ISSN 1560-9197

Natural Resources and Rural Livelihoods in Cambodia:

A Baseline Assessment

Working Paper 23

Bruce McKenney and Prom Tola

Working Paper No. 23

CAMBODIA DEVELOPMENT RESOURCE INSTITUTE

Natural Resources and Rural Livelihoods in Cambodia:
A Baseline Assessment

Working Paper 23

Bruce McKenney and Prom Tola

Cambodia Development Resource Institute
Phnom Penh, June 2002

ISSN 1560-9197

Natural Resources and Rural Livelihoods in Cambodia: A Baseline Assessment — Working Paper 23
July 2002

Bruce McKenney and Prom Tola

Responsibility for the ideas, facts and opinions presented in this research paper rest solely with the authors. Their opinions and interpretations do not necessarily reflect the views of the Cambodia Development Resource Institute.

Cambodia Development Resource Institute
56 Street 315, Tuol Kork, Phnom Penh (Postal address: PO Box 622, Phnom Penh, Cambodia)
Tel: (855-23) 368-053/880-734/883-603 Tel/Fax: (855-23) 366-094
e-mail: cdri@camnet.com.kh website: http://www.cdri.org.kh

Layout: Oum Chantha and Em Sorany
Printed and Bound in Cambodia by Ponloeu Pich Printing House, 87 Street 63, Phnom Penh

Contents

Executive Summary

Of the more than 10 million Cambodians currently living in rural areas, over 8.5 million depend on natural resources to support their livelihoods. Most are subsistent, relying on one crop of rice per year, fish and other aquatic resources, and a range of forest products. Although rice farming remains the dominant activity in rural areas, fisheries and forest resources also play a critical role in supporting livelihoods. As common property resources (publicly held resources to which access is open to all), fisheries and forests provide households a means for diversifying their subsistence and income-generating activities, optimising their labour resources during different seasons, and "insuring" against the risks of agricultural failures. Moreover, people with no land, little money for capital investments, and few alternative livelihood opportunities can still often fish and/or collect forest products for subsistence. In this manner, Cambodia's natural resources not only provide a foundation for food security, income, and employment for most of the population, but also an essential "safety net" for the rural poor.

Over the past decade, rural livelihoods have faced increasing challenges due to a rapid decline in resources. Illegal and unsustainable harvests of fish and timber by commercial enterprises, military, local authorities, and a growing rural population have resulted in high rates of forest loss and degradation and a reduction in the productive value of fisheries. Meanwhile, greater competition for land has led to an increase in the landless population. These problems have been compounded by greater restrictions on the rural population's access to resources. Over the past decade, the government has leased out large tracts of Cambodia's most productive resources to private interests as forest, fisheries, and land concessions. Of Cambodia's 18.1 million hectares (ha) of territory, about 5.5 million ha are presently under concession management – forest (4.24 million ha), land (0.81 million ha), and fisheries (0.42 million ha). This is down from close to eight million ha under concessions during the 1990s.

Increasing pressures on land, fisheries, and forests will make the maintenance of rural subsistence a serious challenge in the coming decade. Census estimates indicate that approximately 55 percent of rural Cambodians were age 19 or below in 1998, suggesting population pressure on natural resources will increase significantly in the near future. In light of this pressure, and the importance of natural resources to rural livelihoods, a central component of future poverty reduction efforts must be effective natural resource management.

With this in mind, CDRI established its Natural Resources and Environment Programme in late-2001. The Programme seeks to support improved policymaking on issues of natural resource management, sustainable development, and poverty reduction. This initial paper provides an assessment of the present status of, and issues surrounding, natural resources and rural livelihoods for three key sectors – agriculture (Chapter 2), fisheries (Chapter 3), and forestry (Chapter 4). From this basis, a number of gaps and needs for socio-

economic research are identified. The paper is based on an extensive review of existing studies and documents, and interviews with a selection of experts and practitioners working on natural resource and rural livelihood issues. A summary of key information on natural resources and rural livelihoods is provided in Table ES-1, followed by a more detailed discussion of findings.

Table ES-1: Summary of Baseline Information on Natural Resources and Rural Livelihoods

	Agriculture	Fisheries	Forests
Key Products for Rural Livelihoods	Rice, other food crops, and livestock	Fresh/processed fish and other aquatic resources (crabs, shrimp, frogs)	Fuelwood, timber, resins, vines, bamboo, rattan, wild vegetables, fruits, and medicines
Average Consumption (person/year)[1]	- 150 kg of rice - 30-35 kg of vegetables - 8 kg of pork - 6.5 kg of poultry - 3 kg of beef	27-38 kg of fish	No national estimates of forest product consumption available
Total Production	- 4.0 million tons of rice (2000-01) - Unreliable data on other food crops - 3.7 million cattle/buffalo - 1.9 million pigs - 15.2 million chickens and ducks (2000)	Annual inland fish catch: 290,000 – 430,000 tons (1994-97)	Harvest data are not reliable due to illegal logging
Management	- 2.3 million ha of rice land under private ownership (2000-01) - 0.8 million ha under agricultural concessions	- 0.4 million ha under fishing lots - Efforts to establish at least ~230,000 ha as community fisheries - Open access areas - Protected areas	- 4.2 million ha under forest concessions - Efforts to establish at least ~70,000 ha as community forests - Protected areas/forests - Other forest areas (not yet designated)
Key Management and Development Challenges	- Poor soil quality limits potential for increasing yields in 50 percent of cultivated areas - Limited viable, cost-effective irrigation expansion opportunities - Post-harvest losses and marketing costs	- Illegal and destructive fishing, increasing fishing pressure, and habitat destruction - Conflicts between lot owners and fishers - Cross-sector impacts of agriculture, logging, and infrastructure - Marketing constraints	- Illegal, destructive, and unsustainable logging - Conflicts between commercial loggers/ subcontractors and local forest users - Lack of marketing support for non-timber forest products

[1] *Estimates indicate average consumption; actual consumption levels vary significantly across the country.*

Agriculture

More than 8.5 million Cambodians depend on agriculture to support their livelihoods. Although farm sizes vary across the country, the average farming household cultivated about 1.4 ha of rice land in 2000-01. Their average yield was 2.1 tons/ha, suggesting potential rice production of approximately 3.0 tons per household (1.4 ha * 2.1 tons/ha). Actual production per household was about 2.4 tons in 2000-01 largely due to problems with flood damage. At prevailing rice prices, this production level does not appear to generate much, if any, disposable income; food security remains the primary motivation for rice cultivation.

About 2.8 million ha of agricultural land were cultivated in 2000-01, of which rice was grown on about 2.32 million ha and other food, fruit, and industrial crops were cultivated on 0.44 million ha. Rice production in 2000-01 eclipsed 4.0 million tons for the second straight year. Over the past decade, rice production has increased at an average annual rate of 2-3 percent, keeping pace with population growth. Trends in the production of other food crops and livestock are less clear due to the unreliability of data, but government estimates suggest that food crop production has been flat while livestock production has increased at about the same rate as population growth.

Looking Ahead

Agricultural development will be essential to improving rural livelihoods in Cambodia for the foreseeable future. Recommendations for agricultural development in existing literature focus on expanding and improving irrigated areas, diversifying farming approaches and increasing agro-processing, improving rice and other crop varieties, improving the efficiency of fertiliser and pesticide use, reducing post-harvest losses and marketing costs, and increasing agricultural support services.

While trends in agricultural production suggest that significant yield and production increases are possible through improvements in these areas, a range of physical, technical, and socio-economic constraints need to be overcome. Of particular concern, there appears to be low potential for yield increases across approximately 50 percent of Cambodia's cultivated areas due to severe soil quality problems. Challenges associated with poor soil quality and water availability/management suggest that expanding irrigation in much of Cambodia's cultivated areas may be uneconomic.

Increasing rice production remains the central focus of Cambodia's agricultural policy. A frequently stated objective is to improve Cambodia's average rice yield (2.1 tons/ha) to the levels of its neighbours Thailand (2.3 tons/ha) and Vietnam (4.3 tons/ha). While improving production alone may be important for enhancing food security, efforts to reduce poverty must also consider the profitability of these production increases. Here, differences in the rice production approaches of Thailand and Vietnam may be instructive. To generalise, rice yields in Thailand are often lower than in Vietnam because Thai production focuses on local high-value varieties that can bring higher profit margins to farmers. In contrast, Vietnamese rice production concentrates on increasing production levels through widespread irrigation, adoption of high-yielding varieties, intensive inputs, and double- and triple-cropping. Though higher yields in Vietnam surely enhance food security, profit margins tend to be lower due to higher input costs and lower quality rice. Such trade-offs and linkages among production, profit, and food security deserve more debate in Cambodia's agricultural policy development

To date, most agricultural research in Cambodia has focused on rice production issues. Despite calls for more diversified agriculture and increased agro-processing and trade, there remains a lack of research-based information on current practices, constraints, and opportunities in these areas. Likewise, government promotion of large-scale agricultural concessions deserves closer scrutiny to determine potential benefits and costs to rural livelihoods, especially in light of information suggesting that 64 percent (16 out of 25) of the concessions with contracts are currently having problems with protests and/or land encroachment from local people.

Fisheries

More than one million Cambodians depend on inland fisheries to support their livelihoods. Most are small-scale fishers (as defined by gear use) living near major inland waters. Although some households fish year-round, the peak period for fishing activity is at the beginning of the dry season (November to February) when floods recede, water levels drop, and fish migrate. Rural households also benefit from fish and other aquatic resources (crabs, shrimp, and frogs) caught in their ricefields. Most of this catch also occurs during the beginning of the dry season when fish and other aquatic life attempt to migrate out of rice paddies to deeper waters.

Rice and fish are the traditional staple foods of the Cambodian diet. Fish is consumed in both fresh and processed forms throughout Cambodia, with average consumption per person estimated to be 27-38 kg per year, but varying widely from 13 kg to over 70 kg per year in some areas. Fresh and processed fish account for a significant proportion of the total animal protein consumed by Cambodians, with estimates ranging from 40 to 90 percent (in fishing villages).

With estimates suggesting that the annual inland fish catch was approximately 290,000 to 430,000 tons from 1994-97, Cambodia's inland fisheries are considered the most productive in the region and fourth most productive in the world. The Great Lake and Tonle Sap River area is known to be Cambodia's richest fishing grounds, producing roughly 50-60 percent of Cambodia's inland commercial fish catch according to government statistics. Due to the scarcity and limitations of fish catch data, however, the above mentioned fish catch estimates should be viewed as indicative but not precise.

Looking Ahead

Although estimates of total inland fish catch are higher now than anytime in the past, this is probably due to increased fishing effort and better data collection rather than improved health of fish stocks. Indeed, most fisheries studies suggest that the future productivity of Cambodia's inland fisheries is under threat due to increasing fishing pressure, widespread illegal fishing, and habitat destruction. Although primary research on the current health of fisheries is limited, anecdotal information suggests that the catch of large migratory fish species, which typically reproduce more slowly, has declined while the catch of small species that reproduce quickly appears to have increased significantly.

Based on this finding and trends toward increasing fishing pressure and habitat destruction, fisheries experts in Cambodia warn of a potential "Bangladesh effect" – the significant reduction in fish stocks and bio-diversity to the point where fish production consists of a limited number of small, low-value species. Under this scenario, the larger, higher value fish species become a diminishing proportion of the total inland fish catch. This occurs because these fish species typically require more than a one-year cycle for reproduction, which makes them more vulnerable to fishing pressure. In contrast, the small, low-value species that reproduce within the limits of a one-year cycle are more resilient to fishing pressure and become an increasing proportion of the total fish catch. This change in the species composition reduces catch values per unit of fishing effort.

In response to fisheries management problems and conflicts between lot owners and small-scale fishers, fisheries sector experts have most frequently recommended establishing community management of fisheries. To provide a better understanding of the present scale and scope of community fisheries activity, CDRI developed an inventory, identifying 162 community fisheries in Cambodia (as of March 2002) covering an area of roughly 230,000 ha. Efforts to implement community fisheries management are largely supported by non-governmental organisations, but the government is playing an increasingly supportive role. Important steps include the release of more than 500,000 ha of fishing lots in 2001, establishment of a Community Fisheries Development Office within the Department of Fisheries, and on-going preparation of a sub-decree on community fisheries.

Opportunities exist for improving fish marketing and trade in a manner that could increase returns to small-scale fishers. Currently, a variety of government interventions and non-competitive practices appear to restrict trade and export activity, including official/unofficial taxes and fees, and formal/informal barriers to entering the trade and export business. Increased competition within the fish trade and export market, in combination with better market price information to local fishers, would likely improve the bargaining position of local fishers, allowing them to profit more from fish catches. In addition, a competitive fisheries sector would provide more opportunities for entrepreneurship, investment, and value-added enterprises at the local level.

Forests

Although national estimates are unavailable, case studies suggest forest use is both widespread and important to rural livelihoods in Cambodia. Forests provide cooking fuel, timber for construction, materials for tools and household items, resins and vines for selling,

wild fruits and vegetables, and medicines. Rural Cambodians also benefit from a range of important non-extractive forest values. These include cultural and spiritual values, rich flora and fauna diversity, and vital ecological services, such as stabilisation of watersheds to regulate flooding and silting levels.

Throughout the 1990s, the Cambodian forestry sector was in a state of crisis due to widespread illegal logging, corruption, ambiguous forest laws and concession agreements, and weak management and enforcement. Forest cover data suggest that deforestation rates increased sharply between 1993 and 1997 (the last year in which data are available). Although government estimates from 1997 indicate 10.6 million ha of forest cover remaining in Cambodia, these estimates are based on interpretations of satellite images, without the "below-the-canopy" inventories of forest resources that could reveal much about the quality/degradation of remaining forests. Nonetheless, two important conclusions can be drawn from 1997 forest cover data:

- **Most of Cambodia's forests are not commercially attractive.** As of 1997, only 6 percent (~630,000 hectares) of Cambodia's forests were in the commercially attractive category of "dense evergreen", while 30 percent of the forest (~3,200,000 hectares) was identified as "disturbed evergreen", which indicates logging ranging from light to severe. Other forest areas are unlikely to be viable for commercial timber production.
- **Most flooded forest areas have been cut and/or converted for agricultural use.** From over one million ha in 1973, flooded forests declined to an area of about 450,000 ha in 1997, of which roughly 30 percent fell into the degraded forest categories of mosaic and regrowth. Since flooded forests provide important fish habitat, breeding, and nursing areas, this loss has surely had a negative impact on fisheries productivity.

Case studies and anecdotal evidence indicate that many remaining forest areas are significantly degraded, suggesting a marked deterioration in the historical "safety net" for rural livelihoods provided by forest resources. These studies note that diminishing forest resources in close proximity to villages is forcing villagers to meet needs from areas farther away. The causes of the decline in available resources are reportedly illegal/unsustainable logging practices and restrictions on access to forest concession areas. As scarcity increases the costs of obtaining forest resources (in terms of time, labour, money, and risk), rural households must bear these costs because, for many forest products, there are no readily available substitutes. Case studies also note increased tensions over forest resources. Conflicts typically occur as a result of denied access to forest resources, the loss of forest resources due to logging damage, and/or the climate of intimidation associated with concession security operations.

Looking Ahead

Prudent policymaking for the forestry sector requires up-to-date information on forest cover, stocks, and harvests. Five logging seasons have passed since the last update of forest cover data. A forest cover update, complemented with a sample of "on-the-ground" inventory studies, would provide an important indicator for assessing progress on forest management since 1997. In addition, such a study would help in identifying the range of places in Cambodia where deforestation is occurring most rapidly, allowing for a more comprehensive assessment of the root causes of deforestation and potential management solutions.

Recent forestry reform efforts suggest an opportunity to reduce deforestation rates and develop management systems more beneficial to the rural poor. These efforts include the recent suspension of concession logging, drafting of a new Forestry Law and Sub-decree on Community Forestry, and development and expansion of community forest management. Moving forward, a pivotal issue for forest management will be whether or not retention of the

concession system is merited. Significant problems with government revenue generation, concession profitability, forest loss and degradation, and social and environmental impacts attest to a concession system that has thus far fallen well short of envisioned forest management and development goals.

Moreover, economic and financial analysis of sustainable forest concession management in Cambodia suggests it is unlikely to ever be achieved. First, enforcing sustainable harvests of 1-3 trees per hectare will be extremely difficult because concession operations are not likely to be economically viable under such low rates of extraction. Second, even if concessionaires could earn a reasonable profit under a sustained yield regime, they have tremendous financial incentives to continue high-intensity harvesting. This practice increases returns and reduces the risks associated with illegal logging by other entities, more restrictive forestry laws and regulations, contract termination, political uncertainty, tree disease, fires, and so on. Sustainable forest concession management requires viable concessions, highly professional concessionaires, and rigorous government enforcement efforts, all of which are largely lacking in Cambodia at present.

Debate over forest concession management must also include consideration of what forest management alternatives might take the place of concessions. Here, much still needs to be learned about the potential role of rapidly growing efforts to establish community forest management. To provide a better understanding of the present scale and scope of community forestry activity, CDRI developed an inventory, identifying 237 community forests in Cambodia (as of March 2002) covering an area of roughly 70,000 ha. These community forests appear to differ considerably in terms of size, organisation, management objectives and approaches, problems addressed, progress toward establishment, and support levels.

In addition to improved forest management, rural livelihoods could benefit from greater support for marketing and value-added processing of non-timber forest products (NTFPs). Case studies suggest that NTFPs account for a significant proportion of livelihood income in forested areas. Marketing support, the removal of unnecessary government licensing and permit constraints, and identification and development of local level value-added processing could all contribute to improved profits for NTFP collectors.

Socio-Economic Research Needs

In developing this baseline assessment, several potential areas for socio-economic research have been identified. They are summarised below and discussed in detail at the end of Chapters 2, 3, and 4.

Potential Research on Agricultural Issues

1. What are the main reasons that Cambodian vegetables and other crops often do not compete well with imports from neighbouring countries?
2. What is the short-term and long-term potential for improving value-added processing capabilities and marketing, and how might such changes affect rural livelihoods?
3. What is the appropriate role for concessions in Cambodia's overall agricultural development? How effective are agricultural concessions in improving rural livelihoods?
4. How are conflicts over agricultural concessions currently settled and what can be done to improve conflict resolution mechanisms? More importantly, what steps can be taken to reduce the potential for conflict in the first place?

Potential Research on Fisheries Issues

1. How effective is the fishing lot system in meeting rural development and poverty alleviation objectives?
2. What are the costs and benefits associated with establishing and managing community fisheries?
3. What changes have taken place in former fishing lot areas and what are the implications for rural livelihoods? How effective are community fisheries in managing areas formerly under fishing lot management?
4. How important are ricefield fisheries to rural livelihoods and what are the implications for agricultural and fisheries development?
5. How are conflicts over fishing areas currently settled and what can be done to improve conflict resolution mechanisms?
6. What is the current status of fish processing, trade, and export activities? How might rural livelihoods be improved through changes in the current approach to these activities?

Potential Research on Forestry Issues

1. How effective is the forest concession system in meeting rural development and poverty alleviation objectives?
2. What are the costs and benefits associated with establishing and managing community forests?
3. How are conflicts over forest resources currently settled and what can be done to improve conflict resolution mechanisms?
4. What is the current status of NTFP processing, trade, and export activities? How might rural livelihoods be improved through changes in the current approach to these activities?

Acronyms and Abbreviations

AACK	Angka Aphivat Chun Kreykra
AEC	Action for Environment and Community
ADB	Asian Development Bank
ADHOC	Cambodian Human Rights and Development Association
AFSC	American Friends Service Committee
AIT	Asian Institute of Technology
APDO	Angkor Participatory Development Organization
ARD	Associates in Rural Development, Inc.
AS	Aphiwat Strey
BDASE	Buddhism Development Association and Supporting Environment
BFD	Buddhism for Development
BFDK	Buddhism for Development Kompong Thom
BPS	Buddhism for Progressive Society
CAA	Community Aid Abroad, Oxfam Australia
CARDI	Cambodian Agricultural Research and Development Institute
CARERE	Cambodia Area Rehabilitation and Regeneration
CCD	Cambodia Community Development
CCK	Chamroen Chiet Khmer
CDRI	Cambodia Development Resource Institute
CED	Community Economic Development
CEDAC	Centre D'etude et de Developpement Agricole Cambodgien
CEPA	Cultural Environmental Preservation Association
CFDS	Cambodia Family Development Services
CFRP	Community Forestry Research Project
Chamkar	Mixed cropping
CHRD	Cambodian Human Resource Development
CIAP	Cambodia-IRRI-Australia Project
CIDSE	Cooperation International pour le Development et la Solidarite
COCMA	*Compagnie Centrale des Materials Agricoles*
CoM	Council of Ministers
Concern	Concern Worldwide
CREDO	Cambodian Rural Economic Development Organization
CRS	Catholic Relief Services
CTIA	Cambodian Timber Industry Association
CWS	Church World Service
DAI	Development Alternatives, Incorporated
DFW	Department of Forestry and Wildlife
DoF	Department of Fisheries
EDCO	Economic Development Community Organization
EEZ	Exclusive Economic Zone
EPDO	Environmental Protection and Development Organization

Acknowledgements

This paper is based on interviews with experts and practitioners working on natural resource and rural livelihood issues, and an extensive review of existing studies and documents. The authors are grateful to all those interviewed for their knowledgeable discussions of issues, and to the many librarians and others who assisted us in identifying and locating important documents for the study. In addition, much of the information on community management found in this study was developed with the assistance of community forestry and fisheries networks and phone interviews with project managers across the country. Many thanks to all for sharing contacts, project information, and experiences.

The authors extend their great appreciation to Yang Saing Koma of *Centre D'etude et de Developpement Agricole Cambodgien* (CEDAC), Peter Degen of the Inland Fisheries Research Institute of Cambodia, and Andrew Cock of NGO Forum – experts in the agricultural, fisheries, and forestry sectors who volunteered their time to review drafts of this study and provide useful comments and valuable insights. The authors also owe a great deal to Sarthi Acharya, Research Director of CDRI, and Eva Mysliwiec, Director of CDRI, for their direction and comments in the preparation of the study.

Phnom Penh, June 2002
Bruce McKenney and Prom Tola
The Cambodia Development Resource Institute

FAO	Food and Agriculture Organization of the United Nations
GDP	Gross domestic product
GTZ	Deutsche Greesellschaft Fuer Techische Zusammenarbeit
ha	hectare
HYV	high-yielding variety
ICC	International Cooperation for Cambodia
IDRC	International Development Research Center
IMF	International Monetary Fund
IRRI	International Rice Research Institute
KAMFIMEX	Kampuchea Fish Import and Export Company
KAWP	Krom Aphi Wat Phum
KHReDO	Khmer Human Resource for Development Organization
KNCED	Khmer National Community Economic Development
KVOD	Khmer Volunteer Organization for Development
LWS	Lutheran World Service
MAFF	Ministry of Agriculture, Forestry and Fisheries
MCC	Mennonite Central Committee
MoC	Ministry of Commerce
MoE	Ministry of Environment
MoP	Ministry of Planning
MRC	Mekong River Commission
NGO	Non-Governmental Organisation
NIS	National Institute of Statistics
NRA	Natural resource accounting
NTFP	Non-Timber Forest Products
PADEK	Partnership for Development in Kampuchea
PMMR	Participatory Management of Mangrove Resources
RLR	Rainfed Lowland Rice
RPFD	Rural Poor Family Development
SADP	Southeast Asia Development Program
SMRP	Sustainable Management of Resources Project
SSP	Strey Santepheap daoembei Parethan
UNDP	United Nations Development Programme
VSG	Village Support Group
WI	Wetlands International
WKK	Wat Khleang Khmot
WSC	Wildlife Conservation Society
WTPS	Wat Toul Preah Srey

Acknowledgements

This paper is based on interviews with experts and practitioners working on natural resource and rural livelihood issues, and an extensive review of existing studies and documents. The authors are grateful to all those interviewed for their knowledgeable discussions of issues, and to the many librarians and others who assisted us in identifying and locating important documents for the study. In addition, much of the information on community management found in this study was developed with the assistance of community forestry and fisheries networks and phone interviews with project managers across the country. Many thanks to all for sharing contacts, project information, and experiences.

The authors extend their great appreciation to Yang Saing Koma of *Centre D'etude et de Developpement Agricole Cambodgien* (CEDAC), Peter Degen of the Inland Fisheries Research Institute of Cambodia, and Andrew Cock of NGO Forum – experts in the agricultural, fisheries, and forestry sectors who volunteered their time to review drafts of this study and provide useful comments and valuable insights. The authors also owe a great deal to Sarthi Acharya, Research Director of CDRI, and Eva Mysliwiec, Director of CDRI, for their direction and comments in the preparation of the study.

Phnom Penh, June 2002
Bruce McKenney and Prom Tola
The Cambodia Development Resource Institute

Chapter 1

Introduction

Over 10 million Cambodians currently live in rural areas.[1] Studies of employment and labour participation suggest that about 85 percent of the rural population (>8.5 million people) depend on agriculture, fisheries, and/or forest resources to support their livelihoods (NIS 2000, Ramamurthy *et al*. 2001). Of this population, approximately 80 percent (>7 million people) are subsistent. Most rely on one crop of rice per year, fish and other aquatic resources, and a range of forest products, such as fuelwood, timber, resins, vines, wild fruits and vegetables, and medicines. In this manner, Cambodia's natural resources provide a foundation for food security, income, and employment for most of the population.

Rural livelihoods have faced increasing challenges over the past decade due to a decline in fisheries and forest resources. Illegal and unsustainable harvests of fish and timber by commercial enterprises, military, local authorities, and a growing rural population have resulted in high rates of forest loss and degradation and a reduction in the productive value of fisheries. Meanwhile, greater competition for land has led to an increase in the landless population. With Census estimates indicating that approximately 55 percent of rural Cambodians were age 19 or below in 1998, pressures on natural resources are likely to increase significantly in the near future as these youth enter the workforce.

For the rural population, the problems of resource loss and degradation have been compounded by greater restrictions on access. Under the forest, fisheries, and land concession systems, the government has leased out large tracts of Cambodia's most productive resources to private interests. Concession contracts confer rights upon the private companies to exploit resources within their concession for a designated period of time. It is therefore typically in the financial interest of the private company to restrict the access of others to these resources during this period. Of Cambodia's 18.1 million hectares (ha) of territory, about 5.5 million ha are presently under concession management – forest (4.2 million ha), land (0.8 million ha), and fisheries (0.4 million ha). This is down from close to eight million ha under concessions during the 1990s.[2]

Many recent planning and policy documents declare the government's fundamental commitment to reducing rural poverty.[3] To be effective, poverty reduction and sustainable rural development efforts must take into account the close linkages between rural livelihoods

---

1 This estimate is based on 1998 Census figures of 9,642,081 people living in rural areas and a population growth rate of 2.49 percent.

2 More than two million ha of forest concessions have been cancelled since 1999. Over 0.5 million ha of fishing concessions were released in 2001. These reductions in commercial concession areas occurred as a result of reform efforts by the government and/or due to resource depletion – the concession was no longer productive as a result of unsustainable harvesting activities.

3 For example, Second Five Year Socioeconomic Development Plan, 2001-2005; Interim Poverty Reduction Strategy Paper; and Governance Action Plan.

and natural resources. Policies that contribute to natural resource loss and degradation should generally be expected to increase poverty problems in rural areas. Likewise, policies that appropriate or excise natural resource wealth held in common (forests, fisheries) and lease it out as private concessions remove this resource wealth from the rural population and may set the stage for conflict.

1.1. Objectives and Methods

CDRI established its Natural Resources and Environment Programme in late-2001. As the Programme's initial task, this paper is intended to provide a basis for: (1) improving understanding of the linkages among rural livelihoods, natural resources, and sustainable development; and (2) identifying gaps/needs for socio-economic research on rural livelihoods and natural resource management. This paper is based on an extensive review of existing studies and documents, and interviews with a selection of experts and practitioners working on natural resource and rural livelihood issues.

1.2. Natural Resources and Rural Livelihood Strategies

Cambodia's main geographic features include the Mekong River, Boeung Tonle Sap (hereafter referred to as the Great Lake), extensive floodplain and lowland areas, and the southwestern and northeastern uplands. Most Cambodians live in lowland areas where their livelihoods are highly adapted to annual wet and dry seasons. Rainfall during the wet season (from May to October), in combination with flooding along rivers and tributaries and the expansion of lakes and wetlands, bring water and nutrient-rich sediments to outlying lowland areas. These lowlands support more than 90 percent of Cambodia's rice cultivation and provide rich habitat for aquatic life. Indeed, Cambodia's inland fisheries are estimated to be the fourth most productive in the world. Forests, which reportedly cover more than half of the country, play an important role in the wet season by stabilising watersheds and regulating flooding and sedimentation levels.

Throughout Cambodia, rural livelihoods are strongly linked to seasonal changes and available natural resources. Although the beginning and end of seasons may differ somewhat from year to year and place to place, Table 1 provides a general overview of the typical periods during which key rural livelihood activities are pursued. Although agricultural activities cover much of the calendar year, rural livelihoods are also highly dependent on "common property resources" – publicly held resources, such as fisheries and forests, to which access is open to all. Access to these resources provides opportunities for rural households to diversify livelihood activities in order to "insure" against the risk of agricultural failures and to optimise their labour resources.

The dominant agricultural activity in Cambodia is cultivation of lowland wet-season rice beginning in May and harvested by January (though early- and medium-maturing varieties may be harvested earlier in the season). In some lowland areas, especially the delta region of the Mekong and Bassac Rivers, dry-season rice is cultivated from November to February through management of receding floodwaters. Likewise, vegetables and other crops are mainly grown during the dry season along riverbanks and other fertile areas where water is available; waterlogging problems constrain cultivation of most wet-season crops other than rice. In upland areas, rice and vegetables are typically cultivated within the same field during the wet season.

Many rural households living near major inland waters fish year-round, while others fish on a seasonal basis or not at all. The peak period for small-scale or "family" fishing is at the beginning of the dry season from about November to February as floods recede, water levels drop, and fish migrate. Rural households also benefit from aquatic resources, such as fish, crabs, shrimp, and frogs, caught in their ricefields. Most of the catch occurs during the

beginning of the dry season when waters recede and fish and other aquatic life attempt to migrate out of rice paddies to deeper waters.

Rural households living within or near forests typically benefit from forest resources year-round. For instance, resin tapping and fuelwood collection are year-round rather than seasonal pursuits. However, forest product collection tends to increase during the dry season when most rural households are not busy with rice cultivation and travel is easier.

Table 1: Generalised Seasonal Calendar of Rural Livelihood Activities in Cambodia – Periods in which Main Activities Are Conducted[1]

Livelihood Activities	Wet Season						Dry Season					
	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr
Wet-season rice (lowlands)	■	■	■	■	■	■	■	■	■			
Dry-season rice (lowlands)	---						■	■	■	■	---	---
Rice/chamkar[2] (uplands)	■	■	■	■	■	■	■	■				
Vegetables (lowlands)							■	■	■	■	---	---
Small-scale family fishing	---	---	---	---	---	---	■	■	■	■	---	---
Ricefield fishing	---	---	---	---	---	---	■	■				
Forest product collection	---	---	---	---	---	---	---	■	■	■	■	■

[1] Rural livelihoods can differ markedly from place to place. The intention here is to provide a general overview of the main times when rural Cambodians conduct important livelihood activities. Shaded areas indicate the time of main/peak activity, while dashes (---) indicate a lower level of activity.

[2] While definitions of "chamkar" can vary, here it refers to the technique popular in upland areas of mixing of rice and vegetable farming in a single field.

1.3. Limitations of Macroeconomic and Employment Indicators

Agriculture, forest, and fisheries sectors accounted for 30 percent of Cambodia's gross domestic product (GDP) and 77 percent of employment in 2000 (CDRI 2002). Among these sectors, agriculture dominated GDP and employment, providing about 23 percent of GDP and 74 percent of employment, compared to forestry (4 percent of GDP and <1 percent of employment) and fisheries (3 percent of GDP and <2 percent of employment). Other studies find similarly low levels of employment in the forestry and fisheries sectors. For example, the *General Population Census of Cambodia* estimates that only 1.5 percent of the workforce was employed in fishing and 0.13 percent in "forestry, logging, and related service activities" in 1998. Likewise, the *Cambodia Socio-Economic Survey* estimates that only about two percent of the workforce was employed in the "fishing sector" in 1999; the report does not disaggregate employment in forestry from agriculture and hunting activities.

National statistics provide a basis for policymaking, so it is important that they accurately reflect reality. Numerous regional and case studies have found that fisheries and forest resources play a far more important role in rural livelihoods than what is indicated by GDP and national employment statistics (for more discussion, see Sections 3.3 and 4.3). National statistics understate the economic and employment contribution of fisheries and forests due to difficulties involved with surveying populations that depend on a range of occupations for their subsistence. First, it is difficult to separate rural Cambodians along occupational lines such as farmers, fishers, and forest product collectors. Occupations vary based on resource endowments, seasons, access, markets, and a range of other factors. Second, most rural Cambodians view their primary occupation as farming, whether this provides most of their livelihood income or not. Fishing and forest product collection may be thought of as vital secondary or tertiary activities. Since national surveys and statistics focus on primary employment, they do not adequately capture the importance of fisheries and forest resources to rural subsistence.

GDP suffers from an additional problem – it is a poor indicator of *sustainable* economic development. GDP and national income measures fail to capture the depletion of natural resource assets such as forest stands and fishery stocks. Unlike the accounting treatment of man-made assets such as buildings and machines, natural resource assets are not considered capital goods subject to depreciation. Therefore, depletion of natural resources is not recorded in national accounts. Indeed, natural resource exploitation has an *exclusively beneficial* effect on economic indicators such as GDP. If economic activity associated with natural resource exploitation increases, so too does the GDP, even if the exploitation is depleting natural resources in a destructive and unsustainable manner. For example, a country could see its GDP rise as it cut down all its forests, depleted its fisheries, exhausted its mineral resources, eroded its soils, and polluted its water resources, but none of these long-term losses and negative impacts would be reflected in national income accounts.

Unfortunately, low-income countries such as Cambodia, which are typically the most dependent on natural resources for employment, revenue, and foreign exchange earnings, are generally instructed by international organisations to use a system for national accounting and macroeconomic analysis that almost completely ignores their principal assets. In recognition of this problem, and due to increasing emphasis on sustainable development, various efforts have been made around the world since the early 1980s to integrate natural resource accounting (NRA) into national accounts. Although much debate continues over which of the different approaches to NRA is most effective, many countries have gone forward in developing and incorporating aspects of NRA into their national accounting systems.

The relationship between Cambodia's GDP growth rates and recent history of increased natural resource exploitation deserves closer scrutiny. Past increases in GDP may not have been a good indicator of *sustainable* economic development. But more importantly, adjustments should be made to the national accounting system so that it better reflects the realities of natural resource exploitation and asset depletion in the future. Such adjustments would improve key economic indicators, which in turn would strengthen the basis for policymaking on sustainable development.

1.4. Structure of Paper

The remainder of this paper focuses on the natural resource sectors most important to rural livelihoods – agriculture (Chapter 2), fisheries (Chapter 3), and forests (Chapter 4). Each chapter assesses the current status of resources, annual harvests and production, linkages to rural livelihoods, historical management patterns, and current management approaches and challenges. Based on this assessment, a number of potential areas for future socio-economic research are identified at the end of each chapter. Chapter 5 provides brief concluding remarks and a summary of recommended research areas.

References

Cambodia Development Resource Institute (2002), *"Main Economic Indicators,"* (Phnom Penh: CDRI, raw data provided by the Ministry of Economy and Finance)

National Institute of Statistics (2000), *Report on the Cambodia Socio-Economic Survey 1999,* (Phnom Penh: Ministry of Planning)

National Institute of Statistics (2000), *General Population Census of Cambodia,* (Phnom Penh: Ministry of Planning)

Ramamurthy, B., B. Sik, P. Ronnas, and H. Sok (2001), *Cambodia 1999-2000: Land, Labour and Rural Livelihood in Focus* (Phnom Penh: CDRI Working Paper No. 21)

Chapter 2
Agriculture

As the dominant subsistence and income-generating activity in Cambodia's rural areas, agriculture plays an essential role to rural livelihoods. Most of Cambodia's agricultural land has historically been used for rice farming, which continues to account for about 85 percent of the total cropland cultivated. Other small-scale agricultural activities important to rural livelihoods include raising livestock and producing food and fruit crops.

This section assesses the current status of Cambodia's agricultural sector, with a focus on rice production because of its central role in rural livelihoods (and greater data availability), and a briefer discussion of other farming activities. Information is provided on principal farming areas, main rice cultivation methods, annual production, regional comparisons, agricultural concessions, and opportunities and challenges to increasing agricultural production. A number of potential areas for future research are then suggested based on an assessment of research gaps and needs.

2.1. Main Agricultural Areas

Based on satellite imaging surveys of land use in 1996/97, the Ministry of Agriculture, Forestry and Fisheries (MAFF) estimates that roughly 6.4 million ha of land in Cambodia may be suitable for agriculture (Ministry of Planning 2001). Of this total, about 2.8 million ha were cultivated in 2000-01. Rice was cultivated on about 2.3 million ha and other food, fruit, and industrial crops were cultivated on 438,000 ha (Table 2.1).

Table 2.1: Area Cultivated for Agriculture, 1980 to 2001

Year[1]	Rice (000 ha)	Other Food Crops[2] (000 ha)	Industrial Crops[3] (000 ha)	Fruit and Permanent Crops[4] (000 ha)	Total (000 ha)
1980-81	1,441	178	32	N/A[5]	1,651
1990-91	1,890	152	108	N/A	2,150
1995-96	2,086	143	102	N/A	2,331
1996-97	2,153	148	120	N/A	2,422
1997-98	2,076	133	128	N/A	2,337
1998-99	2,095	126	118	N/A	2,339
1999-00	2,158	142	116	N/A	2,415
2000-01	2,318	154	120	164	2,757

[1] Crop year defined as from 1st of March to end of February.
[2] Other food crops cultivated in 2000-01 included maize, vegetables, mung bean, cassava, and sweet potato.
[3] Industrial crops cultivated in 2000-01 included soybean, sesame, peanut, sugar cane, tobacco, jute, and rubber.
[4] Fruit crops cultivated in 2000-01 included banana, cashew, coconut, longan, mango, milk fruit, sapodilla, durian, jackfruit, custard apple, orange, coffee, rambutan, guava, pineapple, and black pepper.
[5] N/A indicates information not available.
Source: National Institute of Statistics (2001), MAFF (2001)

INSERT 1997-98 Cambodia Land Cover Map (Map 2.1)

Wet season rice dominates Cambodian agriculture, accounting for 2.06 million ha of cultivated land area in 2000-01, compared to 0.26 million ha for dry season rice. Wet season rice is grown in all of Cambodia's provinces, but the largest concentrations are in the lowland areas around the Great Lake and Mekong, Sap, and Bassac Rivers (Map 2.1). Dry season rice is mainly cultivated in the Mekong River floodplain areas where farmers can manage receding floodwaters. In 2000-01, nearly 80 percent of dry season rice was cultivated in four provinces – Prey Veng, Takeo, Kandal, and Kompong Cham.

Other food and fruit crops, such as maize, vegetables, banana, jackfruit, and mango, tend to be grown on a small-scale in fertile areas near major rivers where there is good access to water and markets. For example, about 70 percent of the land cultivated for maize is in the more densely populated provinces of Kandal, Battambang, and Kompong Cham. Likewise, Kandal province accounts for more than 60 percent of the land cultivated for fruit crops. In addition to commercial cultivation, food and fruit crops are often cultivated in gardens around homes in elevated lowland areas where waterlogging problems can be avoided, and as part of mixed cropping (*chamkar*) in upland areas (Shams 1997).

Over the past two decades, government statistics indicate that rice cultivation area has expanded by more than 60 percent while the cultivated land for other crops has not increased and remains a relatively small area. The average increase in rice cultivation area has been about 44,000 ha per year during this period, equivalent to an average annual increase of about 2-3 percent. However, despite this rate of rice cultivation expansion, land under rice cultivation in 2000-01 (2.3 million ha) was less than land that had been under rice cultivation in 1966-67 (2.5 million ha) prior to years of civil strife (Javier 1997, NIS 2001).

2.2. Rice "Ecosystems" and Cultivation Approaches

Rice cultivation methods in Cambodia have evolved based on rainfall distribution, flooding and recession patterns, topography and field elevation, and soil fertility. Differences in these ecosystem factors affect choices about which rice varieties and cultivation approaches are most likely to bring the most productive and/or secure yields. Cultivation approaches in Cambodia (and other tropical countries) are most commonly classified based on wet and dry seasons. Wet season rice, which includes lowland, deepwater, and upland rice, depends on rainfall between May and November. In addition to rainfall, some lowland and deepwater rice areas benefit from wet season flooding that brings nutrient-rich sediments to paddy fields. Dry season rice farming mainly depends on the management of receding floodwaters; it typically takes place from November (when the rains stop) to February. Table 2.2 provides summary data on wet and dry season rice cultivation from 1966 to 2001.

Table 2.2: Cultivation Area of Main Rice Ecosystems, 1966 to 2001

	Wet Season Rice				Dry Season	
Year[1]	Lowland Rice ('000 ha)	Deepwater Rice ('000 ha)	Upland Rice ('000 ha)	*Sub-total* ('000 ha)	Rice ('000 ha)	Total ('000 ha)
1966-67	1,951	400	N/A[2]	2,351	181	2,532
1980-81	1,249	97	N/A	1,346	95	1,441
1994-95	1,747	84	38	1,869	169	2,038
2000-01	1,927	80	52	2,058	260	2,318

[1] *Crop year defined as from 1st of March to end of February.*
[2] *N/A indicates information not available.*
Source: Javier 1997, MAFF 2001

2.2.1 Rainfed Lowland Rice

Rainfed lowland rice (RLR) accounted for 83 percent of the cultivated rice area in 2000-01. "Rainfed" indicates dependence on rainfall as the main water source rather than irrigation. However, a small proportion of RLR in Cambodia receives supplementary irrigation through formal infrastructure and/or management of seasonal flooding (see *2.3 Irrigation of Rice*

Areas). As shown in Table 2.2, approximately 1.9 million ha were cultivated for RLR in 1966-67, but this level fell dramatically during the 1970s to where only 1.25 million ha were cultivated in 1980-81. Cultivation has since steadily expanded reaching 1.9 million ha again in 2000-01.

RLR is generally classified according to early-, medium-, and late-maturing rice varieties. Farmers make decisions about which varieties to plant based on the topography and land gradient of their fields, soil types, and expected water levels. As shown in Table 2.3, farmers may subdivide their ricefields into upper (*srai leu*), middle (*srai kandal*), and low levels (*srai kraom*). Upper level fields tend to be sandy soils with less silt content and standing water. Farmers plant early-maturing, drought-tolerant rice varieties in these fields, most often for subsistence purposes. Silt content and standing water increase in medium level fields, which tend to support the best quality rice for cooking and commercial purposes. In lower level fields where silt content and standing water are highest, farmers plant late-maturing, submergence-tolerant rice varieties known for good grain weights and cooking quality.

By subdividing their fields into different levels and cultivating crops that mature at different times, farmers reduce their risk of a total crop failure due to droughts and floods, optimise labour resources, and increase food security. Of course, the shorter the time that crops spend in the field, the lower the risks of crop failure. With this in mind, farmers currently plant faster maturing varieties in many areas previously cultivated for late-maturing rice varieties. Early- and medium-maturing varieties accounted for about 20 percent (or about 0.5 million ha) of RLR cultivation in 1966-67, compared to 66 percent (or about 1.3 million ha) in 2000-01.

Table 2.3: Relationship Among Topography, Water Level, and Choice of Rice Variety for Wet Season Lowland Rice

Topography	Standing Water Level	Rice variety
Upper fields	Low (<20 cm)	Early (Late Nov to early Dec harvest)
Medium fields	Medium (10 to 40 cm)	Medium (Mid- to late Dec harvest)
Lower fields	High (30 to >50 cm)	Late (Late Dec to mid-Jan harvest)

Sources: Fujisaka 1988, Lando and Mak 1994a, Nesbitt and Chan 1997

2.2.2. Deepwater Rice

Deepwater rice, which represented only about 3 percent of the cultivated rice area in 2000-01, is grown in standing water that for at least one month has a depth greater than 50 cm and sometimes as deep as three meters (Javier 1997, Pillot *et al.* 2000). It is cultivated in low-lying areas and depressions that accumulate significant floodwater, primarily around the Great Lake and in the delta region of the Mekong and Bassac Rivers. Because of the water depth, the use of inputs such as fertilisers and pesticides is not common (Lando and Mak 1994b).

Whereas deepwater rice was planted on about 400,000 ha in 1966-67, the cultivated area was only 80,000 ha in 2000-01. The significant decline in deepwater rice cultivation can be traced back to the Khmer Rouge policies and civil strife of the 1970s. During the civil war, farmers stopped cultivating rice crops far from their homes, which were often deepwater rice areas. In addition, Khmer Rouge policies intended to increase yields through irrigation discouraged deepwater rice cultivation due to its low yields. With no facilities for the long-term storage of deepwater rice seed varieties, many well-adapted varieties were lost when annual planting was not maintained (Javier 1997). In addition, farmers have probably been moving away from deepwater rice because of the high risks involved. Complete crop failure can occur due to a range of potential water management problems associated with the rate of water rise, maximum water depth, duration of maximum water depth, timing of water recession, and rate of water decline.

2.2.3. Upland Rice

Upland rice, which accounted for about 2 percent of cultivated rice area in 2000-01, is planted in the rolling hills and mountainous areas of Cambodia at elevations ranging from 200 to 1,000 meters above sea level. Due to its dependence on rainfall, upland rice is cultivated during the wet season and typically harvested when the rains end, though this differs according to rice varieties and other conditions. In most upland fields, mixed cropping (*chamkar*) is practised involving the planting of rice and a range of other crops including maize, sweet potato, cassava, gourds, and vegetables. Mixed crop cultivation is most common in the hilly, forested areas of Ratanakiri and Mondulkiri provinces, where it represents the dominant agricultural practice among ethnic minorities.

Upland rice ecosystems and cultivation techniques vary considerably depending on environmental factors, such as elevation, rainfall, and soil type, and cultural practices. Although it does not adequately portray this diversity, upland rice practices are generally divided into categories of shifting and permanent cultivation. Shifting cultivation, which is the more common upland rice practice in Cambodia, involves clearing forest to plant rice and other crops for 2-5 years before rotating/moving to another area (Javier 1997). In most cases, farmers clear areas that were previously cultivated but have been left fallow for several years. Therefore, forest cleared for shifting cultivation is usually secondary forest regrowth, not primary forest. Permanent cultivation of upland rice involves growing rice in the same area every year, typically a small field nearby the farmer's home. This practice is more common among ethnic Khmer than ethnic minorities.

2.2.4. Dry Season Rice

Dry season rice cultivation represented about 11 percent of cultivated rice area in 2000-01. As noted above, it is mainly cultivated in the Mekong River floodplain areas where farmers can manage receding floodwaters and partially irrigate their crops as necessary. Flood recession areas, which may be around lakes and rivers or behind small dams, are generally not suitable for wet season cultivation due to deep waters. Most floodwater recedes between the end of October and the end of December, after which remaining shallow floodwaters recede slowly. In line with this short period of flood recession, most dry season farmers cultivate early-maturing rice varieties that can be harvested in January or February (Pillot *et al.* 2000)

Dry season rice yields tend to be higher than wet season yields due to better water control, higher solar radiation during crop growth, and the cultivation of fertiliser-responsive modern rice varieties. Flood recession areas also tend to be more fertile than lowland areas cultivated for wet season rice. In addition, better water control reduces production risks, encouraging greater investments by farmers in the application of fertilisers (Javier 1997). Higher yields have encouraged expansion of dry-season rice cultivation from 95,000 ha in 1980-81 to 260,000 ha in 2000-01.

2.3. Irrigation of Rice Areas

MAFF estimates that approximately 473,000 ha (23 percent) of rice crops in Cambodia were irrigated in 1997-98, of which 224,000 ha (11 percent) received supplemental wet season irrigation, 224,000 ha (11 percent) received partial dry season irrigation, and only 25,000 ha (1 percent) were fully irrigated (Ministry of Planning 2001) (Table 2.4).[1] Compared to a total

[1] It is important to note here that several other documents estimate that only about 10-15 percent of Cambodia's cultivated areas (or about 250,000 ha) are irrigated (Ministry of Commerce 2001, Urwin and Wrigley 2001). The reason for the discrepancy between recent MAFF estimates and these other estimates is not clear. It is possible that MAFF statistics reflect a high level of double-cropping in areas of wet season supplemental irrigation and flood recession rice irrigation (since both of these estimates are about 224,000 ha). But historically it has not been possible to cultivate crops in flood recession areas during the wet season due to high waters. Even if double-cropping is

irrigated rice area of 276,000 ha in 1993-94, this represents an increase of about 200,000 ha. Gravity-fed dry season irrigation appears to account for the bulk of the gains, whereas wet season supplemental irrigation has been growing at a slower rate. Double-cropping (i.e., cultivating twice on the same land in one year) only occurred on about 20,000 ha of rice land in 1993-94; more current data on double-cropping activity were not available.

During the wet season, supplemental irrigation can improve yields by making farmers less dependent on potentially irregular rainfall. During the dry season, partial irrigation provides essential water and allows farmers to improve yields by controlling water levels. Fully irrigated rice areas are rare in Cambodia, and it has been suggested by the Asian Development Bank (ADB) that the potential for increasing areas under full irrigation using pumps or gravity-fed systems is limited (Nesbitt 1997).

Table 2.4: Rice Cultivation by Irrigation Status, 1993-94 and 1997-98

Irrigation of Rice	Irrigated Rice Areas (ha) 1993-94[1]	Irrigated Rice Areas (ha) 1997-98[2]	Irrigation Type/Method 1997-98
Supplemental Irrigation of Wet Season Rice	172,727	224,200	Gravity-fed (~90 %) Pumping (~10%)
Full or Partial Irrigation of Dry Season Rice	103,656	248,700 (223,700 partial and 25,000 full irrigation)	Gravity-fed (~90%) Pumping (~10%)
Total Irrigated Rice Area	276,393	472,900	Gravity-fed (~90%) Pumping (~10%)
Percent of Total Rice Cultivation	15%	23%	

[1] *Double-cropping occurred on about 20,000 ha in 1993-94, therefore total land irrigated was probably about 256,000 ha in 1993-94.*
[2] *Estimates of double-cropping activity were not available.*
Sources: Halcrow 1994, Ministry of Planning 2001.

It is important to note that the current operational reliability of Cambodia's irrigation systems is not clear. In 1993-94, an extensive study of the potential for rehabilitating irrigation systems identified 841 irrigation systems in Cambodia, of which only 176 (21%) were reportedly fully operational, 550 (65%) were partially operational, and 115 (14%) were not operational (Halcrow 1994).[2] The study divided irrigation systems into four categories:

- *Reservoirs storing water from run-off, streams, or rivers (43 percent of irrigated area, 45 percent of systems).* Most water is used for supplementary wet season irrigation, though in some instances a small dry season area is irrigated. Water is drawn from the reservoirs using gravity or small mobile pumps.
- *Canals offtaking from natural lakes, rivers, and streams by gravity (21 percent of irrigated area, 15 percent of systems).* These systems have no storage and are primarily used for supplementary wet season irrigation.
- *Canals with pump stations (7 percent of irrigated area, 5 percent of systems).* Pumps on perennial rivers allow for double-cropping – cultivating two crops in one year on the same land.
- *Reservoirs storing floodwaters that are released to support dry season recession crops only (29 percent of irrigated area, 35 percent of systems).*

occurring, MAFF would be correct in counting these areas twice in statistics on cultivated areas. Inquiries to MAFF did not result in clarification of the discrepancy between different estimates. This study is describing irrigated areas in accordance with the most recent MAFF statistics.

[2] This study covered 14 Provinces that, according to the Department of Hydraulics and Hydro-meteorology, included all dry season irrigated areas and 99 percent of wet season supplementary irrigated areas. Irrigation systems with existing areas less than 10 ha were excluded from the study.

2.4. Regional Overview of Rice Production

Increasing rice production is often identified as essential for development in Cambodia. Analysts suggest that increased irrigation and fertiliser inputs, in combination with the adoption of higher-yielding rice varieties, can help Cambodian rice yields "catch up" with its neighbours Thailand and Vietnam. However, the approaches of Thailand and Vietnam to rice production are somewhat different, suggesting the need for more debate within Cambodia about which approaches for rice production development may be most appropriate for Cambodia. FAO rice production statistics for Southeast Asian countries offer a starting point for discussion (Table 2.5).

Table 2.5: Comparison of Rice Production in Southeast Asian Countries, 1990 – 2000

Country	Rice	1990	1995	1998	1999	2000	Rice Ecologies and Irrigated Area
Cambodia	Yield (tons/ha)	1.4	1.8	1.8	1.9	2.1	83% lowland, 3% deepwater, 2% upland, 11% dry season (23% of area irrigated)
	Area Harvested (million ha)	1.9	1.9	1.9	2.1	1.9	
	Production (million tons)	2.5	3.4	3.5	4.0	4.0	
Laos	Yield (tons/ha)	2.3	2.5	2.7	2.9	3.1	58% lowland, 41% upland (2% of area irrigated)
	Area Harvested (million ha)	0.7	0.6	0.6	0.7	0.7	
	Production (million tons)	1.5	1.4	1.7	2.1	2.2	
Thailand	Yield (tons/ha)	2.0	2.4	2.3	2.3	2.3	86% lowland, 2% deepwater, 1% upland, 12% dry season (32% of area irrigated)
	Area Harvested (million ha)	8.8	9.1	9.9	10.1	10.0	
	Production (million tons)	17.2	22.0	22.8	23.3	23.4	
Vietnam	Yield (tons/ha)	3.2	3.7	4.0	4.1	4.3	84% lowland, 8% deepwater, 8% upland (60% of area irrigated)
	Area Harvested (million ha)	6.0	6.8	7.4	7.6	7.7	
	Production (million tons)	19.2	25.0	29.1	31.4	32.6	

Sources: Bui 2000, Kupkanchanakul 2000, FAOSTAT 2001, NIS 2001

Rice yields in Cambodia are the lowest among the four Southeast Asian countries, though recent improvement to an average of 2.1 tons/ha indicates that Cambodia may soon surpass Thailand's long stagnant yield of 2.3 tons/ha. Average rice yield in Vietnam was 4.3 tons/ha in 2000, twice the yield of Cambodia. Moreover, many farmers in Vietnam are able to cultivate two or even three rice crops on their land in one year, dramatically increasing land productivity. Such double cropping during spring and summer is common throughout much of Vietnam, while triple cropping (spring-summer-autumn) is more confined to the Mekong Delta region (Bui 2000).

The large divergence in average rice yields between Thailand and Vietnam reflects differences in their rice production approaches. To generalise, Thai farmers focus on cultivation of traditional and "improved" local rice varieties of high quality and long-grain, which command a substantial price advantage over lower grades of rice and can thereby improve farming profits.[3] This emphasis on grain quality is the main reason that adoption of modern, high-yielding rice varieties is lower in Thailand than Vietnam. Low yields in Thailand do not usually reflect poor water control, low inputs, or any of the other constraints commonly associated with low yields (Kupkanchanakul 2000). Although many farmers continue to cultivate rice without irrigation, about 32 percent of Thailand's rice areas were irrigated in 1997-98, about 20 percent as supplemental wet season irrigation and 12 percent as dry season irrigation. Most dry season irrigated rice areas are cultivated with high yielding varieties (Kupkanchanakul 2000).

[3] "Improved local varieties" refers to existing varieties (not genetically modified) that have been identified through research as best suited for cultivation in different rice eco-systems, based on grain quality, yield potential, and other factors.

In contrast to rice production in Thailand, Vietnam has generally focused on cultivating high-yielding modern rice varieties and expanding irrigation. Approximately 60 percent of rice cultivation areas are irrigated, allowing for intensive rice production of 2-3 crops with yields averaging about four tons/ha. Through this intensive production, Vietnam has become the world's third largest exporter of rice behind the United States (no. 1) and Thailand (no. 2) (FAOSTAT 2001). Although Vietnam has been remarkably successful at increasing rice production over the past decade, returns on production tend to be low. The low profitability of rice crops, in combination with increasingly smaller farm sizes and problems associated with intensified agriculture (e.g., pesticide resistance, salinity) threaten the sustainability of Vietnam's rice production levels (FAOSTAT 2001).

Unlike Thailand, Vietnam, and Cambodia, much of the rice production in Laos continues to take place in upland areas, where roughly 60 percent of farmers are estimated to experience annual rice deficits. Despite this shortfall, average yields in Laos have risen steadily over the past decade to 3.1 tons/ha in 2000. This has occurred with very little irrigation (2 percent of cultivated areas), fertiliser inputs, or adoption of other technologies such as high-yielding varieties. More than 85 percent of the rice produced in Laos is traditional waxy or glutinous type ("sticky rice").

Presently, rice production in Cambodia most resembles that of Thailand in terms of rice ecology, average yield, dominance of local varieties, and amount of irrigated area. But agricultural strategies of the Cambodian government tend to focus on increasing rice production in a manner more similar to the Vietnamese approach – increasing irrigation, adopting high-yielding varieties, expanding cultivation and double-cropping where possible. It is not the purpose here to suggest that either the Thai or Vietnamese approach is necessarily appropriate for Cambodia, but the rice production experiences of these neighbours deserves the scrutiny of Cambodia's agricultural policymakers. In particular, while overall increases in national production and yield are important, greater attention should be focused on farmers' livelihoods and the production strategies that can most improve their food security *and* crop profitability.

2.5. Agricultural Production in Cambodia

Government statistics suggest that, while rice and most livestock production have increased significantly over the past decade, most other food and industrial crop production has remained stagnant in Cambodia. From 1990-91 to 2000-01, rice production increased from 2.5 to 4.0 million tons, or more than 60 percent. Rice production has risen faster than increases in domestic consumption, providing Cambodia with a rice surplus in recent years. However, this surplus has been uneven. Many areas of Cambodia continue to experience significant rice deficits due to a range of constraints including physical limitations of the production area (e.g., soil quality, water availability), poor infrastructure, and weaknesses in the flow of trade and market information.

Livestock, which are an integral part of most farming systems in Cambodia, have increased at a somewhat slower rate than rice production. From 1990 to 2000, the total head of cattle increased by about 37 percent, pigs by 28 percent, and poultry by 87 percent. However, buffalo production decreased during this period by about 6 percent. Other food crop production has fluctuated significantly from year to year, with only maize and cassava showing signs of growth. A more detailed discussion of rice, other food, and livestock production follows.

2.5.1. Rice Production

Although rice production has increased significantly over the past decade, this growth has been quite uneven. According to MAFF statistics, almost all production gains were achieved during two periods – in one year from 1994-95 to 1995-96 when production increased by

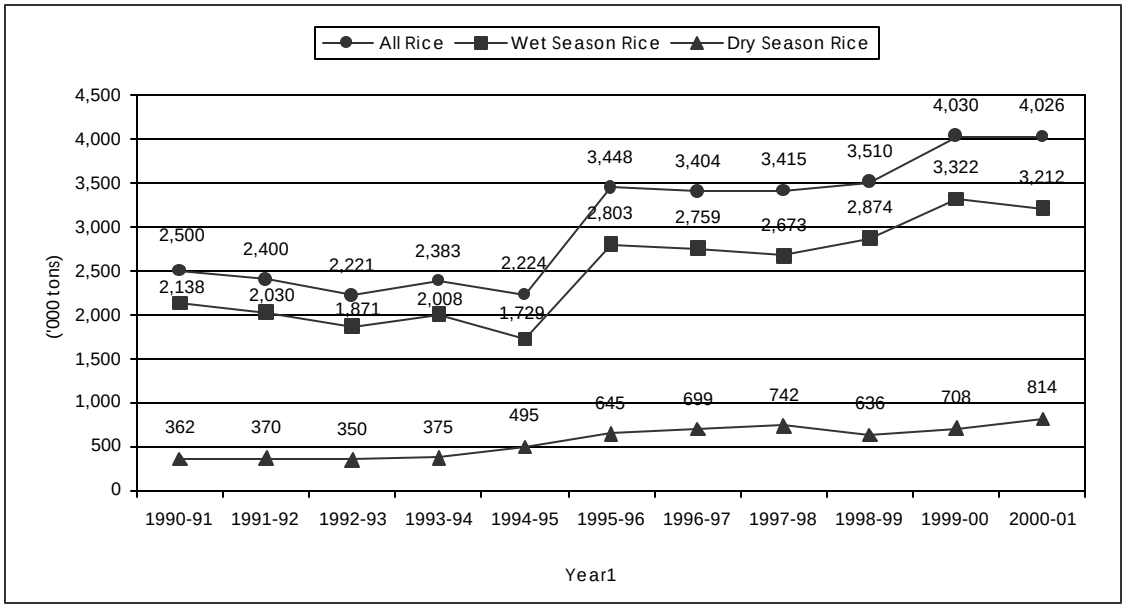
more than 1.2 million tons and in two years from 1998-99 to 1999-00 when production increased by about 0.5 million tons (Figure 2.1). These sharp increases in production (55 percent and 15 percent respectively) reflect years in which both yield and harvested area rose significantly (Figure 2.2). In the years following these sharp increases, production was flat.

Yield improvements have been the primary engine of rice production increases over the past decade, not expansion of cultivated areas. Average rice yields rose from 1.35 to 2.12 tons/ha from 1990-91 to 2000-01– an increase of close to 60 percent. Despite expansion of rice cultivation areas from 1.89 to 2.32 million ha during this period, actual harvested areas have not yet increased significantly. Over the past three years (1998-99 to 2000-01), only 1.97 million ha have been harvested on average compared to 1.86 million ha in 1990-91.

Because production depends on the amount of area harvested, which can fluctuate significantly each year depending on the weather (damaging floods and droughts), yield per ha represents a better long-term indicator of progress toward production improvements. Figure 2.3 shows yield trends for wet and dry season rice over the past decade. Wet season rice yields increased significantly during two 2-year periods – from 1993-94 to 1995-96 (1.20 to 1.64 tons/ha), and from 1998-99 to 2000-01 (1.60 to 1.95 tons/ha). Yields were flat in all other years. Similarly, dry season yields increased dramatically in a one-year period from 1993-94 to 1994-95 (2.50 to 3.00 tons/ha), and rose again from 1998-99 to 2000-01 (2.93 to 3.19 tons/ha). Dry season yields were flat in all other years.

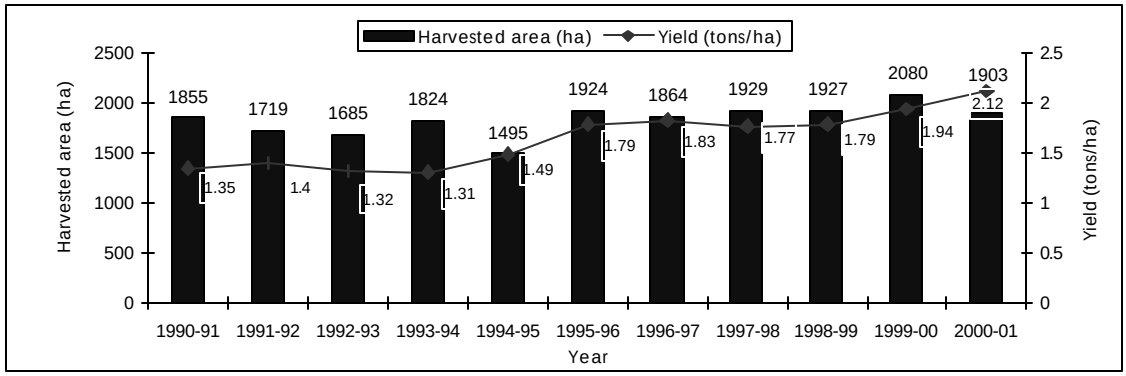
In analysing rice data, it should be noted that MAFF recently improved its rice data collection methods. Beginning in 1998, MAFF began applying sampling methods throughout the country to support more accurate rice data. Prior to 1998, national estimates were developed based on observations made at the local level (by village and commune officials). While in many cases these observations about cultivated area, harvested area, and production may have been accurate, the employment of sampling methods has surely improved precision.

Figure 2.1: Rice Production, 1990-2001



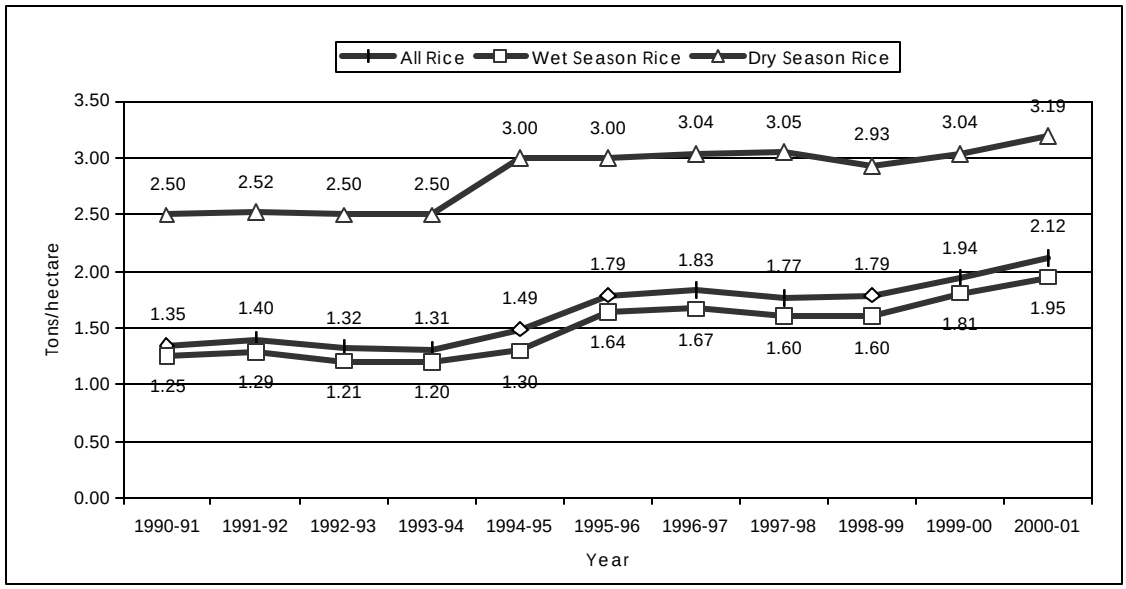
[1] Crop year defined as from 1st of March to end of February.
Sources: NIS 2001, MAFF 2001

Figure 2.2: Rice Yield and Harvested Area, 1990-2001



Sources: NIS 2001, MAFF 2001

Figure 2.3: Wet and Dry Season Rice Yields, 1990-2001



Source: NIS 2001, MAFF 2001

Identifying which factors most contributed to significant yield increases over the past decade is important because such an understanding can provide the basis for targeted agricultural policy changes in support of future yield improvements. However, the two periods of sharp rice yield and production increases over the past decade are not easily explained. Based on the timing of the first increase (1993 to 1995), it appears that the main drivers of yield and production improvements were substantial increases in fertiliser inputs and rapid adoption of higher-yielding rice varieties. The opening of markets in the early 1990s to private sector competition facilitated a large influx of fertiliser inputs by private traders. Imports of fertiliser increased from about 10,000-20,000 tons/year in 1990-1992 to perhaps 80,000-90,000 tons/year in 1993-1995 (Cameron 1995, Center for National Policy 1996).

Prior to the opening of the fertiliser market, fertiliser sales and distribution were controlled by the state-owned company *Compagnie Centrale des Materials Agricoles* (COCMA), operated by MAFF. Farmers cited numerous problems with state-run fertiliser distribution associated with an inability to respond rapidly to changes in demand, haphazard supply, unreliable quality, and a lack of services. Due to these problems, private traders of fertilisers rapidly took market share from COCMA when markets were opened. This occurred despite the fact that COCMA's fertiliser stocks were donated by foreign donors (more than 100,000 tons from 1993-1995), providing COCMA a cost advantage over private traders. By

1995, private sector sales accounted for 75 percent of the market compared to only 25 percent for COCMA (Center for National Policy 1996).

The introduction and adoption of higher-yielding varieties of rice and improved irrigation and water management also contributed to increased rice yields and production. The Cambodia-IRRI-Australia Project (CIAP)[4] is credited for many of the technology-related improvements, including the widespread adoption of the higher-yielding variety IR66 across about 90 percent of dry season rice areas (Young *et al.* 2001). IR66 adoption has been promoted by CIAP and several development agencies, and facilitated by the expansion of dry season irrigation areas (Young *et al.* 2001). As noted above, irrigated rice areas appear to have increased by about 200,000 ha during the 1990s, 75 percent of which was for the purpose of dry season irrigation.

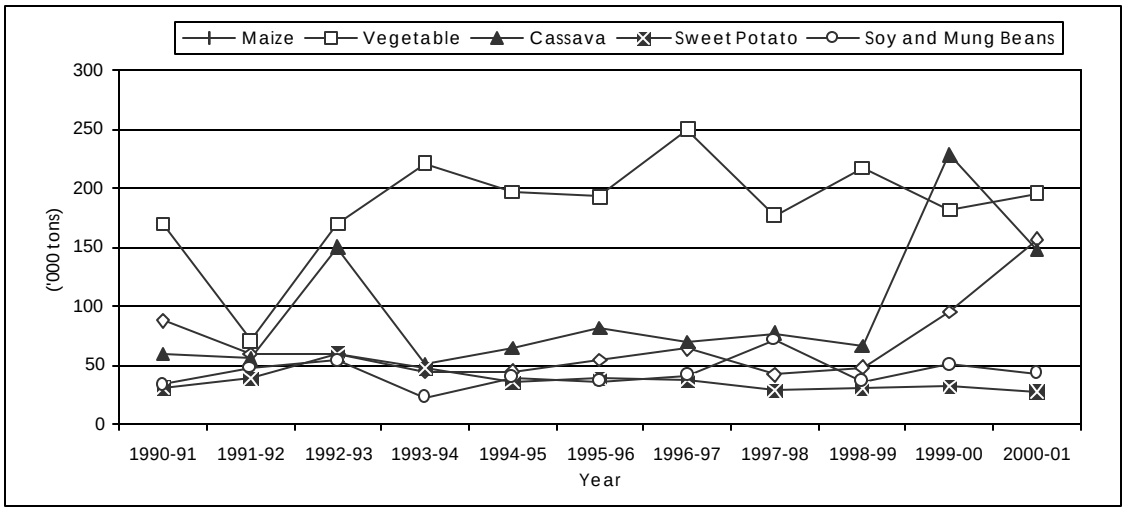
2.5.2. Other Food Crops

Apart from rice, the main crops of importance for rural livelihoods are vegetables and maize. Farmers typically grow vegetables and maize as part of chamkar or in homegardens for subsistence purposes. Maize may be used as livestock feed or for human consumption. Other food crops, such as sweet potatoes, cassava, mung beans and soybeans, are grown by many farmers but production is not as widespread as that of vegetables and maize.

Government data on food crop production over the past decade may not be highly accurate since they are largely based on observation estimates made by local officials rather than a more systematic approach involving sampling procedures. In addition, estimates may reflect formal sources of production such as plantations and chamkar fields, but informal sources such as homegardens may not be well taken into account. Although production from a homegarden may be small in scale, the large number of rural families cultivating homegardens suggests they are an important contributor to national food crop production.

According to government data, food crop production has fluctuated significantly from year to year, but overall growth trends have been flat. Only maize and cassava have shown some recent indications of growth (Figure 2.4). Over the past two years, maize production increased from about 50,000 tons to over 150,000 tons and cassava production enjoyed similar gains. Vegetable production has hovered around 200,000 tons for several years, while production of sweet potatoes, mung beans, and soybeans has been stagnant.

Figure 2.4: Food Crop Production, 1990-2001



Source: NIS 2001, MAFF 2001

[4] CIAP is a joint project of the International Rice Research Institute (IRRI) and MAFF started in 1987. The Australian Agency for International Development provides funding for the IRRI portion of the project.

2.5.3. Livestock Production[5]

Livestock that play an integral role in Cambodia's rural farming systems include cattle, buffalo, pigs, and poultry (chickens and ducks). According to government statistics, the number of cattle, pig, and poultry in Cambodia has increased steadily over the past decade while buffalo numbers have somewhat declined (Table 2.6). Cattle and buffalo are used for farm operations such as ploughing, carrying produce, and as a source of organic fertiliser. Selling cattle for beef is a secondary benefit of cattle; buffalo meat may be mixed with cattle meat or sold to Vietnam but is generally not popular in Cambodia. Farmers raise pigs and poultry in order to sell meat and eggs for cash. Farmers themselves consume relatively little of livestock products.

Table 2.6: Livestock Production, 1990-2000

Year	Cattle ('000 head)	Buffalo ('000 head)	Pig ('000 head)	Poultry ('000 head)
1990	2,181	736	1,515	8,163
1991	2,257	755	1,550	8,816
1992	2,468	804	2,043	9,901
1993	2,542	824	2,123	10,629
1994	2,621	809	2,025	10,026
1995	2,786	765	2,044	10,066
1996	2,762	744	2,151	11,412
1997	2,821	694	2,438	12,098
1998	2,680	694	2,339	13,117
1999	2,826	654	2,189	13,417
2000	2,993	694	1,934	15,249
Average Annual Growth Rate	*3.2%*	*-0.6%*	*2.5%*	*6.4%*

Source: NIS 2001, MAFF 2001

- **Cattle and Buffalo –** Cattle and buffalo are found throughout Cambodia's rice growing areas, but buffalo tend to be concentrated in low-lying areas around the Great Lake and in Prey Veng and Svay Rieng. In part, this concentration reflects the fact that buffalo tend to perform better than cattle in the heavier, sticky soils of many low-lying areas. Rice straw is the staple feed for cattle and buffalo in Cambodia. It is the sole form of fodder during times when grazing is restricted, such as during the early wet season when livestock are kept near the house for work and during the peak of the wet season when all fields are growing rice.

  From 1990-2000, cattle numbers increased steadily from about 2.2 to 3.0 million head – an average annual increase of 3.2 percent. Meanwhile, buffalo numbers declined slightly from 736,000 to 694,000 head. The greater increase in cattle may reflect their faster reproductive rate, farmer preferences for cattle over buffalo, and reported smuggling of buffalo to Vietnam and Thailand. Taken together, the annual rate of increase in cattle and buffalo numbers over the past decade has been about 2.5 percent, or roughly equal to population growth and the expansion of rice cultivation areas. Correspondingly, the average number of cattle and buffalo per rural household engaged in agricultural activity has remained relatively constant at about 2.2 head per household. Households typically need two draft animals for farming.

- **Pigs –** Pig raising activity exists throughout Cambodia, but tends to be concentrated around Phnom Penh and other areas of higher population density. The provinces with the highest number of pigs per households are Svay Rieng, Kampot, and

[5] This section relies heavily on Maclean (1998), which provides a comprehensive assessment of the role of livestock in Cambodian rice farming systems.

Takeo. The proximity of these provinces (especially Svay Rieng) to Vietnam suggests that many pigs may be exported to markets across the border. Most pig diets in Cambodia are based on rice bran, which farmers purchase from rice millers (often it is bran from the farmer's paddy rice). The quantity, quality, and cost of rice bran available from local rice mills are major determinants of the number and profitability of pigs raised in a village. Almost all pigs are sold for cash.

From 1990 to 2000, pig numbers have fluctuated around 2.0 million head, though numbers have declined over the past four years from a peak of 2.4 million head in 1997 to only 1.9 million in 2000. The reasons for this decline are not clear. However, it should be noted that different breeds of pigs have different mature weights and meat quality. Therefore, a decline in pig numbers does not necessarily indicate a reduction in the value of total pig sales if farmers have been shifting toward pig breeds with larger mature weights and higher quality meat.

- **Poultry –** Nearly all farmers raise chickens, whereas duck raising is concentrated in areas where water is available throughout the dry season. Village chickens are free-range scavengers that are typically fed small daily supplements of rice scattered on the ground. Likewise, ducks scavenge in rice paddies, lakes, and ponds. Intensive chicken and duck raising appears to be increasing in Cambodia, especially in areas near Phnom Penh. Although government statistics indicate that poultry numbers have nearly doubled over the past decade, these estimates should only be taken as a general guide due to the various difficulties associated with accurately counting chickens and ducks.

2.6. Importance of Agriculture to Rural Livelihoods

As indicated by the above discussion of rice, other food, and livestock production, agriculture plays a fundamental role in the livelihoods of rural Cambodians. Of the more than 10 million people living in rural areas, about 8.5 million depend on agriculture for their livelihoods. For most, rice farming is the primary basis of food security and the main source of employment and income. The proportion of the overall population employed in the agricultural sector has remained steady over the past decade at about 75 percent.[6] As a percentage of total GDP, agriculture has declined from about 40 percent of GDP in 1990 to about 23 percent in 2000 (CDRI 2002). The reason for the agriculture sector's decreasing share of GDP is that other sectors (especially textiles and garments) have grown at a much faster rate than agriculture in recent years.

For rural households engaged in agriculture, the average amount of land cultivated for rice was about 1.4 ha in 2000-01 (Table 2.7). Of course, farm sizes vary across Cambodia, with farm sizes tending to be smaller (<1.0 ha) in densely populated areas such as Kandal and Kompong Speu, between 1.0-2.0 ha in southeastern provinces, and often 2.0-4.0 ha in less populated areas such as the northwestern provinces (Helmers 1997). Average rice production per household was about 2.4 tons in 2000-01. However, it should be noted that the proportion of cultivated area that was harvested in 2000-01 was relatively low due to flood damage. If all cultivated areas had been harvested, average production per household would have been about 3.0 tons.

[6] "Agricultural sector" is defined here to include rice, other crop, and livestock production. Forestry, rubber, and fisheries have been excluded; these activities accounted for less than three percent of employment and about seven percent of GDP in 2000. See section 1.3. Limitations of Macroeconomic and Employment Indicators for a broader discussion of the limitations of employment and GDP estimates.

Table 2.7: Rice Cultivation and Production per Household, 1998-2001

	1998-99	1999-00	2000-01
Total Rural Population ('000 people)[1]	9,642	9,882	10,128
Total Rural Households ('000 HHs)	1,866	1,913	1,961
Rural Households Engaged in Agriculture ('000 HHs)[2]	1,573	1,613	1,653
Total Area Cultivated for Rice ('000 ha)	2,095	2,158	2,318
Total Area Harvested for Rice ('000 ha)	1,963	2,080	1,903
Average Hectares Cultivated per Household (ha)	1.33	1.34	1.40
Average Hectares Harvested per Household (ha)	1.25	1.29	1.15
Average Rice Yield (tons/ha)	1.79	1.94	2.12
Average *Potential* Rice Production per Household based on Cultivated Area (tons)	2.38	2.60	2.97
Average *Actual* Rice Production per Household Based on Harvested Area (tons)	2.23	2.50	2.44

[1] *Rural population estimates are based on 1998 census statistics and the estimated annual population growth rate for Cambodia of 2.49 percent.*
[2] *An estimated 84.3 percent of the rural population was engaged in the agricultural sector in 1998 (Ramamurthy* et al. *2001).*
Sources: NIS 2000, NIS 2001

Rural households engaged in agriculture depend on a range of activities to secure food and income, including rice, other field crops, homegardening, and livestock production, fishing (see Chapter 3), forest product collection (see Chapter 4), and wage labour. Although levels of food security and income from these activities vary across the country, rice is clearly the staple food of rural households and the most important for food security. On average, rice provides an estimated 65-75 percent of energy/caloric needs for Cambodians (Murshid 1998). Rice is typically supplemented with fish (fresh or in the form of preserved *prahoc*) and vegetables.

2.6.1. Rice Consumption and Income

Per capita rice consumption needs in Cambodia are estimated to be about 150 kg of milled rice per year (Helmers 1997). This is equal to about 250 kg of paddy rice, or roughly 1.3 tons per household.[7] Perhaps an additional 500 kg of paddy rice is needed each year for seeds, compensating for post-harvest losses, and social and ceremonial purposes. Therefore, the average farming household requires roughly 1.8 tons of rice for basic consumption purposes. In comparison, the average household production of 2.4 tons in 2000-01 was about 0.6 tons above this level. However, it is important to emphasise that production varies considerably across the country with areas of significant rice surplus and deficit.

The gross value of rice production per household is about $200-$300, based on average production of 2.4 tons and paddy rice prices in the range of 300-500 riels per kg. If 1.8 tons are consumed, the additional 0.6 tons could be sold for about $50-$80, which may be enough to cover farming costs such as fertilisers, pesticides, and hired labour. Thus, rice production does not appear to generate much, if any, disposable income for the average household; food security remains the primary motivation for rice cultivation.

2.6.2. Vegetable Consumption and Income

Vegetables and other crops represent an important potential source of vitamins, minerals, and proteins that can help to guard against malnutrition and associated problems (e.g., anaemia

[7] White rice recovered after village milling averages about 53 percent of paddy weight, but commercial milling efficiency rates tend to be 60 percent of higher (Rickman et al. 2001). If the average milling efficiency rate for Cambodia is assumed to be about 60 percent, then 250 kg of paddy rice produces 150 kg of milled rice. Average household size in Cambodia was about 5.2 people in 1998, suggesting consumption needs of roughly 1.3 tons of paddy rice per household.

from iron deficiency, night blindness from vitamin A deficiency). Vegetable consumption rates in Cambodia appear to be well below recommended levels. Daily per capita consumption has been estimated to be 100 g per day in 1994 and 41 g per day in 1999 (Ungsa and Hean 1994, Zaman 2000), whereas FAO recommends 200 g per day and the World Health Organisation recommends 300 g per day. However, both of the reported estimates for Cambodian vegetable consumption appear to simply divide Cambodia's official annual vegetable production by the total population. This approach does not include vegetables consumed from informal production (e.g., homegardening) and high levels of vegetable imports from Vietnam and Thailand. Indeed, results from limited surveys suggest that perhaps 25-50 percent of the vegetables consumed in Cambodia are imported.[8]

When estimates of informal vegetable production and vegetable imports are included in total vegetable production, per capita consumption appears to be roughly 80-90 g per day (or 30-35 kg/year).[9] Of course, actual vegetable consumption varies considerably across the country, with consumption in urban areas (where most vegetables are sold) likely to be significantly higher than in rural areas. In addition, it is likely that rural households with vegetable gardens consume more vegetables than households without gardens. A recent survey of 680 households in rural areas of five provinces found that 459 households (or about two-thirds) cultivate homegardens (Helen Keller International Cambodia 2000).

2.6.3. Livestock Consumption and Income

As sources of protein, livestock products continue to play a small role in the average rural Cambodian diet compared to fish consumption. Maclean (1998) estimates that annual per capita consumption of livestock meat was about 17.5 kg in 1997 – 8 kg of pork, 6.5 kg of poultry, and 3 kg of cattle and buffalo. In comparison, studies of fish consumption indicate average per capita consumption of approximately 27-38 kg/year, with wide variance and higher levels of consumption in rural fishing areas (see Chapter 3). While national estimates suggest that livestock products account for one-third of meat consumption, this proportion is likely much lower in rural areas. Most farming households only consume eggs and some poultry; they sell pigs (and cattle and buffalo when they are no longer capable of farm operations) to slaughterhouses, which are mainly serving urban consumers. Although rural households rarely buy any meat from slaughterhouses, they typically consume pork and beef at ceremonies, and in some cases when animals have died from an accident or disease (Maclean 1998).

Cattle, buffalo, and pigs are the primary sources of cash income for farming households. Pigs are directly raised for cash generation, whereas cattle and buffalo are primarily raised for draft power purposes. However, cattle and buffalo can also generate significant amounts of cash. Breeding animals generate cash through the sale of calves and draft animals can be hired out for land preparation. In addition to cash generation, cattle and buffalo represent an efficient means of "storing" wealth, since they have long productive lifetimes (8-10 years for cattle and longer for buffalo) and, in the case of cattle, can readily be sold for slaughter.

[8] Cameron and Twyford-Jones (1995) estimated that at least 50 percent of vegetables consumed in Cambodia are imported based on a limited survey. Ungsa and Hean (1994) found that 26 percent of vegetables sold in Phnom Penh markets were imported.

[9] Total vegetable production was estimated to be roughly 350,000 to 400,000 tons in 1999. This figure represents 180,000 tons reported in official statistics, plus 120,000 tons produced in homegardens (based on an extrapolation from Helen Keller International Cambodia 2000), plus about 50,000-100,000 tons of imported vegetables. No estimates of wild vegetable collection are available. Assuming no exports or spoilage, when total production is divided by total population, per capita consumption is about 80-90 g per day.

2.6.4. Role of Gender and Ethnicity in Agriculture

In examining the importance of agriculture to rural livelihoods, it is also important to examine how gender and ethnicity might affect production, food security, and income. Although a number of gender and ethnographic studies of agriculture and development have been conducted in Cambodia, their findings are often in contradiction making it difficult to draw definite conclusions (Catalla *et al*. 2001). Nonetheless, a few generalisations can be made. Broadly, ethnic Khmer people and ethnic minorities living in upland areas tend to engage in agriculture as their main livelihood activity, whereas ethnic Cham and Vietnamese livelihoods often depend greatly on fishing activities (see Chapter 3). Traditional gender roles exist in the agricultural sector, but they are not typically rigid or inflexible. For rice and vegetable farming, women tend to be more involved with planting and transplanting, weeding, fertiliser application, harvesting, and marketing and trading activities while men play a larger role in land preparation, dike maintenance, and transportation (Ahlers *et al*. 1995, Yang Saing 1998, Pillot *et al*. 2000, Catalla *et al*. 2001, Norris 2001).

2.7. Historical Overview of the Agricultural Sector, 1863-1989[10]

Cambodian farmers have been cultivating rice for at least the last 2000 years and it remains the nation's staple food today. Rice-based agriculture has played a central role in Cambodian history, with times of great productivity, such as the Angkorian period (9th to 14th centuries), and setbacks often due to wars and civil strife. Although it is not possible within the scope of this assessment to capture in detail the fundamental role of agriculture in Cambodian history, a brief overview of agriculture production during more recent historical periods is provided below from the beginning of the French colonial period in 1863 to the transition to a market economy in 1989.

2.7.1. French Colonial Period (1863-1953)

During the French colonial period in Cambodia, the area cultivated for rice ranged from 0.5 to 1.7 million ha with annual yields averaging about 1.0 ton/ha (Tichit 1981, Helmers 1997). The colonial economy focused on the export of primary agricultural products – rice and livestock – to French agro-processing facilities mainly located in Saigon. The French obtained rice for export through the development of plantations and by taxing small farmholders. Rice plantations occupying more than 16,000 ha were established in Battambang Province and surrounding areas. These plantations focused on production of high quality rice using modern farming methods. They were supported by extensive irrigation canal systems and several plant breeding and fertiliser research stations. Because of the importance of rice exports from Battambang Province, a railway was constructed linking it to Phnom Penh, from where rice could be exported by river transport to Saigon.

Cambodia's small farmholders paid the colonial government the highest per capita rates of tax (in rice, labour, and cash) of any farmers in French Indochina. In return, the colonial government provided almost no support to small farmholders. Despite these constraints, Cambodia became the third largest rice-exporting country in the world by 1940, largely through the expansion of areas cultivated by small farmholders. Rice exports reached 200,000 tons, with 30,000 tons from Battambang rice plantations and the remainder from small farmholders.

2.7.2. Independent Period (1953-1975)

From 1953 to 1963, rice cultivation expanded by about 500,000 ha to a total of 2.2 million ha and yields increased slightly to 1.1 tons/ha. With total rice production of about 2.3 million tons, milled rice exports reached levels of about 250,000-400,000 tons/yr. In 1964, the

[10] This section relies heavily on Helmers (1997).

Cambodian government nationalised foreign trade (including rice exports) under control of a state corporation with monopoly control. Initially, official exports increased due to the state corporation's improved organisation of rice collection from farmers. However, because government prices for rice were fixed well below market value, there were strong incentives to smuggle rice exports rather than sell to the state. One estimate indicated that one-third of rice exports in 1966 were sold through informal (black) markets where prices were three times the official state price. As state revenue rapidly declined, the state response was to attempt to forcibly collect rice at the official price. This led to armed rebellions by farmers in Battambang and other provinces in 1967-68.

Cambodia produced its best ever rice crop of 3.8 million tons in 1969-1970 due to favourable weather, but shortly after this harvest the Lon Nol regime came to power and Cambodia became fully embroiled in the Second Indochina War. This fighting devastated rice production, livestock, and rural infrastructure. Official statistics indicate that from 1970 to 1974, rice cultivation declined by 77 percent and rice production dropped by 84 percent.

2.7.3. Democratic Kampuchea, 1975-1979

In terms of agriculture development, the central focus of the Khmer Rouge regime (known as Democratic Kampuchea) was to triple rice production by cultivating two or more crops per year, substituting high-yielding rice varieties for traditional low-yield varieties, constructing and expanding irrigation systems, and increasing areas under cultivation by clearing forests. As has been well documented elsewhere, this effort was a tremendous failure (Shawcross 1979, Chandler 1993). For agriculture, the legacy of the Khmer Rouge regime included large numbers of unusable or useless irrigation systems (perhaps 70-80 percent of systems constructed) and the decimation of the ranks of agricultural planners, technicians, and policymakers from about 1,600 to about 200, with only 10 having received university training. Agricultural research stations had also been destroyed and rice germplasm and technical data were lost (Mysliwiec 1988).

2.7.4. Centrally Planned Economy, 1979-1989

In response to the threat of widespread famine and a shortage of labour, draft animals, and production equipment in 1979, agriculture was organised on a collective basis into groups of 20-25 families (*Krom Samaki*) that could share scarce resources and meet immediate food needs. All land became the property of the state, but *Krom Samaki* were allowed to occupy and use agricultural land. In practice, *Krom Samaki* did not rigorously adhere to collectivisation principles, preferring in many cases for each individual family to farm their own plot of communally owned land, with perhaps some sharing of labour, tools, and draft animals. From 1980 to 1989, rice cultivation area increased from 1.4 to 1.9 million ha and yields improved slightly from 1.2 tons/ha to 1.4 tons/ha. Although rice production fluctuated greatly during this period, with poor years in 1981 (1.5 million tons) and 1984 (1.3 million tons), production reached 2.6 million tons in 1989.

By 1989, it was clear that collectivisation had not been adopted and the planned economic system was failing (Frings 1993). In addition, Cambodia was experiencing the effects of a massive reduction in support from Eastern Bloc countries. In response to these problems, new policies favouring a transition to a market economy were instituted. As part of these reforms, private property rights including private land tenure were established, allowing for communal lands to be divided and allocated to families within each commune area.

2.8. Overview of Institutional Roles in the Agricultural Sector

Since the reforms of 1989, Cambodia's economy has been transitioning from a centrally planned economy to a market economy. This has required a significant shift in the manner in which the government and public institutions support agriculture. For example, prior to

reforms, the government was the sole official importer and distributor of fertilisers. As noted above, during the early 1990s private sector fertiliser suppliers entered the Cambodian market and quickly gained market share. Over time the government has phased out its role in fertiliser support, finally abolishing fertiliser subsidies and the state-owned marketing agency in 1999 (Ministry of Commerce 2001).

The Ministry of Agriculture, Forestry and Fisheries (MAFF) is the primary ministry responsible for agricultural development. Agricultural departments and programs within MAFF focus mainly on crop development (including irrigation), livestock development, promotion of agro-processing, research and education, and extension and technical services. A number of other ministries and public agencies also play important roles in the agricultural sector, with mandates that complement (and at times overlap) with MAFF. Key institutions and their responsibilities relevant to the agricultural sector include:

- Ministry of Rural Development – crop development, road rehabilitation, water resources management, and research and extension.
- Ministry of Water Resources and Meteorology – water resources management including irrigation.
- Ministry of Land Management, Urban Planning, and Construction – management of land
- Ministry of Environment – protection and management of environmentally sensitive areas; assessment and mitigation of potential environmental impacts.
- Ministry of Commerce – promotion and support of marketing, trade, and export.
- Ministry of Women's and Veteran's Affairs – promotion of family food production.
- Cambodia Agricultural Research and Development Institute – development of new rice varieties and seed multiplication.

2.9. Agricultural Concessions

In addition to the above mentioned activities, MAFF is responsible for overseeing leases of agricultural concessions. As of 31 December 2001, the total area under agricultural concessions in Cambodia was 809,296 ha, leased to 40 companies (Table 2.8). All 40 of these concessions have received approval from the Council of Ministers (CoM), but thus far only 25 have entered into the necessary contracts with MAFF (for a more detailed description of the process for granting agricultural concessions, see Chan *et al*. 2001). Sixteen concessions have been cancelled or withdrawn over the past 2-3 years.

Table 2.8: Agriculture Concessions in Cambodia (as of 31/12/2001)[1]

Status of Concession	Number of Concessions	Total Concession Area (ha)	Number of Concessions Over 10,000 ha
Concessions have CoM approval and MAFF contract	25	723,606	11 out of 25
Concessions have CoM approval only; No MAFF contract yet	15	85,690	3 out of 15
Total	**40**	**809,296**	**14 out of 40**
Cancelled concessions	16	123,680	5 out of 16

[1] *See Appendix A for detailed information on Cambodia's agricultural concessions.*
Source: MAFF 2001

The 40 concessions holding contracts or seeking contracts are mainly located in forested areas. Concessionaires are mainly focused on cultivating palm oil (9 concessions), cassava (9 concessions), rubber (8 concessions), and cashew (7 concessions).[11] The largest

[11] Many concessionaires report cultivation of more than one type of crop.

concessions have been leased to Pheapimex company (315,028 ha in Pursat and Kompong Chhnang for tree plantations in support of a pulp mill) and Green Sea Industry Company (100,852 ha in Stung Treng for a teak plantation). Of the 40 concessions, 14 are larger than 10,000 ha – the maximum allowable size under the newly approved *Immovable Property Law* (more commonly known as the "Land Law"). Detailed information on all agricultural concessions in Cambodia, as reported by MAFF, is provided in Appendix A.

Although potential development of agricultural concessions in Cambodia may be promising in some areas, an analysis of the 25 concessions holding contracts indicates a number of problems:

- **Official government revenue collection** – only eight of the 25 concessionaires have paid the necessary deposit to the government for their concession, which suggests that as yet agricultural concessions have not generated significant government revenue.
- **Concession Boundary Demarcation** – only ten concessionaires have completed boundary demarcation, three have demarcated specific areas of their concession, ten have not completed demarcation, and for two no information was available.
- **Land Disputes and Encroachment** – 16 of the 25 concessionaires complain of problems with protests and/or encroachment on concession land by local people.

An additional concern about agricultural concessions is that they do not appear subject to the same bidding process and management requirements as forest concessions. This may be a "loophole" for forest exploitation. Under the *Sub-Decree on the Management of Forest Concessions*, granting of a forest concession must involve a comprehensive bidding process that is both public and competitive (Article 4.4 (a)-(m)). No such process has been established in law for agricultural concessions. Thus, it presently appears possible to circumvent the forest concession bidding process (and future forest concession management requirements) by leasing agricultural concessions instead of forest concessions. Indeed, in at least two recent cases (Tumring Rubber Plantation in Kompong Thom and Green Sea Industry in Stung Treng) former forest concession areas have been leased out as agricultural concessions, after which logging companies have been invited in to harvest timber (NGO Forum 2002). It should also be noted that granting concessions in former forest concession areas is illegal under Article 5.4 of the *Sub-Decree on the Management of Forest Concessions*, which states that cancelled forest concessions must be protected as a natural forest area.

2.10. Physical Constraints on Increasing Agricultural Production

Although constraints on agricultural production differ based on the type of activity – rice, other crops, livestock production – and a range of other factors, it is possible to generalise about some of the most significant physical constraints. Problems with rainfall distribution, floods and droughts, soil fertility, and pests and disease constrain much agricultural production in Cambodia. In some areas, these physical constraints make significant future improvements in agricultural production unlikely, either because technical solutions (irrigation, fertilisers and pesticides) cannot adequately address the problems or proposed approaches are prohibitively expensive.

2.10.1. Rainfall Distribution/Floods and Droughts

Approximately 77 percent of Cambodia's cultivated rice areas are entirely dependent on rainfall as a source of water, and an additional 11 percent depend on rainfall and supplemental irrigation (much of which may be unreliable). In rainfed areas, the occurrence, duration, and amount of rainfall over the course of the wet season can have large impacts on yield. For example:

- Insufficient rainfall during the early wet season (May and June) can lead to poor land preparation, delays in seedbed establishment, less healthy seedlings, and higher levels of pest problems.
- Insufficient rainfall in July and August can delay transplanting and cause poor plant growth.
- Reduced rains in October and early cessation of rains in November can adversely affect the reproductive stage of the rice plant and reduce yields.
- Abnormally low river levels can sharply reduce areas for flood recession cultivation.
- Excessive rains during any period of the wet season can cause yield problems due to flood damage and crop submergence (Javier 1997).

For vegetable production, wet season cultivation is rare due to the waterlogging problems that occur with heavy rainfall, and dry season cultivation is restricted due to a lack of water availability. Livestock numbers are somewhat constrained due to limited grazing areas during the wet season when all fields are growing rice and limited water availability during the dry season.

2.10.2. Poor Soil Fertility

Soil infertility represents one of the most serious constraints on crop yield improvement in Cambodia. Much of Cambodia's soils have poor soil fertility due to centuries of continuous cultivation without adequate replenishment of lost nutrients (Javier 1997). Most soils are deficient in nitrogen (N) and phosphorous (P), and some are deficient in potassium (K). Additional problems with poor physical and chemical soil structure include acidic soils, low cation exchange capacity (CEC), low organic matter content, iron toxicity, and salinity (White *et al.* 1997a).

Table 2.9: Potential for Future Yield Increases Based on Soil Quality in Different Rice Ecosystems, 2000-01[1]

Soil Potential	Rainfed Lowland Rice ('000 ha)	Deepwater Rice ('000 ha)	Upland Rice ('000 ha)	Dry Season Irrigated Rice ('000 ha)	Total ('000ha)	Percent of Rice Cultivation Area
Low[2]	1,079	14	29	52	1,174	50.7%
Medium[3]	405	8	18	36	467	20.1%
High[4]	443	58	4	172	677	29.2%
Total	1,927	80	52	260	2,318	100.0%

[1] An assessment of soil potential for rice areas in Cambodia was conducted in 1997 when total cultivated rice area was 2,076 ha. This table extrapolates from the 1997 assessment, applying soil potential proportionately to 2,318 ha of cultivated rice area in 2000-01.
[2] Low-potential soils have chemical or physical limitations that are difficult to overcome through soil management, such as low cation exchange capacities or iron toxicity problems, and hence are likely to restrict yield.
[3] Medium-potential soils have chemical or physical problems that can be corrected through management, such as N, P, and K deficiencies, and poor soil structure.
[4] High-potential soils have few limitations to rice yields.
Sources: White et al. *1997a, MAFF 2001*

Due to these problems, approximately 50 percent of the areas currently cultivated for rice are considered to have low potential for improving yields (Table 2.9). A further 20 percent of cultivated areas have chemical and physical limitations that may affect yields, but can be addressed through improved soil management. About 30 percent of cultivated areas are considered to have high potential for yield improvements. Dry season flood recession areas tend to be more fertile than rainfed lowland areas, which is part of the reason for higher dry season yields.

2.10.3. Pests and Disease

A number of insect pests and diseases cause damage to rainfed lowland rice and upland rice, but they are generally not considered major problems (Javier 1997). This may be due to a high population of pest predators and parasites, infrequent use of pesticides during the wet season, and diversity of rice varieties in fields. Common pests in agricultural fields include gall midge, stem borer, brown planthopper, green leafhopper, thrips, grasshopper, leaffolder, rice bug, case worm, and army worm. Diseases include sheath blight, bacterial blight, and sheath rot (Jahn *et al.* 1996, Javier 1997). Rice yields may also be affected by crab damage to seedlings, birds eating seeds or ripening grain, or rats damaging crops during any stage of growth. Weed growth can be a significant problem for dry season rice crops, but tends to be more limited for wet season crops if standing water can be maintained (Javier 1997). However, a survey of upland farmers found that 85 percent considered weeds to be a serious problem mainly because weed seeds tend to germinate before upland rice seeds (Jahn *et al.* 1999).

2.11. Potential for Improving Agricultural Development

A wide range of actions is needed to improve agricultural development and rural livelihoods, some of which may be more feasible and cost-effective than others. Recommendations in existing literature focus on expanding and improving irrigated areas, diversifying farming approaches and increasing agro-processing, improving rice and vegetable varieties, improving the efficiency of fertiliser and pesticide use, reducing post-harvest losses and marketing costs, and increasing agricultural support services.

2.11.1. Expand and Improve Irrigated Areas

Lack of irrigation is a commonly cited constraint on increased agriculture production in Cambodia. Erratic wet season rainfall and lack of water availability during the dry season create strong demand for expanded irrigation and improved water management. Policy and planning documents typically suggest widespread potential for increasing irrigated agriculture. For example, the *Socio-Economic Development Plan 2001-2005* suggests "irrigation offers the best opportunity for agricultural growth" (Ministry of Planning 2001). It notes that extensive, shallow aquifers underlie almost all of the arable areas in Cambodia and sufficient surface water resources are available to irrigate an area of at least 1.0 million ha during the dry season.

Other assessments of irrigation potential in Cambodia suggest that cost-effective expansion may be more targeted, small-scale, and limited. For example, a comprehensive study of the potential for groundwater irrigation in Prey Veng concludes that only about 0.6 percent of the province's land area, or about 3,000 ha, can be safely irrigated without beginning to lower the dry season water table below six meters – a level below which it will be difficult for a large proportion of the population to access drinking water (Roberts 1998). The study estimates that the groundwater-irrigated area in Prey Veng was about 1,200 ha in 1998, indicating potential for expansion of only 1,800 ha before irrigation would begin to harmfully lower the dry season water table.

Nesbitt (1997) suggests several inexpensive strategies for reducing the negative effects of the "mini-drought periods" on wet season agriculture. These include levelling fields to evenly distribute water, raising bund heights to retain water during wet periods, and construction of small ponds beside nurseries for supplementary watering. Expansion of cost-effective water management and supplemental irrigation strategies such as these appears promising. However, as noted above, the ADB has indicated that there is only limited potential for increasing fully irrigated areas either through pumps or gravity-fed systems (Nesbitt 1997).

In assessing possibilities for irrigation rehabilitation, Halcrow (1994) notes the importance of good soil quality and water availability to the economic potential of an irrigation project. Although special soil and water management techniques can allow for improvements in yield where soil quality is poor, it is more likely that irrigated cultivation of paddy rice and other crops on poor quality soils will bring low or very low yields. Therefore, the study concludes that areas with poor soil quality should not be supported for cost-effective irrigated development. More recent soil quality studies have found that the soils of about 50 percent of Cambodia's cultivated area are poor quality with low potential for yield improvements (White *et al.* 1997a). This suggests that expanding irrigation in at least half of Cambodia's cultivated area is likely to be uneconomic.

In addition to physical constraints on irrigation potential, it is also important to note that effective long-term management of larger scale irrigation systems requires a significant level of co-operation and organisation among farmers. Such farmer associations and/or water user groups play a crucial role in establishing guidelines and rules for use, management, and maintenance of an irrigation system. Because farmer associations and water user groups are not common in Cambodia, establishing new irrigation systems will likely require significant efforts to organise farmer groups.

As of 2001, approximately 35 irrigation schemes had been identified/proposed for Cambodia, most of which are small to medium in scale. These include both new projects and improvements of existing systems. If all of these irrigation projects were implemented, it would roughly double the area of irrigated crops in Cambodia, and increase the total cultivated area by about 500,000 ha, or close to 20 percent (Urwin and Wrigley 2001).

2.11.2. Develop Diversified Agriculture and Agro-Processing

Agricultural development in Cambodia has thus far focused primarily on increasing rice production to ensure food security. While there has been considerable success in increasing rice production over the past decade, government statistics on vegetable and other crop production suggest little growth. Increased production of these crops could improve food security, health and nutrition, and farmer income. Development of diversified agriculture could spread food production out within a crop year, thereby "smoothing out" seasonal fluctuations in food supply (and prices). In addition, such production might increase the use of post-harvest processing facilities, making investments in such facilities more economically attractive (Ministry of Planning 2001). Growth in small-scale agro-processing would create higher value-added products, improve quality and opportunities for product marketing, and generate employment opportunities.

As noted above, vegetable and other crop production is constrained in many rice-growing areas of Cambodia due to waterlogging problems during the wet season and/or lack of water availability during the dry season. However, even in these areas it appears that small-scale diversified farming can improve farmers' livelihoods. For example, a small-scale study conducted in Svay Rieng comparing farmers who focus mainly on rice production to those who have developed more diversified farming approaches found that diversified farms typically generate significantly more income for farmers (Prom 1999).

2.11.3. Improve Rice and Vegetable Varieties

Across Cambodia's rice ecosystems, there are approximately 2,000 different rice seed varieties. Since 1987, the Cambodia-IRRI-Australia Project (CIAP) has developed and released 34 improved local and modern high-yielding rice varieties through the Varietal Recommendation Committee of Cambodia.[12] Thus far, only IR66 has gained widespread

[12] CIAP's responsibilities were transferred to the Cambodian Agricultural Research and Development Institute (CARDI) in 1999.

acceptance among farmers; as noted above, it is now cultivated in about 90 percent of dry season rice areas. Although improved local and modern high-yielding varieties (HYVs) can bring increased yields, farmers may not be adopting HYVs in some cases due to marketing problems. Domestic rice consumers generally prefer the taste and texture of traditional varieties. For example, farmers in the provinces of Takeo, Svay Rieng, and Prey Veng, where most HYVs are cultivated, report that they do not want to eat IR rice because it is "hard and tasteless" (Sok *et al.* 2001). HYVs are generally grown for sale and export, not household consumption. Despite these problems, HYVs are likely to continue making an important contribution to increasing rice yields and overall rice production in the future.

Local vegetable varieties in Cambodia are generally considered to produce low yields. Part of the problem is seed quality. Although many farmers prefer imported seeds (especially hybrid varieties) that typically come from Vietnam and Thailand, quality control of these seeds is limited. Thus, farmers are often faced with either producing their own seeds from local varieties or purchasing imported seeds despite concerns about their quality. Cambodia has two government institutes focused on vegetable production issues and seed research (Kbal Koh and Prasot), but these are limited programmes that have difficulty meeting the significant seed and service demands of vegetable farmers.

2.11.4. Improve Efficiency of Fertiliser and Pesticide Use

In an effort to improve their livelihoods through higher agricultural yields, Cambodian farmers have increasingly turned to the application of chemical fertilizers and pesticides, but some may be over-using these inputs. Such over-use unnecessarily increases input costs, thereby reducing profit. In addition, over-use and improper application can result in health problems for farmers, damage to fisheries, and contamination of drinking water. For example, a recent study conducted in two villages of Takeo province indicates that a large proportion of farmers may currently apply chemical fertilisers in amounts exceeding the levels recommended by CIAP and approved by MAFF (Table 2.10). The failure by most farmers to apply appropriate amounts of chemical fertiliser appears to be due to a lack of agricultural training, limited information on soil types and recommended application ranges, and the inability of farmers to understand fertiliser product label instructions written in foreign languages (*Mary et al.* 2001).

Table 2.10: Chemical Fertilizer Application Amounts Compared to the Recommended Range, in Prey Sva and Prey Tamao Villages, Takeo Province, 1999-2000 Wet and Dry Seasons

Level of Application	% of Farmers in Prey Sva		% of Farmers in Prey Tamao	
	Wet season	*Dry season*	*Wet season*	*Dry season*
Below the recommended range	9%	29%	57%	43%
Within the recommended range	38%	47%	29%	21%
Above the recommended range	53%	24%	14%	36%

Source: Mary et al. 2001

The World Health Organization has classified pesticides by toxicity/hazard into Class I, II, and III with those in Class I considered the most toxic. Many countries including Cambodia have banned the use of pesticides classified as Ia or Ib.[13] Nonetheless, use of banned pesticides remains common in Cambodia. A recent study conducted by CEDAC in six provinces around the Great Lake indicates that a high level of trade in banned pesticides continues (Yang Saing 2001). Likewise, Mary *et al.* 2001 estimates that banned pesticides represented about 15-30 percent of those applied during the wet season and approximately 35-50 percent of those applied during the dry season for two villages in Takeo province. As with chemical fertilisers, the reasons for use of banned pesticides and improper application

[13] Class Ia and Ib pesticides are banned in Cambodia under the Sub-decree on Standards and Management of Agricultural Materials of 1998.

methods appear to be a lack of information about which pesticides are banned, a lack of training, and inability to read pesticide instruction labels written in foreign languages.

Rather than more efficient use of chemical fertilisers and pesticides, some programs promote approaches for improving yields with little or no use of such inputs. Approaches include integrated pest management (IPM) and the system of rice intensification (SRI). IPM is an ecosystem-based strategy that focuses on prevention and reduction of pest problems through management techniques such as pest habitat manipulation and use of resistance varieties. Pesticides are used only after monitoring indicates they are needed according to established guidelines, and treatments are made with the objective of removing only the target pests. Pest controls are applied in a manner to minimise risks to human health, beneficial and non-target organisms, and the environment.

SRI involves the implementation of improved plant, water, soil, and nutrient management techniques. According to CEDAC, 500 farmers have adopted SRI in Cambodia. They can increase their yields from 1-2 tons/ha to as much as 3-6 tons/ha. SRI is being implemented in several countries around the world with reports of doubling and tripling of yields.[14] Despite its promise, farmer adoption of SRI in some areas where it has been promoted has been low due its intensive labour requirements (Moser and Barrett 2002).

2.11.5. Reduce Post-Harvest Losses and Marketing Costs

Post-harvest losses for rice, vegetables, and other crops are significant in Cambodia due to a range of problems with processing, storage, transport, and marketing. For example, due to inefficient and outdated rice milling technology in most villages, white rice recovered after milling averages only about 53 percent of paddy weight. In well-managed modern mills it is possible to recover 70 percent of paddy weight (Rickman *et al*. 2001). Rice storage losses can be high due to an inability to control moisture, contamination, and pest problems, and transport losses often occur because of poor packaging and handling. Although less information is available on post-harvest losses for vegetables and other crops, losses may be considerable because vegetable quality tends to deteriorate rapidly after harvest. Ungsa and Hean (1994) found that post-harvest losses for vegetables in Kandal province were about 17 percent due to poor storage and packaging methods.

Post-harvest losses are exacerbated by a weak marketing infrastructure that does not efficiently support the transfer of agricultural goods from producers to consumers. Problems include a lack of marketing information and credit services in rural areas, poor transportation infrastructure and high fuel costs, and informal fees reportedly collected at checkpoints along the road network. The costs associated with these problems add to consumer costs, reduce producer/farmer prices, and decrease incentives for trade (including to rice-deficit areas). In addition, marketing costs reduce potential exports of Cambodia's rice surplus (Sok *et al*. 2001, Ministry of Commerce 2001).

2.11.6. Increase Agricultural Support Services

Agricultural support and extension services in Cambodia remain weak or not yet established. Resource and capacity limitations constrain the ability of government-sponsored extension programs to spread technical information in the countryside. Presently, important farming information, such as improved production and post-harvest techniques, market demand and prices, quality requirements, and new varieties, is typically conveyed through informal channels, such as neighbouring farmers, distributors of farm products, and NGOs, if at all. In light of resource constraints for agricultural extension services, it is critical that future

[14] SRI has been introduced in Madagascar, Cambodia, Philippines, China, Indonesia, Sri Lanka, and Bangladesh.

extension efforts work with farmer associations, groups, and cooperatives to the extent possible to increase the efficiency of information dissemination.

Although improvement of publicly financed agricultural services is needed, this effort should be careful not to "crowd out" or reduce incentives for private sector initiatives and services. For example, through farmer training and incentives for improved quality, a private investor in corn production for animal feed was able to lower the rejection rate of corn grown under contract from 80 percent to 10-15 percent in four years. Likewise, another private investor is seeking to produce high quality fragrant rice for export through combined investments in contract farming, extension and input supply services, and a new rice mill. The investor is contracting with 30,000 farmers to produce the rice using high quality seeds (Ministry of Commerce 2001). Such private sector initiatives can play an important role in transferring skills, technology, and information to farmers in the future.

2.12. Conclusions and Recommendations for Research

Agricultural development will continue to be essential to improving rural livelihoods in Cambodia for the foreseeable future. Trends in agricultural production over the past decade suggest that significant yield and production improvements are possible, but a range of physical, technical, and socio-economic constraints need to be overcome. Of particular concern, there appears to be low potential for yield increases across approximately 50 percent of Cambodia's cultivated areas due to soil quality problems. Improving water availability and management will also be critical to improving and diversifying future production. This will require the identification of viable and cost-effective areas for expansion/improvement of irrigation that do not threaten fisheries or the availability of drinking water.

The vast majority of research on agriculture in Cambodia has focused on rice production, often with the objective of supporting improvements in Cambodia's rice yields (2.1 tons/ha) to the levels of its neighbours Thailand (2.3 tons/ha) and Vietnam (4.3 tons/ha). As Cambodia seeks appropriate models for rice production development, much can be learned from the experiences of its neighbours about the linkages and trade-offs among production, profit, and food security. Presently, rice production in Cambodia most resembles that of Thailand in terms of rice ecology, average yield, dominance of traditional varieties, and amount of irrigated area. But government agricultural policy tends to focus on increasing rice production in a manner similar to the Vietnamese approach – increasing irrigation, adopting high-yielding varieties, expanding cultivation and double-cropping where possible. As noted above, it is not the purpose here to suggest that either the Thai or Vietnamese model is necessarily appropriate for Cambodia, only to suggest that different rice production approaches can have varying impacts on farmers' profits and food security. The advantages and disadvantages of these approaches deserve more debate in future agricultural policymaking.

Agricultural data tend to be more comprehensive and reliable for rice than for other food production and related activities. Despite recent calls for more diversified agriculture and increased agro-processing and trade, there remains a dearth of research-based information on current practices, constraints, and opportunities in these areas. Likewise, government promotion of large-scale agricultural concessions deserves closer scrutiny to determine potential benefits and costs to rural livelihoods, especially in light of information suggesting that 64 percent (16 out of 25) of the operating concessions are currently having problems with protests and/or land encroachment from local people.

With about 75 percent of the labour force employed in agriculture, there is wide consensus among agricultural policymakers that future poverty reduction will greatly depend on the success of agricultural development. To be effective, this agricultural development will need to be underpinned by sound policymaking based on reliable data and credible research. In addition to technical research on issues such as water and soil management, irrigation

potential, rice and vegetable varieties, and so on, there is also a strong need for more socio-economic research on how proposed directions for agricultural development might affect rural livelihoods. In particular, greater study is needed of the linkages between agricultural production/expansion, diversification of crops, and processing strategies and the government's wider objectives of rural development and poverty reduction. Although not exhaustive, a number of possible areas for future socio-economic research are described below.

a) What are the main reasons that Cambodian vegetables and other crops often do not compete well with imports from neighbouring countries?

Small-scale studies suggest roughly 25-50 percent or more of vegetables consumed in Cambodia are imported, primarily from Vietnam and Thailand. As Cambodian farmers increasingly move beyond subsistence farming (to meet food security needs) and begin to cultivate crops for market, they will need to compete with imports. Policies calling for more diversified agriculture and greater production of vegetables and other crops may be well-reasoned, but in practice it is not currently clear why some Cambodian farmers are able to compete with imports while others cannot. Overcoming technical barriers to diversified agriculture is only one of the challenges for Cambodian farmers, they must also make a return on their crops or they will not continue growing them. To improve understanding about the competitiveness of Cambodian vegetable and other crop production relative to neighbouring countries, possible research questions include:

- What are the main constraints on vegetable and other small-scale crop cultivation?
- What are the costs of production in Cambodia compared to neighbouring countries? Which costs are significantly higher in Cambodia and how might they be reduced?
- What policy initiatives might improve the competitiveness of domestic vegetable and other crop production?

b) What is the short-term and long-term potential for improving value-added processing capabilities and marketing, and how might such changes affect rural livelihoods?

Recent studies of current practices and challenges for rice milling/processing, trade, and export have provided vital new information for policymakers as they seek to improve agricultural development. Similar studies of processing, trade, and export are needed for other important food crops, such as vegetables, maize, soybeans, and mung beans.

- How do various food crops contribute to farmer incomes? How does the farm gate price compare to the market price? What proportion of the profit margin accrues to various participants in the food crop trade (farmers, traders, processors, retailers, exporters, etc.)?
- How are different food crops currently processed and what opportunities exist for more small-scale value-added processing?
- How and where are food crops traded? Who is involved in this trade? Is this trade free and competitive or is it constrained in some manner such as collusive/monopolistic trading networks or licenses and permits?
- Which food crops are exported (formally and informally)? Do these food products receive further value-added processing after export? What are the opportunities for initiating these value-added processes in Cambodia?

c) What is the appropriate role for concessions in Cambodia's overall agricultural development? How effective are agricultural concessions in improving rural livelihoods?

For several years the government has been promoting investments in agricultural concessions as a means to increasing agricultural production and exports. Presently, 40 agricultural concessions encompassing more than 800,000 ha have been approved by the Council of Ministers, of which 25 concessions covering an area of about 720,000 ha hold the necessary contracts with MAFF. Despite the large role of agricultural concessions in development policy, there is little information on their actual effectiveness in improving rural development. Key research questions include:

- What are the costs, benefits, efficiencies, and impacts of increasing the scale of agricultural operations to large-scale concessions? How does this "scaling up" compare to contract farming approaches involving numerous small farmers?
- What is the process for determining how and where agricultural concessions will be granted? How does this process compare to the process required for awarding forest concessions, especially in terms of public competitive bidding, environmental and social impact assessments, and management planning requirements? How much government revenue (formal and informal) is raised through agricultural concession leases and fees and how is this revenue used to meet rural development objectives?
- How do agricultural concessions affect rural development? What benefits do they provide, such as employment in operations and/or support of processing and marketing facilities? How have agricultural concessions affected natural resource access and use by the surrounding rural population?
- In light of the government's rural development and poverty alleviation goals, on what basis or by what general criteria should agricultural concessions be granted, retained, or cancelled in favour of other types of management?

d) How are conflicts over agricultural concessions currently settled and what can be done to improve conflict resolution mechanisms? More importantly, what steps can be taken to reduce the potential for conflict in the first place?

According to MAFF, 16 of the 25 operating concessions currently have problems with protests and/or land encroachment from local people. Local people complain of severe impacts to their livelihoods due to loss of land and restricted access to natural resources. Likewise, several concessionaires complain that they cannot move forward with their operations and may abandon their investments. In addition to these problems, this atmosphere of conflict will likely dampen the interest of other potential investors in agricultural concessions. A better understanding of the roots of conflict over agricultural concessions is needed. This would provide a basis for improving concession granting/implementation processes in a manner that takes into account all stakeholder interests and reduces the potential for conflict. In addition, more study is needed of the mechanisms for resolving conflicts when they arise.

- What is the formal process for resolving agricultural concession disputes according to the Land Law and relevant sub-decrees and regulations? Who is involved and what is their role? How are conflicts over agricultural concessions typically resolved in practice?
- What relevant lessons and models for dispute resolution of agricultural concession conflicts might be drawn from the experiences of other countries? What steps might be taken before granting concessions to try to reduce the potential for conflict?

- In what ways might the conflict resolution process be improved? Is there an appropriate role for the recently elected commune councils to play in conflict resolution?

References

Ahlers, R. and S. Vlaar (1995), *Up to the Sky: A Study on Gender Issues in Irrigation in Cambodia in the Provinces of Takeo and Prey Veng,* (Phnom Penh: SAWA)

Bui, B. B. (2000), "Bridging the Rice Yield Gap in Vietnam", in Papdemetriou, M.K., F. J. Dent, and E. M. Herath (eds.), *Bridging the Rice Yield Gap in the Asia-Pacific Region* (Bangkok: FAO)

Cambodia Development Resource Institute (2002), "Main Economic Indicators," (Phnom Penh: CDRI, raw data provided by the Ministry of Economy and Finance)

Cameron, B. (1995), *Fertilizer Supply and Quality in Cambodia*, (Phnom Penh: MAFF and Australia Agricultural Assistance Project)

Cameron, B, and P. Twyford-Jones (1995), *Development of the vegetables in Cambodia*, (Phnom Penh: MAFF)

Catalla, R.F., N. Shams, and S. Vignola (2001), "Gender, Sustainable Agriculture and Food Security in Cambodia – An Overview of the Literature" in *Cambodian Journal of Agriculture*, Vol. 4 (Phnom Penh: Cambodian Society of Agriculture)

Center for National Policy (1996), *Fertilizer Sector Policy Issues*, (Phnom Penh: MAFF)

Chan S., S. Tep, and S. Acharya (2001), *Land Tenure in Cambodia, a Data Update,* (Phnom Penh: CDRI Working Paper No. 19)

Chandler, D.P. (1993), *A History of Cambodia*, (Colorado: Westview Press, Second Edition)

FAOSTAT (2001), "Rice Production: General Information and Statistics" (4/6/2001), (www.fao.org/ag/AGP/AGPC/doc/riceinfo/Asia.htm)

Frings, V. (1993), *The Failure of Agricultural Collectivisation in the People's Republic of Kampuchea (1979-1989)*, The Center of Southeast Asian Studies, Working Paper 80 (Victoria, Australia: Monash University)

Fujisaka, S. (1988), "Rice Agroecosystems, Farmer Management, and Social Organization in Kampuchea: Preliminary Assessment and Research Recommendations", *IRRI Research Paper Series*, no. 136, (Manila: International Rice Research Institute)

Halcrow & Partners Limited (1994), *Irrigation Rehabilitation Study in Cambodia: Inventory & Analyses of Existing Systems: Volume 1 – Main Report*, (Phnom Penh: Mekong Secretariat)

Helen Keller International Cambodia, "Round 1: July-September 1999 – Monitoring activities in village model gardens and household gardens," in *Multi-Benefit Food and Health Model Program*, Year 1, Issue 1, March 2000 (Phnom Penh: Helen Keller International Cambodia).

Helmers, K. (1997), "Rice in the Cambodian economy: past and present", in Nesbitt, H.J. (ed.), *Rice Production in Cambodia,* (Phnom Penh: Cambodia-IRRI-Australia Project)

Jahn, G., C. Pol, S. Pheng, B. Khiev, and N. Chhorn (1999), *Pest Management and Rice Production Practices of Farmers in Upland and Deepwater Rice Ecosystems of Cambodia*, (Phnom Penh: Cambodia-IRRI-Australia Project)

Jahh, G., B. Khiev, S. Pheng, and C. Pol (1997), "Pest management in rice", in Nesbitt, H.J. (ed.), *Rice Production in Cambodia,* (Phnom Penh: Cambodia-IRRI-Australia Project)

Jahn, G., S. Pheng, B. Khiev, and C. Pol (1996), *Farmers' Pest Management and Rice Production Practices in Cambodian Lowland Rice*, (Phnom Penh: Cambodia-IRRI-Australia Project)

Javier, E. L. (1997), "Rice ecosystems and varieties", in Nesbitt, H.J. (ed.), *Rice Production in Cambodia,* (Phnom Penh: Cambodia-IRRI-Australia Project)

Kupkanchanakul, T. (2000), "Bridging the Rice Yield Gap in Thailand", in Papdemetriou, M.K., F. J. Dent, and E. M. Herath (eds.), *Bridging the Rice Yield Gap in the Asia-Pacific Region* (Bangkok: FAO)

Lando, R.P. and S. Mak (1994a), "Rainfed Lowland Rice in Cambodia: A Baseline Survey", *IRRI Research Paper Series*, no. 152, (Manila: International Rice Research Institute)

Lando, R.P. and S. Mak (1994b), "Deepwater Rice in Cambodia: A Baseline Survey", *IRRI Research Paper Series*, no. 153, (Manila: International Rice Research Institute)

Mary C., K. Vann, and V. Sun (2001), *A Survey on Environmental and Health Effects of Agrochemical Use in Rice Production in Takeo Province, Cambodia* (Singapore: EEPSEA)

Maclean, M. (1998), *Livestock in Cambodian Rice Farming Systems*, (Phnom Penh: Cambodia-IRRI-Australia Project)

Ministry of Agriculture, Forestry and Fisheries (2001), *Agricultural Statistics 2000-01*, (Statistics Office: MAFF)

Ministry of Agriculture, Forestry and Fisheries (2000), *Agricultural Statistics 1999-00* (Statistics Office: MAFF)

Ministry of Agriculture, Forestry and Fisheries (1999), *Agricultural Statistics 1998-99* (Statistics Office: MAFF)

Ministry of Agriculture, Forestry and Fisheries (1995), *Report on the Pilot Livestock Sample Survey Conducted in Takeo, Kandal and Prey Veng Provinces,* (Phnom Penh: MAFF)

Ministry of Commerce (2001), *Integration and competitiveness study-Part C: Sector studies-rice, diversified agriculture, handicrafts, fisheries, garments, tourism, labour services,* (Phnom Penh: Ministry of Commerce)

Ministry of Commerce (2000), *Cambodia Opportunities for the New Millennium: Business and Investment Handbook 2000*, (Phnom Penh: Ministry of Commerce)

Ministry of Planning (2001), *(Draft) Second Five Year Socioeconomic Development Plan 2001-2005*, (Phnom Penh: Ministry of Planning)

Moser, C. M., and C. B. Barrett (2002), *(Draft) The System of Rice Intensification in Practice: Explaining Low Farmer Adoption and High Disadoption in Madagascar*, (Ithaca, NY: Cornell University)

Murshid, K. A. S. (1998), *Food Security in an Asian Transitional Economy: The Cambodian Experience*, (Phnom Penh: CDRI Working Paper No. 6)

Mysliwiec, E. (1988), *Punishing the Poor: the International Isolation of Kampuchea*, (Oxford: OXFAM)

Mysliwiec, E. (1987), *Kampuchea: The State of Agriculture and Outlook for the Future"*, MPS (Agriculture) Thesis, (Ithaca, NY: Cornell University)

National Institute of Statistics (2001), *Cambodia Statistical Yearbook 2000,* (Phnom Penh: Ministry of Planning)

National Institute of Statistics (2000), *General Population Census of Cambodia 1998* (Phnom Penh: Ministry of Planning)

Nesbitt, H.J. (1997), "Constraints to rice production and strategies for improvement", in Nesbitt, H.J. (ed.), *Rice Production in Cambodia,* (Phnom Penh: Cambodia-IRRI-Australia Project)

Nesbitt, H.J. and P. Chan (1997), "Rice-based Farming systems", in Nesbitt, H.J. (ed.), *Rice Production in Cambodia,* (Phnom Penh: Cambodia-IRRI-Australia Project)

NGO Forum (2002), "Contribution to the NGO submission to the Consultative Group Forestry Sector", (Phnom Penh: NGO Forum)

Norris, C., S. El, and S. Uy (2001), *Gender Analysis of Rice Technologies Developed by the Cambodia-IRRI-Australia Project (CIAP)*, (Phnom Penh: CIAP)

Pillot, D., C. Fusillier, A. Pouliquen, N. Morel, and K. Yang Saing (2000), *Scenarios for the Rural Sector of Cambodia and the Agricultural Education system: Part 2- Farming Systems in Cambodia and Their Evolution,* (Phnom Penh: Ministry of Agriculture, Forestry and Fisheries)

Prom, T. (1999), *"Assessment of Diversified Farming in Chrot Motes Commune, Svay Teap District, Svay Rieng Province, Cambodia"*, Msc. Thesis (Thailand: Asian Institute of Technology)

Ramamurthy, B., B. Sik, P. Ronnas, and H. Sok (2001), *Cambodia 1999-2000: Land, Labour and Rural Livelihood in Focus* (Phnom Penh: CDRI Working Paper No. 21)

Rickman, J. F., B. Som, S. Poa, and P. Meas (2001), "Rice milling in Cambodia", in Cox, P. and C. Ros (eds.), *The Impact of Agricultural Research for Development in Southeast Asia*, (Phnom Penh: Proceedings of an International Conference at CARDI, 24-26 October 2000)

Roberts, M.S., (1998), *Groundwater Irrigation in the Cambodian Mekong Delta,* Msc. Thesis, (Ithaca, NY: Cornell University)

Royal Government of Cambodia (2000), *Sub-Decree on the Forest Concession Management,* (Phnom Penh: RGC No. 05 ONKR-BK)

Shams, N., H. Try, and D. Gutierrez (2000), "A Review of Vegetable Pest Management in Cambodia", in *Cambodian Journal of Agriculture*, Vol. 3 (Phnom Penh: Cambodian Society of Agriculture)

Shams N., M. Ungsa, P. Yech, S. Sodavy, S. Nuth, and H. Try (1997), *Review of Vegetable Production in Cambodia,* (Phnom Penh: MAFF).

Shawcross, W. (1979), *Sideshow: Kissinger, Nixon, and the Destruction of Cambodia,* (New York: Simon and Schuster)

Sik, B. (2000), *Land Ownership, Sales and Concentration in Cambodia: A Preliminary Review of Secondary Data and Primary Data from Four Recent Surveys,* (Phnom Penh: CDRI Working Paper No. 16)

So, S., S. Real, U. Uch, R. Sy, B. Ballard, and S. Acharya, (2001), *Social Assessment of Land in Cambodia, a Field Study,* (Phnom Penh: CDRI Working Paper No. 20)

Sok H., H. Chea, B. Sik (2001*), Cambodia's Annual Economic Review 2001,* (Phnom Penh: Cambodia Development Research Institute)

Tichit, L. (1981), *L'agriculture au Cambodge,* (Paris: Agence de Coopération Culturelle et Technique)

Ungsa, M. and V. Hean (1994), *Vegetable Production, Research and Policy: Country Report,* (Phnom Penh: Department of Agronomy)

Urwin, N. and T. Wrigley (2001), *Environmental Impact Assessment of the Cambodia-IRRI-Australia Project (CIAP),* (Phnom Penh: Cambodia-IRRI-Australia Project)

White, P.F., T. Oberthur, and S. Pheav (1997a), "Soils and Rice", in Nesbitt, H.J. (ed.), *Rice Production in Cambodia*, (Phnom Penh: Cambodia-IRRI-Australia Project)

White, P.F., T. Oberthur, and S. Pheav (1997b), *The Soils Used for Rice Production in Cambodia: A Manual for their Identification and Management,* (Philippines: International Rice Research Institute)

Yang Saing, K. (2001), *Pesticide Use in Tonle Sap Region,* (Phnom Penh: CEDAC) (in Khmer)

Yang Saing, K. (1998), *Sustainable Agriculture Country Profile: Cambodia,* (Phnom Penh: CEDAC, PAN and RUA)

Yang Saing, K. (1996), *Sustainable Agriculture Development Strategies for Cambodia (Draft).* (Phnom Penh: JVC-RUA)

Young, D., R. Raab, R. Martin, S. Sin, B. Leng, B. Abdon, S. Mot, and M. Seng (2001), *Economic Impact Assessment of the Cambodia-IRRI-Australia Project,* (Phnom Penh: Cambodia-IRRI-Australia Project)

Zaman, A. (2000), *Hand Book for Home Gardening in Cambodia: The Complete Manual for Vegetable and Fruit Production (Draft),* (Phnom Penh: Helen Keller International Cambodia)

Chapter 3
Fisheries

Cambodia's inland waters play a critical role in rural livelihoods by supporting some of the most productive freshwater fisheries in the world, providing sources of drinking water and irrigation, and supporting waterway transportation.[1] The abundance and variety of rivers, lakes, and wetlands in Cambodia support a rich diversity of aquatic life including more than 500 fish species. Nearly any species large enough to be caught by standard fishing gear is used for human consumption, feed for domesticated animals, or feed in fish-raising activities (Rainboth 1996).

This section examines the current status of Cambodia's inland and coastal fisheries, with a focus on inland fisheries because of their greater role in supporting rural livelihoods. Information is provided on fish stocks and annual catch, the importance of fisheries to rural livelihoods, the status and challenges of fisheries management, cross-sector impacts to fisheries, and fish marketing and trade issues. A number of potential areas for future research are then suggested based on an assessment of research gaps and needs.

3.1. Main Fishing Areas

Approximately 85 percent of Cambodia lies within the Mekong River basin. From June to October each year, wet season flooding of the Mekong River and its tributaries creates an extensive wetland ecosystem. Thousands of square kilometers of floodplain forests and shrublands are temporarily submerged, allowing fish to access abundant food resources and habitat. This is especially the case around the Great Lake, where the surface area increases during the wet season by four to six times its dry season size, from 2,500-3,000 km^2 to about 10,000-15,000 km^2 (Csavas 1994, Rainboth 1996, NEDECO 1998). The Great Lake varies from 1-2 meters in depth in the dry season to 8-10 meters in the wet season.

This striking increase in the Great Lake's surface area and depth occurs in large measure because the rapid rise of the Mekong River during the wet season causes the Tonle Sap River, flowing from the Great Lake to Phnom Penh, to reverse direction. Estimates suggest that the Mekong River is the source for approximately 62 percent of the Great Lake's wet season volume, with the remaining 38 percent coming from the Great Lake's own catchment (NEDECO 1998).

[1] Inland waters include all surface and underground water not associated with the sea (thus estuaries and coastal lagoons are excluded). These resources may be permanent or temporary and include rivers, streams, lakes, ponds, wetlands, inundated forest, flooded rice fields, irrigation canals and dikes, floodplains, and aquifers.

[Map 3.1 – Fishing Lots of Cambodia]

As shown in Map 3.1, Cambodia's main inland fisheries can be divided into three ecosystems:

- **Great Lake and Tonle Sap River zone**, which provides the richest fishing areas, includes the provinces of Kompong Chhnang, Pursat, Battambang, Banteay Meanchey, Siem Reap, Kompong Thom, and Kandal north of Phnom Penh.
- **Mekong and Tonle Bassac River zone** includes the provinces of Kandal south of Phnom Penh, Kompong Cham, Takeo, Prey Veng, and Svay Rieng.
- **Upper Mekong River zone**, which is considered less significant for commercial fisheries but important in its support for migratory species and subsistence fishing, includes the provinces of Kratie and Stung Treng (Ahmed *et al*. 1998).

In addition to these inland fisheries, Cambodia has a 435-km coastline that runs along the provinces/towns of Koh Kong, Sihanoukville, Kampot, and Kep.[2] The coastline comprises beaches, mangrove forests, coral reefs, and seagrasses that support a range of marine life. Cambodia's coastal waters include a 55,600-km^2 area known as the Exclusive Economic Zone (EEZ) that reaches from the shoreline to 200 nautical miles offshore. However, the demarcation of the EEZ remains a subject of territorial dispute with Vietnam and Thailand.

3.2. Fish Stocks and Annual Catch Levels

Fish catch statistics have never been quantified well in Cambodia. Up until the 1980s, only occasional descriptions of fish catch are available, but no meaningful data exist upon which an analysis of changes in fish catch over time could be undertaken. From 1981-1995, the Department of Fisheries (DoF) estimated an inland fish catch in the range of 50,000 to 75,000 tons per year, but these statistics are problematic for several reasons. First, most of the catch by small-scale fishers is not reflected in national statistics. Second, fishing statistics only reflect fish production for the 13 provinces (including Phnom Penh) where DoF has licensing and leasing systems. No data are collected in Cambodia's other 11 provinces/towns (Ahmed *et al.* 1998). Third, weak and inappropriate data collection systems have resulted in significant underreporting of catches from commercial fisheries. For example, reported statistics are typically based on planned figures rather than a representative sample of actual catches (Van Zalinge *et al*. 2000).

To develop a more realistic estimate of Cambodia's total annual inland fish catch from 1994-97, Van Zalinge *et al*. (2000) combined data from a number of studies of fish catch and consumption across large-, medium-, and small-scale fisheries, and ricefield fisheries. Sources for these data included catch assessment surveys by the Project for the Management of the Freshwater Capture Fisheries of Cambodia (MRC/DoF/Danida), socio-economic household surveys carried out by Ahmed *et al.* (1998), and ricefield fisheries research by Gregory (1997). The combination of these estimates suggests an annual inland fish catch of approximately 290,000 to 430,000 tons (Table 3.1), making Cambodia's inland fisheries the most productive in the region and fourth most productive in the world (Van Zalinge *et al*. 2000). The Great Lake and Tonle Sap River area is known to be Cambodia's richest fishing grounds, producing perhaps 50-60 percent of Cambodia's inland commercial fish catch according to government statistics (NEDECO 1998, Ahmed *et al*. 1998). Due to the scarcity of fisheries catch data in Cambodia, however, all of the above-mentioned fish catch estimates should be viewed as indicative but not precise.

Large-, medium-, and small-scale fishing are categories defined by law and used by the DoF in fisheries management. Large-scale and most medium-scale fishing is for commercial

[2] According to the *General Population Census of Cambodia 1998*, administrative areas in Cambodia include 20 provinces, one province/municipality (Phnom Penh), and three "krong" or towns (Sihanoukville, Kep, and Pailin).

purposes, whereas small-scale fishing supports subsistence. These categories are described in more detail below (see "3.6. Current Management of Fisheries"). The category of ricefield fisheries refers to the harvest of fish and other aquatic resources, such as crabs, shrimps, and frogs, from rice paddies. At the onset of flooding, fish are caught as they leave dry season refuges and migrate into newly inundated areas including rice paddies. As waters recede during the dry season, fish are caught as they migrate out of rice paddies back to deeper waters (Gregory 1997).

DoF statistics for marine fisheries indicate an annual catch of about 30,000 tons, but this estimate is likely much lower than the actual annual catch. DoF catch figures are based on the estimated catch of fishing gears that have been taxed. Rather than trends in the marine fish catch, DoF statistics may better reflect the effectiveness of DoF tax collection. The current method of estimating marine fish catch does not include foreign boats that land their catch outside of Cambodia, illegal commercial boats, and small-scale fishers (Smith 2001).

Table 3.1: Annual Inland Fish Catch in Cambodia from 1994 to 1997

Type of Fishery	Annual Catch Range (tons)
Large-scale fisheries	
Fishing Lots[1]	25,000 – 75,000
Dais (bagnets)[2]	14,000 – 16,000
Medium-scale fisheries[3]	85,000 – 100,000
Small-scale (family) fisheries[3]	115,000 – 140,000
Ricefield fisheries[4]	50,000 – 100,000
Total	289,000 – 431,000

[1] Range reflects uncertainty in annual catch levels.
[2] Range shows approximate minimum and maximum values in 1994-98.
[3] Minimum estimates based on findings for fish catch of medium- and small-scale fishers representing 2.4 million people (Ahmed et al. 1998). Maximum estimates reflect extrapolation to entire country.
[4] Approximately 1.8 million ha of ricefield fisheries multiplied by the likely range of fish yields of 25-62 kg/ha. Estimate of 25 kg/ha based on a minimum figure reported from northeast Thailand by Fedoruk and Leelapatra (1992). Estimate of 62 kg/ha based on findings by Gregory (1997) in Svay Rieng. Nesbitt (1997) estimated that wet season rain-fed, lowland and deep-water rice ecosystems covered about 1.8 million ha in Cambodia in 1994-95.
Sources: Ahmed et al. 1998 and Deap *et al.* 1998 in Van Zalinge *et al.* 2000.

3.2.1. Sustainability of Annual Catch

Due to the lack of reliable fisheries statistics on fish stocks and annual catch, it is not presently possible to estimate sustainable catch levels for Cambodia's fisheries. Although estimates of total inland fish catch are higher now than anytime in the past, this is probably due to increased fishing effort and better data collection; the current catch levels are not necessarily sustainable. Anecdotal information suggests that the catch of large migratory fish species, which typically reproduce more slowly, has declined while the catch of small and fast reproducing species appears as high as ever (Van Zalinge *et al.* 2000).

In light of the trend toward increasing habitat destruction and fishing pressure, fisheries experts warn of a potential future "Bangladesh effect" – the significant reduction in fish stocks and bio-diversity to the point where fish production consists of a limited number of small, low-value species (Degen *et al*. 2000). Under this scenario, the larger, higher value fish species become a diminishing proportion of the total inland fish catch. This occurs because these fish species typically require more than a one-year cycle for reproduction, which makes them more vulnerable to fishing pressure. In contrast, the small, low-value species that reproduce within the limits of a one-year cycle are more resilient to fishing pressure and become an increasing proportion of the total fish catch. This change in the species composition reduces catch values per unit of fishing effort (Degen *et al*. 2000).

3.2.2. The Role of Aquaculture

The vast majority of Cambodia's total freshwater fish catch is from capture fisheries (i.e., harvesting of wild fish stocks). However, the role of aquaculture in fish production appears to be increasing, especially in the Great Lake (Gum 2000). Aquaculture refers to the raising of

fish and other aquatic animals. Official data on aquaculture indicate production has risen from about 9,600 tons of fish and 4,300 crocodiles in 1996 to 15,000 tons of fish and 25,380 crocodiles in 1999 (Nao and Ly 1997, NIS 2001). Most of the crocodiles were 2-3 month old juveniles sold to Thailand.

The main freshwater aquaculture strategies in Cambodia include: (a) fattening juvenile fish for market; (b) stocking surplus fish in order to speculate on market prices; and (c) small-scale, low input fish-raising for food security purposes. Thus far, only fish-raising and, to some extent, crocodile farming have proven viable in Cambodia, though long-term profitability remains in question (Gum 1998). Although there is strong interest in raising other high value aquatic animals, such as eels, frogs, shrimp, and snakes, these aquaculture efforts have not yet been successful on a significant scale and face many challenges (Nao and Ly 1997, Gum 1998).

Along Cambodia's coastline, shrimp farming developed at a rapid rate during the 1990s through investments from Thai businesses. By 1995, DoF statistics indicate that 117 licensed shrimp farms had been established in Koh Kong and Kampot Provinces, covering an area of 1,272 ha that had formerly been mangrove forest (Bann 1997). By the following year, about 70 percent of Cambodia's shrimp farms had been abandoned due to lack of profitability. The continuation of this trend resulted in the collapse of the industry by 1999. Various factors contributed to the demise of shrimp farming including poor soil quality, disease, salinity level problems, weak fertiliser response, poor pond management, and a drop in international shrimp prices (Mastaller 1999).

Salt farming is another shoreline activity that has affected coastal fisheries. Establishing salt farms involves significant conversion of mangrove forests. Mastaller (1999) estimates 3,000-4,000 ha of former mangrove areas have been converted to salt farms in Kampot and Kep. Since mangroves provide important fish habitat for breeding and nursing, their loss and degradation contribute to a decline in fisheries productivity.

3.3. Importance of Fisheries to Rural Livelihoods

As a rich common property resource, Cambodia's fisheries play a critical role in rural livelihoods by providing opportunities for households to:

- Diversify their livelihood activities and thereby "insure" against the risk of agricultural failures;
- Optimise their labour resources among different livelihood activities during different seasons;
- Access an income-generating activity with very little capital investment and no land;
- Maintain/improve nutrition, as fresh and processed fish represent a significant source of protein.

Fisheries provide food security, income, and employment for a large proportion of rural Cambodians. A survey by Ahmed *et al.* (1998) provides an indication of the importance of fishing to households located along main inland water bodies and seasonally inundated areas in Cambodia. The study's findings were representative of about 2.4 million people in 328 communes in 1995-96. Roughly 40 percent of these households, or more than 900,000 people, were found to be significantly "dependent" on fishing and/or related activities such as processing, selling, fish raising, or gear making.[3] This finding suggests that a national survey,

[3] The study defined a fishing-dependent household as one in which the household head or at least one family member was actively engaged in at least one of the above-mentioned fishing activities for most of the year.

which included other productive inland fishing areas and ricefield fisheries, would likely find well over one million people dependent on inland fisheries for their livelihoods.[4]

3.3.1. Fish Consumption and Food Security

Rice and fish are the traditional staple foods of the Cambodian diet. Fish is consumed in both fresh and processed forms throughout Cambodia, with estimates of average consumption per person varying widely from 13.3 kg to over 70 kg per year in some areas (Table 3.2). Fresh fish and processed fish also account for a significant proportion of the total animal protein consumed by Cambodians, with estimates ranging from 40 to 60 percent (Csavas 1994), to 75 percent (widely cited, for example Nao and Ly 1997, Degen *et al.* 2000), to 90 percent in fishing-dependent communes (Ahmed *et al.* 1998).[5] In light of the importance of fish to the Cambodian diet, it has been suggested that the inland fisheries of Cambodia contribute more to national food security than any other inland fisheries in the world (Van Zalinge *et al.* 2000). Information on marine fish consumption is much more limited; reports suggest that no more than 20 percent of the total marine catch is used for local consumption (Azimi *et al.* 2001).

3.3.2. Income Generation and Employment

Van Zalinge *et al.* (2000) estimate that the monetary value of Cambodia's freshwater fish catch at landing sites ranges from $100-$200 million, excluding fish production for subsistence purposes. A recent estimate of all freshwater fish production, including subsistence fishing, suggests a value of about $300 million (Jensen 2000 in Degen *et al.* 2000). In comparison, the total monetary value of paddy rice in Cambodia is roughly $350-400 million.[6]

Many rural households subsist on a combination of agricultural and fishing activities, but most view agriculture as their primary employment and fishing as a vital secondary or tertiary occupation. As a result, national statistics focused on primary employment may not adequately capture the dual importance of subsistence agriculture and fishing production for employment and income generation. For example, the *General Population Census of Cambodia 1998* estimates that 1.5 percent of the Cambodian workforce is employed in fishing compared to 75.7 percent in "Agriculture, Hunting, and Forestry."[7] Likewise, the

---

[4] No precise estimate has been developed of the coastal population dependent on marine fisheries. However, the combination of a limited coastline and low population density in coastal areas (two to three times less than the national average) suggest that the population dependent on marine fisheries is small, and certainly far less than the population dependent on Cambodia's extensive inland fisheries (Smith 2001).

[5] While fish consumption is certainly an important source of animal protein for Cambodians, there does not appear to be an original survey source for the 40-60 percent estimate or the more frequently cited 75 percent estimate. In tracing citations of the 75 percent estimate as far back as 1992, no national survey from which it might have been developed was identified. Rather, the estimate appears to have been drawn from a hypothetical example in Mekong River Commission Secretariat (1992). Gum (2000) also attempted to find an original source for the 75 percent estimate, noting a UNICEF/UN World Food Programme nutritional and poverty baseline survey conducted by Kenefick (1999). However, upon closer examination, this study also does not provide a concrete basis for the 75 percent estimate. Kenefick (1999) sought information on food consumption by children in non-randomly selected households in eight provinces; it was not intended to be a representative national study of animal protein consumption. Moreover, the survey sought information on *which* foods children had eaten on the previous day, but did not ask about the *quantity* of each item consumed.

[6] This estimate is based on a total rice harvest of about 4 million tons multiplied by an average paddy rice (farmgate) price of 350-400 riels per kg.

[7] Fishing employment is defined as "Fishing, operation of fish hatcheries and fish farms; service activities incidental to fishing".

Cambodia Socio-Economic Survey 1999 estimates that only about two percent of the workforce is employed in the "fishing sector" compared to 75 percent in the "agriculture, hunting, and forestry sectors" (NIS 2000).

Table 3.2: Estimates of Fish Consumption Per Capita in Cambodia

Average Fish Consumption Per Person (kg/year)	Time of Study	Population or Area Represented by Study	Source
21.6	1957	Cambodia	Bardach 1959
20-25	1970	Cambodia	Lagler 1976 in Csavas 1994
13.3	1991	Cambodia	Mekong River Commission Secretariat 1992 in Csavas 1994
16.0	1991	Cambodia	Department of Fisheries 1992 in Csavas 1994
25	1993	Svay Rieng province	Touch 1993 in Nao and Ly 1997
27-38	1994-97	Cambodia – based on a total catch estimate of 290,000 to 430,000 tons/year	Van Zalinge *et al.* 2000
32	1995	Upland areas in Siem Reap province	Hy 1995 in Nao and Ly 1997
71	1995	Floating villagers in Siem Reap province	
75.6*	1995-96	2.4 million people in "fishing dependent communes" of eight provinces	Ahmed *et al.* 1998
31.6 (over 7 months)	Aug 1995 - Feb 1996	Svay Rieng province – 15 households in three different villages	Gregory 1997

** Total represents 43.5 kg fresh fish, 27.5 kg fresh fish equivalent based on consumption of 14 kg processed fish, and 4.5 kg fresh fish equivalent based on consumption of 5.6 liters of fish sauce.*

In contrast, a household survey conducted by Ahmed *et al*. (1998), discussed above, collected information on primary, secondary, and tertiary employment representative of 2.4 million people living in areas located along main water bodies and inundated areas. The survey found that 36 percent of household heads were actively employed in fishing, with 9.3 percent indicating it as their primary occupation, 20.3 percent as their secondary occupation, and 6.3 percent as their tertiary occupation. Although these findings cannot be extrapolated to Cambodia as a whole, they illustrate the importance of collecting information beyond primary employment in order to provide a more complete account of the variety of employment activities supporting rural livelihoods.

3.4. Ethnicity and Gender Issues

Ethnicity plays an important and at times sensitive role in Cambodia's fisheries sector. Small- and medium-scale fishing activities tend to be organised on a kinship basis rather than through fishing associations, clubs, or co-operatives. In general, ethnic Vietnamese and Cham tend to be highly dependent on fisheries resources for their livelihoods, whereas ethnic Khmer more often rely on agriculture. It appears that few ethnic Vietnamese and Cham own agricultural land (Swift 1997, Degen and Nao 2000, Gum 2000). For example, most of the roughly 83,000 people living in floating villages on the Great Lake are ethnic Vietnamese (NEDECO 1998).

Fishing lot owners tend to be Khmer or Chinese-Khmer, but they typically hire Vietnamese master fishers to operate fishing activities within the lot (Degen and Nao 2000). Lot owners report that, in addition to being excellent fishers, Vietnamese and Cham are rarely involved in conflicts with lot owners and are more likely to purchase fishing licenses than Khmer. However, the purchase of licenses may reflect selective, discriminatory enforcement by the predominantly Khmer local authorities (Gum 2000). Widespread prejudice against Vietnamese may also play a role in where they live and fish. Degen and Nao (2000) note that Vietnamese tend to settle near police stations and military posts and rarely take extended

fishing trips or fish far from home. In contrast, Cham are known to take extended fishing trips, sometimes away from home for the entire fishing season.

Gender issues in fisheries are not well documented. In general, women are not perceived to be as involved in the fisheries sector because they do not tend to fish except for small-scale, daytime fishing. But women are very active in most on-shore activities including processing, marketing and selling, tending fish culture ponds and cages, and maintaining fishing gear. Men are often responsible for activities requiring more physical strength, such as using middle-scale fishing gear or travelling to remote locations for fishing or fuelwood collection (Ahmed *et al*. 1998, Gum 1998).

3.5. Historical Management of Fisheries

Current fisheries management in Cambodia consists of a wide array of complex formal and informal arrangements governing fishing access, rights, and practices. The roots of this management system can be traced back to the reign of King Norodom (1859-1897) and his predecessors. Under their reigns, revenue from the fishing sector was collected through the selling of user rights to fishing areas. Investors and Chinese traders purchased these fishing concessions from the King and sub-leased them to fishers, often earning twice the amount paid to the Royal Treasury. Fishing concessions would then be sub-leased multiple times, making it possible for several middlemen to earn relatively high returns for little risk and effort (Darboux *et al.* 1906 and Pétillot 1911 in Degen and Nao 2000).

The establishment of the French Protectorate in Cambodia did not significantly change the pre-existing approach to fisheries exploitation. Fisheries laws and regulations were formalised and published by the colonial administration in 1908, but the purpose of these Royal ordinances was to generate revenue for the colonial administration, not to change existing patterns of fisheries exploitation (Degen and Nao 2000).

Over the succeeding decades, no major changes occurred in the concession and sub-leasing system of fisheries management until the rise of the Democratic Kampuchea regime under Pol Pot. During this period, fishing activity was quite limited. Only a few designated "fishing units" harvested and processed fish. For the most part, fisheries resources were neglected in favour of agricultural development that involved widespread clearing of flooded forests and wetlands (Degen *et al*. 2000).

After the overthrow of the Democratic Kampuchea regime in 1979, collective fishing was encouraged until the late-1980s. During this period, Cambodia's fisheries were managed through a system of solidarity groups called "krom samaki". In practice, fisheries access was open to all in many places and the collective aspects of the system ignored, except for the delivery of specified quotas of fish products to civil servants and the military (Chheng 2000, Degen *et al.* 2000).

A fishing concession system was reintroduced in the late-1980s similar to what had existed for more than a century prior to the rise of the Democratic Kampuchea regime. This system remains the primary approach to managing fisheries to the present. The government's main motivation for a return to the concession system in the late-1980s appears to have been the need to raise revenue (Degen *et al*. 2000).

3.6. Current Management of Fisheries

DoF within the Ministry of Agriculture, Forestry and Fisheries (MAFF) has regulatory authority to manage, protect, conserve, and develop Cambodia's fisheries resources. With a staff of more than 1,500 and facilities in each province, DoF is responsible for enforcing regulations, granting concessions and issuing licenses (including to foreign boats operating in coastal waters), collecting fees, and controlling processing, trade, and export activities.

DoF obtains the majority of its revenue from fees paid for concession leases, with the remainder of revenue derived from licenses, fines, and implementation of donor and government funded projects.

Over the past decade, the DoF has raised between $1 to $4 million annually in official revenue (Ministry of Economy and Finance 2002). Local authorities may be collecting far larger amounts of informal income from fisheries (Swift 1997, Gum 1998).

The fishing concession system remains the primary means by which DoF manages Cambodia's fisheries, but reforms initiated in late-2000 are beginning to challenge and reshape this management approach. The key elements of reform have included the reduction of lot areas and promotion of community fisheries management through the development of a sub-decree on community fisheries and the establishment of a Community Fisheries Development Office within DoF. These reforms began following a speech by Prime Minister Hun Sen on 24 October 2000 in which he noted the serious conflicts between lot owners and local fishers and the need for improved fisheries management (Cambodian People's Party 2001).

Current fisheries reforms need to be viewed within Cambodia's existing legal context and traditional fisheries management practices. This section examines the legal categories for fishing, typical arrangements involved with fishing lot ownership and operation, the status of fishing lots before and after recent reforms, and the emergence of community fisheries.

3.6.1. Legal Categories of Fishing

Fisheries management in Cambodia depends on a system of rules that establish access, user rights, boundaries, authorities, and enforcement conditions. These rules are defined in the Fiat-Law on Fishery Management and Administration of 1987 and subsequent sub-decrees, declarations, and proclamations (Touch Seang 1990). At present, a new Fisheries Law is being drafted, though it appears to retain much of the rules and structure of the 1987 Fiat Law (DoF 2001a).

The basis of fisheries management is a separation between commercial and subsistence fishing. Under the Fiat-Law on Fishery Management and Administration of 1987, inland fishing is subdivided into large- and middle-scale fishing for commercial purposes and small-scale fishing for subsistence (State of Cambodia 1987). These categories are described in more detail below, with rules on fishing access, boundaries, and seasons summarised in Table 3.3.

- **Large-scale** fisheries include fishing lots and *dai* lots that have been leased out to the highest bidder for exclusive rights to commercial fishing for a two-year concession period.[8] These lots are often the most productive fishing grounds in the area. In addition to fisheries laws and regulations, the management of each fishing lot must be in accordance with its "burden book", which specifies the boundaries for exclusive fishing and "open access" areas, times of "open" and "closed" seasons, rules on allowable fishing operations, and payment conditions.
- **Middle-scale** fishing is characterised by the use of larger-scale fishing gear than family fishers, but smaller-scale than commercial fishing lot operations. The DoF requires users of this gear to obtain a license and restricts fishing to the open season but allows fishing anywhere in the public domain (i.e., outside of fishing lots and protected sanctuaries).

[8] Whereas a fishing lot encompasses a specified land and water area, a *dai* lot is an anchoring position in a river for a bagnet or stationary trawl that can be used to capture fish migrating downstream.

- **Small-scale** fishers are defined by the use of small-scale fishing gear. These fishers are allowed "open access" to fish anywhere at anytime, except within fishing lots during the open season and within protected sanctuaries. In practice, the notion of open access is erroneous since most of these fishing areas are under some type of informal ownership and management arrangement, often imposed by lot owners and powerful local interests (Degen *et al*. 2000).

Table 3.3: Legal Categories of Freshwater Capture Fisheries

Categories of Fishing	Access	Fishing Area	Fishing Season
Large-scale (Industrial fishing for commercial purposes)	Lots leased out through an auction	Inside fishing lot area, not including areas within the lot set aside for open-access fishing	October 1 to May 31 north of Phnom Penh; November 1 to June 30 south of Phnom Penh
Medium-scale (Licensed fishing for gear sizes between large- and small-scale)	Requires a license	Public fisheries domain (i.e., areas outside fishing lots, fish sanctuaries, and protected inundated forests)	October 1 to May 31 north of Phnom Penh; November 1 to June 30 south of Phnom Penh
Small-scale (Family-scale fishing for subsistence only)	Open access, no license required	Public fisheries domain and inside fishing lots during the closed season	All year

Source: Ly et al. *2000*

3.6.2. Fishing Lot Leaseholder Structure

Current lot leasing practices closely resemble historical leasing practices. The government leases out fishing lots for two-year periods to lot "owners", who may share capital costs, responsibilities, and benefits of lots with co-sharers (Figure 3.1).[9] In most cases, the lot owner and co-sharers will sub-lease areas of the lot for operation on an annual basis. In turn, areas of the lot may then be sub-leased multiple times. Leaseholders may also sell conditional fishing rights to fishers, allowing fishing within the lot for a fee or share of the catch (Chheng 1999, Ly *et al.* 2000). Lot owners may offer some area of their lots to the military in exchange for protection services (Ly *et al.* 2000). Conversely, the military or armed groups may assert control over an area and require protection money from lot owners (Gum 1998).

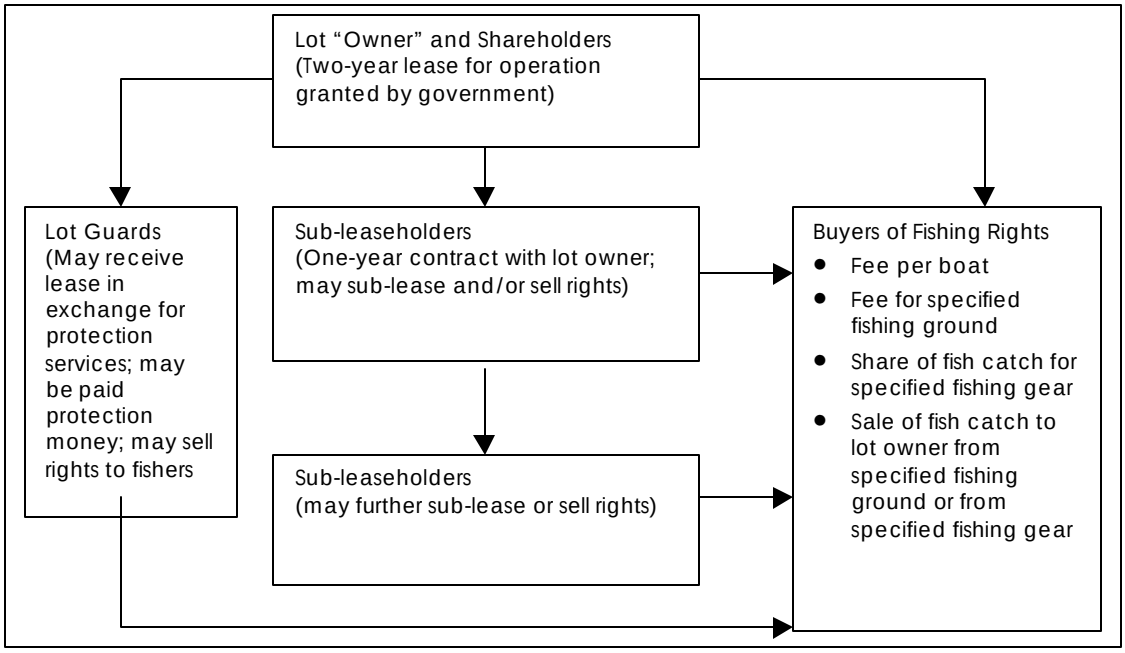
3.6.3. Status of Fishing Lots Before and After Recent Reforms

Prior to reforms in late-2000, 135 fishing lots occupied close to 1 million ha of the most productive fishing areas in Cambodia. With orders from the Prime Minister, MAFF led a reform effort from November 2000 to February 2001 aimed at reducing the number and size of fishing lots. The process involved the enactment of a series of sub-decrees at the provincial level and varying levels of consultation and negotiation with concerned stakeholders (Degen *et al.* forthcoming). As shown in Table 3.4, the reforms resulted in a significant drop in fishing lots from 135 to 82 and a dramatic decrease in the surface area of lots to from 954,000 to 417,000 ha – a reduction of about 56 percent. These reforms became effective in June 2001.

Degen *et al.* (forthcoming) note two aspects of the fisheries reforms that will presumably reduce fisheries conflicts. First, the number of people living within fishing lot boundaries has been reduced from about 756,000 to 148,000. Second, conflicts between lot owners and rice farmers over competing uses of the floodplain for fisheries and agriculture should decrease. Of the estimated 440,000 ha of agricultural land within lots prior to reforms, less than one-third remains after reforms.

[9] Many large fishing lots were converted to "research lots" in mid-1999 under four-year leases awarded without an auction process. These leases were cancelled as part of the reforms in 2001 due to controversy about non-transparent leasing procedures.

Figure 3.1: The Typical Leaseholder Structure and Fishing Rights Arrangements for a Fishing Lot



Source: Ly et al. 2000

Although formal reductions in the number and size of fishing lots provide an opportunity to ease tensions and reduce conflicts in the fisheries sector, thus far there is little information available about what has actually been occurring "on-the-ground" in former fishing lot areas. NGO Forum (2001) suggests a potential for continued conflicts because lot releases did not include productive fishing areas traditionally used by local fishers and "in certain locations, local authorities, armed forces, and fishing lot operators have ignored the sub-decree and prohibited local people from fishing." This practice by local authorities has occurred in past cancellations of fishing lots (Chheng 2000).

Table 3.4: Comparison of the Number and Surface Area of Fishing Lots in 2000 and 2001

	Fishing Lots in 2000		Fishing Lots in 2001		
Province	No. of Lots	Surface Area (ha)	No. of Lots	Surface Area (ha)	**Net Reduction in Lot Area (%)**
Banteay Meanchey	4	32,756	2	6,398	80.5
Battambang	12	146,532	9	102,718	29.9
Kompong Cham	12 + 12[1]	65,005	7	24,131	62.9
Kompong Chhnang	19	62,256	12	45,085	27.6
Kompong Thom	7	127,126	7	69,353	45.5
Kandal	19 + 1[1]	179,728	15 + 1[1]	51,640	71.3
Kratie	8 + 7[1]	8,725	0	0	100.0
Phnom Penh	1	3,475	0	0	100.0
Prey Veng	19	143,069	14	55,340	61.3
Pursat	7	55,120	5	24,848	54.9
Siem Reap	7	83,941	3	22,725	72.9
Takeo	20	46,007	8	15,201	67.0
Total	**135 + 20[1]**	**953,740**	**82 + 1[1]**	**417,438**	**56.2**

[1] Includes "sand beach fishing lots" – 12 in Kompong Cham, 1 in Kandal, and 7 in Kratie – all of which were released except for one lot in Kandal.
Source: Department of Fisheries, MAFF, as reported in Cambodian People's Party (2001).

3.6.4. Community Fisheries Management

In response to fisheries management problems and conflicts between lot owners and small-scale fishers, fisheries sector experts have most frequently recommended establishing "co-management" of fisheries, also referred to as community fisheries management (Gum 2000, Degen *et al.* 2000, Ly *et al.* 2000). As discussed above, the DoF has recently focused more

effort on developing community fisheries by preparing a sub-decree on community fisheries and establishing a Community Fisheries Development Office within DoF.

The concept of community fisheries remains broadly defined in Cambodia as a voluntary partnership among stakeholders of a fisheries resource, with the common objective to manage the resource sustainably for the benefit of all stakeholders (Gum 2000, DoF 2001b). Stakeholders, including local community members, relevant authorities, and commercial fishers, are responsible for developing a management plan in accordance with existing laws. This plan should address issues such as sustainable use, fishing gears and times, implementation and enforcement, conservation, and dispute resolution.

A study of fisheries co-management across Asia suggests several important conditions for facilitating successful co-management implementation (Pomeroy *et al.* 1998). These include clearly defined co-management area boundaries and membership, co-management benefits that outweigh investment costs, enforcement of management rules, cooperation and leadership at the community level, and participation in co-management by all affected parties. Other studies express concerns about the difficulties of community organising, sustained participation, and co-management costs (McConney 1998, Kupernan *et al.* 1998). They note that collective organising and action tend to occur in response to crises rather than in a sustained manner, and costs associated with initiating co-management can be greater than centralised management (though over time co-management costs may be less than centralised management).

In Cambodia, Gum (2000) and Degen *et al.* (2000) note several challenges to establishing community fisheries, including:

- Perceptions that establishing community fisheries will simply provide a means for local authorities to expropriate fishing rights and sell them.
- Perceptions among some DoF staff and others in the fisheries sector that community fisheries will lead to over-fishing.
- Lack of experience with community fisheries in Cambodia.
- Potential for transaction costs of negotiating and enforcing community fisheries to outweigh the benefits.

In order to provide a better understanding of the present scale and scope of community fisheries activity in Cambodia, CDRI developed an inventory of current projects based on existing documents, fisheries network information, and phone interviews (January-March 2002). No field visits were conducted to verify information. Community fisheries vary widely in terms of fishing areas, organisation, management objectives and approaches, problems addressed, progress toward establishment, and support levels. For the purposes of this inventory, "community fisheries activity" is defined broadly to include local efforts to improve fisheries management and sustainable use. It is not the intention here to define "community fisheries" precisely or to evaluate the effectiveness of current efforts.

CDRI identified 162 community fisheries in Cambodia (Table 3.5).[10] These projects are subdivided into categories of those started prior to 2000 and those started in 2000 or later, in order to distinguish community fisheries that are likely more mature and established from those that have only recently started (and therefore may be more involved in planning and organising). Projects started prior to 2000 have resulted in the development of 110 community fisheries, involving 235 villages (or about 180,000 people), and covering an area

[10] Similarly, MAFF (2002) reported that "more than 170 fishing communities have been established" in Cambodia. CDRI was unable to obtain additional information (e.g., location, size, stakeholders) from DoF on these 170 fishing communities. Therefore, it is unclear the degree to which community fisheries identified by CDRI overlap with those identified by DoF.

of approximately 185,000 ha. As a rough indication of resource quality, project representatives were asked to compare the productivity of community fisheries to nearby commercial fishing lots. Where applicable, most representatives suggested that the productivity of community fisheries was about the same or somewhat worse than nearby lots.

Fisheries reforms, decentralisation efforts, and greater focus on community-based natural resource management have all resulted in increasing community fisheries activities over the past two years. Projects started since 2000 are in the process of developing at least 52 community fisheries involving 116 villages (or about 123,000 people). The size of these fishing areas is largely unknown at present since many projects are seeking to establish community fisheries in recently released concession areas.

Table 3.5: Community Fisheries Activity in Cambodia[1]

Province	No. of Community Fisheries	No. of Villages Involved	Estimated Population Affected[2]	Estimated CF Area (ha)	Comparison of CF Productivity to Nearby Lot[3]	Starting Date of Project	Agency/NGO Working on Establishing CF
Community Fisheries Activity Started Prior to 2000							
B. Meanchey	2	11	6,721	26,231	Same	Nov 1999	VSG
Battambang	N/A*	6	7,226	12,844	Same	Apr 1998	Leucaena
	3	6	1,300	N/A	Worse	Oct 1999	AS
Koh Kong	2	2	2,143	4,560	N/A	Dec 1997	PMMR/MoE
K. Cham	1	10	3,600	6,000	Same	Aug 1998	ADHOC
K. Chhnang	19	N/A	10,100	9,843	Same	Jul 1999	CCD/MRC
K. Thom	8	N/A	3,191	N/A	Worse	Dec 1999	AACK
Kratie	27	27	28,836	7,500	N/A	1996	CAA
Ratanakiri	3	N/A	3,372	N/A	N/A	1999	Seila/IDRC
Siem Reap	10	111	83,000	108,000	Same	1995	FAO
	1	1	1,641	60	Same	Apr 1998	FLOW
Stung Treng	29	29	9,848	10,000	N/A	Jan 1998	CAA
Svay Rieng	3	3	270	2	N/A	1994	AIT
	2	29	18,360	N/A	N/A	1998	CRS/Santi Sena
Total	*110*	*235*	*179,608*	*185,040*			
Community Fisheries Activity Started in 2000 or Later							
Battambang	1	1	802	N/A	N/A	Nov 2000	CFDS
	5	N/A	8,019	N/A	N/A	Dec 2000	KNCED
	2	9	53,500	5,625	Same	Jul 2001	VSG
	1	3	3,408	3,308	Worse	2002	KAWP
Kandal	16	16	14,600	7,327	Same	Jan 2000	MRC
Kampot	1	4	5,432	N/A	N/A	Apr 2000	Dayku Aphiwat
Koh Kong	1	4	3,387	10,000	N/A	Jan 2001	AFSC
K. Chhnang	3	3	N/A	N/A	Same	Jul 2000	KHReDO
Kompong	1	9	N/A	N/A	N/A	N/A	GTZ
Thom	2	2	N/A	N/A	N/A	N/A	CREDO
Pursat	3	3	950	2,458	Worse	Mar 2001	CFDS/EPDO
	2	4	900	7	N/A	2000	BDASE
Sihanoukville	1	8	6,672	20	N/A	Dec 1999	WI/MoE/ADB
Stung Treng	9	9	4,528	13,500	N/A	May 2000	CEPA
Takeo	1	7	3,570	N/A	N/A	2001	CCD
	3	34	17,329	500	Worse	Dec 2001	CCK
Subtotal	*52*	*116*	*123,097*	*42,745*			
Grand Total	**162**	**351**	**302,705**	**227,785****			

[1] "Community fisheries activity" is defined broadly to include local efforts to improve fisheries management and sustainable use.

[2] In some cases, estimates reflect the estimated number of households multiplied by the average household size for the province.

[3] Community fisheries projects were asked how the productivity *of CF areas compares to any nearby commercial fishing lots: (1) better; (2) same; or (3) worse. If information was not available or CF projects are not located near a fishing lot, N/A is indicated.*

** N/A indicates that information was either not available or not applicable.*

*** Information on the hectares of community fisheries was not available for 30 community fisheries.*

Source: Phone interviews (Jan-Mar 2002). No field visits were conducted to verify information.

3.7. Fisheries Management Problems

It is not clear yet how well recent fisheries reforms are addressing the sector's long-standing management problems, including lack of secure access and rights to open access areas for small-scale fishers, destructive/illegal fishing practices by both small-scale and commercial fishers, and rival claims over fisheries, floodplains, and water resources. Exacerbating these management problems have been an increasing number of entrants to the fisheries sector each year (including seasonal in-migration from upland areas), weak management and enforcement

practices, and a lack of accurate fisheries statistics from which effective monitoring might be possible. A more detailed discussion of key fisheries management problems is provided below:

- **Illegal/destructive fishing.** Almost all reports on Cambodia's fisheries, both inland and coastal, note illegal fishing as a serious problem due to the high incidences of these practices and their severe impacts on fish stocks and habitat (for example, Swift 1997, Gum 1998, Mastaller 1999, Degen *et al.* 2000, Mak 2000a). Common illegal practices include electro-fishing and poisoning, use of brush parks ("samras"),[11] pumping water out of fishing grounds, use of nets with excessively small mesh sizes, use of other illegal fishing gear, trawling and sweeping operations (more than one time), fishing during the closed season with large- or medium-scale gear, and the collection of wild fish seed. Despite their illegality, surveys suggest these fishing practices are common throughout Cambodia. For instance, a survey of 30 fishing lots located in seven provinces in 1998-99 found a high incidence of illegal practices by both lot owners and small-scale fishers (Ly *et al.* 2000). Infractions by lot owners included brush park fishing (22 lots), sweeping areas more than one time (21 lots), electro-fishing (12 lots), and pumping fishing grounds (8 lots). Infractions by small-scale fishers within fishing lots included poaching (24 lots), cutting flooded forest (21 lots), and electro-fishing (17 lots). Likewise, a survey of 257 households living within or nearby fishing lots in four different provinces found high incidences of illegal activity in lots and open access areas (Van Acker 1999 in Degen *et al.* 2000).
- **Illegal extension of fishing lot boundaries and expropriation and sale of open access areas.** Lot owners, military, and local authorities often expropriate open access areas and lease them to businesses or require small-scale fishers to pay for fishing rights (Gum 1998, Nao and Srun 1999, Ly *et al.* 2000). They take advantage of poorly marked lots and open access boundaries to illegally extend fishing lots beyond their true boundaries, encompassing any outlying productive areas. In many cases, boundaries have been extended to include all seasonally flooded areas (Nao and Srun 1999, Swift 1999, Mak 2000a, Star Kampuchea 2000). The military plays a significant role in protecting and controlling fishing lots.
- **Competing uses of land and water for agricultural and fishing purposes.** Conflicts arise over land and water use in lot areas because these resources play important roles in supporting both agriculture and fisheries. Whereas lot owners want to protect flooded forests and shrubland vegetation because it provides essential fish habitat and improves fish productivity, farmers often seek to clear these areas in order to cultivate rice (Swift 1997, Degen *et al.* 2000). Similarly, lot owners may seek to drain reservoirs and ponds to make it easier to catch fish, but farmers want this water for agriculture and would like to use it more gradually (Ly *et al.* 2000). Some villagers have claimed that lot owners deny them access to water, destroy their irrigation structures, and prevent them from digging ponds for family use or irrigation (Swift 1999, Mak 2000a). Competition between agricultural and fisheries development is discussed in more detail below (see "3.8. Cross-Sector Impacts on Inland Fisheries").
- **Poaching and fuelwood collection within fishing lots and destruction of mangrove forests in coastal areas.** Poaching occurs in almost all fishing lots, especially where open access areas are small or have been taken away. Poaching is often done by the illegal practice of electro-fishing because this reduces poaching

[11] Brush parks or "samras" are constructed using wooden sticks, bamboo, branches, metal wire, and other materials to create suitable habitat for fish. As water levels drop, fishers encircle the brush park with a seine net. They then remove the brush park materials and capture all the fish.

risks by allowing for more rapid catches. Villagers also frequently cut fuelwood from the inundated forests within fishing lots. This illegal practice can degrade fish habitat, breeding, and nursing areas (Swift 1997, Gum 1998, Swift 1999, Ly *et al.* 2000). Similar to flooded forests in inland waters, the loss of mangrove forests in coastal areas has been occurring at a rapid rate. The causes of mangrove deforestation and degradation include harvesting of mangroves for fuelwood and charcoal production, shrimp and salt farming, and illegal fishing activities such as using explosives and poisons (Mastaller 1999, Marschke 2000b).

- **Closing waterways to travel.** Lot owners may close a river, channel, or other waterway to carry out fishing operations or protect fishing areas. This hinders travel and trading activities for communities living within the fishing lot area (Nao and Srun 1999, Ly *et al.* 2000). At times, people travelling through a lot area may be required to pay a fee (Chheng 1999, Mak 2000a).
- **Weak management and enforcement by local authorities.** Insufficient salaries and resources are often cited as the main reason that local authorities are unable to carry out responsibilities effectively. Local authorities are reported to focus more on short-term informal revenue generation than long-term fisheries management. Key management and enforcement problems include a lack of transparency in granting lots, "irregularities" in revenue collection, selective enforcement of fisheries regulations in favour of lot owners and larger-scale fishers (including foreign boats in coastal waters), and a lack of mechanisms for lodging complaints and resolving conflicts (Swift 1997, Gum 1998, Mak 2000a).

These fisheries management problems were resulting in an increasing number of conflicts prior to recent reforms. Although formal data on fisheries conflicts tend to be unavailable, incomplete, or fragmented, the DoF has data on written complaint letters received from five provinces. These data indicate an increase in complaints from 168 in 1998 to 356 in 1999, with the most dramatic increases occurring in three provinces around the Great Lake (Degen *et al.* 2000). Mistrust of government authorities likely prevents many people from reporting complaints, and many complaints are not passed up the administrative chain of command, so these data likely only reflect a small proportion of actual complaints.

In addition to formal complaints, numerous case studies indicate widespread conflicts over fisheries resources. For example, conflicts have been noted in: Battambang (Gum 1998, Mak 2000a), Siem Reap (Nao and Srun 1999, Chan *et al.* 2001), Kompong Cham (Star Kampuchea 2000), Kompong Chhnang (Swift 1997, Swift 1999), Kompong Thom (Gum 2000), Stung Treng (Mak 2000b, Gum 2000), and Takeo (Swift 1997, Kato 1999).

3.8. Cross-Sector Impacts on Inland Fisheries

In addition to illegal fishing and weak management, development activities in other sectors threaten the sustainability of Cambodia's fisheries. Cross-sector impacts to fisheries are mainly caused by expanding agriculture, widespread logging, and infrastructure development projects.

3.8.1. Agriculture Competes with Fisheries for Land and Water Resources

Cambodia has a total of about 2.4 million ha under rice cultivation, of which about 1.8 million ha are permanent agricultural land and 0.6 million ha are floodplain, depending on the extent of annual flooding. Floodplains support multiple activities including agriculture, collection of flooded forest products, and fishing. These activities are often in competition:

- **Irrigation and water control projects improve agricultural yields but decrease fisheries productivity by reducing available fisheries habitat, especially dry-season refuges.** Fishing lot owners often claim the water and fish in reservoirs

constructed to store water for irrigation during the dry season are part of their lot lease. They may either break a reservoir dam to prevent water storage or illegally pump a reservoir dry at the end of the fishing season (which is already the dry season for farming). This may leave no water for dry season irrigation purposes. In addition to water storage, farmers may affect fisheries productivity by diverting natural water flows through irrigation canals during flooding or recession periods. During the flooding period, water diversion for agriculture may reduce flooding to lot areas, thereby reducing the amount of fish carried into the lot. During the recession period, impeding the recession of water may affect the capacity of the lot operator to catch fish at the most appropriate time, when fish are returning to the main rivers with the recession of the water (Degen *et al.* 2000).

- **Land cleared of flooded forest and shrub vegetation for agriculture reduces fisheries productivity because submerged vegetation provides excellent habitat for fish spawning, nursing, and feeding.** A large proportion of Cambodia's flooded forests and wetlands have already been converted for agriculture. Flooded forest areas decreased from an estimated 937,900 ha in 1973 to about 370,000 ha in 1997 (see "4.1. Forest Cover"). It is important to note that with less forest, soil erosion occurs and less sediment is deposited during flooding periods, often resulting in declining soil quality and crop yields in converted areas.
- **Pesticides and chemical fertilisers may reduce water quality and fisheries productivity.** Agricultural chemical runoff may affect nearby fisheries and directly impact rice paddy fish productivity (Nao and Ly 1997). Due to a lack of research on this subject in Cambodia, it is not possible to determine whether the levels of agricultural chemical runoff are significant enough to affect the health of fisheries. Anecdotal evidence suggests that high pesticide use in some areas is affecting the fish productivity of rice paddies and nearby fishponds (Gregory 1997, Shams and Try 1998, Gum 2000).

3.8.2. Intensive Logging May Cause Increased Sedimentation of the Great Lake

An increase in sediment deposition in the Great Lake could reduce dry season depth, place considerable stress on fisheries (especially due to reduced dissolved oxygen), and over time threaten the existence of the Lake itself. Much concern has been expressed that sedimentation rates may have risen significantly in recent years due to sharp increases in logging, continued clearance of flooded forest areas around the Lake, and gem mining activity in the upper reaches of tributaries to the Lake (Csavas 1994; Nao and Ly 1997; Azimi *et al.* 2001). Others suggest sedimentation concerns are overstated, arguing that: (a) in tropical climates new vegetation establishes quickly in deforested areas, thereby reducing or eliminating potential for erosion for more than a temporary period; (b) a large proportion of sediments caused by erosion settle close to the exposed area rather than flow to the Lake; and (c) the National Roads 5 and 6 surrounding the Lake intercept a large amount of the sediment (Tes 1997, NEDECO 1998, Chaktomuk Project Management Unit 2000).

Recent debate over possible Great Lake sedimentation continues a long-running discussion on the topic that has generated a range of predictions about the Lake's future. For instance, French geographers estimated in 1923 that the Great Lake would continue to exist on a permanent basis for another 200 years, after which the Lake would only exist during the rainy season. In the 1950s, a more qualitative study relying on fishers' observations estimated that in 50 years the Great Lake would no longer exist during the dry season (Bardach 1959). In 1962-63, a French team conducted an extensive study of Great Lake sedimentation that involved drilling 19 holes in the Lake bottom and measuring sediment entering the Lake (Carbonnel 1964 in NEDECO 1998). The study found that approximately 4.7 million tons of sediment entered the Lake in 1962-63, of which 2.7 million tons entered from the Mekong

River via the Tonle Sap River and the other 1.9 million tons entered via tributaries to the Lake. This amount of sediment translated to an average sedimentation rate of about 0.3-0.5 mm per year. At this rate, the study estimated that the Lake would not disappear for about 1,500 years (Carbonnel 1964 in NEDECO 1998).

More recently, Csavas (1990) suggested that the rate of sedimentation in the Great Lake was as high as four cm per year, resulting in speculation that the Great Lake could dry up within a decade (NEDECO 1998). More than a decade later, it is clear that the Great Lake has not rapidly disappeared due to sedimentation. Nonetheless, in the absence of recent data and analysis of sedimentation rates, it remains an open question as to whether widespread logging over the past decade has increased sedimentation rates to levels that threaten the long-term existence of the Great Lake.

3.8.3. Infrastructure Projects May Affect Fish Migration, Habitat, and Production

Infrastructure projects, such as dams, roads, and culverts, can significantly affect fisheries production by blocking migration, reducing water quality, and degrading and/or reducing available habitat. Dam projects, in particular, can have severe impacts on fisheries and overall water quality. For example, recent construction of the Yali Falls Dam in Vietnam just 70 km from the Cambodian border has had enormous impacts on the livelihoods of an estimated 20,000 downstream villagers. In addition to flooding impacts from dam releases, villagers report a severe decline in water quality and fisheries productivity (Ratanakiri Provincial Fisheries Office 2000, McKenney 2001).

Dams within the Mekong River basin may also affect seasonal river flows by reducing flows in the wet season and increasing them in the dry season. These "flood control" impacts are often cited as a benefit of dams, but in regions such as the Mekong River basin where agriculture and fisheries productivity are highly dependent on seasonal flooding, a significant change in the flooding regime can have severe impacts. Fish productivity in Cambodia is positively correlated with the extent and duration of wet-season flooding, which is caused primarily by a rise in Mekong River water levels (Van Zalinge *et al*. 2000). When this seasonal rise in the Mekong River is reduced, so too is the floodplain inundation that benefits fisheries. Since the 1950s, thousands of large and small dams have been constructed in the Mekong River basin for irrigation, flood control, hydropower, and other purposes. These water management projects are fragmenting aquatic habitats, blocking migration and spawning areas, and reducing water quality and quantity (Coates 2001). It is estimated that wet season Mekong River flows have decreased by about 12-15 percent during the 1980s and 1990s (Nam 2000, Van Zalinge *et al.* 2000). Water management projects appear to be the main cause of decreased flows; climatic changes have been ruled out.

A model developed by the Mekong River Commission suggests that implementation of proposed future water management schemes could reduce the river flow at Phnom Penh by a further 15 percent, which in turn would reduce the wet season flow of the Tonle Sap River to the Great Lake by 20 percent (Van Zalinge *et al*. 2000). Approximately 240,000 ha of the regularly submerged land around the Great Lake would no longer be flooded. In addition, the model indicates that flooding of wetlands in northeastern Cambodia would be significantly reduced. Such dramatic losses of fisheries habitat would have severe impacts on fisheries productivity.

3.9. Fish Marketing, Trade, and Export Issues

Most of Cambodia's freshwater fish catch are consumed domestically, either as fresh fish or processed products such as dried fish, fermented fish, fish paste (*prahok*), and fish sauce (*tuk trey*). Fish are commonly processed and preserved through traditional techniques including sun-drying, salt-drying, smoking, and steaming. Processing primarily occurs during the peak

fishing season (December to February) when fishers catch large amounts of small fish (Nao and Ly 1997).

Fish exports from Cambodia represent a small proportion of the total annual catch. Ministry of Commerce (2001) estimates that between 30,000 and 100,000 tons of freshwater and marine fish were exported in 1998, of which about 75 percent was exported to Thailand and most of the remainder exported to Vietnam. Thailand and Vietnam appear to further process these fresh fish imports for markets in Bangkok, Hong Kong, Malaysia, Singapore, Europe, and the United States. Clearly, if Cambodia were capable of exporting directly to these more lucrative markets, significant revenue gains could be generated for the fisheries sector.

A variety of government interventions and non-competitive practices restrict trade and export activity, including official and unofficial taxes and fees, and formal and informal barriers to entering the trade and export business (e.g., export licenses, cartels and collusive behaviour). Due to these constraints, fishers and processors may prefer to sell to local markets rather than seek to market products for higher prices abroad (Csavas 1994, Ministry of Commerce 2001).

The Kampuchea Fish Import and Export Company (KAMFIMEX) appears to play the strongest role in constraining fish trade and export. KAMFIMEX is a state-owned, MAFF-managed enterprise granted with the sole authority to control fish exports. KAMFIMEX offices are located at official export points in the northwest (to Thailand), southeast (to Vietnam), Kompong Som port, and Pochentong airport (Ministry of Commerce 2001). Exporters must sell all fish products to KAMFIMEX; there is no other legal means to export. This monopsonist position gives KAMFIMEX the power to set its own buying price. Faced with this export system, it is not surprising that perhaps half of all fish exports from Cambodia are smuggled out illegally. Ministry of Commerce (2001) notes several other ways in which KAMFIMEX constrains trade and export including:

- **Authorising "distributors" to collect fees of four percent of the fish landing price in each province.** KAMFIMEX authorises the sale of one distribution license in each province for a term of five years. Licenses reportedly cost up to $50,000 each. They entitle the distributor to establish an office and collect a four percent fee on all fish exported through the province. There are no services provided for this fee.
- **Charging fish export fees at Kompong Som port and Pochentong airport.** KAMFIMEX collects an export license fee of $1 per kg of fish.
- **Controlling commercial fish processing.** KAMFIMEX owns four processing plants that it leases to the private sector, one in Phnom Penh and three in Kompong Som. There are no large-scale fish processing facilities located near the Great Lake.

In addition to the trade and export inefficiencies associated with KAMFIMEX, Ministry of Commerce (2001) notes several other fees and obstacles to trade, including:

- **A tax of 10 percent on all fish exports.** On behalf of the Ministry of Economy and Finance, the DoF is responsible for ensuring that this export tax is collected. Cambodia is the only country in the region that levies an export tax on fish products.
- **Transportation registration, checkpoint, and export fees.** Transporters of fish pay a registration fee to the DoF and also pay a series of unofficial checkpoint fees from the landing site to the border. Border authorities charge an additional fee of about $25 per ton to bring fish across the Thai border to the Arranyaphatet market.
- **High spoilage rates.** Most fish exported to Thailand are transported in pickup trucks piled high with fish and ice. Up to 50 percent of fish spoil before they reach their destination due to poor storage facilities, poor road infrastructure, and delays

associated with unofficial road taxes and license fees. The threat of ever-increasing spoilage erodes transporters' bargaining position for negotiating checkpoint fees and selling prices.

3.10. Conclusions and Recommendations for Research

Increasing fishing pressure, in combination with destructive fishing practices and habitat degradation and loss, threaten the sustainability of Cambodia's fisheries. A continuation of this trend could threaten the food security and income of the more than one million Cambodians dependent on the fisheries sector for their livelihoods. Population growth estimates suggest a significant increase in the number of rural youth entering the labour force in the years to come, which will likely exacerbate current fishing pressure problems. Many of these youth will seek to earn or supplement their livelihoods through subsistence fishing because the entry barriers are low – no land or other costly investments are required. Ensuring sustainable fisheries and livelihoods will require significant improvements in several areas, including:

- Enforcement measures to reduce illegal fishing and flooded forest losses.
- Management reforms that appropriately address the fishing access and user rights issues of small-scale fishers and sustainability issues.
- Development planning that takes into account cross-sector impacts to fisheries from agriculture, forestry, and infrastructure development.

Prudent policymaking for the fisheries sector requires substantial data and information inputs, which in many cases do not currently exist. For instance, little is known about the status of fish stocks, changes in the amount and composition of annual catches over time, the appropriate "sustainable" catch for the Great Lake, changes in hydrology, flooding, and sedimentation, and fish migration and spawning patterns. To improve information in these areas, a range of scientific, hydrological, and biological studies are needed, some of which are already being conducted by the Mekong River Commission and Department of Fisheries (Nao and Van Zalinge 2000).

In addition to these scientific studies, there is a need for more socio-economic research on the relationship between fisheries resources and rural livelihoods. While it is widely recognised that many rural people depend on fisheries for their livelihoods, large questions remain about how best to manage fisheries resources to achieve rural development and poverty alleviation objectives. To address these questions, some possible areas for future socio-economic research are described below.

1. **How effective is the fishing lot management system in meeting rural development and poverty alleviation objectives?**

Although recent reforms have reduced fishing lots by half, they remain the dominant management approach for more than 400,000 ha of Cambodia's most productive fisheries. The leasing of fishing lots is intended to achieve several objectives, including:

- Sustainable fisheries management to ensure future generations benefit from fisheries resources.
- Increased government revenue through leasing and other fees. Ideally, these funds support rural development and poverty alleviation projects in areas negatively affected by fishing lots.
- Job creation and rural development for local people. For example, fishing lots might support commercial processing and other related enterprises that provide employment to people living in or nearby the lots.

Fishing lot management and sustainability issues have been the focus of several case studies, but less attention has been given to what role fishing lots play in meeting rural development and poverty alleviation objectives. Possible research questions include:

- How much government revenue (formal and informal) is raised through fishing lot leases and fees and how is this revenue used to meet rural development objectives?
- What other rural development benefits do fishing lots provide, such as employment in lot operations and/or support of processing and marketing facilities?
- In light of the government's rural development and poverty alleviation goals, on what basis or by which criteria should fishing lots be retained or released for other types of management?
- How have fishing lots affected fisheries access, food security, and livelihood income of rural Cambodians?

2. What are the costs and benefits associated with establishing and managing community fisheries?

Several NGOs are supporting the development of community fisheries, and the Department of Fisheries has recently launched similar efforts. Establishing community fisheries can be a large undertaking involving significant costs. These costs include community organizing activities, negotiations among small-scale fishers, authorities, and other stakeholders, development of management plans and rules, monitoring and enforcement, and conflict resolution. Successful establishment of community fisheries will depend on lowering start-up and management costs and increasing potential fisheries benefits.

Clearly, the potential benefits of community fisheries are closely linked to the productivity of the fishing area. NGO Forum (2001) suggests that recent lot releases have not included productive fishing areas traditionally used by local fishers. If the most productive fisheries are retained as fishing lots while marginal, non-productive fisheries are designated for community management, stakeholders will have minimal incentives to invest the time and effort necessary to establish and effectively manage community fisheries. Key research questions include:

- What is the historical productivity of fishing areas designated for community management? How does this productivity compare to other nearby fishing areas? What are the implications for establishing community management? How might the potential benefits of community fisheries be increased?
- How significant are costs associated with the start-up and on-going management of community fisheries? How might these costs be reduced?
- What lessons can be drawn from the start-up experiences of community fisheries that might be applied to future efforts?

3. What changes have taken place in former fishing lot areas and what are the implications for rural livelihoods? How effective are community fisheries in managing areas formerly under fishing lot management?

Following an order from the Prime Minister in late-2000, MAFF released approximately 56 percent of fishing lot areas for public use. DoF reported in early 2002 that it has established 170 community fisheries and plans to double this number within a year (MAFF 2002). Thus far, there is little information available about these 170 community fisheries or what is occurring "on-the-ground" in former fishing lot areas. The focus of current reforms on decentralisation of fisheries management provides an opportunity for improving rural livelihoods through a more equitable distribution of fisheries benefits. Research to support reform efforts might focus on the following questions:

- In areas where lots have been released, what fisheries management approach has filled the vacuum? What has changed for people whose agricultural land and/or homes are no longer within fishing lots? How has water management changed? How has flooded forest management changed?
- What was the DoF's process for establishing 170 community fisheries? Who participated in this process? Where are the 170 new community fisheries established by DoF located and how has management changed in these areas? For example, are fishing areas within the community fisheries sub-leased out? What are the sub-leasing arrangements and fishing rights of community members? What is the role of local authorities? How are management rules monitored and enforced? How are disputes resolved?

4. How important are ricefield fisheries to rural livelihoods and what are the implications for agricultural and fisheries development?

According to annual catch estimates, ricefield fisheries account for roughly 20 percent of the total inland fish catch. However, this estimate is based on a small number of village-level studies not representative of ricefield fisheries throughout the country. Additional research is needed to better determine the importance of ricefield fisheries to rural livelihoods. Key research questions include:

- What is the typical annual catch from ricefield fisheries for a representative sample of villages in Cambodia? What is the productivity trend for these ricefield fisheries over time?
- What impact are agricultural expansion, intensification, and chemical fertilisers and pesticides having on the productivity of ricefield fisheries?
- What steps can be taken to ensure farmers optimise their returns from agriculture and ricefield fisheries?

5. How are conflicts over fishing areas currently settled and what can be done to improve conflict resolution mechanisms?

Although recent fisheries reforms may help to reduce conflicts over fishing areas, there remains a strong need for a fair process to resolve fisheries disputes. Information on current dispute resolution practices is limited. Initial research in this area might assess the following:

- What is the formal process for resolving fisheries disputes according to the Fisheries Law and relevant sub-decrees and regulations? Who is involved and what is their role?
- How are fisheries conflicts typically resolved in practice?
- What relevant lessons and models for fisheries dispute resolution might be drawn from the experiences of other countries?
- In what ways might the conflict resolution process be improved? For example, is there an appropriate role for the recently elected commune councils to play in conflict resolution?

6. What is the current status of fish processing, trade, and export activities? How might rural livelihoods be improved through changes in the current approach to these activities?

Ministry of Commerce (2001) outlines some of the problems associated with Cambodia's fish processing, trade, and export sector. The study notes the need for fish processing and marketing improvements that add value to fish products and increase profitability. The study

also calls for enhanced fish trade and export promotion to increase earnings within the fisheries sector.

Except for the Ministry of Commerce (2001) report, few studies discuss the status of Cambodia's fish processing, trade, and export activities. As Cambodia is estimated to have the fourth most productive inland fisheries in the world, and fish are typically a high value product, additional research on the potential for value-added processing and the apparent non-competitive practices of the fish trade is warranted. Increased competition among fish traders and exporters for the purchase of fish, in combination with better market price information to local fishers, would likely improve the bargaining position of local fishers, allowing them to profit more from fish catches. In addition, a competitive fisheries sector would provide more opportunities for entrepreneurship, investment, and value-added enterprises at the local level. Further research on fish processing and trade issues might address several questions:

- How are fish marketed domestically and for export? What are the various official and unofficial fees and costs associated with the fish trade? In practice, what are the profit margins to various participants in the fish trade (fishers, buyers, traders, transporters, exporters)? How do these profit margins compare to the product or service provided by the market participant?
- What steps, such as increasing competition among buyers and improving the accessibility of market price information, can be taken to improve the bargaining position of small-scale fishers in the sale of their catches?
- What is the purpose of the "distributors" system? What services are provided in return for the 4 percent fee charged by distributors? Why do some provinces around the Great Lake have distributors and others do not? Likewise, why does KAMFIMEX have sole authority over fish exports? What marketing/distribution services is KAMFIMEX providing in return for the fees it charges?
- What are the formal and informal barriers to entering the fish processing and trade business? In what respects is fish processing and trade controlled by monopolistic or collusive behavior? What are the opportunities for small-scale entrepreneurship and value-added enterprises at the local level?

References

Ahmed, M., N. Hap, V. Ly, and M. Tiongco (1998), *Socio-economic Assessment of Freshwater Capture Fisheries of Cambodia: Report on a Household Survey*, (Phnom Penh: Department of Fisheries, DANIDA, and Mekong River Commission)

Azimi, A., W. Knowland, J. Carew-Reid, I. Ruzicka, and A. Zola (2001), *Environments in Transition: Cambodia, Lao PDR, Thailand, Viet Nam,* (Manila: Asian Development Bank)

Bann, C. (1997), *An Economic Analysis of Alternative Mangrove Management Strategies in Koh Kong Province, Cambodia* (Singapore: Economy and Environment Program for SE Asia)

Bardach, J. (1959), *Report on Fisheries in Cambodia*, (Phnom Penh: USOM/Cambodia)

Cambodian People's Party (2001), "Fisheries Reform" in *The Pracheachun Magazine* (08/2001) available at http://www.cambodianpeopleparty.org/magazie.htm

Chaktomuk Project Management Unit (2000), *Chaktomuk Area: Environment, Hydraulics and Morphology Phase 1 Inception Report*, (Phnom Penh: Mekong River Commission Secretariat)

Chan, T., S. Kim, T. Em, S. Thay, and S.M. So (2001), "Changes in Fisheries Resources Use and Management in Lot No. 3 Peam Taour Village, Keo Por Commune, Pouk District, Siem Reap Province: A Case Study", in CBNRM Team, *CBNRM Lessons Shared: A Series of CBNRM Case Studies from the Tonle Sap, Siem Reap Province* (Phnom Penh: WWF Conservation Program in Cambodia)

Chea, V. (1999), "Fisheries activities in Stung Treng Province, Cambodia" in N. Van Zalinge, T. Nao, and L. Deap (eds.), *Present Status of Cambodia's Freshwater Capture Fisheries and Management Implications: Nine presentations given at the Annual Meeting of the Department of Fisheries Ministry of Agriculture, Forestry and Fisheries, 19-21 January 1999* (Phnom Penh: Mekong River Commission/DANIDA) pp. 59-66

Chheng, V. (2000), "Evaluation of ex-fishing lot no. 5 after its abolishment in 1988, Siem Reap province, Cambodia" in Van Zalinge, N., T. Nao, and S. Lieng (eds.) *Management aspects of Cambodia's Freshwater Capture Fisheries: Eleven presentations given at the Annual Meeting of the Department of Fisheries of the Ministry of Agriculture, Forestry and Fisheries, 27-28 January 2000,* (Phnom Penh: Mekong River Commission and Department of Fisheries) pp. 129-134

Chheng, V. (1999), "Case study of fishing lot no. 3 in Siem Reap Province, Cambodia" in N. Van Zalinge, T. Nao, and L. Deap (eds.), *Present Status of Cambodia's Freshwater Capture Fisheries and Management Implications: Nine presentations given at the Annual Meeting of the Department of Fisheries Ministry of Agriculture, Forestry and Fisheries, 19-21 January 1999* (Phnom Penh: Mekong River Commission/DANIDA) pp. 111-114

Coates, D. (2001), *Biodiversity and Fisheries Management Opportunities in the Mekong River Basin*, (Vientiane: Mekong River Commission Secretariat)

Csavas, I., D. J. Doulman, T. O. Petr, J. Prado, and L. Debas (1994), *Cambodia – Rehabilitation and development needs of the fishery sector*, (Rome: *FAO Fisheries Circular*, No. 873)

Deap, L. (1999), "The Bagnet (Dai) Fishery in the Tonle Sap River" in N. Van Zalinge, T. Nao, and L. Deap (eds.), *Present Status of Cambodia's Freshwater Capture Fisheries and Management Implications: Nine presentations given at the Annual Meeting of the Department of Fisheries Ministry of Agriculture, Forestry and Fisheries, 19-21 January 1999* (Phnom Penh: Mekong River Commission/DANIDA) pp. 141-149

Degen, P., V. Ly, C.T. Prum, D. Yin, P. Chap, and S. Lieng (forthcoming), *(Draft) People, Power and Fishery Policy: Fisheries Management Reform Addressing Community Fisheries in Cambodia*, (Phnom Penh: Department of Fisheries, Inland Fisheries Research Institute)

Degen, P. and T. Nao (2000), "Historical, cultural and legal perspectives on the fishing lot system in Cambodia", p. 49-60 in M. Ahmed and P. Hirsch (eds.), *Common property in the Mekong: issues of sustainability and subsistence*, (Manila: ICLARM Study Review 26)

Degen, P., F. Van Acker, N. van Zalinge, N. Thuok, and D. Loeung (2000), *Taken for granted: Conflicts over Cambodia's freshwater fish resources*, (Bloomington, Indiana: 8th IASCP Conference, 31 May to 4 June 2000)

Degen, P. and L. Mong (1999), "Socio-economic issues: fisheries research activities and 'awareness building'" in N. Van Zalinge, T. Nao, and L. Deap (eds.), *Present Status of Cambodia's Freshwater Capture Fisheries and Management Implications: Nine presentations given at the Annual Meeting of the Department of Fisheries Ministry of Agriculture, Forestry and Fisheries, 19-21 January 1999* (Phnom Penh: Mekong River Commission/DANIDA) pp. 25-32

Degen, P. and T. Nao (1998), *Inland Fishery Management in Cambodia: Is the concept of community-based management appropriate for fishing lots?* (Vancouver, Canada: Mekong Panel at the Seventh Common Property Conference of the International Association for the Study of Common Property, 10-14 June 1998)

Department of Fisheries (2001a), *Draft Fisheries Law – 18 May 2001*, (Phnom Penh: Agriculture Productivity Improvement Project, PIU – The Fisheries Component)

Department of Fisheries (2001b), *Draft Sub-Decree on Community Fisheries – 16 August 2001*, (Phnom Penh: unofficial translation by Oxfam GB Cambodia Livelihoods Study Project)

DFID (no date), *An Analysis of Poverty and Aquatic Resources Use – focusing especially on the Livelihoods of the Poor of Cambodia,* (Bangkok: DFID Aquatic Resources Management Programme)

Fisheries Action Coalition Team (FACT) (2002), *Feast or Famine? Solutions to Cambodia's fisheries conflicts*, (London: Environmental Justice Foundation, Phnom Penh: NGO Forum)

Gregory, R. (1997), *Ricefield Fisheries Handbook*, (Phnom Penh: Cambodia-IRRI-Australia Project)

Gregory, R. and H. Guttman (1997), "Capture and culture ricefield fisheries in Cambodia" in H.J. Nesbitt (ed.), *Rice Production in Cambodia*, (Phnom Penh: Cambodia-IRRI-Australia Project) pp. 99-106

Gum, W. (2000), *Inland Aquatic Resources and Livelihoods in Cambodia: A Guide to the Literature, Legislation, Institutional Framework and Recommendations,* (Phnom Penh: Oxfam GB Cambodia Land Study Project)

Gum, W. (1998), *Natural Resource Management in the Tonle Sap Biosphere Reserve in Battambang Province,* (Phnom Penh: European Commission Support Programme (SPEC))

Gum, W. (1997), *Consultancy Report on Fisheries Development in Northwest Cambodia,* (Phnom Penh: UNDP/UNOPS/CARERE)

Hirsch, P. (1998), *Holding and Managing Resources in Common: Issues of Scale in Mekong Development* (Vancouver, Canada: seventh annual conference of the International Association for the Study of Common Property, June 10-14)

Kato, E. (1999), *Where Has All the Land Gone? Land Rights and Access in Cambodia, Volume 1, Case Studies,* (Phnom Penh: Oxfam Great Britain)

Kenefick, E. (1998), *Report on the Cambodian 1998 Joint Unicef-WFP Baseline Survey of CASD Project and WFP Target Areas,* (Phnom Penh: U.N. Children's Fund, U.N. World Food Programme, and Ministry of Planning)

Kuperan, K., N. Mustapha, R. Abdullah, R.S. Pomeroy, E. Genio, and A. Salamanca (1998), *Measuring Transaction Costs of Fisheries Co-Management* (Vancouver, Canada: seventh annual conference of the International Association for the Study of Common Property, June 10-14)

Lagler, K. F. (1976), "Fisheries and integrated Mekong River Basin development", *Terminal Report of the Mekong Basinwide Fishery Studies* (Ann Arbor: University of Michigan)

Ly, V., D. Yin, and P. Degen (2000), "The management of the freshwater capture fisheries in Cambodia: Legal principles and field implementation" in Van Zalinge, N., T. Nao, and S. Lieng (eds.) *Management aspects of Cambodia's Freshwater Capture Fisheries: Eleven presentations given at the Annual Meeting of the Department of Fisheries of the Ministry of Agriculture, Forestry and Fisheries, 27-28 January 2000,* (Phnom Penh: Mekong River Commission and Department of Fisheries) pp. 90-98

Mak, S. (2000a), *Fishing Conflict in Battambang*, (Phnom Penh: Environmental Working Group, NGO Forum)

Mak, S. (2000b), *Review of the Fishery Conflict in Stung Treng*, (Phnom Penh: Environmental Working Group, NGO Forum)

Marschke, M. (ed.) (2000a), *Mangrove Meanderings: Learning about Life in Peam Krasaop Wildlife Sanctuary* (Phnom Penh: Ministry of Environment, Participatory Management of Mangrove Resources)

Marschke, M. (ed.) (2000b), *Smashed Livelihoods: Life as a Charcoal Producer in PKWS, Koh Kong: A Case Study* (Phnom Penh: Ministry of Environment, IDRC)

Mastaller, M. (1999), *Environmental Management of the Coastal Zone of Cambodia: Assessment of Sustainable Livelihood Alternatives to Mangrove Exploitation* (KAMPSAX International, prepared for DANIDA)

McConney, P. (1998), *Climate for Co-Management* (Vancouver, Canada: seventh annual conference of the International Association for the Study of Common Property, June 10-14)

McKenney, B. (2001), *Economic Valuation of Livelihood Income Losses and Other Tangible Downstream Impacts from the Yali Falls Dam to the Se San River Basin in Ratanakiri Province, Cambodia*, (Phnom Penh: Oxfam America)

Mekong River Commission, (2000), *Chaktomouk Area: Environment, Hydraulics and Morphology, Phase 1*, (Phnom Penh: MRC Chaktomouk Project Management Unit)

Mekong River Commission Secretariat (1992), *Fisheries in the Lower Mekong Basin*, (Bangkok: Interim Mekong Committee)

Ministry of Agriculture, Forestry and Fisheries (2002), *Progress Report on Natural Resource Management to the Follow Up Meeting Second Semester 2001 between the Royal Government of Cambodia and Donor Community, 16 January 2002*, (Phnom Penh: MAFF)

Ministry of Commerce (2001), *Integration and competitiveness study – Part C: Sector studies – rice, diversified agriculture, handicrafts, fisheries, garments, tourism, labor services*, (Phnom Penh: Ministry of Commerce)

Nam, S. (2000), "Mekong River Flow Data Analysis" in Van Zalinge, N., T. Nao, and S. Lieng (eds.) *Management aspects of Cambodia's Freshwater Capture Fisheries: Eleven presentations given at the Annual Meeting of the Department of Fisheries of the Ministry of Agriculture, Forestry and Fisheries, 27-28 January 2000,* (Phnom Penh: Mekong River Commission and Department of Fisheries) pp. 23-29

Nao, T., and N. Van Zalinge (2000), "Challenges in managing Cambodia's inland fisheries: How can we meet them?" in Van Zalinge, N., T. Nao, and S. Lieng (eds.) *Management aspects of Cambodia's Freshwater Capture Fisheries: Eleven presentations given at the Annual Meeting of the Department of Fisheries of the Ministry of Agriculture, Forestry and Fisheries, 27-28 January 2000,* (Phnom Penh: Mekong River Commission and Department of Fisheries) pp. 10-17

Nao, T. and L.S. Srun (1999), *Report on Field Survey Work of Fishing Lot #6, Kompong Khleang Commune, Sotr Nikum District, Siem Reap Province, Cambodia* (Phnom Penh: Department of Fisheries)

Nao, T. (1998), "Inland Fishery Management and Enhancement in Cambodia" in T. Petr (ed.), *Inland Fishery Enhancements* (Rome, FAO Fisheries Technical Paper)

Nao, T., and S. Ly (1997), *Review of the Fisheries and Aquaculture Sector in Cambodia,* prepared for the Project: CMB/95/003, "Natural Resources-Based Development Strategy for the Tonle Sap Area", (Phnom Penh: Department of Fisheries)

National Institute of Statistics (2001), *Cambodia Statistical Yearbook 2000*, (Phnom Penh: Ministry of Planning)

National Institute of Statistics (2000), *Report on the Cambodia Socio-Economic Survey 1999*, (Phnom Penh: Ministry of Planning)

National Institute of Statistics (2000), *General Population Census of Cambodia*, (Phnom Penh: Ministry of Planning)

NEDECO (1998), *Natural Resources-Based Development Strategy for the Tonle Sap Area, Cambodia: Final Report, Volume 2, Part B, Sectoral Studies* (Phnom Penh: Cambodia National Mekong Committee)

Nesbitt, H.J. (ed.) (1997), *Rice Production in Cambodia*, (Phnom Penh: Cambodia-IRRI-Australia Project)

NGO Forum (2001), "NGO Statement to the 2001 Consultative Group Meeting on Cambodia", available at http://www.bigpond.com.kh/users/ngoforum/cg2001/fisheries.htm

Nguyen, X. T. (1991), *Summary of the Report on the Freshwater Fishery Resources Survey in Cambodia (1986-1988)*, (Hanoi: Socialist Republic of Vietnam, Ministry of Fisheries)

Paul, N.C. (1998), *Mangrove Area Encroachment in Cambodia: Problems and Findings* (Vancouver, Canada: seventh annual conference of the International Association for the Study of Common Property, June 10-14)

Pomeroy, R.S., B. M. Katon, and I. Harkes (1998), *Fisheries Co-Management: Key Conditions and Principles Drawn from Asian Experiences* (Vancouver, Canada: seventh annual conference of the International Association for the Study of Common Property, June 10-14)

Rainboth, W.J. (1996), *FAO species identification field guide for fishery purposes: Fishes of the Cambodian Mekong*, (Rome: FAO)

Ratanakiri Provincial Fisheries Office (2000), *A Study of the Downstream Impacts of the Yali Falls Dam in the Se San River Basin in Ratanakiri Province, Northeast Cambodia*, (Ratanakiri: Fisheries Office and Non-Timber Forest Products Project)

Ring, M.W., R.S. Pomeroy, B.M. Katon, and L. Garces (1998), *Measuring Co-Management* (Vancouver, Canada: seventh annual conference of the International Association for the Study of Common Property, June 10-14)

Shams, N. and H. Try (1998), *Cambodia's Rice Field Ecosystem Biodiversity: Resources and Benefits*, (Phnom Penh: GTZ)

Smith, J. D. (ed.) (2001), *Biodiversity, The Life of Cambodia – Cambodian Biodiversity Status Report 2001*, (Phnom Penh: Cambodia Biodiversity Enabling Activity)

Star Kampuchea (2000), *Conflict in Fishing Lot Number 2 and Experiences in Solving the Problem through Advocacy in Kompong Cham Province*, (Phnom Penh: Star Kampuchea)

State of Cambodia (1987), *Fiat-Law on Fisheries Management and Administration*, No. 33 KRO. CHOR., 19 March 1987, translated in Touch Seang, T. (1990), *Compiled Theme of Fishery Laws* (Phnom Penh: Department of Fisheries)

Swift, P. (1999), *Long-term Case Study of the Fishery Setting in Phlong Village, Kompong Chhnang Province, Initial Information Gathering and Outline of Future Work Program* (Phnom Penh: SADP)

Swift, P. (1997), *Developing a Research Framework for the Fishing Lot System in Cambodia: Two Preliminary Case Studies on Fishing Lots in Takeo and Kompong Chhnang Provinces*, (Phnom Penh: Mekong River Commission, Department of Fisheries, and DANIDA)

Tes, S. (1997), "Hydrological Studies of the Tonle Sap/Great Lake Area" in *Natural Resources-Based Development Strategy for the Tonle Sap Area, Cambodia: Final Report, Volume 2, Part B, Sectoral Studies* (Phnom Penh: Cambodia National Mekong Committee)

Touch Seang, T. (1990), *Compiled Theme of Fishery Laws* (Phnom Penh: Department of Fisheries)

Van Zalinge, N., T. Nao, S. T. Touch, and L. Deap (2000), "Where there is water, there is fish? Cambodian fisheries issues in a Mekong River basin perspective", p. 37-48 in M. Ahmed and P. Hirsch (eds.), *Common property in the Mekong: issues of sustainability and subsistence*, (Manila: ICLARM Study Review 26)

Van Zalinge, N. and T. Nao (1999), "Present status of Cambodia's freshwater capture fisheries and management implications" in N. Van Zalinge, T. Nao, and L. Deap (eds.), *Present Status of Cambodia's Freshwater Capture Fisheries and Management Implications: Nine presentations given at the Annual Meeting of the Department of Fisheries Ministry of Agriculture, Forestry and Fisheries, 19-21 January 1999* (Phnom Penh: Mekong River Commission/DANIDA) pp. 11-16

Chapter 4
Forestry

Forests play an essential role in supporting rural livelihoods in Cambodia. Forests provide cooking fuel, timber for construction, materials for tools and household items, resins, vines, wild fruits and vegetables, livestock fodder, and medicines. Rural Cambodians also benefit from a range of important non-extractive forest values. These include cultural and spiritual values, rich flora and fauna diversity, and vital ecological services, such as stabilisation of watersheds to regulate flooding and silting levels.

This section examines the current status of Cambodia's forests, focusing on forest cover and annual harvest information, the importance of forests to rural livelihoods, the status and challenges of forest management, and forestry reform efforts. A number of potential areas for future research are then suggested based on an assessment of research gaps and needs.

4.1. Forest Cover

The forest types of Cambodia can be broadly divided into evergreen, deciduous, and flooded forests. Evergreen forests tend to have denser, closed canopies and are located in areas that receive high levels of rainfall. In Cambodia, evergreen forests are mainly located in the Cardamom Mountains, the northeastern uplands, and the northern provinces of Kompong Thom and Preah Vihear (Map 4.1). The open, less dense forests of Cambodia tend to be deciduous – leaves drop from the trees due to lack of water during the dry season. These forests are mainly located in lowland areas of the northern, northeastern, and southwestern regions, including the provinces of Mondulkiri, Kratie, southern Ratanakiri, Stung Treng, Preah Vihear, and Pursat. Flooded forests and grasslands are interspersed around the Great Lake and throughout the Mekong and Bassac Rivers delta region. Although these regions once comprised extensive flooded forests and grasslands, most areas have been converted for rice farming.

Data on Cambodia's forest cover have not been updated since 1997. It is therefore difficult to assess with precision the condition of the *current* forest resource base. Historical data on forest cover from 1964 to 1997 provide useful information on forest cover trends, though it should be recognised that these data sets have been collected using different forest-type categories, which in some cases makes it difficult to evaluate changes over time. In addition, forest cover data have been developed based on interpretations of satellite images, without the "below-the-canopy" inventories of forest resources that could reveal much about the quality/degradation of remaining forests. Nonetheless, a number of conclusions can be drawn from existing forest cover data (Tables 4.1 and 4.2):

[Map 4.1. Forest Concessions and Land Cover 1996/97]

- **Most of Cambodia's forests are not commercially attractive.** As of 1997, only 6 percent (~630,000 hectares) of Cambodia's forests were in the commercially attractive category of "dense evergreen", while 30 percent of the forest (~3,200,000 hectares) was identified as "disturbed evergreen", which indicates logging ranging from light to severe. "Mixed" and "mosaic" evergreen areas, which account for 15 percent of the forest (~1,600,000), are unlikely to be viable for commercial timber production. Cambodia's remaining forest is primarily deciduous and not considered commercially viable.
- **Deforestation rates appear to have increased beginning in the mid-1990s.** From 1973 to 1993, the average deforestation rate was 70,000 to 90,000 ha per year. Although much uncertainty remains about deforestation rates from 1993 to 1997, data indicate a range of about 55,000 to 190,000 ha per year. World Bank (1999) suggests that the accelerated rate of deforestation was largely the result of increased harvesting pressure from loggers.
- **Most flooded forest areas have been cut and/or converted for agricultural use.** From over one million ha in 1973, flooded forests declined to an area of about 450,000 ha in 1997, of which roughly 30 percent fell into the degraded forest categories of mosaic and regrowth.
- **Updated information on forest resources is needed.** Five logging seasons have passed since the last update of forest cover data. Such an update would provide an important indicator for evaluating progress toward improved forest management since 1997. [1]

It is not presently possible to determine with precision how much of Cambodia's estimated 10.6 million ha of forest cover fall into different forest categories and under different controlling authorities. Although the draft Forestry Law is seeking to clarify management and jurisdictional authority over forests, as well as define categories of forest, these conceptual and legal efforts have not yet been implemented/demarcated on an available map of Cambodia's forests.[2] The draft Law does make clear that the Ministry of Agriculture, Forestry and Fisheries (MAFF) maintains jurisdiction over much of Cambodia's forests, while protected areas are under the management of the Ministry of Environment (MoE) and flooded forests are under the management of the Department of Fisheries (DoF). On this basis, the following information provides an indication of current jurisdictional authority for much of Cambodia's forests:

- 6.5 million ha were awarded in more than 30 forest concessions from 1994 to 1997 under the jurisdiction of MAFF. Due to cancellations, only 19 concessions covering about 4.2 million ha remain valid currently. Of the remaining 4.2 million ha under concessions, only about 50 percent are under high forest (Fraser Thomas *et al.* 2000).

---

[1] The necessary satellite data are available for purchase from several commercial sources for perhaps $6,000-$10,000. Additional funds of roughly $15,000 would probably be necessary to support data interpretation (Martin Geiger, Forest Programme Coordinator, WWF Indochina Programme Office, personal communication). This investment could generate critical information on the current status of forest resources. Such an assessment might be complemented with "below-the-canopy" data on timber inventories and forest composition, which are being collected as part of the development of new concession management plans.

[2] For example, the draft Forestry Law designates several categories of forest as under State/MAFF control, including "production forest" for sustainable production of timber and non-timber forest products, "protection forest" for ecosystem conservation, and "conversion forest for other development purposes" for State forest areas not yet designated for any use (Royal Government of Cambodia 2001). It is not clear how much forest is currently included in each of these categories.

Table 4.1: Data on Forest Cover in Cambodia, 1964 – 1997

Forest Type	1964 (ha)[1]	1973 (ha)[2]	1993 (ha)[2]	Forest Type	1992/93 (ha)[3]	1996/97 (ha)[3]	1997 (ha)[4]
Evergreen	3,955,300	6,876,400	4,763,300	Evergreen Dense	654,442	625,177	634,869
Dwarf Evergreen	288,700			Evergreen Disturbed	3,255,533	3,183,395	3,223,527
Coniferous	17,800	9,300	9,800	Evergreen Mosaic	129,902	178,147	135,632
Mixed	2,504,000		977,300	Mixed Dense	99,124	95,560	111,842
Secondary			517,000	Mixed Disturbed	1,325,353	1,284,446	1,184,689
				Mixed Mosaic	110,066	125,320	97,905
Subtotal of Evergreen and Mixed Forest	*6,765,800*	*6,885,700*	*6,267,400*	*Subtotal of Evergreen and Mixed Forest*	*5,574,420*	*5,492,045*	*5,388,464*
Deciduous	5,296,700	4,792,900	4,301,200	Deciduous	4,008,000	3,931,219	3,777,678
				Deciduous Mosaic	342,204	350,178	274,553
				Forest Regrowth	435,618	374,197	544,778
				Forest Plantation	72,307	82,425	
Subtotal of Deciduous & Other Forest	*5,296,700*	*4,792,900*	*4,301,200*	*Subtotal of Deciduous & Other Forest*	*4,858,129*	*4,738,019*	*4,597,009*
Flooded Forest	681,400	937,900	370,700	Inundated Forest	229,266	219,906	222,150
Flooded Secondary Forest			259,800	Inundated Forest Mosaic	98,587	94,582	105,465
				Inundated Forest Regrowth	21,623	20,819	23,591
Bamboo	387,400			Bamboo	32,224	33,730	21,823
Mangrove	96,300	94,600	85,100	Mangrove	77,669	72,835	77,260
Subtotal of All Flooded Forest	*1,165,100*	*1,032,500*	*715,600*	*Subtotal of All Flooded Forest*	*459,369*	*441,872*	*450,289*
Total	**13,227,100**	**12,711,100**	**11,284,200**	**Total**	**10,891,939**	**10,671,956**	**10,535,762**
% of Total Area of Cambodia	**73.0%**	**70.2%**	**62.3%**	**% of Total Area of Cambodia**	**60.2%**	**58.9%**	**58.2%**

[1] Report No. 2 of Ministry of Water, Forest and Hunting (1965) in Ung (1991).
[2] FAO (1994) in World Bank, UNDP, and FAO (1996).
[3] MAFF in Chan et al. (2001).
[4] Mekong River Commission Forest Cover Monitoring Project in World Bank (1999)

Table 4.2: Forest Cover Loss in Cambodia, 1964-1997

Forest Cover Loss	1964-1973	1973-1993	1993-1997	1964-1997
Total Forest Cover Loss (ha)	516,000	1,426,900 - 1,819,161	219,983 - 748,438	2,555,144 - 2,691,338
Percent of Total Forest Cover Loss	3.9%	11.2-14.3%	2.0-6.6%	19.3-20.3%
Average Annual Forest Cover Loss (ha)	57,333	71,345- 90,958	54,996-187,110	77,429-81,556
Average Annual Percent of Forest Cover Loss	0.43%	0.56-0.72%	0.50-1.66%	0.59-0.62%

- 3.3 million ha have been set aside as protected areas under the jurisdiction of MoE. The protected areas system includes seven National Parks, ten Wildlife Sanctuaries, three protected landscapes, and three Multiple Use Areas, not all of which is forested. Illegal logging in protected areas has been widespread in the past.
- 0.8 million ha have been allocated to agricultural concessions under the jurisdiction of MAFF. (See Chapter 2). Many of these concessions have been granted in currently or previously forested areas.
- 0.45 million ha of forests are flooded forests under the jurisdiction of DoF.

4.2. Timber Harvests, Processing and Trade

Throughout the mid-1990s, logging was rampant in Cambodia. Logging activity was characterised by widespread illegal and unsustainable harvests, a high level of (illegal) log exports, and weak regulation and enforcement, resulting in significant forest loss and degradation. In early 1999, a government crackdown on illegal logging was effective in halting rampant logging, though logging of an unknown level continued until a moratorium on logging activities was imposed on January 1, 2002. Reliable data on logging, processing capacity, and trade have not been generated since the late-1990s, making it difficult to assess the efficacy of forestry reforms.

4.2.1. Timber Harvests

Department of Forestry and Wildlife (DFW) statistics suggest that annual timber harvests ranged between 200,000 to 500,000 cubic meters (m^3) from 1985 to 1999. However, due to high levels of illegal logging and underreporting of logging activity, these statistics are not a very meaningful indication of actual harvest levels. For example, a study by the World Bank-funded Log Monitoring and Logging Control Project estimated that the total log harvest in 1997 was 3.2 to 4.3 million m^3 round wood equivalent, but only about *6-8 percent* of this harvest was legal (Table 4.3).

Table 4.3: Estimated Forest Production in Cambodia, 1997

Production/Trade Categories	Estimated Volumes (m^3 log equivalent)
Direct illegal log export to adjacent countries[1]	902,500
Direct illegal sawnwood exports to adjacent countries	954,900 – 2,085,900
Production for local consumption (uncontrolled, legal status unknown)[2]	670,000
Unreported concession production[3]	166,200
Collection permits issued for illegally felled timber (taxed)	214,700
Collection permits for illegally felled timber (untaxed)[4]	Unknown
Concession harvests reported to DFW (legal and taxed)	248,000
Total estimated harvest	**3,156,300 – 4,287,300**

[1] Adjacent countries are Thailand, Vietnam, and Lao PDR.
[2] Based on an estimated annual production from non-concessionaires of .067m^3 per capita for local consumption.
[3] Based on evidence that concessionaires underreport production by 40 percent.
[4] Tax-exempt permits have reportedly been issued for a significant volume of illegally felled timber. Some information exists in DFW but was not made available to Development Alternatives Incorporated (DAI)
Source: DAI 1998

The 1997 harvest far exceeded the estimated sustainable cut of 0.5-1.0 million m^3 per year, raising grave concerns about future timber supplies (Fraser Thomas *et al.* 2000). Cambodia's standing commercial timber volume in 1997 was estimated to be 20 million m^3, which suggested forests could be logged out in five years if the current logging rates continued. Illegal logging was also affecting protected areas in 1997, with approximately 21 percent of forested areas undergoing intensive harvesting (Development Alternatives Incorporated 1998).

Fortunately, illegal logging rates declined significantly after January 1999 when the Prime Minister issued Declaration No. 1, a 17-point order designed to stop illegal logging and processing. At the June 1999 Consultative Group Meeting, the Minister of Agriculture, Forestry and Fisheries claimed that Declaration No. 1 had resulted in a 95 percent reduction in illegal logging compared to the previous year and that all illegal sawmills had been closed and their equipment confiscated or destroyed. Though a 95 percent reduction in illegal logging could not be fully substantiated, studies by Fraser Thomas *et al.* (2000) and Global Witness (2001) confirm that a dramatic reduction in illegal felling occurred following the crackdown. However, Global Witness (2001) also suggests that illegal logging began to increase again during the 2000-2001 logging season.[3]

[3] Cambodia's logging season corresponds with the dry season (from November to April) when loggers can more easily access remote forest stands. It is worth noting, however, that the DFW

4.2.2. Log Processing and Trade

Cambodia's installed timber processing capacity was estimated to be about 1.2 million m^3 of roundwood per year in 1999-2000 (Fraser Thomas *et al.* 2000). Veneer/plywood plants accounted for about 55 percent of this capacity and registered sawmills accounted for most of the remainder. Much of this capacity was established as a result of investment agreements between the government and timber companies that called for large investments in processing capacity.

In addition to registered processing plants, there were perhaps 1,000 small, unregistered sawmills around the country supplied mainly by illegal logging in 1999-2000. Therefore, total installed processing capacity for the industry was estimated to be roughly 2 million m^3 per year, or two to four times as much as the estimated annual sustainable harvest (Fraser Thomas *et al.* 2000). Since returns on fixed investments in log processing capacity increase with higher capacity utilisation (i.e., increased throughput of log volume), investors/companies have strong incentives to maintain logging activities at levels well-above sustainable harvests in order to fully utilise processing capacity.

Estimating the level of trade, export, and domestic consumption of Cambodian timber is very difficult due to the high degree of illegal logging and poor statistical records. However, it is clear that much of Cambodia's timber is exported to Thailand, Vietnam, and China to meet their domestic demand. Over the past several years, each of these countries has imposed a ban on domestic logging, creating increased demand for imported timber, especially from Cambodia and Laos.

A study by Castren (1999) for the Asian Development Bank assesses the extent of logging in Southeast Asia using wood demand, supply, and trade flows information. Under this approach, the study estimates that Thailand consumed about 10 million m^3 of timber per year in the late-1990s, of which Cambodia supplied about 2 million m^3 per year. The study also suggests that Vietnam was the next largest consumer of Cambodian timber, importing about 1 million m^3 annually. Much of the timber supplied to Vietnam supports the garden furniture industry. The estimates developed by Castren (1999) are generally supported by 1997 export findings of the Log Monitoring and Logging Control Project (Table 4.3).

Log processing capacity and exports have likely fallen due to a crackdown on illegal logging in 1999, a moratorium on logging beginning on January 1, 2002, and other enforcement actions (see "4.10. Forestry Reform Efforts"). For example, MAFF reported the destruction of 158 sawmills in 2001. Regarding exports, Global Witness (2000) reported that timber exports to Vietnam were generally lower in 1999 than in previous years. Timber exports to Thailand were somewhat lower in 1999, but the flow of sawn timber into Thailand remains widespread by land and sea with possibly all the timber requirements of eastern Thailand currently met with Cambodian timber. Many Cambodian logs are also "laundered" through Laos and exported to Thailand (Global Witness 2000a).

4.3. Importance of Forests to Rural Livelihoods

Cambodia's forests are a rich common property resource that plays a crucial role in rural livelihoods. Forest resources support subsistence and income-generating activities such as

bases its forest management activities and data collection on the *calendar* year. Therefore, timber harvest statistics for a given year reflect production activities from parts of two logging seasons (January to April and November to December). This approach can result in many regulatory difficulties. For example, a calendar year cutting permit actually allows cutting during parts of two logging seasons. A timber company with a cutting permit ending on December 31 can cut rapidly during the first two months of the dry season (November-December), and then use the remainder of the dry season for processing/transporting. In practice, it is also quite difficult for enforcement officials to distinguish the difference between logs cut in November/December and logs cut later in the logging season.

small-scale timber harvesting, fuelwood collection, resin tapping, and collection of wild fruits, vegetables, and medicines. These activities typically complement agriculture and fishing, thereby providing households a means for diversifying their livelihood activities, optimising their labour resources, and "insuring" against the risks of agricultural failures and poor fishing catches. However, even people with no land, little money for capital investments, and few alternative livelihood opportunities can collect forest resources for subsistence. In this manner, the forest resource base serves as an essential "safety net" for the rural poor.

Many rural households view agriculture as their primary employment and the collection of forest resources as a vital secondary or tertiary occupation. As a result, national statistics focused on primary employment may not adequately capture the importance of forest resources in rural subsistence. For example, the *General Population Census of Cambodia 1998* estimates that only 6,653 people, or 0.13 percent of the workforce, are employed in "Forestry, Logging, and related service activities", whereas 75.7 percent of the workforce is employed in "Agriculture, Hunting, and Forestry". Likewise, the *Cambodia Socio-Economic Survey 1999* estimates that 74.7 percent of Cambodians were employed in the "agriculture, hunting, and forestry sectors", but forestry employment is not disaggregated from agriculture and hunting activities.

Case studies of forest resource use suggest that the level of informal employment and income generation derived from forest products is significant, but varies widely across the country. Clearly, more richly forested areas can support higher levels of employment and income generation, but many other areas demonstrate high dependence on forests for a range of livelihood needs, most prominently fuelwood. To illustrate the dependence of rural livelihoods on forest resources, findings from a number of case studies are briefly described below.

- **Kampot Province – four villages** (Hou *et al.* 2001). Average net income from forest resources accounted for 38 percent of total net income for four Chumkiri District villages in 1999-2000. Villagers noted that they must now spend 15-30 days travelling long distances to find suitable timber for house construction, whereas in the past these activities only required a few days. Villagers also complained about the various fees they must pay to military personnel and other armed groups at unofficial checkpoints. On average, these fees represented 11 percent of villagers' forest product income in 1999-2000; no forest management services were provided in return for the fees. In addition to checkpoint fees, villagers voiced concerned about the increased risks of illness, mainly from malaria, associated with long trips to the forest.
- **Kompong Thom – three villages** (Chea *et al.* 1998). Two of the three villages selected were in or adjacent to a forest concession. These two villages were found to be highly dependent on forest resources, including timber and poles for construction, fuelwood, resin, vines, rattan, bamboo, wild fruit and tree leaves, wildlife, medicinal plants, and mushrooms and wild potatoes. The third village, which is located farther from the forest, was less dependent on forest resources. All three villages complained of problems with concessionaires, including the logging of resin trees without villagers' permission or compensation, illegal logging and forest loss, prohibiting access to and collection of forest resources, and causing noise problems and other damage by transporting logs at night.
- **Kompong Thom Province – one village** (Chan forthcoming). Due to insufficient farmland and poor soil quality, total rice production in the village only meets about one-third of consumption needs. As a result, villagers' livelihoods are strongly dependent on forest resources. However, restrictions on access to forest resources imposed by concessionaires, degradation and destruction of forests, and rapid population growth within the village, have resulted in increasing poverty for

villagers. Although villagers benefited from anarchic logging activities from 1991-1994, receiving 3,000-4,000 riels per m^3 of log from sawmill owners, the granting of three different concessions in the area beginning in 1994 resulted in an immediate halt to these activities. Private trucks transporting logs were forbidden and 11 of the 13 sawmills in the area were shutdown. From 1996-1998, the concessionaires also cut many of the resin trees "owned" by villagers (passed down from generation to generation). Of the 25 households claiming to have possessed 300-700 trees each, most now have about 50 trees and some have lost all their trees. Presently, accessing forest resources (especially timber) is very difficult because concession security personnel strictly patrol the forests day and night.

- **Mondulkiri Province – one village** (So *et al.* 2001). This primarily ethnic Phnong village was found to earn more than half its livelihood income through trips to the forest. Villagers' incomes depended mainly on resin collection (32 percent) and hunting (30 percent), followed by shifting cultivation (19 percent), livestock raising (13 percent), and fishing (3 percent).
- **Ratanakiri Province – six villages** (Ratanakiri Provincial Rural Development Department *et al.* 2000). This cultural resource study was undertaken to identify forest areas of religious and cultural significance to ethnic Kreung people living within the Hero Taiwan Company forest concession. The study found that the physical environment of the Kreung is fundamentally connected to their religion and culture, with the most powerful spirits present in areas called spirit forests, spirit mountains, and sacred groves. Each area has its own history and associated legends passed down verbally from generation to generation for hundreds of years. Kreung believe that ancestor and guardian spirits in these areas watch over villages. When treated well, these spirits ward off disease, poor crop harvests, and other problems. When not treated well, the consequences can be severe. More than twenty sites considered exceptionally sacred to Kreung were identified within the study area, most of which were spirit forests that would be affected by the logging concession.
- **Takeo Province – three villages** (Yoshida *et al.* 2001). Although the forest is beginning to recover, shortages of fuel for daily cooking remain a significant problem. Roughly 20 to 35 percent of villagers depend on purchased fuelwood to meet their needs. Some households use rice husks and cow dung for cooking fuel.

The case studies of forest resource use by rural communities reveal a number of common issues and problems:

- **Increasing deforestation, degradation, and forest access problems.** Diminishing supplies of forest resources in close proximity to villages is forcing villagers to meet needs from areas farther away. The causes of the decline in available forest resources include restrictions on access to forested areas due to the designation of forest concessions (4.2 million ha), illegal and unsustainable logging practices, and population pressure and resultant unsustainable use of forest resources in areas nearby to villages.
- **No viable substitute for many forest products.** For forest resources important to rural livelihoods, such as fuelwood, there are few products that can be substituted when resources become scarce. When the costs of obtaining forest resources increase (in terms of time, labour, money, and risk), villagers must bear these costs. Thus, the declining health of, and restricted access to, forest resources imposes new burdens on rural livelihoods.
- **Increasing rural poverty due to the forest concession system.** Under the current concession approach to forest management, concessionaires typically hold exclusive rights to forest resources. The right of rural communities to common property is not

recognised. Denying access to common resources confines rural communities to livelihood activities on private property (residential and agricultural land). In light of the widespread dependence of rural communities on forest resources, it follows that exclusion from these resources will result in increased poverty.

- **Increasing tensions over forest resources.** Conflicts commonly occur as a result of denied access to forest resources, the loss of forest resources due to logging damage, and/or the climate of intimidation associated with concession security operations.

4.4. Historical Overview of Forest Management

Prior to the rise of the Democratic Kampuchea regime in 1975, legal forest harvesting in Cambodia took place under a system of "collection permits" that had been established during French colonial times. Under the collection permit system, permits were issued for set periods of time and designated volumes of timber in exchange for a flat fee. The permit system offered considerable flexibility for both loggers and authorising authorities, as loggers with a permit did not need to have a concession, management plan or spatially defined harvesting area.

Little is known about forest management under the Democratic Kampuchea regime from 1975 to 1979, though internal upheaval and international isolation probably resulted in reduced commercial logging and associated deforestation. However, the regime's focus on agricultural expansion resulted in substantial clearance of flooded forests.

During the 1980s, the Forestry Department played a direct role in forestry exploitation, operating logging yards in Kompong Cham, Stung Treng, Ratanakiri, Mondulkiri, and Kompong Thom, and saw mills in Phnom Penh, Prey Veng, Kompong Cham, and Kompong Thom. Logging was also carried out by solidarity groups called "krom samaki," who would then sell their logs to the Forestry Department at fixed prices well below market value. At least one logging concession of 75,000 ha in Kratie was granted to the Socialist Republic of Vietnam on a year-to-year basis (Curtis 1989).

The pace of forest exploitation increased beginning in the late-1980s, as various political and military factions, Thai military officers, and businessmen engaged in rapid cutting and sale of valuable tropical hardwood species. By the early 1990s, there were reports of widespread logging throughout Cambodia. Noting a potential four-fold increase in logging activity, the Far Eastern Economic Review (1992) suggested that "[p]ast ravages may pale alongside the full-fledged attack on forests now planned by the country's four once-warring factions…. [E]ach needs funds to prepare for next May's election of a national government, and the forests provide an easy answer" (in Talbott 1998). Due to the isolation and dangerous conditions in much of the Cambodian countryside at the time, there is little documentation on the logging activities and arrangements. However, it is clear that all three major political forces vying for control of Cambodia – Cambodian People's Party, FUNCINPEC party, and the Khmer Rouge – were deeply involved in logging the areas under their control (Talbott 1998).

After the 1993 elections, uncontrolled logging problems continued. Of particular note was the government's decision in June 1994 to give control of timber exports to the Ministry of National Defense. This decision, which was intended to generate timber revenues for the Royal Cambodian Army's campaign against the Khmer Rouge, solidified the military's role in logging.

During the 1990s the government reintroduced the collection permits system and private industrial forest concessions as the primary instruments of commercial forest management. Both are discussed in more detail below. Although collection permits were banned in 1999, concession forestry remains the most dominant approach to forest management in Cambodia to this day.

4.5. Collection Permits System

The collection permits system, which had existed prior to the rise of the Democratic Kampuchea regime in 1975, returned as a basis for widespread logging in Cambodia from 1994 to 1998. Collection permits authorised by the Council of Ministers, MAFF, Ministry of National Defense, provincial governors, or other high ranking officials were provided to forest concessionaires, military units, timber trading companies, and individuals. These permits authorised the collection of a fixed volume of "old, illegal, or anarchic" logs left in a forested area during an established time period.

The collection permit system was justified as a means for avoiding the loss of valuable raw materials that would otherwise be left to rot. In practice, the Log Monitoring and Logging Control Project found that "old" logs were usually the result of logging conducted by either: (a) sub-contractors of a concessionaire, acting on its request, (b) independent logging groups acting on the belief that collection permits may provide a future market for their logs, or (c) local logging groups controlled by government officials acting on the knowledge that a collection permit had been granted (DAI 1998). Collection permit volumes were largely met through illegal logging, not the collection of old logs.

While logs sold via collection permits accounted for about six percent of the total harvest in 1997, an unknown volume of timber was felled and sold under collection permits where all royalties and fees had been waived (Table 4.3). Although data on the total number of tax-free collection permits and allowable harvest volumes were not provided to the Log Monitoring and Logging Control Project, these permits allegedly accounted for a significant portion of the 1997 harvest (DAI 1998).

Armed forces were also granted special harvest permits for substantial volumes of timber, but no clear record of these authorisations is available. In addition to authorised military logging activities, there was significant logging by unauthorised armed groups – some run by military commanders and some by other strongmen such as provincial government officials. Armed groups engaged in logging usually sold their logs to local sawmills, buyers from neighbouring countries, permit holders, traders, or concessionaires (DAI 1998).

The Prime Minister's Declaration No. 1 of January 1999, noted above, banned the issuance of new collection permits and invalidated existing permits. While this ban appears to have been largely effective in curtailing the authorisation of logging through collection permits, the Forest Crimes Monitoring Unit has reported some infractions. For example, it appears that Superwood IPEP Ltd. was granted permission to "collect old logs" in 1999-2000, apparently for the purpose of generating funds to support investments in concession operations (Forest Crime Monitoring Unit 2000).

4.6. Forest Concession Management

From 1994 to 1997, the government reintroduced forest concessions as the primary instrument of forest management. More than 30 concessions were granted covering an area of about 6.5 million ha – equal to more than one-third of the country and over half of Cambodia's forests. The new concession system was superimposed on the existing collection permit system creating an ambiguous legal context for commercial forest management.

By reintroducing a forest concession system, the government sought to delegate responsibility for forest management to private sector companies and raise much needed revenue for national development. However, concessions were granted in private negotiations between high-level officials and concessionaires that resulted in ambiguous contracts strongly favourable to the concessionaire. According to legal analysts supported by the World Bank-funded Forest Policy Reform Project, "concession contracts so strongly favour the concessionaire that it is questionable whether they can be considered commercially

reasonable" (White and Case 1998). The analysts found the contracts to be so ambiguous and rife with problems that a line-by-line critique would be of little use. Among 42 separate problems, they noted:

- Concession contracts lack reference to benchmarks or standards for evaluation of compliance with sustained yield management.
- Concession contracts do not specify royalty payment procedures, provide maximum revenue or other benefits to the government, or provide penalties for non-payment.
- Concession contracts lack detailed descriptions of concession boundaries.

The granting of concessions also took place without forest resource assessments or consideration of environmental and social impacts (Fraser Thomas *et al.* 2000). Concession boundaries were allocated on maps with apparently little consideration for the potential impacts on local people, cultural sites, important watersheds, and sensitive ecological areas. Attesting to the problems of concession boundaries, MAFF recently reported that 751,968 ha (or 17 percent) of current forest concession areas are under agricultural cultivation (MAFF 2002).

4.6.1. Status of Current Concessions

According to MAFF, 15 logging companies presently hold contracts for 19 concessions covering about 4.2 million ha in Cambodia (Table 4.4). Numerous concessions have been cancelled over the past 3-4 years, but in most cases these cancellations have not resulted in forest preservation because the concessions were largely logged out before they were cancelled. The government cancelled 12 forest concession contracts in 1999, involving 10 companies and a total area of about 2.3 million ha. These contracts were cancelled based on violation of Article 10.4 of their Investment Agreements.[4] One other company voluntarily terminated its concession agreement due to the commercial non-viability of its concession. Two more concessions (Hero Taiwan Company and Voot Tee Peanich Import Export Co., Ltd) were cancelled in May 2002.[5] It has also been reported that the GAT International Company concessions were cancelled in late-June 2002 due to violations of the moratorium on logging, but these cancellations could not be officially confirmed at the time of publication.

All timber companies currently operating in Cambodia are members of the Cambodian Timber Industry Association (CTIA). Despite the presence of a trade association and many foreign-owned companies, the potential transfer of foreign technical expertise to the management of Cambodia's forests does not appear to have occurred. According to rankings by the Cambodian Forest Concession Review (2000) and separate analyses by Global Witness (1999a), it appears that only two companies – GAT International and Samling International – possess the technical capacity to practice professional forest management techniques, but both of these companies have been cited for illegal activities.[6] The remaining companies are

[4] Article 10.4: In case the Investor fails to act on this agreement and fails to commence commercial activities in the concession area within one (1) years from the date of this Agreement, the Royal Government of Cambodia reserves the right to terminate the Agreement without conditions and without the payment of compensation. Such termination will result in the Investor forfeiting Deposits paid to the Royal Government in accordance with Article 13 of the Forest Timber License.

[5] The concessions were officially cancelled by Decision 27 Sor Sor Rour, signed by the Prime Minister on 8 May 2002 (Global Witness 2002).

[6] For example, during the 1999-2000 logging season GAT illegally cut 777 logs (about 2000m^3) in the Central Cardamoms. More recently, Global Witness (2002) reported illegal logging by GAT of approximately 1,000 trees (with an estimated market value of $1 million) in an area outside of its legal coupe. This logging was carried out during 2002 when all logging activities were officially suspended under the *Prakas on Suspension of Forest Concession Logging Activities* effective 1

investors who subcontract the actual logging activities to third parties. According to reports from Global Witness (1995-2001), these subcontractors are often military units or powerful and well-connected businesspeople who log indiscriminately inside and outside of concession areas, as well as in protected areas.

The Cambodia Forest Concession Review (2000) found that no forest concession in Cambodia has been managed sustainably, with harvesting far outpacing the rates expected under the 25- to 30-year Forest Timber Licenses. Only in 1999 did harvesting rates fall, which the Concession Review attributes to "the fact that concessionaires simply cannot find enough harvestable trees." As shown in Table 4.4, seven concessions have fewer than 5 years harvest left, seven have between 5 to 10 years harvest left, and seven have 10 to 15 years harvest left. In addition to the concessions shown in Table 4.4, the Concession Review identified three concessions that were not considered viable for commercial management due to the depletion of forest resources. On the Concession Review's recommendation, the government terminated these three contracts just prior to the Consultative Group meetings with donors in May 2000.[7]

4.6.2. Concessionaire Profitability

According to a draft study prepared by KPMG in 2001, the concession system has also not proven profitable for concessionaires. With CTIA support, KPMG collected primary data from five representative concessionaires to evaluate their average profitability and corresponding ability to pay royalties and export taxes. These concessions accounted for about 40 percent of the total area under forest concessions in Cambodia. KPMG concluded that "over the past three years [1997-1999], the average Cambodian producer has not generated significant positive net revenues and has never met reasonable profit expectations." Average net revenue per cubic meter of log volume (before payment of royalties and export taxes) was estimated to be -$17.34 in 1997, -$49.53 in 1998, and $7.73 in 1999. KPMG suggested that the "extremely poor" performance of concessionaires left little if any revenue for paying royalties and export taxes to the government: "Only in 1999 did the average company generate a small positive net revenue, but only when government taxes (royalties and export tax) are excluded…. This means that there was no residual value or rent available for payment of royalties or taxes in any year covered by the study."

January 2002. Samling International is one of only two companies to receive official reprimand from the government over its activities (Global Witness 1999a).

[7] The cancelled contracts were with: (1) Lansong International Co. Ltd. – only consisted of five coupes; (2) Long Day Machinery Industry Co. Ltd. – consisted of 11 coupes, of which four had no operable area and seven had been heavily logged by past illegal activities; and (3) Cambodia Timber Product Pty. Ltd. – only consisted of three coupes, all of which had been depleted by illegal logging operations (Fraser Thomas *et al.* 2000).

Table 4.4: Forest Concession Information

Name of Company	Province	Origin of Company	Area (ha)	Years of Harvest Remaining[1]
1. GAT International Co., Ltd[2,3]	Koh Kong, Pursat	Malaysia	215,720	>10
2. GAT International Co., Ltd[2]	Kompong Thom, Kratie	Malaysia	149,780	5-6
3. Colexim Enterprise	Kompong Thom	Cambodia/ Japan	147,187	10-15
4. Casotim Co., Ltd	Kratie	Cambodia/ Russia	131,380	3-6
5. Samling International Ltd	Kratie, Kompong Cham, Mondulkiri	Malaysia	467,484	3-5
6. Samling International Ltd[3]	Kompong Speu, Koh Kong	Malaysia	298,598	5
7. Mieng Ly Heng Investment Co., Ltd	Kompong Thom, Preah Vihear, Kompong Cham	Cambodia	198,500	6-7
8. Pheapimex Fuchan Cambodia Co., Ltd	Kompong Thom, Kratie, Stung Treng, Preah Vihear	Taiwan/ Cambodia	358,725	5-10, >10 in Stung Treng
9. Pheapimex Fuchan Cambodia Co., Ltd	Stung Treng, Ratanakiri	Taiwan/ Cambodia	350,000	>10
10. King Wood Industry Pte, Ltd	Kratie, Stung Treng, Mondulkiri	Taiwan	301,200	3
11. Cambodia Cherndar Plywood Mfg. Co., Ltd	Preah Vihear	Taiwan	103,300	5-10
12. Sam Rong Wood Industry Pte., Ltd	Siem Reap	Cambodia	200,050	5-10
13. Everbright CIG Wood Co., Ltd	Kratie, Stung Treng	China	136,376	10-15
14. Super Wood IPEP Ltd	Pursat, Kompong Speu	Malaysia	94,419	10-15
15. Timas Resources Ltd	Kompong Cham, Kratie, Preah Vihear	Singapore	161,450	10-12
16. Silverroad Wood Products Ltd[3]	Koh Kong, Pursat	China	215,460	<5
17. Silverroad Wood Products Ltd	Koh Kong	China	100,000	<5
18. You Ryasco Company	Pursat, Battambang	Cambodia	214,000	<10
19. TPP Cambodia Timber Product PTE, Ltd	Siem Reap, Preah Vihear, Pursat	Thailand	395,900	2-4
15 companies, 19 concessions	**Concessions located in 12 provinces**	**Foreign company involvement in 16 of 19 concessions**	**4,239,529 (equal to 40% of all forest area)**	**6 concessions with >10 years, 6 concessions with 5-10 years, 7 concessions with <5 years**

[1] Estimates are based on assessments conducted during the 1999-2000 logging season.

[2] It was reported that the GAT International concessions were cancelled in late-June due to violations of the moratorium on logging, but these cancellations could not be officially confirmed at the time of publication.

[3] It was reported that protection of the Central Cardamom Mountains would be granted in late-June, suggesting large sections of these concessions would be changed from production areas to protected forest.

Sources: Fraser Thomas *et al.* 2000, Appendix 8; Chan *et al.* 2001

4.7. Community Forest Management

With the bulk of government and donor resources focused on developing and reforming the forest concession system, community forestry has often been marginalised in Cambodia. For example, the influential World Bank report *Cambodia: A Vision for Forestry Sector Development* (1999) called for a forestry sector where "reasonably well stocked" forests are available for commercial production and "small forest areas and scattered trees" are managed by local communities. "Community forestry needs to be recognised as a means for achieving sustainable management for the large bulk of forest resources that are not suited to commercial production and which will be beyond the direct management capacity of Government." The vision did not comment on whether communities residing within or adjacent to commercially valuable forests should have priority rights to benefit from those resources, or how the motivation of communities to manage forests sustainably might be affected if they are only granted rights to low value, degraded forest areas.

More recently, community forestry has received considerable attention as a potential alternative (or complement) to forest concession management. Community forestry is broadly an effort to support and empower communities to continue their traditional uses of forest resources and encourage sustainable practices. Community forestry is also intended to harness local knowledge and skills regarding forest management and ensure communities have a stronger voice in forestry sector decision-making. Signs of increasing support for community forestry include greater on-the-ground efforts to organise and develop community forests, increased donor support for community forestry, establishment of national-level community forestry units within DFW and MoE, holding of a National Community Forestry Workshop in 2001, and ongoing drafting of a Community Forestry Sub-Decree.

In order to provide a better understanding of the present scale and scope of community forestry activity in Cambodia, CDRI developed an inventory of current projects based on existing documents, forestry network information, and phone interviews (January-March 2002). No field visits were conducted to verify information. Community forests vary widely in terms of forest types, organisation, management objectives and approaches, problems addressed, progress toward establishment, and support levels. For the purposes of this inventory, "community forestry activity" is defined broadly to include local efforts to improve forest access, regrowth, management, and sustainable use. It is not the intention here to define "community forestry" precisely or to evaluate the effectiveness of current efforts.

CDRI identified 237 community forests in Cambodia (Table 4.5).[8] These projects are subdivided into categories of those started prior to 2000 and those started in 2000 or later, in order to distinguish community forests that are likely more mature and established from those that have only recently started (and therefore may be more involved in planning and organising). Projects started prior to 2000 have resulted in the development of 127 community forests, involving 288 villages (or about 230,000 people), and covering an area of approximately 47,000 ha. The differing approaches to community forests are reflected in the wide variance in community forest size and populations affected. Several community forests are small areas, often near pagodas, where the focus is on regenerating the forest for spiritual, recreational, and aesthetic purposes rather than improving available forest resources. While these forests play an important role in communities, and may affect a large number of people, forest products are not typically collected in significant amounts from these forests.

As a rough indication of the potential for community forest resources to support rural livelihoods, project representatives were asked to assess the quality/stock of the forest product

[8] MAFF (2002) reported "the establishment of 110 community forests in 15 provinces" in Cambodia. This estimate is based on DFW consultations with provincial offices. No additional information on location, size, stakeholders, etc., is currently available. It is unclear the degree to which community forests identified by CDRI overlap with those identified by DoF.

resource base for fuelwood, non-timber forest products, and timber. For each product, representatives indicated whether resources within the community forests are: (1) not enough for household consumption; (2) enough for household consumption only; (3) enough for household consumption and selling. For the community forest projects started prior to 2000, only community forests in Ratanakiri, Mondulkiri, and Preah Vihear have sufficient timber resources for household consumption. Fuelwood and non-timber forest resources for household consumption appear to be more widely available.

Forestry reforms, decentralisation efforts, and greater focus on community-based natural resource management have all resulted in increasing community forestry activities over the past two years. Projects started since 2000 are in the process of developing at least 110 community forests involving 128 villages (or about 180,000 people). The size of these forest areas is largely unknown at present since many projects are in the planning stages and/or seeking to establish community forests within concession areas. In general, the forest product resource base of these more recently established community forest projects appears to be less degraded than earlier projects.

YakPoy Forest Community: A Case Example

In January 2001, an agreement between relevant provincial and local government officials and the Yakpoy Forest Community Committee was signed designating 5,399 ha of forest in Poy Commune, O Chum District, Ratanakiri Province as the Yakpoy Forest Community. This agreement was the culmination of five years of work by six ethnic Kreung villages with support from the Ratanakiri Non-Timber Forest Project and other NGOs. In 1997, the six villages formed a Community Forestry Association for the Yakpoy forest area, which lies within the Hero Taiwan Company concession. The Community Forestry Association developed and agreed on forest use and protection regulations and the functions and responsibilities of the Association. Under the "Statute of Yakpoy Forest Community", members of Yakpoy Community Forest are allowed to:

- Collect bamboo, rattan, and vines for domestic consumption;
- Cut timber for domestic purposes with permission from the relevant authorities;
- Gather other NTFPs for commercial purposes within the rule of law and without destroying the forest;
- Hunt small animals and fish using traditional hunting and fishing gear.

The regulations prohibit all types of commercial timber exploitation, burning and clearing land for swiddens and home gardens, mineral exploitation, fishing and hunting using modern technology and/or for commercial purposes, and hunting large mammals or endangered species. The duration of the agreement is not specified, but forest management is subject to annual monitoring and evaluation. Repeated management problems and violations of the agreement can result in its termination.

(Bottomley 2000, Ratanakiri Non-Timber Forest Products Project 2001)

Table 4.5: Community Forestry Activity in Cambodia[1]

Community Forestry Activity Started Prior to 2000									
Province	No. of Community Forests	No. of Villages Involved	Estimated Population Affected[2]	Estimated CF Area (ha)	Status of Forest Products[3]			Starting Date of Project	Agency/NGO Working to Establish CF
					Fuel wood	NTFP	Timber		
B. Meanchey	5	22	17,045	15	No significant products			1998	BFD
	6	6	3,815	523	N/A	N/A	N/A	1999	LWS/Seila/Addess
Battambang	10	17	15,905	20	No significant products			1996	BFD
Kompong Chhnang	12	12	5,535	750	2	2	1	1991	Concern
	N/A*	7	N/A	N/A	2	2	1	Jul 1998	AEC/SADP
K. Speu	3	3	466	35	N/A	N/A	N/A	1999	PRASAC
Kompong Thom	1	8	7,046	3	No significant products			1997	WTPS
	2	2	2,013	30	No significant products			1997	WKK
	5	5	N/A	159	N/A	N/A	N/A	1999	GTZ
	3	6	2,661	2402	2	3	1	Nov 1999	BFDK
Mondulkiri	2	5	1,146	326	3	3	3	Dec 1998	DFW/SMRP
Preah Vihear	6	14	15,538	N/A	3	2	2	Nov 1998	BPS
Prey Veng	N/A	7	15,619	70	No significant products			1994	Padek
	2	N/A	3,897	7	No significant products			1998	Chet Thor
Pursat	11	11	5,953	631	2	3	1	1995	Concern
	3	3	190	327	2	3	1	Dec 1999	EPDO
	6	6	5,883	299	N/A	N/A	N/A	1998	Seila
Ratanakiri	4	32	17,996	10000	3	2	3	1996	NTFP/ICC
	5	N/A	18,277	10000	3	2	3	1996	Seila/IDRC
Siem Reap	5	5	547	131	2-3	3	1	1995	Padek
	30	90	68,951	20000	2	2-3	1	1997	FAO
	4	4	4965	100	N/A	N/A	N/A	1995	APDO
Svay Rieng	1	5	3360	414	N/A	N/A	N/A	1994	Santi Sena
Takeo	1	18	12,513	500	1	2	1	1992	MCC
Subtotal	*127*	*288*	*229,321*	*46,742*	*2.2*	*2.5*	*1.3*		

Community Forestry Activity Started in 2000 or Later									
					Status of Forest Products[3]				
Province	No. of Community Forests	No. of Villages Involved	Estimated Population Affected[2]	Estimated CF Area (ha)	Fuel wood	NTFP	Timber	Starting Date of Project	Agency/NGO Working to Establish CF
B. Meanchey	11	11	12,655	3,000	N/A	N/A	N/A	Jan 2000	CHRD
Battambang	7	7	6,549	N/A	3	3	1-2	Jan 2001	Seila/MoE
	10	10	8,213	2030	N/A	N/A	N/A	2000	ADDESS
Kampot	1	3	700	200	3	3	1	Jul 2000	CFRP/CIDSE
Koh Kong	2	3	635	300-400	3	3	2	Jul 2001	CFRP/AFSC
K. Chhnang	2	2	1,516	60	2	1	1	Dec 2001	LWS
Kompong Speu	1	2	621	120-140	1	2	1	Jun 2001	LWS
	1	3	232	400	N/A	N/A	N/A	Aug 2001	Mlup Baitong
	3	3	1224	100	N/A	N/A	N/A	2000	GTZ/CGFP
Kompong Thom	8	8	6,920	N/A	N/A	N/A	N/A	Dec 2000	KVOD
	3	5	3,593	N/A	3	3	3	Jan 2001	RPFD
	6	6	3,624	1200	3	3	2	Jan 2001	KCAD
	1	3	6,039	800	2	3	2	Dec 2001	CFRP
Kratie	9	9	5,762	2000-3000	3	2	2	Jan 2001	CED
	4	15	11,605	1200	3	2	2	Feb 2001	EDCO
	6	N/A	28,811	N/A	3	3	1	Feb 2001	SSP
	2	N/A	4,528	2000	2	3	1	Aug 2001	CFRP/KAFDOC
Mondulkiri	4	N/A	16,040	N/A	3	3	3	Feb 2001	SSP
	1	1	300	N/A	2-3	2-3	2-3	Jul 2001	WCS
Pailin	5	5	35,050	N/A	2	3	3	Apr 2000	FLOW
Preah Vihear	1	1	N/A	N/A	2-3	2-3	2-3	Nov 2001	WCS
Pursat	1	1	792	N/A	3	1	1	Nov 2000	CFDS
	1	5	N/A	N/A	2	2	1	Feb 2001	AEC/SADP
	2	3	600	600	2	3	3	Dec 2001	BDASE
	8	8	7218	952	N/A	N/A	N/A	2000	ADDESS
Ratanakiri	2	6	8,942	7000	3	2	3	2000	CIDSE
Siem Reap	2	2	2,189	210	3	3	1	Jul 2000	Concern
	1	3	2,260	2200	2	2	1	Jul 2001	CFRP
Stung Treng	4	N/A	4,528	N/A	3	3	3	Feb 2001	SSP
Svay Rieng	1	3	973	50	2	1	1	Jul 2001	CWS
Subtotal	*110*	*128*	*182,119*	*22,982*	*2.8*	*2.6*	*2.0*		
Grand Total	**237**	**416**	**411,440**	**71,724****	**2.5**	**2.5**	**1.7**		

[1] *"Community forestry activity" includes local efforts to improve forest access, regrowth, management, and sustainable use.*

[2] *In some cases, estimates reflect the estimated number of households multiplied by the average household size for the province.*

[3] *For each forest product, CF projects were asked if the CF provides: (1) not enough for household consumption; (2) enough for household consumption only; (3) enough for household consumption and selling. Some CFs are small regeneration/conservation projects (often near pagodas) from which few, if any, forest products are collected.*

** N/A indicates that information was either not available or not applicable. **Information on hectares of community forest was not available for 47 CFs.*

Source: Community Forestry Working Group, phone interviews (Jan-Mar 2002). No field visits were conducted to verify information.

4.8. Government Revenue

One of the main goals of establishing a forest concession system in Cambodia was to generate government revenue. In 1996, the World Bank, UNDP, and FAO estimated that government forest revenue in Cambodia could eclipse $100 million annually. The World Bank later adjusted this estimate to $40-$80 million annually. These revenue projections have proven to be overly optimistic. Since the initial revenue projection in 1996, official government forest revenue has ranged between $6-$12 million per year. Revenue was somewhat higher in 1994 and 1995 when many concessions were first granted (Table 4.6). Privately, several donors now concede that the forestry sector is unlikely to ever generate significant government revenue. In addition, it is worth noting that future timber harvest levels are likely to be lower than in the past due to forestry reforms that emphasise sustainable management and the fact that there are fewer available trees to harvest. This will result in even less future royalty and export tax revenue for the government.[9]

Table 4.6: Official Government Forest Revenue, 1992 – 2001

Year	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Government Forest Revenue (million US$)	0.8	1.4	33.5	21.5	10.4	12.5	6.0	9.5	10.6	7.4

Source: Ministry of Economy and Finance (2002)

Although the forestry sector may not appear important to the Cambodian economy when examining official government revenue statistics, these formal numbers mask the past and present significance of the forestry sector's contribution. Through largely informal channels, timber revenues support provincial and district governments, the military, national government, political "strongmen," political parties, and civil servants (Global Witness 1995-2001). These funds are generated through the collection of provincial and district taxes, informal fees, and direct participation in forestry activities by the military. Timber companies reportedly pay $40-$80 per cubic meter in informal fees to various government officials and armed groups (Forest Crime Monitoring Unit 2000).[10] Informal fees collected in 1997 may have exceeded $150 million (DAI 1998). It is unknown what portion of these informal payments financed legitimate public services (through a parallel budget) and what portion went into individuals' pockets. It is also unknown how much of these informal payments represented bribes to avoid paying formal taxes.

4.9. Legal and Institutional Basis for Forest Management

Reviewing the formal legal and institutional basis for forestry management may not provide a clear picture of what actual practices are taking place under the law or which institutions are involved. This is due to the current ambiguity of Cambodia's forestry laws and regulations, which allow officials significant discretion in setting government practice, and the historical lack of transparency regarding the government's role in the forestry sector (White and Case 1998, Fraser Thomas *et al.* 2000). It is therefore difficult to determine which ministries and/or officials actually may have authorised and/or benefited from various allocations of forest land, (illegal) logging activities, and wood processing investments. Likewise, there is little information on the precise interactions and links among government ministries, officials, military, and concessionaires and their various sub-contractors (i.e., armed forces, companies).[11]

---

[9] Timber royalty rates in Cambodia are presently $54 per m^3 for Class 2 timber, which is the most common grade produced from concessions (Fraser Thomas *et al.* 2000). This rate is imposed regardless of concession location, production cost, or market price.

[10] These payments are difficult to document. The Log Monitoring and Logging Control Project estimated that suggested unofficial payments of roughly $50 per m^3 in 1997 (DAI 1998).

[11] Reports and investigations by Global Witness (1995-2001) have made the most progress in bringing to light this web of relationships and activities.

4.9.1. Forest Laws and Regulations

A new Forestry Law was adopted by the Council of Ministers on July 20, 2001, and submitted to the National Assembly on August 17, 2001. The Law is currently under discussion within a technical committee of the National Assembly. The new Law is intended to clarify national forestry objectives, forest categories and jurisdiction, management and administration, resource rights, and enforcement. Until the new Forestry Law is passed, the foremost law governing Cambodia's forests will continue to be Kret No. 35 KRC of June 25, 1988. According to legal analysts White and Case (1998), this law's ambiguity provides the government substantial discretionary power regarding forest exploitation and management.

In addition to Kret No. 35 KRC of 1988, a number of other forestry regulations (Prakas) and government orders/declarations have been issued on forest management, exports, and enforcement from 1986 to the present.[12] These include the Sub-decree on Forest Concession Management of February 2000, which establishes requirements sustainable forest concession management, and the Prakas on Suspension of Forest Concession Logging Activities issued on December 13, 2001. This recent Prakas imposes a moratorium on all concession logging activities and suspends the issuance of any logging permit effective January 1, 2002. For the suspension to be lifted, concessionaires must develop and receive approval of new forest concession management plans consistent with legislation and technical regulations.

4.9.2. Institutional Role of Government in the Forestry Sector

Although DFW under MAFF holds primary responsibility for managing state-owned forests, many other government ministries, departments, and authorities play important roles. The formal institutional roles and responsibilities of government in the forestry sector are as follows:

- DFW under MAFF is responsible for management of forest areas outside protected areas and flooded forests.
  - DFW headquarters in Phnom Penh is organised into six offices, one research institute, and three companies. Two of the companies are COLEXIM and CASOTIM, which operate largely independently and are both concessionaires.
  - Forestry Offices around the country are under the Provincial or District Department of Agriculture, which reports to DFW headquarters.
- Department of Nature Conservation and Protection under the Ministry of Environment (MoE) is responsible for managing Cambodia's 23 protected areas (3.3 million ha). Only a small number of the protected areas have full-time paid staff for management and enforcement.
- Forest Crime Monitoring and Reporting units have been established within MoE and DFW. Global Witness plays an independent monitoring role outside of these units, reporting on their efforts to the Council of Ministers and donors.
- Department of Fisheries under MAFF is responsible for management of flooded forests and coastal mangrove areas.

[12] Prakas No. 049 SSR of September 12, 1986; Kret No. 35 KRC of June 25, 1988; Prakas No. 035 SSR of May 30, 1988; Declaration No. 05 of January 7, 1995; Declaration No. 02 DRGC of December 26, 1996 (further defined by MAFF Declaration No. 074 of February 26, 1997); Declaration No. 5 of 1997; Declaration No. 1 of January 1999; Sub-Decree on Forest Concession Management, No. 5 ONKR-BK, of February 7, 2000; and Prakas No. 5721 MAFF of December 13, 2001.

- The Council of Ministers is responsible for approving investment agreements with concessionaires.
- Armed Forces and sections of the Police are available for enforcing forest laws.
- The Cambodia Development Council, Ministry of Economy and Finance, Ministry of Commerce, and Ministry of Planning are all involved in approving and managing development programs, including those associated with forestry.
- The Ministry of Industry, Mines and Energy is responsible for issuing permits for sawmills and other forest product processing installations.

4.10. Forestry Reform Efforts

The international donor community first began to express serious concerns about problems in Cambodia's forestry sector in the early 1990s. These concerns were later substantiated in reports from Global Witness that provided detailed investigative field information of forest sector crimes and abuses. In postponing a $20 million loan to Cambodia in November 1995, the International Monetary Fund (IMF) pointed to the inability or unwillingness of the government to control logging activities, and the diversion of high amounts of revenue away from the Ministry of Economy and Finance to the Ministry of National Defense. Additional evidence of the involvement of high-level government officials in corrupt logging practices led to a freezing of this loan in May 1996 (Talbott 1998). Several other donors called for a ban of log exports and a review of concessions at a July 1996 international donor meeting. Yielding to this pressure, the government promulgated a decree banning the export of all logs on December 31, 1996. However, as evidenced by the extremely high level of illegal logging in 1997 (see above), this ban was not effective.

In November 1996, prior to the announcement of the log export ban, a joint mission of the World Bank, UNDP, and FAO presented a model for managing Cambodia's forest resources in support of wider development objectives. The mission endorsed the use of a forest concession system as the appropriate tool for development of Cambodia's forest resources, noting that "many forest-rich countries use concession systems and they can make important contributions toward various sectoral development objectives putting concessions among the most useful instruments of forest policy" (World Bank *et al.* 1996). This endorsement of the concession system also included calls for reform aimed at ensuring a sustained yield of timber from concessions and increasing government forest revenue. When the outright ban on log exports failed in 1997, the donor community largely embraced the sustainable forest concession management approach promoted by the joint mission.[13]

4.10.1. Major Forest Concession Reform Projects and Initiatives

With the aim of achieving sustainable forest management, government and donors have invested a great deal of resources over the past several years towards reforming the concession system. Major projects and initiatives have included the following:

- **Forest Policy Reform Project.** The World Bank funded a range of technical assistance studies on the forestry sector in 1997-98 under the Forest Policy Reform Project, including:
  - *Legal Counsel*, White and Case (April 1998) – reviewed forest law and concession contracts.

[13] While definitions abound, "sustainable forest management" generally entails ensuring that forest resources provide a sustained timber yield into perpetuity while maintaining natural forest quality, conserving biodiversity and ecosystem functions, protecting other forest services such as soil and watershed values, maintaining rights of forest access and use for local communities, and preserving cultural values.

- *Log Monitoring and Logging Control*, Development Alternatives, Inc. (May 1998) – assessed illegal logging activities and recommended strategies for reducing these activities.
- *Forest Policy Reform*, Associates in Rural Development, Inc. (May 1998) – reviewed forest policy.
- *Forest Concession Management*, FORTECH, (December 1998) – prepared standards and guidelines for concession management.

Findings from the project suggested enormous problems with uncontrolled and illegal logging in and around concessions, minimal government revenue collection, and ambiguous forest laws and concession contracts. Despite these problems, the project concluded that "[t]he Forest Concession system is the most appropriate for commercial development of forest resources in Cambodia but needs refinement to suit Cambodian conditions" (Associates for Rural Development 1998). The findings were later synthesised by the World Bank into a strategic vision for the forestry sector that reaffirmed support for sustainable forest concession management in Cambodia (World Bank 1999).

- **Declaration No. 1.** As noted above, the government renewed its efforts to crackdown on illegal logging in January 1999 with the Prime Minister's Declaration No. 1. The far-reaching 17-point order, which significantly reduced illegal logging during the remainder of the 1998-1999 logging season (January-May 1999), called for:
  - A ban on new collection permits and cancellation of existing permits.
  - An immediate stop to all trade in illegal logs and renewed enforcement of the log export ban (previous ban was issued on December 31, 1996).
  - Armed forces and police to assist the DFW in forest law enforcement.
  - The formulation and adoption of a new Forestry Law and improved monitoring of progress toward forestry sector reform.

- **Sustainable Forest Management Project.** From 1999 to 2000, the ADB-funded Sustainable Forest Management Project (SFMP) conducted a review of the forest concession system and concluded that the extremely poor performance of concessions indicated "a total system failure." The review found that no forest concession had been managed sustainably, with harvesting far outpacing the rates expected under a 25-year timber license. Despite these grim findings, SFMP recommended continued support for a forest concession system in Cambodia, albeit a restructured and reformed one. Among other recommendations, the SFMP called on concessionaires to prepare sustainable management plans by November 2001 – the beginning of the 2001 logging season. Concessionaires, DFW, and concerned donors agreed with this recommendation in May 2000, setting September 2001 as the deadline for concessionaires to submit management plans and November 2001 as the deadline for government approval decisions.
- **Joint Working Group on Forest Concession Management.** To support the management planning process, the Joint Working Group on Forest Concession Management was established (with DFID funding) between the CTIA and DFW. Although the Joint Working Group reconfirmed September 2001 as the deadline for submission of concession management plans at meetings in October 2000 and May 2001, no management plans were submitted by the deadline.

- **Forest Crimes Monitoring Project (FCMP).** In April 1999, the government requested assistance from UNDP/FAO for establishing independent FCMP units in MAFF and MoE. The necessary support was made available and technical assistance began in January 2000. Global Witness plays an independent monitoring role in reporting to the Council of Ministers on the efforts of the two government units.
- **Sub-Decree on Forest Concession Management.** Adopted in February 2000, this sub-decree includes regulations on the application and approval process for concessions, concession planning and management, monitoring, and enforcement. However, Article 5.1 appears to exclude existing concessions from the regulations of the sub-decree unless contracts are re-negotiated. It states that: "[f]or existing forest concession it shall be also governed by the new concession agreement with approval by two parties through negotiation or when the existing concession agreement has expired."
- **Forest Concession Management and Control Pilot Project.** The World Bank has continued its support for the forest concession system with the launch of the three-year Forest Concession Management and Control Pilot Project (2001-2003). The objective of this project is to improve the effectiveness of forest management, operational guidelines, and control procedures in forest concession areas, and to establish effective forest crime monitoring and prevention capabilities (World Bank 2000). The World Bank is providing additional assistance for the FCMP via the Forest Concession Management and Control Pilot Project.
- **Prakas on Suspension of Forest Concession Logging Activities.** Issued on December 13, 2001 and effective on January 1, 2002, this Prakas imposes a moratorium on all concession logging activities and suspends the issuance of any logging permit until concessionaires have developed and received approval of new forest concession management plans consistent with legislation and technical regulations.

4.10.2. Future Forest Management Reforms

An important debate is currently taking place in Cambodia about how best to reform forest management. Over the past seven years, government and donors have focused resources on reforming the concession system with the goal of achieving sustainable forest management. However, due to significant problems with the concession system regarding official government revenue generation, concession profitability, forest loss and degradation, and social and environmental impacts, the strategy of continuing to direct scarce forest management resources toward concession reform is being questioned.

McKenney (2002) notes several economic and financial reasons why sustainable forest concession management in Cambodia is unlikely to ever be achieved. First, enforcing sustainable harvests of 1-3 trees per hectare (10 m^3/hectare) will be extremely difficult because concession operations are not likely to be economically viable under such low rates of extraction. Second, even if concessionaires could earn a reasonable profit under a sustained yield regime, they have tremendous financial incentives to continue high-intensity harvesting because this practice increases their returns and reduces risks. Key financial incentives for high-intensity harvesting include the following:

- **Rapid and intensive harvesting reduces concessionaires' risk exposure.** Harvesting timber from a concession over 25-30 years under a sustained yield regime, instead of harvesting in say 5 to 10 years under current practices, greatly increases a concessionaire's risk exposure. In Cambodia these risks include illegal logging by other entities, more restrictive forestry laws and regulations, contract

termination, political uncertainty, natural disasters such as tree disease, fires, and floods, and so on.

- **A far higher annual rate of return can be earned by harvesting intensively and investing profits elsewhere than by harvesting sustainably.** From a concessionaire's perspective, the benefits of changing from high-intensity harvesting to a sustained yield are that the unharvested commercial evergreen forest is allowed to grow in volume and value over time, allowing for a second harvest in 25-30 years. But due to the combination of slow wood volume growth in Cambodia's forests and low real price appreciation in tropical timber markets, concessionaires only stand to earn an annual rate of return of perhaps 2-3 percent by "waiting to cut." Rather than adopt a sustained yield regime for the promise of low annual returns at high risk, concessionaires have strong financial incentives to harvest as rapidly as possible. Profits from these harvests can be immediately invested for returns far superior to what can be earned under sustainable management.
- **Concessionaires' existing investments in log processing capacity may be underutilised if sustainable forest management reduces logging harvests.** Cambodia's existing log processing capacity of roughly 1.2 to 2.0 million m^3 per year is well above the estimated sustainable timber harvest of 0.5 to 1.0 million m^3 per year. Returns on fixed investments in log processing capacity increase with higher capacity utilisation (i.e., increased throughput of log volume). Where the implementation of sustainable forest concession management reduces log harvests and results in lower utilisation of concessionaires' processing capacity, earnings on their fixed investments will be reduced.

In light of the challenges to establishing sustainable forest concession management, and the importance of forest resources to rural livelihoods, alternative approaches such as community-based forest management have recently received greater attention and support (see "4.7 Community Forest Management"). However, many community forests are still in their infancy. Successful widespread implementation of community forestry will depend on government support for decentralising forest management, identification of low-cost management models, and drawing upon lessons from both successes and failures. This suggests an important future need for independent assessments of the quality and effectiveness of community management efforts.

In addition to community management, there is renewed effort to designate forest areas for outright protection where biodiversity, watershed, conservation, and/or potential eco-tourism values are deemed important. The government has already taken important steps toward establishing a "protected forest" in the central Cardamom Mountains, despite much of the area being under three different concessions. This government action implicitly acknowledges that concessionaires are not currently capable of implementing sustainable forest management to protect environmental values in this area.

4.11. Conclusions and Recommendations for Research

The Cambodian forestry sector was in a state of crisis throughout the 1990s due to widespread anarchic and illegal logging, pervasive corruption, ambiguous forest laws and concession agreements, and weak management and enforcement. Forest cover data suggest that deforestation rates increased sharply between 1993 and 1997 (the last year in which data are available). In addition, case studies and anecdotal evidence indicate that the quality of the remaining forest has been significantly degraded, suggesting a marked deterioration in the historical "safety net" for rural livelihoods provided by forest resources.

Despite this bleak context, recent reform efforts provide an opportunity to reduce deforestation rates and develop management systems more beneficial to the rural poor. These

efforts include the recent suspension of concession logging, drafting of a new Forestry Law and Sub-decree on Community Forestry, and development and expansion of community forest management structures. Moving forward, a pivotal issue for forest management will be whether or not retention of the concession system is merited. Significant problems with government revenue generation, concession profitability, forest loss and degradation, and social and environmental impacts attest to a concession system that has thus far fallen well short of envisioned forest management and development goals. Debate over this issue must also include consideration of what forest management alternatives might take the place of concessions. Here, much still needs to be learned about the potential role of rapidly expanding community forest management approaches.

Prudent policymaking for the forestry sector requires up-to-date information on forest cover, stocks, and harvests. Five logging seasons have passed since the last update of forest cover data. A forest cover update, complemented with a sample of "on-the-ground" studies, would provide an important indicator for assessing progress on forest management since 1997. In addition, such a study would help in identifying the range of places in Cambodia where deforestation is occurring most rapidly, allowing for a more comprehensive examination of the root causes of deforestation.

In addition to improved information on the forest resource base, there is a need for more socio-economic research on the relationship between forest resources and rural livelihoods. While it is widely recognised that many rural people depend on forests for their livelihoods, debate continues over how best to manage forest resources to achieve rural development and poverty alleviation objectives. To inform this debate, some possible areas for future socio-economic research are described below.

1. How effective is the forest concession system in meeting rural development and poverty alleviation objectives?

Although forest concessions have been reduced in recent years, they remain the dominant management approach encompassing 4.2 million ha of Cambodia's most productive forests. Forestry concession management is intended to achieve several objectives, including:

- Sustainable forest management to ensure future generations benefit from forest resources.
- Increased government revenue through leasing and other fees. Ideally, these funds support rural development and poverty alleviation projects in areas negatively affected by forest concessions.
- Job creation and rural development for local people. For example, logging, processing, and other related activities may provide employment to people living in or nearby the concessions.

Although a comprehensive review of forest concessions was conducted in 2000, the study focused mainly on evaluating the forest management practices of concessionaires, not the effectiveness of the concession system in meeting rural development objectives. Possible research questions to investigate include:

- How much government revenue (formal and informal) is raised through forest concession leases and fees and how is this revenue used to meet rural development objectives?
- What other rural development benefits do forest concessions provide, such as employment in operations and/or support of processing and marketing facilities?
- In light of the government's rural development and poverty alleviation goals, on what basis or by which criteria should forest concessions be retained or cancelled in favour of other types of management?

- How have forest concessions affected forest resource access and use, livelihood activities, food security and the common property "safety net" for rural people?

2. What are the costs and benefits associated with establishing and managing community forests?

Several NGOs are assisting in the development of community forests in Cambodia. The DFW's Community Forestry Office and a forthcoming Sub-decree on Community Forestry are seeking to support these efforts. As with community fisheries, establishing community forests can be a large undertaking involving significant costs. These costs include community organising activities, negotiations among stakeholders, development of management plans and rules, monitoring and enforcement, and conflict resolution. Successful establishment of community forests will depend on lowering start-up and management costs and increasing potential forest resource benefits.

Clearly, the potential benefits of community forests are closely linked to the productivity of the resource base. Since most valuable forest areas have been granted as forest concessions to commercial interests, it is likely that many of the current community forests are managing degraded areas. If stakeholders believe the potential benefits from a community forest will be minimal, they will generally have less incentive to invest the time and effort necessary to maintain effective management. Key research questions include:

- What is status of the forest areas designated for community management? How does this resource base compare to other nearby areas (in concessions)? What are the implications of the resource base quality for establishing and maintaining community management? How might the potential benefits of community forests be increased?
- How significant are costs associated with the start-up and on-going management of community forests? How might these costs be reduced?
- What lessons can be drawn from the start-up experiences of existing community forests that might be applied to future efforts?

3. How are conflicts over forest resources currently settled and what can be done to improve conflict resolution mechanisms?

Conflicts over forest resources are common. For example, conflicts frequently occur over resin trees because they are valuable to both resin collectors and concessionaires. Rural people also complain about problems accessing forest resources within concessions and other "controlled" areas. There appears to be a strong need for processes and mechanisms to resolve disputes over forest resources, but information on current dispute resolution practices is limited. Similar to proposed research for fisheries dispute resolution, initial research on forest resource conflicts might assess the following:

- What is the formal process for resolving forest resource disputes according to the Forestry Law and relevant sub-decrees and regulations? Who is involved and what is their role?
- How are conflicts over forest resources typically resolved in practice?
- What relevant lessons and models for dispute resolution of forest resource conflicts might be drawn from the experiences of other countries?
- In what ways might the conflict resolution process be improved? For example, is there an appropriate role for the recently elected commune councils to play in conflict resolution?

4. What is the current status of NTFP processing, trade, and export? How might rural livelihoods be improved through changes in the current approach to these activities?

For example, preliminary research by NGO Forum and others suggests that resin selling accounts for a significant proportion of livelihood income in forested areas. However, there are currently many barriers to the trade of resin, foremost of which is the need for a resin transport license. Because transporting without a license is illegal, and licenses are expensive and difficult to obtain, resin collectors generally face a choice of either selling resin to licensed traders at below-market prices or findings ways to smuggle resin to market (at some cost and risk). Resin collectors lose potential income under either option. Removal of the current licensing system may be warranted, since this would likely increase competition among resin traders and exporters for the purchase of resin, thereby improving the bargaining position of resin collectors.

In addition to study of the current licensing system for transporting resin, options for value-added processing of resin products at the local level deserve exploration. For example, the essential oils in resin are used as ingredients in many high value goods such as perfumes. There may be processing steps that could be undertaken to add value at the local level and increase selling prices.

Further research on resin trade and processing issues might include the following:

- How is resin traded and exported? Who is involved and what are the main market destinations? What are the various official and unofficial fees and costs associated with these exports? In practice, what are the profit margins to various participants in the resin export market (tappers/collectors, buyers, traders, transporters, exporters)? How do the profit margins for each market participant compare to the product or service provided?
- What are the formal and informal barriers to entering the resin trade and export business? In what respects is resin trade controlled by monopolistic or collusive behaviour?
- Why does the transport of resin require a license? Beyond revenue generation, what is the purported forest management objective of requiring this license?
- What steps can be taken to improve the bargaining position of resin collectors in the sale of resin?
- How is resin processed (in Vietnam and Thailand)? What are the opportunities for establishing local resin processing, thereby adding value locally and increasing returns? What are the opportunities to export resin directly to higher value markets abroad?

References

Agrawal, A. and C. Gibson (1999), "Enchantment and Disenchantment: The Role of Community in Natural Resource Conservation", in *World Development*, Vol. 27, No. 4, pp. 629-649

Ashwell, D. (no date), *Information and Issues Pertaining to Community Based Management of Forest Resources in Cambodia: A Discussion Paper*, (Phnom Penh: Community Forestry Working Group)

Associates for Rural Development, Inc. (1998), "Proceeds of Meeting to Brief the International Community and Senior Officials of the Royal Government of Cambodia on Forest Policy Reform" (Phnom Penh: Fortech Presentation)

Baltzer, M.C., T.D. Nguyen, and R.G. Shore (eds.) (2001), *Towards a Vision for Biodiversity Conservation in the Forests of the Lower Mekong Ecoreion Complex*, (Hanoi/Washington D.C.: WWF Indochina/WWF US)

Bottomley, R. (2000), *Structural Analysis of Deforestation in Cambodia* (Ratanakiri and Japan: Non-Timber Forest Products Project; Mekong Watch and Institute for Global Environmental Studies)

Castren, Tuukka (2000), *Timber Trade and Wood Flow Study: Cambodia*, (Regional Environmental Technical Assistance 5771, Poverty Reduction & Environmental Management in Remote Greater Mekong Subregion (GMS) Watersheds Project (Phase I))

Chan, S. (forthcoming), "Case Study Report on Dang Kdar Village, Kampong Thom Province", (Phnom Penh: CDRI)

Chan S., S. Tep, and S. Acharya (2001), *Land Tenure in Cambodia: A Data Update* (Phnom Penh: CDRI Working Paper No. 19)

Chea, S.A., and ARD Inc. (1998), *The Study of Effects of Forests on Rural Livelihoods in Kampong Thom Province, Cambodia*, (Phnom Penh: Department of Forestry and Wildlife)

Curtis, G. (1989), *Cambodia: A Country Profile*, (Stockholm: Swedish International Development Authority)

Development Alternatives, Inc. (DAI) (1998), *Result of the National Assessment on Illegal Logging, Processing and Timber Exports in Cambodia,* (Phnom Penh: Log Monitoring and Logging Control Project, submitted to Royal Government of Cambodia, Ministry of Economy and Finance, Ministry of Agriculture, Forestry and Fisheries)

DAI (1998), *Findings and Recommendations of the Log Monitoring and Logging Control Project-Main Report: Final Edition,* (Phnom Penh: Log Monitoring and Logging Control Project, submitted to Royal Government of Cambodia, Ministry of Economy and Finance, and Ministry of Agriculture, Forestry and Fisheries)

Forest Crime Monitoring Unit (2000), *Forest Crime Monitoring and Reporting Project: Independent Monitoring and Verification, Final Report, June 2000*, (Phnom Penh: Forest Crime Monitoring Unit)

Fraser Thomas, GFA-AGRAR, and ANZDEC (2000), *Cambodia Forest Concessionaire Review Report* with *Appendix 1: Individual Assessment of Concessions,* (Phnom Penh: Sustainable Forest Management Project, Asian Development Bank)

Fraser Thomas, GFA-AGRAR, and ANZDEC (2000), *Community Forest Guidelines*, (Phnom Penh: Sustainable Forest Management Project, Asian Development Bank)

Fraser Thomas and Department of Forestry and Wildlife (2000), *Forest Concession Management Planning Manual*, (Phnom Penh: ADB and World Bank)

Global Witness (2002), *Deforestation without limits: How the Cambodian government failed to tackle the untouchables*, (Phnom Penh: Global Witness)

Global Witness (2001), *The Credibility Gap – and the Need to Bridge It: Increasing the pace of forestry reform*, (Phnom Penh: Global Witness)

Global Witness (2000a), *Chainsaws speak louder than words*, (Phnom Penh: Global Witness)

Global Witness (2000b), *ADB Concession Review – Still Falling Short*, (Phnom Penh: Global Witness)

Global Witness (2000c), *Illegal Activities of GAT International in the Cardamom Mountains*, (Phnom Penh: Global Witness)

Global Witness (1999a), *The Untouchables: Forest crimes and the concessionaires – can Cambodia afford to keep them?*, (Phnom Penh: Global Witness)

Global Witness (1999b), *Situation Report – Update on Cambodian Forest Sector*, (Phnom Penh: Global Witness)

Global Witness (1999c), *Crackdown or Pause: A Chance for Forestry Reform in Cambodia?*, (Phnom Penh: Global Witness)

Global Witness (1997), *A Tug of War: The Struggle to Protect Cambodia's Forests*, (Phnom Penh: Global Witness)

Global Witness (1996), *Cambodia, Where Money Grows on Trees*, (Phnom Penh: Global Witness)

Global Witness (1995a), *Forests, Famine, and War: The Key to Cambodia's Future*, (Phnom Penh: Global Witness)

Global Witness (1995b), *Thai – Khmer Rouge Links & The Illegal Trade in Cambodia's Timber*, (Phnom Penh: Global Witness)

Hardcastle, P.D. (2001), *Evaluation of National Community Forestry Programme: CONCERN Cambodia* (Phnom Penh: Concern Worldwide)

Hong, N. (1997), "Country Paper on Some Aspects of Forestry in Cambodia", in *Asia-Pacific Forestry Sector Outlook Study Working Paper Series*, No. 18 (Bangkok: FAO)

Hou, K., R. Sy, C. Chay, and S. Meas (2001), *Forest Use and Product Flow in Chumkiri District*, Kampot Province, (Singapore: Economy and Environment Program for Southeast Asia)

Hou, K. and T. Carson (2000), *Scoping Report: Community Based Natural Resource Management (CBNRM) in Cambodia*, (Phnom Penh: WWF Conservation Program in Cambodia and IDRC)

Kim Phat, N., Y. Uozumi, S. Ouk, and T. Ueki (1999), *Forest Management Problems in Cambodia – A Case Study of Forest Management of F Company*, (Nagano, Japan: Shinshu University)

Kim Phat, N., Y. Uozimi, T. Ueki, and W. Drury (1998), *Analysis on the Demand for Cambodia's Forest Products*, (Nagano, Japan: Shinshu University)

Kollert W., T. Dillon, and A. McNaughton (2000), *Cambodian Forest Concession Review: Evaluation of the Draft Report and Recommendation for Follow up Action*, (Phnom Penh: Sustainable Forest Management Project, Asian Development Bank)

KPMG International Forestry and Environmental Advisory Services Group (2001), *(Draft) The Equitability of the Forest Taxation System in Cambodia*, (Phnom Penh: prepared for Cambodia Timber Industry Association)

Lim, S., D.V. Samrang, S. Kim, and K. Mom (2001), "Case Study on Wild Fruit Collection in Bosthom Community Forestry", in CBNRM Team, *CBNRM Lessons Shared: A Series of CBNRM Case Studies from the Tonle Sap, Siem Reap Province* (Phnom Penh: WWF Conservation Program in Cambodia)

Lun, K., K. Hou, M. Srey, S. Ken, R. Choir, S. Lao, K. Phan, and M. Im (1998), *Forest Resource Use by Local Communities in Cambodia*, (Phnom Penh: IDRC and RECOFTC)

McKenney, B. (2002), "Questioning Sustainable Concession Forestry in Cambodia", in *Cambodia Development Review*, Vol. 6, Issue 1, pp. 1-7

McKenney, B. (2001), *Baseline Assessment of Cambodia's Forestry Sector*, (Phnom Penh: WWF Conservation Program in Cambodia)

Ministry of Agriculture, Forestry and Fisheries (2002), *Progress Report on Natural Resource Management to the Follow Up Meeting Second Semester 2001 between the Royal Government of Cambodia and Donor Community, 16 January 2002*, (Phnom Penh: MAFF)

Ministry of Agriculture, Forestry and Fisheries (2001), *Prakas on Suspension of Forest Concession Logging Activities*, (Phnom Penh: MAFF)

Ministry of Economy and Finance (2002), "Forestry revenue data", (Phnom Penh: provided to CDRI)

National Institute of Statistics (2000), *Report on the Cambodia Socio-Economic Survey 1999*, (Phnom Penh: Ministry of Planning)

National Institute of Statistics (2000), *General Population Census of Cambodia 1998* (Phnom Penh: Ministry of Planning)

Ratanakiri Non-Timber Forest Products Project (2001), *Agreement: Yakpoy Forest Community, Poy Commune, O Chum District, Ratanakiri Province*, (Ratanakiri: NTFP Project)

Ratanakiri Non-Timber Forest Products Project (2001), *Statute of Yakpoy Forest Community, Poy Commune, O Chum District, Ratanakiri Province*, (Ratanakiri: NTFP Project)

Rao, Sar (1999), *The Assessment of Logging Damage: A Case Study in the Forest Concession Area of Colexim at Kompong Thom Province, Cambodia*, (Göttingen, Germany: Thesis to obtain Master of Science degree in Tropical Forestry at Georg-August University of Göttingen)

Ratanakiri Provincial Rural Development Department *et al.* (2000), *Cultural Resource Study: Impacts of the Hero Taiwan Company Concession on Sites of Religious and Cultural Significance in O Chum District, Ratanakiri*, (Ratanakiri, Cambodia)

Royal Government of Cambodia (20 July 2001), *(Draft) Forestry Law*, (Phnom Penh: submitted to National Assembly)

Royal Government of Cambodia (2000), *Sub-Decree on the Forest Concession Management*, (Phnom Penh: RGC No. 05 ONKR-BK)

Royal Government of Cambodia (1999), *Declaration on Managerial Measures and Stopping of Forestry Anarchy*, (Phnom Penh: Declaration No. 1)

So, S.M., M. Cheam, B. Son, T. Em, D. V. Samrang (2001), *Economic Valuation of Livelihoods Activities in Pourapet Village of Mondulkiri Province*, (Phnom Penh: WWF Conservation Program in Cambodia)

Srey, M., S. Colm, and K. Hou (2000), *Cultural Resource Study: Impacts of the Hero Taiwan Company Concession on Sites of Religious and Cultural Significance in O Chum District, Ratanakiri*, (Ratanakiri: CARERE, CIDSE, and NTFP-Ratanakiri)

Talbott, K. (1998), "Logging in Cambodia: Politics and Plunder" in Brown, F.Z. and D.G. Timberman (eds.) *Cambodia and the International Community: The Quest for Peace, Development and Democracy*, (Singapore: ISEAS)

Ung, S. A. (1991), *Forestry Situation in Kampuchea*, (Bangkok: RECOFTC Paper 79)

White and Case (1998), *Analysis of Cambodian Law and Forest Concession Contracts*, (Phnom Penh: Forest Policy Reform Project, submitted to Royal Government of Cambodia, Ministry of Economy and Finance, Ministry of Agriculture, Forestry and Fisheries)

World Bank (2000), *Project Appraisal Document on a Proposed Learning and Innovation Credit in the Amount of US$4.82 Million Equivalent to the Kingdom of Cambodia for a Proposed Forest Concession Management and Control Pilot Project* (Rural Development and Natural Resources Sector, East Asia and Pacific Region)

World Bank (1999), *Cambodia: A Vision for Forestry Sector Development*, (World Bank Background Note: 1999 Cambodia Consultative Group meeting)

World Bank, United Nations Development Programme, and Food and Agriculture Organisation (1996), *Cambodia Forestry Policy Assessment*, (World Bank: Report No. 15777-KH)

World Bank, United Nations Development Programme, and Food and Agriculture Organisation (1997), *Cambodia-Recent Development in Forestry Policy-Overview and Recommendations*, (Phnom Penh: World Bank/UNDP/FAO)

World Rainforest Movement (2001), "Cambodia: Resin tapping incomes at odds with logging", in *WRM Bulletin*, No. 48 (http://www.wrm.org.uy/bulletin/48/Cambodia.html)

Yoshida, K., S. Chea, S. Khun, P. Lay, P. Sok, and K. Ouk (2001), *Forest Resource Utilization and Tree Planting Activities around Phnom Tamao Area, Bati District, Takeo Province, Cambodia*, (Phnom Penh: Department of Forestry and Wildlife and Japan International Cooperation Agency)

Conclusions and Summary of Recommended Research Areas

With more than seven million rural Cambodians dependent on agriculture, fisheries, and forests for subsistence, an essential element of any future efforts to reduce rural poverty will be effective natural resource management. Over the past decade, illegal and unsustainable harvests of timber and fish by commercial enterprises, military, local authorities, and a growing rural population have resulted in high rates of forest loss and degradation and a reduction in the productive value of many fisheries. Meanwhile, greater competition for land has led to an increase in the landless population. Rapid population growth and continuing pressures on land, forest, and fisheries suggest that maintenance of rural subsistence may be a serious challenge in the coming decade.

Policies directed at reducing poverty and improving rural livelihoods need to carefully consider the close linkages between rural livelihoods and natural resources, especially the important role of forest and fisheries resources held in common. These resources often serve as the livelihood "safety net" for the poorest of the poor – those with few assets and no land. Policies that contribute to natural resource loss and degradation should generally be expected to increase poverty problems in rural areas. Likewise, concession management strategies that restrict access to natural resource wealth previously held in common will tend to exacerbate rural poverty and may result in conflict. Poverty alleviation policies are more likely to be effective if they focus on *integrated* development approaches that seek to enhance rural livelihood strategies and mitigate cross-sector impacts (such as potential agricultural development impacts on fisheries).

Sound policymaking depends on up-to-date data, meaningful indicators on key issues, and useful analysis. Current information on natural resources and rural livelihoods could be improved in several ways:

- **Update and improve data on forest cover and fish catch and composition.** Forest cover data has not been updated since 1997, making it difficult to evaluate progress toward forest management reform. Total fish catch figures have not been updated since an estimate was developed for 1994-1997. While a direct estimate of annual fish catch may not be practical due to data collection challenges, an annual survey of fish consumption by representative households, in combination with improved fish export estimates, would provide a basis for "backing out" useful annual catch estimates. In addition, a survey of fish catch composition would provide important information on the changing species types and catch values.
- **Include secondary and tertiary employment categories in national census and socio-economic surveys.** The practice of collecting data on primary employment alone tends to focus attention on agriculture while understating the importance of

fishing and forest product collection in rural livelihoods. The inclusion of secondary and tertiary employment would improve the accuracy of national survey findings, making them a better reflection of rural livelihood realities.

- **Revise the national accounting system so macro-economic indicators provide a more accurate basis for assessing progress toward *sustainable* economic development.** GDP and national income measures currently fail to capture the depletion of natural resource assets such as forest stands and fishery stocks. Such exploitation has an *exclusively beneficial* effect on economic indicators such as GDP, even if rates of exploitation are unsustainable. Natural resource accounting adjustments would help the national accounting system better reflect realities of natural resource exploitation and asset depletion, thereby improving key economic indicators and strengthening the basis for policymaking on sustainable development.

Much still needs to be better understood about the linkages among rural livelihoods, natural resource management, and sustainable development. In developing this baseline assessment, several potential areas for socio-economic research on natural resources and rural livelihoods have been identified related to concession management, community management, production and trade issues, and conflict resolution. These potential research areas are discussed in detail at the end of Chapters 2, 3, and 4; the main research questions are summarised below.

Potential Research on Agricultural Issues

1. What are the main reasons that Cambodian vegetables and other crops often do not compete well with imports from neighbouring countries?
2. What is the short-term and long-term potential for improving value-added processing capabilities and marketing, and how might such changes affect rural livelihoods?
3. What is the appropriate role for concessions in Cambodia's overall agricultural development? How effective are agricultural concessions in improving rural livelihoods?
4. How are conflicts over agricultural concessions currently settled and what can be done to improve conflict resolution mechanisms? More importantly, what steps can be taken to reduce the potential for conflict in the first place?

Potential Research on Fisheries Issues

1. How effective is the fishing lot system in meeting rural development and poverty alleviation objectives?
2. What are the costs and benefits associated with establishing and managing community fisheries?
3. What changes have taken place in former fishing lot areas and what are the implications for rural livelihoods? How effective are community fisheries in managing areas formerly under fishing lot management?
4. How important are ricefield fisheries to rural livelihoods and what are the implications for agricultural and fisheries development?
5. How are conflicts over fishing areas currently settled and what can be done to improve conflict resolution mechanisms?
6. What is the current status of fish processing, trade, and export activities? How might rural livelihoods be improved through changes in the current approach to these activities?

Potential Research on Forestry Issues

1. How effective is the forest concession system in meeting rural development and poverty alleviation objectives?
2. What are the costs and benefits associated with establishing and managing community forests?
3. How are conflicts over forest resources currently settled and what can be done to improve conflict resolution mechanisms?
4. What is the current status of NTFP processing, trade, and export? How might rural livelihoods be improved through changes in the current approach to these activities?

APPENDIX A

Detailed Information on Land Concessions:
Literal Translation of a Document Prepared by Ministry of Agriculture, Forestry and Fisheries

No.	Name of Company	Location	Land Size (Ha)	Type of Crop	a. Date of Agreement[1] b. Date of Contract[2] c. Deposit	Company Implementation
1	Agrostar	Kompong Cham	2,400	Cashew	a. 20-12-94 b. 09-01-95c. c. Not yet paid	- Crop cultivation started. - Problems/constraints: local people protesting against land concession
2	Sokimex Rubber Plantation Investment	Kompong Cham	9,900	Rubber	a. 09-05-98 b. 27-05-00 c. Not yet paid	- Land concession demarcation completed. - The company is considering whether to continue or abandon the investment project. - Problems/constraints: Local people encroaching on the land to grow their own crops. The red soil suitable for growing rubber represents only 30-35% of total land area (Company's study)
3	T.T.Y Company	Kompong Cham	1,070	Rubber	a. 31-12-96 b. 02-05-00 c. Not yet paid	- Land concession demarcation and statistical record not yet completed. - The company is considering whether to continue or abandon the investment project: local people encroach on land for crop growing on almost 100% of land concession (Company's study).
4	CAMBODIA EVERSKY	Kompong Thom	10,000	Agricultural crop (cotton)	a. 16-06-97 b. 03-11-98 c. Paid	- Land concession demarcation and statistical record completed. - Experimental growing of some crops like maize, rice and cotton on the land concession. - Problems/constraints: land concession contains sandy soil and subject to flooding.
5	Cam Chi International Agriculture Development	Kompong Thom	26,500	Cassava	a. 06-01-00 b. 03-03-00 c. Not yet paid	- Land concession demarcation and statistical record completed. - Relevant document submitted to MAFF for project implementation. - Contract deposit: company asks MAFF to issue exploitation permit before deposit payment.

No.	Name of Company	Location	Land Size (Ha)	Type of Crop	a. Date of Agreement[1] b. Date of Contract[2] c. Deposit	Company Implementation
6	Leng Ho Hong Agro-industrial Development and Processing	Battam-bang	8,000	Sugarcane, cassava	a. 04-08-99 b. 07-06-00 c. Paid	- Land concession demarcation and statistical record completed. - Problems/constraints: people occupy land and local authority sells receipts of land ownership to the people.
7	RATANA VISAL Development Co.; Ltd	Pursat	3000	Cashew and caster oil plant	a. 04-08-97 b. 15-10-98 c. Paid	- Land concession demarcation and statistical record not yet completed. - 300 Ha of caster oil plant and 700 Ha of cashew plant is cultivated. - Problems/constraints: caster oil plants do not produce fruit. Local people encroach land. Some planted areas are burned by criminals. Very bad road condition.
8	PHEAPIMEX Co., LTD	Pursat & Kompong Chhnang	315,028	Tree cultivation & paper pulp factory	a. 23-09-97 b. 08-01-00 c. Not yet paid	- Land concession demarcation and statistical record completed for first year on 6,700 Ha at Krokar district, Pursat province. - Project cannot be implemented because of protests from local people. - The Ministry has helped to solve the problem. - Problems/constraints: strong protests from local people. - Company is doing pre-feasibility study in Kompong Chhnang because it plans to move its investment to Kompong Chhnang.
9	Cambo Victor & Investing Developing	Kompong Speu	26,550	Agricultural crops	a. 09-08-2000 b. 13-08-2001 c. Not yet paid	- Preparing to demarcate the land concession and to gather statistical record on it.
10	Mong Rithy Investment Cambodia Palm Oil Co. LTD	Sihanouk- ville	11,000	Palm oil	a. 15-05-95 b. 09-01-95 c. Not yet paid	- Land concession demarcation and statistical record not yet completed. - Only 2/3 of total land is suitable for crop growing (Company's study), and 3,100 Ha already planted oil palm. - The company will construct processing plant very soon. - Problems/constraints: illegal logging in Bokor national park, and log transport across the plantation, cause serious road damage. If log transport is banned, criminals come to burn oil palm trees. There are also people encroaching on the land, but the company has solved this problem directly with the people.
11	Mong Rithy Investment	Sihanouk- ville	1,800	Cassava	a. 22-04-98 b. 18-03-00	- Land concession demarcation and statistical record not yet completed.

No.	Name of Company	Location	Land Size (Ha)	Type of Crop	a. Date of Agreement[1] b. Date of Contract[2] c. Deposit	Company Implementation
	Cassava in Cambodia				c. Not yet paid	- 700-800 Ha out of total land can be used for crop growing (Company's study), which is already in process. Also 1000 cattle are raised there. - Company will construct processing plant very soon. - Problems/constraints: illegal logging in Bokor national park, and log transport across the plantation, cause serious road damage. If log transport is banned, criminals come to burn oil palms. There are also people encroaching on the land, but the company has solved this problem directly with the people. The land concession is not large enough for investment projects.
12	China Cambodia State Farm International	Koh Kong	7,500	Agricultural crops and livestock raising	a. 19-12-97 b. 06-10-98 c. Not yet paid	- Land concession demarcation and statistical record completed. - Project on livestock raising is postponed because local people are encroaching on the land. - Problems/constraints: Local people encroach on land concession and local authority creates difficulties for company in land issue.
13	Talam Plantation Holding SDN.BHD	Koh Kong	36,700	Rubber and palm oil	a. 06-06-98 b. 05-10-98 c. Paid	- Land concession demarcation and statistical record completed. - Waiting for decision from Ministry on land concession area. - Problems/constraints: many local people occupy big plots of land in concession area, which is causing the company to have insufficient land for its investment project.
14	The Green Rich Co.; LTD	Koh Kong	60,200	Palm oil and acacia	a. 08-09-98 b. 25-11-98 c. Paid	- Land concession demarcation and statistical record not yet completed. - Request to delay contract till January 2001. - After deadline, the company did not inform the Ministry. In addition, the company builds road and raises shrimp farm inside concession area. - The Forestry Department and the Provincial Department of Agriculture have banned the company activity.
15	Henan (Cambodia) Economic & Trade Development Zone	Kompong Speu	4,100	Agricultural crops and livestock raising	a. 30-12-99 b. 29-07-99 c. Not yet paid	- Land concession demarcation and statistical record completed. Waiting for local authority to approval on the working group report. - Problems/constraints: many local people occupy big plots of land in concession area. District Cadastral Office creates difficulties for compiling the statistical

No.	Name of Company	Location	Land Size (Ha)	Type of Crop	a. Date of Agreement[1] b. Date of Contract[2] c. Deposit	Company Implementation
						record.
16	Cambodia Haining Group Co. LTD	Kompong Speu	23,000	Cassava and palm oil	a. 30-03-98 b. 23-07-99 c. Not yet paid	- Land concession demarcation and statistical record completed, but there are problems with statistical record in Phnom Sruoch district. - The Ministry has interceded with the provincial committee for land dispute resolution. - Experimental crop growing in Oral district. - Problems/constraints: anarchic encroachment on concession land especially at the beginning of the road leading to Kirirom National Park. - The Ministry is in process of interceding for a second time with the provincial committee for land dispute resolution.
17	Corporation S eC Cambodia Ltd.	Kompong Speu	3,000	Cassava	a. 10-9-99 b. 15-11-99 c. Not yet paid	- For 3000 Ha of land: Prime Minister Office instruct MAFF to sign the agreement but the army is the implementing agency - Cassava planting on 3000 Ha of land concession completed.
			5,000		a. 10-09-99 b. 20-04-2001 c. Paid	- For 5000 Ha of land: Land concession demarcation and statistical record completed. - Waiting for decision from Ministry to allow the Company to proceed with productive exploitation of 5000 Ha of land concession.
18	Produce Cassava Powder Ltd	Stung Treng	7,400	Teak & cashew	a. 24-12-98 b. 13-11-99 c. Paid	- Land concession demarcation and statistical record completed - In process of implementing decision No 1633 dated 06-10-00 of Council of Ministers. - Problems/constraints: complains filed by local people.
19	Men Sarun Fellowship and Rama Khmer	Ratanakiri	20,000	Palm oil	a. 21-09-95 b. 21-12-99 c. Not yet paid	- Land concession demarcation and statistical record not yet completed - In process of doing a feasibility study on palm oil and coffee.
20	China National COECLD Co.; LTD.	Kompong Speu	8,000	Agro-industrial crop	a. 23-04-98 b. 26-09-00 c. Not yet paid	- Preparing to make land demarcation and statistical land record.
21	Kimsville Corp	Kompong Speu	3,200	Cassava	a. 25-02-00 b. 24-10-00 c. Paid	- Land concession demarcation and statistical record completed in area A. - Operation started but failure because opposition party incites people to protest and destroy materials of the company. - The Ministry has intervened to help to resolve the problem.

No.	Name of Company	Location	Land Size (Ha)	Type of Crop	a. Date of Agreement[1] b. Date of Contract[2] c. Deposit	Company Implementation
						- Problems/constraints: land concession overlaps with many land plots owned by local people.
22	Keim Lein Import Export	Kompot	16,400	Palm oil	a. 13-11-96 b. 26-10-00 c. Not yet paid	- Land concession demarcation and statistical record not yet completed with MAFF. - The company has collaborated with local authority to collect statistical record on land. - Constraints: People occupy land and grow crops. Some parts of land concession overlap with Bokor National Park making actual land concession not big enough for investment project.
23	Ok Khun Industrial Crop Development	Kompong Speu	12,506	Cashew	a. 01-09-00 b. 25-05-01 c. Not yet paid	- Land concession demarcation and statistical record completed. - Company collaborated with local authority to put up company logo, but some bad elements destroyed it. - Company asked MAFF to help to resolve problem of putting up logo. - MAFF has interceded with provincial authority which asked to complete first the operation of weapon control in the area before the logo can be put up. - Deposit: period for payment in contract not yet expired.
24	Green Sea Industry Co. LTD	Stung Treng	100,852	Teak	a. 26-10-01 b. 23-10-01 c. Not yet paid	- None
25	Heng Sarat's Family Community	Kompong Cham	500	Cashew	a. 17-11-92 b. 23-01-92 c. Not yet paid	- Unable to contact/communicate
26	Shing Yui Commercial	Kompot	10,000	Rubber & palm oil	a. 15-05-96 b. No contract yet	- Unable to contact/communicate
27	China Evergret Cambodia Agriculture Development	Kompot	4,000	Rubber & palm oil	a. 23-05-98 b. No contract yet	- Unable to contact/communicate
28	Bopha Angkorimex Trankong	Kompong Cham	5,000	Rubber	a. 17-02-99 b. No contract yet	- Unable to contact/communicate
29	Ford Thai	Mondulkiri	200	Agriculture	a. Kor Sar Kor b. No contract yet	- Unable to contact/communicate
30	Hour Hong Investment	Kompong Speu	2,040	Agricultural crops	a. 08-12-98 b. No contract yet	- Unable to contact/communicate
31	Unborin Trade Agriculture	Kompong Speu	16,600	Cassava	a. 11-06-98 b. Not contract yet	- Unable to contact/communicate

No.	Name of Company	Location	Land Size (Ha)	Type of Crop	a. Date of Agreement[1] b. Date of Contract[2] c. Deposit	Company Implementation
	Development					
32	Tai Seng Import Export	Ratanakiri	2000	Rubber	a. 25-12-98 b. No contract yet	- Unable to contact/communicate
33	Meang Ly Heng Investment	Kompong Cham	3,000	Rubber	a. 09-12-95 b. No contract yet	- Meeting at MAFF: preparation to visit new field study site.
34	Lim Kryi Agricultural Development	Takeo	1,050	Rice	a. 03-08-95 b. No contract yet	- Meeting at MAFF: preparation to visit new field study site.
35	Sour Kear Co. LTD.	Pursat	300	Cashew	a. 07-01-98 b. No contract yet	- Unable to contact/communicate
36	Cambodia Tapioca Enterprise	Kompot	5,100	Cassava	a. 06-11-96 b. No contract yet	- MAFF intercede with provincial committee of land dispute resolution to solve problem of land encroachment by local people.
37	Sin Thai Kompot Co. LTD	Kompot	5,700	Cashew & durian	a. 26-06-96 b. No contract yet	- Unable to contact/communicate
38	Chung Shing Cambodia	Koh Kong	16,000	Palm oil	a. 11-01-96 b. No contract yet	- Request to keep the land concession
39	M. Consolidated Plantation	Kompong Speu	12,700	Suntan?, cassava, rice	a. 04-08-97 b. No contract yet	- Request communication with Council of Ministers
40	Naco Rice	Battam-bang	2,000	Rice	a. 11-11-96 b. No contract yet	- Unable to contact/communicate
41	Angkor Industrial Crop Development	Kompong Speu	20,000	Sugar-cane, livestock	a. Kor Sor Kor (MAFF) b. Contract cancelled	- Prakas No. 406 Pro-Kor-Kor-Sar-Kor dated 15-09-98
42	Sor Out	Kompong Speu	1,550	Coffee & tea	a. Kor-Sor-Kor (MAFF) b. Contract cancelled	
43	Ly Seng Import Export	Takeo	500	Cashew	a. 06-12-96 b. Agreement cancelled	- No. 442 Sar-Chor-Nor-Kor-Sar dated 20-03-00
44	Yean Jan Trading Co. LTD Cambodia Tapio-ca Corp. LTD.	Kompot	3,800	Cassava	a. 06-11-96 b. Agreement cancelled	- No. 442 Sar-Chor-Nor-Kor-Sar dated 20-03-00
45	Chel Jadang (C & J Cambodia)	Kompong Speu	18,300	Cassava	a. 04-08-97 b. Agreement cancelled	- No. 442 Sar-Chor-Nor-Kor-Sar dated 20-03-00
46	S K Prosperous Development	Ratanakiri	4,000	Rubber	a. 11-03-97 b. – Agreement cancelled	- No. 442 Sar-Chor-Nor-Kor-Sar dated 20-03-00
47	Yunex International Trade Unity	Mondulkiri	20,000	Rubber & coffee	a. 02-11-95 b. Agreement	- No. 442 Sar-Chor-Nor-Kor-Sar dated 20-03-00

No.	Name of Company	Location	Land Size (Ha)	Type of Crop	a. Date of Agreement[1] b. Date of Contract[2] c. Deposit	Company Implementation
					cancelled	
48	Asia Golden Dragon	Kompong Cham	4,000	Rubber	a. 11-10-95 b. Agreement cancelled	- Prakas No. 333 Pro-Kor-Kor-Sar-Kor dated 31-05-00
49	K Q ehsn Enterprise	Kompong Cham	6,250	Cassava	a. 11-10-95 b. Agreement cancelled	- Prakas No. 333 Pro-Kor-Kor-Sar-Kor date: 31-05-00
50	Cambodia Palm Oil	Koh Kong	15,200	Palm oil	a. 19-12-96 b. Agreement cancelled	- Prakas No. 333 Pro-Kor-Kor-Sar-Kor date: 31-05-00
51	Agricultural Development Association	Kompong Cham	500	Rubber	a. Kor-Sar-Kor b. Agreement cancelled	- No. 1381 Sar-Chor-Nor dated 14-08-00
52	Vat Vanny	Kompong Thom	3,000	Rice	a. 05-09-95 b. Agreement cancelled	- No. 1381 Sar-Chor-Nor dated 14-08-00
53	Cambo Can Co. LTD	Kompong Thom	11,400	Floating rice	a. 18-08-98 b. Agreement cancelled	- No. 1381 Sar-Chor-Nor dated 14-08-00
54	Maca Plantation	Kompong Speu	10,800	Rubber	a. 15-11-96 b. Agreement cancelled	- No. 1381 Sar-Chor-Nor dated 14-08-00
55	Chung Thai Investment	Koh Kong	550	Cassava & fruit tree	a. Kor-Sar-Kor b. Agreement cancelled	- No. 1381 Sar-Chor-Nor dated 14-08-00
56	Cambodia Shan Shoei	Koh Kong	3,830	Fruit tree & livestock	a. Kor-Sar-Kor b. Agreement cancelled	- No. 1381 Sar-Chor-Nor dated 14-08-00

Footnotes added by CDRI:

[1] *In most cases, this is an "agreement in principle" between the prospective concessionaire and the Council of Ministers.*

[2] *In most cases, this is a contract between the prospective concessionaire and the Ministry of Agriculture, Forestry and Fisheries.*

CDRI Working Papers

1) Kannan, K. P. (November 1995), Construction of a Consumer Price Index for Cambodia: A Review of Current Practices and Suggestions for Improvement (Working Paper No. 1) $5.00

2) McAndrew, John P. (January 1996), *Aid Infusions, Aid Illusions: Bilateral and Multilateral Emergency and Development Assistance in Cambodia, 1992–1995* (Working Paper No. 2) $5.00

3) Kannan, K. P. (January 1997), *Economic Reform, Structural Adjustment and Development in Cambodia* (Working Paper No. 3) $5.00

4) Chim Charya, Srun Pithou, So Sovannarith, John McAndrew, Nguon Sokunthea, Pon Dorina & Robin Biddulph (June 1998), *Learning from Rural Development Programmes in Cambodia* (Working Paper No. 4) $7.50

5) Kato, Toshiyasu, Chan Sophal & Long Vou Piseth (September 1998), *Regional Economic Integration for Sustainable Development in Cambodia* (Working Paper No. 5) $6.00

6) Murshid, K. A. S. (December 1998), *Food Security in an Asian Transitional Economy: The Cambodian Experience* (Working Paper No. 6) $9.00

7) McAndrew, John P. (December 1998), *Interdependence in Household Livelihood Strategies in Two Cambodian Villages* (Working Paper No. 7) $9.00

8) Chan Sophal, Martin Godfrey, Toshiyasu Kato, Long Vou Piseth, Nina Orlova, Per Ronnås & Tia Savora (January 1999), *Cambodia: The Challenge of Productive Employment Creation* (Working Paper No. 8) $9.00

9) Teng You Ky, Pon Dorina, So Sovannarith & John McAndrew (April 1999), *The UNICEF/ Community Action for Social Development Experience—Learning from Rural Development Programmes in Cambodia* (Working Paper No. 9) $4.50

10) Gorman, Siobhan, with Pon Dorina & Sok Kheng (June 1999), *Gender and Development in Cambodia: An Overview* (Working Paper No. 10) $6.00

11) Chan Sophal & So Sovannarith (June 1999), *Cambodian Labour Migration to Thailand: A Preliminary Assessment* (Working Paper No. 11) $3.00

12) Chan Sophal, Toshiyasu Kato, Long Vou Piseth, So Sovannarith, Tia Savora, Hang Chuon Naron, Kao Kim Hourn & Chea Vuthna (September 1999), *Impact of the Asian Financial Crisis on the SEATEs: The Cambodian Perspective* (Working Paper No. 12) $4.50

13) Ung Bunleng, (January 2000), *Seasonality in the Cambodian Consumer Price Index* (Working Paper No. 13) $3.00

14) Toshiyasu Kato, Jeffrey A. Kaplan, Chan Sophal and Real Sopheap (May 2000), *Enhancing Governance for Sustainable Development* (Working Paper No. 14) $6.00

15) Martin Godfrey, Chan Sophal, Toshiyasu Kato, Long Vou Piseth, Pon Dorina, Tep Saravy, Tia Savara and So Sovannarith (August 2000), *Technical Assistance and Capacity Development in an Aid-dependent Economy: the Experience of Cambodia* (Working Paper No. 15) $10.00

16) Sik Boreak, (September 2000), *Land Ownership, Sales and Concentration in Cambodia* (Working Paper No. 16) $7.00

17) Chan Sophal, and So Sovannarith, with Pon Dorina (December 2000), *Technical Assistance and Capacity Development at the School of Agriculture Prek Leap* (Working Paper No. 17) $8.00

18) Martin Godfrey, So Sovannarith, Tep Saravy, Pon Dorina, Claude Katz, Sarthi Acharya, Sisowath D. Chanto and Hing Thoraxy (August 2001), *A Study of the Cambodian Labour Market: Reference to Poverty Reduction, Growth and Adjustment to Crisis* (Working Paper No. 18) $7.00

19) Chan Sophal, Tep Saravy and Sarthi Acharya (October 2001), Land Tenure in Cambodia: a Data Update (Working Paper No. 19) $10.00

20) So Sovannarith, Real Sopheap, Uch Utey, Sy Rathmony, Brett Ballard and Sarthi Acharya (November 2001), *Social Assessment of Land in Cambodia* (Working Paper No. 20) $10.00

21) Bhargavi Ramamurthy, Sik Boreak, Per Ronnås and Sok Hach (December 2001), *Cambodia 1999-2000: Land, Labour and Rural Livelihood in Focus* (Working Paper No. 21) $10.00

22) Chan Sophal and Sarthi Acharya (July 2002), *Land Transaction in Cambodia* (Working Paper No. 22) $8.00

Natural Resources and Rural Livelihoods in Cambodia: A Baseline Assessment

Of the more than 10 million Cambodians currently living in rural areas, over 8.5 million depend on natural resources to support their livelihoods. Most are subsistent, relying on one crop of rice per year, fish and other aquatic resources, and a range of forest products. In this manner, natural resources provide a foundation for food security, income, and employment, and an essential "safety net" for the rural poor. But increasing pressures on land, fisheries, and forests suggest maintenance of rural subsistence will be a serious challenge in the coming decade.

Effective natural resource management will be a central component of future poverty reduction efforts in Cambodia. With this in mind, CDRI established its Natural Resources and Environment Programme in late-2001. The Programme seeks to support improved policymaking on issues of natural resource management, sustainable development, and poverty reduction. This initial paper provides an assessment of the present status of, and issues surrounding, natural resources and rural livelihoods for three key sectors – agriculture, fisheries, and forestry. This includes an examination of production and harvest information, management challenges and opportunities, cross-sector impacts, and marketing and trade issues. From this basis, a number of gaps and needs for future socio-economic research are identified.

———————————————

Prom Tola is a Researcher at CDRI and Bruce McKenney is Programme Manager for Natural Resources and Environment at CDRI.

$ 10.00

56 Street 315, Tuol Kork, Phnom Penh, Cambodia
(Postal address: PO Box 622, Phnom Penh, Cambodia)
Tel: (855-23) 880-734 / 368-053 / 883-603 Fax: (855-23) 366-094
e-mail: cdri@camnet.com.kh website: http://www.cdri.org.kh