community.

Kasaan is part of the North Prince of Wales community group (see Table 3.23-6). Detailed employment data are available for this community group by economic sector for 1990, 1995, and 2000 in the planning record for this EIS. Wood products employment in the North Prince of Wales community group declined by 186 jobs or 69 percent between 1990 and 1999. Wood products employment accounted for 83 jobs or 23 percent of total employment in this community group in 1999.

Potential Effects

Community Use Area

The general area commonly used or related to by many of the residents of Kasaan in their local day-to-day work, recreational, and subsistence activities is shown on Figure 3.23-15. This area contains 540,324 acres of National Forest System land (among other land ownerships). Table 3.23-32 shows how the land within this community use area would be distributed among the LUD groups by alternative. The LUD groups are explained in the introduction to Chapter 3.

Development LUDs presently account for about 47 percent of the total acreage within the Kasaan community use area. Alternatives 5 and 6 would not have a significant effect on existing LUD allocations in the community use area because the acreage by LUD group would remain the same as under the existing Forest Plan. The acreage allocated to Wilderness/National Monument LUDs would remain constant under all alternatives. The amount of acreage allocated to Mostly Natural LUDs would increase under Alternatives 1 through 3. The largest increase would occur under Alternative 1, with the acreage allocated to Mostly Natural LUDs increasing from 45 percent under Alternative 5 (No Action) to 78 percent under Alternative 1, with a commensurate reduction in development LUDs (Table 3.23-32). Alternatives 4 and 7 would increase the acreage in development LUDs. Development LUDs would account for 61 percent and 72 percent under Alternatives 4 and 7, respectively, compared to 47 percent under Alternative 5.

Total suitable acres would range from 6 percent under Alternative 1 to 24 percent under Alternative 7, compared to 13 percent of the total community use area under Alternative 5 (No Action) and Alternative 6 (Proposed Action).

Figure 3.23-15
Kasaan's Community Use Area

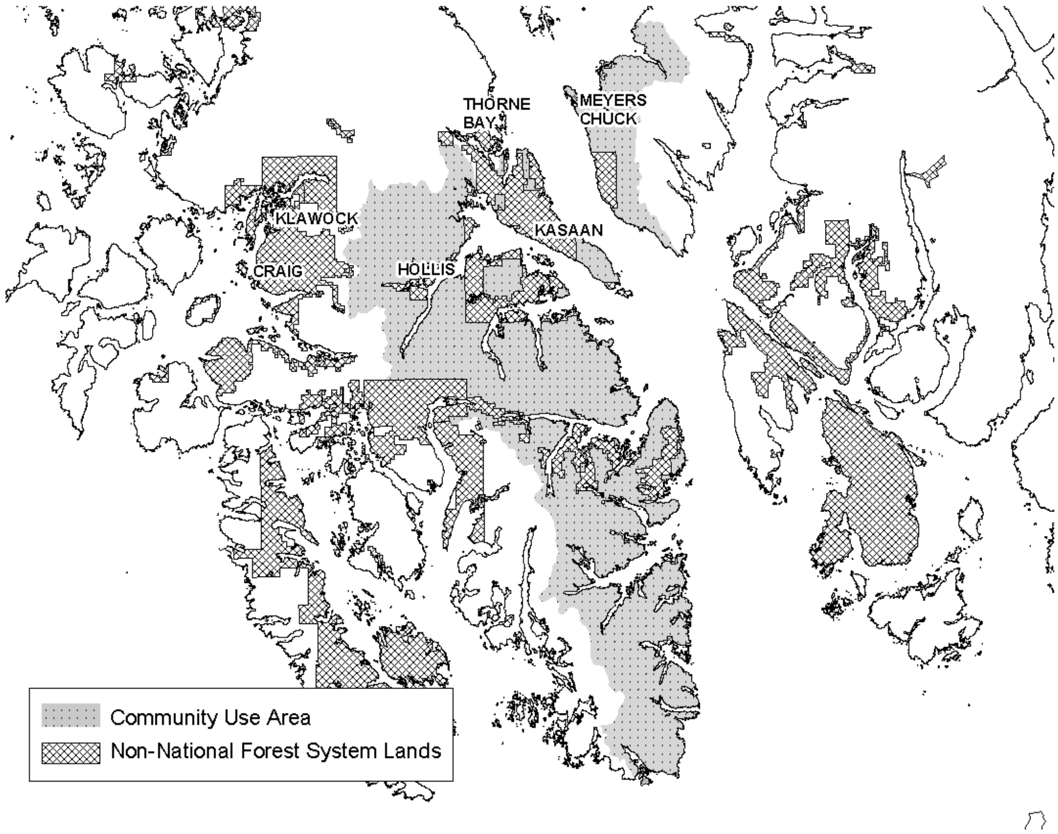


Table 3.23-32
LUD Groups in Kasaan's Community Use Area by Alternative

	Alternative						
	1	2	3	4	5	6	7
	Suitable National Forest System Acres for Timber Management						
Suitable Acres	29,928	45,137	63,693	93,428	70,810	69,888	128,100
LUD Groups	**Acres of National Forest System Land per LUD Group**						
Wilderness/National Monument	42,343	42,343	42,343	42,343	42,343	42,343	42,343
Mostly Natural	421,877	348,098	264,463	166,490	242,878	242,474	107,599
Moderate Development	22,156	42,265	45,291	85,178	53,098	51,591	106,158
Intensive Development	53,947	107,619	188,227	246,313	202,005	203,916	284,224
Total	**540,324**	**540,324**	**540,324**	**540,325**	**540,325**	**540,324**	**540,324**

[1] See the accompanying large LUD map for the distribution of existing LUDs and the Alternative Maps for the distribution of LUDs by alternative.

Economy

Subsistence use and commercial fishing are the primary elements of Kasaan's economy. Commercial fisheries employment is not likely to be affected under any of the alternatives. Much of the timber harvest in the vicinity of Kasaan is on private land owned by the Kasaan Native Corporation. This land would not be affected under any of the alternatives.

Subsistence

No significant effect on salmon, other finfish, or invertebrate habitat capability is expected from implementation of any alternative. These resources account for 74 percent of the total edible pounds of subsistence resources harvested by Kasaan households (Kruse and Frazier 1988) and 75 percent of per capita harvest in 1998 (ADF&G 2006).

The 1988 TRUCS survey found that deer account for 22 percent of the total edible pounds of subsistence resources harvested by Kasaan households (Kruse and Frazier 1988). Deer accounted for 15 percent of per capita subsistence harvest by Kasaan residents in 1998 (ADF&G 2006).

The majority of deer harvest by Kasaan residents takes place near the community on north Prince of Wales Island, which is included in GMU 2. Deer harvest and hunter effort in GMU 2 generally increased during 1997-2000 and subsequently declined during 2000-2004; however, no change has been noted in the average number of hunter-days required to harvest a deer (ADF&G 2005). As noted above, the population of Kasaan fluctuated from 1970 to 2000. From 2000 to 2005 Kasaan's population increased by 56 percent, with an estimated population of 61 in 2005.

Residents of Kasaan harvest the majority (90 percent) of their deer from WAA 1315 on north Prince of Wales Island (Table 3.23-33). The Kasaan portion makes up 1 percent of the total harvest and 2 percent of the rural hunter harvest in this WAA. About 35 percent of the harvest in this WAA is by non-rural hunters, suggesting that there is a harvest buffer that could be restricted, if necessary, before restrictions are placed on rural harvests.

Table 3.23-33
Deer Harvest (1996 to 2002) and Deer Habitat Capability on NFS Lands in 2005 and After 100+ Years of Full Implementation under Each Alternative, Expressed as a Percent of 1954 Habitat Capability, for the WAAs where Kasaan Residents Obtain Approximately 75% of their Average Annual Deer Harvest*

	Average Deer Harvest from 1996 to 2002			Deer Habitat Capability in 2005 and after 100+ Years of Full Implementation Under Each Alternative, Expressed as a Percent of the 1954 Habitat Capability							
WAA	Kasaan Residents	All Rural Hunters	All Hunters	2005	Alt 1	Alt 2	Alt 3	Alt 4	Alt 5	Alt 6	Alt 7
1315	4	175	270	55	50	49	47	44	47	47	41

*Calculated based on harvest where location is known

WAA 1315 occurs in an area with substantial past harvest and, therefore, deer habitat capabilities are currently estimated to be considerably below 1954 levels (Table 3.23-33). Under each of the alternatives, additional harvest would occur that would reduce habitat capabilities after 100+ years to 41-50 percent of 1954 levels (Table 3.23-33).

The Deer Availability and Anticipated Demand analysis completed for the 1997 Forest Plan EIS determined that the 1997 Alternatives 2, 6, and 11, which are similar to the four highest harvest alternatives in this EIS, should be able to provide sufficient habitat capability for deer hunted in the Kasaan community use area by Kasaan residents in the short term and long term. This alternative was also estimated to provide sufficient habitat for all rural hunters in the short term. Projected deer harvest for all hunters in the Kasaan community use area exceeds the level that is both sustainable and provides a reasonably high level of hunter success for their effort in the short term and long term. Projected deer harvest for all rural hunters also exceeds this level in the long term.

Kasaan is currently competing with other communities in their subsistence use areas and this is likely to continue to do so under all alternatives. Alternatives increasing access by road due to harvest activity may increase competition from other communities on Prince of Wales Island indirectly impacting Kasaan's use. An increase in access may also allow Kasaan households to increase the range of their use.

In summary, use of most subsistence resources by Kasaan residents (fish and marine invertebrates) is not expected to be affected by any of the alternatives. However, subsistence use of deer may be affected to the point that some restriction in hunting might be necessary over the long term, even under Alternative 1. The risks of this occurring are greatest under Alternative 7 because of its general emphasis on Development LUDs, and lower under the other six alternatives. The risk of hunting restrictions would be reduced somewhat, through more intensive management (e.g., thinning) of the existing and future closed-canopy, young-growth forests in this area. Indirect effects associated with increased competition for deer within Port Protection's subsistence use areas could also occur under all alternatives due to displacement of hunters from other communities due to timber harvest activity. Additional road development under the alternatives would improve access but may increase competition with other non-local hunters. The level of road development is already relatively high in this WAA. Existing open road densities are 1.5 miles per square mile and existing total road densities are 2.0 miles per square mile, respectively (all ownerships combined). Long-term (100+ years) road development would vary by alternative and would result in estimated maximum total road densities ranging from 2.7 miles per square mile in these WAAs under Alternative 1, to 2.9 miles per square mile in these WAAs under Alternative 7 (for all ownerships combined).

Ketchikan

Ketchikan is located on Revillagigedo Island near the southernmost boundary of Alaska. Ketchikan lies approximately 679 miles north of Seattle and 235 miles south of Juneau. It is the first Alaska port-of-call for northbound ships. Ketchikan Gateway Borough includes Ketchikan, Saxman, Mountain Point, Clover Pass, Ward Cove and Herring Cove, which are located on the Ketchikan road system, and Pennock Island.

According to the 2000 Census, Ketchikan Gateway Borough had a 2000 population of 14,070, with 56 percent of the population living in the city of Ketchikan. Alaska Natives make up 18 percent of the borough population (U.S. Census Bureau 2001). Native populations in 1990 varied from a high of 80 percent in Saxman to a low of less than 8 percent in the Ketchikan suburbs. Alaska Natives accounted for 66 percent of total population in Saxman in 2000. Refer to the section on Saxman for information directly relating to that community.

The Ketchikan area was a summer fishing camp for the Tlingit Alaska Natives. Their name for the area, "kitschk-him," meant "thundering wings of an eagle." Its abundant fish and timber resources eventually attracted non-Natives, with the first cannery opening in Ketchikan in 1886 and four more by 1912. Nearby gold and copper discoveries briefly brought activity to Ketchikan during the late 1890s, but timber and fishing became the chief economic forces at the turn of the century and have remained important. The 1954 construction of a pulp mill in Ward Cove continued a tradition begun by the 1903 opening of Ketchikan Spruce Mills, which operated for more than 70 years. Ketchikan has also remained an important hub for fishing, both for fish processing and as home to those with commercial fishing permits (401 area residents).

The population of Ketchikan increased by 14 percent between 1980 and 1990 and then decreased by 4 percent between 1990 and 2000. The population decreased by a further 3 percent (237 residents) between 2000 and 2005. Total estimated population was 7,662 in Ketchikan in 2006 (Alaska DOL 2007a).

Year	1970	1980	1990	2000	2005	2006
Population	6,994	7,198	8,263	7,922	7,685	7,662

Source: USDA Forest Service 1997a; U.S. Census Bureau 2001; Alaska DOL 2007a

Ketchikan is an industrial center and a major port of entry in Southeast Alaska. It has a diverse economy, supported by a large fishing fleet, fish processing facilities, timber and tourism. The estimated gross fishing earnings of local residents neared $10 million in 2000. Four canneries, three cold storage facilities, and a fish processing plant support the fishing industry in summer months. Ketchikan is a cruise ship stop and receives over 650,000 annual visitors. While the timber industry is important to the economy with the home base for several timber companies, the Ketchikan Pulp Corporation's pulp mill closed almost a decade ago, in March 1997.

Ketchikan received approximately 887,000 cruise ship visitors in 2005 and has a well-developed network and system of shore-excursions, with 47 shore excursions advertised by the various cruise lines that dock there. Most nature-based activities that originate in Ketchikan fell into four general categories: flightseeing, marine charters, adventure experiences, and general sightseeing. In all cases, the majority of clients participating in these activities were cruise ship passengers (Dugan et al. 2006).

Employment by industry data compiled by the Alaska DCED from the 2000 Census are summarized in the table below. Approximately 8 percent of the labor force in Ketchikan was identified as unemployed and seeking work in 2000, compared to 7 percent for Southeast Alaska as a whole. Median household income was $45,802, compared to a regional median of $44,118 (Alaska DCED 2002).

Employment by Industry	Number	Percent of Total
Agriculture, Forestry, Fishing & Hunting, Mining	170	4
Construction	276	7
Manufacturing	219	6
Wholesale Trade	85	2
Retail Trade	427	11
Transportation, Warehousing & Utilities	430	11
Information	93	2
Finance, Insurance, Real Estate, Rental & Leasing	229	6
Professional, Scientific, Management, Administrative & Waste Mgmt	238	6
Education, Health & Social Services	731	19
Arts, Entertainment, Recreation, Accommodation & Food Services	414	11
Other Services (Except Public Admin)	183	5
Public Administration	393	10
Total Employment	**3,888**	**100**

Source: Alaska DCED 2002

Please refer to the 1997 Forest Plan EIS for further details on the history, economy, and subsistence use of this community.

Ketchikan Gateway Borough is comprised of the Ketchikan and Revillagigideo community groups (see Table 3.23-6). Detailed employment data are available for this community group by economic sector for 1990, 1995, and 2000 in the planning record for this EIS.

Since completion of the 1997 Forest Plan EIS analysis, the Ketchikan pulp mill has closed. Closure of the mill, the community's largest employer, resulted in the loss of 500 direct jobs, many of which were high paying and year round. Employment data compiled by the Alaska DOL indicate that employment in the lumber and wood products sector declined from 11.8 percent of total wage and salary employment in 1996 to 5.7 percent in 1999 (Baker 2001). A study by the Alaska DOL found that 3 years after the mill closure about 45 percent of the laid-off workers were employed in other jobs in the Ketchikan/Prince of Wales area, about 15 percent were employed elsewhere in Alaska, and about 40 percent had left the state altogether (Landry 2001).

Gateway Forest Products opened lumber and veneer facilities on the former site of the KPC Pulp Mill in Ketchikan in 2000. Gateway Forest Products filed for bankruptcy protection in February 2002. This application was dismissed by the U.S. Bankruptcy Court in April 2002. The Ketchikan veneer mill restarted in 2007 using timber imported from British Columbia. More recently, the mill has acquired timber from a logging contractor that purchased timber from several Southeast Alaska timber sales (Brackley and Haynes, in press; Damstedt 2007).

The Pacific Log and Lumber sawmill, one of the larger remaining sawmills in Southeast Alaska is also located in Ketchikan. According to the 2006 mill survey conducted for the USDA Forest Service, this mill, which has an installed production capacity of 39.6 MMBF, processed approximately 4.2 MMBF in 2006 and employed 20 people (Juneau Economic Development Council 2007).

Approximately 21 percent of employment in the Ketchikan community group was in non-federal government. Services and retail trade accounted for 21 and 17 percent of total employment, respectively, with recreation-related activities comprising 10 percent of total employment.

Potential Effects

Community Use Area

The general area commonly used or related to by many of the residents of Ketchikan in their local day-to-day work, recreational, and subsistence activities is shown on Figure 3.23-16. This area contains 1,975,122 acres of National Forest System land (among other land ownerships). Table 3.23-34 shows how the land within this community use area would be distributed among the LUD groups by alternative. The LUD groups are explained in the introduction to Chapter 3.

Development LUDs presently account for about 21 percent of the total acreage within the Ketchikan community use area. Alternatives 5 and 6 would not have a significant effect on existing LUD allocations in the community use area because the acreage by LUD group would remain the same as under the existing Forest Plan. The acreage allocated to Wilderness/National Monument LUDs would remain constant under all alternatives. The amount of acreage allocated to Mostly Natural LUDs would increase under Alternatives 1 through 3. The largest increase would occur under Alternative 1, with the acreage allocated to Mostly Natural LUDs increasing from 31 percent under Alternative 5 (No Action) to 48 percent under Alternative 1, with a commensurate reduction in development LUDs (Table 3.23-34). Alternatives 4 and 7 would increase the acreage in development LUDs. Development LUDs would account for 32 percent and 33 percent under Alternatives 4 and 7, respectively, compared to 21 percent under Alternative 5.

Figure 3.23-16
Ketchikan's Community Use Area

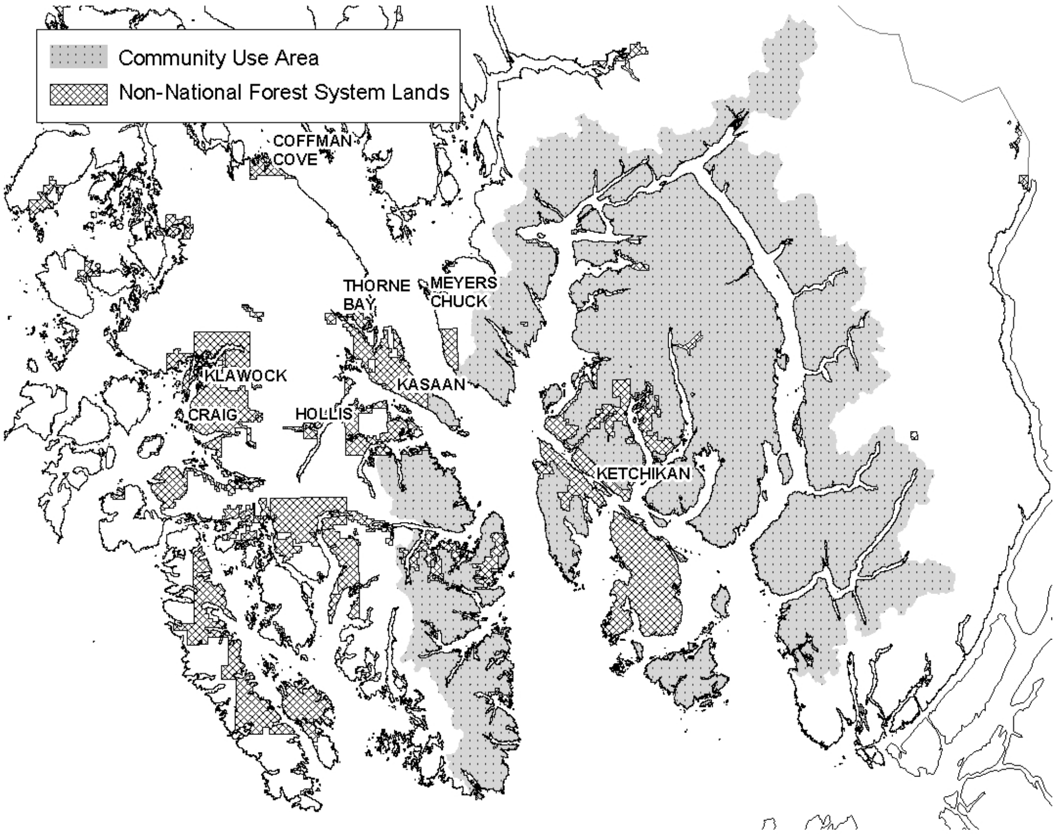


Table 3.23-34
LUD Groups in Ketchikan's Community Use Area by Alternative

	Alternative						
	1	**2**	**3**	**4**	**5**	**6**	**7**
	Suitable National Forest System Acres for Timber Management						
Suitable Acres	47,897	90,739	111,299	176,699	127,271	124,987	204,834
LUD Groups	**Acres of National Forest System Land per LUD Group**						
Wilderness/National Monument	934,620	934,619	934,619	934,616	934,620	934,619	934,619
Mostly Natural	943,733	764,232	665,107	417,910	618,698	615,905	396,436
Moderate Development	36,231	82,362	88,211	187,083	100,554	97,706	199,418
Intensive Development	60,538	193,909	287,185	435,514	321,252	326,892	444,655
Total	**1,975,122**	**1,975,122**	**1,975,122**	**1,975,123**	**1,975,123**	**1,975,122**	**1,975,129**

[1] See the accompanying large LUD map for the distribution of existing LUDs and the Alternative Maps for the distribution of LUDs by alternative.

Total suitable acres would range from 2 percent under Alternative 1 to 10 percent under Alternative 7, compared to 6 percent of the total community use area under Alternative 5 (No Action) and Alternative 6 (Proposed Action).

Economy

Ketchikan would be primarily influenced by changes in timber processing, recreation and tourism use, commercial fishing, and recreation opportunities, as well as potential restrictions on transportation and utility projects.

Pacific Log and Lumber had approximately 43 MMBF under contract in August 2006. In addition, 24.5 MMBF is presently under contract with Alcan Forest Products, who are located in Ketchikan, but do not operate a facility there. Approximately 75 percent (32.1 MMBF) of the volume under contract with Pacific Log and Lumber could potentially be affected under Alternative 1, which would maintain all Inventoried Roadless Areas on the Tongass in a natural condition and not permit timber harvest in these areas. Alternative 1 would also affect 62 percent (15.2 MMBF) of volume under contract with Alcan Forest Products. None of the other alternatives would affect this volume. These data provide an indication of potential impacts, actual impacts would depend on the volume that is under contract when the decision is implemented and whether potentially affected existing sales were cancelled as part of the decision.

Recreation and tourism have become increasingly important to the economy of Ketchikan, with more than 650,000 cruise ship passengers visiting Ketchikan annually. Ketchikan is also the stopover point for visitors traveling to Misty Fiords and Prince of Wales Island.

Commercial fisheries employment is not likely to be affected under any of the alternatives.

Subsistence

Ketchikan is not classified as a subsistence community; however, many residents use the surrounding Tongass for hunting and fishing. Ketchikan Gateway Borough is the second largest community in Southeast Alaska and accounted for 19 percent of the region's population in 2005, with an estimated total of 13,125 residents. Given the non-subsistence status of the community and its large size, no attempt is made here to summarize the WAAs that community residents use to hunt deer. The following paragraphs do, however, summarize the findings of the 1997 EIS and provide a general overview of the likely impacts of the current alternatives.

The majority of deer harvest by Ketchikan residents likely takes place within the community's identified use area (Figure 3.23-16), which is mainly located within GMU 1A and GMU 2. Deer harvest in GMU 1A generally declined from 1997 to 2004, with the number of hunters and hunter effort also decreasing over this period (ADF&G 2005). Deer harvest in GMU 2 generally increased between 1997 and 2000 and subsequently declined between 2001 and 2004. The average number of days required to harvest a deer, however, remained constant across the entire period (ADF&G 2005).

The Deer Availability and Anticipated Demand analysis completed for the 1997 Forest Plan EIS determined that the 1997 Alternatives 2, 6, and 11, which are similar to the four highest harvest alternatives in this EIS, should be able to provide sufficient habitat capability for deer hunted by all hunters in the short term. However, projected deer harvest in the long term by rural hunters and Ketchikan residents and all hunters exceeds the level that is both sustainable and provides a reasonably high level of hunter success for their effort. If a restriction were necessary, sport hunting by Ketchikan residents would be restricted before subsistence hunting by rural hunters is restricted.

In summary, use of most subsistence resources by Ketchikan residents (fish and marine invertebrates) is not expected to be affected by any of the alternatives. However, subsistence use of deer may be affected to the point that some restriction in hunting might be necessary over the long term, even under Alternative 1. The risks of this occurring are greatest under Alternative 7, and second highest under Alternative 4 because of its lower use of Non-Development LUDs than the other alternatives. Alternatives 1, 2, and 3 would have the lowest risk and Alternatives 5 and 6 would be intermediate.

Klawock

Klawock is located on the west coast of Prince of Wales Island, across from Klawock Island, approximately 56 air miles from Ketchikan. It is connected by road to Craig and to other communities on the Prince of Wales Island road system. According to the 2000 Census, Klawock had a 2000 population of 854, with Alaska Natives comprising 51 percent of the total (U.S. Census Bureau 2001).

The mouth of the Klawock River, where the village of Klawock is now located, has been the site of Tlingit occupation for at least the past 600 years. According to oral history, some members of the Kuiu *kwaan* of Kuiu Island moved to Klawock as well (ADF&G 1994). Klawock is now the center of the Tlingit population on west Prince of Wales Island.

The history of Klawock is closely tied to the fishing industry. A trading post and salmon saltery were established in 1868, and the first cannery in Alaska was built here by a San Francisco firm in 1878. A hatchery for red salmon operated at Klawock Lake between 1897 and 1917 (Alaska DCED 2006). In 1929, Klawock incorporated as a first class city. The community has a local Fish and Game Advisory Committee (ADF&G 1994).

The community has been historically dependent on fishing and cannery operations. The timber industry increased in importance in recent years with a relatively large number of residents employed in logging and ship loading in the Klawock and Craig area (Alaska DCED, 2002). Viking Lumber, one of the larger sawmills presently operating in the region, is located between Klawock and Craig. According to the 2006 mill survey conducted for the USDA Forest Service, this mill, which has an installed production capacity of 80 MMBF, processed approximately 19 MMBF in 2006 and employed 42 people (Juneau Economic Development Council 2007).

A total of 47 residents hold commercial fishing permits.

Retail trade and services have become increasingly important to the economy of Klawock. Many residents of communities on northern Prince Wales, as well as recreationists and tourists shop at the shopping center located in Klawock. Klawock has a new airport that has the capacity to accommodate large jet aircraft. The new airport is currently not in commercial operation.

Klawock's population, which more than tripled between 1970 and 1990, increased by 132 people or 18 percent between 1990 and 2000. The population decreased by 74 people or 9 percent between 2000 and 2005. Total estimated population was 776 in Klawock in 2006 (Alaska DOL 2007a).

Year	1970	1980	1990	2000	2005	2006
Population	213	318	722	854	780	776

Source: USDA Forest Service 1997a; U.S. Census Bureau 2001.; Alaska DOL 2007a

Historically, the Klawock economy has been dependent on fishing and cannery operations. The cannery operations were closed in the late 1980's and the timber industry has become increasingly important. Sealaska's logging operation, through a contract with Shaan-Seet, Inc., is the largest employer. The City and school district are also significant employers. The state operates a salmon hatchery on Klawock Lake to maintain the local salmon fisheries (Alaska DCED 2002).

Employment by industry data compiled by the Alaska DCED from the 2000 Census are summarized in the table below. Approximately 16 percent of the labor force in Klawock was identified as unemployed and seeking work in 2000, compared to 7 percent for Southeast Alaska as a whole. Median household income was $35,000, compared to a regional median of $44,118 (Alaska DCED 2002).

Please refer to the 1997 Forest Plan EIS for further details on the history, economy, and subsistence use of this community.

Klawock is part of the Central Prince of Wales community group (see Table 3.23-6). Detailed employment data are available for this community group by economic sector for 1990, 1995, and 2000 in the planning record for this EIS.

Employment by Industry	Number	Percent of Total
Agriculture, Forestry, Fishing & Hunting, Mining	50	13
Construction	41	11
Manufacturing	24	6
Wholesale Trade	13	3
Retail Trade	75	20
Transportation, Warehousing & Utilities	17	5
Information	5	1
Finance, Insurance, Real Estate, Rental & Leasing	6	2
Professional, Scientific, Management, Administrative & Waste Mgmt	4	1
Education, Health & Social Services	53	14
Arts, Entertainment, Recreation, Accommodation & Food Services	28	8
Other Services (Except Public Admin)	32	9
Public Administration	24	6
Total Employment	**372**	**100**

Source: Alaska DCED 2002

Potential Effects

Community Use Area

The general area commonly used or related to by many of the residents of Klawock in their local day-to-day work, recreational, and subsistence activities is shown on Figure 3.23-17. This area contains 767,934 acres of National Forest System land (among other land ownerships). Table 3.23-35 shows how the land within this community use area would be distributed among the LUD groups by alternative. The LUD groups are explained in the introduction to Chapter 3.

Development LUDs presently account for about 55 percent of the total acreage within the Klawock community use area. Alternatives 5 and 6 would not have a significant effect on existing LUD allocations in the community use area because the acreage by LUD group would remain largely the same as under the existing Forest Plan. The acreage allocated to Wilderness/National Monument LUDs would remain constant under all alternatives. The amount of acreage allocated to Mostly Natural LUDs would increase under Alternatives 1 through 3. The largest increase would occur under Alternative 1, with the acreage allocated to Mostly Natural LUDs increasing from 39 percent under Alternative 5 (No Action) to 63 percent under Alternative 1, with a commensurate reduction in development LUDs (Table 3.23-35). Alternatives 4 and 7 would increase the acreage in development LUDs. Development LUDs would account for 64 percent and 72 percent under Alternatives 4 and 7, respectively, compared to 55 percent under Alternative 5.

Total suitable acres would range from 15 percent under Alternative 1 to 28 percent under Alternative 7, compared to 20 percent of the total community use area under Alternative 5 (No Action).

Figure 3.23-17
Klawock's Community Use Area

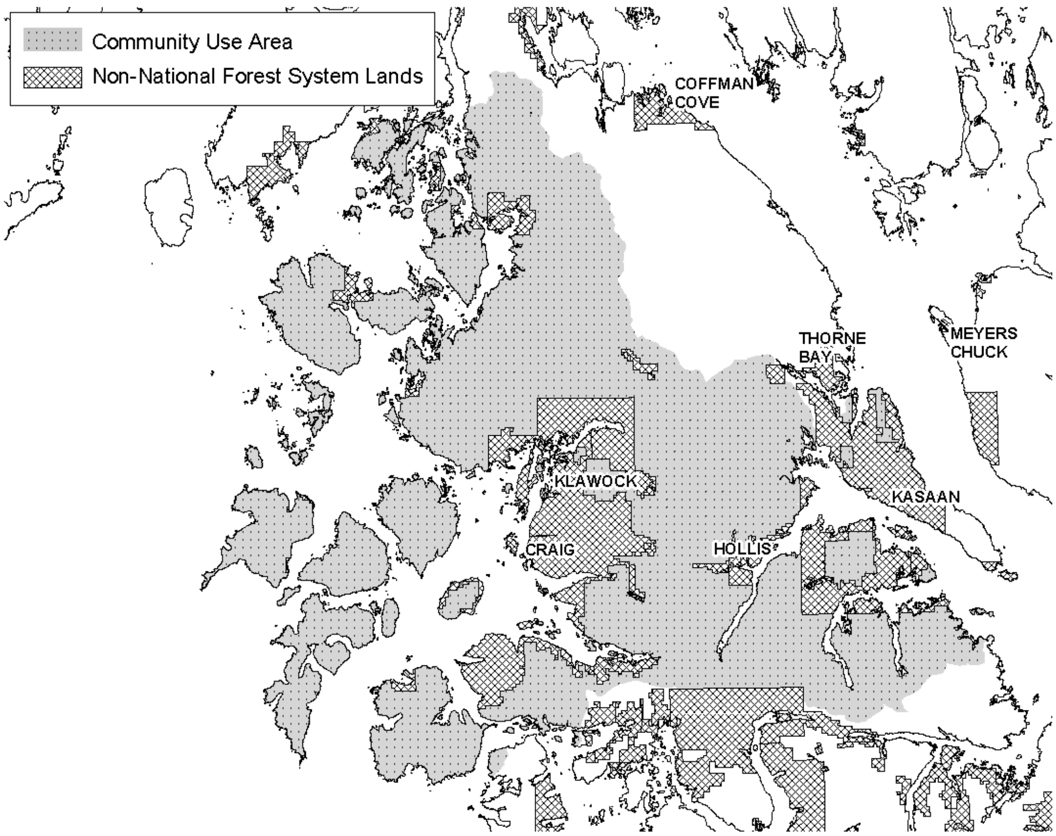


Table 3.23-35
LUD Groups in Klawock's Community Use Area by Alternative

	Alternative						
	1	2	3	4	5	6	7
	Suitable National Forest System Acres for Timber Management						
Suitable Acres	113,371	132,673	147,957	170,424	153,413	149,162	212,194
LUD Groups	**Acres of National Forest System Land per LUD Group**						
Wilderness/National Monument	45,518	45,518	45,518	45,518	45,518	45,518	45,518
Mostly Natural	479,982	386,022	314,182	229,123	302,146	308,274	166,626
Moderate Development	42,759	59,597	71,035	86,288	76,686	74,907	100,174
Intensive Development	198,674	275,797	336,201	406,006	342,585	338,235	454,615
Total	**766,933**	**766,933**	**766,935**	**766,935**	**766,934**	**766,933**	**766,934**

[1] See the accompanying large LUD map for the distribution of existing LUDs and the Alternative Maps for the distribution of LUDs by alternative.

Economy
Klawock is a traditional native community. Timber employment, subsistence use, and retail services are most likely to be affected in this community. Viking Lumber one of the larger remaining sawmills in the region is located between Craig and Klawock.

Viking Lumber had 27 MMBF under contract in August 2006. Approximately 17 percent (4.6 MMBF) of this volume could be potentially affected under Alternative 1, which would maintain all Inventoried Roadless Areas on the Tongass in a natural condition and not permit timber harvest in these areas. None of the other alternatives would affect this volume. These data provide an indication of potential impacts, actual impacts would depend on the volume that is under contract when the decision is implemented and whether potentially affected existing sales were cancelled as part of the decision.

Subsistence
No significant effect on salmon, other finfish, or invertebrate habitat capability is expected from implementation of any alternative. These resources account for 75 percent of the total edible pounds of subsistence resources harvested by Klawock households (Kruse and Frazier 1988). Marine resources (fish and marine invertebrates) accounted for 69 percent of per capita subsistence harvest in Klawock in 1997. The 1988 TRUCS study found that deer accounted for 19 percent of the total edible pounds of subsistence resources harvested by Klawock households (Kruse and Frazier 1988). Deer accounted for 15 percent of per capita subsistence harvest by Klawock residents in 1997 (ADF&G 2006).

Klawock residents mainly harvest deer on north Prince of Wales Island, which is included in GMU 2. Deer harvest and hunter effort in GMU 2 generally increased during 1997-2000 and subsequently declined during 2000-2004; however, no change has been noted in the average number of hunter-days required to harvest a deer (ADF&G 2005). As noted above, the human population of Klawock increased steadily from 1970 to 2000, but decreased by an estimated 9 percent between 2000 and 2005. Klawock had an estimated population of 78 in 2005.

Residents of Klawock harvest the majority (75 percent) of their deer from six WAAs in north Prince of Wales Island (Table 3.23-36). The Klawock portion represents from about 4 percent (WAA 1315) to 31 percent (WAA 1318) of the total harvest and about 6 percent to 37 percent of the rural hunter harvest in these WAAs. About 33 percent of the combined harvest in these WAAs is by non-rural hunters, suggesting that there is a limited harvest buffer that could be restricted, if necessary, before restrictions are placed on rural harvests.

Most of the WAAs identified in Table 3.23-36 occur in areas with substantial past harvest and, therefore, deer habitat capabilities are currently estimated to be below 1954 levels. Under each of the alternatives, additional harvest would occur that would reduce habitat capabilities after 100+ years to 64-85 percent of 1954 levels in WAA 1318 and 41-50 percent in WAA 1315.

The Deer Availability and Anticipated Demand analysis completed for the 1997 Forest Plan EIS determined that the 1997 Alternatives 2, 6, and 11, which are similar to the four highest harvest alternatives in this EIS, should be able to provide sufficient habitat capability for deer hunted by Klawock residents in the short term and long term. Projected deer harvest for all rural and for all hunters was estimated to exceed the level that the analysis assumed would provide a reasonably high level of hunter success for their effort in both the short term and long term. At some point a restriction in hunting may be necessary.

Table 3.23-36
Deer Harvest (1996 to 2002) and Deer Habitat Capability on NFS Lands in 2005 and After 100+ Years of Full Implementation under Each Alternative, Expressed as a Percent of 1954 Habitat Capability, for the WAAs where Klawock Residents Obtain Approximately 75% of their Average Annual Deer Harvest*

	Average Deer Harvest from 1996 to 2002			Deer Habitat Capability in 2005 and after 100+ Years of Full Implementation Under Each Alternative, Expressed as a Percent of the 1954 Habitat Capability							
WAA	Klawock Residents	All Rural Hunters	All Hunters	2005	Alt 1	Alt 2	Alt 3	Alt 4	Alt 5	Alt 6	Alt 7
1318	73	198	234	92	85	78	76	66	72	75	64
1422	50	209	300	60	50	48	47	46	47	47	43
1529	25	122	226	73	63	61	60	56	59	59	50
1420	14	151	231	52	43	42	40	39	40	40	36
1315	11	175	270	55	50	49	47	44	47	47	41
1214	10	53	91	79	70	66	65	62	64	64	53

*Calculated based on harvest where location is known

In summary, use of most subsistence resources by Klawock residents (fish and marine invertebrates) is not expected to be affected by any of the alternatives. However, subsistence use of deer may be affected to the point that some restriction in hunting might be necessary over the long term, even under Alternative 1. The risks of this occurring are greatest under Alternative 7 because of its low level of Non-Development LUDs throughout most of Prince of Wales Island, and second highest under Alternative 4 because of its lower use of Non-Development LUDs than the other alternatives. Alternatives 1, 2, and 3 would have the lowest risk and Alternatives 5 and 6 would be intermediate. The risk of hunting restrictions would be reduced somewhat, through more intensive management (e.g., thinning) of the existing and future closed-canopy, young-growth forests in this area. Indirect effects associated with increased competition for deer within the Klawock subsistence use areas could also occur under all alternatives due to displacement of hunters from other communities due to timber harvest activity. Additional road development under the alternatives would improve access but may increase competition with other non-local hunters. The level of road development is already relatively high in these WAAs. For example, for the three WAAs with the highest deer harvest by Klawock residents, existing open road densities range from 0.9 to 1.9 miles per square mile and existing total road densities range from 1.5 to 1.9 miles per square mile (all ownerships combined). Long-term (100+ years) road development in these three WAAs would vary by alternative and would result in estimated maximum total road densities ranging from 1.7 to 2.8 miles per square mile under Alternative 1, to 2.0 to 3.0 miles per square mile under Alternative 7 (for all ownerships combined).

Metlakatla

Metlakatla is located on Annette Island, 15 miles south of Ketchikan. According to the 2000 Census, Metlakatla had a 2000 population of 1,375, with Alaska Natives comprising 82 percent of the total (U.S. Census Bureau 2001).

Metlakatla, which is believed to have been occupied at one time by Tlingit Indians, was settled in 1887 by Church of England minister William Duncan and about 830 Tsimshian followers from northern British Columbia. In 1891, an Act of Congress declared Annette Island an Indian Reservation (the Annette Island Reserve), the only one in Alaska. This action set aside the reservation for the exclusive use and occupancy by “Metlakatla Indians and such other Natives of Alaska who might join them” (ADF&G 1994).

Metlakatla is a traditional Tsimshian community with a subsistence lifestyle. The community was not part of ANCSA. The 86,000-acre Island reservation and surrounding 3,000 feet of coastal waters are not subject to State jurisdiction. The Annette Island Reserve regulates commercial fishing in these waters, and operates its own tribal court system (Alaska DCED 2006). The community participates in regional fish and game management issues (ADF&G 1994).

Non-federal government was the largest employer in the Metlakatla community group in 1999, accounting for 322 jobs or 68 percent of total employment. Wood products employment, which decreased by 60 percent (56 jobs) between 1990 and 1999, accounted for 40 jobs or 9 percent of total employment in 1999. These jobs were all in the sawmill sector. The two sawmills located in Metlakatla, Annette Island Sawmill and Metlakatla Forest Products, were both idle in 2005 and are not expected to reopen. A total of 49 residents hold commercial fishing permits.

The population of Metlakatla, which increased by a third between the 1980 and 1990 census, saw a 2 percent decline between 1990 and 2000. The population declined by an estimated 33 people—a further 2 percent—between 2000 and 2005. Total estimated population was 1,377 in Metlakatla in 2006 (Alaska DOL 2007a).

Year	**1970**	**1980**	**1990**	**2000**	**2005**	**2006**
Population	1,050	1,056	1,407	1,375	1,342	1,377

Source: USDA Forest Service 1997a; U.S. Census Bureau 2001; Alaska DOL 2007a

Metlakatla is a federal Indian reservation with no local taxes. The economy is based primarily on the fishing and wood products industry. Metlakatla Indian Community, the largest employer, operates a salmon hatchery on Tamgas Creek, the tribal court, and all local services. Annette Island Packing Co. is a cold storage facility in Metlakatla owned by the community (Alaska DCED 2002).

Employment by industry data compiled by the Alaska DCED from the 2000 Census are summarized in the table below. Approximately 21 percent of the labor force in Metlakatla was identified as unemployed and seeking work in 2000, compared to 7 percent for Southeast Alaska as a whole. Median household income was $43,516, compared to a regional median of $44,118 (Alaska DCED 2002).

Employment by Industry	**Number**	**Percent of Total**
Agriculture, Forestry, Fishing & Hunting, Mining	36	7
Construction	54	11
Manufacturing	41	8
Wholesale Trade	3	1
Retail Trade	44	9
Transportation, Warehousing & Utilities	42	8
Information	4	1
Finance, Insurance, Real Estate, Rental & Leasing	13	3
Professional, Scientific, Management, Administrative & Waste Mgmt	12	2
Education, Health & Social Services	149	30
Arts, Entertainment, Recreation, Accommodation & Food Services	19	4
Other Services (Except Public Admin)	8	2
Public Administration	76	15
Total Employment	**501**	**100**

Source: Alaska DCED 2002

Please refer to the 1997 Forest Plan EIS for further details on the history, economy, and subsistence use of this community.

Metlakatla is part of the Metlakatla community group (see Table 3.23-6). Detailed employment data are available for this community group by economic sector for 1990, 1995, and 2000 in the planning record for this EIS. Non-federal government and retail trade were the main employers in the Metlakatla community group in 1999, accounting for 68 and 10 percent of total employment, respectively.

Potential Effects

Community Use Area

The general area commonly used or related to by many of the residents of Metlakatla in their local day-to-day work, recreational, and subsistence activities is shown on Figure 3.23-18. This area contains 1,975,123 acres of National Forest System land (among other land ownerships). Table 3.23-37 shows how the land within this community use area would be distributed among the LUD groups by alternative. The LUD groups are explained in the introduction to Chapter 3.

Figure 3.23-18
Metlakatla's Community Use Area

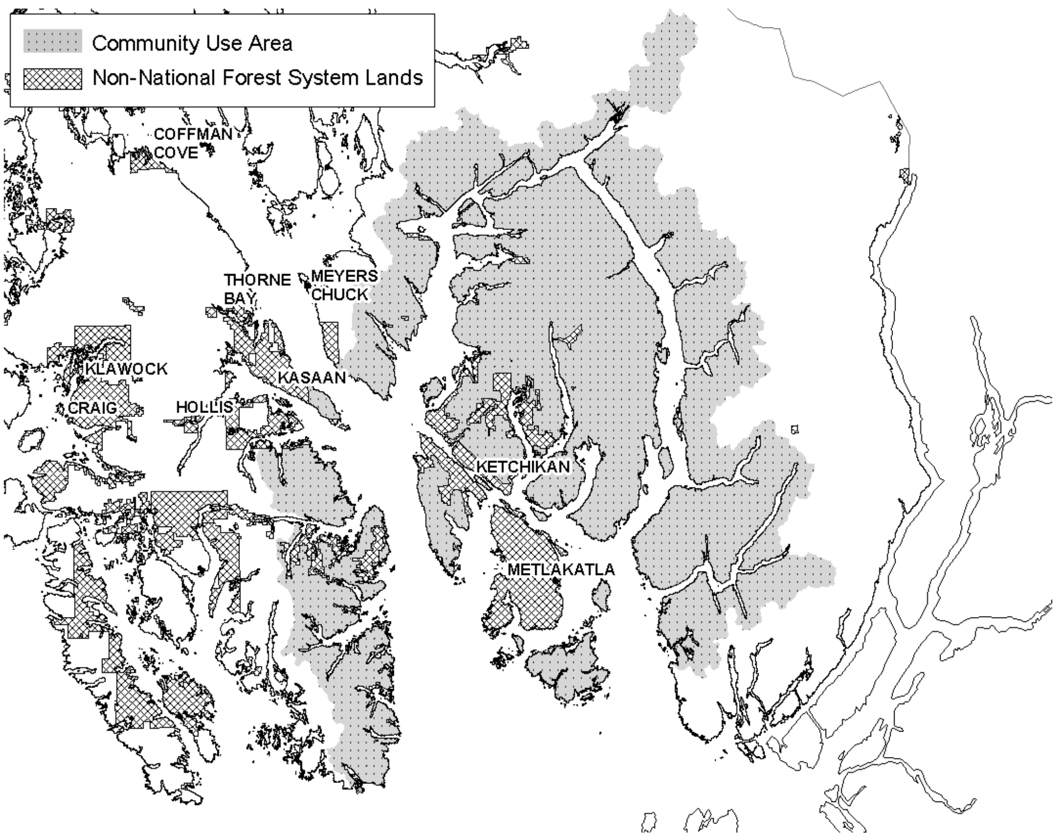


Table 3.23-37
LUD Groups in Metlakatla's Community Use Area by Alternative

	Alternative						
	1	2	3	4	5	6	7
	Suitable National Forest System Acres for Timber Management						
Suitable Acres	47,897	90,739	111,299	176,699	127,271	124,987	204,834
LUD Groups	**Acres of National Forest System Land per LUD Group**						
Wilderness/National Monument	934,620	934,619	934,619	934,616	934,620	934,619	934,619
Mostly Natural	943,733	764,232	665,107	417,910	618,698	615,905	396,436
Moderate Development	36,231	82,362	88,211	187,083	100,554	97,706	199,418
Intensive Development	60,538	193,909	287,185	435,514	321,252	326,892	444,655
Total	**1,975,122**	**1,975,122**	**1,975,122**	**1,975,123**	**1,975,123**	**1,975,122**	**1,975,129**

[1] See the accompanying large LUD map for the distribution of existing LUDs and the Alternative Maps for the distribution of LUDs by alternative.

Development LUDs presently account for about 21 percent of the total acreage within the Metlakatla community use area. Alternatives 5 and 6 would not have a significant effect on existing LUD allocations in the community use area because the acreage by LUD group would remain the same as under the existing Forest Plan. The acreage allocated to Wilderness/National Monument LUDs would remain constant under all alternatives. The amount of acreage allocated to Mostly Natural LUDs would increase under Alternatives 1 and 2. The largest increase would occur under Alternative 1, with the acreage allocated to Mostly Natural LUDs increasing from 31 percent under Alternative 5 (No Action) to 48 percent under Alternative 1, with a commensurate reduction in development LUDs (Table 3.23-37). Alternatives 4 and 7 would increase the acreage in development LUDs. Development LUDs would account for 32 percent and 33 percent under Alternatives 4 and 7, respectively, compared to 21 percent under Alternative 5.

Total suitable acres would range from 2 percent under Alternative 1 to 10 percent under Alternative 7, compared to 6 percent of the total community use area under Alternative 5 (No Action) and Alternative 6 (Proposed Action).

Economy

Metlakatla could be affected primarily by changes in commercial fishing, timber processing, and subsistence opportunities.

Commercial fisheries employment is not likely to be affected under any of the alternatives. As noted above, the two sawmills in Metlakatla are presently idle and not expected to re-open. Alternatives 1 and 2 would provide sufficient volume to support the existing Southeast Alaska sawmills operating at their current production levels. The sawmills in Metlakatla would be unlikely to re-open under these alternatives.

Subsistence

No significant effect on salmon, other finfish, or invertebrate habitat capability is expected from implementation of any alternative. These resources account for 75 percent of the total edible pounds of subsistence resources harvested by Metlakatla households (Kruse and Frazier 1988). Marine resources (fish and marine invertebrates) accounted for 75 percent of per capita subsistence harvest in Metlakatla in 1987.

The 1988 TRUCS study found that deer account for 15 percent of the total edible pounds of subsistence resources harvested by Metlakatla households (Kruse and Frazier 1988). Deer accounted for 15 percent of per capita subsistence harvest by Metlakatla residents in 1987 (ADF&G 2006).

The majority of deer harvest by Metlakatla residents occurs in the vicinity of the community in GMU 1A and on north Prince of Wales Island in GMU 2. Deer harvest in GMU 1A generally declined from 1997 to 2004, with the number of hunters and hunter effort also decreasing over this period (ADF&G 2005). Deer harvest in GMU 2 generally increased between 1997 and 2000 and subsequently declined between 2001 and 2004. The average number of days required to harvest a deer, however, remained constant across the entire period (ADF&G 2005). As noted above, the human population of Metlakatla increased from 1970 to 1990, declined from 1990 to 2000, and declined a further estimated 2 percent from 2000 to 2005. Metlakatla had an estimated population of 1,342 in 2005.

The majority (70 percent) of deer harvest by Metlakatla residents takes place in three WAAs located in the vicinity of the community (WAAs 101, 202, and 405) (Table 3.23-38). Metlakatla residents account for 100 percent of rural harvest in these WAAs and from 33 percent to 90 percent of total harvest. The other WAA identified as important to Metlakatla residents in Table 3.23-38, is located on north Prince of Wales Island. Metlakatal residents account for just 2 percent of rural harvest in this area. About 60 percent of the combined harvest in these WAAs is by non-rural hunters, suggesting that there is a harvest buffer that could be restricted, if necessary, before restrictions are placed on rural harvests.

Table 3.23-38
Deer Harvest (1996 to 2002) and Deer Habitat Capability on NFS Lands in 2005 and After 100+ Years of Full Implementation under Each Alternative, Expressed as a Percent of 1954 Habitat Capability, for the WAAs where Metlakatla Residents Obtain Approximately 75% of their Average Annual Deer Harvest*

	Average Deer Harvest from 1996 to 2002			Deer Habitat Capability in 2005 and after 100+ Years of Full Implementation Under Each Alternative, Expressed as a Percent of the 1954 Habitat Capability							
WAA	Metlakatla Residents	All Rural Hunters	All Hunters	2005	Alt 1	Alt 2	Alt 3	Alt 4	Alt 5	Alt 6	Alt 7
101	16	16	99	94	94	89	87	86	86	86	85
202	8	8	12	0	0	0	0	0	0	0	0
405	3	3	31	83	80	74	73	73	74	73	71
1529	3	122	226	73	63	61	60	56	59	59	50

*Calculated based on harvest where location is known

The Deer Availability and Anticipated Demand analysis completed for the 1997 Forest Plan EIS determined that the 1997 Alternatives 2, 6, and 11, which are similar to the four highest harvest alternatives in this EIS, should be able to provide sufficient habitat capability for deer hunted in the Metlakatla community use area by Metlakatla residents, all rural hunters, and all hunters in both the long term and short term.

In summary, use of most subsistence resources by Metlakatla residents (fish and marine invertebrates) is not expected to be affected by any of the alternatives. However, subsistence use of deer may be affected to the point that some restriction in hunting might be necessary over the long term, even under Alternative 1. The risks of this occurring are greatest under Alternative 7 because of its overall emphasis on Development LUDs, and lower under the other six alternatives. The risk of hunting restrictions would be reduced somewhat, through more intensive management (e.g., thinning) of the existing and future closed-canopy, young-growth forests in this area. The two WAAs of highest importance to Metlakatla hunters have existing open and total road densities ranging from less than 0.1 to 0.8 mile per square mile (for all ownerships combined). Long-term (100+ years) road development would vary by alternative and would result in estimated maximum total road densities ranging from 0.2 to 2.3 miles per square mile in these WAAs under

Alternative 1, to 0.5 to 2.3 miles per square mile in these WAAs under Alternative 7 (for all ownerships combined); however, the contribution of Tongass lands to these projected road densities is relatively small.

Meyers Chuck

Meyers Chuck is a small fishing village on the northwest tip of Cleveland Peninsula, 40 miles northwest of Ketchikan. According to the 2000 Census, Meyers Chuck had a 2000 population of 21, none of whom were Alaska Native (U.S. Census Bureau 2001).

Beginning as a protected anchorage for fishing vessels, Meyers Chuck grew with the building of a cannery in Union Bay in 1916. Postal service began in 1922. Fishing and fish processing, and support services sustained the community until the mid-1900s. Fishing and fish processing are still the basic sources of income in the community.

Meyers Chuck's population was the same in 1990 as it was in 1970, but declined by 16 residents, or 43 percent, between 1990 and 2000. The population declined by a further 6 people or 29 percent between 2000 and 2005. Total estimated population was 11 in Meyers Chuck in 2006 (Alaska DOL 2007a).

Year	1970	1980	1990	2000	2005	2006
Population	37	50	37	21	15	11

Source: USDA Forest Service, 1997a; U.S. Census Bureau, 2001; Alaska DOL, 2007a

The Meyers Chuck economy is primarily based on fishing with five residents (25 percent of the population) holding commercial fishing licensees. Due to the relatively few cash opportunities, many residents depend on subsistence activities (Alaska DCED, 2002).

Employment by industry data for Meyers Chuck is not included because it was based on a very small sample size and may not be a good indicator of the economy as a whole. The 2000 U.S. Census identified 3 people as employed in a potential workforce of 13 residents. While no adults in Meyers Chuck were identified as unemployed and seeking work in 2000, 77 percent of the population was identified as unemployed and not seeking work. Median household income was $64,375 compared to a regional median of $44,118 (Alaska DCED, 2002).

Please refer to the 1997 Forest Plan EIS for further details on the history, economy, and subsistence use of this community.

Meyers Chuck is part of the Cleveland Peninsula community group (see Table 3.23-6). Detailed employment data are available for this community group by economic sector for 1990, 1995, and 2000 in the planning record.

Potential Effects

Community Use Area

The general area commonly used or related to by many of the residents of Meyers Chuck in their local day-to-day work, recreational, and subsistence activities is shown on Figure 3.23-19. This area contains 380,308 acres of National Forest System land (among other land ownerships). Table 3.23-39 shows how the land within this community use area would be distributed among the LUD groups by alternative. The LUD groups are explained in the introduction to Chapter 3.

Development LUDs presently account for 30 percent of the total acreage within the Meyers Chuck community use area. Alternatives 5 and 6 would not have a significant effect on existing LUD allocations in the community use area because the acreage by LUD group would remain the same as under the existing Forest Plan. The acreage allocated to Wilderness/National Monument LUDs would remain constant under all alternatives. The amount of acreage allocated to Mostly Natural LUDs would increase under Alternatives 1 through 3. The largest increase would

Figure 3.23-19
Meyers Chuck's Community Use Area

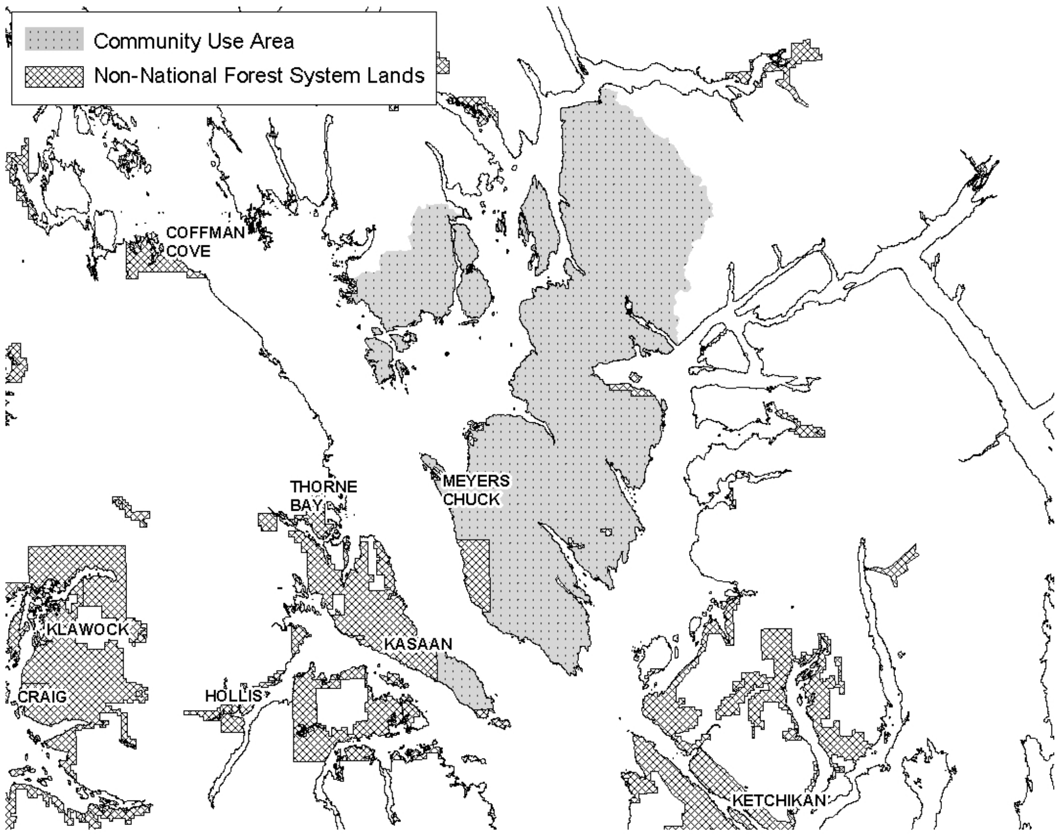


Table 3.23-39
LUD Groups in Meyers Chuck's Community Use Area by Alternative

	Alternative						
	1	2	3	4	5	6	7
	Suitable National Forest System Acres for Timber Management						
Suitable Acres	0	2,222	11,711	56,183	31,849	31,259	78,597
LUD Groups	**Acres of National Forest System Land per LUD Group**						
Wilderness/National Monument	48,596	48,596	48,596	48,596	48,596	48,596	48,596
Mostly Natural	329,712	324,174	281,769	134,504	214,661	212,167	89,166
Moderate Development	0	2,191	19,138	69,814	33,310	32,295	92,573
Intensive Development	0	3,348	28,805	125,413	81,742	85,251	147,974
Total	**378,308**	**378,308**	**378,308**	**378,327**	**378,308**	**378,308**	**378,308**

[1] See the accompanying large LUD map for the distribution of existing LUDs and the Alternative Maps for the distribution of LUDs by alternative.

occur under Alternatives 1, with the acreage allocated to Mostly Natural LUDs increasing from 56 percent under Alternative 5 (No Action) to 87 percent, with a commensurate reduction in development LUDs (Table 3.23-39). Alternatives 4 and 7 would increase the acreage in development LUDs. Development LUDs would account for 52 percent and 64 percent under Alternatives 4 and 7 compared to 30 percent under Alternative 5.

Total suitable acres would range from no acreage under Alternative 1 to 21 percent under Alternative 7, compared to 8 percent of the total community use area under Alternative 5 (No Action) and Alternative 6 (Proposed Action).

Economy

Meyers Chuck is primarily a fishing community and would be primarily influenced by changes in fishing. Commercial fishing is not likely to be affected under any of the alternatives.

Subsistence

No significant effect on salmon, other finfish, or invertebrate habitat capability is expected from implementation of any alternative. These resources account for 80 percent of the total edible pounds of subsistence resources harvested by Meyers Chuck households (Kruse and Frazier, 1988). Marine resources (fish and marine invertebrates) accounted for the majority (83 percent) of per capita subsistence harvest in Meyers Chuck in 1987.

The 1988 TRUCS study found that deer account for 5 percent of the total edible pounds of subsistence resources harvested by Meyers Chuck households (Kruse and Frazier, 1988). Deer accounted for 5 percent of per capita subsistence harvest by Meyers Chuck residents in 1987 (ADF&G 2006).

The WAAs used by Meyers Chuck residents for hunting deer lie within GMUs 1A, 2, and 4. Meyers Chuck had an estimated population of 15 in 2005 and this is reflected in the small total number of deer harvested by community residents (Table 3.23-40). Four WAAs accounted for more than 75 percent of the annual average harvest by Meyers Chuck residents from 1996 to 2002. The WAA located in GMU 4 (3308) is located outside the Meyers Chuck community use area and was only hunted in one year. This WAA is not considered further in this analysis.

Deer harvest in GMU 1A generally declined from 1997 to 2004, with the number of hunters and hunter effort also decreasing over this period (ADF&G 2005). Deer harvest in GMU 2 generally increased between 1997 and 2000 and subsequently declined between 2001 and 2004. The average number of days required to harvest a deer, however, remained constant across the entire period (ADF&G 2005).

Meyers Chuck residents take almost half (49 percent) of their deer from three WAAs (1003, 614, and 1319). These WAAs would each be affected under the alternatives, with the greatest effects occurring under Alternatives 4 and 7 (Table 3.23-40).

In summary, use of most subsistence resources (fish and marine invertebrates) by Meyers Chuck residents is not expected to be affected under any of the alternatives. Subsistence deer harvest patterns would be most likely to be affected under Alternative 7, which allocates the largest share of WAAs used by Meyers Chuck residents to development LUDs.

Table 3.23-40
Deer Harvest (1996 to 2002) and Deer Habitat Capability on NFS Lands in 2005 and After 100+ Years of Full Implementation under Each Alternative, Expressed as a Percent of 1954 Habitat Capability, for the WAAs where Meyers Chuck Residents Obtain Approximately 75% of their Average Annual Deer Harvest*

	Average Deer Harvest from 1996 to 2002			Deer Habitat Capability in 2005 and after 100+ Years of Full Implementation Under Each Alternative, Expressed as a Percent of the 1954 Habitat Capability							
WAA	Meyers Chuck Residents	All Rural Hunters	All Hunters	2005	Alt 1	Alt 2	Alt 3	Alt 4	Alt 5	Alt 6	Alt 7
1003	4	17	61	66	54	53	53	49	51	52	47
614	2	4	8	98	98	98	98	72	98	98	70
3308	2	98	158	66	64	59	57	53	56	57	51
1319	2	177	220	74	69	67	66	59	64	64	54

*Calculated based on harvest where location is known.

Naukati Bay

Naukati Bay is a town, approximately 6.5 square miles in size, located on the northwest coast of Prince of Wales Island. According to the 2000 Census, Naukati Bay had a 2000 population of 135, with Alaska Natives comprising 10 percent of the total (U.S. Census Bureau 2001).

The U.S. Coast and Geodetic Survey named the area “Naukatee Nay” in 1904 after the local Native name. Naukati Bay was first developed as a logging camp, but in 1991 an area approximately a mile from the camp was opened by the State Department of Natural Resources as a land disposal site for homesteaders (Alaska DCED 2006).

The population of Naukati Bay increased by 42 people or 45 percent between 1990 and 2000. The population declined by 29 people or 21 percent between 2000 and 2005. Total estimated population was 129 in Naukati Bay in 2006 (Alaska DOL 2007a).

Year	1990	2000	2005	2006
Population	93	135	106	129

Source: USDA Forest Service, 1997a; U.S. Census Bureau 2001; Alaska DOL, 2007a

The Naukati Bay economy is heavily dependent on the timber industry and employment is primarily seasonal. The Naukati Logging camp provides log transfer services for several smaller camps on Prince of Wales Island (Alaska DCED 2002).

Employment by industry data compiled by the Alaska DCED from the 2000 Census are summarized in the table below. Approximately 29 percent of the labor force in Naukati Bay was identified as unemployed and seeking work in 2000, compared to 7 percent for Southeast Alaska as a whole. Median household income was $27,500, compared to a regional median of $44,118 (Alaska DCED 2002).

Please refer to the 1997 Forest Plan EIS for further details on the history, economy, and subsistence use of this community.

Naukati Bay is located in the Thorne Bay Ranger District and is part of the North Prince of Wales community group (see Table 3.23-6). Detailed employment data are available for this community group by economic sector for 1990, 1995, and 2000 in the planning record. Wood products employment in the North Prince of Wales community group declined by 186 jobs or 69 percent between 1990 and 1999. Wood products employment accounted for 83 jobs or 23 percent of total employment in this community group in 1999.

Employment by Industry	Number	Percent of Total
Agriculture, Forestry, Fishing & Hunting, Mining	17	44
Construction	2	5
Manufacturing	0	0
Wholesale Trade	0	0
Retail Trade	2	5
Transportation, Warehousing & Utilities	0	0
Information	2	5
Finance, Insurance, Real Estate, Rental & Leasing	0	0
Professional, Scientific, Management, Administrative & Waste Mgmt	2	5
Education, Health & Social Services	9	23
Arts, Entertainment, Recreation, Accommodation & Food Services	3	8
Other Services (Except Public Admin)	0	0
Public Administration	2	5
Total Employment	**39**	**100**

Source: Alaska DCED 2002

Potential Effects

Community Use Area

The general area commonly used or related to by many of the residents of Naukati Bay in their local day-to-day work, recreational, and subsistence activities is shown on Figure 3.23-20. This area contains 1,109,349 acres of National Forest System land (among other land ownerships). Table 3.23-41 shows how the lands within this community use area would be distributed among the LUD groups by alternative. The LUD groups are explained in the introduction to Chapter 3.

Development LUDs presently account for 48 percent of the total acreage within the Naukati Bay community use area. Alternatives 5 and 6 would not have a significant effect on existing LUD allocations in the community use area because the acreage by LUD group would remain the same as under the existing Forest Plan. The acreage allocated to Wilderness/National Monument LUDs would remain constant under all alternatives. The amount of acreage allocated to Mostly Natural LUDs would increase under Alternatives 1 through 3. The largest increase would occur under Alternative 1, with the acreage allocated to Mostly Natural LUDs increasing from 45 percent under Alternative 5 (No Action) to 63 percent under Alternative 1, with a commensurate reduction in development LUDs (Table 3.23-41). Alternatives 4 and 7 would increase the acreage in development LUDs. Development LUDs would account for 55 percent and 69 percent under Alternatives 4 and 7, respectively, compared to 48 percent under Alternative 5.

Total suitable acres would range from 15 percent under Alternative 1 to 28 percent under Alternative 7, compared to 19 percent of the total community use area under Alternative 5 (No Action).

Economy

Naukati Bay is primarily a logging community and as such will be directly affected by the amount of logging opportunities on north Prince of Wales Island. Approximately 6.5 MMBF was under contract in the Thorne Bay Ranger District in August 2006. This volume would not be affected under any of the alternatives. These data provide an indication of potential impacts, actual impacts would depend on the volume that is under contract when the decision is implemented and whether potentially affected existing sales were cancelled as part of the decision.

Figure 3.23-20
Naukati Bay's Community Use Area

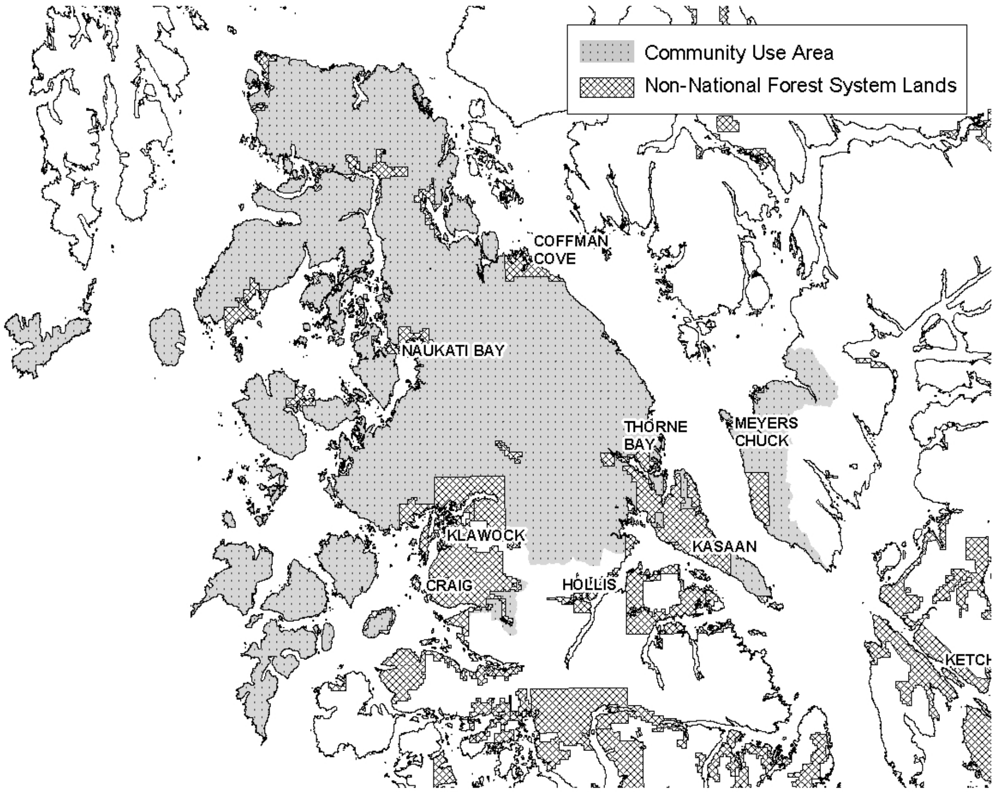


Table 3.23-41
LUD Groups in Naukati Bay's Community Use Area by Alternative

	Alternative						
	1	**2**	**3**	**4**	**5**	**6**	**7**
	Suitable National Forest System Acres for Timber Management						
Suitable Acres	168,053	182,465	193,690	228,053	210,908	204,686	308,479
LUD Groups	**Acres of National Forest System Land per LUD Group**						
Wilderness/National Monument	75,923	75,923	75,923	75,923	75,923	75,923	75,923
Mostly Natural	695,124	615,063	556,587	423,984	500,059	509,065	268,147
Moderate Development	95,904	112,411	139,346	168,888	160,274	159,214	265,623
Intensive Development	242,395	305,951	337,493	440,556	373,094	365,146	499,656
Total	**1,109,347**	**1,109,348**	**1,109,350**	**1,109,351**	**1,109,350**	**1,109,348**	**1,109,349**

[1] See the accompanying large LUD map for the distribution of existing LUDs and the Alternative Maps for the distribution of LUDs by alternative.

Subsistence

Naukati Bay was not surveyed by the Tongass Resource Use Cooperative Survey, and there are no baseline subsistence data for this community. No significant effect on salmon, other finfish, or invertebrate habitat capability is expected from implementation of any alternative. Marine resources (fish and marine invertebrates) accounted for 73 percent of per capita subsistence harvest in Naukati Bay in 1987.

Deer accounted for 19 percent of per capita subsistence harvest by Naukati Bay residents in 1988 (ADF&G 2006).

Naukati Bay residents harvest deer almost entirely on Prince of Wales Island, which is included in GMU 2. Deer harvest and hunter effort in GMU 2 generally increased during 1997-2000 and subsequently declined during 2000 to 2004; however, no change has been noted in the average number of hunter-days required to harvest a deer (ADF&G 2005). As noted above, Naukati Bay's human population decreased by an estimated 21 percent between 2000 and 2005.

Residents of Naukati Bay harvest the majority (78 percent) of their deer from three WAAs on north Prince of Wales Island (1422, 1527, and 1529). As shown in Table 3.23-42, the Naukati Bay portion ranges from 4 percent to 28 percent of the total harvest and from 7 percent to 46 percent of the rural hunter harvest in these WAAs. About 37 percent of the combined harvest in these WAAs is by non-rural hunters, suggesting that there is a harvest buffer that could be restricted, if necessary, before restrictions are placed on rural harvests.

Table 3.23-42
Deer Harvest (1996 to 2002) and Deer Habitat Capability on NFS Lands in 2005 and After 100+ Years of Full Implementation under Each Alternative, Expressed as a Percent of 1954 Habitat Capability, for the WAAs where Naukati Bay Residents Obtain Approximately 75% of their Average Annual Deer Harvest*

WAA	Average Deer Harvest from 1996 to 2002			Deer Habitat Capability in 2005 and after 100+ Years of Full Implementation Under Each Alternative, Expressed as a Percent of the 1954 Habitat Capability							
	Naukati Bay Residents	All Rural Hunters	All Hunters	2005	Alt 1	Alt 2	Alt 3	Alt 4	Alt 5	Alt 6	Alt 7
1422	53	209	300	60	50	48	47	46	47	47	43
1527	14	31	50	73	65	61	60	60	59	59	55
1529	8	122	226	73	63	61	60	56	59	59	50

*Calculated based on harvest where location is known.

WAAs 1422, 1527, and 1529 occur in an area with substantial past harvest and, therefore, deer habitat capabilities are currently estimated to be considerably below 1954 levels (Table 3.23-42). Under each of the alternatives, additional harvest would occur that would reduce habitat capabilities after 100+ years to 43-50 percent of 1954 levels in WAA 1422, 55-65 percent in WAA 1527, and 50-63 percent in WAA 1529.

The Deer Availability and Anticipated Demand analysis completed for the 1997 Forest Plan EIS determined that the 1997 Alternatives 2, 6, and 11, which are similar to the four highest harvest alternatives in this EIS, should be able to provide sufficient habitat capability for deer hunted in the Naukati Bay community use area by Naukati residents, all rural hunters, and all hunters in the short term. Projected deer harvest for all rural hunters and all hunters would exceed 10 percent habitat capability, the level that the analysis assumed would provide a reasonably high level of hunter success for their effort in the long term. The Final EIS analysis concluded that at some point a restriction in hunting might be necessary.

In summary, use of most subsistence resources by Naukati Bay residents (fish and marine invertebrates) is not expected to be affected by any of the alternatives. However, subsistence use of deer may be affected to the point that some restriction in hunting might be necessary over the long term, even under Alternative 1. The risks of this occurring are greatest under Alternative 7 because of its overall emphasis on Development LUDs within the Naukati Bay use area, and lower under the other six alternatives. The risk of hunting restrictions would be reduced somewhat, through more intensive management (e.g., thinning) of the existing and future closed-canopy, young-growth forests in this area. Indirect effects associated with increased competition for deer within Naukati Bay's subsistence use areas could also occur under all alternatives due to displacement of hunters from other communities due to timber harvest activity. Additional road development under the alternatives would improve access but may increase competition with other non-local hunters. The level of road development is already relatively high in these WAAs. Existing open road densities are 1.0. 0.9, and 0.9 mile per square mile and existing total road densities are 1.9, 1.5, and 1.5 miles per square mile in WAAs 1422, 1527, and 1529, respectively). Long-term (100+ years) road development would vary by alternative and would result in estimated maximum total road densities ranging from 1.7 to 2.1 mile per square mile in these WAAs under Alternative 1, to 1.9 to 2.5 miles per square mile in these WAAs under Alternative 7 (for all ownerships combined).

Pelican

Pelican is a fishing village along Lisianski Inlet on the northwest corner of Chichagof Island, located approximately 70 air miles north of Sitka and 70 air miles west of Juneau. Part of the community is built on pilings over tideland. A boardwalk serves as the town's main thoroughfare due to lack of flat land for roads. According to the 2000 Census, Pelican had a 2000 population of 199, with Alaska Natives comprising 21 percent of the total (U.S. Census Bureau 2001).

Prior to its settlement in 1938, the Pelican area was used as a safe harbor by fishermen and as a hunting, fishing, trapping, and gathering site by Hoonah Tlingit groups, who claimed lands on either side of Cross Sound (ADF&G 1994).

Pelican was incorporated as a second class city in 1943. Pelican employs a full-time city manager and is governed by a mayor and city council. The community has a local Fish and Game Advisory Committee. The Native community, largely Tlingit, is represented by a local Tlingit and Haida Community Council. No Native land allotments or withdrawals occur in the immediate vicinity of Pelican. Pelican is accessible via the Alaska ferry system, as well as floatplane from Juneau or Sitka (ADF&G 1994).

The population of Pelican, which grew by 67 percent between 1970 and 1990, decreased by 27 percent between 1990 and 2000. The population continued to decline in the first part of this decade, decreasing by 48 people or 29 percent between 2000 and 2005. Total estimated population was 106 in Pelican in 2006 (Alaska DOL 2007a).

Year	1970	1980	1990	2000	2005	2006
Population	133	180	222	163	115	106

Source: USDA Forest Service, 1997a; U.S. Census Bureau, 2001; Alaska DOL, 2007a

The Pelican economy is primarily based on commercial fishing (41 residents hold permits) and seafood processing. Pelican Seafoods, the largest employer, operates a seafood processing plant, the electric utility, a fuel company, and a store. It was purchased by Kaioh Suisan, a Japanese firm, in 1989 and then closed in 1996. It was subsequently purchased by Kake Tribal Corporation and re-opened during the same year. The plant processes salmon, halibut, sable fish, rockfish, and dungenesss crab (Alaska DCED 2002).

There have been low levels of tourism in Pelican for some time but more recently with the decline in commercial fishing tourism has begun to play a more important role in the local economy (Dugan et al. 2006). Tourism in Pelican is primarily focused on sport fishing and marine wildlife viewing charters, with 12 marine charters operating out of the town in 2005. The town also serves as a jumping-off point for independent travelers accessing nearby wilderness.

Employment by industry data compiled by the Alaska DCED from the 2000 Census are summarized in the table below. Approximately 8 percent of the labor force in Pelican was identified as unemployed and seeking work in 2000, compared to 7 percent for Southeast Alaska as a whole. Median household income was $48,750, compared to a regional median of $44,118 (Alaska DCED 2002).

Employment by Industry	Number	Percent of Total
Agriculture, Forestry, Fishing & Hunting, Mining	21	26
Construction	2	2
Manufacturing	25	31
Wholesale Trade	0	0
Retail Trade	3	4
Transportation, Warehousing & Utilities	7	9
Information	0	0
Finance, Insurance, Real Estate, Rental & Leasing	0	0
Professional, Scientific, Management, Administrative & Waste Mgmt	2	2
Education, Health & Social Services	16	20
Arts, Entertainment, Recreation, Accommodation & Food Services	0	0
Other Services (Except Public Admin)	0	0
Public Administration	5	6
Total Employment	**81**	**100**

Source: Alaska DCED 2002

Please refer to the 1997 Forest Plan EIS for further details on the history, economy, and subsistence use of this community.

Pelican is part of the North Chichagof community group, which also includes Elfin Cove and Hoonah (see Table 3.23-6). Detailed employment data are available for this community group by economic sector for 1990, 1995, and 2000 in the planning record. Manufacturing and non-federal government were the major employers in the North Chichagof community group in 1999, accounting for 34 and 30 percent of total employment, respectively. Logging and seafood processing accounted for 24 and 10 percent of total employment, respectively.

Potential Effects

Community Use Area

The general area commonly used or related to by many of the residents of Pelican in their local day-to-day work, recreational, and subsistence activities is shown on Figure 3.23-21. This area contains 488,851 acres of National Forest System land (among other land ownerships). Table 3.23-43 shows how the lands within this community use area would be distributed among the LUD groups by alternative. The LUD groups are explained in the introduction to Chapter 3.

Development LUDs account for less than one percent of the lands in the Pelican community use area under Alternative 5 (No Action). The acreage allocated to Wilderness/National Monument LUDs would remain constant under all alternatives. The main difference between the alternatives is the amount of acres allocated to development LUDs. Under Alternatives 4 and 7, approximately 5 percent of the area would be allocated to development LUDs, compared to less than 1 percent under Alternatives 2, 3, 5, and 6 and zero under Alternative 1.

Figure 3.23-21
Pelican's Community Use Area

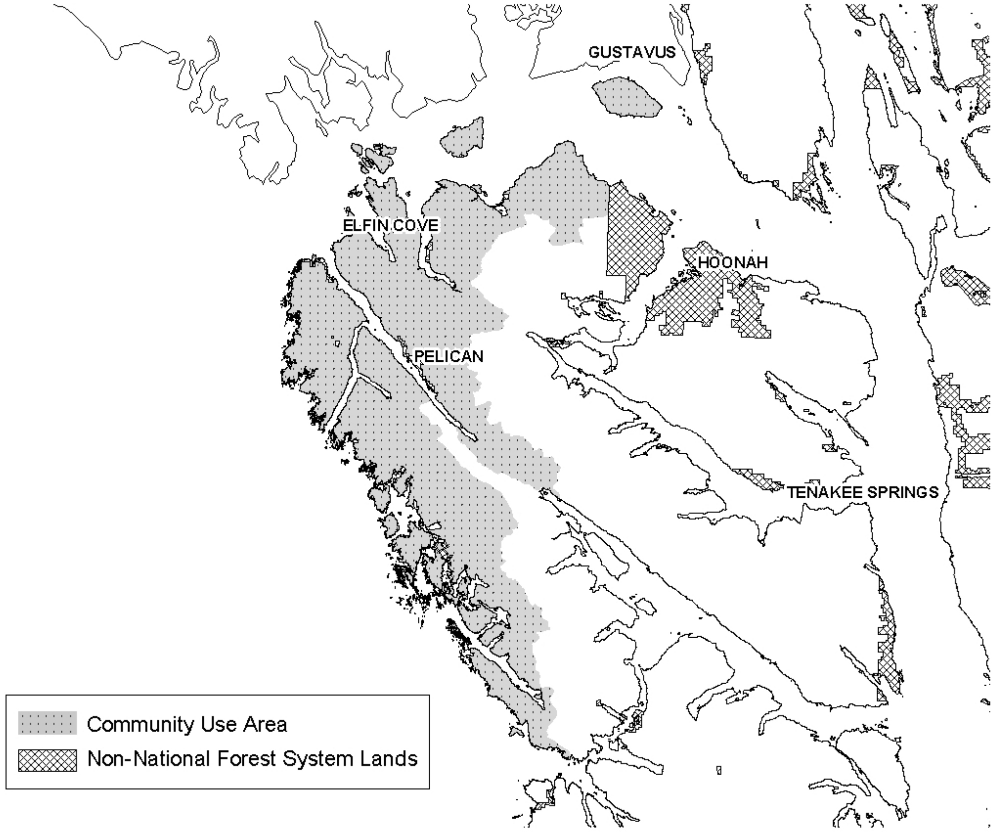


Table 3.23-43
LUD Groups in Pelican's Community Use Area by Alternative

	Alternative						
	1	**2**	**3**	**4**	**5**	**6**	**7**
	Suitable National Forest System Acres for Timber Management						
Suitable Acres	0	972	972	8,063	820	972	8,127
LUD Groups	**Acres of National Forest System Land per LUD Group**						
Wilderness/National Monument	245,569	245,569	245,569	245,569	245,569	245,569	245,569
Mostly Natural	243,281	240,434	240,430	218,829	240,602	240,425	218,829
Moderate Development	0	0	0	1,729	0	0	1,729
Intensive Development	0	2,848	2,851	22,723	2,679	2,857	22,723
Total	**488,851**	**488,851**	**488,851**	**488,851**	**488,851**	**488,851**	**488,851**

[1] See the accompanying large LUD map for the distribution of existing LUDs and the Alternative Maps for the distribution of LUDs by alternative.

Economy

Pelican is primarily a commercial fishing and seafood processing town. Employment within the community is expected to remain stable as long as the Pelican Seafoods plant continues to operate. Commercial fishing is not expected to be significantly affected under any of the alternatives.

Subsistence

In terms of subsistence use, Lisianski Inlet, Icy Strait, northwest Chichagof, and Yakobi Island are the most important areas to Pelican. These areas are presently legislatively withdrawn from timber harvest as either Wilderness or LUD II or allocated to the Mostly Natural LUDs. Therefore, it is unlikely that subsistence use in Pelican would be directly affected under any of the alternatives.

No significant effect on salmon, other finfish, or invertebrate habitat capability is expected from implementation of any alternative. These resources account for 63 percent of the total edible pounds of subsistence resources harvested by Pelican households (Kruse and Frazier, 1988). Marine resources (fish and marine invertebrates) accounted for 64 percent of per capita subsistence harvest in Pelican in 1987.

The 1988 TRUCS study found that deer account for 30 percent of the total edible pounds of subsistence resources harvested by Pelican households (Kruse and Frazier, 1988). Deer accounted for 30 percent of per capita subsistence harvest by Pelican residents in 1987 (ADF&G 2006).

The WAAs used by Pelican residents for hunting deer lie within Game Management Unit (GMU) 4. Deer harvest in GMU 4 is considered very high relative to other areas of Southeast Alaska, which is indicative of relatively high deer populations (ADF&G 2005). Over 1997-2004, there has been no significant trend in the number of deer harvested or in the number of hunters (ADF&G 2005). As noted above, the number of residents in Pelican decreased by 29 percent from 2000 to 2005.

Pelican residents take the majority (94 percent) of their deer from three WAAs on northwestern Chichagof Island (3417, 3418, and 3419). As shown in Table 3.23-44, these WAAs would not be affected by any of the alternatives because they are in wilderness, LUD II areas, or are in other Non-development LUDs.

Table 3.23-44
Deer Harvest (1996 to 2002) and Deer Habitat Capability on NFS Lands in 2005 and After 100+ Years of Full Implementation under Each Alternative, Expressed as a Percent of 1954 Habitat Capability, for the WAAs where Pelican Residents Obtain Approximately 75% of their Average Annual Deer Harvest*

	Average Deer Harvest from 1996 to 2002			Deer Habitat Capability in 2005 and after 100+ Years of Full Implementation Under Each Alternative, Expressed as a Percent of the 1954 Habitat Capability							
WAA	Pelican Residents	All Rural Hunters	All Hunters	2005	Alt 1	Alt 2	Alt 3	Alt 4	Alt 5	Alt 6	Alt 7
3418	37	62	70	100	100	100	100	100	100	100	100
3419	35	35	47	100	100	100	100	100	100	100	100
3417	28	100	159	100	100	100	100	100	100	100	100

*Calculated based on harvest where location is known.

The Deer Availability and Anticipated Demand analysis completed for the 1997 Forest Plan EIS determined that the 1997 Alternatives 2, 6, and 11, which are similar to the four highest harvest alternatives in this EIS, should be able to provide sufficient habitat capability for deer hunted in the Pelican community use area by Pelican residents, all rural hunters, and all hunters in the short term and long term.

In summary, use of most subsistence resfources (fish and marine invertebrates) by Pelican residents is not expected to be affected under any of the alternatives. In addition, subsistence use of deer by Pelican households would not be directly affected by any of the alternatives as the areas most heavily used by Pelican. Marine resources (fish and marine invertebrates) accounted for 64 percent of per capita subsistence harvest in Pelican in 1987.

Petersburg and Kupreanof

Petersburg is located on the northern tip of Mitkof Island across Wrangell Narrows from Kupreanof Island. It lies midway between Juneau and Ketchikan, about 120 miles from either community. According to the 2000 Census, Petersburg had a 2000 population of 3,224, with Alaska Natives comprising 7 percent of the total (U.S. Census Bureau 2001). The community of Kupreanof, with a population of 23 in 2000, is located less than one mile from Petersburg, on Kupreanof Island. This settlement is economically tied to Petersburg, where most residents find employment, purchase goods, and attend school (ADF&G 1994).

Prior to Petersburg's development by homesteaders and fishermen around 1900, Tlingit use of the area occurred at many small settlements (ADF&G 1994). The community of Petersburg was founded by Norwegian Peter Buschmann in 1899 and incorporated in 1906. More Norwegians followed and settled into a Scandinavian-style community. Petersburg has a local Fish and Game Advisory Committee, which takes an active interest in resource management issues (ADF&G 1994).

The population of Petersburg, which increased by 57 percent between 1970 and 1990, increased by less than 1 percent between 1990 and 2000. The population decreased by 69 people or 2 percent between 2000 and 2005. Total estimated population was 3,129 in Petersburg in 2006 (Alaska DOL 2007a).

Year	1970	1980	1990	2000	2005	2006
Population	2,042	2,821	3,207	3,224	3,155	3,129

Source: USDA Forest Service 1997a; U.S. Census Bureau 2001; Alaska DOL 2007a

The Petersburg economy is primarily based on the commercial fishing (469 residents have commercial fishing permits) and timber industries and, unlike the rest of Southeast Alaska, has escaped the severe swings in economic cycles. Estimated gross fishing revenues of local residents was almost $22 million in 2000. Petersburg is among the top-ranked ports in the United States for quality and value of fish landed. The city includes several processors operating cold storage, canneries, and custom packing services and the state-run Crystal Lake salmon hatchery. Petersburg also provides supplies and services for many of the area logging camps. While there is no deep water dock suitable for cruise ships, there is independent sportsmen and tourist visitation (Alaska DCED, 2002).

Employment by industry data compiled by the Alaska DCED from the 2000 Census are summarized in the table below. Approximately 10 percent of the labor force in Petersburg was identified as unemployed and seeking work in 2000, compared to 7 percent for Southeast Alaska as a whole. Median household income was $49,028, compared to a regional median of $44,118 (Alaska DCED, 2002).

Please refer to the 1997 Forest Plan EIS for further details on the history, economy, and subsistence use of this community.

Petersburg and Kupreanof are part of the Petersburg community group (see Table 3.23-6). Detailed employment data are available for this community group by economic sector for 1990, 1995, and 2000 in the planning record.

Non-federal government and seafood processing were the main employers in the Petersburg community group in 1999, accounting for 25 and 24 percent of total employment, respectively. Employment in the wood products sector declined by 93 percent between 1990 and 1999, with just 5 people employed in this sector in 1999. Three sawmills, The Mill, Alaska Fibre, and Southeast Alaska Wood Products, were identified in Petersburg in the mill survey conducted for the Forest Service in 2006. The mill survey noted that Alaska Fibre sold its primary processing equipment in 2005, but reportedly has plans to purchase and install new equipment (Juneau Economic Development Council 2007). According to the 2006 mill survey, The Mill and Southeast Alaska Wood Products had respective installed production capacities of 8.5 MMBF and 4.5 MMBF, and together processed approximately 250 MBF in 2006 and employed 2 people (Juneau Economic Development Council 2007).

Employment by Industry	Number	Percent of Total
Agriculture, Forestry, Fishing & Hunting, Mining	301	20
Construction	75	5
Manufacturing	136	9
Wholesale Trade	6	0
Retail Trade	165	11
Transportation, Warehousing & Utilities	111	7
Information	60	4
Finance, Insurance, Real Estate, Rental & Leasing	25	2
Professional, Scientific, Management, Administrative & Waste Mgmt	39	3
Education, Health & Social Services	268	18
Arts, Entertainment, Recreation, Accommodation & Food Services	128	8
Other Services (Except Public Admin)	96	6
Public Administration	118	8
Total Employment	**1,528**	**100**

Source: Alaska DCED 2002

Potential Effects

Community Use Area

The general area commonly used or related to by many of the residents of Petersburg in their local day-to-day work, recreational, and subsistence activities is shown on Figure 3.23-22. This area contains 742,197 acres of National Forest System land (among other land ownerships). Table 3.23-45 shows how the lands within this community use area would be distributed among the LUD groups by alternative. The LUD groups are explained in the introduction to Chapter 3.

Development LUDs presently account for about 40 percent of the total acreage within the Petersburg community use area. Alternatives 5 and 6 would not have a significant effect on existing LUD allocations in the community use area because the acreage by LUD group would remain the same as under the existing Forest Plan. The acreage allocated to Wilderness/National Monument LUDs would remain constant under all alternatives. The amount of acreage allocated to Mostly Natural LUDs would increase under Alternatives 1 through 3. The largest increase would occur under Alternative 1, with the acreage allocated to Mostly Natural LUDs increasing from 30 percent under Alternative 5 (No Action) to 58 percent under Alternative 1, with a commensurate reduction in development LUDs (Table 3.23-45). Alternatives 4 and 7 would increase the acreage in development LUDs.

Figure 3.23-22
Petersburg's Community Use Area

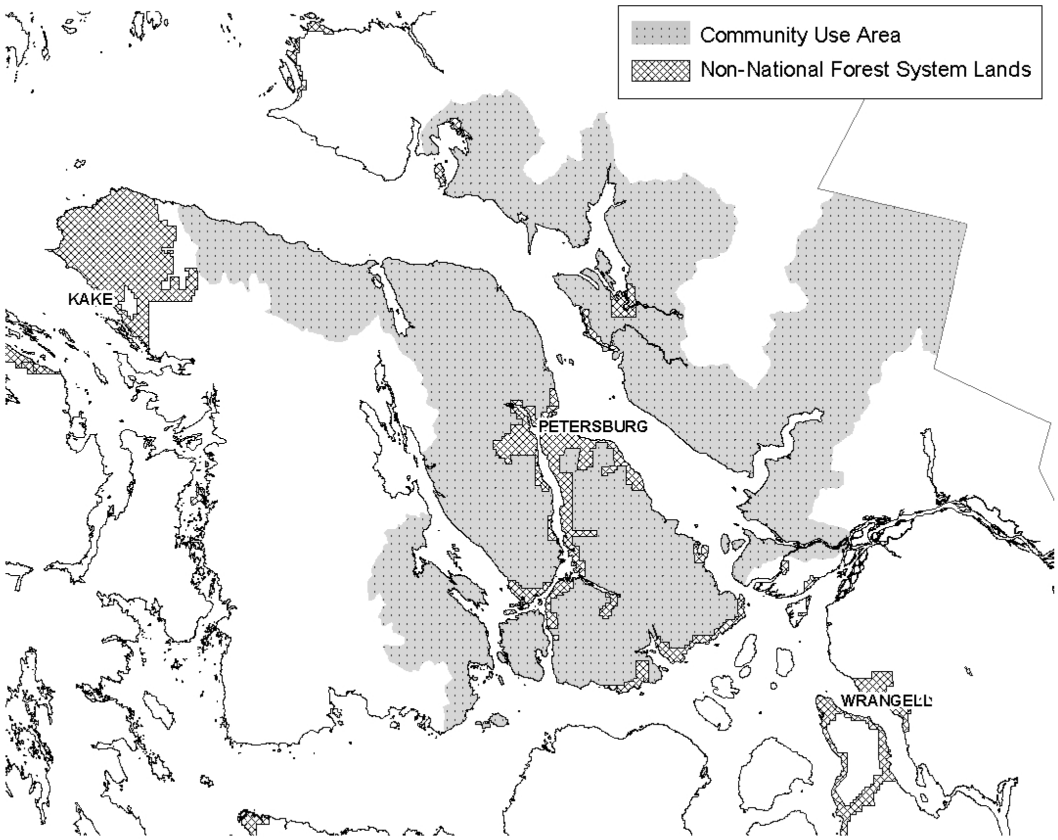


Table 3.23-45
LUD Groups in Petersburg's Community Use Area by Alternative

	Alternative						
	1	2	3	4	5	6	7
	Suitable National Forest System Acres for Timber Management						
Suitable Acres	37,346	64,756	80,848	99,068	86,229	86,177	115,610
LUD Groups	**Acres of National Forest System Land per LUD Group**						
Wilderness/National Monument	223,285	223,285	223,285	223,285	223,285	223,285	223,285
Mostly Natural	432,243	336,442	251,709	170,174	223,095	233,287	125,381
Moderate Development	45,518	100,014	147,536	195,479	162,219	160,680	220,238
Intensive Development	41,151	82,456	119,667	153,259	133,598	124,946	173,300
Total	**742,197**	**742,197**	**742,197**	**742,198**	**742,198**	**742,197**	**742,205**

[1] See the accompanying large LUD map for the distribution of existing LUDs and the Alternative Maps for the distribution of LUDs by alternative.

Development LUDs would account for 47 percent and 53 percent under Alternatives 4 and 7, respectively, compared to 40 percent under Alternative 5.

Total suitable acres would range from 5 percent under Alternative 1 to 16 percent under Alternative 7, compared to 12 percent of the total community use area under Alternative 5 (No Action) and Alternative 6 (Proposed Action).

Economy

Commercial fishing is particularly important to Petersburg. Commercial fisheries employment is not likely to be affected under any of the alternatives. Southeast Alaska Wood Products had 1.7 MMBF under contract with the Forest Service in August 2006. This volume would not be affected under any of the alternatives. Approximately 20.6 MMBF is presently under contract in the Petersburg Ranger District in August 2006. About 4.6 MMBF of this volume would be affected under Alternative 1, which would maintain all Inventoried Roadless Areas on the Tongass in a natural condition and not permit timber harvest in these areas. None of the other alternatives would affect this volume. These data provide an indication of potential impacts, actual impacts would depend on the volume that is under contract when the decision is implemented and whether potentially affected existing sales were cancelled as part of the decision.

Subsistence

No significant effect on salmon, other finfish, or invertebrate habitat capability is expected from implementation of any alternative. These resources account for 52 percent of the total edible pounds of subsistence resources harvested by Petersburg households (Kruse and Frazier, 1988). Marine resources (fish and marine invertebrates) accounted for 65 percent of per capita subsistence harvest in Petersburg in 1987.

The 1988 TRUCS study found that deer accounted for 21 percent of the total edible pounds of subsistence resources harvested by Petersburg households (Kruse and Frazier 1988). Deer accounted for 22 percent of per capita subsistence harvest by Petersburg residents in 1987 (ADF&G 2006).

Petersburg residents harvest deer on and around Mitkof and Kupreanof Islands, with the majority of harvest occurring within GMUs 3 and 4. Deer harvest in GMU 3 declined between 1998-2002 and increased between 2002-2004. The number of deer hunters declined between 2000-2002 and slightly increased between 2002-2004 (ADF&G 2005). Deer harvest in GMU 4 is considered very high relative to other areas of Southeast Alaska, which is indicative of relatively high deer populations (ADF&G 2005). Over 1997-2004, there has been no significant trend in the number of deer harvested or in the number of hunters (ADF&G 2005). As noted above, the human population of Petersburg declined by an estimated 2 percent between 2000 and 2005. Petersburg had an estimated human population of 3,155 in 2005.

Eight WAAs account for the majority (78 percent) of deer harvest by Petersburg residents. As shown in Table 3.23-46, the Petersburg portion represents about three-quarters of the total and rural hunter harvest in these WAAs.

The Deer Availability and Anticipated Demand analysis completed for the 1997 Forest Plan EIS determined that the 1997 Alternatives 2, 6, and 11, which are similar to the four highest harvest alternatives in this EIS, should be able to provide sufficient habitat capability for deer hunted by Petersburg residents in the short term and long term. There was also sufficient habitat capability for deer hunted in the Petersburg community use area by all rural hunters in both the short term and long

Table 3.23-46
Deer Harvest (1996 to 2002) and Deer Habitat Capability on NFS Lands in 2005 and After 100+ Years of Full Implementation under Each Alternative, Expressed as a Percent of 1954 Habitat Capability, for the WAAs where Petersburg Residents Obtain Approximately 75% of their Average Annual Deer Harvest*

	Average Deer Harvest from 1996 to 2002			Deer Habitat Capability in 2005 and after 100+ Years of Full Implementation Under Each Alternative, Expressed as a Percent of the 1954 Habitat Capability							
WAA	Petersburg Residents	All Rural Hunters	All Hunters	2005	Alt 1	Alt 2	Alt 3	Alt 4	Alt 5	Alt 6	Alt 7
2007	143	143	143	79	74	68	67	62	66	65	58
1905	115	400	400	77	72	67	67	59	66	65	57
3939	88	114	125	100	100	100	100	100	100	100	100
1605	52	54	42	76	76	71	64	57	63	63	56
3938	44	52	102	100	100	100	100	100	100	100	100
5138	40	47	49	88	79	70	69	64	68	68	59
5133	36	38	38	98	97	97	96	82	84	85	80
3940	34	75	77	92	92	92	92	92	92	92	92

*Calculated based on harvest where location is known.

term. Projected deer harvest for all hunters would exceed 10 percent habitat capability, the level that the analysis assumed would provide a reasonably high level of hunter success for their effort, in the long term. The Final EIS analysis concluded that at some point a restriction in hunting might be necessary.

In summary, use of most subsistence resources by Petersburg residents (fish and marine invertebrates) is not expected to be affected by any of the alternatives. However, subsistence use of deer in some of the WAAs hunted by Petersburg residents may be affected to the point that some restriction in hunting might be necessary over the long term, even under Alternative 1. The risks of this occurring are greatest under Alternative 7 because of its general lack of Non-Development LUDs within the Petersburg use area, and lower under the other six alternatives. The risk of hunting restrictions would be reduced somewhat, through more intensive management (e.g., thinning) of the existing and future closed-canopy, young-growth forests in this area. Indirect effects associated with increased competition for deer within Petersburg's subsistence use areas could also occur under all alternatives due to displacement of hunters from other communities due to timber harvest activity. Additional road development under the alternatives would improve access but may increase competition with other non-local hunters.

Point Baker

Point Baker is located on the northern tip of Prince of Wales Island, 101 air miles northwest of Ketchikan. Point Baker received its name in 1793 from Captain George Vancouver. According to the 2000 Census, Point Baker had a 2000 population of 35, with Alaska Natives comprising 3 percent of the total (U.S. Census Bureau 2001).

Native settlement of the area was already established during Vancouver's time. Tlingits used fish camps at Point Baker to participate in both customary trade and subsistence fishing. Commercial fishing at Point Baker began in the early 1900s, when the area was used as the site of a floating fish packer. Land sales in Point Baker accounted for part of an increase in year-round residents, the majority being non-Native (ADF&G 1994).

Point Baker is accessible by floatplane and skiff. Point Baker is not an incorporated city, nor is it within any other local government jurisdiction. It is not part of any

Native organization and has no traditional council. The town is not recognized under the Alaska Native Claims Settlement Act. Residents of Point Baker are members of the Sumner Strait Fish and Game Advisory Committee (ADF&G 1994).

The population of Point Baker, which decreased by about a half between 1970 and 1990, was fairly constant between 1990 and 2000. The population decreased by an estimated 13 people or 37 percent between 2000 and 2005. Total estimated population was 16 in Point Baker in 2006 (Alaska DOL 2007a).

Year	1970	1980	1990	2000	2005	2006
Population	80	90	39	35	22	16

Source: USDA Forest Service, 1997a; U.S. Census Bureau, 2001; Alaska DOL, 2007a

The Point Baker economy is heavily dependent on the fishing industry, with three quarters of the population holding commercial fishing permits (Alaska DCED 2002).

Employment by industry data compiled by the Alaska DCED from the 2000 Census are summarized in the table below. These data are an extrapolation based on information from a sample of residents. An extrapolation of a small sample may have inaccuracies but should provide a general indication of the distribution of employment. The 2000 U.S. Census estimated that 15 residents are employed. While no adults in Point Baker were identified as unemployed and seeking work in 2000, 58 percent of the population was identified as not employed and not seeking work. Median household income was $28,000, compared to a regional median of $44,118 (Alaska DCED 2002).

Employment by Industry	Number	Percent of Total
Agriculture, Forestry, Fishing & Hunting, Mining	6	40
Construction	0	0
Manufacturing	0	0
Wholesale Trade	0	0
Retail Trade	2	13
Transportation, Warehousing & Utilities	0	0
Information	0	0
Finance, Insurance, Real Estate, Rental & Leasing	0	0
Professional, Scientific, Management, Administrative & Waste Mgmt	0	0
Education, Health & Social Services	5	33
Arts, Entertainment, Recreation, Accommodation & Food Services	0	0
Other Services (Except Public Admin)	0	0
Public Administration	2	13
Total Employment	**15**	**100**

Source: Alaska DCED 2002

Please refer to the 1997 Forest Plan EIS for further details on the history, economy, and subsistence use of this community.

Point Baker is part of the North Prince of Wales community group (see Table 3.23-6). Detailed employment data are available for this community group by economic sector for 1990, 1995, and 2000 in the planning record. Wood products employment in the North Prince of Wales community group declined by 186 jobs or 69 percent between 1990 and 1999. Wood products employment accounted for 83 jobs or 23 percent of total employment in this community group in 1999.

Potential Effects

Community Use Area

The general area commonly used or related to by many of the residents of Point Baker in their local day-to-day work, recreational, and subsistence activities is shown on Figure 3.23-23. This area contains 842,636 acres of National Forest System land (among other land ownerships). Table 3.23-47 shows how the lands within this community use area would be distributed among the LUD groups by alternative. The LUD groups are explained in the introduction to Chapter 3.

Development LUDs presently account for 43 percent of the total acreage within the Point Baker community use area. Alternatives 5 and 6 would not have a significant effect on existing LUD allocations in the community use area because the acreage by LUD group would remain the same as under the existing Forest Plan. The acreage allocated to Wilderness/National Monument LUDs would remain constant under all alternatives. The amount of acreage allocated to Mostly Natural LUDs would increase under Alternatives 1 through 3. The largest increase would occur under Alternative 1, with the acreage allocated to Mostly Natural LUDs increasing from 48 percent under Alternative 5 (No Action) to 64 percent under Alternative 1, with a commensurate reduction in development LUDs (Table 3.23-47). Alternatives 4 and 7 would increase the acreage in development LUDs. Development LUDs would account for 52 percent and 61 percent under Alternatives 4 and 7, respectively, compared to 43 percent under Alternative 5.

Total suitable acres would range from 13 percent under Alternative 1 to 25 percent under Alternative 7, compared to 17 percent of the total community use area under Alternative 5 (No Action) and Alternative 6 (Proposed Action).

Economy

Commercial fisheries and subsistence use are important to Point Baker. Commercial fisheries employment is not likely to be affected under any of the alternatives.

Subsistence

No significant effect on salmon, other finfish, or invertebrate habitat capability is expected from implementation of any alternative. These resources account for 59 percent of the total edible pounds of subsistence resources harvested by Point Baker households (Kruse and Frazier, 1988). Marine resources (fish and marine invertebrates) accounted for 79 percent of per capita subsistence harvest in Point Baker in 1996.

The 1988 TRUCS study found that deer account for 27 percent of the total edible pounds of subsistence resources harvested by Point Baker households (Kruse and Frazier 1988). Deer accounted for 16 percent of per capita subsistence harvest by Point Baker residents in 1996 (ADF&G 2006).

Point Baker residents harvest deer on north Prince of Wales Island and Kupreanof Island, which are included in GMUs 2 and 3, respectively. Deer harvest and hunter effort in GMU 2 generally increased during 1997-2000 and subsequently declined during 2000-2004; however, no change has been noted in the average number of hunter-days required to harvest a deer (ADF&G 2005). Deer harvest in GMU 3 declined between 1998-2002 and increased between 2002-2004. The number of deer hunters declined between 2000-2002 and slightly increased between 2002-2004 (ADF&G 2005). Point Baker had a total estimated population of 22 people in 2005, 13 fewer people than in 2000.

Figure 3.23-23
Point Baker's Community Use Area

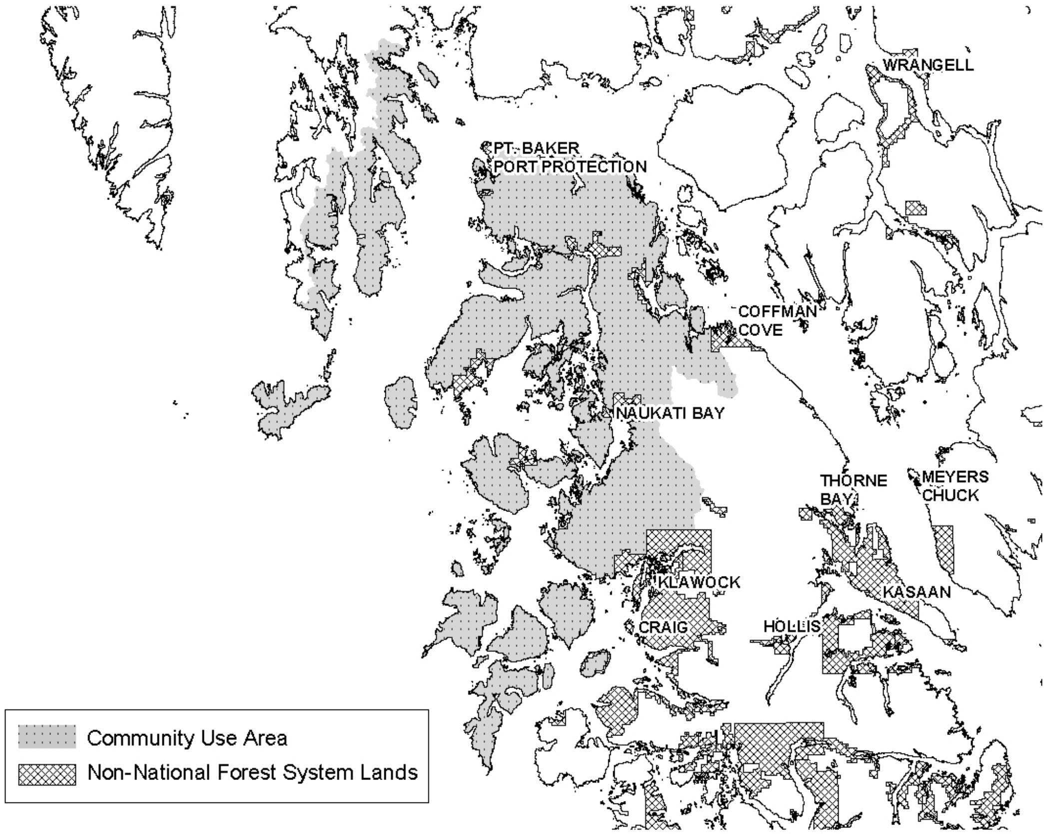


Table 3.23-47
LUD Groups in Point Baker's Community Use Area by Alternative

	Alternative						
	1	2	3	4	5	6	7
	Suitable National Forest System Acres for Timber Management						
Suitable Acres	112,293	123,969	130,724	161,202	146,330	141,600	211,416
LUD Groups	**Acres of National Forest System Land per LUD Group**						
Wilderness/National Monument	78,757	78,757	78,757	78,757	78,757	78,757	78,757
Mostly Natural	542,684	481,817	446,696	322,317	404,971	411,024	247,568
Moderate Development	47,608	57,686	78,121	98,590	93,354	94,718	133,755
Intensive Development	173,586	224,376	239,064	342,975	265,556	258,138	382,556
Total	**842,635**	**842,636**	**842,638**	**842,638**	**842,638**	**842,636**	**842,636**

[1] See the accompanying large LUD map for the distribution of existing LUDs and the Alternative Maps for the distribution of LUDs by alternative.

Residents of Point Baker harvest the majority (72 percent) of their deer from two WAAs on north Prince of Wales Island (1529) and Kupreanof Island (5134). As shown in Table 3.23-48, the Point Baker portion ranges from 6 percent to 19 percent of the total harvest and from 3 percent to 16 percent of the rural hunter harvest in these WAAs. About 41 percent of the combined harvest in these WAAs is by non-rural hunters, suggesting that there is a harvest buffer that could be restricted, if necessary, before restrictions are placed on rural harvests.

The Deer Availability and Anticipated Demand analysis completed for the 1997 Forest Plan EIS determined that the 1997 Alternatives 2, 6, and 11, which are similar to the four highest harvest alternatives in this EIS, selected alternative (Alternative 11 in the 1997 Forest Plan EIS) should be able to provide sufficient habitat capability for deer hunted by Point Baker residents in the short term and long term. There was also sufficient habitat capability for deer hunted in the Point Baker community use area by all rural hunters in both the short term and long term. Projected deer harvest for all hunters would exceed 10 percent habitat capability, the level that the analysis assumed would provide a reasonably high level of hunter success for their effort, in the long term. The Final EIS analysis concluded that at some point a restriction in hunting might be necessary.

In summary, use of most subsistence resources by Point Baker residents (fish and marine invertebrates) is not expected to be affected by any of the alternatives. However, subsistence use of deer on Prince of Wales Island may be affected to the point that some restriction in hunting might be necessary over the long term, even under Alternative 1. The risks of this occurring are greatest under Alternative 7 because of its general emphasis on Development LUDs within the Point Baker use area, and lower under the other six alternatives. The risk of hunting restrictions would be reduced somewhat, through more intensive management (e.g., thinning) of the existing and future closed-canopy, young-growth forests in this area. Indirect effects associated with increased competition for deer within Point Baker's subsistence use areas on Prince of Wales Island could also occur under all alternatives due to displacement of hunters from other communities due to timber harvest activity. Additional road development under the alternatives would improve access but may increase competition with other non-local hunters. The level of road development is already relatively high in one of the WAAs most used by Point Baker residents (1529), with an existing open and total road densities of 0.9 and 1.5 miles per square mile, respectively. Road densities are very low in the other WAAs (5014 and 5134) important to Point Baker subsistence deer hunters. Long-term (100+ years) road development would vary by alternative and would result in estimated

Table 3.23-48
Deer Harvest (1996 to 2002) and Deer Habitat Capability on NFS Lands in 2005 and After 100+ Years of Full Implementation under Each Alternative, Expressed as a Percent of 1954 Habitat Capability, for the WAAs where Point Baker Residents Obtain Approximately 75% of their Average Annual Deer Harvest*

	Average Deer Harvest from 1996 to 2002			Deer Habitat Capability in 2005 and after 100+ Years of Full Implementation Under Each Alternative, Expressed as a Percent of the 1954 Habitat Capability							
WAA	**Point Baker Residents**	**All Rural Hunters**	**All Hunters**	**2005**	**Alt 1**	**Alt 2**	**Alt 3**	**Alt 4**	**Alt 5**	**Alt 6**	**Alt 7**
1529	7	122	226	73	63	61	60	56	59	59	50
5134	6	33	39	92	92	92	89	83	87	87	83
5014	2	4	4	96	96	96	96	70	75	75	64

*Calculated based on harvest where location is known.

maximum total road densities ranging from 0.1 to 1.7 mile per square mile in these three WAAs under Alternative 1, to 0.3 to 2.5 miles per square mile in these WAAs under Alternative 7 (for all ownerships combined).

Port Alexander

Port Alexander is located on the southern tip of Baranof Island about 85 miles south of Sitka. According to the 2000 Census, Port Alexander had a 2000 population of 81, with Alaska Natives comprising 4 percent of the total (U.S. Census Bureau 2001).

Port Alexander was named in 1849 by the governor of the Russian American colonies. In 1913, salmon trollers discovered the rich fishing grounds in the area, and two floating processors arrived soon after. By 1916, there was a fishing supply store, a shore station, and a bakery at Port Alexander. During the 1920s and 1930s, a prosperous fishing fleet evolved, and houses, stores, restaurants, and a school were constructed. The 1940s and 1950s saw a steep decline in Port Alexander's population. Today, people choose Port Alexander as a home because of its independent, subsistence lifestyle, and commercial fishing opportunities, as well as its remote setting. There are no roads in Port Alexander; travel within the community is by skiff, boardwalks, and footpaths (ADF&G 1994). The community has a local Fish and Game Advisory Committee.

Port Alexander's population, which was three times larger in 1990 than it was in 1970, decreased by 32 percent (39 residents) between 1990 and 2000. The population stayed relatively constant between 2000 and 2005, decreasing by an estimated 6 people over this period. Total estimated population was 64 in Port Alexander in 2006 (Alaska DOL 2007a).

Year	1970	1980	1990	2000	2005	2006
Population	36	86	119	81	75	64

Source: USDA Forest Service 1997a; U.S. Census Bureau 2001; Alaska DOL 2007a

The economy of Port Alexander is largely based on commercial fishing and subsistence use of marine and forest resources. More than 40 percent of the population hold commercial fishing permits (35 residents). The City, the school, and post office provide the only full time employment in the area (Alaska DCED 2002).

Employment by industry data for Port Alexander is not included since it was based on a very small sample size and may not be a good indicator of the economy as a whole. The 2000 U.S. Census identified 29 residents of Port Alexander as being employed out of a potential work force (aAge 16+) of 48. Approximately 9 percent of the labor force in Port Alexander was identified as unemployed and seeking work in 2000, compared to 7 percent for Southeast Alaska as a whole. Median household income was $31,563 compared to a regional median of $44,118 (Alaska DCED 2002).

Please refer to the 1997 Forest Plan EIS for further details on the history, economy, and subsistence use of this community.

Port Alexander is part of the Kuiu Island community group (see Table 3.23-6). Detailed employment data are available for this community group by economic sector for 1990, 1995, and 2000 in the planning record. Logging employment accounted for 91 percent of total employment (77 jobs) in this community group in 1990. There was no logging employment in this community group in 1999, and the non-federal government sector accounted for 13 of the 14 recorded jobs.

Potential Effects

Community Use Area

The general area commonly used or related to by many of the residents of Port Alexander in their local day-to-day work, recreational, and subsistence activities is shown on Figure 3.23-24. This area contains 86,828 acres of National Forest System land (among other land ownerships). Table 3.23-49 shows how the lands within this community use area would be distributed among the LUD groups by alternative. The LUD groups are explained in the introduction to Chapter 3.

None of Port Alexander's community use area is presently allocated to development LUDs and this would be the case under all the alternatives evaluated in this EIS. There would be no change in the LUD allocation for this community under any of the alternatives.

Economy

Port Alexander is primarily a commercial fishing town. Commercial fishing and subsistence use are important to the community. Commercial fishing is not expected to be significantly affected under any of the alternatives.

Subsistence

No significant effect on salmon, other finfish, or invertebrate habitat capability is expected from implementation of any alternative. These resources account for 55 percent of the total edible pounds of subsistence resources harvested by Port Alexander households (Kruse and Frazier 1988). Marine resources (fish and marine invertebrates) accounted for 55 percent of per capita subsistence harvest in Port Alexander in 1987.

Deer account for 36 percent of the total edible pounds of subsistence resources harvested by Port Alexander households (Kruse and Frazier, 1988). Deer accounted for 35 percent of per capita subsistence harvest by Port Alexander residents in 1987 (ADF&G 2006).

Port Alexander residents take the majority (95 percent) of their deer from one WAA (3734) on the south end of Baranof Island. This WAA is located within GMU 4. Deer harvest in GMU 4 is considered very high relative to other areas of Southeast Alaska, which is indicative of relatively high deer populations (ADF&G 2005). Over 1997-2004, there has been no significant trend in the number of deer harvested or in the number of hunters (ADF&G 2005). Port Alexander's human population declined slightly between 2000 and 2005.

As shown in Table 3.23-50, WAA 3734 would not be affected under any of the alternatives.

The Deer Availability and Anticipated Demand analysis completed for the 1997 Forest Plan EIS determined that the 1997 Alternatives 2, 6, and 11, which are similar to the four highest harvest alternatives in this EIS, should be able to provide sufficient habitat capability for deer hunted in the Port Alexander community use area by Port Alexander residents, all rural hunters, and all hunters in the short term and long term.

Figure 3.23-24
Port Alexander's Community Use Area

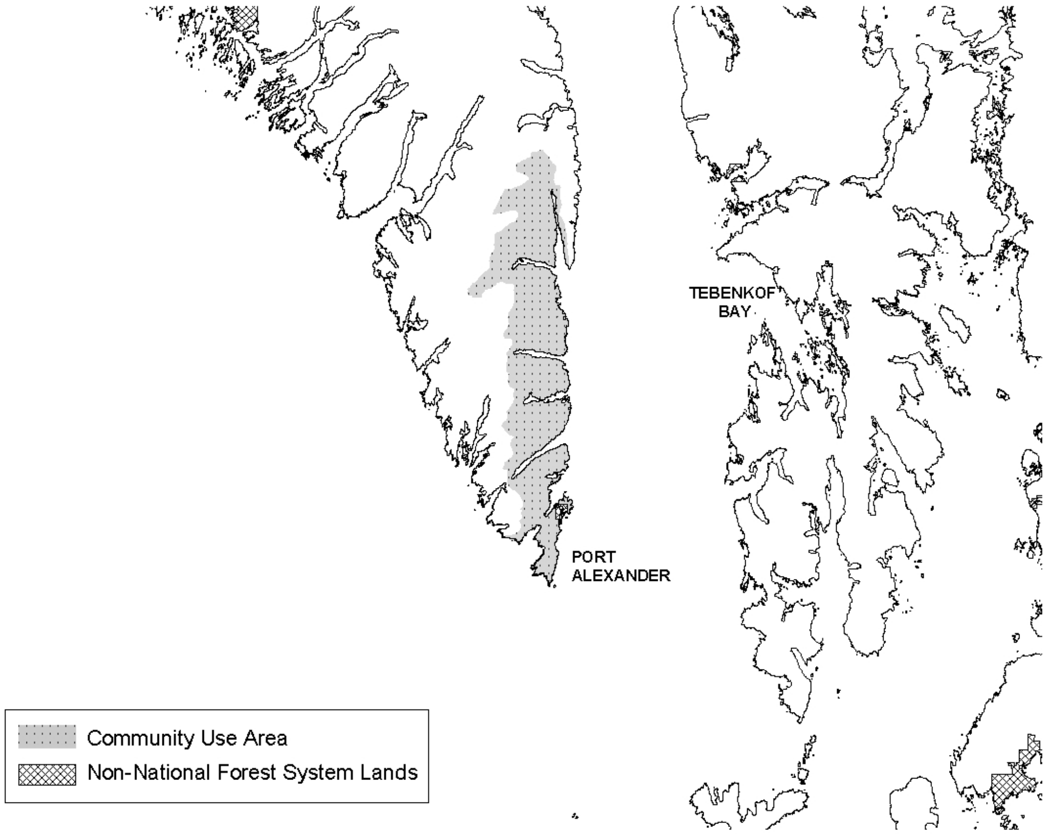


Table 3.23-49
LUD Groups in Port Alexander's Community Use Area by Alternative

	Alternative						
	1	**2**	**3**	**4**	**5**	**6**	**7**
	Suitable National Forest System Acres for Timber Management						
Suitable Acres	**0**	**0**	**0**	**0**	**0**	**0**	**0**
LUD Groups	**Acres of National Forest System Land per LUD Group**						
Wilderness/National Monument	17,972	17,972	17,972	17,972	17,972	17,972	17,972
Mostly Natural	68,856	68,856	68,856	68,793	68,856	68,856	68,856
Moderate Development	0	0	0	0	0	0	0
Intensive Development	0	0	0	63	0	0	0
Total	**86,828**	**86,828**	**86,828**	**86,828**	**86,828**	**86,828**	**86,828**

[1] See the accompanying large LUD map for the distribution of existing LUDs and the Alternative Maps for the distribution of LUDs by alternative.

Table 3.23-50
Deer Harvest (1996 to 2002) and Deer Habitat Capability on NFS Lands in 2005 and After 100+ Years of Full Implementation under Each Alternative, Expressed as a Percent of 1954 Habitat Capability, for the WAAs where Port Alexander Residents Obtain Approximately 75% of their Average Annual Deer Harvest*

	Average Deer Harvest from 1996 to 2002			Deer Habitat Capability in 2005 and after 100+ Years of Full Implementation Under Each Alternative, Expressed as a Percent of the 1954 Habitat Capability							
WAA	Port Alexander Residents	All Rural Hunters	All Hunters	2005	Alt 1	Alt 2	Alt 3	Alt 4	Alt 5	Alt 6	Alt 7
3734	38	74	85	100	100	100	100	100	100	100	100

*Calculated based on harvest where location is known.

In summary, use of most subsistence resources (fish and marine invertebrates) by Port Alexander residents is not expected to be affected under any of the alternatives. In addition, subsistence use of deer by Port Alexander households would not be directly affected by any of the alternatives as the area most heavily used by Port Alexander residents is in Non-development LUDs. It is also unlikely that Port Alexander residents would be affected by increased competition or access because of the limited access and the lack of activities under the alternatives in this area.

Port Protection

Port Protection, located on the northern end of Prince of Wales Island in a quiet bay facing Sumner Strait, is only accessible by air and water. The nearby logging camp site at Labouchere Bay, however, is a roaded port. The community's setting along the waterfront of the cove requires skiff travel for most purposes (ADF&G 1994).

Port Protection is not an incorporated city, nor is it within any local government jurisdiction. Residents of Port Protection are members of the Sumner Strait Fish and Game Advisory Committee (ADF&G 1994). According to the 2000 Census, Port Protection had a 2000 population of 63, none of whom were Alaska Natives (U.S. Census Bureau 2001).

Port Protection was first reported to the western world by the English explorer George Vancouver in 1793. Signs of earlier indigenous occupation of the northern shoreline of Prince of Wales Island include stone and wooden stake fish weirs and traps, as well as shell middens of edible marine invertebrates (ADF&G 1994).

A scow served as a fish-buying station until it was replaced in 1946 by a trading post. A long float dock accommodated many fishing boats at the post (ADF&G 1994).

The population of Port Protection, which increased by approximately 50 percent between 1980 and 1990, was approximately the same in 2000 as it was in 1990. The population decreased by an estimated 9 people or 14 percent between 2000 and 2005. Total estimated population was 59 in Port Protection in 2006 (Alaska DOL 2007a).

Year	1980	1990	2000	2005	2006
Population	40	62	63	54	59

Source: USDA Forest Service, 1997a; U.S. Census Bureau, 2001; Alaska DOL, 2007a

The Port Protection economy peaks during the fishing season in summer and fall. Fourteen residents hold a commercial fishing permit and some residents provide sport fishing charters. Local residents depend on subsistence for year-round support (Alaska DCED 2002; 2006).

The 2000 U.S. Census identified a potential work force of 61 residents and total employment of 34. Employment by industry data compiled by the Alaska DCED from the 2000 Census are summarized in the table below. These data is extrapolated from a sample of the city population. Because the sample size was small, the extrapolation is not accurate in detail, but should provide a general indication of distribution of employment. While no adults in Port Protection were unemployed and seeking work in 2000, 44 percent were unemployed and not seeking work. Median household income was $10,938, compared to a regional median of $44,118 (Alaska DCED 2002).

Employment by Industry	Number	Percent of Total
Agriculture, Forestry, Fishing & Hunting, Mining	5	5
Construction	5	5
Manufacturing	0	0
Wholesale Trade	2	2
Retail Trade	8	9
Transportation, Warehousing & Utilities	5	5
Information	4	4
Finance, Insurance, Real Estate, Rental & Leasing	7	8
Professional, Scientific, Management, Administrative & Waste Mgmt	2	2
Education, Health & Social Services	27	30
Arts, Entertainment, Recreation, Accommodation & Food Services	3	3
Other Services (Except Public Admin)	7	8
Public Administration	16	18
Total Employment	**91**	**100**

Source: Alaska DCED 2002

Please refer to the 1997 Forest Plan EIS for further details on the history, economy, and subsistence use of this community.

Port Protection is part of the North Prince of Wales community group (see Table 3.23-6). Detailed employment data are available for this community group by economic sector for 1990, 1995, and 2000 in the planning record. Wood products employment in the North Prince of Wales community group declined by 186 jobs or 69 percent between 1990 and 1999. Wood products employment accounted for 83 jobs or 23 percent of total employment in this community group in 1999.

Potential Effects

Community Use Area

The general area commonly used or related to by many of the residents of Port Protection in their local day-to-day work, recreational, and subsistence activities is shown on Figure 3.23-25. This area contains 706,627 acres of National Forest System land (among other land ownerships). Table 3.23-51 shows how the lands within this community use area would be distributed among the LUD groups by alternative. The LUD groups are explained in the introduction to Chapter 3.

Development LUDs presently account for 49 percent of the total acreage within the Port Protection community use area. Alternatives 5 and 6 would not have a significant effect on existing LUD allocations in the community use area because the acreage by LUD group would remain the same as under the existing Forest Plan.

Figure 3.23-25
Port Protection's Community Use Area

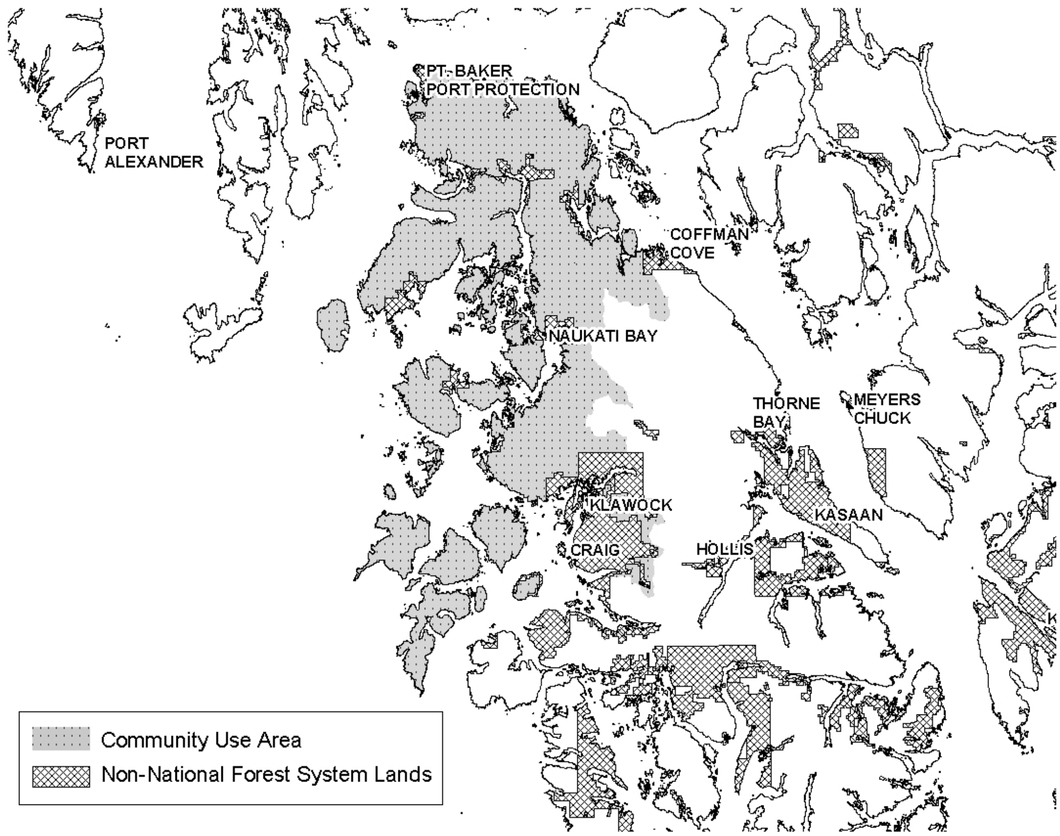


Table 3.23-51
LUD Groups in Port Protection's Community Use Area by Alternative

	Alternative						
	1	2	3	4	5	6	7
	Suitable National Forest System Acres for Timber Management						
Suitable Acres	108,469	120,049	127,290	135,243	134,817	129,563	180,164
LUD Groups	**Acres of National Forest System Land per LUD Group**						
Wilderness/National Monument	17,019	17,019	17,019	17,019	17,019	17,019	17,019
Mostly Natural	474,390	407,001	367,958	320,675	345,451	353,087	245,932
Moderate Development	48,236	58,268	78,759	81,614	81,785	82,807	116,805
Intensive Development	166,980	224,338	242,892	287,321	262,373	253,714	326,871
Total	**706,625**	**706,626**	**706,628**	**706,629**	**706,628**	**706,626**	**706,627**

[1] See the accompanying large LUD map for the distribution of existing LUDs and the Alternative Maps for the distribution of LUDs by alternative.

The acreage allocated to Wilderness/National Monument LUDs would remain constant under all alternatives. The amount of acreage allocated to Mostly Natural LUDs would increase under Alternatives 1 through 3. The largest increase would occur under Alternative 1, with the acreage allocated to Mostly Natural LUDs increasing from 49 percent under Alternative 5 (No Action) to 64 percent under Alternative 1, with a commensurate reduction in development LUDs (Table 3.23-51). Alternatives 4 and 7 would increase the acreage in development LUDs. Development LUDs would account for 53 percent and 64 percent under Alternatives 4 and 7 compared to 49 percent under Alternative 5.

Total suitable acres would range from 17 percent under Alternative 1 to 25 percent under Alternative 7, compared to 19 percent under Alternative 5 (No Action).

Economy

Port Protection's economy primarily depends upon commercial fishing. Subsistence use is also important in this community. Commercial fisheries employment is not likely to be affected under any of the alternatives.

Subsistence

No significant effect on salmon, other finfish, or invertebrate habitat capability is expected from implementation of any alternative. Marine resources (fish and marine invertebrates) accounted for 69 percent of per capita subsistence harvest in Port Protection in 1996.

Deer accounted for 21 percent of per capita subsistence harvest by Port Protection residents in 1996 (ADF&G 2006).

Port Protection residents take the majority (95 percent) of their deer from one WAA (1529) on the north end of Prince of Wales Island. This WAA is located within GMU 2. Deer harvest and hunter effort in GMU 2 generally increased during 1997-2000 and subsequently declined during 2000-2004; however, no change has been noted in the average number of hunter-days required to harvest a deer (ADF&G 2005). Port Protection's population declined slightly between 2000 and 2005.

As shown in Table 3.23-52, the Port Protection portion of harvest represents about 4 percent of the total harvest and about 8 percent of the rural hunter harvest in WAA 1529. About 46 percent of the harvest in this WAA is by non-rural hunters, suggesting that there is a harvest buffer that could be restricted, if necessary, before restrictions are placed on rural harvests.

WAA 1529 occurs in an area with substantial past harvest and, therefore, deer habitat capabilities are currently estimated to be considerably below 1954 levels (Table 3.23-52). Under each of the alternatives, additional harvest would occur that would reduce habitat capabilities after 100+ years to 50-63 percent of 1954 levels (Table 3.23-52).

The Deer Availability and Anticipated Demand analysis completed for the 1997 Forest Plan EIS determined that the 1997 Alternatives 2, 6, and 11, which are similar to the four highest harvest alternatives in this EIS, should be able to provide sufficient habitat capability for deer hunted by Port Protection residents and by all hunters in the short-term. In the long-term, the affected WAAs may not be able to provide deer for all hunters.

Table 3.23-52
Deer Harvest (1996 to 2002) and Deer Habitat Capability on NFS Lands in 2005 and After 100+ Years of Full Implementation under Each Alternative, Expressed as a Percent of 1954 Habitat Capability, for the WAAs where Port Protection Residents Obtain Approximately 75% of their Average Annual Deer Harvest*

	Average Deer Harvest from 1996 to 2002			Deer Habitat Capability in 2005 and after 100+ Years of Full Implementation Under Each Alternative, Expressed as a Percent of the 1954 Habitat Capability							
WAA	Port Protection Residents	All Rural Hunters	All Hunters	2005	Alt 1	Alt 2	Alt 3	Alt 4	Alt 5	Alt 6	Alt 7
1529	10	122	226	73	63	61	60	56	59	59	50

*Calculated based on harvest where location is known.

In summary, use of most subsistence resources by Port Protection residents (fish and marine invertebrates) is not expected to be affected by any of the alternatives. However, subsistence use of deer may be affected to the point that some restriction in hunting might be necessary over the long term, even under Alternative 1. The risks of this occurring are greatest under Alternative 7 because of its general emphasis on Development LUDs within the Port Protection use area, and lower under the other six alternatives. The risk of hunting restrictions would be reduced somewhat, through more intensive management (e.g., thinning) of the existing and future closed-canopy, young-growth forests in this area. Indirect effects associated with increased competition for deer within Port Protection's subsistence use areas could also occur under all alternatives due to displacement of hunters from other communities due to timber harvest activity. Additional road development under the alternatives would improve access but may increase competition with other non-local hunters. The level of road development is already relatively high in this WAA. Existing open road density is 0.9 mile per square mile and existing total road density is 1.5 miles per square mile, respectively (all ownerships combined). Long-term (100+ years) road development would vary by alternative and would result in an estimated maximum total road density of 1.7 mile per square mile under Alternative 1, to 2.0 miles per square mile under Alternative 7 (for all ownerships combined).

Saxman

Saxman is located on west Revillagigedo Island on the Tongass Highway, about three miles south of Ketchikan. According to the 2000 Census, Saxman had a 2000 population of 431, with Alaska Natives comprising 66 percent of the total (U.S. Census Bureau 2001).

In 1894, Tlingits from the old Cape Fox and Tongass villages chose Saxman as the site for a new village in which to locate a government school and a new Presbyterian church. The Saxman people are also known as the Cape Fox people or Sanya in the earlier ethnographies. Saxman was incorporated in 1929 and was certified by the federal government as a second class municipal corporation. Three years later, the federal government issued a patent to 365 acres of land to the townsite trustee for Saxman (ADF&G 1994).

When the Ketchikan Gateway Borough was formed in 1963, Saxman was included within its boundaries. In 1971 and 1973, respectively, Saxman was recognized and then certified as a Native village under the Alaska Native Claims Settlement Act. An elected mayor and six city council members constitute the governing body of the municipality as organized under state law. The community has a local Fish and Game Advisory Committee (ADF&G 1994).

When the Tlingits left their old villages to move to Saxman, they abandoned houses, totems, carvings, and other cultural and ceremonial artifacts. In 1938, the Civilian Conservation Corps retrieved and brought to Saxman original totems from the abandoned villages and cemeteries of Tongass, Cat, and Pennock Islands, and Cape Fox. The Totem Park in Saxman has become a major attraction for Ketchikan area visitors (ADF&G 1994).

The population of Saxman, which more than doubled between 1970 and 1990, increased by 17 percent between 1990 and 2000. The population decreased by 26 people or 6 percent between 2000 and 2005. Total estimated population was 422 in Saxman in 2006 (Alaska DOL 2007a).

Year	1970	1980	1990	2000	2005	2006
Population	135	273	369	431	405	422

Source: USDA Forest Service, 1997a; U.S. Census Bureau, 2001; Alaska DOL, 2007a

Most employment opportunities for Saxman residents are in the city of Ketchikan. The City of Saxman, the Saxman Seaport, and the Cape Fox Corporation provide employment for a number of local residents. The Saxman Totem Park with a tribal house, a carving center, and a cultural hall for traditional Tlingit dance, has become an attraction for Ketchikan area visitors (Alaska DCED 2002).

Employment by industry data compiled by the Alaska DCED from the 2000 Census are summarized in the table below. Approximately 26 percent of the labor force in Saxman was identified as unemployed and seeking work in 2000, compared to 7 percent for Southeast Alaska as a whole. Median household income was $44,375, compared to a regional median of $44,118 (Alaska DCED 2002).

Employment by Industry	Number	Percent of Total
Agriculture, Forestry, Fishing & Hunting, Mining	8	5
Construction	19	13
Manufacturing	7	5
Wholesale Trade	0	0
Retail Trade	19	13
Transportation, Warehousing & Utilities	13	9
Information	3	2
Finance, Insurance, Real Estate, Rental & Leasing	18	12
Professional, Scientific, Management, Administrative & Waste Mgmt	2	1
Education, Health & Social Services	16	11
Arts, Entertainment, Recreation, Accommodation & Food Services	17	11
Other Services (Except Public Admin)	8	5
Public Administration	21	14
Total Employment	**151**	**100**

Source: Alaska DCED 2002

Please refer to the 1997 Forest Plan EIS for further details on the history, economy, and subsistence use of this community.

Saxman is located in the Ketchikan Ranger District and is part of the Ketchikan community group (see Table 3.23-6). Detailed employment data are available for this community group by economic sector for 1990, 1995, and 2000 in the planning record.

Potential Effects

Community Use Area

The general area commonly used or related to by many of the residents of Saxman in their local day-to-day work, recreational, and subsistence activities is shown on Figure 3.23-26. This area contains 1,975,123 acres of National Forest System land (among other land ownerships). Table 3.23-53 shows how the lands within this community use area would be distributed among the LUD groups by alternative. The LUD groups are explained in the introduction to Chapter 3.

Development LUDs presently account for 21 percent of the total acreage within the Saxman community use area. Alternatives 5 and 6 would not have a significant effect on existing LUD allocations in the community use area because the acreage by LUD group would remain the same as under the existing Forest Plan. The acreage allocated to Wilderness/National Monument LUDs would remain constant under all alternatives. The amount of acreage allocated to Mostly Natural LUDs would increase under Alternatives 1 and 2. The largest increase would occur under Alternative 1, with the acreage allocated to Mostly Natural LUDs increasing from 31 percent under Alternative 5 (No Action) to 48 percent under Alternative 1, with a commensurate reduction in development LUDs (Table 3.23-53). Alternatives 4 and 7 would increase the acreage in development LUDs. Development LUDs would account for 32 percent and 33 percent under Alternatives 4 and 7, respectively, compared to 21 percent under Alternative 5.

Total suitable acres would range from 2 percent under Alternative 1 to 10 percent under Alternative 7, compared to 6 percent of the total community use area under Alternative 5 (No Action) and Alternative 6 (Proposed Action).

Economy

Saxman, a traditional native community, could be affected primarily by changes in recreation and tourism use, commercial fishing, timber processing, and subsistence opportunities.

Approximately 42.8 MMBF was under contract in the Ketchikan Ranger District in August 2006. About 75 percent (32.1 MMBF) of this volume could be potentially affected under Alternative 1, which would maintain all Inventoried Roadless Areas on the Tongass in a natural condition and not permit timber harvest in these areas. None of the other alternatives would affect this volume. These data provide an indication of potential impacts, actual impacts would depend on the volume that is under contract when the decision is implemented and whether potentially affected existing sales were cancelled as part of the decision.

Commercial fisheries employment is not likely to be affected under any of the alternatives. Recreation and tourism in Saxman is also unlikely to be affected under any of the alternatives.

Subsistence

No significant decline in salmon, other finfish, or invertebrate habitat capability is expected from implementation of any alternative. These resources account for 68 percent of the total edible pounds of subsistence resources harvested by Saxman households (Kruse and Frazier, 1988). Marine resources (fish and marine invertebrates) accounted for 71 percent of per capita subsistence harvest in Saxman in 1987.

Figure 3.23-26
Saxman's Community Use Area

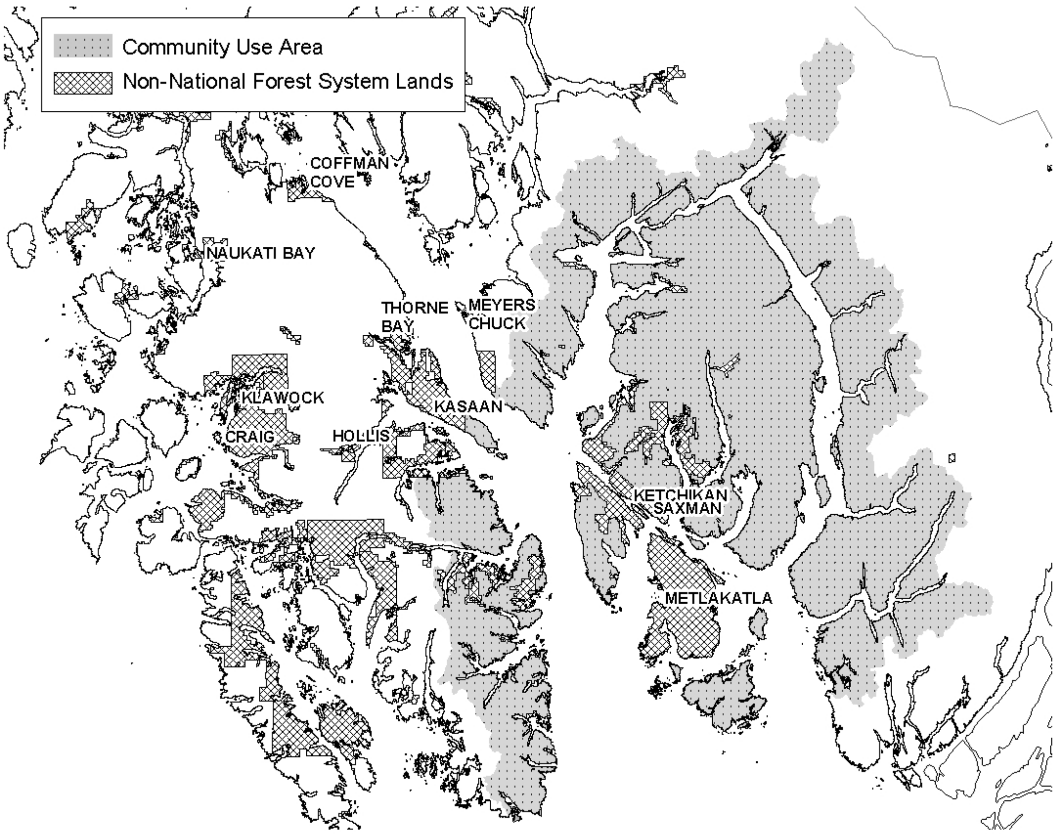


Table 3.23-53
LUD Groups in Saxman's Community Use Area by Alternative

	Alternative						
	1	2	3	4	5	6	7
	Suitable National Forest System Acres for Timber Management						
Suitable Acres	47,897	90,739	111,299	176,699	127,271	124,987	204,834
LUD Groups	**Acres of National Forest System Land per LUD Group**						
Wilderness/National Monument	934,620	934,619	934,619	934,616	934,620	934,619	934,619
Mostly Natural	943,733	764,232	665,107	417,910	618,698	615,905	396,436
Moderate Development	36,231	82,362	88,211	187,083	100,554	97,706	199,418
Intensive Development	60,538	193,909	287,185	435,514	321,252	326,892	444,655
Total	**1,975,122**	**1,975,122**	**1,975,122**	**1,975,123**	**1,975,123**	**1,975,122**	**1,975,129**

[1] See the accompanying large LUD map for the distribution of existing LUDs and the Alternative Maps for the distribution of LUDs by alternative.

The 1988 TRUCS study found that deer accounted for 19 percent of the total edible pounds of subsistence resources harvested by Saxman households (Kruse and Frazier 1988). Deer accounted for 18 percent of per capita subsistence harvest by Saxman residents in 1987 (ADF&G 2006).

Data were not provided separately for Saxman in the ADF&G deer harvest reports for 1996 to 2002. The majority of deer harvest by Saxman residents likely takes place in GMU 1A. Deer harvest in GMU 1A generally declined from 1997 to 2004, with the number of hunters and hunter effort also decreasing over this period (ADF&G 2005). As noted above, the population of Saxman decreased by an estimated 6 percent between 2000 and 2005. Saxman had an estimated population of 405 residents in 2005. Marine resources (fish and marine invertebrates) accounted for 71 percent of per capita subsistence harvest in Saxman in 1987.

The Deer Availability and Anticipated Demand analysis completed for the 1997 Forest Plan EIS determined that the 1997 Alternatives 2, 6, and 11, which are similar to the four highest harvest alternatives in this EIS, should be able to provide habitat capability for deer hunted in the Saxman community use area by Saxman residents, all rural hunters, and all hunters in the short term. This alternative was also estimated to provide sufficient habitat capability for Saxman residents and all rural hunters in the long term. However, projected deer harvest for all hunters was estimated to exceed 10 percent habitat capability, the level that the analysis assumed would provide a reasonably high level of hunter success for their effort, in the long term.

In summary, use of most subsistence resources by Saxman residents (fish and marine invertebrates) is not expected to be affected by any of the alternatives. However, subsistence use of deer may be affected to the point that some restriction in hunting might be necessary over the long term, even under Alternative 1. The risks of this occurring are greatest under Alternative 7, and second highest under Alternative 4 because of their lower use of Non-Development LUDs compared with the other alternatives. Alternatives 1, 2, and 3 would have the lowest risk and Alternatives 5 and 6 would be intermediate.

Sitka

Located on the west side of Baranof Island, Sitka is the only community in Southeast Alaska that fronts the open sea. According to the 2000 Census, Sitka had a 2000 population of 8,835, with Alaska Natives comprising 19 percent of the total (U.S. Census Bureau 2001).

Present-day Sitka was originally inhabited by a major tribe of Tlingits who called the village “Shee Atika.” Traditionally, the Tlingits used a wide area surrounding the community for hunting, fishing, and gathering wild resources. The site became “New Archangel” in 1799, the capital of Russian America (ADF&G 1994).

Sitka became the focal point of Russian fur trade in North America beginning in 1741. During the mid-1800s, Sitka was the major port on the north Pacific coast, with ships calling from many nations. After the purchase of Alaska by the United States in 1867, it remained the capital of the Territory until 1906, when the seat of government moved to Juneau. During the early 1900s gold mines contributed to its growth, and during World War II the town was fortified. After the war, the Bureau of Indian Affairs converted some of the buildings to a boarding school for Alaska Natives (ADF&G, 1994). The APC pulp mill operated in Sitka from 1959 through 1993, employing almost 400 people at the time of closure.

The population of Sitka, which grew by 41 percent between 1970 and 1990, increased by just 3 percent between 1990 and 2000, and 1 percent or an estimated 112 residents between 2000 and 2005. Total estimated population was 8,833 in Sitka in 2006 (Alaska DOL 2007a).

Year	1970	1980	1990	2000	2005	2006
Population	6,109	7,803	8,588	8,835	8,947	8,833

Source: USDA Forest Service, 1997a; U.S. Census Bureau, 2001; Alaska DOL, 2007a

Sitka has a diversified economy, with tourism, fishing, fish processing, government, health care services, transportation, and retail all contributing to its base. A total of 586 residents hold commercial fishing permits. Cruise ships contribute an estimated $11 million dollars to the local economy and residents realized an estimated $20 million in gross fishing revenue in 2002. Sound Seafood and Seafood Producers Co-op are major employers of local residents. Regional health care services and the U.S. Forest Service also employ a number of people (Alaska DCED 2002; 2006).

A study conducted by the Alaska DOL in 2003 suggested that Sitka's economy appears to have survived the downturn in its economy caused by the pulp mill closure, in large part because it has a relatively diversified economy (Gilbertson 2003). While the community of Sitka does not appear to have been as negatively affected by the closure of the pulp mill as some predicted, the effects have been felt by the workers who lost their jobs. By 2001, 57 percent of the former pulp mill labor force were no longer employed in Alaska, 43 percent had left the State, and 14 percent were in the State but had left the workforce, most likely retired. Only 25 percent of the former pulp mill workers were still living and working in Sitka (Gilbertson 2003).

Nature-based tourism in Sitka is less dominated by large cruise ships than in the other coastal communities with independent travelers making up a larger share of total visitors (Dugan et al. 2006). Multi-day fishing packages and kayaking and hunting are popular nature-based tourist activities operating from Sitka. An estimated 267,000 cruise ship passengers were scheduled to visit Sitka in 2006. There is no deepwater dock in Sitka so cruise ships anchor offshore and transport passengers to Sitka on smaller vessels.

Employment by industry data compiled by the Alaska DCED from the 2000 Census are summarized in the table below. Approximately 8 percent of the labor force in Sitka was identified as unemployed and seeking work in 2000, compared to 7 percent for Southeast Alaska as a whole. Median household income was $51,901, compared to a regional median of $44,118 (Alaska DCED 2002).

Please refer to the 1997 Forest Plan EIS for further details on the history, economy, and subsistence use of this community.

Employment by Industry	Number	Percent of Total
Agriculture, Forestry, Fishing & Hunting, Mining	407	9
Construction	253	6
Manufacturing	189	4
Wholesale Trade	54	1
Retail Trade	476	11
Transportation, Warehousing & Utilities	245	6
Information	72	2
Finance, Insurance, Real Estate, Rental & Leasing	148	3
Professional, Scientific, Management, Administrative & Waste Mgmt	191	4
Education, Health & Social Services	1,414	32
Arts, Entertainment, Recreation, Accommodation & Food Services	354	8
Other Services (Except Public Admin)	292	7
Public Administration	257	6
Total Employment	**4,352**	**100**

Source: Alaska DCED 2002

Sitka is part of the Sitka community group (see Table 3.23-6). Detailed employment data are available for this community group by economic sector for 1990, 1995, and 2000 in the planning record.

Wood products employment declined from 404 in 1990 (10 percent of total employment) to 0 in 1999 in the Sitka community group. Services, non-federal government, and retail trade accounted for 31, 22, and 17 percent of total employment in 1999, with recreation-related activities accounting for 10 percent. A total of 206,279 cruise ship passengers visited Sitka in 2001, approximately 18 percent less than the number of passengers in 1996.

Potential Effects

Community Use Area

The general area commonly used or related to by many of the residents of Sitka in their local day-to-day work, recreational, and subsistence activities is shown on Figure 3.23-27. This area contains 425,121 acres of National Forest System land (among other land ownerships). Table 3.23-54 shows how the lands within this community use area would be distributed among the LUD groups by alternative. The LUD groups are explained in the introduction to Chapter 3.

Development LUDs presently account for 22 percent of the total acreage within the Sitka community use area. Alternatives 5 and 6 would not have a significant effect on existing LUD allocations in the community use area because the acreage by LUD group would remain the same as under the existing Forest Plan. The acreage allocated to Wilderness/National Monument LUDs would remain constant under all alternatives. The amount of acreage allocated to Mostly Natural LUDs would increase under Alternatives 1 and 2. The largest increase would occur under Alternative 1, with the acreage allocated to Mostly Natural LUDs increasing from 74 percent under Alternative 5 (No Action) to 96 percent under Alternative 1, with a commensurate reduction in development LUDs (Table 3.23-54). Alternatives 4 and 7 would increase the acreage in development LUDs. Development LUDs would account for 59 percent of community use area acres under both of these alternatives compared to 22 percent under Alternative 5.

Total suitable acres would range from no acreage under Alternative 1 to 12 percent under Alternative 7, compared to 5 percent of the total community use area under Alternative 5 (No Action) and Alternative 6 (Proposed Action).

Economy

Commercial fishing, recreation and tourism, and subsistence are important to Sitka residents. Commercial fishing is not expected to be significantly affected under any of the alternatives. None of the alternatives are expected to affect recreation and tourism-related employment in Sitka.

Subsistence

No significant effect on salmon, other finfish, or invertebrate habitat capability is expected from implementation of any alternative. These resources account for 69 percent of the total edible pounds of subsistence resources harvested by Sitka households (Kruse and Frazier 1988). Marine resources (fish and marine invertebrates) accounted for 68 percent of per capita subsistence harvest in Sitka in 1996.

Figure 3.23-27
Sitka's Community Use Area

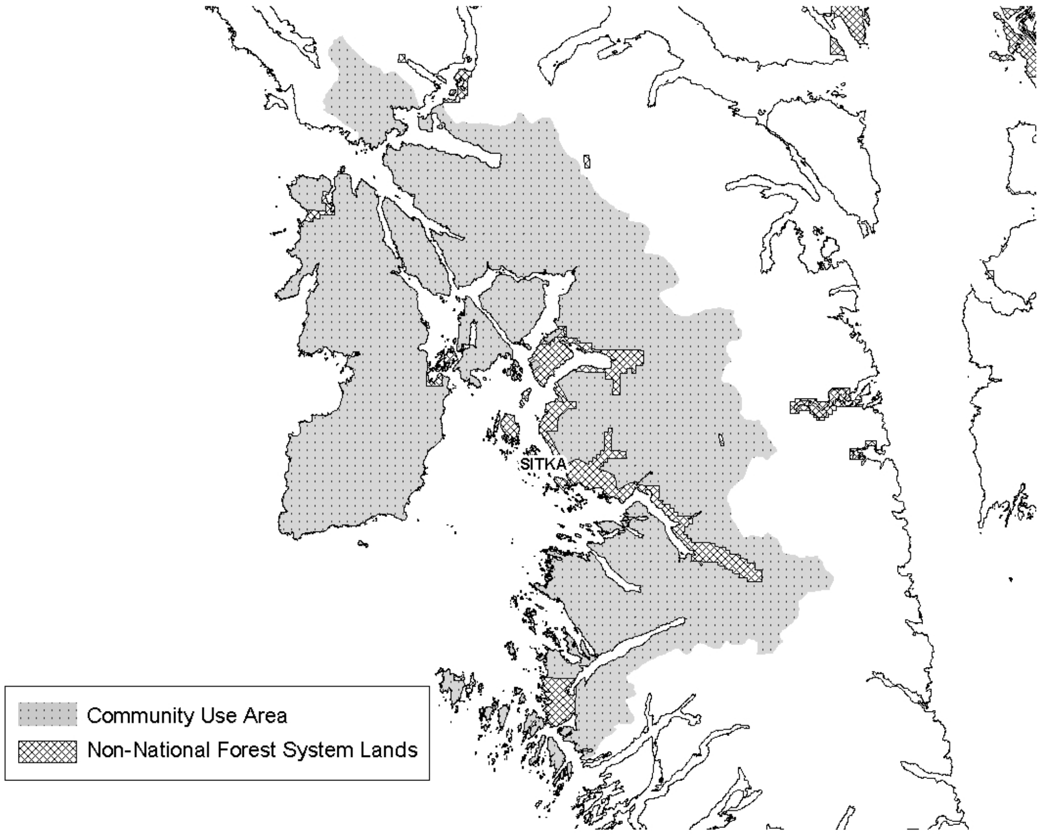


Table 3.23-54
LUD Groups in Sitka's Community Use Area by Alternative

	Alternative						
	1	**2**	**3**	**4**	**5**	**6**	**7**
	Suitable National Forest System Acres for Timber Management						
Suitable Acres	0	14,966	21,677	48,130	22,339	21,691	51,992
LUD Groups	**Acres of National Forest System Land per LUD Group**						
Wilderness/National Monument	16,471	16,471	16,471	16,471	16,471	16,471	16,471
Mostly Natural	408,650	339,984	317,611	156,419	315,416	317,453	156,221
Moderate Development	0	23,960	40,025	55,097	40,851	40,360	55,257
Intensive Development	0	44,706	51,014	197,133	52,383	50,837	197,172
Total	**425,121**	**425,121**	**425,121**	**425,120**	**425,121**	**425,121**	**425,120**

[1] See the accompanying large LUD map for the distribution of existing LUDs and the Alternative Maps for the distribution of LUDs by alternative.

The 1988 TRUCS study found that deer accounted for 27 percent of the total edible pounds of subsistence resources harvested by Sitka households (Kruse and Frazier, 1988). Deer accounted for 22 percent of per capita subsistence harvest by Sitka residents in 1996 (ADF&G 2006).

Sitka residents mainly harvest deer on Baranof Island, which is included in GMU 4. Deer harvest in GMU 4 is considered very high relative to other areas of Southeast Alaska, which is indicative of relatively high deer populations (ADF&G 2005). Over 1997-2004, there has been no significant trend in the number of deer harvested or in the number of hunters (ADF&G 2005). As noted above, the human population of Sitka increased by an estimated 1 percent between 2000 and 2005. Sitka had an estimated population of 8,947 in 2005.

Eleven WAAs account for the majority (76 percent) of deer harvest by Sitka residents. As shown in Table 3.23-55, the Sitka portion represents over 95 percent of the rural hunter harvest and almost 90 percent of the total harvest in these WAAs. About 6 percent of the combined harvest in these WAAs is by non-rural hunters, suggesting that there is very little harvest buffer that could be restricted, if necessary, before restrictions are placed on rural harvests.

The Deer Availability and Anticipated Demand analysis completed for the 1997 Forest Plan EIS determined that the 1997 Alternatives 2, 6, and 11, which are similar to the four highest harvest alternatives in this EIS, would not be able to provide sufficient habitat capability for deer hunted in the Sitka community use area by Sitka residents, all rural hunters, and all hunters in the short term. Sitka residents were identified as harvesting 15 percent of habitat capability a year, which exceeds 10 percent habitat capability, the level that the analysis assumed would provide a reasonably high level of hunter success for their effort. The Final EIS analysis concluded that at some point a restriction in hunting might be necessary.

In summary, use of most subsistence resources by Sitka residents (fish and marine invertebrates) is not expected to be affected by any of the alternatives. However, subsistence use of deer in some of the WAAs hunted by Sitka residents may be affected to the point that some restriction in hunting might be necessary over the

Table 3.23-55
Deer Harvest (1996 to 2002) and Deer Habitat Capability on NFS Lands in 2005 and After 100+ Years of Full Implementation under Each Alternative, Expressed as a Percent of 1954 Habitat Capability, for the WAAs where Sitka Residents Obtain Approximately 75% of their Average Annual Deer Harvest*

	Average Deer Harvest from 1996 to 2002			Deer Habitat Capability in 2005 and after 100+ Years of Full Implementation Under Each Alternative, Expressed as a Percent of the 1954 Habitat Capability							
WAA	Sitka Residents	All Rural Hunters	All Hunters	2005	Alt 1	Alt 2	Alt 3	Alt 4	Alt 5	Alt 6	Alt 7
3001	414	422	431	81	81	79	79	72	78	79	71
3002	314	318	329	69	69	68	68	67	68	68	67
3104	166	177	193	73	73	69	68	65	68	68	64
3003	121	121	129	85	84	83	80	73	79	80	72
3313	120	130	141	65	64	57	56	50	52	53	48
3310	118	127	140	93	93	93	93	93	93	93	93
3207	118	120	130	100	100	100	100	100	100	100	100
3733	118	145	158	100	100	100	100	100	100	100	100
3314	110	110	124	88	88	87	87	73	87	87	73
3105	97	97	103	99	99	99	98	97	97	97	97
3311	97	99	103	97	97	97	97	88	89	91	86

*Calculated based on harvest where location is known.

long term, even under Alternative 1. The risks of this occurring are greatest under Alternative 7 because of its general lack of Non-Development LUDs within the Sitka use area, and lower under the other six alternatives. The risk of hunting restrictions would be reduced somewhat, through more intensive management (e.g., thinning) of the existing and future closed-canopy, young-growth forests in this area. Indirect effects associated with increased competition for deer within Sitka's subsistence, use areas could also occur under all alternatives due to displacement of hunters from other communities due to timber harvest activity. Additional road development under the alternatives would improve access but may increase competition with other non-local hunters.

Skagway

Skagway is located in northern Southeast Alaska at the head of Taiya Inlet, 95 air miles north of Juneau. It is the end-of-the line for the Alaska Marine ferry and the entrance to the Klondike Highway. According to the 2000 Census, Skagway had a 2000 population of 862, with Alaska Natives comprising 3 percent of the total (U.S. Census Bureau 2001).

Prior to the founding of the community, the area was settled by Chilkoot Tlingit who called it "Skagua," or "the place where the north wind blows." The Chilkoots controlled access into the interior along what has become known as the Chilkoot Trail, which follows along the Taiya River and over the Chilkoot Pass. The Chilkoot Trail was a major trade route for the Chilkoot Tlingit, interior Tlingit, and Athabaskans (ADF&G 1994).

Settlement began in Skagway in 1887 when a seafarer named William Moore decided to develop a trading and mining route into the Yukon Territory using the Chilkoot Trail. As the Klondike gold rush hit the area in 1896, the Chilkoot and White Pass trails became the major routes into the Interior. Within a few years, the trails were superseded by the adjacent White Pass and Yukon Railway. The railway continued to function as a supply and shipping route between Skagway and Whitehorse until 1982 (ADF&G 1994). The railway currently operates as a tourist attraction.

Skagway is incorporated as a first class city. The community participates in the Upper Lynn Canal Fish and Game Advisory Committee (ADF&G 1994). A total of 610,145 cruise ship passengers visited Skagway in 2001, more than double the number in 1996.

The population of Skagway, which declined between 1980 and 1990, increased by 170 people or 25 percent between 1990 and 2000. The population decreased by an estimated 28 residents or 3 percent between 2000 and 2005. Total estimated population was 854 in Skagway in 2006 (Alaska DOL 2007a).

Year	1970	1980	1990	2000	2005	2006
Population	675	814	692	862	834	854

Source: USDA Forest Service, 1997a; U.S. Census Bureau, 2001; Alaska DOL, 2007a

Skagway has a strong base in the tourism industry. It is a port of call for cruise ships and a transfer site for interior rail and bus tours. The State ferry also connects travelers to the rest of Southeast Alaska. More than 600,000 cruise ship passengers and numerous State ferry travelers visit Skagway each year. Skagway is also the site of trans-shipment of lead/zinc ore, fuel, and freight via the Port and Klondike Highway to and from Canada (Alaska DCED 2002; 2006).

Employment by Industry	Number	Percent of Total
Agriculture, Forestry, Fishing & Hunting, Mining	2	0
Construction	69	15
Manufacturing	0	0
Wholesale Trade	5	1
Retail Trade	68	14
Transportation, Warehousing & Utilities	114	24
Information	6	1
Finance, Insurance, Real Estate, Rental & Leasing	14	3
Professional, Scientific, Management, Administrative & Waste Mgmt	26	5
Education, Health & Social Services	52	11
Arts, Entertainment, Recreation, Accommodation & Food Services	74	16
Other Services (Except Public Admin)	13	3
Public Administration	32	7
Total Employment	**475**	**100**

Source: Alaska DCED 2002

Employment by industry data compiled by the Alaska DCED from the 2000 Census are summarized in the table below. Approximately 14 percent of the labor force in Skagway was identified as unemployed and seeking work in 2000, compared to 7 percent for Southeast Alaska as a whole. Median household income was $49,375 compared to a regional median of $44,118 (Alaska DCED 2002).

Please refer to the 1997 Forest Plan EIS for further details on the history, economy, and subsistence use of this community.

Skagway is part of the Skagway community group (see Table 3.23-6). Detailed employment data are available for this community group by economic sector for 1990, 1995, and 2000 in the planning record. The retail trade, services, and non-federal government sectors were the major employers in the Skagway community group in 1999, accounting for 32, 20, and 17 percent of total employment, respectively. Recreation-related activities (lodging, restaurants, and recreation services) accounted for 25 percent of total employment, illustrating the importance of recreation and tourism for this area.

Potential Effects

Community Use Area

The general area commonly used or related to by many of the residents of Skagway in their local day-to-day work, recreational, and subsistence activities is shown on Figure 3.23-28. This area contains 199,938 acres of National Forest System land (among other land ownerships). Table 3.23-56 shows how the lands within this community use area would be distributed among the LUD groups by alternative. The LUD groups are explained in the introduction to Chapter 3. Only 4 percent of the acres in the Skagway community use area would be allocated to development LUDs under Alternative 5 (No Action) and Alternative 6 (Proposed Action). There would be no acres allocated to development LUDs under Alternatives 1 and 2, and approximately 5 percent under Alternatives 4 and 7, with approximately 4 percent under Alternative 3. There would be no suitable acres under any of the alternatives.

Figure 3.23-28
Skagway's Community Use Area

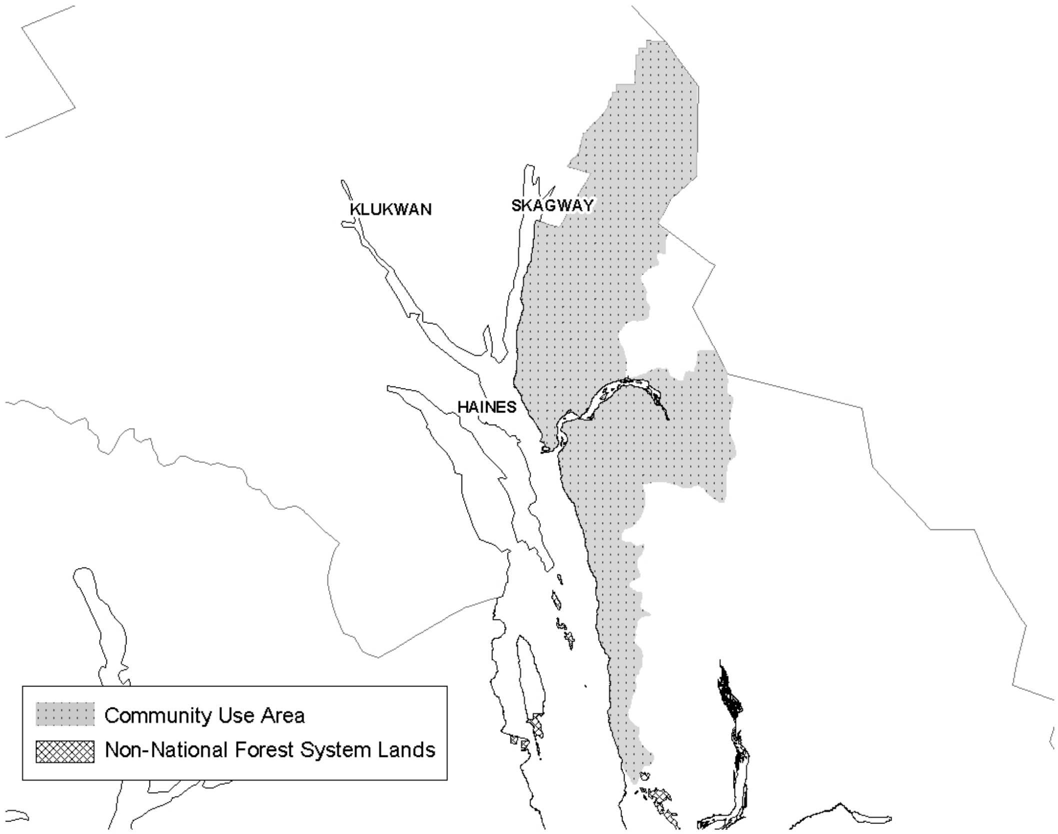


Table 3.23-56
LUD Groups in Skagway's Community Use Area by Alternative

	Alternative						
	1	**2**	**3**	**4**	**5**	**6**	**7**
	Suitable National Forest System Acres for Timber Management						
Suitable Acres	0	0	168	386	171	168	511
LUD Groups	**Acres of National Forest System Land per LUD Group**						
Wilderness/National Monument	0	0	0	0	0	0	0
Mostly Natural	199,938	199,938	192,699	190,804	192,402	192,699	190,804
Moderate Development	0	0	7,239	9,135	7,537	7,239	9,135
Intensive Development	0	0	0	0	0	0	0
Total	**199,938**	**199,938**	**199,938**	**199,939**	**199,938**	**199,938**	**199,939**

[1] See the accompanying large LUD map for the distribution of existing LUDs and the Alternative Maps for the distribution of LUDs by alternative.

There are no acres within the Skagway Community Use Area allocated to Wilderness/National Monument LUDs under any of the alternatives.

Economy

Recreation, tourism, and subsistence use are important to the community of Skagway. None of the alternatives are expected to affect recreation and tourism-related employment in Skagway.

Subsistence

No significant effect on salmon, other finfish, or invertebrate habitat capability is expected from implementation of any alternative. These resources account for 88 percent of the total edible pounds of subsistence resources harvested by Skagway households (Kruse and Frazier 1988). Marine resources (fish and marine invertebrates) accounted for 88 percent of per capita subsistence harvest in Skagway in 1987.

The 1988 TRUCS study found that deer account for only a small fraction of the total edible pounds of subsistence resources harvested by Skagway households (Kruse and Frazier, 1988). Deer accounted for 7 percent of per capita subsistence harvest by Skagway residents in 1987 (ADF&G 2006).

Skagway residents harvested very few deer from 1996-2002 (Table 3.23-57). Residents harvested an annual average of more than one deer in just four WAAs over this period. Three of these WAAs are located in GMU 4; the other is located in GMU 1C. Deer harvest in GMU 4 is considered very high relative to other areas of Southeast Alaska, which is indicative of relatively high deer populations (ADF&G 2005). Over 1997-2004, there has been no significant trend in the number of deer harvested or in the number of hunters (ADF&G 2005). GMU 1C has been characterized from 1997-2004 by substantial annual variation in deer harvest, with no evident long-term trend in harvest levels (ADF&G 2005).

Skagway residents take the majority (68 percent) of their deer from four WAAs: two on Baranof Island, one on south Chichagof Island, and one on Douglas Island (Table 3.23-57). These numbers are, however, somewhat misleading due to the overall low deer harvest levels.

Table 3.23-57
Deer Harvest (1996 to 2002) and Deer Habitat Capability on NFS Lands in 2005 and After 100+ Years of Full Implementation under Each Alternative, Expressed as a Percent of 1954 Habitat Capability, for the WAAs where Skagway Residents Obtain Approximately 75% of their Average Annual Deer Harvest*

	Average Deer Harvest from 1996 to 2002			Deer Habitat Capability in 2005 and after 100+ Years of Full Implementation Under Each Alternative, Expressed as a Percent of the 1954 Habitat Capability							
WAA	Skagway Residents	All Rural Hunters	All Hunters	2005	Alt 1	Alt 2	Alt 3	Alt 4	Alt 5	Alt 6	Alt 7
2722	3	5	261	100	100	100	100	88	100	100	100
3001	2	422	431	81	81	79	79	72	78	79	71
3002	2	318	329	69	69	68	68	67	68	68	67
3308	2	98	158	66	64	59	57	53	56	57	51

*Calculated based on harvest where location is known.

Three of the WAAs identified in Table 3.23-57 are in areas with substantial past harvest and deer habitat capabilities are currently estimated to be considerably below 1954 levels. Under each of the alternatives, additional harvest would further reduce habitat capabilities. Reductions would be smallest under Alternatives 1 and 2 and greatest under Alternative 7 in WAAs 3001, 3002, and 3308. There would only be a reduction in habitat capability under Alternative 4 in the other WAA (2722), used relatively heavily by Skagway residents.Marine resources (fish and marine invertebrates) accounted for 88 percent of per capita subsistence harvest in Skagway in 1987.

The Deer Availability and Anticipated Demand analysis completed for the 1997 Forest Plan EIS determined that 1997 Alternatives 2, 6, and 11, which are similar to the four highest harvest alternatives in this EIS, should be able to provide sufficient habitat capability for deer hunted by Skagway residents and all rural hunters in the short term. However, it concluded that demand would exceed the capability of the habitat to produce deer populations sufficient to avoid effects on hunter success for all hunters in the long term.

In summary, use of most subsistence resources by Skagway residents (fish and marine invertebrates) is not expected to be affected by any of the alternatives. However, subsistence use of deer may be affected to the point that some restriction in hunting might be necessary over the long term, even under Alternative 1.

Tenakee Springs

Tenakee Springs is located 50 miles northeast of Sitka on the north shore of Tenakee Inlet (east Chichagof Island). According to the 2000 Census, Tenakee Springs had a 2000 population of 104, with Alaska Natives comprising 3 percent of the total (U.S. Census Bureau 2001). Tenakee Springs, accessible only by floatplane or boat, is a stop on the Alaska Marine Highway ferry system.

A Tlingit winter village site was located in the vicinity of the present-day harbor and a summer village was located across the Inlet at Kadashan Bay (ADF&G 1994). Early prospectors and fishermen came to the site to wait out the winters and enjoy the natural hot springs in Tenakee. Around 1895, a large tub and building were constructed to provide a warm bathing place. The 108-degree sulfur springs is the social focus of the community, with bathing times scheduled for men and women.

In 1904, E. Snyder bought a tract of land from a Tlingit resident, including a house located near the public bathhouse. The post office, established in 1903, used the name Tenakee. In 1928, the community’s name was changed to Tenakee Springs. The community has a local Fish and Game Advisory Committee, and many residents practice a subsistence lifestyle, actively exchanging resources with neighbors (ADF&G 1994).

Tenakee Springs’ population increased slightly between 1990 and 2000, and decreased slightly between 2000 and 2005. Total estimated population was 109 in Tenakee Springs in 2006 (Alaska DOL 2007a).

Year	1970	1980	1990	2000	2005	2006
Population	86	138	94	104	98	109

Source: USDA Forest Service, 1997a; U.S. Census Bureau, 2001; Alaska DOL, 2007a

While Tenakee Springs is often considered a retirement community, commercial fishing (18 residents have permits), and tourism are important sources of income. The City and local store are the primary employers (Alaska DCED 2002).

An estimated 25 percent of the homes in Tenakee Springs are second homes. Tourism activities are limited to two family-run marine charters and Tenakee Springs residents have been vocal in their opposition to tourism development (Dugan et al. 2006). The Chichagof Conservation Council commenting on the Draft EIS noted that small-scale, locally-owned businesses catering to independent travelers are a large part of the Tenakee Springs economy. Local residents opposed cruise ship development, not all tourism development.

Employment by industry data compiled by the Alaska DCED from the 2000 Census are summarized in the table below. Approximately 14 percent of the labor force in Tenakee Springs was identified as unemployed and seeking work in 2000, compared to 7 percent for Southeast Alaska as a whole. Median household income was $33,125, compared to a regional median of $44,118 (Alaska DCED 2002).

Please refer to the 1997 Forest Plan EIS for further details on the history, economy, and subsistence use of this community.

Tenakee Springs is part of the Chatham Strait community group (see Table 3.23-6). Detailed employment data are available for this community group by economic sector for 1990, 1995, and 2000 in the planning record. The non-federal government, wood products, and services sectors were the major employers in the Chatham Strait community group in 1999, accounting for 49, 18, and 17 percent of total employment, respectively. The wood products employment was entirely in the logging sector.

Employment by Industry	Number	Percent of Total
Agriculture, Forestry, Fishing & Hunting, Mining	5	11
Construction	2	5
Manufacturing	0	0
Wholesale Trade	0	0
Retail Trade	5	11
Transportation, Warehousing & Utilities	8	18
Information	0	0
Finance, Insurance, Real Estate, Rental & Leasing	0	0
Professional, Scientific, Management, Administrative & Waste Mgmt	4	9
Education, Health & Social Services	4	9
Arts, Entertainment, Recreation, Accommodation & Food Services	2	5
Other Services (Except Public Admin)	3	7
Public Administration	11	25
Total Employment	**44**	**100**

Source: Alaska DCED 2002

Potential Effects

Community Use Area

The general area commonly used or related to by many of the residents of Tenakee Springs in their local day-to-day work, recreational, and subsistence activities is shown on Figure 3.23-29. This area contains 196,031 acres of National Forest the System land (among other land ownerships). Table 3.23-58 shows how the lands within this community use area would be distributed among the LUD groups by alternative. The LUD groups are explained in the introduction to Chapter 3.

Development LUDs presently account for 60 percent of the total acreage within the Tenakee Springs community use area. Alternatives 5 and 6 would not have a significant effect on existing LUD allocations in the community use area because the acreage by LUD group would remain the same as under the existing Forest Plan. The acreage allocated to Wilderness/National Monument LUDs would remain constant under all alternatives. The amount of acreage allocated to Mostly Natural LUDs would increase under Alternatives 1 through 3. The largest increase would occur under Alternative 1, with the acreage allocated to Mostly Natural LUDs increasing from 40 percent under Alternative 5 (No Action) to 93 percent under

Figure 3.23-29
Tenakee Springs' Community Use Area

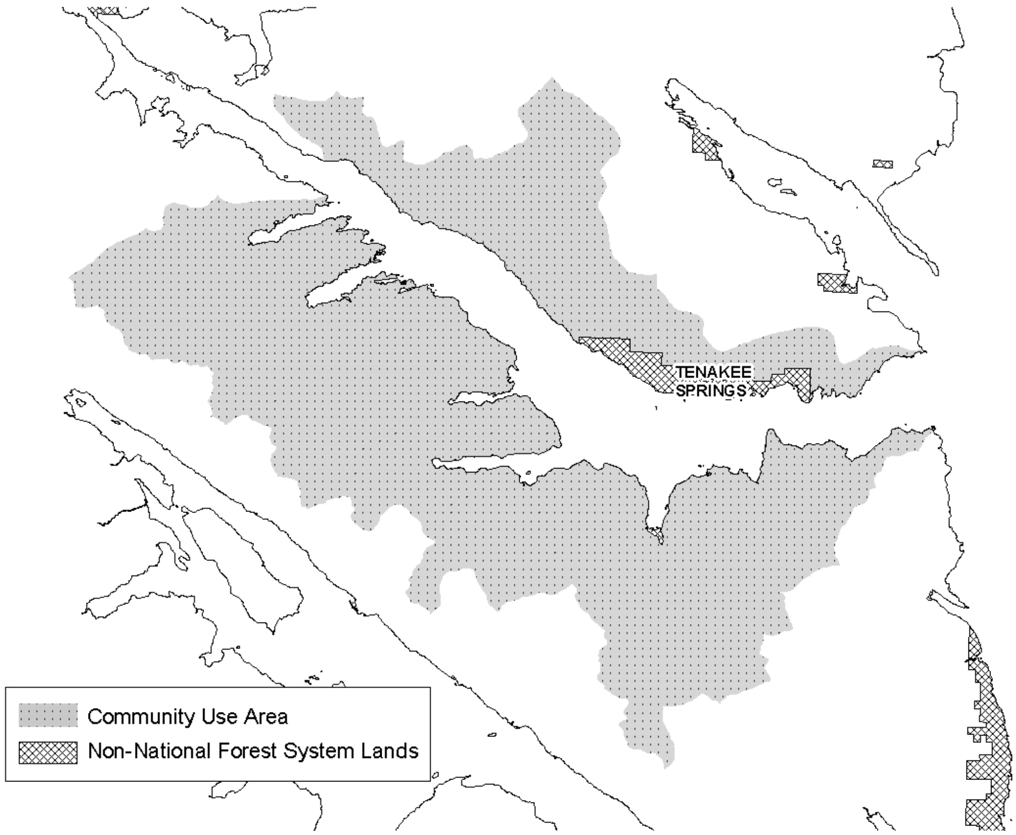


Table 3.23-58
LUD Groups in Tenakee Springs' Community Use Area by Alternative

	Alternative						
	1	**2**	**3**	**4**	**5**	**6**	**7**
	Suitable National Forest System Acres for Timber Management						
Suitable Acres	5,693	14,034	20,040	34,158	26,547	25,726	40,971
LUD Groups	**Acres of National Forest System Land per LUD Group**						
Wilderness/National Monument	0	0	0	0	0	0	0
Mostly Natural	181,878	153,699	126,906	57,489	78,488	94,892	45,536
Moderate Development	1,369	3,803	4,604	10,039	4,457	5,152	13,096
Intensive Development	12,784	38,528	64,520	128,503	113,085	95,987	137,398
Total	**196,031**	**196,031**	**196,031**	**196,031**	**196,031**	**196,031**	**196,031**

[1] See the accompanying large LUD map for the distribution of existing LUDs and the Alternative Maps for the distribution of LUDs by alternative.

Alternative 1, with a commensurate reduction in development LUDs (Table 3.23-58). Alternatives 4 and 7 would increase the acreage in development LUDs. Development LUDs would account for 71 percent and 77 percent under Alternatives 4 and 7, respectively, compared to 60 percent under Alternative 5.

Total suitable acres would range from 3 percent under Alternative 1 to 21 percent under Alternative 7, compared to 14 percent of the total community use area under Alternative 5 (No Action) and 13 percent under Alternative 6 (Proposed Action).

Economy

Tenakee Springs is primarily a commercial fishing, subsistence, and retirement community. The lands along Tenakee Inlet are some of the most important to the community. Kadashan and Trap Bay watersheds are legislated LUD II areas. These areas were designated in the Tongass Timber Reform Act, in part, because of their high value for subsistence use for Tenakee Springs residents.

Commercial fishing is not expected to be significantly affected by Forest Service activities during the next 10 years.

Subsistence

No significant effect on salmon, other finfish, or invertebrate habitat capability is expected from implementation of any alternative. These resources account for 55 percent of the total edible pounds of subsistence resources harvested by Tenakee Springs households (Kruse and Frazier 1988). Marine resources (fish and marine invertebrates) accounted for 53 percent of per capita subsistence harvest in Tenakee Springs in 1987.

The 1988 TRUCS study found that deer accounted for 39 percent of the total edible pounds of subsistence resources harvested by Tenakee Springs households (Kruse and Frazier, 1988). Deer accounted for 41 percent of per capita subsistence harvest by Tenakee Springs residents in 1987 (ADF&G 2006). The WAAs used by Tenakee Springs residents for hunting deer lie within GMU 4. Deer harvest in GMU 4 is considered very high relative to other areas of Southeast Alaska, which is indicative of relatively high deer populations (ADF&G 2005). Over 1997-2004, there has been no significant trend in the number of deer harvested or in the number of hunters (ADF&G 2005). However, as shown above, Tenakee Springs' human population decreased slightly from 2000 to 2005, with an estimated 98 residents identified in 2005.

Tenakee Springs residents take the majority (67 percent) of their deer from two WAAs on Chichagof Island (3627 and 3526). As shown in Table 3.23-59, the Tenakee Springs portion represents about 35 percent and 20 percent of the total harvest and about 72 percent and 74 percent of the rural hunter harvest in these WAAs, respectively. About 64 percent of the combined harvest in these WAAs is by non-rural hunters, suggesting that there is a harvest buffer that could be restricted, if necessary, before restrictions are placed on rural harvests.

WAAs 3627 and 3526 occur in an area with substantial past harvest and, therefore, deer habitat capabilities are currently estimated to be below 1954 levels (Table 3.23-59). Under each of the alternatives, additional harvest would occur that would reduce habitat capabilities after 100+ years to 61-70 percent of 1954 levels in WAA 3627 and 60-77 percent in WAA 3526.

Table 3.23-59
Deer Harvest (1996 to 2002) and Deer Habitat Capability on NFS Lands in 2005 and After 100+ Years of Full Implementation under Each Alternative, Expressed as a Percent of 1954 Habitat Capability, for the WAAs where Tenakee Springs Residents Obtain Approximately 75% of their Average Annual Deer Harvest*

	Average Deer Harvest from 1996 to 2002			Deer Habitat Capability in 2005 and after 100+ Years of Full Implementation Under Each Alternative, Expressed as a Percent of the 1954 Habitat Capability							
WAA	Tenakee Springs Residents	All Rural Hunters	All Hunters	2005	Alt 1	Alt 2	Alt 3	Alt 4	Alt 5	Alt 6	Alt 7
3627	25	35	72	76	70	67	65	62	64	65	61
3526	23	31	115	81	77	73	72	69	72	72	60
3629	11	16	43	91	91	89	85	75	79	80	73

*Calculated based on harvest where location is known.

The Deer Availability and Anticipated Demand analysis completed for the 1997 Forest Plan EIS determined that 1997 Alternatives 2, 6, and 11, which are similar to the four highest harvest alternatives in this EIS, should be able to provide sufficient habitat capability over the short term for deer hunted by Tenakee Springs residents, all rural hunters, and all hunters. However, it concluded that all alternatives may have future inadequate habitat capability for the total deer hunter and at some point a restriction in hunting may be necessary.

In summary, use of most subsistence resources by Tenakee Springs residents (fish and marine invertebrates) is not expected to be affected by any of the alternatives. However, subsistence use of deer may be affected to the point that some restriction in hunting might be necessary over the long term, even under Alternative 1. The risks of this occurring are greatest under Alternative 7, and lower under the other six alternatives. The risk of hunting restrictions would be reduced somewhat, through more intensive management (e.g., thinning) of the existing and future closed-canopy, young-growth forests in this area.

Thorne Bay

Thorne Bay is located at the head of Thorne Bay on eastern Prince of Wales Island, approximately 40 air miles northwest of Ketchikan. According to the 2000 Census, Thorne Bay had a 2000 population of 557, with Alaska Natives comprising 16 percent of the total (U.S. Census Bureau 2001).

Petroglyphs and other archaeological remains indicate occupation and use of the area by Alaska Natives dating back at least 3,000 years. Post-contact development began in the early 1900s with construction of a saltery on the south shore of Thorne Bay (ADF&G 1994).

In 1960, a floating logging camp was built in Thorne Bay, and, in 1962, a shop, barge terminal, log sort yard, and camp were built to replace facilities at Hollis. Thorne Bay was incorporated as a second class city in 1982, making it one of Alaska's newest cities. Thorne Bay is accessible by road, water, or floatplane. Three air carriers serve the community with six to ten flights daily, and the Alaska Marine Highway system is accessed by the road system to Hollis (ADF&G 1994).

Thorne Bay's population decreased by 4 percent between 1990 and 2000. Population in Thorne Bay decreased further between 2000 and 2005, with an estimated net loss of 71 residents or 13 percent of the community's population in 2000. Total estimated population was 482 in Thorne Bay in 2006 (Alaska DOL 2007a).

Year	1970	1980	1990	2000	2005	2006
Population	443	377	581	557	486	482

Source: USDA Forest Service, 1997a; U.S. Census Bureau, 2001; Alaska DOL, 2007a

The Thorne Bay economy is primarily based on the timber industry and the U.S. Forest Service management of the National Forest. Logging operations in the area are generally seasonal (March to November) and include a major log transfer site for Prince of Wales Island. The 2006 mill survey conducted for the USDA Forest Service identified three active timber processors in Thorne Bay: Porter Lumber Company, Thuja Plicata Lumber Company, and Thorne Bay Wood Products. These mills had a combined installed production capacity of 25 MMBF and together processed approximately 1.2 MMBF in 2006 and employed about 8 people (Juneau Economic Development Council 2007). Northern Star Cedar Products, also located in Thorne Bay, was recently subdivided and sold as three separate operations, with each part now under new ownership.

Commercial fishing (22 residents hold permits), tourism, and government also provide employment (Alaska DCED 2002).

Employment by industry data compiled by the Alaska DCED from the 2000 Census are summarized in the table below. Approximately 15 percent of the labor force in Thorne Bay was identified as unemployed and seeking work in 2000, compared to 7 percent for Southeast Alaska as a whole. Median household income was $45,625, compared to a regional median of $44,118 (Alaska DCED 2002).

Employment by Industry	Number	Percent of Total
Agriculture, Forestry, Fishing & Hunting, Mining	53	20
Construction	33	12
Manufacturing	16	6
Wholesale Trade	3	1
Retail Trade	25	9
Transportation, Warehousing & Utilities	15	6
Information	3	1
Finance, Insurance, Real Estate, Rental & Leasing	2	1
Professional, Scientific, Management, Administrative & Waste Mgmt	13	5
Education, Health & Social Services	61	23
Arts, Entertainment, Recreation, Accommodation & Food Services	8	3
Other Services (Except Public Admin)	6	2
Public Administration	31	12
Total Employment	**269**	**100**

Source: Alaska DCED 2002

Please refer to the 1997 Forest Plan EIS for further details on the history, economy, and subsistence use of this community.

Thorne Bay is part of the North Prince of Wales community group (see Table 3.23-6). Detailed employment data are available for this community group by economic sector for 1990, 1995, and 2000 in the planning record. Wood products employment in the North Prince of Wales community group declined by 186 jobs or 69 percent between 1990 and 1999. Wood products employment accounted for 83 jobs or 23 percent of total employment in this community group in 1999.

Potential Effects

Community Use Area

The general area commonly used or related to by many of the residents of Thorne Bay in their local day-to-day work, recreational, and subsistence activities is shown on Figure 3.23-30. This area contains 1,000,251 acres of National Forest System land (among other land ownerships). Table 3.23-60 shows how the lands within this community use area would be distributed among the LUD groups by alternative. The LUD groups are explained in the introduction to Chapter 3.

Development LUDs presently account for 54 percent of the total acreage within the Thorne Bay community use area. Alternatives 5 and 6 would not have a significant effect on existing LUD allocations in the community use area because the acreage by LUD group would remain the same as under the existing Forest Plan. The acreage allocated to Wilderness/National Monument LUDs would remain constant under all alternatives. The amount of acreage allocated to Mostly Natural LUDs would increase under Alternatives 1 through 3. The largest increase would occur under Alternative 1, with the acreage allocated to Mostly Natural LUDs increasing from 40 percent under Alternative 5 (No Action) to 61 percent under Alternative 1, with a commensurate reduction in development LUDs (Table 3.23-60). Alternatives 4 and 7 would increase the acreage in development LUDs. Development LUDs would account for 62 percent and 78 percent under Alternatives 4 and 7, respectively, compared to 55 percent under Alternative 5.

Total suitable acres would range from 17 percent under Alternative 1 to 31 percent under Alternative 7, compared to 21 percent of the total community use area under Alternative 5 (No Action) and Alternative 6 (Proposed Action).

Economy

Thorne Bay is primarily a logging community and as such would be directly affected by the amount of logging opportunities on north Prince of Wales Island, as well as elsewhere on the Tongass. The mill survey conducted by the Forest Service in 2000 identified four sawmills operating in Thorne Bay. Three of these mills were also identified in the survey conducted for 2006 (Juneau Economic Development Council 2007). Approximately 6.5 MMBF was under contract in the Thorne Bay Ranger District in August 2006. This volume would not be affected under any of the alternatives. These data provide an indication of potential impacts, actual impacts would depend on the volume that is under contract when the decision is implemented and whether potentially affected existing sales were cancelled as part of the decision.

The 1997 Forest Plan EIS indicated that several small timber operators produce value-added products in Thorne Bay. These value added products include music wood, cabinets, and other products. They need relatively low volumes of timber, but of specific species and grades to meet their needs. All alternatives should meet these needs.

The lodges located near the community would not be affected under any of the alternatives.

Subsistence

No significant effect on salmon, other finfish, or invertebrate habitat capability is expected from implementation of any alternative. These resources account for 75 percent of the total edible pounds of subsistence resources harvested by Thorne Bay households (Kruse and Frazier 1988). Marine resources (fish and marine

Figure 3.23-30
Thorne Bay's Community Use Area

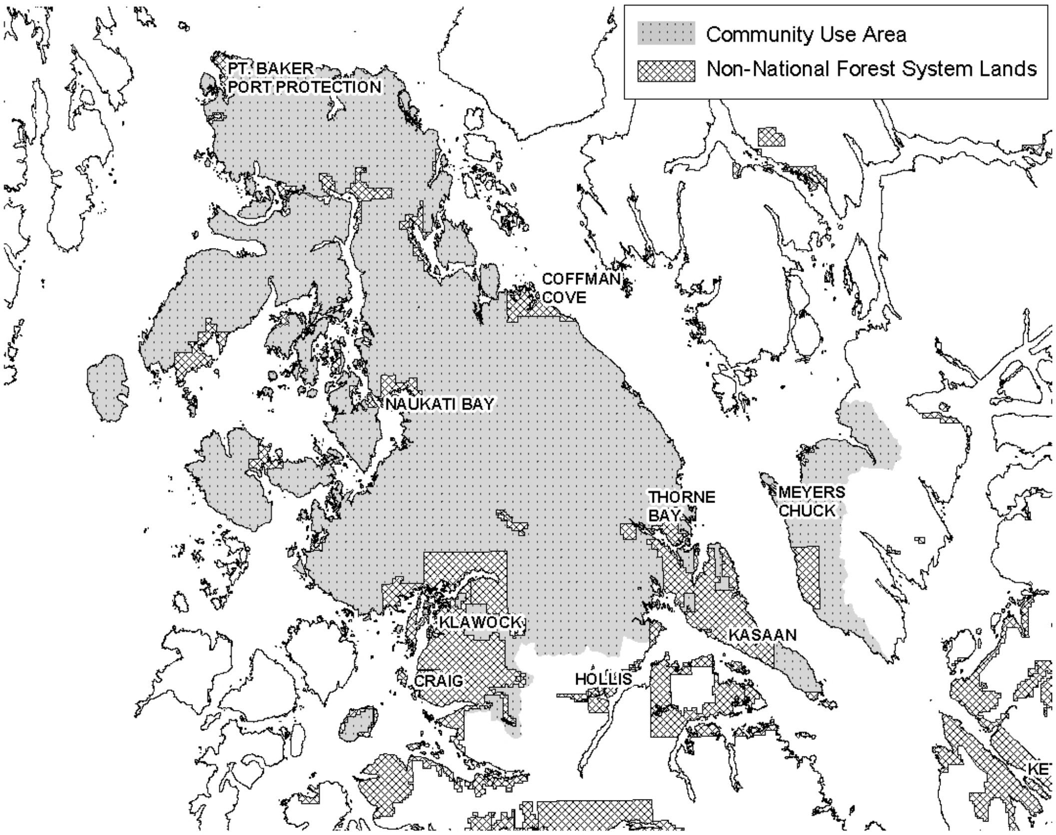


Table 3.23-60
LUD Groups in Thorne Bay's Community Use Area by Alternative

	Alternative						
	1	2	3	4	5	6	7
	Suitable National Forest System Acres for Timber Management						
Suitable Acres	168,118	183,297	194,535	229,341	212,196	205,531	309,814
LUD Groups	**Acres of National Forest System Land per LUD Group**						
Wilderness/National Monument	51,176	51,176	51,176	51,176	51,176	51,176	51,176
Mostly Natural	610,703	521,333	462,782	328,739	404,829	415,260	172,901
Moderate Development	95,974	112,481	139,418	168,888	160,346	159,286	265,649
Intensive Development	242,395	315,259	346,875	451,449	383,900	374,528	510,523
Total	**1,000,248**	**1,000,249**	**1,000,251**	**1,000,252**	**1,000,251**	**1,000,249**	**1,000,249**

[1] See the accompanying large LUD map for the distribution of existing LUDs and the Alternative Maps for the distribution of LUDs by alternative.

invertebrates) accounted for 54 percent of per capita subsistence harvest in Thorne Bay in 1998.

The 1988 TRUCS study found that deer accounted for 20 percent of the total edible pounds of subsistence resources harvested by Thorne Bay (Kruse and Frazier 1988). Deer accounted for 27 percent of per capita subsistence harvest by Throne Bay residents in 1998 (ADF&G 2006).

Thorne Bay residents harvest deer almost entirely on Prince of Wales Island, which is included in GMU 2. Deer harvest and hunter effort in GMU 2 generally increased during 1997-2000 and subsequently declined during 2000-2004; however, no change has been noted in the average number of hunter-days required to harvest a deer (ADF&G 2005). As noted above, Thorne Bay's human population declined by an estimated 13 percent between 2000 and 2005, with an estimated 2005 population of 486.

Residents of Thorne Bay harvest the majority (79 percent) of their deer from two WAAs in north-central Prince of Wales Island (1319 and 1315). As shown in Table 3.23-61, the Thorne Bay portion represents about 56 percent and 42 percent of the total harvest and about 70 percent and 65 percent of the rural hunter harvest in these WAAs, respectively. About 28 percent of the combined harvest in these WAAs is by non-rural hunters, suggesting that there is a limited harvest buffer that could be restricted, if necessary, before restrictions are placed on rural harvests.

WAAs 1319 and 1315 occur in an area with substantial past harvest and, therefore, deer habitat capabilities are currently estimated to be below 1954 levels (Table 3.23-61). Under each of the alternatives, additional harvest would occur that would reduce habitat capabilities after 100+ years to 54-69 percent of 1954 levels in WAA 1319 and 41-50 percent in WAA 1315.

Table 3.23-61
Deer Harvest (1996 to 2002) and Deer Habitat Capability on NFS Lands in 2005 and After 100+ Years of Full Implementation under Each Alternative, Expressed as a Percent of 1954 Habitat Capability, for the WAAs where Thorne Bay Residents Obtain Approximately 75% of their Average Annual Deer Harvest*

	Average Deer Harvest from 1996 to 2002			Deer Habitat Capability in 2005 and after 100+ Years of Full Implementation Under Each Alternative, Expressed as a Percent of the 1954 Habitat Capability							
WAA	Thorne Bay Residents	All Rural Hunters	All Hunters	2005	Alt 1	Alt 2	Alt 3	Alt 4	Alt 5	Alt 6	Alt 7
1319	123	177	220	74	69	67	66	59	64	64	54
1315	115	175	270	55	50	49	47	44	47	47	41

*Calculated based on harvest where location is known.

The Deer Availability and Anticipated Demand analysis completed for the 1997 Forest Plan EIS determined that 1997 Alternatives 2, 6, and 11, which are similar to the four highest harvest alternatives in this EIS, should be able to provide sufficient habitat capability over the long term for deer hunted by Thorne Bay residents. Projected deer harvest in the Thorne Bay community use area by all rural hunters and all hunters is estimated to exceed 10 percent habitat capability, the level that the analysis is assumed would provide a reasonably high level of hunter success for their effort, in the short and long term.

In summary, use of most subsistence resources by Thorne Bay residents (fish and marine invertebrates) is not expected to be affected by any of the alternatives.

However, subsistence use of deer may be affected to the point that some restriction in hunting might be necessary over the long term, even under Alternative 1. The risks of this occurring are greatest under Alternative 7 because of its general lack of Non-Development LUDs throughout most of Prince of Wales Island, and second highest under Alternative 4 because of its lower use of Non-Development LUDs than the other alternatives. Alternatives 1, 2, and 3 would have the lowest risk and Alternatives 5 and 6 would be intermediate. The risk of hunting restrictions would be reduced somewhat, through more intensive management (e.g., thinning) of the existing and future closed-canopy, young-growth forests in this area. Indirect effects associated with increased competition for deer within Thorne Bay's subsistence use areas could also occur under all alternatives due to displacement of hunters from other communities due to timber harvest activity. Additional road development under the alternatives would improve access but may increase competition with other non-local hunters. The level of road development is already relatively high in these WAAs. Existing open road densities are 0.6 and 1.5 miles per square mile and existing total road densities are 1.2 and 2.0 miles per square mile in WAAs 1319 and 1315, respectively (all ownerships combined). Long-term (100+ years) road development would vary by alternative and would result in estimated maximum total road densities of 1.3 and 2.7 miles per square mile in these two WAAs under Alternative 1, to 1.7 and 2.9 miles per square mile in these two WAAs under Alternative 7 (for all ownerships combined).

Whale Pass

Whale Pass is a dispersed unincorporated community located on the northeast coast of Prince of Wales Island. According to the 2000 Census, Whale Pass had a 2000 population of 58, with Alaska Natives comprising one percent of the total (U.S. Census Bureau 2001).

Whale Pass was originally established as a logging camp by Ketchikan Pulp Company in the early 1960s. According to local residents, a float camp housed loggers and their families in this location for almost 30 years. In 1982, the float camp was removed and many of the logging families left. Others moved to trailer pads on land at the head of the cove. That same year, Whale Pass became the site of a State land sale, which brought renewed population growth and the founding of a homeowners association. The community has been connected to the road system on Prince of Wales Island since 1981. A log transfer station remains on the southwest side of the bay (ADF&G, 1994).

The population of Whale Pass decreased by 17 residents between 1990 and 2000. Population has increased by an estimated 18 residents or 31 percent since 2000. Total estimated population was 61 in Whale Pass in 2006 (Alaska DOL 2007a).

Year	1980	1990	2000	2005	2006
Population	90	75	58	76	61

Source: USDA Forest Service, 1997a; U.S. Census Bureau, 2001; Alaska DOL, 2007a

Whale Pass is primarily dependent on the timber industry, with logging operations and the local school being the only employers in the area (Alaska DCED 2002).

Employment by industry data compiled by the Alaska DCED from the 2000 Census are summarized in the table below. These data are extrapolated from a sample of the city population. Since the sample size was small, the extrapolation may not be exact but should provide a general indication of the distribution of employment. The 2000 U.S. Census identified a potential work force of 37 residents and total employment of 14. While no adults in Whale Pass were identified as unemployed and looking for work in 2000, 62 percent were identified as unemployed and not looking for work. Median household income was $62,083, compared to a regional median of $44,118 (Alaska DCED 2002).

Employment by Industry	Number	Percent of Total
Agriculture, Forestry, Fishing & Hunting, Mining	9	64
Construction	0	0
Manufacturing	0	0
Wholesale Trade	0	0
Retail Trade	3	21
Transportation, Warehousing & Utilities	0	0
Information	0	0
Finance, Insurance, Real Estate, Rental & Leasing	0	0
Professional, Scientific, Management, Administrative & Waste Mgmt	2	14
Education, Health & Social Services	0	0
Arts, Entertainment, Recreation, Accommodation & Food Services	0	0
Other Services (Except Public Admin)	0	0
Public Administration	0	0
Total Employment	**14**	**100**

Source: Alaska DCED 2002

Please refer to the 1997 Forest Plan EIS for further details on the history, economy, and subsistence use of this community.

Whale Pass is located in the Thorne Bay Ranger District and is part of the North Prince of Wales community group (see Table 3.23-6). Detailed employment data are available for this community group by economic sector for 1990, 1995, and 2000 in the planning record. Wood products employment in the North Prince of Wales community group declined by 186 jobs or 69 percent between 1990 and 1999. Wood products employment accounted for 83 jobs or 23 percent of total employment in this community group in 1999.

Potential Effects

Community Use Area

The general area commonly used or related to by many of the residents of Whale Pass in their local day-to-day work, recreational, and subsistence activities is shown on Figure 3.23-31. This area contains 1,000,251 acres of National Forest System land (among other land ownerships). Table 3.23-62 shows how the lands within this community use area would be distributed among the LUD groups by alternative. The LUD groups are explained in the introduction to Chapter 3.

Development LUDs presently account for 54 percent of the total acreage within the Whale Pass community use area. Alternatives 5 and 6 would not have a significant effect on existing LUD allocations in the community use area because the acreage by LUD group would remain the same as under the existing Forest Plan. The acreage allocated to Wilderness/National Monument LUDs would remain constant under all alternatives. The amount of acreage allocated to Mostly Natural LUDs would increase under Alternatives 1 through 3. The largest increase would occur under Alternative 1, with the acreage allocated to Mostly Natural LUDs increasing from 40 percent under Alternative 5 (No Action) to 61 percent under Alternative 1, with a commensurate reduction in development LUDs (Table 3.23-62). Alternatives 4 and 7 would increase the acreage in development LUDs. Development LUDs would account for 62 percent and 78 percent under Alternatives 4 and 7, respectively, compared to 54 percent under Alternative 5.

Figure 3.23-31
Whale Pass' Community Use Area

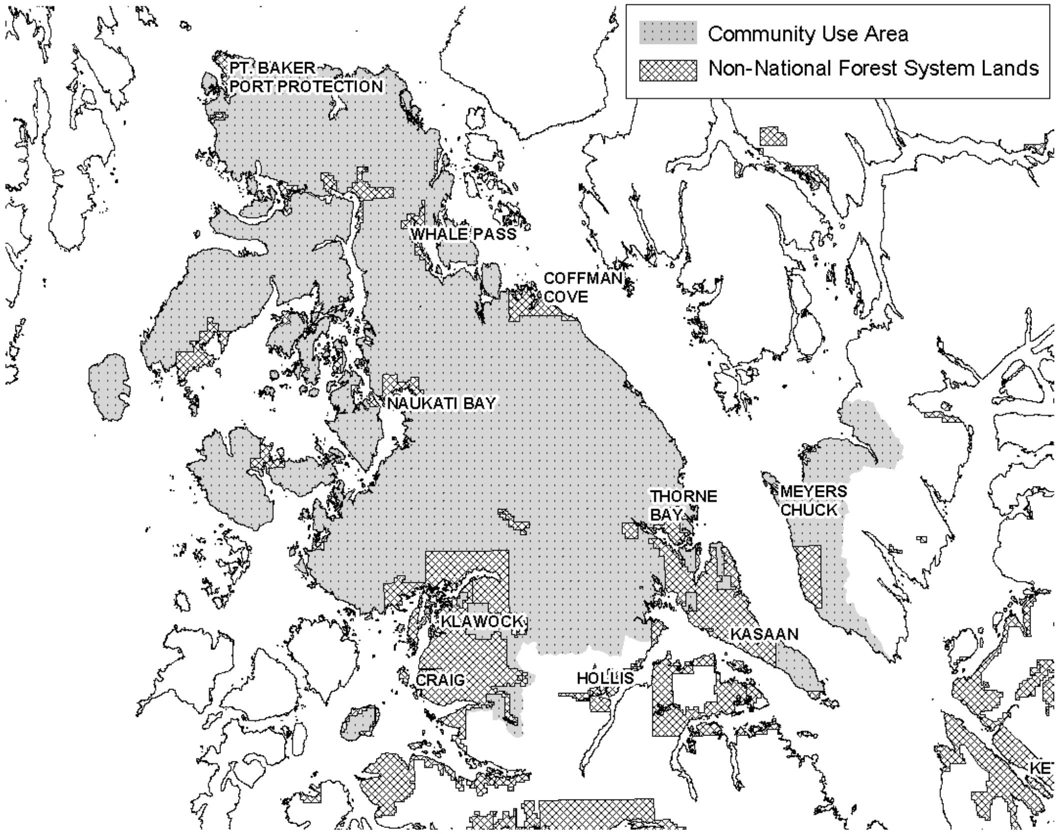


Table 3.23-62
LUD Groups in Whale Pass' Community Use Area by Alternative

	Alternative						
	1	2	3	4	5	6	7
	Suitable National Forest System Acres for Timber Management						
Suitable Acres	168,118	183,297	194,535	229,341	212,196	205,531	309,814
LUD Groups	**Acres of National Forest System Land per LUD Group**						
Wilderness/National Monument	51,176	51,176	51,176	51,176	51,176	51,176	51,176
Mostly Natural	610,703	521,333	462,782	328,739	404,829	415,260	172,901
Moderate Development	95,974	112,481	139,418	168,888	160,346	159,286	265,649
Intensive Development	242,395	315,259	346,875	451,449	383,900	374,528	510,523
Total	**1,000,248**	**1,000,249**	**1,000,251**	**1,000,252**	**1,000,251**	**1,000,249**	**1,000,249**

[1] See the accompanying large LUD map for the distribution of existing LUDs and the Alternative Maps for the distribution of LUDs by alternative.

Total suitable acres would range from 17 percent under Alternative 1 to 31 percent under Alternative 7, compared to 21 percent of the total community use area under Alternative 5 (No Action) and Alternative 6 (Proposed Action).

Economy

Residents of Whale Pass could be potentially affected by changes in timber harvest, karst protection, recreation and tourism, and subsistence opportunities. Members of several speliological societies derive a portion of their income from cave and karst analysis and exploration in the vicinity. The Whale Pass Resort and a retail store are located in Whale Pass.

Approximately 6.5 MMBF was under contract in the Thorne Bay Ranger District in August 2006. This volume would not be affected under any of the alternatives. These data provide an indication of potential impacts, actual impacts would depend on the volume that is under contract when the decision is implemented and whether potentially affected existing sales were cancelled as part of the decision.

Subsistence

No significant effect on salmon, other finfish, or invertebrate habitat capability is expected from implementation of any alternative. These resources account for 60 percent of the total edible pounds of subsistence resources harvested by Whale Pass households (Kruse and Frazier 1988). Marine resources (fish and marine invertebrates) accounted for 65 percent of per capita subsistence harvest in Whale Pass in 1998.

The 1988 TRUCS study found that deer account for 27 percent of the total edible pounds of subsistence resources harvested by Whale Pass households (Kruse and Frazier, 1988). Deer accounted for 27 percent of per capita subsistence harvest by Whale Pass residents in 1998 (ADF&G 2006).

The majority of deer harvest by Whale Pass residents occurs on Prince of Wales Island, which is included in GMU 2. Deer harvest and hunter effort in GMU 2 generally increased during 1997-2000 and subsequently declined during 2000-2004; however, no change has been noted in the average number of hunter-days required to harvest a deer (ADF&G 2005). As noted above, the human population of Whale Pass increased by and estimated 31 percent from 2000 to 2005, with an estimated 2005 population of 76, which roughly matches the community's 1990 population level.

Residents of Whale Pass harvest the majority (83 percent) of their deer from two WAAs in north Prince of Wales Island (1530 and 1529). As shown in Table 3.23-63, the Whale Pass portion represents about 12 percent and 2 percent of the total harvest and about 21 percent and 3 percent of the rural hunter harvest in these WAAs, respectively. About 46 percent of the combined harvest in these WAAs is by non-rural hunters, suggesting that there is a harvest buffer that could be restricted, if necessary, before restrictions are placed on rural harvests.

WAAs 1530 and 1529 occur in an area with substantial past harvest and, therefore, deer habitat capabilities are currently estimated to be below 1954 levels (Table 3.23-63). Under each of the alternatives, additional harvest would occur that would reduce habitat capabilities after 100+ years to 50-58 percent of 1954 levels in WAA 1530 and 50-63 percent in WAA 1529.

Table 3.23-63
Deer Harvest (1996 to 2002) and Deer Habitat Capability on NFS Lands in 2005 and After 100+ Years of Full Implementation under Each Alternative, Expressed as a Percent of 1954 Habitat Capability, for the WAAs where Whale Pass Residents Obtain Approximately 75% of their Average Annual Deer Harvest*

	Average Deer Harvest from 1996 to 2002			Deer Habitat Capability in 2005 and after 100+ Years of Full Implementation Under Each Alternative, Expressed as a Percent of the 1954 Habitat Capability							
WAA	**Whale Pass Residents**	**All Rural Hunters**	**All Hunters**	**2005**	**Alt 1**	**Alt 2**	**Alt 3**	**Alt 4**	**Alt 5**	**Alt 6**	**Alt 7**
1530	17	80	147	62	58	57	55	54	55	55	50
1529	4	122	226	73	63	61	60	56	59	59	50

*Calculated based on harvest where location is known.

The Deer Availability and Anticipated Demand analysis completed for the 1997 Forest Plan EIS determined that 1997 Alternatives 2, 6, and 11, which are similar to the four highest harvest alternatives in this EIS, should be able to provide sufficient habitat capability over the long term for deer hunted by Whale Pass residents. Projected deer harvest in the Whale Pass community use area by all rural hunters and all hunters is estimated to exceed 10 percent habitat capability, the level that the analysis assumed would provide a reasonably high level of hunter success for their effort, in the short term and long term.

In summary, use of most subsistence resources by Whale Pass residents (fish and marine invertebrates) is not expected to be affected by any of the alternatives. However, subsistence use of deer may be affected to the point that some restriction in hunting might be necessary over the long term, even under Alternative 1. The risks of this occurring are greatest under Alternative 7 because of its general lack of Non-Development LUDs throughout most of Prince of Wales Island, and second highest under Alternative 4 because of its lower use of Non-Development LUDs than the other alternatives. Alternatives 1, 2, and 3 would have the lowest risk and Alternatives 5 and 6 would be intermediate. The risk of hunting restrictions would be reduced somewhat, through more intensive management (e.g., thinning) of the existing and future closed-canopy, young-growth forests in this area. Indirect effects associated with increased competition for deer within the Whale Pass subsistence use areas could also occur under all alternatives due to displacement of hunters from other communities due to timber harvest activity. Additional road development under the alternatives would improve access but may increase competition with other non-local hunters. The level of road development is already relatively high in these WAAs. Existing open road densities are 1.1 and 0.9 miles per square mile and existing total road densities are 1.7 and 1.5 miles per square mile in WAAs 1530 and 1529, respectively (all ownerships combined). Long-term (100+ years) road development would vary by alternative and would result in estimated maximum total road densities of 1.9 and 1.7 miles per square mile in these two WAAs under Alternative 1, to 2.0 miles per square mile in both WAAs under Alternative 7 (for all ownerships combined).

Wrangell

Wrangell is located on the north end of Wrangell Island, near the mouth of the Stikine River, an historic trade route to the Canadian interior. According to the 2000 Census, Wrangell had a 2000 population of 2,308, with Alaska Natives comprising 16 percent of the total (U.S. Census Bureau 2001).

Wrangell began as an important Tlingit site primarily because of its proximity to the Stikine River. Wrangell clans held a monopoly of trading rights along the Stikine. In 1811, the Russians began fur trading with area Tlingits and built a stockade named

Redoubt Saint Dionysius in 1834. In 1867, a military post named Fort Wrangell was established as part of the Alaska Territory. The community continued to grow because of its strategic location as a military fur trading center, and as an outfitter for gold prospectors between 1861 and the 1930s (ADF&G 1994; Alaska DCED 2006).

Wrangell is incorporated as a home rule municipality and has maintained its historic cultural diversity. The community has a local Fish and Game Advisory Committee. In a move to emphasize the importance of subsistence, the Wrangell Indian Reorganization Act Council has formed its own local Fish and Game Advisory Committee (ADF&G 1994).

The Silver Bay sawmill is located in Wrangell. According to the 2006 mill survey conducted for the USDA Forest Service, this mill, which has an installed production capacity of 65 MMBF, processed approximately 6 MMBF in 2006 and employed 30 people (Juneau Economic Development Council 2007).

Wrangell's population, which increased 22 percent between 1970 and 1990, decreased by 171 residents or 7 percent between 1990 and 2000. The population decreased by a further estimated 334 residents or 14 percent from 2000 to 2005. Total estimated population was 1,911 in Wrangell in 2006 (Alaska DOL 2007a).

Year	1970	1980	1990	2000	2005	2006
Population	2,029	2,184	2,479	2,308	1,974	1,911

Source: USDA Forest Service, 1997a; U.S. Census Bureau, 2001; Alaska DOL, 2007a

The Wrangell economy is primarily based on commercial fishing (250 residents hold permits), fish processing, and the timber industry. Estimated gross fishing earnings of local residents approached $5 million in 2000. A dive fishery, including for urchins, sea cucumbers, and geoducks, is developing. The Alaska Pulp Corp. sawmill, closed in 1994, was sold to Silver Bay Logging and reopened in April 1998. Wrangell also has a tourist business attracted by sportfishing in Stikine River and by a deep-water port for docking large and small cruise ships (Alaska DCED 2002; 2006).

Employment by industry data compiled by the Alaska DCED from the 2000 Census are summarized in the table below. Approximately 9 percent of the labor force in Wrangell was identified as unemployed and seeking work in 2000, compared to 7 percent for Southeast Alaska as a whole. Median household income was $43,250, compared to a regional median of $44,118 (Alaska DCED 2002).

Employment by Industry	Number	Percent of Total
Agriculture, Forestry, Fishing & Hunting, Mining	176	16
Construction	98	9
Manufacturing	78	7
Wholesale Trade	7	1
Retail Trade	89	8
Transportation, Warehousing & Utilities	77	7
Information	27	3
Finance, Insurance, Real Estate, Rental & Leasing	23	2
Professional, Scientific, Management, Administrative & Waste Mgmt	51	5
Education, Health & Social Services	238	22
Arts, Entertainment, Recreation, Accommodation & Food Services	69	6
Other Services (Except Public Admin)	38	4
Public Administration	108	10
Total Employment	**1,079**	**100**

Source: Alaska DCED 2002

Please refer to the 1997 Forest Plan EIS for further details on the history, economy, and subsistence use of this community.

Wrangell is part of the Wrangell City community group (see Table 3.23-6). Detailed employment data are available for this community group by economic sector for 1990, 1995, and 2000 in the planning record.

Sawmill employment decreased by 62 percent in the Wrangell City community group between 1990 and 1999, a reduction from 162 to 62 jobs. The wood products sector accounted for 9 percent of total employment in the Wrangell City community group in 1999. The main employers in 1999 were the non-federal government and retail trade sectors, which accounted for 24 and 18 percent of total employment, respectively.

Potential Effects

Community Use Area

The general area commonly used or related to by many of the residents of Wrangell in their local day-to-day work, recreational, and subsistence activities is shown on Figure 3.23-32. This area contains 819,240 acres of National Forest System land (among other land ownerships). Table 3.23-64 shows how the lands within this community use area would be distributed among the LUD groups by alternative. The LUD groups are explained in the introduction to Chapter 3.

Development LUDs presently account for about 36 percent of the total acreage within the Wrangell community use area. Alternatives 5 and 6 would not have a significant effect on existing LUD allocations in the community use area because the acreage by LUD group would remain the same as under the existing Forest Plan. The acreage allocated to Wilderness/National Monument LUDs would remain constant under all alternatives. The amount of acreage allocated to Mostly Natural LUDs would increase under Alternatives 1 and 2. The largest increase would occur under Alternative 1, with the acreage allocated to Mostly Natural LUDs increasing from 20 percent under Alternative 5 (No Action) to 45 percent under Alternative 1, with a commensurate reduction in development LUDs (Table 3.23-64). Alternatives 4 and 7 would increase the acreage in development LUDs. Development LUDs would account for 48 percent under both of these alternatives compared to 36 percent under Alternative 5.

Total suitable acres would range from 5 percent under Alternative 1 to 16 percent under Alternative 7, compared to 11 percent of the total community use area under Alternative 5 (No Action) and Alternative 6 (Proposed Action).

Economy

Commercial fishing, timber processing, recreation and tourism, and subsistence opportunities are particularly important to Wrangell. Wrangell is one of the stop-over points for visitors traveling to the Stikine River and the Stikine-LeConte Wilderness.

Commercial fisheries employment and recreation and tourism activities are not likely to be affected under any of the alternatives.

Approximately 26.2 MMBF of timber was under contract in the Wrangell Ranger District in August 2006. About 58 percent (15.2 MMBF) of this volume could be potentially affected under Alternative 1, which would maintain all Inventoried Roadless Areas on the Tongass in a natural condition and not permit timber harvest in these areas. None of the other alternatives would affect this volume. These data

Figure 3.23-32
Wrangell's Community Use Area

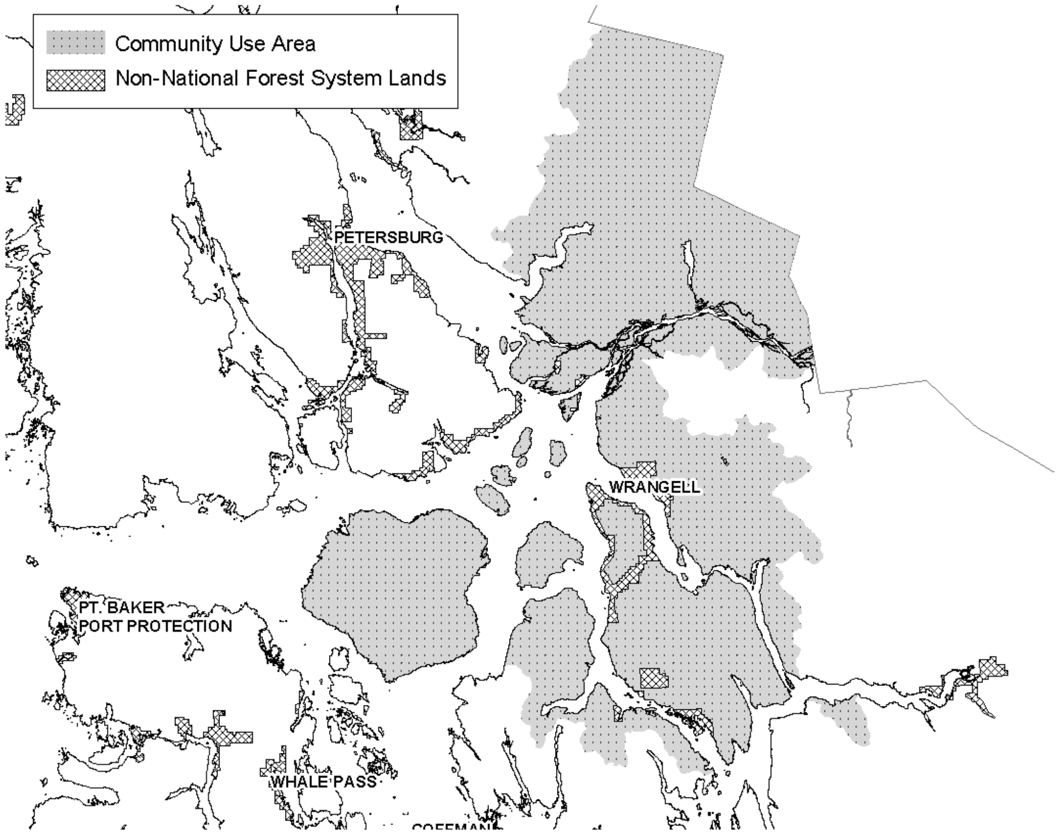


Table 3.23-64
LUD Groups in Wrangell's Community Use Area by Alternative

	Alternative						
	1	**2**	**3**	**4**	**5**	**6**	**7**
	Suitable National Forest System Acres for Timber Management						
Suitable Acres	38,268	65,753	87,283	116,010	87,266	87,628	128,413
LUD Groups	**Acres of National Forest System Land per LUD Group**						
Wilderness/National Monument	363,146	363,146	363,146	363,146	363,146	363,146	363,146
Mostly Natural	367,625	254,848	162,305	61,076	161,015	161,265	60,538
Moderate Development	36,970	76,979	149,387	228,846	150,577	149,950	229,418
Intensive Development	51,498	124,268	144,403	166,173	144,503	144,880	166,139
Total	**819,240**	**819,240**	**819,240**	**819,241**	**819,241**	**819,240**	**819,240**

[1] See the accompanying large LUD map for the distribution of existing LUDs and the Alternative Maps for the distribution of LUDs by alternative.

provide an indication of potential impacts, actual impacts would depend on the volume that is under contract when the decision is implemented and whether potentially affected existing sales were cancelled as part of the decision.

Subsistence

No significant effect on salmon, other finfish, or invertebrate habitat capability is expected from implementation of any alternative. These resources account for 52 percent of the total edible pounds of subsistence resources harvested by Wrangell households (Kruse and Frazier 1988). Marine resources (fish and marine invertebrates) accounted for 84 percent of per capita subsistence harvest in Wrangell in 1987.

The 1988 study found that deer account for 21 percent of the total edible pounds of subsistence resources harvested by Wrangell households (Kruse and Frazier 1988). Deer accounted for a small amount of per capita subsistence harvest by Wrangell residents in 1987 (ADF&G 2006).

Wrangell residents mainly harvest deer on Wrangell and surrounding islands, with the majority of harvest occurring in GMU 3. Deer harvest in GMU 3 declined between 1998-2002 and increased between 2002-2004. The number of deer hunters declined between 2000-2002 and slightly increased between 2002-2004 (ADF&G 2005). As noted above, the human population of Wrangell decreased by an estimated 14 percent between 2000 and 2005. Wrangell had an estimated population of 1,974 in 2005.

Deer harvest by Wrangell residents is spread over many WAAs, but the majority (76 percent) of their deer are from five WAAs located on Wrangell and surrounding islands. Zarembo Island (WAA 1905) alone accounts for about half (51 percent) of Wrangell deer harvest. The Wrangell portion of the harvest in these five WAAs represents about 72 percent of the total harvest and about 80 percent of the rural hunter harvest (Table 3.23-65).

The majority of the WAAs used heavily by Wrangell residents are in areas with substantial past harvest and deer habitat capabilities are currently estimated to be considerably below 1954 levels (Table 3.23-65). Under each of the alternatives, additional harvest would further reduce habitat capabilities after 100+ years. Reductions would be smallest under Alternative 1 and highest under Alternative 7.

Table 3.23-65
Deer Harvest (1996 to 2002) and Deer Habitat Capability on NFS Lands in 2005 and After 100+ Years of Full Implementation under Each Alternative, Expressed as a Percent of 1954 Habitat Capability, for the WAAs where Wrangell Residents Obtain Approximately 75% of their Average Annual Deer Harvest*

	Average Deer Harvest from 1996 to 2002			Deer Habitat Capability in 2005 and after 100+ Years of Full Implementation Under Each Alternative, Expressed as a Percent of the 1954 Habitat Capability							
WAA	Wrangell Residents	All Rural Hunters	All Hunters	2005	Alt 1	Alt 2	Alt 3	Alt 4	Alt 5	Alt 6	Alt 7
1905	283	400	400	77	72	67	67	59	66	65	57
1903	60	60	60	86	80	73	72	63	71	71	60
1901	30	31	38	91	87	80	78	70	77	77	64
1530	26	80	147	62	58	57	55	54	55	55	50
1906	17	17	20	59	55	55	55	55	55	55	53

*Calculated based on harvest where location is known.

The Deer Availability and Anticipated Demand analysis completed for the 1997 Forest Plan EIS determined that the 1997 Alternatives 2, 6, and 11, which are similar to the four highest harvest alternatives in this EIS, should be able to provide sufficient habitat capability for deer hunted in the Wrangell community use area by Wrangell residents, all rural hunters, and all hunters in the short term. This is also estimated to be the case for Wrangell residents and all rural hunters in the long term. Projected deer harvest by all hunters is, however, estimated to exceed 10 percent habitat capability, the level that the analysis assumed would provide a reasonably high level of hunter success for their effort, in the long term.

In summary, use of most subsistence resources by Wrangell residents (fish and marine invertebrates) is not expected to be affected by any of the alternatives. However, subsistence use of deer may be affected to the point that some restriction in hunting might be necessary over the long term, even under Alternative 1. The risks of this occurring are greatest under Alternative 7, and second highest under Alternative 4. Alternatives 1, 2, and 3 would have the lowest risk and Alternatives 5 and 6 would be intermediate. The risk of hunting restrictions would be reduced somewhat, through more intensive management (e.g., thinning) of the existing and future closed-canopy, young-growth forests in this area. Indirect effects associated with increased competition for deer within Wrangell's subsistence use areas could also occur under all alternatives due to displacement of hunters from other communities due to timber harvest activity. Additional road development under the alternatives would improve access but may increase competition with other non-local hunters. The level of road development is already relatively high in most of these WAAs. Existing open road densities range from 0.3 to 1.1 miles per square mile and existing total road densities range from 0.3 to 1.7 miles per square mile in the five most important WAAs for Wrangell deer harvest). Long-term (100+ years) road development would vary by alternative and would result in estimated maximum total road densities ranging from 0.4 to 1.9 miles per square mile in these WAAs under Alternative 1, to 1.1 to 2.0 miles per square mile under Alternative 7 (for all ownerships combined).

Yakutat

Yakutat is located in the lowlands along the northern Gulf of Alaska, 212 miles northwest of Juneau at the mouth of Yakutat Bay. According to the 2000 Census, Yakutat had a 2000 population of 680, with Alaska Natives comprising 47 percent of the total (U.S. Census Bureau 2001).

Yakutat, which means "the place where the canoes rest," has a diverse cultural history. The original settlers, believed to have been Eyak people from the Copper River area, were later conquered by the Tlingits. Intensive contact with European explorers came in the late 1700s when a Russian fur trading company moved into the Yakutat area. By the mid-1800s, foreign traders were well established along the coast. The contemporary town grew up around "the old village," which was established in 1889 by missionaries (ADF&G 1994).

Incorporated as a first-class city in 1948, Yakutat is governed by a mayor and a city council. Yakutat Borough, incorporated in 1992, expanded the original city boundaries to include a large section of the Gulf Coast north of Cape Fairweather. Yakutat has a local Fish and Game Advisory Committee. Yakutat is accessible by jet service from Juneau and Anchorage. Wrangell-Saint Elias National Park, Russell Fiords Wilderness, and Glacier Bay National Park are located northwest, northeast, and southeast of Yakutat, respectively.

The population of Yakutat, which almost tripled between 1970 and 1990, increased by 27 percent between 1990 and 2000. Population in Yakutat has, however, decreased since 2000, with an estimated net loss of 62 residents or 9 percent of the

2000 population. Total estimated population was 609 in Yakutat in 2006 (Alaska DOL 2007a).

Year	1970	1980	1990	2000	2005	2006
Population	190	449	534	680	618	609

Source: USDA Forest Service, 1997a; U.S. Census Bureau, 2001; Alaska DOL, 2007a

The Yakutat economy is primarily dependent on fishing, fish processing, and government. A total of 162 residents hold commercial fishing permits. Fishing opportunities in the area, both freshwater in the Situk River and saltwater, are considered world class, and 25 percent of the local residents have commercial fishing licenses. North Pacific Processors is the major private employer (Alaska DCED 2002; 2006).

Employment by industry data compiled by the Alaska DCED from the 2000 Census are summarized in the table below. Approximately 8 percent of the labor force in Yakutat was identified as unemployed and seeking work in 2000, compared to 7 percent for Southeast Alaska as a whole. Median household income was $46,786, compared to a regional median of $44,118 (Alaska DCED 2002).

Please refer to the 1997 Forest Plan EIS for further details on the history, economy, and subsistence use of this community.

Yakutat is part of the Yakutat community group (see Table 3.23-6). Detailed employment data are available for this community group by economic sector for 1990, 1995, and 2000 in the planning record.

Employment by Industry	Number	Percent of Total
Agriculture, Forestry, Fishing & Hunting, Mining	136	31
Construction	32	7
Manufacturing	25	6
Wholesale Trade	0	0
Retail Trade	21	5
Transportation, Warehousing & Utilities	64	15
Information	5	1
Finance, Insurance, Real Estate, Rental & Leasing	9	2
Professional, Scientific, Management, Administrative & Waste Mgmt	0	0
Education, Health & Social Services	62	14
Arts, Entertainment, Recreation, Accommodation & Food Services	43	10
Other Services (Except Public Admin)	13	3
Public Administration	30	7
Total Employment	**440**	**100**

Source: Alaska DCED 2002

The services and non-federal government sectors were the main employers in the Yakutat community group in 1999, accounting for 24 and 21 percent of total employment, respectively. Seafood processing accounted for 17 percent and recreation and tourism-related activities (lodging, restaurants, and recreation services) accounted for 19 percent of total employment. Wood products (logging) employment decreased by 65 percent between 1990 and 1999 and accounted for just 3 percent of total employment in 1999.

Potential Effects

Community Use Area

The general area commonly used or related to by many of the residents of Yakutat in their local day-to-day work, recreational, and subsistence activities is shown on Figure 3.23-33. This area contains 250,271 acres of National Forest System land (among other land ownerships). Table 3.23-66 shows how the lands within this community use area would be distributed among the LUD groups by alternative. The LUD groups are explained in the introduction to Chapter 3.

Development LUDs presently account for just 15 percent of the acreage in the Yakutat community use area. Alternatives 5 and 6 would not have a significant effect on existing LUD allocations in this community use area because the acreage by LUD group would remain the same as under the existing Forest Plan. The acreage allocated to Wilderness/National Monument LUDs would remain constant under all alternatives. The amount of acreage allocated to Mostly Natural LUDs would increase under Alternatives 1 and 2. The largest increase would occur under Alternative 1, with the acreage allocated to Mostly Natural LUDs increasing from 47 percent under Alternative 5 (No Action) to 62 percent under Alternative 1, with a commensurate reduction in development LUDs (Table 3.23-66). Alternatives 4 and 7 would increase the acreage in development LUDs. Development LUDs would account for 18 percent of the Yakutat Community Use Area under both of these alternatives compared to 15 percent under Alternative 5.

Total suitable acres would range from no acreage under Alternative 1 to 8 percent under Alternatives 4 and 7, compared to 7 percent of the total community use area under Alternative 5 (No Action).

Economy

Commercial fishing and subsistence are important to Yakutat. Oil exploration may begin again in the Pacific Ocean close to Yakutat. The Yakutat Forelands are some of the community's most important subsistence use areas. Commercial fishing is not expected to be affected under any of the alternatives.

Subsistence

No significant effect on salmon, other finfish, or invertebrate habitat capability is expected from implementation of any alternative. These resources account for 82 percent of the total edible pounds of subsistence resources harvested by Yakutat households (Kruse and Frazier 1988). Marine resources (fish and marine invertebrates) accounted for 74 percent of per capita subsistence harvest in Yakutat in 2000.

Moose are more important than deer as a subsistence meat source for Yakutat residents. Moose availability would not be significantly affected under any of the alternatives.

The 1988 TRUCS study found that deer account for only a small fraction of the total edible pounds of subsistence resources harvested by Yakutat households (Kruse and Frazier, 1988). Deer accounted for 1 percent of per capita subsistence harvest by Yakutat residents in 2000 (ADF&G 2006).

Figure 3.23-33
Yakutat's Community Use Area

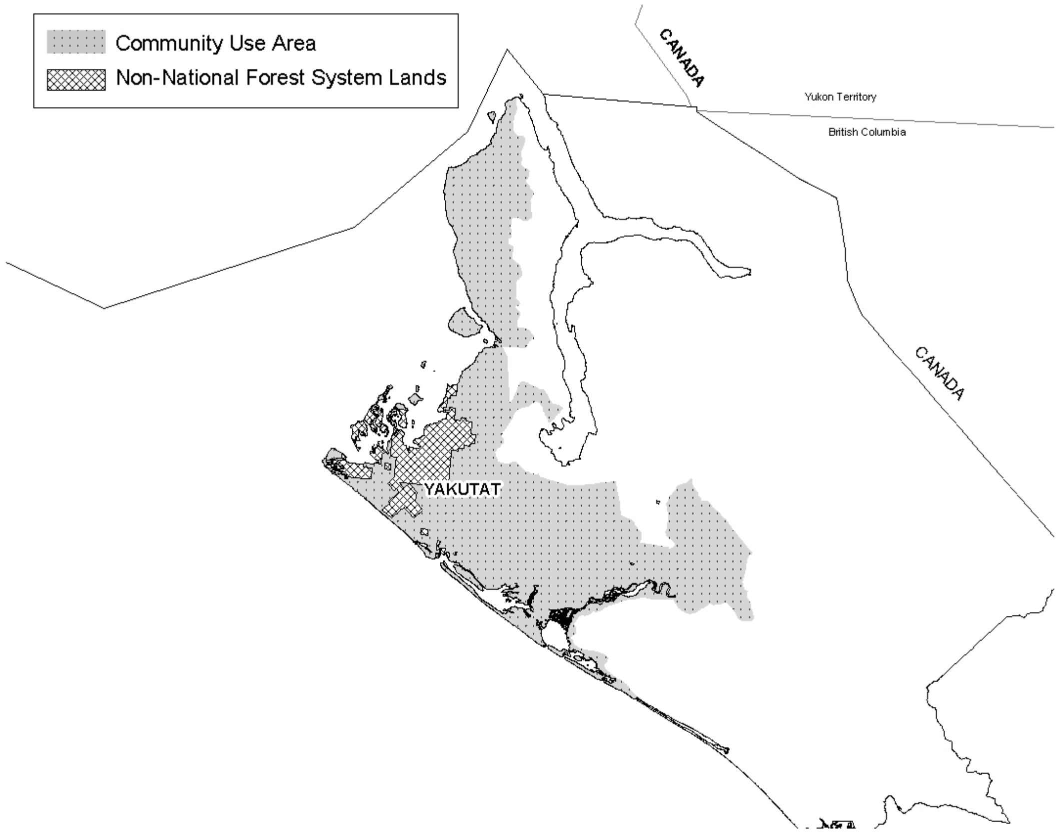


Table 3.23-66
LUD Groups in Yakutat's Community Use Area by Alternative

	Alternative						
	1	**2**	**3**	**4**	**5**	**6**	**7**
	Suitable National Forest System Acres for Timber Management						
Suitable Acres	0	9,089	18,548	20,170	18,548	18,548	20,267
LUD Groups	**Acres of National Forest System Land per LUD Group**						
Wilderness/National Monument	95,871	95,871	95,871	95,871	95,871	95,871	95,871
Mostly Natural	154,401	138,784	117,169	108,175	117,168	117,168	108,893
Moderate Development	0	13,514	20,667	19,029	20,668	20,668	18,077
Intensive Development	0	2,103	16,565	27,195	16,565	16,565	27,431
Total	**250,271**	**250,271**	**250,271**	**250,270**	**250,271**	**250,271**	**250,272**

[1] See the accompanying large LUD map for the distribution of existing LUDs and the Alternative Maps for the distribution of LUDs by alternative.

Yakutat residents harvested very few deer from 1996-2002, harvesting an annual average of more than one deer in just two WAAs over this period (Table 3.23-67). One of these WAAs is located in GMU 4; the other is located in GMU 5A. Deer harvest in GMU 4 is considered very high relative to other areas of Southeast Alaska, which is indicative of relatively high deer populations (ADF&G 2005). Over 1997-2004, there has been no significant trend in the number of deer harvested or in the number of hunters (ADF&G 2005). The human population of Yakutat declined by an estimated 9 percent between 2000 and 2005, with an estimated 2005 population of 618 residents.

Yakutat residents take the majority (78 percent) of their deer from two WAAs (Table 3.23-67). These numbers are, however, somewhat misleading due to the overall low deer harvest levels. In addition, deer harvest only occurred in WAA 4252, which is some distance from Yakutat near Hoonah, during one year.

Table 3.23-67
Deer Harvest (1996 to 2002) and Deer Habitat Capability on NFS Lands in 2005 and After 100+ Years of Full Implementation under Each Alternative, Expressed as a Percent of 1954 Habitat Capability, for the WAAs where Yakutat Residents Obtain Approximately 75% of their Average Annual Deer Harvest*

	Average Deer Harvest from 1996 to 2002			Deer Habitat Capability in 2005 and after 100+ Years of Full Implementation Under Each Alternative, Expressed as a Percent of the 1954 Habitat Capability							
WAA	Yakutat Residents	All Rural Hunters	All Hunters	2005	Alt 1	Alt 2	Alt 3	Alt 4	Alt 5	Alt 6	Alt 7
4252	4	75	99	92	92	78	78	70	77	76	69
4504	3	3	4	100	100	100	100	100	100	100	100
3835	1	4	218	100	100	100	100	100	100	100	100

*Calculated based on harvest where location is known.

The Deer Availability and Anticipated Demand analysis completed for the 1997 Forest Plan EIS determined that the 1997 Alternatives 2, 6, and 11, which are similar to the four highest harvest alternatives in this EIS, should be able to provide sufficient habitat capability for deer hunted in the Yakutat community use area by Yakutat residents, all rural hunters, and all hunters in the short term. This is also estimated to be the case for Yakutat residents and all rural hunters in the long term. Projected deer harvest by all hunters is, however, estimated to exceed 10 percent habitat capability, the level that the analysis assumed would provide a reasonably high level of hunter success for their effort, in the long term.

In summary, use of most subsistence resources by Yakutat residents (fish and marine invertebrates) is not expected to be affected by any of the alternatives. However, subsistence use of deer may be affected to the point that some restriction in hunting might be necessary over the long term, even under Alternative 1. With the exception of WAA 4252, the highest use areas for Yakutat households are within Wilderness and LUD II designations that will not change by alternative.

Environmental Justice

Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations, requires each federal agency to make the achievement of environmental justice part of its mission by identifying and addressing disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority and low-income populations. The Order further stipulates that the agencies conduct their programs and activities in a manner that does not have the effect of excluding persons from participating in, denying persons the benefits of, or subjecting persons to discrimination under such programs, policies, and activities because of their race, color, or national origin.

Race and ethnicity are shown by borough in Table 3.23-68. These data show that 68 percent of the population of Southeast Alaska identified as White in the 2000 census. American Indian and Alaska Native was the largest minority group, accounting for 17 percent of the total Southeast Alaska population. Table 3.23-68 indicates that there are relatively large proportions of Alaska Natives in the Yakutat Borough and Prince of Wales-Outer Ketchikan and Skagway-Hoonah-Angoon Census Areas. The populations of Haines and Juneau, in contrast, have relatively low proportions of Alaska Natives, below the Southeast Alaska average of 17 percent.

Alaska Native populations are identified as a percentage of total population by community in Table 3.23-8. This information is presented graphically in Figure 3.17-1 (in the *Subsistence* section). These data indicate that 13 of Southeast Alaska's 32 communities have Alaska Native populations that comprise a larger share of total population than the regional average (17 percent). Alaska natives comprised a particularly large share of total population in Angoon (82 percent), Hoonah (61 percent), Hydaburg (85 percent), Kake (67 percent), Klawock (51 percent), Metlakatla (82 percent), and Saxman (66 percent), all considered traditional Native communities.

Table 3.23-68
Race/Ethnicity by Borough/Census Area, 2000

	2000 Population	Percent White	Percent American Indian and Alaska Native	Percent Two or More Races	Percent Other[1]	Percent Hispanic or Latino[2]
Northern Boroughs						
Haines Borough	2,392	83	12	5	1	1
Juneau Borough	30,711	75	11	7	7	3
Sitka Borough	8,835	69	19	8	5	3
Skagaway-Hoonah-Angoon CA	3,436	57	36	6	2	2
Yakutat Borough	808	50	40	8	2	1
Southern Boroughs						
Ketchikan Gateway Borough	14,070	74	15	5	5	3
Prince of Wales-Outer Ketchikan CA	6,146	53	39	7	1	2
Wrangell-Petersburg CA	6,684	73	16	8	3	2
Southeast Alaska	**73,082**	**68**	**17**	**7**	**8**	**3**
Alaska	626,932	69	16	5	10	4

[1] The "Other" category presented here includes respondents identifying as Black or African American, Asian, Native Hawaiian and Other Pacific Islander, and Other. These categories have been combined for ease of presentation and because they comprise small percentages of local populations.
[2] "Hispanic" can be of any race.
Source: U.S. Census Bureau, 2001.

The percent of households below the poverty line and the median household income in 2000 are also identified by community in Table 3.23-8. The percent of households below the poverty line in Alaska as a whole was 7 percent in 2000. Median household income was approximately $51,571. The U.S. Census identified 14 communities in Southeast Alaska with a larger percent of households below the poverty line than the state average. These communities include Klawock, Hoonah, Edna Bay, Hydaburg, Port Alexander, and Angoon, as well as Hyder and Port

Protection. Median household incomes ranged from $36,048 in Haines Borough to $49,924 in the City and Borough of Juneau (U.S. Census Bureau 2001). All but four of the communities identified in Table 3.23-8 had median household incomes below the state average. Communities with median household income below the regional average included Port Protection, Hyder, Point Baker, Edna Bay, Angoon, and Hydaburg.

The potential effects of the alternatives on the economic and social environment of Southeast Alaska are discussed in the *Economic and Social Environment* section of this document. The principal regional effects would be those associated with changes in the timber industry and recreation and tourism. There could also be potential effects upon subsistence use and heritage resources that have particular significance for Alaska Native populations.

The effects of the alternatives on communities are discussed by community in the preceding part of this section. These community assessments include a discussion of potential timber harvesting within each community's use area and the potential effects to the subsistence resources and the land base used by each community.

Wood products employment is projected to be higher than current levels under all of the alternatives, except Alternative 1. Projected increases for the other alternatives ranging from 1.8 times the 2005 harvest level under Alternative 2 to 3.9 times under Alternative 7. The slight increases in projected employment under Alternative 2 when compared to 2005 harvest levels is still a decrease when compared to projected employment levels under Alternative 5 (No Action). Further, it could be argued that the alternatives that do not emphasize timber production represent a possible foregone opportunity for increased employment in the wood products sector. Even viewed in terms of a comparison of alternative projections, relative reductions in employment would be unlikely to have a disproportionately high effect on low-income and minority communities or groups. Relative reductions in sawmill employment would be concentrated in Ketchikan, Wrangell, and Craig. Reductions in logging employment would likely be distributed throughout Southeast Alaska, depending upon the alternative.

The mix of available recreation opportunities would vary by alternative based on the allocation of the Forest to different LUD groups. However, viewed in terms of projected recreation and tourism employment over the next decade, there would be very little difference between the alternatives. Recreation and tourism-related economic impacts are not expected to disproportionately affect minority or low-income populations.

Subsistence issues are discussed for the region as a whole in the *Subsistence* section and for each of Southeast Alaska's 32 communities in the preceding part of this section. The deer analysis presented in the 1997 Tongass Forest Plan Final EIS indicated that deer habitat capabilities in several portions of the Tongass may not be adequate to sustain the current levels of deer harvests, which may result in restrictions on subsistence use at some point in the future.

The potential effects of the alternatives upon heritage resources are expected to be the same or lower than under the current Forest Plan. Because of the protection offered by Forest-wide standards and guidelines, effects on heritage resources are expected to be low under all the alternatives.

CHAPTER 4
LIST OF PREPARERS

List of Preparers

Provided below are brief biosketches of the preparers from Tetra Tech and the primary reviewers and contributors from the Forest Service. Other Forest Service, Tetra Tech, and other agency staff, who contributed to various sections through an extensive internal review process, or in other ways, are also listed.

Lee Kramer, Forest Service Project Manager

Education

B.S., Forest Management, Auburn University, 1979

A.A., Degree from Eastern Wyoming College, 1975

Experience

Thirty years of Forest Service experience, including various Ranger District staff positions in Alabama, Virginia, Oklahoma, and New Mexico.

Forest Planning or Forest Staff positions in Colorado, Wyoming, and Montana.

Larry Lunde, Tongass Planning Staff Officer – Forest Service

Education

B.S., Forest Management, Washington State University, 1973

Experience

Twenty-eight years of Forest Service experience.

Tongass National Forest, Environmental Coordinator and Planner.

Previous experience in forest and multiple-use management positions as District Resource Staff and District Ranger, including Nez Perce National Forest in Idaho, Eldorado National Forest in California, Gifford Pinchot National Forest in Washington, and Mount Hood and Fremont National Forests in Oregon.

Patricia O'Connor – Tongass Wildlife and Subsistence Staff Officer

Education

M.S., Natural Resource Management, Humboldt State University, 1988

B.S., Biology, Cornell University, 1983

Experience

Nineteen years of Forest Service experience, including several years as a staff wildlife biologist on the Mt. Hood National Forest in Oregon and on the Lolo National Forest in Montana. Five years as the Yukatat District Ranger on the Tongass National Forest.

Randal Fairbanks, Interdisciplinary Team Leader, Project Manager – TtEC

Education

M.S., Forest Resources, University of Washington, 1979

B.S., Wildlife Science, University of Washington, 1972

Experience

Thirty-three years of experience in design, conduct, and management of ecological and forest inventory and research, impact assessments, and mitigation plans.

Project manager or interdisciplinary team leader for 11 major forest management-related EIS/EA efforts.

Major contributor to dozens of other EISs, EAs, and Environmental Reports.

Joe Iozzi, Silviculturist/Forester, Asst. Project Manager – TtEC

Education

Silviculture Institute, University of Washington, 1984 to 1985

B.S., Forest Management, Rutgers University, 1977

Experience

Twenty-seven years of experience in silviculture and natural resource management, primarily on Forest Service and NEPA projects.

Thirteen years as a certified silviculturist for the Forest Service.

Nine years of experience working on timber sale and transportation management projects on the Tongass National Forest, project manager for the Forest-wide roads analysis and several NEPA projects.

Matt Dadswell, Senior Social Scientist/Economist – TtEC

Education

Ph.D., Candidate, Geography, University of Washington

M.A., Geography, University of Cincinnati, 1990

B.A., Economics and Geography, Portsmouth Polytechnic, 1988

Experience

Fifteen years of experience conducting economic, social, and environmental regulatory analysis on a variety of natural resource projects, including Forest Service and NEPA projects.

Ten years of experience working on Forest Service projects, including projects on the Tongass National Forest.

John Knutzen, Senior Fisheries Biologist/Aquatic Ecologist – TtEC

Education

M.S., Fisheries, University of Washington, 1977

B.A., Biology, Western Washington State College, 1972

Experience

Twenty-nine years of experience evaluating developmental activity impacts to lakes, rivers, and stream water quality and aquatic resources in the Pacific Northwest, with emphasis on salmonids.

Experience working on more than 60 projects in the Pacific Northwest, including assessing effects of federal actions on endangered fish species.

Provided scientific evaluation on more than 25 NEPA documents, including Forest Service EISs for the Tongass National Forest.

Steve Negri, Wildlife Biologist – TtEC

Education

M.S., Wildlife Ecology, Michigan State University, 1995

B.S., Business Finance, University of Missouri, 1985

Experience

Thirteen years of experience as a wildlife biologist, including work on three EISs for the Tongass National Forest and more than a dozen Forest Service-related projects.

Experience working on approximately 15 EISs and other NEPA documents in the Pacific Northwest and Alaska.

Previous experience includes working 5 years as threatened and endangered species biologist for the Washington Department of Fish and Wildlife.

Brita Woeck, Wildlife Biologist – TtEC

Education

M.S., Wildlife Ecology and Management, University of Missouri, Columbia, 2003

BS, Wildlife Science, University of Washington, 1999

Experience

Seven years of experience conducting all phases of ecological research.

Experience includes ecological study development and coordination, data collection and analysis, results interpretation and presentation, and NEPA analysis.

Work experience focuses on population dynamics, resource selection and space use patterns, and community ecology; with responsibility for vegetation and wildlife population surveys, radiotelemetry, and wildlife capture and immobilization.

Mary Jo Russell, GIS Analyst – TtEC

Education

B.S., Computer Information Systems, Menlo College

Experience

Fourteen years of experience as a GIS analyst specializing in creating complex riparian models, surface models, habitat models, perspective scene analysis, aerial photo interpretation of logging units, preparation of field maps, and final production of maps for numerous timber sale EISs.

Experience includes serving as lead GIS analyst on more than a dozen Forest Service projects, including four EIS projects specific to Southeast Alaska and the Tongass National Forest.

Mary Clare Schroeder, Wetland Scientist /Botanist – TtEC

Education

B.A., Botany, University of Washington, 2000

MBA, University of Chicago, 1993

Experience

Six years of experience working on EIS and NEPA documents.

Field experience performing wetland delineation; wetland mitigation; planning and monitoring; and national, state, and local project permitting.

Experience conducting wetland and plant surveys on the Tongass National Forest.

Stephanie Phippen, PG, Geoscientist – TtEC

Education

M.S., Geology/Watershed Science, Colorado State University, 2000

B.A., Geology, Carleton College, 1996

Professional Geologist, UT, Number 5557302-2250

Experience

Seven years of experience in siting, environmental assessment of impacts to watersheds and water resources.

Field of expertise is geomorphology (fluvial, colluvial, and glacial), with supporting strengths in hydrology (surface and groundwater), soil science, and statistics.

Experience completing analyses of water quality, road networks, geomorphology, soils, hydrology, geology, and cumulative effects for EIS, EA, landscape and watershed assessment, geologic risk assessment, and geomorphic mapping projects. Published original research that quantifies the impacts of roads and other forms of land management on stream-channel equilibrium, sediment movement, and watershed stability.

Dave Cox, Hydrologist/Minerals Specialist – TtEC

Education

B.S., Geology, Western Washington University, 2000

Experience

Six years of experience in hydrology, geomorphology, and natural resource management, primarily on Forest Service and NEPA projects.

Field of expertise is hydrology, geomorphology, and regulatory compliance with supporting strengths in soil science.

Previous experience working on three National Forests, including four years on the Tongass National Forest as project manager, hydrologist, and minerals administrator for projects including mine development, hydropower, transportation, and recreation.

Susan Corser, Landscape Architect/Recreation Planner – Ernst Corser Associates

Education

M.U.P., Urban Planning, University of Washington, 1989

M.A., Landscape Design, Conway School of Landscape Design, 1983

B.A., Geography and Environmental Studies, Macalester College, 1977

Experience

Twenty-one years of experience conducting visual analyses, recreation demand studies, urban planning, and public meeting facilitation. Conducted visual, recreation, and land use impact analyses for hydropower, mine, landfill, ski area, and water supply projects.

Ten years of experience working on environmental analyses on Forest Service or BLM lands, including two years experience working on NEPA projects within the Tongass National Forest.

Marcy Rand, Public Involvement Coordinator – TtEC

Education

B.A., Journalism and Mass Communications, Washington and Lee University, 1992

Experience

Thirteen years of writing/editing/public involvement experience.

Extensive writing/editing/public involvement experience with NEPA and Forest Service documents, including 10 EISs/EAs.

Experience includes developing, writing, and producing factsheets, brochures, newsletters, news releases and advertisements; public outreach plan development and implementation; scoping and public comment coordination; and public meeting assistance.

Maggie Huffer, Technical Editor/Public Involvement Coordinator – TtEC

Education

B.A., Journalism/Public Relations, Western Washington University, 2000

Experience

Seven years of experience writing, editing, and coordinating numerous environmental reports, including multi-volume EISs and other NEPA documents.

Experience working on four Forest Service EISs specific to Southeast Alaska and the Tongass National Forest.

T. Weber Greiser, Heritage Resource Specialist/Archaeologist

Education

M.A., Anthropology, University of New Mexico, 1972

B.A., Anthropology, University of New Mexico, 1969

Experience

Twenty-seven years of experience as Project Manager and/or Principal Investigator on heritage resource projects in Alaska and throughout the Western U.S. Experience includes prehistoric and historic archaeological predictive modeling; heritage resource surveys, testing projects, and excavations; laboratory analysis of artifacts and faunal remains; and ethnographic investigations and oral interviews of native inhabitants regarding land use, water use, and sacred lands.

Heritage resource Principal Investigator for background research, cultural resource survey, preparation of specialist report, and/or preparation of EA or EIS cultural resource sections for nine projects since 1993 on the Tongass.

Eric Henderson, SPECTRUM Model Analyst – USDS Forest Service, Region 9

Education

M.S., Forest Management (2003), University of Minnesota

B.B.A., Business Administration (2000), University of Iowa

Experience

Four years of experience as Forest Service Analyst/Planner, specializing in landscape planning models, growth and yield models, historic vegetation analysis, and computer programming languages.

Other Contributors

Forest Service

Rick Abt – Land Management Planner
Richard Aho – Forest Fisheries Biologist
Susan J. Alexander – Regional Economist
John Autrey – Tribal Government Relations Specialist
Jim Baichtal – Karst Specialist
Gabriele Bosch – GIS Database Manager
Jeff Defreest – Minerals
Karen Dillman – Ecologist

4 List of Preparers

Pam Fletcher – Invasive Species Coordinator
Colleen Grundy – Regional Silviculturist
Bob Housley – Timber Valuation – Regional Office
John Inman – Tongass Contracting Officer
Karen Iwamoto – Land Management Planner
Susan Jennings – Tongass Document Coordinator
Steve Kessler – Regional Subsistence – Program Manager
Patti Krosse – Forest Ecologist
Dennis Landwehr – Soil Scientist
Jan Lerum – Regional Planner
Mark McCallum – Archaeologist
Dom Monaco – Forest Landscape Architect
Dennis Neill – Partnership and Public Affairs Staff Officer
Jack Oien – Supervisory Engineer
Eric Ouderkirk – Forest Plan Adjustment COR
Steve Paustian – Hydrology Program Manager
Betsy Rickards – Alaska Region Environmental Coordinator
Jim Russell – Silviculture Program Manager
Jim Schramek – Senior GIS Analyst
Carol Seitz – Warmuth, Monitoring
Cynthia Sever – Timber Planning
JT Stangl – Wildlife Biologist
Barbara Stanley – Lands
Julianne Thompson – Hydrologist
Bill Tremblay – Wilderness/Developed Rec/Rec Special Uses
Erin Uloth – Ecosystem Services
Betty Wilt – Highway Engineer

Office of General Council
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Jack E. Phelps – Office of Economic Development
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Marty Freeman – Department of Natural Resources
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Dale Rabe – Department of Fish and Game
Tina Cunning – Department of Fish and Game
Tom Brookover – Department of Fish and Game

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Chris Spagnuolo – GIS Analyst
Wayne Watson – GIS Analyst
Andrea Slusser – Project Record

Judy Brown – Desktop Publishing
Dawn Stuart – Desktop Publishing
Steve Flegel – Desktop Publishing
Josh Breen – Desktop Publishing

Consultants
John Hendee – Technical Review: Wilderness
Tom Aley – Technical Review: Karst Resources

4 List of Preparers

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CHAPTER 5
LIST OF DOCUMENT RECIPIENTS

List of Document Recipients

Federal Agencies

Bureau of Land Management, Alaska State Office
Bureau of Land Management, Juneau Minerals Information Center
Department of Transportation, Western Federal Lands Highway Division
Federal Aviation Administration, Office of the Regional Administrator
Federal Energy Regulatory Commission, Environmental Compliance Branch
Federal Highway Administration, Division Administrator
Federal Highway Administration, Regional Administrator - Western Region
Federal Railroad Administration, Office of Transportation and Regulatory Affairs
Housing and Urban Development, Alaska Office of Housing and Urban Development
Library of Congress
National Marine Fisheries Service, Alaska Region
National Marine Fisheries Service, Protected Resources Management Division
National Oceanic and Atmospheric Administration, Office of Policy and Strategic Planning
National Park Service, Glacier Bay National Park
National Park Service, Wild and Scenic Rivers Program
Office of Federal Register, National Archives and Records Administration
Point Baker Post Office
Tongass National Forest, Admiralty National Monument
Tongass National Forest, Assistant Forest Supervisor, Alaska Region
Tongass National Forest, Craig Ranger District
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Tongass National Forest, Petersburg Ranger District
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Tongass National Forest, Rocky Mountain Research Station
Tongass National Forest, Sitka Ranger District
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Tongass National Forest, Wrangell Ranger District
Tongass National Forest, Yakutat Ranger District
US Advisory Council on Historic Preservation, Planning and Review
US Army Corps of Engineers, Field Office Manager
US Army Corps of Engineers, Juneau Regulatory Field Office
US Army Corps of Engineers, Northwestern Division
US Army Corps of Engineers, Pacific Ocean Division
US Army Corps of Engineers, Regulatory Office
US Army Engineer District, East Section
US Bureau of Mines
US Coast Guard, Environmental Management CG-443
US Coast Guard, Seventeenth Coast Guard District
US Department of Agriculture, APHIS PPD/EAD

5 List of Document Recipients

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US Department of Energy, Office of NEPA Policy and Compliance
US Department of the Interior, Office of Environmental Policy and Compliance
US Department of the Interior, Office of the Secretary
US Department of the Interior, US Geological Survey
US Department of Transportation, Environmental Division
US Environmental Protection Agency, Alaska Operations
US Environmental Protection Agency, Geo. Imp. Unit
US Environmental Protection Agency, Office of Federal Activities
US Environmental Protection Agency, Region 10
US Fish and Wildlife Service, Office of Subsistence Management
US Fish and Wildlife Service, Refuge Planning
US Navy, Environmental Protection Division
US Navy, Naval Oceanography Division
US Navy, Office of Chief of Navy Operations
US Navy, US Naval Air Systems Command
US Senate, Public Land and Forest Subcommittee
US Small Business Administration
USDA Forest Service, Alaska Region
USDA Forest Service, Chugach National Forest
USDA Forest Service, Director of Ecosystem Planning and Budget
USDA Forest Service, Division of Forest Management
USDA Forest Service, Ecosystem Management Coord. Staff
USDA Forest Service, Forestry Sciences Laboratory
USDA Forest Service, Forestry Services Library
USDA Forest Service, Hiawatha National Forest
USDA Forest Service, Office of the Chief
USDA Forest Service, Region 10, Regional Office
USDA Forest Service, Region 9, Regional Office
USDA Forest Service, SE Regional Subsistence Advisory Council
USDA Forest Service, Supervisor's Office

State and Federal Congressional Representatives

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Sander Levin, U.S. Representative
Steven Rothman, U.S. Representative
Michael McNulty, U.S. Representative
Jim Marshall, U.S. Representative
Richard J Durbin, U.S. Senator
Lisa Murkowski, U.S. Senator
Ted Stevens, U.S. Senator
Albert Kookesh, State Senator
Peggy Wilson, State Representative

Alaska Native Tribes and Corporations

Aboriginal Rights Committee
Alaska Federation of Natives
Alaska Native Brotherhood
Alaska Native Brotherhood, Camp #01
Alaska Native Brotherhood, Camp #03
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Alaska Native Sisterhood, Camp #90
Angoon Advisory Committee
Angoon Tlingit and Haida Community Council
Angoon Traditional Council
Cape Fox Corporation
Central Council Tlingit and Haid Tribes of Alaska
Chilkat Indian Village (Klukwan)
Chilkoot Indian Association IRA

5 List of Document Recipients

Chugach Alaska Corporation
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Craig Tlingit and Haida Community Council
Douglas Indian Association
Edna Bay Advisory Committee
Elfin Cove Community, Chairperson
Gathering Council of Kake
Gustavus Community Association
Haida Corporation
Haida Society
Haida Tribe
Hollis Community Action Council
Hoonah Tlingit and Haida Community Council
Huna Totem Corporation
Hydaburg Cooperative Association
Kadin Corporation
Kake Tribal Corporation
Ketchikan Advisory Committee
Ketchikan Indian Community
Klawock Cooperative Association
Klawock Heenya Corporation
Klawock Tlingit and Haida Community Council
Klawock Tribal Government
Klukwan Tlingit and Haida Community Council
Kootznoowoo Inc.
Kuiu Thlingit Nation
Metlakatla Indian Community
Metlakatla Tlingit and Haida Community Council
Meyers Chuck Community Association
Native American Fish and Wildlife Society
Native Forest Network
Native Subsistence Commission
Native Village of Kasaan
Organized Village of Kake IRA
Organized Village of Kasaan
Organized Village of Saxman
Pelican Tlingit and Haida Community Council
Petersburg Indian Association
Point Baker Community Council
Port Tongass Village Association
Saanya Kwan -– Tei Kweidi
Saxman Advisory Committee
SE AK Regional Subsistence Council
Sitka Advisory Committee
Sitka Tlingit and Haida Community Council
Sitka Tribe of Alaska
Skagua Traditional Council
Skagway Village IRA
Southeast Alaska Conservation Council
Southeast Native Subsistence Commission
Southeast Regional Advisory Council
Sumner Strait Advisory Committee
Tanana Chiefs Council
Tlingit and Haida Community Council
Tlingit and Haida Indians, CBJ
Tongass Tribe
Tsimpshian
Tsimpshian Tribal Council
Wrangell Advisory Committee
Wrangell Cooperative Association
Wrangell Resource Council
Yak-Tat Kwaan, Inc.
Yakutat Native Association
Yakutat Tlingit Tribe

State Agencies

Alaska Coastal Management Program, OPMP
Alaska Department of Commerce and Economic Development
Alaska Department of Environmental Conservation
Alaska Department of Fish and Game, Alaska Board of Game
Alaska Department of Fish and Game, ANILCA
Alaska Department of Fish and Game, Boards Support
Alaska Department of Fish and Game, Division of Commercial Fisheries
Alaska Department of Fish and Game, Division of Habitat and Restoration
Alaska Department of Fish and Game, Division of Subsistence
Alaska Department of Fish and Game, Division of Wildlife Conservation
Alaska Department of Fish and Game, Special Areas Planner
Alaska Department of Fish and Game, Sport Fish Division
Alaska Department of Fish and Game, Wildlife Division
Alaska Department of Labor
Alaska Department of Natural Resources, Office of Habitat Management and Planning

Alaska Department of Natural Resources, State Preservation Office
Alaska Department of Natural Resources, Division of Forestry
Alaska Department of Natural Resources, Division of Mining, Land and Water
Alaska Department of Natural Resources, Office of Program Management
Alaska Department of Transportation and Public Facilities
Alaska Division of Telecommunication Operations
Alaska Energy Authority
Alaska Mental Health Trust
Alaska Natural Heritage Program
Alaska State Department of Labor
Alaska State Parks Advisory Board
Office of the Governor, State of Alaska
Resource Development Council of Alaska

City and Borough Agencies, Libraries, and Schools

Alaska Court System, Juneau Law Library
Alaska Court System, Ketchikan Law Library
Alaska State Library
Angoon Public School Library
Bruce Hill School
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City of Klawock
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Ketchikan Gateway Borough
Ketchikan High School Library
Ketchikan Public Library
Ketchikan Visitors Bureau
Kettleson Memorial Library
Klawock Public Library
Legislative Reference Library
Mendenhall Valley Public Library
Metlakatla Centennial Library
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Northwestern University, Urban Affairs and Policy Research
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Port Protection School
Prince of Wales Chamber of Commerce
Prince of Wales Community Advisory Council

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University of Alaska - Southeast, William A. Egan Library
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University of Alaska at Fairbanks, School of Natural Resources and Agricultural Sciences, Palmer Research Center
University of Alaska Land Management
University of Minnesota, Forestry Library
USDA National Agriculture Library
Utah State University, College of Natural Resources
Virginia Polytechnic Inst. and State Univ, Dept Fish and Wildlife
Whale Pass School
Wrangell Chamber of Commerce
Wrangell Public Library
Yakutat School District Library

Other Organizations

3-D Logging
Adam Baskett's Equip. Repair
Adams Alaskan Safari
Admiralty Bears Association
Admiralty Tours
Adventure Alaska Southeast
Age Cedar Products
Ahtna Incorporated
Alaska Quiet Rights Coalition
Alaska Angling
Alaska Association for Historic Preservation
Alaska Biological Research
Alaska Board of Fish
Alaska Center for the Environment
Alaska Chapter Sierra Club, Auke Bay Group
Alaska Charter & Adventures
Alaska Charter Service
Alaska Coalition
Alaska Coastal Adventures
Alaska Coastal Guiding
Alaska Coastal Hunting
Alaska Coastal Outfitters
Alaska Conservation Alliance
Alaska Conservation Foundation
Alaska Discovery
Alaska Environmental Lobby
Alaska Fibre
Alaska Fish Tales
Alaska Fly N Fish Charters
Alaska Forest Association
Alaska Forest Products
Alaska Island Adventures
Alaska Loggers Association
Alaska Longline Fishermen's Association
Alaska Miners Association
Alaska Natural History Association
Alaska Outdoor Adventures
Alaska Pacific Logging, Inc.
Alaska Pacific Powder Co.
Alaska Pacific Trading Company
Alaska Passages
Alaska Peak & Seas
Alaska Power & Telephone Co.
Alaska Public Radio Network
Alaska Rainforest Campaign
Alaska Scenic Charters
Alaska Scenic Waterways
Alaska Ship & Drydock, Inc.
Alaska Society of Forest Dwellers
Alaska Timber Wolf
Alaska Timberland Corporation
Alaska Travel Adventures
Alaska Travel Industry Association
Alaska Trollers Association
Alaska Tugboat Tours
Alaska Vistas
Alaska Waters, Inc / Leslie Cutters, Inc
Alaska Wilderness League
Alaska Wildlife Alliance
Alaska Women in Timber
Alaska Woods Service Company
Alaska Wyldewind
Alaska Yacht Adventures
Alaskan Natural Mystic
Alaskan Star Charters
Alaskan Yacht Charters
Alaskans for Responsible Resource
Alcan Forest Products
All Aboard Yacht Charters
Allweather Industries / The Roadhouse Lodge

Alpine Communications
Alsek River Lodge
American Forest & Paper Association
American Safari Cruises, Inc.
American Society of American Foresters
American Society of American Foresters Juneau Chapter
Anahootz Alaskan Adventure
Anderson & Associates
Annette Natural Resource Center
AP&T
Applied Sociocultural Research
Aqua Sports Enterprises
Associates in Pathology
Atelier PS
Atterbury Consultants, Inc.
Audubon Alaska
Aurora Films
Baja Alaskan Experience
Baltar Consulting
Baranof Expeditions
Baranof Wilderness Lodge
Bear Creek Outfitters
Bear Valley Lodge
BearDown Adventures
Big “R” Manufacturing
Blackwell Log
Blue Heron Inn
Bluewater Adventures, Ltd.
Bluewater Outfitter
Boardwalk Wilderness Lodge
Brabazon Expeditions
Bravo Venture Group, Inc.
Breakaway Adventures
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Concerned Citizens for Wise Use
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Crossings
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Ketchikan Sportfishing
Kettle Range Conservation Group
KFSK Public Radio
KHNS – FM
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KINY – AM, KSUP – FM, Juneau
KJNO – AM, KTKU – FM, Juneau
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MSM Resource
Muskeg Excursions
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The Fishermen's Inn
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Yakutat Marine & Supply, Inc.
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Individuals

The Final Environmental Impact Statement was also sent to approximately 2,700 individuals.

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CHAPTER 6
REFERENCES

References

Adams, J. Global Carbon Reservoir Data. Accessed September 2007at http://www.esd.ornl.gov/projects/qen/carbon2.html

ADEC (Alaska Department of Environmental Conservation). 2007. Juneau's Mendenhall Valley Proposed PM10 Limited Maintenance Plan. Alaska Department of Environmental Conservation.

ADEC. 2006a. Water Quality Standards. As Amended through September 1, 2006. 18 AAC 70.

ADEC. 2006b. Alaska's Final 2004 Integrated Water Quality Monitoring and Assessment Report. April 2006.

ADEC and USDA Forest Service. 1992. Memorandum of Agreement between the Alaska Department of Environmental Conservation and the USDA Forest Service, Alaska Region. 2534.1 - Exhibit 01.

ADF&G (Alaska Department of Fish and Game). 2006. Subsistence Community Profile Database. Available online at: http://www.state.ak.us/local/akpages/FISH.GAME/subsist

ADF&G. 2005. Alaska Wildlife Harvest summary 2004-2005. Division of Wildlife Conservation, Juneau, Alaska.

ADF&G. 2004a. Comprehensive Salmon Enhancement Plan for Southeast Alaska: Phase III. Developed by Joint Northern/Southern Southeast Regional Planning Team. Juneau, Alaska. June 2004.

ADF&G. 2004b. Southeast Alaska Sport Fish Harvest by Species, 1995-2004. Available online at: www.sf.adfg.state.ak.us/statewide/participationandharvest/main.cfm

ADF&G. 2003. Wolf Management Report of Survey-Inventory Activities 1 June 1999-30 June 2002. C. Healy, Editor. Juneau, Alaska.

ADF&G. 2000. Southeast Alaska Unit 4 Brown Bear Management Strategy. Available online at: http://www.alaskabears.alaska.gov/management/planning/planning_pdfs/u4rep.pdf

ADF&G. 1999. Draft Southeast Alaska Elk Management Plan. Division of Wildlife Conservation.

ADF&G. 1998. Tongass Fish and Wildlife Resource Assessment.

ADF&G. Various years (1996-2004). Deer hunter survey summary. Available online at: http://www.wc.adfg.state.ak.us/index.cfm

ADF&G. 1996. 1996 Deer Hunter Survey Summary Statistics. Region 1-Southeast Alaska. Available online at: http://www.wc.adfg.state.ak.us/pubs/techpubs/mgt_rpts/dhsry96.pdf

ADF&G. 1994. Subsistence Resource Use Patterns in Southeast Alaska: Summaries of 30 Communities.

References 6

ADNR (Alaska Department of Natural Resources). 2006. Alaska's Mineral Industry 2005: A Summary. Information Circular 52. Alaska Department of Natural Resources, Division of Geological and Geophysical Surveys. May 2006.

ADNR. 1997-2005. Alaska's Mineral Industry. Special Reports 51-59 (annual reports for 1996 through 2004). Alaska Department of Natural Resources, Division of Geological and Geophysical Surveys.

ADNR. 2004. Alaska Forest Resources & Practices Regulations. Division of Forestry. Anchorage, Alaska.

ADNR. 2000. Declines and Abiotic Factors. Available online at: www.dnr.state.ak.us/forestry/pdfs/00cedardecl.pdf

Alaska Commercial Fisheries Entry Commission. 2006. Commercial Fishing Statistics, various species, 2003 to 2005. Available online at: http://www.cfec.state.ak.us/mnurpts.htm

Alaska Commercial Fisheries Entry Commission. 2002. Commercial Fishing Statistics, various years and species. Available online at: http://www.cfec.state.ak.us/mnurpts.htm

Alaska DCRA (Department of Community and Regional Affairs). 1995. DCRA Community Database. Juneau, Alaska. Ref. R-873.

Alaska DCBD (Division of Community and Business Development). 2001. 2000 Southeast Alaska Commercial Recreation Survey, Preliminary Draft Report, February 2001.

Alaska DCED (Department of Community and Economic Development). 2006. Community Profiles Online. Available online at: http://www.dced.state.ak.us/

Alaska DCED. 2002. Community Profiles Online. Available online at: http://www.dced.state.ak.us/

Alaska DEC (Department of Environmental Conservation). 2007. Juneau's Mendenhall Valley Proposed PM10 Limited Maintenance Plan. Alaska.

Alaska DOL (Department of Labor). 2007a. Table 4.3 Alaska Places by Borough and Census Area 2000-2006. Available online at: http://www.labor.state.ak.us/research/pop/estimates/06t4-3x.xls

Alaska DOL. 2007b. Unemployment Rates and Labor Force Statistics, Southeast Alaska 1996 and 2005. Downloaded from: http://almis.labor.state.ak.us/

Alaska DOL. 2007c. Labor Force Statistics by Month for State of Alaska 1990 to Present. http://www.labor.state.ak.us/research/emp_ue/aklf.htm

Alaska DOL. 2007d. Fish Harvesting Employment by Species and Month, 2000 – 2006. Southeast Region. http://almis.labor.state.ak.us/

Alaska DOL. 2007e. Southeast Region: Species Composition, 2005. By Ex-Vessel Value. http://almis.labor.state.ak.us/

Alaska DOL. 2007f. Gross Earnings of Seafood Harvesters Fishing in Southeast Region Waters by Residency 2005. http://almis.labor.state.ak.us/

Alaska DOL. 2007g. Local Seafood Processing Workforce, 2000-2006. http://almis.labor.state.ak.us/

Alaska DOL. 2007h. Alaska Population Projections 2007-2030. Alaska Population by Area: 2006 to 2030. July. http://www.labor.state.ak.us/research/pop/projections/AlaskaPopProj.pdf

Alaska DOL. 2006a. Industry Employment Estimates Southeast Region 2001 to Present. Alaska DOL and Workforce Development, Research and Analysis Section. Available at http://almis.labor.state.ak.us

Alaska DOL. 2006b. Annual Employment and Earnings, 1997 to 2005 (Preliminary). Available at: http://almis.labor.state.ak.us

Alaska DOL. 2002. Unpublished Community Group Employment Data for 1999.

Alaska DOL. 2001. Southeast Region: Industry Employment Estimates – 1995 to Present. Nonagricultural Wage and Salary Employment estimates by industry for Southeast Alaska: 1995 to present. Alaska DOL and Workforce Development, Research and Analysis Section. Available online at: http://www.labor.state.ak.us/research/emp_ue/se95prs.htm.

Alexander. S, K. Nicholson, and R. Housley. 2007. Impacts on sawmill and logging employment in southeast Alaska of the limited interstate shipment policy. USDA Forest Service. Alaska Region. August 30.

AKEPIC (Alaska Exotic Plant Information Clearing House). 2006. AKEPIC Inventory. Alaska Natural Heritage Program, UAA, USDA Forest Service, State and Private Forestry. Available online at: http://akweeds.uaa.alaska.edu/

Alaska DOT (Department of Transportation). 2006. Email correspondence/Personal communication between Patrick Nobilio of the Alaska Department of Transportation and Shaun Brooks, Tetra Tech EC. August 17.

Alaska DOT&PF (Department of Transportation and Public Facilities). 2004. Southeast Alaska Transportation Plan. August 2004.

Alaska Native Heritage Center. 2000. Eyak, Tlingit, Haida & Tsimshian. http://www.alaskanative.net/38.asp

Alaska State Parks. 2004. Alaska's Outdoor Legacy. Statewide Comprehensive Outdoor Recreation Plan (SCORP) 2004-2009. July. Available online at: http://www.dnr.state.ak.us/parks/plans/scorp/2004scorpweb.pdf

Alaska Travel Industry. 2006. Email correspondence/Personal communication between Mark Miller of the Alaska Travel Industry and Shaun Brooks, Tetra Tech EC. July 27.

Alaska Volcano Observatory. 2006. Edgecumbe. Available online at: http://www.avo.alaska.edu/volcanoes/volcinfo.php?volcname=Edgecumbe. [2006, August 11].

Albert, D. and J. Schoen. 2007. A Conservation Assessment for the Coastal Forests and Mountains Ecoregion of Southeastern Alaska and the Tongass National Forest. From the Southeast Alaska Conservation Assessment, Chapter 2 of The Coastal Forests and Mountains Ecoregion of Southeastern Alaska and the Tongass National Forest; a conservation assessment and resource synthesis. Editors: Schoen, J. and Dovichin, E. March 2007.

Albert, D. and J. Schoen. 2006. A Preliminary Classification and Conservation Assessment of Terrestrial Ecosystems in Southeast Alaska. The Nature Conservancy, Juneau, AK. 23 pp.

Alexander, S. 2007. Employment Coefficients and Indirect Effects for NEAT-R. Regional Economist, USDA Forest Service, Alaska Region. Revised August 29.

Alexander, S. 2006. Calculation of net standing volume by species and grade for the Tongass National Forest. Regional Economist, USDA Forest Service, Alaska Region. December 7.

Aley, T., C. Aley, W.R Elliott, and P. Huntoon. 1993. Karst and Cave Resource Significance Assessment Ketchikan Area, Tongass National Forest, Alaska. Final Report. Prepared for Ketchikan Area of the Tongass National Forest. 79 pp. and Appendix.

Arhangelsky, K. 2005. Non-native Plant Species of Prince of Wales Island, Alaska Summary of Survey Findings. Final Report of USDA Forest Service, State and Private Forestry. Turnstone Environmental Consultants, Inc. Portland, OR.

Arians, Alison. 2003. Summary of monitoring studies of the effectiveness of practices under the Alaska Forest Resources and Practices Act 1990-2002. DNR Division of Forestry. April.

Bachelet D., J. Lenihan, R. Neilson, R. Drapch, and T. Kittle. 2005. Simulating the response of natural ecosystems and their fire regimes to climate variability in Alaska.

Bachman, R., W. Bergmann, J. Breese, W. Davidson, P. Doherty, S. Forbes, D. Gordon, D. Harris, S. Heinl, K. Jensen, M. Kallenberger, S. Kelley, B. Lynch, B. Meredith, K. Monagle, P. Skannes, L. Shaul, T, Thynes, A. Tingley, and G. Woods. 2005. 2005 Commercial, Personal Use, and Subsistence Salmon Fisheries: Report to the Alaska Board of Fisheries. Alaska Department of Fish and Game. Division of Sport Fish and Commercial Fisheries. Fishery Management Report No. 05-68. December 2005.

Baichtal, J. 2006. Geologic Resources, Paleontology, Geologic Special Areas, and Listing of Significant Caves. Forest Plan Adjustment Proposal Report. Rationale and process used in making the recommended changes to the Plan. USDA Forest Service, Tongass National Forest. File Code 2880 Geology and Karst Resources. Letter to Lee Kramer, Forest Plan Adjustment Coordinator. March 24.

Baichtal J.F. and D.N. Swanston. 1996. Karst Landscapes and Associated Resources: A Resource Assessment. General Technical Report, PNW-GTR-383. USDA Forest Service, Pacific Northwest Research Station, Portland, OR. 13 pp.

Baker, R. 2001. The Ketchikan Gateway Borough. A Profile of the Island Community in Southeast Alaska, in Alaska Economic Trends, January, pp 11-16.

Barbour, R. J., R. R. Zaborske, M. H. McClellan, L. Christian, and D. Golnick. 2005. Young-stand Management Options and Their Implications for Wood Quality and Other Values. Landscape and Urban Planning 72:79-94.

Belt, G.H., J. O'Laughlin, and T. Merrill. 1992. Design of Forest Riparian Buffer Strips for the Protection of Water Quality: Analysis of Scientific Literature. Idaho Forest, Wildlife and Range Policy Analysis Group Report No. 8. June 1992.

Ben-David, M., R.T. Bowyer and J.B. Faro. 1996. Niche Separation by Mink and River Otters: Coexistence in a Marine Environment. Oikos 75(1):41-48.

Berg, H.C. 1984. Regional Geologic Summary, Metallogenisis and Mineral Resources of Southeastern Alaska. U.S. Geological Survey Open-file Report 84-572. 298 pp. Ref. 24216.

Berman, M., G.P. Juday, and R. Burnside. 1998. Climate change and Alaska's forests: People problems and policies. In G.Weller and P. A. Anderson, compilers. Assessing the consequences of climate change for Alaska and the Bering Sea region. Proceedings from a workshop held 29-30 October 1998, University of Alaska, Fairbanks.

Bidlack, A.L. and J.A. Cook. 2002. A nuclear perspective on endemism in northern flying squirrels (*Glaucomys sabrinus*) of the Alexander Archipelago, Alaska.

Bidlack, A.L., and J.A. Cook. 2001. Reduced genetic variation in insular northern flying squirrels (*Glaucomys sabrinus*) along the North Pacific Coast. Animal Conservation 4: 283-290.

Binkley, C.S., M.J. Apps, R.J. Dixon, P.F. Kauppi, and L.O. Nilsson. 1997. Sequestering Carbon in Natural Forests. Critical Reviews in Environmental Science and Technology, 27 (Special) S23-S45.

Birdsey, R. A., A. J. Plantinga, and L. S. Heath. 1993. Past and prospective carbon storage in United States forests. Forest Ecology and Management. 58 (1993) pages 33-40.

Bittenbender, P.E., J.C. Still, K.M. Maas, and M.E. McDonald, Jr. 1999. Mineral Resources of the Chichogof and Baranof Islands Area, Southeast Alaska. U.S. Department of the Interior, Bureau of Land Management, BLM-Alaska Technical Report 19. BLM/AK/ST-99/005+3090+933. February 1999.

Black, H.C. 1979. Black's Law Dictionary. Fifth Edition. West Publishing Company, St. Paul, Minn. 1,451 pp., appendix.

BLM (Bureau of Land Management). 2006. Ring of Fire Proposed Resource Management Plan and Final Environmental Impact Statement. U.S. Department of the Interior, Bureau of Land Management, Anchorage Field Office. Anchorage, Alaska. July 2006.

Boag, D. A., and M. A. Schroeder. 1992. Spruce Grouse. In: A. Poole, P. Stettenheim, and F. Gill, editors. The Birds of North America. Philadelphia: The Academy of Natural Sciences. Washington, DC. The American Ornithologists' Union.

Bonsal, B. R. and T. D. Prowse. 2006. Regional Assessment of CCM-Simulated Current Climate Over Northern Canada. Artic Vol. 59, No, 02, pages 33-40

Bosakowski, T., B. McCullough, F.J. Lapsansky, and M. E. Vaughn. 1999. Northern Goshawks nesting on a private industrial forest in western Washington. Journal of Raptor Research 33:240-244.

Boutin, S. 1992. Predation and moose population dynamics: a critique. Journal of Wildlife Management. 56: 116-127.

Bowker, J.M. 2001. Outdoor recreation by Alaskans: projections for 2000 through 2020. General Technical Report PNW-GTR-527. Portland, Oregon. USDA Forest Service, Pacific Northwest Research Station. 22p. Available online at: http://www.fs.fed.us/pnw/pubs/gtr527.pdf

Bowyer, R.T., D. K. Person, and B. M. Pierce. 2005. Detecting top-down versus bottom-up regulation of ungulates by large carnivores: implications for conservation of biodiversity. Pages 342–361 *in* J. C. Ray, K. H. Redford, R. S. Steneck, and J. Berger, editors. Large carnivores and biodiversity conservation. Island, Covelo, California, USA.

Bowyer, R.T., G.M.Blundell, M. Ben-David, S.C. Jewett, T.A. Dean, and L.K. Duffy. 2003. Effects of the Exxon Valdez oil spill on river otters: injury and recovery of a sentinel species. Wildlife Monographs No. 153:1-53.

Boyce, D. A., Jr., R. T. Reynolds, and R. T. Graham. 2006. Goshawk status and management: what do we know, what have we done, where are we going? Pp 312-3325 in M. L. Morrison, editor. The northern goshawk: a technical assessment of its status, ecology, and management. Studies in Avian Biology No. 31, Cooper Ornithological Society.

Boyce, D. A., P.L. Kennedy, P. Beier, M.F. Ingraldi, S.R. MacVean, M.S. Siders, J.R. Squires, and B. Woodbridge. 2005. When are goshawks not there? Is a single visit enough to infer absence at occupied nest areas? Journal Raptor Research 39:296-302.Brackley, A.M. and R.W. Haynes. In press. Timber Products Output and Timber Harvests in Alaska: An Addendum. Manuscript in Preparation for USDA Forest Service Pacific Northwest Research Station, Research Note.

Brackley, A.M., T.D. Rojas, and R.W. Haynes. 2006a. Timber Products Output and Timber Harvests in Alaska: Projections for 2005-25. Gen. Tech. Rep. PNW-GTR-677. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 33 p.

Brackley, A.M., D.J. Parrent, and T.D. Rojas. 2006b. Estimating Sawmill Processing Capacity for Tongass Timber: 2003 and 2004 Update. U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. Portland, Oregon. Res. Note. PNW-RN-553. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 15 p.

Brew, D.A., L.J. Drew, L.M. Schmidt, D.H. Root, and D.F. Huber. 1991. Undiscovered Locatable Mineral Resources of the Tongass National Forest and Adjacent Areas, Southeastern Alaska. USGS Open-file Report 91-10. 370 pp., 16 maps, 11 figures.

Brickell, J.E. 1989. Review of Forest Inventory Methodology and Results, Tongass National Forest. USDA Forest Service, Alaska Region, unpublished report. 28 pp.

Brinkman, T.J. 2006. The Prince of Wales Island Deer Hunter Project. Preliminary Summary of Hunter Responses to Interview Questions. Community Report. Unpublished report. February.

Brohman, R. and L. Bryant (eds.). 2005. Existing Vegetation Classification and Mapping Technical Guide. Gen. Tech. Rep. WO–67. Washington, DC: U.S. Department of Agriculture Forest Service, Ecosystem Management Coordination Staff. 305 pp.

Brooks, D.J. and R.W. Haynes. 1997. Timber Products Outputs and Timber Harvests in Alaska: Projections for 1997-2010. Gen. Tech. Rep. PNW-GTR-409. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 17pp.

Brooks, D.J. and R.W. Haynes. 1994. Timber Products Outputs and Timber Harvests in Alaska: Projections for 1992-2010. Gen. Tech. Rep. PNW-GTR-261. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station.

Brooks D.J. and R.W. Haynes. 1990. Timber Products Outputs and Timber Harvests in Alaska: Projections for 1989-2010. Gen. Tech. Rep. PNW-GTR-334. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station.

Brown, M. 1997. Letter from Alaska Department of Environmental Conservation Office of the Commissioner to Phil Janik, Regional Forester, USDA Forest Service, Alaska Region, Juneau, Alaska. January 22, 1997.

Browning, D.K. 1986. Pike Lakes Resource Report. USDA Forest Service, Juneau Ranger District, Juneau, Alaska. 11 pp. Ref. 8170.

Bryant and Everest 1998. Management and Condition of Watersheds in Southeast Alaska: The Persistence of Anadromous Salmon. Northwest Science, Vol. 72, No. 4, 1998

Bryant, M.D. 1985. Changes 30 years after logging in large woody debris, and its use by salmonids, pp. 329-334. In: R.R. Johnson, C.D. Ziebell, D.R. Patton, P.R. Folliot, and R.H. Hamre (editors). Riparian ecosystems and their management: Reconciling conflicting uses. First North American Riparian Conference, Tuscon, Arizona. General Technical Report RM-120. USDA Forest Service, Rocky Mountain Forest and Range Experiement Station, Fort Collins, CO.

Bryant, M.D. 1980. Evolution of large, organic debris after timber harvest: Maybeso Creek, 1949 to 1978. General Technical Report pnw-101. USDA Forest Service, Pacific Northwest Forest and Range Experiment Station, Portland, OR.

Bryant and Wright in press. Bryant, M.D., B.E. Wright. An analysis of juvenile salmonid densities from a diverse long-term data set.

Bschor, D. E. 2007. Limited Interstate Shipments of Unprocessed Sitka Spruce and Western Hemlock Timber. Forest Supervisor, Tongass National Forest. March 14. http://www.fs.fed.us/r10/ro/policy-reports/for_mgmt/ship_timber/FS_correspondence3_13.doc

Caouette, J.P., and E.J. DeGayner. 2005. Predictive Mapping for Tree Sizes and Densities in Southeast Alaska. J. Land. Urban Plan. 72(1-3):49-63.

Caouette, J.P. and G. DeGayner. 2001. Modeling forest structure in the Tongass National Forest. Unpublished draft.

Caouette, J.P., M.G. Kramer, and Nowacki, G.J. 2001. Deconstructing the Timber Volume Paradigm in the Management of the Tongass National Forest. General Technical Report PNW-GTR-482. U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. Portland, OR. 20 pp.

Carey, A.B. 2003. Biocomplexity and Restoration of Biodiversity in Temperate Coniferous Forest: Inducing Spatial Heterogeneity with Variable-density Thinning. Forestry Volume 76, No. 2.

Carmean, W.H. 1975. Forest Site Quality Evaluation in the United States. Adv. Agron. 27, 209-269.

Carstensen, R., J. Schoen, and D. Albert. 2007. Biogeographic provinces of southeastern Alaska. In: J. Schoen and E. Dovichin, eds. The coastal forests and mountains ecoregion of southeastern Alaska and the Tongass National Forest: A conservation assessment and resource synthesis. Audubon Alaska and The Nature Conservancy. Anchorage, Alaska.

Cederholm, C.J., L.M. Reid, E.O. Salo. 1981. Cumulative effects of logging road sediment on salmonid populations in the Clearwater River, Jefferson County, Washington, pages 38-47 in, Proceedings, conference on salmon spawning gravel: a renewable resource in the Pacific Northwest? Report 39: Washington State University, Water Research Center, Pullman, Washington

CGC-ASR (Center for Global Change and Arctic System Research). 1998. Implications of Global Change in Alaska and the Bering Sea Region. Proceedings of a Workshop at the University of Alaska Fairbanks on 3–6 June 1997. G. Weller and P.A. Anderson, eds. Center for Global Change and Arctic System Research, University of Alaska Fairbanks, Fairbanks, Alaska, 152 pages plus appendices.

Chamberlin, T.W., R.D. Harr, and F.H. Everest. 1991. Timber Harvesting, Silviculture, and Watershed Processes. In: Influences of Forest and Rangeland Management on Salmonid Fishes and Their Habitats, W.R. Meehan (ed.), American Fisheries Society Special Publication 19:181-205. 1991.

Christensen, G.A., K.R. Julin, R.J. Ross, and S. Willits. 2002. Volume Recovery, Grade Yield and Properties of Lumber from Young-growth Sitka Spruce and Weatern hemlock in Southeast Alaska. Forest Products Journal Volume 52, no. 5, May 2002.

Cleland, D.T., P.E. Avers, W.H. McNab, M.E. Jensen, R.G. Bailey, T. King, and W.E. Russell. 1997. National Hierarchical Framework of Ecological Units, pp. 181-200. In: M. S. Boyce and A. Haney (eds.). Ecosystem management . Yale University, New Haven, CT. 361 pp.

Coe, D. 2004. The Hydrologic Impacts of Roads at Varying Spatial and Temporal Scales: A Review of Published Literature as of April 2004. Prepared for Upland Processes Science Advisory Group of the Committee for Cooperative Monitoring, Evaluation, and Research.

Coldwell, J.R. 1990. An Economic Analysis, Tongass Land Management Plan, Mineral Resource Inventory Inferred Reserves. Unpublished U.S. Bureau of Mines report, Alaska Field Operations Center, Juneau Branch. 154 pp.

Colt, S. 2001. The Economic Importance of Healthy Alaska Ecosystems. Prepared for Alaska Conservation Foundation. January. Available online at: http://www.iser.uaa.alaska.edu/resourcestudies/healthy-ecosystems.pdf

Concannon, J.A. 1995. Characterizing Structure, Microclimate, and Decomposition of Peatland, Beachfront, and Newly-logged Forest Edges in Southeastern Alaska. University of Washington, Seattle, WA.

Conference on Integrating GIS and Environmental Modeling (GIS/EM4): Problems, Prospects, and Research Needs. Banff, Alberta, Canada. No. 35. September 2-8. Available online at: http://www.colorado.edu/research/cires/banff/pubpapers/35/.

Conroy, C.J., and J.A. Cook. 2000. Phylogeography of a post-glacial colonizer: *Microtus longicaudus* (Rodentia: Muridae).

Conroy, C.J., J.R. Demoski, and J.A. Cook. 1999. Mammalian biogeography of the Alexander Archipelago of Alaska: a north temperate nested fauna. Journal of Biogeography 26:343-352.

Cook, J.A., N.G. Dawson, and S.O. MacDonald. 2006. Conservation of Highly Fragmented Systems: The North Temperate Alexander Archipelago. Biol. Conserv. 133: 1-15.

Cook, J.A., A.M. Runk, and C.J. Conroy. 2004. Historical biogeography at the crossroads of the northern continents: molecular phylogenetics of the of the red-backed vole (Rodentia: Arvicolinae).

Cook, J.A., A.L. Bidlack, C.J. Conroy, J.R. Demboski, M.A. Fleming, A.M. Runck, K.D. Stone, and S.O. MacDonald. 2001. A phylogeographic perspective of endemism in the Alexander Archipelago of Southeast Alaska. Biological Conservation 97: 215-227.

Cook, J.A., and S.O. MacDonald. 2001. Should endemism be the focus of conservation efforts along the North Pacific Coast of North America? Biological Conservation 97: 207-213.

Costanza, R. et al. 1997. The value of the world's ecosystem services and natural capital. Nature 387: 253-260.

Cotter, P. 2007a. American dipper. Chapter 7.7 *In* J.W. Schoen and E. Dovichin, editors. The Coastal Forests and Mountains Ecoregion of Southeastern Alaska and the Tongass National Forest: A conservation assessment and resource synthesis. The Nature Conservancy and Audubon Alaska.

Cotter P. 2007b. Northern Goshawk. Chapter 7.1 *In* J.W. Schoen and E. Dovichin, editors. The Coastal Forests and Mountains Ecoregion of Southeastern Alaska and the Tongass National Forest: A conservation assessment and resource synthesis. The Nature Conservancy and Audubon Alaska.

Cotter, P. 2007c. Townsend's warbler. Chapter 7.6 *In* J.W. Schoen and E. Dovichin, editors. The Coastal Forests and Mountains Ecoregion of Southeastern Alaska and the Tongass National Forest: A conservation assessment and resource synthesis. The Nature Conservancy and Audubon Alaska.

Coulson, J., J. Butterfiled, and E. Henderson. 1990. The Effect of Open Drainage Ditches on the Plant and Invertebrate Communities of Moorland and on the Decomposition of Peat. The Journal of Applied Ecology. Vol. 27, No. 2. August, 1990. pp 549-561.

Cowardin, L., Carter, V., Golet, F., and LaRoe, E. 1979. Classification of Wetlands and Deepwater Habitats of the United States. U.S. Fish and Wildlife Service, FWS/OBS-79/31. Washington DC.

Cox, D.P. and D.A. Singer. 1986. Mineral Deposit Models. U.S. Geological Survey Bulletin 1693. 379 pp. Ref. 18716.

Crocker-Bedford, D. C. 1990. Goshawk reproduction and forest management. Wildlife Society Bulletin. 18:262-269.

Cruise Line Agencies of Alaska. 2006. Personal communication between Fred Reeder of Cruise Line Agencies of Alaska and Shaun Brooks, Tetra Tech EC. August 31.

Cullen, P.L. 1987. Using Soil and Landform Characteristics to Predict Site Productivity on Prince Of Wales Island, Alaska. B.S., Senior Project. Soil Science Department, California Polytechnic State University. 112 pp.

Curley, K. and T. Bristol. 2006. Where the Wild Lands Are: Southeast Alaska. The Importance of Roadless Areas to Southeast Alaska's Fish, Wildlife, Hunting & Angling. Trout Unlimited.

D'Amore, D. V. and W. C. Lynn. 2002. Classification of forested Histosols in southeast Alaska. Soil Science Society of America Journal 66:554-62

Dale, V. H. , L. A. Joyce, S. Mcnulty, R. P. Neilson, M. P. Ayres, M. D. Flannigan, P. J. Hanson, L. C. Irland, A. E. Lugo, C. J. Peterson, D. Simberloff, F. J. Swanson, B. J. Stocks, and B. M. Wotton. 2001. Climate Change and Forest Disturbances. Bioscience, Vol. 51 No. 9. September 2001.

Damstedt, A. 2007. Jenkins: Veneer mill on track. Ketchikan Daily News. December 6.

Daniel, T. W., J. A. Helms, and F. S. Baker. 1979. Principles of Silviculture, Second Edition, McGraw-Hill, New York.

Dawson, N.G., S.O. MacDonald, J.A. Cook. 2007. Endemic mammals of the Alexander Archipelago. Chapter 6.7 *In* J.W. Schoen and E. Dovichin, editors. The Coastal Forests and Mountains Ecoregion of Southeastern Alaska and the Tongass National Forest: A conservation assessment and resource synthesis.. The Nature Conservancy and Audubon Alaska.

Day, R.H., K.L. Oakley and D.R. Barnard. 1983. Nest Sites and Eggs of Kittlitz's and Marbled Murrelets. Condor 85(3):265-273.

Deal, R.L., and J.C. Tappeiner. 2002. The effects of partial cutting on stand structure and growth in western hemlock-Sitka spruce stands in Southeast Alaska. Forest Ecology and Management 159: 173-186.

Deal, R.L., J.C. Tappeiner and P.E. Hennon, 2002. Developing silvicultural systems based on partial cutting of western hemlock-Sitka spruce stands of southeast Alaska. Forestry 75: 425-431.

Deal, R.L., P.E. Hennon, E.H. Orlikowska, and D.V. D'Arnore. 2004. Stand dynamics of mixed red alder-conifer forests of southeast Alaska. Canadian Journal of Forest Research 34:969-980.

Deal, R.L. 2001. The effects of partial cutting on forest plant communities of western hemlock--Sitka spruce stands in southeast Alaska. Canadian Journal of Forest Research. 31: 2067-2079.

Deal, R.L. 1997. Understory plant diversity in riparian alder-conifer stands after logging in Southeast Alaska. USDA Forest Service Pacific Northwest Research Station. Research Note PNW-RN-523.

Deal, R.L., J. H. Barbour, M. H. McClellan, and D. L. Parry. 2003. Development of epicormic sprouts in Sitka spruce following thinning and pruning in south-east Alaska. Forestry Vol. 76 No. 04 2003

Deal, R.L. and J. C. Tappenier 2002. The effects of partial cutting on stand structure and growth of western hemlock-Sitka spruce stands in Southeast Alaska. Forest Ecology and Management 159 (2002) pages 173-186.

Deal, R.L., J. C. Tappenier, and P.E. Hennon 2002. Developing Silvicultural Systems Based on Partial Cutting in Western Hemlock-Sitka Spruce Stands of Southeast Alaska. Forestry Volume 75, number 4.

DeGange, A.R. 1996. Extinction Rates in Archipelagos: Implications for Populations in Fragmented Habitats. Conservation Biology. 9: 527-541

DeGayner, G. 1997. Summary of the 1997 American Marten Risk Assessment Panel. Tongass Land Management Plan Revision Planning File.DeGayner, E., M. G. Kramer, J. G. Doerr, and M. J. Robertsen. 2005. Windstorm disturbance effects on forest structure and black bear dens southeast Alaska. Ecological Applications, 15(4):1306-1316.

DeGayner, G. 1996. TLMP Revision old growth assessment panel summary. USDA Forest Service, Tongass National Forest, Juneau, AK. Unpublished memo. 32 pp.

Dellasala, D.A., J.C. Hagar, K.A. Engel, W.C. McComb, R.L. Fairbanks, E.G. Campbell. 1996. Effects of silvicultural modifications of temperate rainforest on breeding and wintering bird communities, Prince of Wales Island, Southeast Alaska. The Condor 98: 706-721.

DellaSala, D.A., K.A.Engel, D.P. Voisen, and R.L. Fairbanks. 1994. Effectiveness of Silvicultural Modifications of Young-Growth Forest for Enhancing Wildlife Habitat on the Tongass National Forest. Prepared under contract for USDA Forest Service Region 10.

Demboski, J.R., Stone, K.D., Cook, J.A., 1999. Further perspectives on the Haida Gwaii glacial refugium hypothesis. Evolution 53, 2008–2012.

Demboski, J.R., and J.A. Cook. 2001. Phylogeography of the dusky shrew, *Sorex monticolus* (Insectivora, Soricidae): insight into deep and shallow history in northwestern North America. Molecular Ecology 10: 1227-1240.

Demboski, J.R., and J.A. Cook. 2003. Phylogenetic diversification within the *Sorex Cinereus* group (Soricidae). Journal of Mammalogy 84: 144-158.

Demboski, J.R., B. K. Jacobsen, and J. A. Cook. 1998. Implications of cytochrome b sequence variation for biogeography and conservation of the northern flying squirrel (*Glaucomys sabrinus*) of the Alexander Archipelago, Alaska. Canadian Journal of Zoology 76:1771–1776.

DeMeo, T., J. Martin, R. West. 1992. Forest Plant Association Guide Ketchikan Area, Tongass National Forest. USDA Forest Service. Alaska Region R10-MB-210. December 1992.

De Santo, T.L, M.F. Wilson, K.M. Bartecchi, J. Weirqstein. 2003: Variation in nest sites. nesting success, territory size; frequency of polygyny in winter wrens in northern temperate coniferous forests. Wilson Bulletin 115: 29-37.

DeVelice, R. L. and J. R. Martin. 2001. Assessing the Extent to Which Roadless Areas Complement the Conservation of Biological Diversity. *Ecological Applications* 11(4) 1008-1018.

Dillman, K.L., L.H. Geiser, and G. Brener. 2007. Air Quality Bio-monitoring with Lichens-Tongass National Forest; USDA Forest Service. Petersburg, Alaska.

DOE. 2006. Carbon Dioxide Emissions from the Generation of Electric Power in the United States - A joint DOE/EPA report.

Doerr, J.G., E.J. DeGayner, and G. Ith. 2005. Winter habitat selection by Sitka black-tailed deer. J. Wildl. Mange 69(1): 322-331.

Doyle, F. I. 2006. Breeding success of the goshawk (A. g. laingi) on Haida Gwaii/Queen Charlotte Islands: is the population continuing to decline? Wildlife Dynamics Consulting.

Doyle, F.L. 2004a. Blue grouse habitat on the Haida Gwaii/ Queen Charlotte Islands. Prepared for Habitat Conservation Trust Fund.

Doyle, F. I. 2004b. Managing for goshawks in TFL39 on Haida Gwaii/Queen Charlotte Islands - Goshawk and marbled murrelet habitat suitability. Wildlife Dynamics Consulting.

Dugan, D., H. Griego, G. Fay, and S. Colt. 2006. Nature-Based Tourism in Southeast Alaska: Results from 2005. Institute of Social and Economic Research. University of Alaska Anchorage. Report prepared for the Alaska Conservation Foundation. September.

Dunlap, R. 1996. Fish/Riparian Assessment Panel Summary, Tongass National Forest, Juneau, Alaska. February 13, 1996.

Dunlap, R. 1997. Summary of the 1997 Fish Habitat Risk Assessment Panel, Tongass National Forest, Juneau, Alaska. May 7, 1997.

Environment Canada. 2006. http://www.speciesatrisk.gc.ca/search/ speciesDetails_e.cfm?SpeciesID=56. Northern Goshawk. Accessed October 2007.

Environmental Laboratory, 1987. Corps of Engineers Wetlands Delineation Manual. Technical Report Y-87-1, U.S. Army Waterways Experiment Station, Vicksburg, Mississippi. Available on line at: http://el.erdc.usace.army.mil/wetlands/pdfs/wlman87.pdf

Everest, F.H., and G. H. Reeves 2007. Riparian and Aquatic Habitats of the Pacific Northwest and Southeast Alaska: Ecology, Management History, and Potential Management Strategies (FNW-GTR-692). USDA Forest Service, Pacific Northwest Research Station, Portland, Oregon.

Faris, T.L. and K.D. Vaughan. 1985. Log transfer and storage facilities in Southeast Alaska: A review. USDA Forest Service GTR PNW-174. Portland, Oregon. 24 pp., plus map. Ref. 7667.

Farr, W.A. 1984. Site Index and Height Growth Curves for Unmanaged Even-aged Stands of Western Hemlock and Sitka Spruce in Southeast Alaska. Res. Pap. PNW-326. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Forest and Range Experiment Station. 26 pp.

Farr, W.A. and A. S. Harris 1971. Partial cutting of western hemlock and sitka spruce in Southeast Alaska. USDA Forest Service, PNW-124. 107 pp. Ref. 8420.

Farr, W.A. and M.H. McClellan. 1994. Size and Age Structure of Trees in the Old-Growth Forests of Southeast Alaska. USDA Forest Service, Pacific Northwest Research Station. Unpublished, non-peer-reviewed manuscript on file at Juneau Forestry Sciences Laboratory, Juneau, AK. Ref. R-721.

Fay, V. 2002. Alaska Aquatic Nuisance Species Management Plan. Juneau, Alaska. October. Available online at: http://www.adfg.state.ak.us/special/invasive/ak_ansmp.pdf

Federal Geographic Data Committee—Vegetation Subcommittee. 1997. Vegetation classification standard. FGDC-STD-005. Reston, VA: Federal Geographic Data Committee, U.S. Geological Survey.

Flatten, C., K. Titus, and S. Lewis. 2002. Technical assistance, analysis and dissemination of results from an interagency northern goshawk study on the Tongass National Forest. Alaska Department of Fish and Game.

Flatten, C., K. Titus, and R. Lowell. 2001. Northern goshawk population monitoring, population ecology and diet on the Tongass National Forest. Alaska Department of Fish and Game, Juneau, AK. Final Research Performance Report, Endangered Species Conservation FundGrant SE-4-2-6:33, Studies 2-6. Juneau, Alaska 32 pp.

Fleming, M.A., and J.A. Cook. 2002. Phylogeography of endemic ermine (*Mustela erminea*) in Southeast Alaska. Molecular Ecology 11: 795-807.

Flynn, R., S.B. Lewis, L.R. Beier, G.W. Pendleton. 2007. Brown bear use of riparian and beach zones of northeast Chichagof Island: implications for streamside management in coastal Alaska. Wildlife Research Final Report. Alaska Department of Fish and Game, Douglas, Alaska.

Flynn, R., T.V. Schumacher, and M. Ben-David. 2004. Abundance, prey availability, and diets of American martens: implications for the design of old-growth reserves in Southeast Alaska. Wildlife Research Final Report. Alaska Department of Fish and Game.

Flynn, R.W., and T. Schumacher. 2001. Ecology of martens in southeast Alaska, 1 July 2000-30 June 2001. Alaska Department of Fish and Game. Federal aid in wildlife restoration final research performance report, grants W-23-4 to W-27-4. Study 7.16. Juneau, AK.

Flynn, R.W., and T. Schumacher. 1999. Ecology of martens in southeast Alaska. Alaska Department of Fish and Game. Federal aid in wildlife restoration annual research report, July 1998-June 1999. Grant W-27-2. Study 7.16. Juneau, Alaksa.

Flynn, R.W. and L.H. Suring. 1993. Harvest Rates of Sitka Black-tailed deer Populations in Southeast Alaska for Land-use Planning. Alaska Department of Fish and Game, Douglas, Alaska. 9 pp. Ref. 5760.

FEMAT (Forest Ecosystem Management Assessment Team). 1993. Forest Ecosystem Management: An Ecological, Economic, and Social Assessment. U.S. Government Printing Office: 1993-793-071. USDA Forest Service, Washington DC.

Finch, D. M., and P. W. Stangel, editors. 1992. Status and management of Neotropical migratory birds; General Technical Report RM-229. U.S. Forest Service, Rocky Mountain Forest and Range Experiment Station, Fort Collins, Colorado

Franklin, J., 1995. Predictive vegetation mapping: geographic modeling of biospatial patterns in relation to environmental gradients. Prog. Phys. Geogr. 19, 474-499.

Franklin, J.F. 1993. Preserving Biodiversity: Species, Ecosystems, or Landscapes? Ecological Applications. 3:202-205.

Fuller T.K., and P.R. Siever. 2001. Carnivore demography and the consequences of changes in prey availability. Pages 163-178 *In* J. L. Gittleman, S.M. Funk D.W. MacDonald, and R.K. Wayne, editors. Carnivore Conservation. Cambridge University Press, Cambridge, England.

Fuller, T. K., L. D. Mech, and J. F. Cochrane. 2003. Wolf population dynamics. Pages 161-191 *In* L. D. Mech and L. Boitani, editors. Wolves: behavior, ecology, and conservation. University of Chicago Press, Chicago, Illinois

Furniss, M.J., T.D. Roelofs, and C.S. Yee. 1991. Road Construction and Maintenance. In: Influences of Forest Rangeland Management on Salmonid Fishes and Their Habitat, W.R. Meehan (ed.), American Fisheries Society Special Publication 19:297-323, 1991.

Galginaitus, M. 2004. Subsistence Resource Report for the Couverden Forest Service Project. Applied Sociocultural Research. Anchorage, Alaska.

Geiser, L.H., C.C. Derr, and K.L. Dillman. 1994. Air Quality Monitoring on the Tongass National Forest, Methods and Baselines Using Lichens. Report R10-TB-46, USDA Forest Service, Petersburg, Alaska.

Gende, S., and T. Quinn. 2004. The relative importance of prey density and social dominance in determining intake rates of bears feeding on salmon. Canadian Journal of Zoology 82:75–85.

Gende, S., T. Quinn, M. Willson, A. Hendry, and B. Dickerson. 2004a. Brown bears selectively kill salmon with higher energy content but only in habitats that facilitate choice. Oikos 104:518–528.

Gende, S., T. Quinn, M. Willson, R. Heintz, and T. Scott. 2004b. Magnitude and fate of salmon-derived N, P, and energy in a coastal stream ecosystem. a Journal of Freshwater Ecology 19:149–160.

Gende, S., M.F. Willson, B.H. Marston, M. Jacobson, W.P. Smith. 1998. Bald Eagle nesting density and success in relation to distance from clearcut logging in Southeast Alaska. Biological Conservation 83: 121-126.

Gibson, J.R., Haedrich, R.L., and Wenerheim. 2005. Loss of Habitat as a Consequence of Inappropriately Constructed Stream. *Fisheries*, 30(1), 10-16.

Gilbertson, N. 2006. Southeast Sputters. Alaska Economic Trends. April. Available online at: http://www.labor.state.ak.us/trends/

Gilbertson, N. 2004. Southeast Alaska. A Tale of Two Economies. Alaska Economic Trends. March. Available online at: http://www.labor.state.ak.us/trends/

Gilbertson, N. 2003. Sitka: An Economic Profile. Alaska Economic Trends. February. pp. 3-9

Glaser, P.H. 1999. The Impact of Forestry Roads on Peatlands within the Tongass National Forest, Southeast Alaska.

Gomi, T., R.D. Moore, and M.A. Hassan. 2005. Suspended Sediment Dynamics in Small Forest Streams of the Pacific Northwest. Journal of the American Water Resources Association, 41, 4; ProQuest Science Journals, pp. 877. August 2005.

Gomi, T., R.C. Sidle, and D.N. Swanston. 2004. Hydrogeomorphic linkages of sediment transport in headwater streams, Maybeso Experimental Forest, southeast Alaska. Hydrological Processes. 18: 667-683.

Griffiths, P.A., T. Aley, K. Prussian, J. Baichtal, S. Hohensee, S.R.H. Worthington, C. Mayn, W.K. Jones. 2002. Karst Management Standards and Implementation Review: Final Report of the Karst Review Panel. USDA Forest Service, Tongass National Forest.

Groves, D.J. 2006. Alaska Productivity Surveys of Geese, Swans, and Brant 2005. Migratory Bird Management. USFWS. Juneau, AK. 15 pp.

Groves C. 2003. Drafting a Conservation Blueprint: A Practitioner's Guide to Planning for Biodiversity. Washington, D.C.: Island Press.

Hadland, J, A. Wink, A. Soden, and B. Laurent. 2006. Nonresidents Working in Alaska 2004. Alaska Department of Labor and Workforce Development. January. Available online at: http://146.63.75.50/research/reshire/nonres.pdf

Haines Convention and Visitors Bureau. 2006. Personal communication between Julie Shook of the Haines Convention and Visitors Bureau and Shaun Brooks, Tetra Tech EC. July 27.

Hamer, T. E., and S. K. Nelson. 1995. Characteristics of marbled murrelet nest trees and nesting stands. Pages 69-82 *In* J. C. Ralph, G. L. Hunt, Jr., M. G. Raphael, and J. F. Piatt, editors. Ecology and conservation of the marbled murrelet. USDA Forest Service Pacific Southwest Research Station. General technical report PSW-GTR-152. Albany, California.

Hanley, T. A. 2005. Potential Management of Young-growth Stands for Understory Vegetation and Wildlife Habitat in Southeastern Alaska. Landscape and Urban Planning 72: 95-112.

Hanley, T.A. 1996. Small mammals of even-aged, red alder–conifer forests in southeastern Alaska. Canadian Field Naturalist 110, 626–629.

Hanley, T.A., W.P. Smith, and S. M. Gende. 2005. Maintaining Wildlife Habitat in Southeastern Alaska: Implications of New Knowledge for Forest Management and Research. Landscape and Urban Planning 72: 113-133.

Harding, K.A. and D.C. Ford. 1993. Impacts of Primary Deforestation upon Limestone Slopes in Northern Vancouver Island, British Columbia. Environmental Geology 21:137-143.

Hanley, T.A., and J.C. Barnard. 1998. Red alder, *Alnus rubra*, as a potential mitigation factor for wildlife habitat following clearcut logging in southeastern Alaska. The Canadian Field-Naturalist 112: 647-652.

Hanley, T.A., R.L. Deal., and E.H. Orlikowska 2006. Relations between red alder composition and understory vegetation in young mixed forests of Southeast Alaska. Canadian Journal of Forestry Research 36: 738-748.

Hanley, T.A., and T. Hoel. 1996. Species composition of old-growth and riparian Sitka spruce-western hemlock forests in southeastern Alaska. Canadian Journal of Forest Research 26: 1703-1708.Hargis C.D., J.A. Bissonette, D.L. Turner. 1999. The influence of forest fragmentation and landscape pattern on American martens. Journal of Applied Ecology 36:157–172.

Harmon, M.E., W.K. Ferrell, and J.F. Franklin. 1990. Effects on Carbon Storage of Old-Growth Forests to Young Forests Science Volume 247, February 1990.

Harris, A. S.. 1999. Wind in the Forests of Southeast Alaska and Guides for Reducing Damage. USDA Forest Service. General Technical Report. PNW-GTR-244.

Harris, C.C. 1996. Rural Communities in the Inland Northwest—An Assessment of Small Communities in the Interior and Upper Columbia River Basins. Interior Columbia River Basin Ecosystem Management Project, Walla Walla, WA.

Harris, A.S. 1977. Natural Reforestation on a Mile-Square Clearcut in Southeast Alaska, USDA Forest Service PNW-52.

Harris, A.S. and D.L. Johnson 1983. Western Hemlock-Sitka Spruce. In: USDA Forest Service Agriculture Handbook No. 445, pp 1 to 8.

Harris, A.S. and W.A. Farr. 1974. The Forest Ecosystem of Southeast Alaska: Forest Ecology and Timber Management. USDA Forest Service, Pacific Northwest Forest and Range Experiment Station. General Technical Report PNW-25. Ref. R-717.

Hassan, M.A., M. Church, T.T. Lisle, F. Brardinoni, L. Benda, and G.E. Grant. 2005. Sediment Transport and Channel Morphology of Small, Forested Streams. Journal of the American Water Resources Association, 41, 4; ProQuest Science Journals, pp. 853. August 2005.

Haufler, J.B. 2007. Review of conservation science produced since 1997 and its relationship to the Tongass National Forest Land and Resources Management Plan. Prepared for Tetra Tech EC, Inc. and the Tongass National Forest.

Haufler, J.B. 2006. Review of Conservation Science Produced Since 1997 and Its Relationship to the Tongass National Forest Land and Resource Management Plan. Final Draft. Prepared for Tongass National Forest. Ecosystem Management Research Institute (EMRI). August 2006. 35 pp.

Haufler, J.B., R.K Baydack, H. Campa, B.J. Kernohan, L.J. O'Neil, L. Waits, C. Miller 2002. Performance Measures for Ecosystem Management and Ecological Sustainability. Bethesda, Maryland: The Wildlife Society.

Haufler, J.B. 1999. Strategies for conserving terrestrial biological diversity. In: Baydack RK, Campa H, Haufler JB, eds. Practical approaches to the conservation of biological diversity. San Diego, CA: Island Press. p. 17-30.

Haynes, R.W. and D.J. Brooks. 1990. An analysis of the timber situation in Alaska: 1970-2010. Gen. Tech. Rep. PNW-GTR-264. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 33 p.

Heard, W.R. 1991. Life History of Pink Salmon (Oncorhynchus gorbuscha), pp. 119-230. In: Pacific Salmon Life Histories., C. Groot and L. Margolis (eds.). University of British Columbia in co-operation with the Government of Canada, Department of Fisheries and Oceans. British Columbia, Canada.

Hendee, J.C., and C.P. Dawson. 2002. Wilderness Management, Stewardship and Protection of Resources and Values. Third edition. Fulcrum Publishing. Golden, Colorado. 640 pp.

Hennon, P. E. and M. H. McClellan. 2003. Tree mortality and forest structure in the temporate rain forests of southeast Alaska. Canadian Journal of Forestry Res 33 1621-1634 (2003)

Hennon, P.E., M.H. McClellan, and P. Palkovic. 2002. Comparing deterioration and ecosystem function of decay-resistant and decay-susceptible species of dead trees. Pages 435-444 *In* P. Shea, editor. Symposium on the ecology and management of dead wood in Western forests. Gen. Tech. Rep. PSW-GTR-181. U.S. Department of Agriculture, Forest Service, Pacific Southwest Research Station, Berkley, California.

Hennon, P.E. and C.G. Shaw. 1997. The Enigma of Yellow-Cedar Decline. Journal of Forestry. 95(12) p. 4-10.

Hennon P.E. and D. DeMars 1997. Development of Wood Decay in Wounded Western Hemlock and Sitka Spruce in Southeast Alaska. Can. J. For. Res./Rev. can. rech. for. 27(12): 1971-1978 (1997).

Hilderbrand, G. V., C.C. Schwartz, C. Robbins, M. E. Jacoby, T. A. Hanley, S. M. Arthur, and C. Servheen. 1999. Importance of meat, particularly salmon, to body size, population productivity, and conservation of North American brown bears. Canadian Journal of Zoology 77:132-138.

Holimon, W. C., C. W. Benkman, and M. F. Willson. 1998. The importance of mature conifers to red crossbills in southeast Alaska. Forest Ecology and Management 102:167-72.

Holsten, E., E. Hennon, L. Trummer, and M. Schultz. 2001. Insects and Diseases of Alaskan Forests. USDA Forest Service R10-TP-87, April 2001.

Holtby, L.B., and J.C. Scrivener. 1989. Observed and simulated effects of climatic variability, clear-but logging and fishing on the numbers of chum salmon (*Oncorhynchus kisutch)* smolts and fry and chum salmon (*O. Keta*) fry from Carnation Creek, British Columbia. Canadian Journal of Fisheries and Aquatic Sciences 46:1396-1405.

Hoover, C and S. Stout. 2007. The Carbon Consequences of Thinning Techniques: Stand Structure Makes the Difference. Journal of Forestry, Vol. 105, No. 5, July/August 2007.

Howe, A.L., R.J. Walker, C. Olnes, K. Sundet, and A.E. Bingham. 2001 Participation, Catch, and Harvest in Alaska Sport Fisheries during 1999. Alaska Department of Fish and Game. Fishery Data Series No. 01-8.

Howe, A.L., G. Fidler, and M.J. Mills. 1995. Harvest, Catch, and Participation in Alaska Sport Fisheries During 1994. Alaska Department of Fish and Game, Division of Sport Fish, Fishery Data Series No. 95-24. October.

IOC (Intergovernmental Oceanographic Commission). 2007. Ocean Carbon Sequestration: A Watching Brief of the Intergovernmental Oceanographic Commission of UNESCO and the Scientific Committee of Ocean Research. Version 2. January 2007

IFA (Inter-Island Ferry Authority). 2006a. Personal communication between Tom Biggs of Alaska's Inter-Island Ferry Authority and Shaun Brooks, Tetra Tech EC. August 30.

IFA. 2006b. About the IFA. Available online at: http://www.interislandferry.com/aboutus.html

IPCC (Intergovernment Panel on Climate Change). 2007. Climate Change2007: The Physical Science Basis. Intergovernmental Panel on Climate Change. Working Group I, Forth Assessment Report. WMO and UNEP. Feb. 2007.

Iverson, C. 1997a. Summary of the 1997 Northern Goshawk Risk Assessment Panel. Tongass Land Management Plan Revision Planning File.

Iverson, C. 1997b. Summary of the 1997 Other Endemic Mammals Assessment Panel. Tongass Land Management Plan Revision Planning File.

Iverson, C. 1997c. Summary of the 1997 Alexander Archipelago Wolf Risk Assessment Panel. Tongass Land Management Plan Revision Planning File.

Iverson, C. 1996a. Northern Goshawk Viability Panel Assessment Summary. Tongass Land Management Plan Revision Planning File.

Iverson C. 1996b. Brown Bear Viability Panel Assessment Summary. Tongass Land Management Plan Revision Planning File.

Iverson, C. 1996c. Alexander Archipelago Wolf Viability Panel Assessment Summary. Tongass Land Manaegment Plan Revision Planning File.

Iverson, C. 1996d. American Marten Viability Assessment Panel Summary. Tongass Land Management Plan Revision Planning File

Iverson, C.G., G.D. Hayward, K. Titus, E. DeGayner, R.E. Lowell, D.C. Crocker-Bedford, P.F. Schempf, and J. Lindell. 1996. Conservation Assessment for the Northern Goshawk in Southeast Alaska. Gen. Tech. Rep. PNW-GTR-387, November 1996, Pacific Northwest Research Station, Portland, Oregon. USDA, Forest Service. 101 pp.

Janish, J.E. and M.E. Harmon 2002. Successional changes in live and dead wood carbon stores: implications for net ecosystem productivity. Tree Physiology 22, 77-89,

Jennings, G.B., K. Sundet, and A.E. Bingham. 2007. Participation, Catch, and Harvest in Alaska Sport Fisheries During 2004. Alaska Department of Fish and Game, Division of Sport Fish, Fishery Data Series No. 07-40. June.

Jennings, G.B., K. Sundet, A.E. Bingham, and D.Sigurdsson. 2006. Participation, Catch, and Harvest in Alaska Sport Fisheries During 2003. Alaska Department of Fish and Game, Division of Sport Fish, Fishery Data Series No. 06-44. August.

Johnson, A.C., D.N. Swanston, and K.E. McGee. 2000. Landslide initiation, runout, and deposition within clearcuts and old-growth forests of Alaska. Journal of the American Water Resources Association. 36: 17-30.

Johnson, A.C., R.T. Edwards, and R. Erhardt. 2007. Ground-water response to forest harvest: Implications for hillslope stability. Journal of the American Water Resources Association. Vol. 43, No. 1, February. p. 134-147.

Johnson, S.W., J. Heifetz, and K.V. Koski. 1986. Effects of logging on the abundance and seasonal distribution of juvenile steelhead in some southeastern Alaska streams. North American Journal of Fisheries Management 6:532-537.

Joy, J.B. 2000. Characteristics of nest cavities and nest trees of the red-breasted sapsucker in coastal montane forests. Journal of Field Ornithology 71: 525-530.

Juday, G. P., R. A, Ott, D. W. Valentine, and V. A. Barber. 1998. Forests, Climate Stress, Insects, and Fire. In Implications of Gobal Change in Alaska and the Bering Sea Region.

Julin, K.R. and D.V. D'Amore. 2003. Tree Growth on Forested Wetlands of Southeastern Alaska Following Clearcutting. Western Journal of Applied Forestry. Vol. 18(1).

Julin, K.R. and J.P. Caouette. 1997. Options for Defining Old-growth Timber Volume Strata: A Resource Assessment. In: K. R. Julin (Compiler), Assessments of Wildlife Viability, Old-growth Timber Volume Estimates, Forested Wetlands, Slope Stability. General Technical Report PNW-GTR-392. USDA Forest Service, Pacific Northwest Research Station, Portland, OR. pp. 24-37.

Julin, K. R., C.G. Shaw III, W.A. Farr, and T.M. Hinckley 1993. The fluted western hemlock of Alaska. II Stand observations and synthesis. Forest Ecology and management 60 (1993) 133-141.

Juneau Convention and Visitors Bureau. 2007. Cruise ship passengers data. Personal communication with Matt Dadswell of Tetra Tech EC, November 20.

Juneau Economic Development Council. 2006. Mill Capacity and Utilization Study, CY 2005. (Evaluating Demand for Tongass Timber). Wood Products Development Service.

Juneau Economic Development Council. 2007. Tongass Sawmill Capacity and Production Report for CY 2006. Prepared for the USDA Forest Service. Wood Products Development Service. October 11.

Kahklen, K. and W. Hartsog. 1999. Results of Road Erosion Studies on the Tongass National Forest. Unpublished report. 47 pp. On file with: USDA Forest Service, Pacific Northwest Research Station, Forestry Sciences Laboratory, 2770 Sherwood Lane, Suite 200, Juneau, AK 99801.

Kahklen, K. and J. Moll. 1999. Measuring Effects of Roads on Groundwater: Five Case Studies. USDA Forest Service Technology and Development Program. January 1999.

Kauffman, K. 1996. Lives of North American Birds. Houghton Mifflin Company, Boston, MA.

Kelly, B.P., T. Ainsworth, D.A. Boyce JR., E. Hood, P. Murphy, and J. Powell 2007. Climate Change, Predicted Impacts on Juneau, Scientific Panel on Climate Change City and Borough of Juneau, Report to Mayor Bruce Botelho and the City and Borough of Juneau Assembly. April 2007.

Kiester, A.R. and E. Eckhardt. 1994. Review of Wildlife Management and Conservation Biology on the Tongass National Forest: A Synthesis with Recommendations. Pacific Northwest Research Station, USDA Forest Service, Corvallis, Oregon.

Kilborn, K.A., D.J. Parrent, and R.D. Housley. 2004. Estimating sawmill processing capacity for Tongass timber. Res. Note. PNW-RN-545. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 12 p.

Kingery, H. E. 1996. American Dipper (*Cinclus mexicanus*). In A. Poole and F. Gill, editors. The Birds of North America, No. 229. The Academy of Natural Sciences, Philadelphia, PA, and The American Ornithologists' Union, Washington, D.C.\

Kirchhoff, M.J. 2003. Deer pellet-group surveys in Southeast Alaska. Federal Aid in Wildlife Restoration Annual Report. Alaska Department of Fish and Game, Juneau, AK.

Kirchhoff, M. D., and D. L Larsen. 1998. Dietary overlap between native Sitka black-tailed deer and introduced elk in Southeast Alaska. Journal of Wildlife Management 62:236-242.

Kissling, M.L. 2003. Effects of Forested Buffer Width on Breeding Bird Communities in Coastal Forests of Southeast Alaska with a Comparison of Avian Sampling Techniques. M.S. Thesis, University of Idaho, Moscow, Idaho.

Kline, J. D. 2006. Defining and Economics Research Program to Describe and Evaluate Ecosystem Services. USDA Forest Service, Pacific Northwest Research Station. General Technical Report PNW-GTR-700. December.

Kocis, S.M., D.B.K. English, S.J. Zarnoch, R. Arnold, L. Warren, and C. Ruka. 2004. National Visitor Use Monitoring Results. USDA Forest Service. Region 10. Tongass National Forest. August.

Konopacky Environmental. 1996. Water Turbidity in Streams, Related to the Installation of Road Culverts of Various Diameters for Timber Harvest Activities, on the Tongass National Forest, Southeast Alaska, During 1994 and 1995. In: Exhibit A, Presentation Sypnosis, Konopacky Project No. 002-0. February 7, 1996.

Koski, A.V., J. Heifetz, S. Johnson, M. Murphy, and J. Thedinga. 1984. Evaluation of Buffer Strips for Protection of Salmonid Rearing Habitat and Implications for Enhancement. In: Pacific Northwest Stream Habitat Management Workshop. National Marine Fisheries Service, NOAA. Auke Bay, Alaska. pp 138-155. October 10-12, 1984.

Koski, K.V. 1972. Effect of sediment on fish resources, a paper presented at Washington State Department of Natural Resources Management Seminar, Lake Limerick, Washington

Kramer, M.G. 2001. Maritime Windstorm Influence on Soil Process in a Temperate Rainforest. PhD Dissertation. Submitted to Oregon State University, May 04, 2001. 114 pp.

Krieger, D.J. 2001. The Economic Value of Forest Ecosystem Services: A Review. Prepared for the Wilderness Society.

Kruse, G.H. 1998. Salmon Run Failures in 1997-1998: A Link to Anomalous Ocean Conditions? Alaska Fishery Research Bulletin. 5(1):55-63.

Kruse, J. and R. Frazier. 1988. Reports to the Communities of Southeast Alaska (one per community). Tongass Resource Use Cooperative Survey. Institute of Social and Economic Research. University of Alaska Anchorage.

Kruse, J. and R. Muth. 1990. Subsistence Use of Renewable Resources by Rural Residents of Southeast Alaska. August. 160 pp.

Kuletz, K.J., S.W. Stephensen, D.B. Irons, E.A. Labunski, and K. M. Brenneman. 2003. Changes in Distribution and Abundance of Kittlitz's Murrelets Brachyramphus brevirostris relative to glacial recession in Prince William Sound, Alaska. Marine Ornithology 31:133-140.

Lambeck, R.J. and R.J. Hobbs. 2002. Landscape and Regional Planning for Conservation: Issues and Practicalities. In: Gutzwiller KJ, editor. Applying landscape ecology to biological conservation. New York, NY: Springer-Verlag. p. 360-380.

Landres, P., S. Boutcher, L, Merigliano, C. Barns, D. Davis, T. Hall, S. Henry, B. Hunter, P. Janiga, M. Laker, A. McPherson, D. Powell, M. Rowan, and S. Sater. 2005. Monitoring Selected Conditions Related to Wilderness Character: A National Framework. USDA Forest Service. Rocky Mountain Research Station. General Technical Report. RMRS-GTR-151. April.

Landres, P. and S. Meyer. 2000. National Wilderness Preservation System Database: Key Attributes and Trends, 1964 through 1999. USDA Forest Service, RM Research Station, General Technical Report RMRS-GTR-18-Revised Edition. Ogden, UT.

Landry, G. 2001. The Ketchikan Pulp Mill Closure. A Study of Laid-off Workers, in Alaska Economic Trends, January, pp 3-10.

Landwehr, D.J. 2006. Reasonable Assurance of Windfirmness Guidelines, Tongass National Forest, June 13, 2006.

Landwehr, D. 1993. Soil disturbance monitoring transects: Thorne Bat Ranger District, Tongass National Forest. In: Proceedings of Watershed '91: Soil, Air, and Water Stewardship Conference, 16-17 April 1991, Juneau, Alaska. T. Brock, Editor. USDA Forest Service, Alaska Region, R10-MB-217. Page 58.

Larsen, D.N. 1984. Feeding Habits of River Otters in Coastal Southeastern Alaska. Journal of Wildlife Management 48(4): 1446-1452.

Laurent, T.H. 1974. The Forest Ecosystem of Southeast Alaska. Chapter 6. Forest Diseases. GTR PNW-23. Portland OR.

Leighty, W.W., S.P. Hamburg, and J. Caouette. 2006. Sequestration in Forest Biomass in Southeast Alaska. Ecosystems (2006) 9: 1051-1065

Lerum, L. and P.C. Krosse. 2005. Tongass National Forest Invasive Plant Management Plan. Tongass National Forest. Ketchikan, AK.

Lewis, S. B., K. Titus, and M. R. Fuller. 2006. Northern Goshawk Diet during the Breeding Season on Southeast Alaska. Journal of Wildlife Management 70(4): 1151-1160.

Lewis, S. B. 2005. Analysis of Queen Charlotte goshawk radio-telemetry and nest site data. Federal Aid Interim Performance Report. Alaska Dept. of Fish and Game.

Lewis, S. B., M. R. Fuller, and K. Titus. 2004. A comparison of three methods for assessing raptor diet during the breeding season. Wildlife Society Bulletin 32:373–385.

Lewis, S. B. 2001. Breeding season diet of northern goshawks in southeast Alaska with a comparison of techniques used to examine raptor diet. Thesis, Boise State University, Idaho, USA.

Loomis, J.B. 2000. Economic Values of Wilderness Recreation and Passive Use: What We Think We Know at the Beginning of the 21st Century. In: McCool, S.F., Cole, D.N., Borrie, W.T., and O'Loughlin, comps. Wilderness Science in a time of change conference—Volume 2: Wilderness within the context of larger systems; 1999 May 23-27; Missoula, MT. Proceedings RMRS-P-15-VOL-2. Ogden, UT: USDA Forest Service, Rocky Mountain Research Station. Available on line at: http://www.wilderness.net/pubs/science1999/volume2/lommis-2-3.pdf

Lowell, R.E. 2005. Unit 3 deer management report. Pages 58-69 in C. Brown, editor. Deer management report of survey and management activities 1 July 2002-30 June 2004. Alaska Department of Fish and Game, Juneau, Alaska.

Lowell, R. E. 2004. Unit 3 furbearer management report. Pages 50–61in C. Brown, editor. Furbearer management report of survey and inventory activities 1 July 2000–30 June 2003. Alaska Department of Fish and Game. Project 7.0. Juneau, Alaska.

Lloyd, D.S. 1987. Turbidity as Water Quality Standard for Salmonid Habitats in Alaska. North American Journal of Fisheries Management. 7:34-45.

Lloyd, D.S., J.P Koenings, and J.D. LaPerriere. 1987. Effects of Turbidity in Freshwaters of Alaska. North American Journal of Fisheries Management. 7:18-33.

Lucid, M. and J. Cook. 2004. Phylogeography of Keen's mouse (Peromyscus keeni) in a naturally fragmented landscape. Journal of Mammalogy 85: 1149-1159.

Maas, K.M. P.E. Bittenbender, and J.C. Still. 1995. Mineral Investigations in the Ketchikan Mining District, Southeastern Alaska, U.S. Department of the Interior, Bureau of Mines, Open File Report 11-95.

MacDonald, S. O. 2003. The Amphibians and Reptiles of Alaska: a Field Handbook. Available online at: http://www.alaskaherps.info. Accessed September 2006.

MacDonald, S.O. and J.A. Cook. 2000. The Mammal Fauna of Southeast Alaska. University of Alaska Museum, second printing. 141 pp.

MacDonald, S.O. and J.A. Cook. 1996. The Land Mammal Fauna of Southeast Alaska. CanadianField-Nat., 110:571-598

Marcot, B.G., M.J. Widsom, H.W. Li and G.C. Castillo. 1994. Managing for Featured Threatened, Endangered, and Sensitive Species and Unique Habitats for Ecosystem Sustainability. USDA Forest Service, PNW-GTR-329.

Martin, D.J. and L.E. Benda. 2001. Patterns of Instream Wood Recruitment and Transport at the Watershed Scale. Transactions of the American Fisheries Society. Vol. 130, Issue 5. September. pp. 940-958.

Martin, J.R., R.L. DeVelice, and S. Brown. 2000. Landscape Analysis and Biodiversity Specialist Report. USDA Forest Service. Roadless Area Conservation Final EIS. Available online at: http://roadless.fs.fed.us/documents/feis/ specrep/xlandscape_spec_rpt.pdf

Martin et al. 1998. Martin, D.J., M.E. Robinson, R.A. Grotefendt. The Effectiveness of Riparian Buffer Zones for Protection of Salmonid Habitat in Alaska Coastal Streams. Prepared for Sealaska Corporation and Alaska Forest Association, May 1, 1998.

Martin D.J., M.E. Robinson, R.A. Grotefendt 1998. The Effectiveness of Riparian Buffer Zones for Protection of Salmonid Habitat in Alaska Coastal Streams, Prepared for Sealaska Corporation and Alaska Forest Association

Martin, D.J. 1997. A summary of stream water quality monitoring data: South Fork Michael Creek, Admiralty Island, Alaska. Martin Environmental.

Martin, D.J., and R.A. Grotefendt. 2007. Stand mortality in buffer strips and the supply of woody debris to streams in Southeast Alaska. Can. J. For. Res. 37: 36-49 (2007)

Martin, D.J. 1996. Monitoring the effects of timber harvest activities on fish habitat in streams of coastal Alaska. Project status report.

Martin, D.J., and J.A. Kirtland. 1995. An assessment of fish habitat and channel conditions in streams affected by debris flows at Hobart Bay. Project 16-004 report written by Pentec Environmental, Inc., Edmonds, Washington. Written for Goldbelt, Inc., Juneau, Alaska. 40pp. plus Appendix.

Martin, J., S. Trull, W. Brady, R. West, J. Downs. 1995. Forest Plant Associations Management Guide, Chatham Area, Tongass National Forest. USDA Forest Service. Alaska Region. R10-TP-57. March 1995.

Matsuoka, S.M., C. M. Handel, and D. D. Roby. 1997a. Nesting ecology of Townsend's Warblers in relation to habitat characteristics in a mature boreal forest. Condor 99: 271-281.

Matsuoka, S.M., C. M. Handel, D. D. Roby, and D. L. Thomas. 1997b. The relative importance of nesting and foraging sites in selection of breeding territories by Townsend's Warblers. Auk 114: 657-667.

McClaren, E. 2004. Queen Charlotte goshawk. Accounts and Measures for Managing Identified Wildlife. Accounts V.

McClellan, M.H. 2005. Recent Research on the Management of Hemlock-spruce Forests in Southeast Alaska. Landscape and Urban Planning 72 (2005) 65-78.

McClellan, M.H. 2004. Development of silvicultural systems for maintaining old-growth conditions in the temperate rainforest of southeast Alaska. Forest Snow and Landscape Research 78: 173-190.

McClellan, M.H., D.N. Swanston, P.E. Hennon, R.L. Deal, T.L. De Santo, and M.S. Wipfli. 2000. Alternatives to clearcutting in the old-growth forests of Southeast Alaska: study plan and establishment report. USDA Forest Service Pacific Northwest Research Station. General Technical Report PNW-GTR-494.

McDowell Group. 2006a. A Profile of Visitors to Rural Alaska and the Central Southeast Region. Alaska Travelers Survey. Prepared for the State of Alaska Department of Commerce, Community, and Economic Development. March.

McDowell Group. 2006b. Timber Markets Update and Analysis of an Integrated Southeast Alaska Forest Products Industry. Update and Clarification. Letter from Jim Calvin to Murray Walsh, Southeast Conference. December 30.

McDowell Group. 2005. Juneau Cruise Visitor Profile 2005. Alaska Travelers Survey. Prepared for the City and Borough of Juneau. December. Available online at: http://www.traveljuneau.com/downloads/ATSJuneauCruiseFinal.pdf

McDowell Group. 1999. Alaska Visitor Industry Economic Impact Study 1999 Update. Prepared for Division of Tourism, Alaska Department of Commerce and Economic Development. Juneau, Alaska. May.

McDowell Group, DataPath Systems, and Davis, Hibbitts & Midghall, Inc. 2007. Alaska Visitor Statistics Program. Alaska Visitor Volume and Profile. Summer 2006. Prepared for the State of Alaska Department of Commerce, Community and Economic Development. April.

McDowell Group, Walt Sheridan Associates, and Leonard Guss Associates. 2004. Timber markets update and analysis of an integrated southeast Alaska forest products industry. Final report, prepared for the Southeast Conference. McDowell Group, Juneau, Alaska. 63 p.

McGee, K.E. 2000. Effects of Forest Roads on Surface and Subsurface Flow in Southeast Alaska. Master of Science Thesis. Oregon State University, Corvallis, Oregon.

McNeil, W.J. 1964. Effect of spawning bed environment on reproduction of pink and chum salmon. Fishery Bulletin 65:495-523.

McPherson, E.G. and R.J. Simpson 1999. Carbon Dioxide Reduction Through Urban Forestry. GSW 171 January 1999

Meade, C. 1997. Brown Bear Risk Assessment Panel Summary. Tongass Land Management Plan Revision Planning File.

Mech D., L. G. Adams, T. J. Meier, J. W. Burch, and B. W. Dale. 1998. The wolves of Denali. University of Minnesota Press, Minneapolis, USA.

Meehan, W.R. (ed). 1991. Influences of Forest and Rangeland Management on Salmonid Fishes and Their Habitats. USDA Forest Service. American Fisheries Society Special Publication 19. Bethesda, MD.

Meehan, W.R., W.A. Farr, D.M. Bishop, J.H. Patric. 1969 Effects of clearcutting on salmon habitat in two southeast Alaska streams. Res. Pap. PNW-82, Portland, OR. USDA Forest Service, Pacific Northwest Forest and Range Experiment Station, Portland, Oregon.

Messier, F. 1995. On the functional and numeric responses of wolves to changing prey density. Pages 187-198 *In* L.N. Carbyn, S.H. Fritts, and D.R. Seip, editors. Ecology and conservation of wolves in a changing world. Canadian Circumpolar Institute, Edmonton, AB., pp. 187-198.

Messier, F.. 1994. Ungulate population models with predation: a case study with the North American moose. Ecology. 75(2): 478-488.

Millar. C., R. Neilson, D. Bachelet, R. Drapek, and J. Lenihan. 2006. Climate Change at Multiple Scales, Chapter 3 in: Forest, Carbon and Climate Change: A Synthesis of Science Findings. Oregon Forest Resources Institute. Oregon State University College of Forestry.

Millennium Ecosystem Assessment. 2005. Ecosystems and Human Well-being: Synthesis. Island Press. Washington DC. http://www.maweb.org//en/Products.Synthesis.aspx

Montgomery, David R. 1994. Road surface drainage, channel initiation, and slope instability. Water Resources Research, Volume 30, Issue 6, p. 1925-1932.

Morrison, M.L., B.G. Marcot, and R.W. Mannan. 1992. Wildlife-Habitat relationships: Concepts and Application. University of Wisconsin Press. Madison, WI.

Morrissey, C. 2004. Effect of altitudinal migration within a watershed on the reproductive success of American dippers. Canadian Journal of Zoology 82:800-807.

Morse, K.S. 2000. Responding to the Market Demand for Tongass Timber: using adaptive management to implement Sec. 101 of the 1990 Tongass Timber Reform Act. Manag. Bull. R10-MB-413. Juneau, AK: U.S. Department of Agriculture, Forest Service, Alaska Region. 43 p.

Morton, P. 2000. Wildland Economics: Theory and Practice. In McCool, S.F. and D.N. Cole. Wilderness Science in a Time of Change. Proceedings RMRS-P-00. Ogden, UT: USDA Forest Service, Rocky Mountain Research Station.

Muir, J.A. 2006. FIA Monitoring Project: Monitoring hemlock dwarf mistletoe in coastal forests of British Columbia. Unpublished Report prepared for International Forest Products, Campbell River, BC.

Murphy, M.L. 1985. Die-offs of pre-spawn adult pink salmon and chum salmon in southeastern Alaska. North American Journal of Fisheries Management 5:302-308.

Murphy and Milner. 1997. Murphy, M.L., A.M. Milner. Alaska Timber Harvest and Fish Habitat IN: A.M. Milner and M.W. Oswood (Eds) Freshwaters of Alaska, Ecological Syntheses. Springer.

Murphy, M.L. and K.V. Koski, 1986. Input and depletion of woody debris in Alaska streams and implication for streamside management. North American Journal of Fisheries Management 9:427-436.

Neilson, P. 2007. Climate Change and Uncertainty and Forcasts of Global to Landscape Ecosystem Dynamics. Forest Ecology Lecture Series. Accessed on the Web at www.fs.fed.us/pnw/pep/climatechange/neilson/index.html. August 2007.

Nicholls, D.L., A.M. Brackley, and T.D. Rojas. 2006. Alaska's Lumber-drying Industry—Impacts from a Federal Grant Program. USDA Forest Service, Pacific Northwest Research Station. General Technical Report PNW GTR-683.

NMFS (National Oceanic and Atmospheric Administration [NOAA] Fisheries – National Marine Fisheries Service). 2005. Final Environmental Impact Statement for Essential Fish Habitat and Conservation in Alaska. April.

NMFS. 1996. Coastal Salmon Conservation: Working Guidance for Comprehensive Salmon Restoration Initiatives on the Pacific Coast. September 1996.

Northern Economics. 2002. Alaska Visitor Arrivals and Profile Summer 2001. Prepared for the State of Alaska, Department of Community and Economic Development. November. Available online at: http://www.dced.state.ak.us/cbd/toubus

Northern Economics. 2004. Alaska Visitor Arrivals: Summer 2004. Prepared for the Alaska Department of Commerce Community and Economic Development. December.

Noss, R.F. 1991. From Endangered Species to Biodiversity. In: K.A. Kohn (ed.). Balancing on the Brink of Extinction. The Endangered Species Act and Lessons for the Future, p. 227-246. Island Press. Washington, D.C.

Noss, R.F. 1990. Indicators for Monitoring Biodiversity: A Hierarchial Approach. Conservation Biology 4(4):355-36

Noss, R.F. and A.Y. Cooperrider. 1994. Saving Nature's Legacy: Protecting and Restoring Biodiversity. Island Press. Washington DC.

Nowacki, G., M. Shephard, P. Krosse, W. Pawuk, G. Fisher, J. Baichta,; D. Brew, E. Kissinger, T. Block. 2001. Ecological subsections of Southeast Alaska and neighboring areas of Canada. USDA Forest Service, Alaska Region. Technical Publication No. R10-TP-75. October.

Nowacki, G. S. and M. G. Krammer. 1998. The Effects of Wind Disturbance on Temperate Rain Forest Structure and Dynamics of Southeast Alaska. USDA Forest Service. PNW GTR-421, April 1998.

Oswood, N.W., A.M. Milner, and J.G. Irons III. 1992. Climate Change and Alaskan Rivers and Streams. IN Global Climate Change and Freshwater Ecosystems. Springer-Verlig. New York.

Parker, K.L, M.P. Gillingham, T.A. Hanley, and C.T. Robbins. 1999. Energy and protein balance of free-ranging black-tailed deer in a natural forest environment. Wildlife Monographs No. 143.

Parson, E.A., L. Carter, P. Anderson, B. Wang, and G. Weller. 2001. Potential Consequences of Climate Variability and Change for Alaska, Chapter 10 in Climate Change Impacts on the United States, National Assessment Synthesis Team, 618 pp. 2001

Patton, M. and D. Robinson. 2006. Employment in the Alaska Fisheries. Positive signs in 2003 and 2004. Alaska Economic Trends. February.

Paustian, S. 2005. Background on Integrated Resource Plan Proposal. June 2005.

Paustian, S., C. Gundy, D. Landwehr, C. SeitzWarmuth, J. McDonell, and J. Thompson. 2006. Evaluation of Concern 04-25, Class Stream Management. March 10, 2006.

Paustian, S.J. 1987. Monitoring nonpoint source discharge of sediment from timber harvesting activities in two southeast Alaska watersheds. In: Water Quality in the Great Land—Alaska's Challenge. Proceedings: Alaska Section, American Water Resources Association. R.G. Huntsinger, Technical Chairman. Water Research Center, Institute of Northern Engineering, University of Alaska, Fairbanks. Pages: 153-168.

Paustian, S.J. (ed.), K. Anderson, D. Blanchet, S. Brady, M. Cropley, J. Edgington, J. Fryxell, G. Johnejack, D. Kelliher, M. Kuehn, S. Maki, R. Olson, J. Seesz, and M. Wolanek. 1992. A Channel Type Users Guide for the Tongass National Forest, Southeast Alaska, USDA Forest Service, Alaska Region, R10 Technical Paper 26, April.

Pawuk, W.H. and E.J. Kissinger. 1989. Preliminary Forest Plant Associations of the Stikine Area, Tongass National Forest. USDA-Forest Service, Alaska Region, R1O-TP-72.

Perez-Garcia, J., B. Lippke, J. Comnick, and C. Manriquez. 2005. An Assessment of Carbon Pools, Storage, and Wood Products Market Substitution Using Life-Cycle Analysis Results. College of Forest Resources, University of Washington. Seattle

Person, D. 2001. Alexander Archipelago wolves: ecology and population viability in a disturbed, insula landscape. Doctoral dissertation, University of Alaska Fairbanks, AK.

Person, D., C. Darimont, P. Paquet, and R. Bowyer. 2001. Succession debt: effects of clear-cut logging on wolf-deer predator-prey dynamics in coastal British Columbia and Southeast Alaska. Paper presented at Canid Biology and Conservation: An International Conference. Oxford University.

Person, D., M. Kirchhoff, V. Van Ballenberghe, C. Iverson, and E. Grossman. 1996. The Alexander Archipelago Wolf (Canis lupus ligoni): A Conservation Assessment. Gen. Tech. Rep. PNW-GTR-384. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station.

Petersen, K. and J. Bruns. 2005. Prince of Wales Island: Hotbed for Small Sawmill Operators Bent on Value-added Commodities. Alaska Business Monthly. August 2005.

Peterson, R.O. 1977. Wolf ecology and prey relationships on Isle Royale. United Stated Department of the Interior National Park Service. Scientific Monograph Series No. 11.

Petruncio, M.D. 1994. Effects of Pruning on Growth of Western hemlock and Sitka Spruce in Southeast Alaska. PhD, University of Washington Seattle, WA. 154 p.

Phillips, S. and R. Silverman. 2007. Greater than Zero: Toward the Total Economic Value of Alaska's National Forest Wildlands. Draft paper prepared for The Wilderness Society. March.

Piatt, J.F., K.J. Kuletz, A.E. Burger, S.A. Hatch, V.L. Friesen, T.P. Birt, M.L.Arimitsu, G.S.Drew, A.M.A. Harding, and K.S. Bixler. 2007. Status Review of the marbled murrelet (*Brachyramphus marmoratus*) in Alaska and British Columbia. .U.S. Geological Survey Open-File Report 2006-1387.

Piatt, J.F., and P.J. Anderson. 1996. Response of Common Murres to the Exxon Valdez Oil Spill and Long-term Changes in the Gulf of Alaska Marine Ecosystem. American Fisheries Society Symposium. 18:720-737.

Piatt, J.F., and R. G. Ford. 1993. Distribution and abundance of Marbled Murrelets in Alaska. Condor 95: 662–669.

Poiani, K.A., B.D. Richter, M.G. Anderson, and H.E. Richter. 2000. Biodiversity Conservation at Multiple Scales: Functional Sites, Landscapes, and Networks. Bioscience 50(2):133-146.

Porter, B. 2005. Unit 2 Deer Management Report. pp 39-57 In: C. Brown, editor. Deer management report of survey and inventory activities 1 July 2002-30 June 2004. Alaska Department of Fish and Game, Juneau, Alaska.

Powell, R. A., R. Lande, D. R. McCullough, W. Z. Lidicker, Jr., A. J. Hansen, R. L. Jarvis, Paquet, J. T. Ratti, C. C. Smith, R. D. Taber, and C. R. Benkman. 1997. Joint statement of members of the peer review committee concerning the inadequacy of conservation measures for vertebrate species in the

Tongass National Forest Land Management Plan of Record. Unpublished Rept. Submitted to the U.S. Forest Service, Juneau, Alaska. September, 1997. 14pp.

Pritchett, W.L. 1979. Properties and Management of Forest Soils. John Wiley & Sons, New York. 500 pp.

Pyare, S. and W.P. Smith. 2006. Functional landscape connectivity of old-growth reserves in the Tongass. Abstract of presentation at the 2006 conference of the Wildlife Society, Anchorage Alaska..

Pyare, S. and W.P. Smith. 2005. Functional Connectivity of Tongass Old-Growth Reserves: An Assessment Based on Flying-Squirrel Movement Capability. Progress report for Tongass monitoring grants, April 30, 2005.

Raphael, M.G. 2006. Conservation of the marbled murrelet under the Northwest Forest Plan. Conservation Biology 20:297–305.

Ratner, S. 2000. The Informal Economy in Rural Community Development. TVA Rural Studies. Contractor Paper 00-03. February. Available online at: http://www.rural.org/publications/Ratner00-03.pdf

Reeves, G.H., L.E. Benda, K.M. Burnett, P.A. Bisson, and J.R. Sedell. 1995. A Disturbance-based Ecosystem Approach to Maintaining and Restoring Freshwater Habitats of Evolutionarily Significant Units of Anadromous salmonids in the Pacific Northwest. American Fisheries Society Symposium 17:334-349.

Reid, L.M. and T. Dunne. 1984. Sediment Production from Forest Road Surfaces. Water Resources Research, WRERAC 20(11) 1753-1761. November 1984.

Reynolds, R. T., R. T. Graham, and D. A. Boyce Jr. 2006. An Ecosystem-based Conservation Strategy for the Northern Goshawk. Pp 299-311 in M. L. Morrison, editor. The Northern Goshawk: a Technical Assessment of its Status, Ecology, and Management. Studies in Avian Biology No. 31, Cooper Ornithological Society.

Reynolds, R. T., R. T. Graham, M. H. Reiser, R. L. Bassett, P. L. Kennedy, D. A. Boyce, G. Goodwin, R. Smith, and E. L. Fisher. 1992. Management recommendations for the Northern Goshawk in the Southwestern United States. General Technical Report RM-217. USDA Forest Service, Rocky Mountain Forest and Range Experiment Station, Fort Collins, Colorado.

Ricketts, T.H., E. Dinerstein, D.M Olson, C.J. Loucks, and W. Eichbaum. 1999. Terrestial Ecoregions of North America: A Conservation Assessment. Island Press. Washington DC.

Rogers, G. and W. vanHees. 1985a Timber Resource Statistics for the Ketchikan Area of the Tongass National Forest. PNW-RB-184.

Rogers, G. and W. vanHees . 1985b. Timber Resource Statistics for the Stikine Area of the Tongass National Forest. , USDA Forest Service. PNW-RB-185.

Rogers, G. and W. vanHees. 1985ca Timber Resource Statistics for the Chaatham Area of the Tongass National Forest. PNW-RB-186.

Rudzitis, G. and R. Johnson. 2000. The impact of wilderness and other wildlands on local economies and regional development trends. In: S.F.McCool, D.N. Cole, W.T. Borrie, J. O'Loughlin, comps. 2000. Wilderness science in a time of change conference—Volume 2: Wilderness within the context of larger systems; 1999 May 23–27; Missoula, MT. Proceedings RMRS-P-15-VOL-2. Ogden, UT: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. p. 14-26

Runck, A. M. 2001. Molecular and morphological perspectives on post-glacial colonization of Clethrionomys rutilus and Clethrionomys gapperi in Southeast Alaska. M.S. Thesis, University of Alaska Fairbanks.

Runck, A.M., and J.A. Cook. 2005. Postglacial expansion of the southern red-backed vole (*Clethrionomys gapperi*) in North America. Molecular Ecology 14: 1445-1456.

Russell, A. L. 1999 Habitat relationships of spruce grouse in Southeast Alaska. M. S. Thesis, Texas Tech. Univ. 84 pp.

Ruth, R. H. and A. S. Harris. 1979. Management of Western Hemlock-Sitka Spruce for USDA Forest Service, Forest Production. GTR PNW-88.

Sallabanks, R. E. Arnett, T. Bently, and L. Irwin 2001. Accommodating birds in managed forests of North America: a review of bird-forestry relationships. National Council for Air and Stream Improvement. Technical Bull. No 822.

Salo, E.O. 1991. Life History of Chum Salmon. (Oncorhynchus keta). pp. 231-310. In: Pacific Salmon Life Histories., C. Groot and L. Margolis (eds.). University of British Columbia in co-operation with the Government of Canada, Department of Fisheries and Oceans. British Columbia, Canada.

Schmiege, D.C., A.E. Helmers, and D.M. Bishop. 1974. The forest ecosystem of Southeast Alaska. 8. Water. PNW-28. 26 pp. Ref. 22300.

Schoen, J., and L. Beier. 1990. Brown bear habitat preferences and brown bear logging and mining relationships in southeast Alaska. Brown bear habitat preferences and brown bear logging and mining relationships in Southeast Alaska. Federal Aid in Wildlife Restoration. Final report. Grant W-22. Alaska Department of Fish and Game, Juneau, AK.

Schrader, B. and P. Hennon. 2005. Assessment of Invasive Species in Alaska and its National Forests. Complied by Schrader and Hennon with contributing authors from USDA Forest Service Alaska Regional Offices. August 30, 2005. 26 pp.

Schroeder, P. 1991. Can Intensive Management Increase Carbon Storage in Forests. Environmental Management. Volume 15 No. 4, pp 475 – 481.

Schroeder, R. and R. Mazza. 2005. A Synthesis of Recent Subsistence Research in Southeast Alaska. Available on request.

Schroeder, R., L. Cerveny, and G. Robertson. 2005. Tourism Growth in Southeast Alaska: Trends, Projections, and Issues. In R. Mazza and L.E. Kruger (eds) Social Conditions and Trends in Southeast Alaska. USDA Forest Service, Pacific Northwest Research Station, General Technical Report. PNW-GTR-653. August.

Schwartz, M.W. 1999. Choosing the Appropriate Scale of Reserves for Conservation. Annual Review of Ecology and Systematics. 30:83-108. Science. Washington State Department of Ecology. Publication #05-06-006. Olympia, WA.

Scott, J.M., B. Csuti, K. Smith, J.E. Estes, S. Caisso. 1991. Gap Analysis of Species Richness and Vegetation Cover; an Integrated Biodiversity Conservation Strategy. In: K.A. Kohn (ed). Balancing on the Brink of Extinction: The Endangered Species Act and Lessons for the Future, p. 282-297. Island Press. Washington D.C.

Shaw, C.G. 1999. Use of risk assessment panels during revision of the Tongass Land and Resources Management Plan. USDA Forest Service Pacific Northwest Research Station. General Technical Report PNW-GTR-460.

Shaw, C.G. III; Hennon, P.E. 1991. Spread, intensification, and upward advance of dwarf mistletoe in thinned, young stands of western hemlock in southeast Alaska. Plant Disease 75 363-367

Shaw, T., and W. Smith. 1995. Other Terrestrial Mammals Panel Assessment Summary. Tongass Land Management Plan Revision Planning File.

Sheldon, D., T. Hruby, P. Johnson, K. Harper, A. McMillan, T. Granger, S. Stanley, and E. Stockdale. 2005. Wetlands in Washington State - Volume 1. March.

Shephard, M. 1995. Plant Community Ecology and Classification of the Yakutat Foreland, Alaska. USDA Forest Service, R10-TP-56. 215 pp.

Sheridan W.L., M.P. Perensovich, T. Faris, K. Koski. 1984. Sediment content of streambed gravels in some pink salmon spawning streams in Alaska. In: Meeham W.R., T.R. Merrell Jr., T.A. Hanley (Eds). Fish and wildlife relationships in old-growth forests. Proc Symp. American Institut6e of Fishery Research Biologists [Available from J.W. Reintges, Rt. 4, Box 84, Morehead City, NC 28557].

Shrader, B. and P. Hennon. 2005. Assessment of Invasive Species in Alaska and its National Forests, 2005. Unpublished report, USDA Forest Service, R10.

Sieving, K. E. and M. F. Willson. 1998. Nest predation and avian species diversity in northwestern forest understory. Ecology 79: 2391-2402.

Sitka Convention and Visitors Bureau. 2006. Email correspondence/Personal communication between Philip Rupell of the Sitka Convention and Visitors Bureau and Shaun Brooks, Tetra Tech EC. August 30.

Skagway Convention and Visitors Bureau. 2006. Email correspondence/Personal communication between Kristin Wilkinson of the Skagway Convention and Visitors Bureau and Shaun Brooks, Tetra Tech EC. July 27.

Skovlin, J. M., L. D. Bryant, P. J. Edgerton. 1989. Effects of Timber Harvest on Elk Distribution in the Blue Mountains of Oregon. Res. Pap. PNW-RP-415. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station.

Slaughter, Charles; Gasborro, Tony, eds. 1988. Proceedings of the Alaska Forest Soil Productivity Workshop. USDA Forest Service, Pacific Northwest Research Station and School of Agriculture and Land Resources Management, University of Alaska Fairbanks. Anchorage, Alaska, April 28-30, 1987. General Technical Report PNW-GTR-219.

Slenkamp, P. 2007. Personal communication between Paul Slencamp, Alaska Department of Natural Resources, Division of Forestry, Area Forester, Southern Southeast Area Office and Matt Dadswell, Tetra Tech EC. August 28.

Small, M.P., K.D. Stone, and J.A. Cook. 2003. American marten (Martes americana) in the Pacific Northwest: Population Differentiation Across a Landscape fragmented in time and space. Molecular Ecology 12:89-103.

Smith, J.E., L.S. Heath, and P.B. Woodbury. 2004a. How to Estimate Forest Carbon for Large areas from Inventory Data. Journal of Forestry, July/August 2004.

Smith, W.P. 2005. Evolutionary diversity and ecology of endemic small mammals of southeastern Alaska with implications for land management planning. Landscape and Urban Planning 72:135-155.

Smith, W.P. and J.V. Nichols. 2003. Demography of the Prince of Wales Flying Squirrel: an Endemic of Southeastern Alaska Temperate Rainforest. Journal of Mammalogy 84:1044-1058.

Smith, W.P., and P.A. Zollner. 2005. Sustainable management of wildlife habitat and risk of extinction. Biological Conservation 125: 287-295.

Smith, W.P., S.M. Gende, and J.V. Nichols. 2005. The northern flying squirrel as an indicator species of temperate rain forest: test of an hypothesis. Ecological Applications 15: 689-700.

Smith, W.P., S, Gende, and J.V. Nichols. 2004b. Ecological correlates of flying squirrel microhabitat use and density in temperate rainforests of southeastern Alaska. Journal of Mammalogy 85: 540–551.

Sperry, D.M. 2006. Avian Nest Survival in Post-logging Coastal Buffer Strips on Prince of Wales Island, Alaska. M.S. Thesis, Humboldt State University, Arcata, California.

Spies, T.A. and J.F. Franklin 1991. The Structure of Natural Young, Mature, and Old-growth Douglas-fir Forest in Oregon and Washington; in Wildlife and Vegetation of Unmanaged Douglas-fir Forests, General Technical Report PNW-285.

Squires, John R., and Richard T. Reynolds. 1997. Northern Goshawk (Accipiter gentilis), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu/bna/species/298.

Stenhouse, I.J. 2007. Important bird areas of southeastern Alaska. Chapter 7.9 *In* W. Schoen and E. Dovichin, editors. The Coastal Forests and Mountains Ecoregion of Southeastern Alaska and the Tongass National Forest: A conservation assessment and resource synthesis. The Nature Conservancy and Audubon Alaska.

Stewart, A. and A. Lance. 1991. Effects of Moor-Draining on the Hydrology and Vegetation of Northern Pennine Blanket Bog. The Journal of Applied Ecology, Vol. 28, No. 3. December, 1991. Pp 1105-1117.

Still, J.C., P.E. Bittenbender, K.W. Bean, and E.G. Gensler. 2002. Mineral Assessment of the Stikine Area, Central Southeast Alaska. U.S. Department of the Interior, Bureau of Land Management, BLM-Alaska Technical Report 51. BLM/AK/ST-02/024+3091+932. May 2002.

Stone, K., and J. Cook. 2002. Molecular evolution of the Holarctic genus Martes. Molecular Phylogenetics and Evolution 24, 169-179.

Stone, K., R. Flynn, and J. Cook. 2002. Post-glacial colonization of northwestern North America by the forest associated American marten (*Martes americana*). Molecular Ecology 11, 2049–2064.

Suring, L.H., D.C. Crocker-Bedford, R.W. Flynn, C.S. Hale, G.C. Iverson, M.D. Kirchhoff, T.E. Schenck, L.c. Shea, and K. Titus. 1994. Response to the peer review of: a proposed strategy for maintaining well distributed, viable populations of wildlife associated with old-growth forests in Southeast Alaska. Report of an Interagency Committee.

Suring, L.H., D.C. Crocker-Bedford, R.W. Flynn, C.S. Hale, G.C. Iverson, M.D. Kirchhoff, T.E. Schenck, L.C. Shea, and K. Titus. 1993. A Proposed Strategy for Maintaining Well-distributed Viable Populations of Wildlife Associated with Old-growth Forests in Southeast Alaska. U.S. Department of Agriculture, Forest Service, Alaska Region; report of the interagency committee, Tongass Land Management Planning Team.

Suring, L.H., A.T. Doyle, R.W. Flynn, D.N. Larsen, M.L. Orme, and R.E. Wood. 1988. Habitat Capability Model for River Otter in Southeast Alaska: Spring habitat. USDA Forest Service. Draft. 15 pp.

Suring, L.H., S.D. Farley, G.V. Hildebrand, M.I. Goldstein, S. Howlin, and W.P. Erickson. 2006. Patterns of landscape use by female brown bears on the Kenai Peninsula, Alaska. Journal of Wildlife Management 70: 1580-1587.

Swanston, D.N. 1997 Controlling stability characteristics of steep terrain with discussion of needed standardization for mass movement hazard Indexing: a resource assessment. In: Julin K.R. (Ed.), Assessments of wildlife viability, old-growth timber volume estimates, forested wetlands, and slope stability. Gen. Tech. Rep. PNW-GTR-392. U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station, Portland, OR, pp. 58.

Swanston, D. N. 1989. Unpublished field data from landslide inventory. USDA Forest Service Research Data. PNW 6 pp.

Swanston, D.N. 1974. Slope stability problems associated with timber harvesting in mountainous regions of the western United States. USDA Forest Service, Pacific Northwest Forest and Range Experiment Station, General Technical Report PNW-21. 14pp.

Swanston, D.N. 1969. Mass wasting in coastal Alaska. USDA Forest Service, Pacific Northwest Forest and Range Experiment Station, Research Paper PNW-83. 15pp.

Swanston, D.N. and D.A. Marion. 1991. Landslide Response to Timber Harvest in Southeast Alaska. In: Proceedings of the Fifth Interagency Sedimentation Conference, Federal Energy Regulatory Commission, Las Vegas, Nevada. 10pp.

Swanston, D.N., C.G. Shaw III, W.P. Smith, K.R. Julin, G.A. Cellier, and F.H. Everest. 1996. Scientific Information and the Tongass Land Management Plan: Key Findings from the Scientific Literature, Species Assessments, Resource Analyses, Workshops, and Risk Assessment Panels. USDA Forest Service General Technical Report PNW-GTR-386.

Szacki, J. 1999. Spatially Structured Populations: How Much Do They Match the Classic Metapopulation Concept? Landscape Ecology 14:369-379.

Taverner, P.A. 1940. Variation in the American goshawk. Condor 42:157-160.

Taylor, P.D., L. Fahrig, K. Henein, and G. Merriam. 1993. Connectivity is a Vital Element of Landscape Structure. Oikos, 68: 571-573.

Taylor, R.F. 1934. Yield of Second Growth Western Hemlock-Sitks Spruce Stands in Southeast Alaska.

Tear T.H., P. Kareiva, P.L. Angermeier, P. Comer, B. Czech, R. Kautz, L. Landon, D. Mehlman, K. Murphy, M. Ruckelshaus, and others. 2005. How much is enough? The Recurrent Problem of Setting Measurable Objectives in Conservation. Bioscience 55(10):835-849.

The Nature Conservancy. 1982. Natural Heritage Program Operations Manual. Arlington, VA.: The Nature Conservancy.

Thedinga, J.F., M.L. Murphy, J. Heifetz, K.V. Koski, and S.W. Johnson. 1989. Effects of logging on size and age composition of juvenile coho salmon and density of presmolts in southeast Alaska streams. Canadian Journal of Fisheries and Aquatic Sciences 46:1383-1391.

Thomas, A.J., R.I. Alfaro, W.J. Bloomberg, and R.B. Smith. 2005. Impact of dwarf mistletoe on growth of western hemlock having different patterns of suppression and release. Canadian Journal of Forestry. Res. 15 (4(: 665-668 (1985).

Thomson, A, J., R.I. Alearow, .J. Bloomberga, and R.B. Smith. 1985. Impact of dwarf mistletoe on the growth of western hemlock trees having different patterns of suppression and release Canandian.Journal of Forestry. Res. 15:665-668.

Thysell, D. R. and A. B. Carry. 2000. Effects of Forest Management on Understory and Overstory Vegetation: A Retrospective Study. USDA Forest Service. PNW-GTR-488. March 2000.

Tomasik, E., and J.A. Cook. 2005. Mitochondrial phylogeography and conservation genetics of wolverine (*Gulo gulo*) of northwestern North America. Journal of Mammalogy 86: 386-396.

Tongass Conservation Strategy Review Workshop. 2006.

Trummer, L.T., P.E. Hennon, E.M. Hansen, P. Muir. 1998. Modeling the Incidence and Severity of Hemlock Dwarf Mistletoe in 110-year Old Wind-disturbed Forests of Southeast Alaska. Can. J. For. Res. 28: 1501-1508.

United Nations Environment Programme. 1991. Fourth Revised Draft Convention on Biological Diversity. United Nations Environment Programme.

URS Corporation. 2006. Mineral Potential Report, Ring of Fire Planning Area, Alaska. Prepared for Bureau of Land Management, Anchorage Field Office. Anchorage, Alaska. July 2006.

U.S. Army Corps of Engineers. 2004. Juneau Field Regulatory Office. Letter signed by John C. Leeds III, February 10, 2004.

U.S. Bureau of Mines and U.S. Geological Survey. 1980. Principles of a Resource Reserves Classification for Minerals. US Geological Survey Circular #831. Ref. 25573.

U.S. Census Bureau. 2007. Table 4: Cumulative Estimates of the Components of Population Change for Counties of Alaska: April 1, 2000 to July 1, 2006 (CO-EST2006-04-02) Source: Population Division, U.S. Census Bureau.

U.S. Census Bureau. 2001. State & County QuickFacts. http://quickfacts.census.gov/qfd/states/02000.html

U.S. Census Bureau. 2006. Alaska Department of Labor and Workforce Development, Research and Analysis Section, Demographics Unit. Table 4.3 Alaska Places by Borough and Census Area 2000-2005. Available online at: http://www.labor.state.ak.us/research/pop/estimates/05t4-3x.xls

U.S. Census Bureau. 1995. Population of Counties by Decennial Census: 1900 to 1990. Available online at: http://www.census.gov/population/cencounts/ak190090.txt

U.S. Department of Commerce, Bureau of Economic Analysis. 2007a. Regional Economic Information System. Table CA04—Personal income and employment summary. Available online at: http://www.bea.gov/bea/regional/reis/CA04fn.cfm

U.S. Department of Commerce, Bureau of Economic Analysis. 2007b. Regional Economic Information System. Table CA25N—Total employment by industry (NAICS 2001-2005). Available online at: http://www.bea.gov/bea/regional/reis/CA25Nfn.cfm

U.S. Department of Commerce, Bureau of Economic Analysis. 2007c. Regional Economic Information System. Table CA35—Personal current transfers detail. Available online at: http://www.bea.gov/bea/regional/reis/CA35fn.cfm

U.S. Department of Commerce, Bureau of Economic Analysis. 2007d. Regional Economic Information System. Table CA34—Total wages, wage employment, average wage per job. Available online at: http://www.bea.gov/bea/regional/reis/CA34fn.cfm

U.S. Department of Commerce, Bureau of Economic Analysis. 2002. Regional Economic Information System. Available online at: http://fisher.lib.virginia.edu/reis/

U.S. Department of Labor, Bureau of Labor Statistics. 2007. Annual average unemployment rate, civilian labor force 16 years and over (percent) for the U.S. http://www.bls.gov/cps/prev_yrs.htm

USDA Forest Service. Not dated. Preliminary Forest Plant Associations of the Stikine Area, Tongass National Forest. USDA Forest Service. Alaska Region. R10-TP-72.

USDA Forest Service. 2007a. Tongass National Forest, 2006 Annual Monitoring and Evaluation Report. USDA Forest Sevice, Tongass National Forest. R10-MB-609.

USDA Forest Service. 2007b. Tongass Land and Resource Management Plan Draft Environmental Impact Statement Plan Amendment. R10-MB-602a. January

USDA Forest Service. 2007c. Draft Alaska National Interest Lands Conservation Act Section 706(a) Report to Congress report tables. Unpublished data available on request.

USDA Forest Service. 2007d. Draft Alaska National Interest Lands Conservation Act Section 706(a) 706(a) Timber Supply and Demand Report Statistical Appendix 2006

USDA Forest Service. 2007e. Timber Volume under Contract. Report available for review at: http://www.fs.fed.us/r10/ro/policy-reports/for_mgmt/

USDA Forest Service. 2007f. NEPA Cleared Volume and Timber Harvest Projects to have NEPA Completed. Unpublished tables provided by Cynthia Sever, Timber Sale Planning Program Manager. USDA Forest Service, Tongass National Forest.

USDA Forest Service. 2007g. The State of the Forest. Tongass National Forest. Fiscal Year 2006. Draft.

USDA Forest Service. 2007h. Tongass National Forest Fiscal Year 2006 Budget Allocation by Resource Item.

USDA Forest Service. 2007i. Payments to States. Secure Rural School and Community Self-Determination Act of 2000. http://wwwnotes.fs.fed.us:81/r4/payments_to_states.nsf

USDA Forest Service. 2006a. Tongass Young Growth Management Strategy 2006, Exhibit 7. Draft. June 13, 2006.

USDA Forest Service. 2006b. Tongass National Forest—Forest Management Facts: Do Forest Service culverts keep fish from swimming upstream to spawn? Available online at: http://www.fs.fed/.us/r10/tongass/forest_facts/faqs/forestmgmt.shtml

USDA Forest Service. 2006c. Parcels Acquired Since TLMP 1997. Unpublished spreadsheet. USDA Forest Service, Alaska Region, Tongass National Forest, Lands Staff. June 2006.

USDA Forest Service. 2006d. The State of the Forest: Tongass National Forest, Fiscal Year 2005. USDA Forest Service, Alaska Region, Tongass National Forest. March 2006.

USDA Forest Service. 2006e. Sum of acres. Unpublished table of land ownership data for the Tongass National Forest, derived from Forest Service GIS database. USDA Forest Service, Alaska Region, Tongass National Forest.

USDA Forest Service. 2006f. Personal communication between Fran Martin of the USDA Forest Service and Shaun Brooks, Tetra Tech EC regarding Mendenhall Glacier visitors. July 26.

USDA Forest Service. 2006g. Email correspondence/Personal communication between Mike Driscoll of the USDA Forest Service, Recreation and Lands Special Uses and Shaun Brooks, Tetra Tech EC regarding Juneau Icefield Tour passengers. July 26.

USDA Forest Service. 2006h. Email correspondence/Personal communication between Mike Driscoll of the USDA Forest Service, Recreation and Lands Special Uses and Shaun Brooks, Tetra Tech EC. August 30.

USDA Forest Service. 2006i. Special Uses Database. Unpublished database maintained by the USDA Forest Service.

USDA Forest Service. 2005a. Alaska Region Invasive Plant Strategy. Alaska Region. Juneau, AK.

USDA Forest Service. 2005b. Assessment of Invasive Species in Alaska and its National Forest. Compiled by B. Schrader and P. E. Hennon. Unpublished report, Alaska Region.

USDA Forest Service. 2005c. Sealaska Proposed Comprehensive Tongass-wide Land Exchange. Fact Sheet. USDA Forest Service, Alaska Region, Tongass National Forest. July 2005.

USDA Forest Service. 2005d. Craig Recreation Land Purchase Act. Fact Sheet. USDA Forest Service, Alaska Region, Tongass National Forest. July 2005.

USDA Forest Service. 2005e. Travel Management; Designated Routes and Areas for Motor Vehicle Use. Final Rule. Federal Register/Volume 70, No. 216. November 9.

USDA Forest Service. 2004a. 2004 Tongass Monitoring and Evaluation Report, Karst and Cave. Available online at: http://www.fs.fed.us/r10/tongass/projects/tlmp/2004_monitoring_report/Karst.pdf. [2006, August 11].

USDA Forest Service. 2004b. 2004 Tongass Monitoring and Evaluation Report, Soil and Water. [Online]. Available online at: http://www.fs.fed.us/r10/tongass/projects/tlmp/2004_monitoring_report/Soil%20and%20Water.pdf. [2006, August 11].

USDA Forest Service. 2004c. Tongass National Forest: 2004 Annual Monitoring and Evaluation Report: Fish Habitat and Soil and Water. Available online at: http://www.fs.fed.us/r10/tongass/projects/tlmp/monitoring/monitoring.shtml

USDA Forest Service. 2004d. Existing vegetation classification and mapping technical guide. Ecosystem Planning Department. Washington D.C.

USDA Forest Service 2004f. National Strategy and Implementation Plan for Invasive Species Management. FS-805. Washington DC. October 2004.

USDA Forest Service. 2004g. Shoreline Outfitter/Guide Final Environmental Impact Statement. Tongass National Forest, Alaska Region.

USDA Forest Service. 2004h. Tongass 5-year review final determination paper. Available online at: http://www.tongass-5yearreview.net/p/5-year_Review_Final_Determination_Paper.pdf

USDA Forest Service. 2004i. 2004 Annual monitoring and evaluation report. Wildlife Section. Available online at: http://www.fs.fed.us/r10/tongass/projects/tlmp/2004_monitoring_report/index.shtml

USDA Forest Service. 2003a. 2003 Tongass Monitoring and Evaluation Report, Karst and Caves. Available online at: http://www.fs.fed.us/r10/tongass/projects/tlmp/2003_monitoring_report/07_karst_caves_geology.pdf. [2006, August 11].

USDA Forest Service. 2003b. Tongass Land Management Plan Revision. Roadless Area Evaluation for Wilderness Recommendations. Final Supplemental Environmental Impact Statement. USDA Forest Service, Alaska Region, Tongass National Forest. Forest Service R10-MB-481a. February.

USDA Forest Service. 2003c. Forest-Level Roads Analysis. USDA Forest Service, Alaska Region, Tongass National Forest.

USDA Forest Service. 2002a. Timber Supply and Demand 2000. Alaska National Interest Lands Conservation Act Section 706(a) Report to Congress, Report Number 20. USDA Forest Service, Alaska Region.

USDA Forest Service. 2002b. Tongass Land Management Plan Revision. Roadless Area Evaluation for Wilderness Recommendations. Draft Environmental Impact Statement.

USDA Forest Service. 2002c. Shoreline Outfitter/Guide Draft Environmental Impact Statement. USDA Forest Service, Alaska Region.

USDA Forest Service. 2001a. USDA Forest Service Handbook, FSH 2090.21 – Aquatic Habitat Management Handbook. USDA Forest Service, Alaska Region, Juneau, Alaska. Amendment No. 2090.21-2001-1. November.

USDA Forest Service. 2001b. Tourism Trend Graphs. Unpublished graphs developed by the USDA Forest Service, Juneau Forestry Sciences Laboratory using data compiled from a variety of government sources.

USDA Forest Service. 2000. Forest Service Roadless Area Conservation Rule Final EIS. USDA Forest Service, Washington Office. November. Available online at: http://roadless.fs.fed.us/documents/feis/

USDA Forest Service. 1999a. Southeast Chichagof Landscape Analysis. On file with: USDA Forest Service, Alaska Region.

USDA Forest Service. 1999c. Unidentified USDA Forest Service Document on Rescinding wild and Scenic Recommendation for Niblack Lakes and Streams. USDA Forest Service, Alaska Region, Tongass National Forest.

USDA Forest Service. 1997a. Tongass Land Management Plan Revision, Final Environmental Impact Statement. USDA Forest Service, Tongass National Forest, R10-MB-338dd (Record of Decision, Final Environmental Impact Statement—Part 1 and Part 2, Map Packet, Appendix—Volume 1, Volume 2, Volume 3, Volume 4, and Errata). Alaska Region, Juneau, Alaska.

USDA Forest Service. 1997b. Tongass National Forest Land and Resource Management Plan. R10-MB-338dd. USDA Forest Service, Alaska Region. 1997.

USDA Forest Service. 1995a. Report to Congress, Anadromous Fish Habitat Habitat Assessment. Pacific Northwest Research Station and Region 10. R10-MB-279.

USDA Forest Service. 1995b. Alaska Region Watershed Restoration Strategy. Updated October 1995.

USDA Forest Service. 1994. Air Quality Monitoring on the Tongass National Forest: Methods and Baselines Using Lichens.

USDA Forest Service. 1993a. Status of the Tongass National Forest 1991 Report. R10-MB-238. USDA Forest Service, Alaska Region. July 1993.

USDA Forest Service. 1993b. The Principal Laws Relating to Forest Service Activities. R10-MB-238. USDA Forest Service, Washington, D.C. Office. Pp. 299-305.

USDA Forest Service. 1991. Tongass National Forest Land Management Plan Revision Supplemental Draft Environmental Impact Statement. USDA Forest Service, Alaska Region.

USDA Forest Service. 1990. Silvics of North America, Volume 1, Conifers. Agricultural Handbook 654.

USDA Forest Service. 1983. Silvicultural Systems for the Major Forest Types of the United States. Agriculture Handbook 445.

USDA Forest Service and ADNR. 2007. Forest Health Conditions in Alaska – 2007, A Forest HealthProtection Report. Compiled by C. Snyder, Edited by J. Lundquest. R10-PR-11. April 2007.

USDA Forest Service and ADNR. 2002. Forest Health Protection Report. Forest Insects and Disease Conditions in Alaska – 2001. Compiled by D. Wittwer R10-TP-102. January 2002.

USDA Forest Service and ADNR. 2000. Forest Health Protection Report. Forest Insects and Disease Conditions in Alaska – 1999. Compiled by D. Wittwer R10-TP-82. February 2000.

U.S. Department of Energy, Office of Fossil Energy. 2005. Carbon Sequestration, Developing the Technology Base and Infrastructure to Enable Sequestration as a Greenhouse Gas Mitigation Option. National Energy Technology Laboratory, May 2005.

USFWS (U.S. Fish and Wildlife Service). 2007. Queen Charlotte Goshawk status review. Alaska Region, Juneau Field Office.

USFWS. 2006. National Wetlands Inventory (NWI). Available online at: http://wetlandsfws.er.usgs.gov/NWI/data-uses.html

USFWS. 1988. Final Subsistence Management and Use. Implementation of Title VIII and ANILCA. 420 pp. Ref.7638

USGCRP (U.S. Global Change Research Program). 2003. Observed Climate Change in Alaska: The Early Consequences of Global Warming. USGCRP Seminar. Available online at: http://www.usgcrp.gov/usgcrp/seminars/971202DDhtml

van Hees, W. W. S. 2001. Summary estimates of forest resources on unreserved lands of the Chatham inventory unit, Tongass National Forest, southeast Alaska, 1998 Resour. Bull. PNW-RB-234. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 12 p..

van Vliet, G. 1993. Status concerns for the "Global" population of Kittlitz's Murrelet: Is the "Glacier Murrelet" receding? Pacific Seabird Group Bulletin 20(1):15-16.

van Vliet, G. B., and M. McAllister. 1994. Kittlitz’s murrelet: the species most impacted by direct mortality from the Exxon Valdez oil spill? Pacific Seabirds 21:5-6.

Walters, D. and B. Prefontaine. 2005. Stream Temperature Monitoring Report 1997-2002, Prince of Wales Island, Alaska. Alaska USDA Forest Service, Tongass National Forest, Thorne Bay Ranger District. March 2005.

Weckworth, B., S. Talbot, G. Sage, D. Person, and J. Cook. 2005. A signal for independent coastal and continental histories for North American wolves. Molecular Ecology 14, 917–931.

Wells R.W., F.L., Bunnell, D. Haag, and G. Sutherland. 2003. Evaluating Ecological Representation within Differing Planning Objectives for the Central Coast of British Columbia. Can. J. For. Res. 33:2141-2150.

White, B. 2006. Alaska Salmon Enhancement Program 2005 Annual Report. Fishery Management Report No. 06-19. Alaska Department of Fish and Game, Divisions of Sports Fish and Commercial Fisheries. March 2006.

Wiggins, D.A. 2005. Brown Creeper (Certhia americana): a Technical Conservation Assessment. Prepared for the USDA Forest Service, Rocky Mountain Region, Species Conservation Project. January. Available online at: http://www.fs.fed.us/r2/projects/scp/assessments/browncreeper.pdf.

Wilcove, D. 1993. Getting Ahead of the Extinction Curve. Ecological Applications 3.

Wilcove, D.S., C.H. McLelloan and A.P. Dobson. 1986. Habitat Fragmentation in the Temperate Zone in: Soulé, ed. Conservation Biology. The Science of Scarcity and Diversity, p. 237 256. Sinauer Associates, Inc. Sunderland, MA.

Wing, M.G. 2000. Landslide and Debris Flow Influences on Aquatic Habitat Conditions. 4th International Conference on Integrating GIS and Environmental Modeling (GIS/EM4): Problems, Prospects, and Research Needs. Banff, Alberta, Canada. No. 35. September.

The Wilderness Society. 2007. Comments on the Draft Proposed Land and Resource Management Plan and Draft Environmental Impact Statement (DEIS) for the Forest Plan Revision for the Tongass National Forest. April 30.

Wipfli, M.S., R.L. Deal, P.E. Hennon, A.C. Johnson, R.T. Edwards, T.L. De Santo, T. Gomi, E.H. Orlikowska, M.D. Bryant, and M.E. Schultz, C. LeSage, R. Kimbirauskus, and D.V. D'Amore. 2003. Compatible management of red alder-conifer ecosystems in southeastern Alaska. Pages 55-81 *In* R.A. Monserud, R.W. Haynes, and A.C. Johnson, editors. Compatible Forest Management. Kluwer Academic Publishers, The Netherlands.

Wipfli, M.S., J. Hudson, and J. Caouette. 1998. Influence of Salmon Carcasses on Stream Productivity: Response of Biofilm and Benthic Macroinvertebrates in Southeastern Alaska, U.S.A. Can. J. Fish. Aquat. Sci. Vol. 55. pp 1503-1511.

Wolfe, R.J. 2004. Local Traditions and Subsistence: A Synopsis from Twenty-Five Years of Research by the State of Alaska. Technical Paper No. 284. Alaska Department of Fish and Game, Division of Subsistence, Juneau, Alaska. July. Available online at: http://www.subsistence.adfg.state.ak.us/

Wolfe, R.J. 2000. Subsistence in Alaska: a year 2000 update. Alaska Department of Fish and Game, Division of Subsistence, Juneau, Alaska. Available online at: http://www.state.ak.us/adfg/subsist/geninfo/publctns/articles.htm

World Commission on Environment and Development. 1987. Our Common Future, Report of the World Commission on Environment and Development. Published as Annex to General Assembly document A/42/427. Available online at: http://www.un-documenst.net/wccd-ocf.htm.

World Wildlife Fund (WWF). 2003. No place to hide: effects of climate change on protected areas. WWF Climate Change Programme.

Zaborski, R. R., M. H. McClellan, and T.A. Handley. 2002. Understory vegetation development following commercial thinning in southeast Alaska: preliminary results from the Second-growth management Area Demonstration Project. In Beyond 2001: a silvicultural odyssey to sustaining terrestrial and aquatic ecosystems – proceedings of the national Silviculture workshop, May 6-10, Hood River OR. USDA Forest Service, PNW Portland, OR. pp 74-82.

Zaborski, R. R., M. H. McClellan, J. Barbour, T. L. Laufenberg, and C.G. Shaw III. 2000. The Southeast Alaska Timber Resource and Industry: What Might the Future Hold? in Proceedings: Linking Healthy Forests and Communities Through Alaska Value-Added Forest Products. USDA Forest Service PNW-GTR-500

Zwickel, F.C., and J. F. Bendell. 2005. Blue Grouse (*Dendragapus obscurus*). The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu/bna/species/015

CHAPTER 7
GLOSSARY

Glossary

The Glossary for the Final EIS is located in Chapter 7 of the Final Land and Resource Management Plan volume.

7 Glossary

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CHAPTER 8
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APPENDICES

Appendices

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APPENDIX B MODELING AND ANALYSIS

APPENDIX C POTENTIAL LAND ADJUSTMENTS

APPENDIX D OLD-GROWTH HABITAT CONSERVATION STRATEGY, WILDLIFE STANDARDS AND GUIDELINES, AND WILDLIFE VIABILITY

APPENDIX E CATALOGUE OF PAST HARVEST

APPENDIX F BIOLOGICAL ASSESSMENT

APPENDIX G TIMBER DEMAND AND SUPPLY

APPENDIX H COMMENTS AND RESPONSES

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Photograph taken looking northeast with Lindenberg Peninsula on Kupreanof Island and the mouth of Petersburg Creek (front cover) in the foreground, Petersburg Mountain (front cover) in the middleground, and Frederick Sound and the mainland in the background.