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- River Basin Description
- Population and Land Use
- Local Governments and Planning Authorities
- Water Use Classifications

Section 2

River Basin Characteristics

This section describes the following major characteristics of the Ogeechee River basin:

- *River basin description* (Section 2.1): the physical features and natural processes of the basin.
- *Population and land use* (Section 2.2): the sociological features of the basin, including the types of human activities that might affect water quality and water resource use.
- *Local governments and planning authorities* (Section 2.3): identification and roles of the local authorities within the basin.
- *Water use classifications* (Section 2.4): description of water use classifications and baseline goals for management of waters within the basin as defined in the state regulatory framework.

2.1 River Basin Description

This section describes the important geographical, geological, hydrological, and biological characteristics of the Ogeechee River basin.

The physical characteristics of the Ogeechee River basin include its location, physiography, soils, climate, surface water and ground water resources, and natural water quality. These physical characteristics influence the basin's biological habitats and the ways people use the basin's land and water resources.

2.1.1 River Basin Boundaries

The Ogeechee River basin is located in mid to southeastern Georgia and is flanked by the Altamaha and Oconee River basins to the west and the Savannah River basin to the east (Figure 2-1). The headwaters are located in the southeastern edge of the Piedmont Province and the basin continues southeastward to the Atlantic Ocean. In the headwaters, the North and South Fork Ogeechee Rivers join to form the Ogeechee River which runs

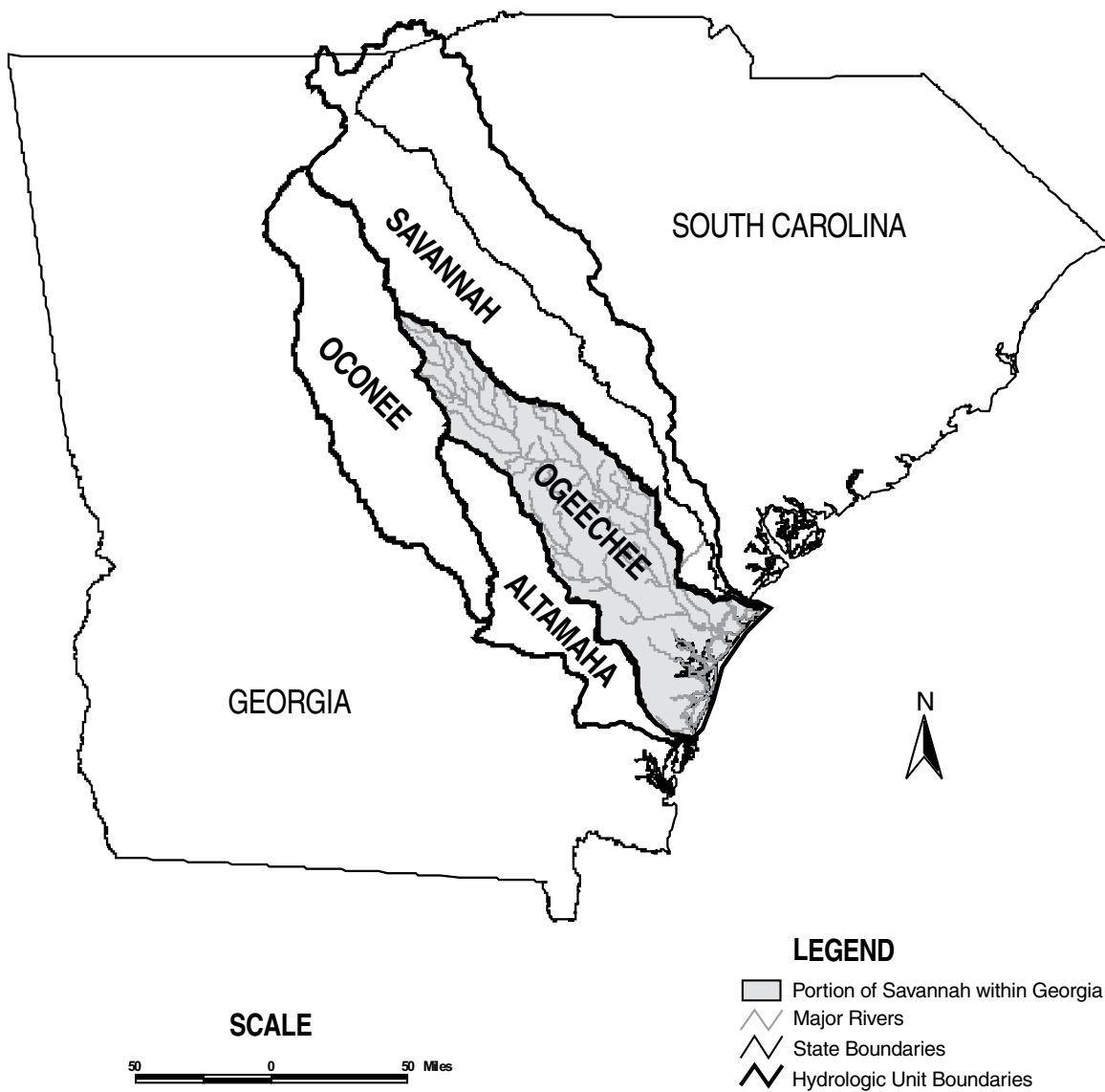


Figure 2-1. Location of the Ogeechee River Basin

245 miles in a southeasterly direction nearly the entire length of the basin. The Ogeechee River basin is located entirely in the State of Georgia and drains approximately 5,540 square miles.

The U.S. Geological Survey (USGS) has divided the Ogeechee River basin into four subbasins, or Hydrologic Unit Codes (HUCs; see Table 2-1). These HUCs are referred to repeatedly in this report to distinguish conditions in different parts of the Ogeechee River basin. Figure 2-2 shows the location of these subbasins and the associated counties within each subbasin.

Table 2-1. Hydrologic Unit Codes (HUCs) of the Ogeechee River Basin in Georgia

03060201	Upper Ogeechee River
03060202	Lower Ogeechee River
03060203	Canoochee River
03060204	Ogeechee Coastal

2.1.2 Climate

The Ogeechee River basin is characterized by mild winters and hot summers. Mean annual precipitation ranges from 40 to 52 inches per year. Precipitation occurs chiefly as rainfall, and to a lesser extent in the upper portion of the basin, as snowfall. Rainfall is fairly evenly distributed throughout the year, but a distinct dry season occurs from mid-summer to late fall. Rainfall is usually greatest in March and least in October. The mean annual temperature is about 60 degrees Fahrenheit (Journey and Atkins, 1996; citing Peck et al., 1992; Schneider et al., 1965; and Carter and Stiles, 1983).

2.1.3 Physiography, Geology, and Soils

Physiography

The Ogeechee River basin contains parts of the Piedmont and Coastal Plain physiographic provinces, which extend throughout the southeastern United States. Similar to much of the Southeast, the basin's physiography reflects a geologic history of mountain building in the Appalachian Mountains and long periods of repeated land submergence in the Coastal Plain Province. The northernmost part of the Ogeechee River Basin is within the Piedmont Province where the headwaters arise.

The Piedmont Province is underlain by mostly Precambrian as well as early Paleozoic crystalline rocks that include a wide variety of gneisses, granites, schists, amphibolites and phyllites. Metavolcanic and metasedimentary rocks are also present. The area is characterized by numerous inactive fault zones and joint patterns within the rocks that dictate the surface stream patterns and ground water resources. The crystalline rocks typically are overlain by a porous, residual soil generally known as saprolite.

The Fall Line is the boundary between the Piedmont and Coastal Plain provinces. This boundary approximately follows the contact between older crystalline metamorphic rocks of the Piedmont Province and the younger unconsolidated Cretaceous and Tertiary sediments of the Coastal Plain Province. As implied by the name, streams flowing across the Fall Line can undergo abrupt changes in gradient, which are marked by the presence of rapids and shoals. Geomorphic characteristics of streams differ between the Piedmont and Coastal Plain provinces. In the Coastal Plain, streams typically lack the riffles and

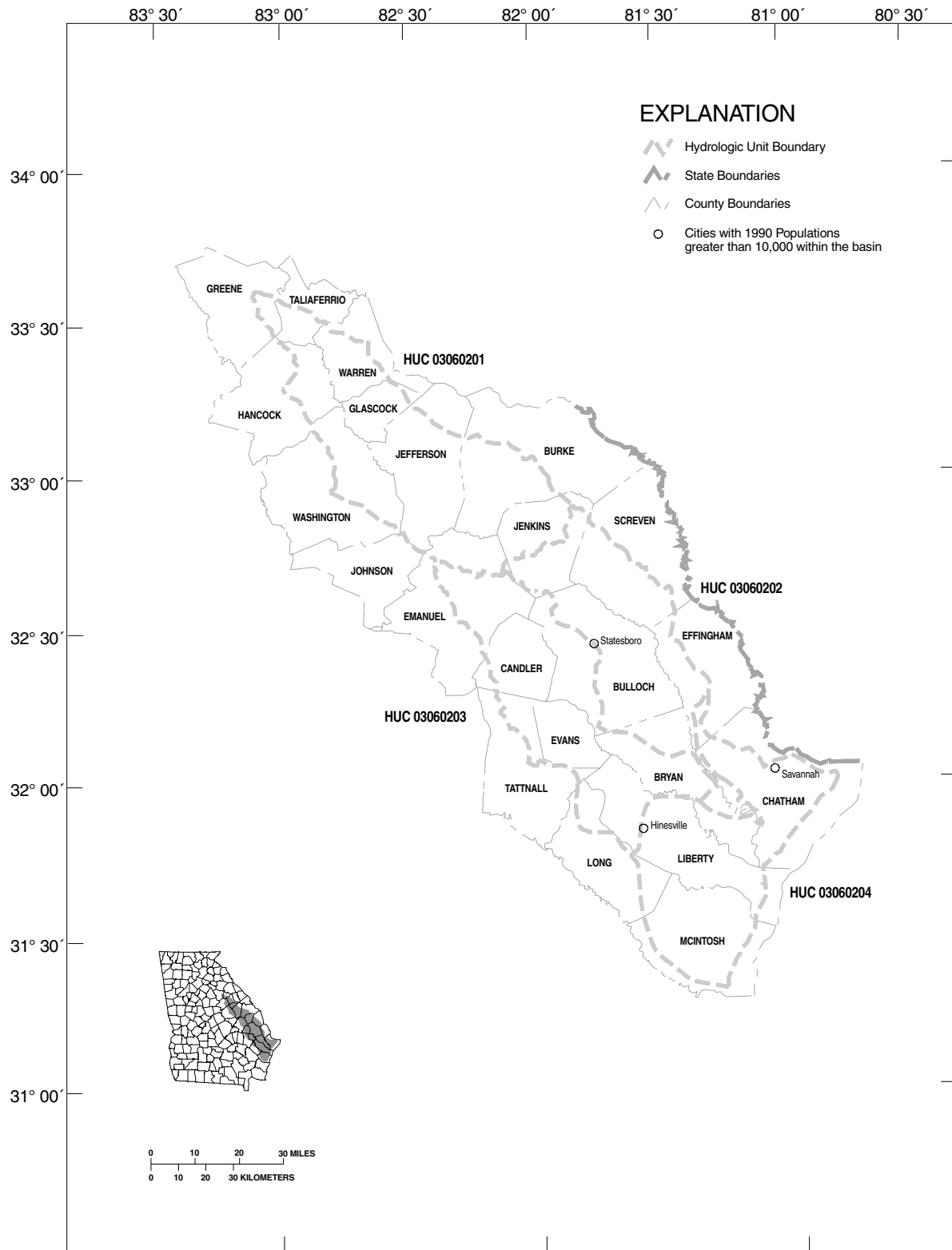


Figure 2-2. Hydrologic Units and Counties of the Ogeechee River Basin

shoals common to stream in the piedmont and exhibit greater floodplain development and increased sinuosity.

Geology

The northernmost part of the Basin is within the Piedmont Province. This province constitutes less than 5 percent of the Ogeechee River Basin and is underlain by crystalline metamorphic and igneous rocks. The metamorphic rocks originally were sedimentary, volcanic, and plutonic igneous rocks that have been altered by several stages of regional metamorphism as well as several episodes of granite intrusion. A large portion of the exposed rocks of the Ogeechee River Basin consist of several types of gneisses and granites. The gneisses include several varieties of biotite gneiss, felsic gneiss, granite gneiss, and amphibolite gneiss. Granites include biotite and porphyritic varieties. Other rock types found in the basin include metasedimentary rocks, schists and phyllites, felsic and mafic metavolcanic rocks, and amphibolite.

Coastal Plain sediments constitute more than 95 percent of the Ogeechee River basin. Approximately 80 percent of the Coastal Plain sediments in the basin are sands and clays. The rest include calcareous sediments and Quaternary alluvium. Coastal Plain sediments overlap the igneous and metamorphic rocks of the southern edge of the Piedmont Province at the Fall Line. Coastal Plain sediments nearest to the Fall Line are Cretaceous to Eocene in age. These sediments are dominantly terrestrial to shallow marine in origin and consist of sand, kaolinitic sand, kaolin, and pebbly sand. They host the major kaolin deposits in Georgia with many of these deposits found within the Ogeechee River Basin.

Much of the southeastern Piedmont is covered by deeply weathered bedrock called saprolite. Average saprolite thickness in the Piedmont rarely exceeds 20 meters, but the thickness can vary widely within a short distance. A considerable amount of ground water flows through the saprolite and recharges streams in the Piedmont. Saprolite is easily eroded when covering vegetation and soil are removed. Extensive erosion of soil and saprolite caused by agricultural practices during the 1800s and early 1900s contributed a vast quantity of sediment into stream valleys, choking the streams and raising the streams base level. As conservation practices stabilized erosion, streams began to reestablish grade and cut into the thick accumulations of sediments, remobilizing them into the major rivers and eventually into reservoirs.

Soils

The Ogeechee River watershed in Georgia crosses four major land resource areas (MLRA's), which generally reflect the physiographic provinces and are shown in Figure 2-3. About 6 percent of the area is in the Southern Piedmont MLRA, about 4 percent in the Carolina and Georgia Sand Hills MLRA, 48 percent in the Southern Coastal Plain MLRA, and 42 percent in the Atlantic Coast Flatwoods MLRA. Soils vary widely across the watershed, ranging from nearly level to steep, from shallow to very deep, from excessively drained to very poorly drained, and from sandy to clayey. There are some general trends with soils across the watershed. Going from north to south, degree of slope decreases, water tables are generally higher, and soil textures go from to clayey in the Southern Piedmont, to sandy or sandy over loamy in the Sand Hills, Coastal Plain, and Atlantic Coast Flatwoods.

Most of the soils in the Southern Piedmont region are characterized by very deep, well drained, red clayey soils that formed from felsic, high grade metamorphic or igneous rocks.

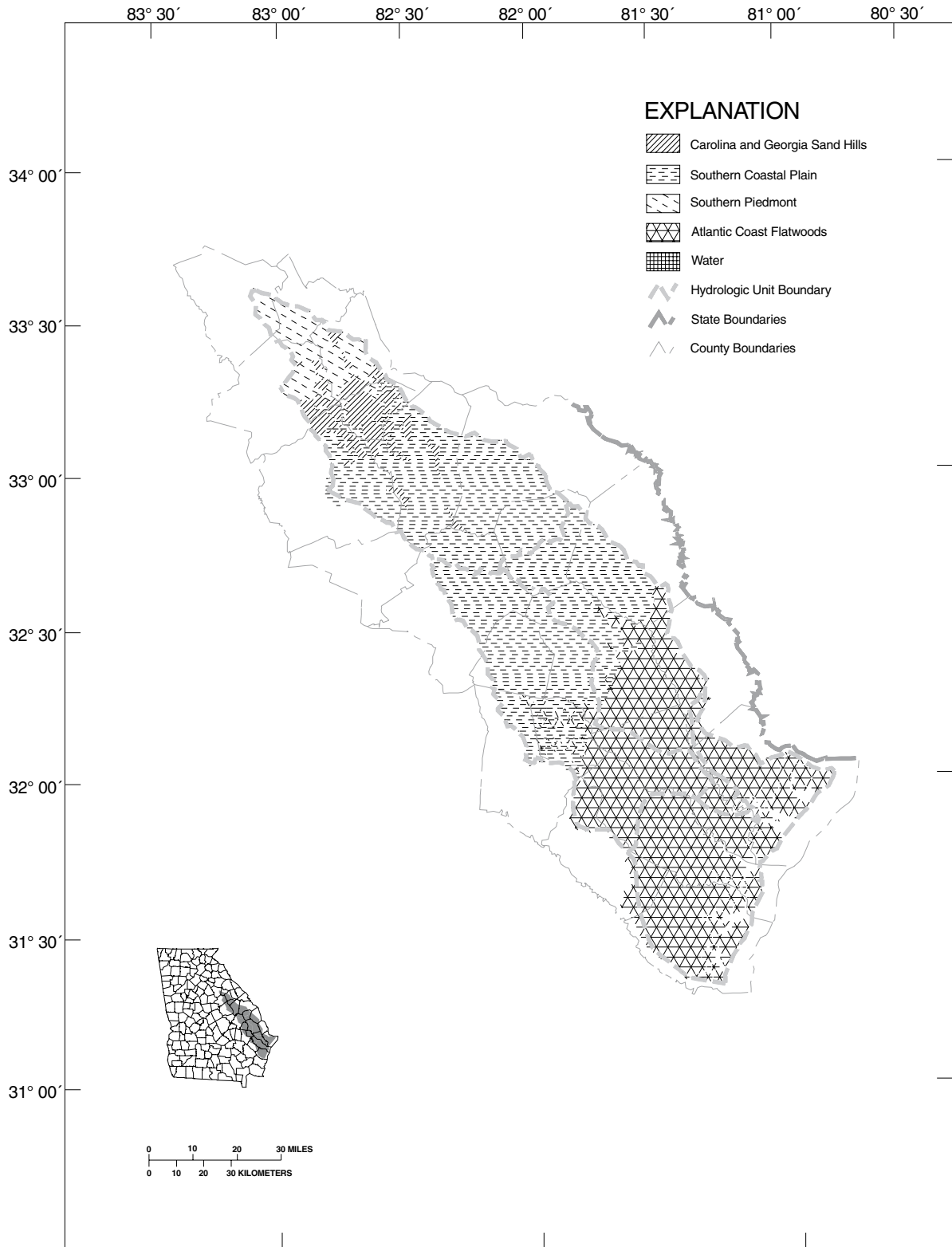


Figure 2-3. Major Land Resource Areas in the Ogeechee River Basin

The Carolina and Georgia Sand Hills portion of the Ogeechee basin is characterized by soils formed primarily in sandy and loamy marine sediments, which occasionally overlie residual Piedmont materials. There are two major groups of soils in this area. One group consists of deep sands ranging from 40 to more than 80 inches deep. The other group consists primarily of soils that have a sandy surface and a loamy subsoil, often exhibiting dense or brittle properties. Soils in this MLRA are generally less developed than soils in other parts of the watershed. The dominant soils in this part of the watershed have 40 to 60 inches of sandy materials overlying a loamy subsoil. Soils in the Southern Coastal Plain part of the watershed are more variable than in other parts, particularly with regards to textures and water table depths. Typically, soils have a sandy surface layer that overlies a red to yellow, loamy subsoil. The depth of the sandy surface is quite variable. Soils in this region are on more gently sloping landforms than in previously mentioned MLRA's. There is a continuum of soils ranging from well-drained soils on ridges and hillsides to poorly drained soils in depressions and along drainageways.

Landforms in the Atlantic Coast Flatwoods part of the watershed are nearly level. Water tables are generally closer to the surface in this area than in other parts of the watershed. Typically, soils have a sandy surface layer that is 20 to 40 inches deep over a loamy subsoil. This varies considerably, however. Characteristic of part of this MLRA are sandy soils that have an accumulation of an organic matter-aluminum complex. There is also a significant area of marsh soils along coastal areas.

2.1.4 Surface Water Resources

The Ogeechee River is the dominant waterbody in the basin, while its principal tributary, the Canoochee River, drains approximately 1,400 square miles and is the only other major river in the basin. Numerous smaller tributaries flow into these two rivers throughout the basin. Other significant water features are the coastal estuaries, sounds, and Atlantic Intracoastal waterway. There are no large storage reservoirs or hydroelectric plants in the Ogeechee River basin, however, there are many small lakes, reservoirs and farm ponds. Stream networks within each HUC are shown in Figures 2-4 through 2-7.

In addition to the year-to-year variability in flow, there is also great variation from stream to stream. Streamflows are typically high in late winter and early spring and flow at lower levels in the late summer and fall. The flow regime of the Canoochee River, particularly low flows, differs significantly from the Ogeechee River. The Canoochee River experiences more severe low flows. The higher low flows of the Ogeechee River are attributed to the runoff characteristics and relative impermeability of the upstream Piedmont Province. The annual mean discharge (water years 1937 to 1997) for the Ogeechee River near Eden (USGS Station 02202500), which drains 2,650 square miles, is 2,342 cubic feet per second (cfs). The annual mean discharge (water years 1937 to 1997) for the Canoochee River near Claxton (USGS Station 02203000), which drains 555 square miles, is 472 cfs. For these same gages the lowest annual mean for the Ogeechee and Canoochee Rivers is 874 cfs and 77.7 cfs, respectively.

River slopes of less than 1.5 feet per mile are not observed on the Ogeechee River until it reaches the final 130 miles of its length, all of which is below the 100-foot elevation. On the coast, salt water wedges can be detected upstream nearly as far as tidal influences. The latter extend some 30 to 35 miles up the river under low flow conditions.

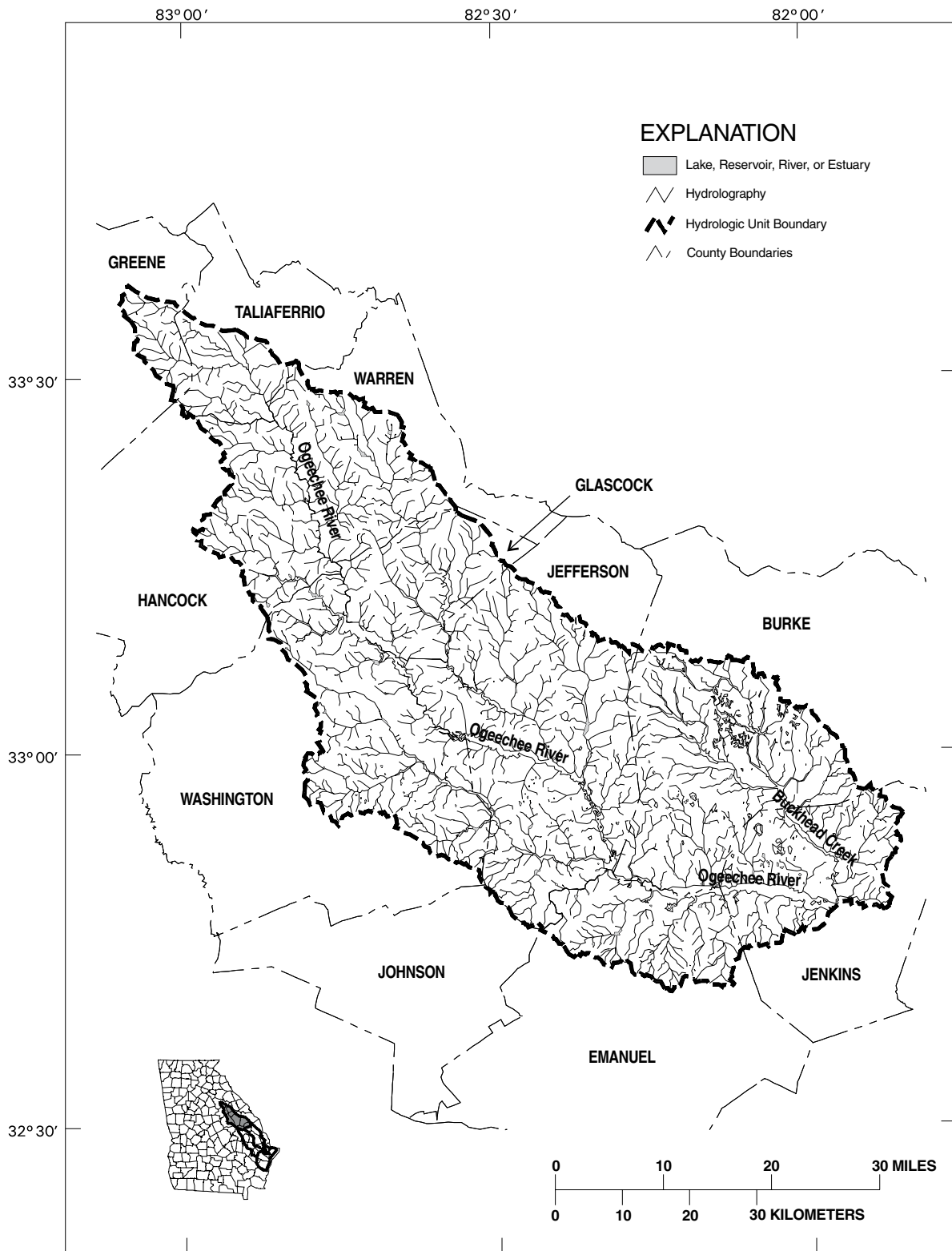


Figure 2-4. Hydrography, Ogeechee River Basin, HUC 03060201

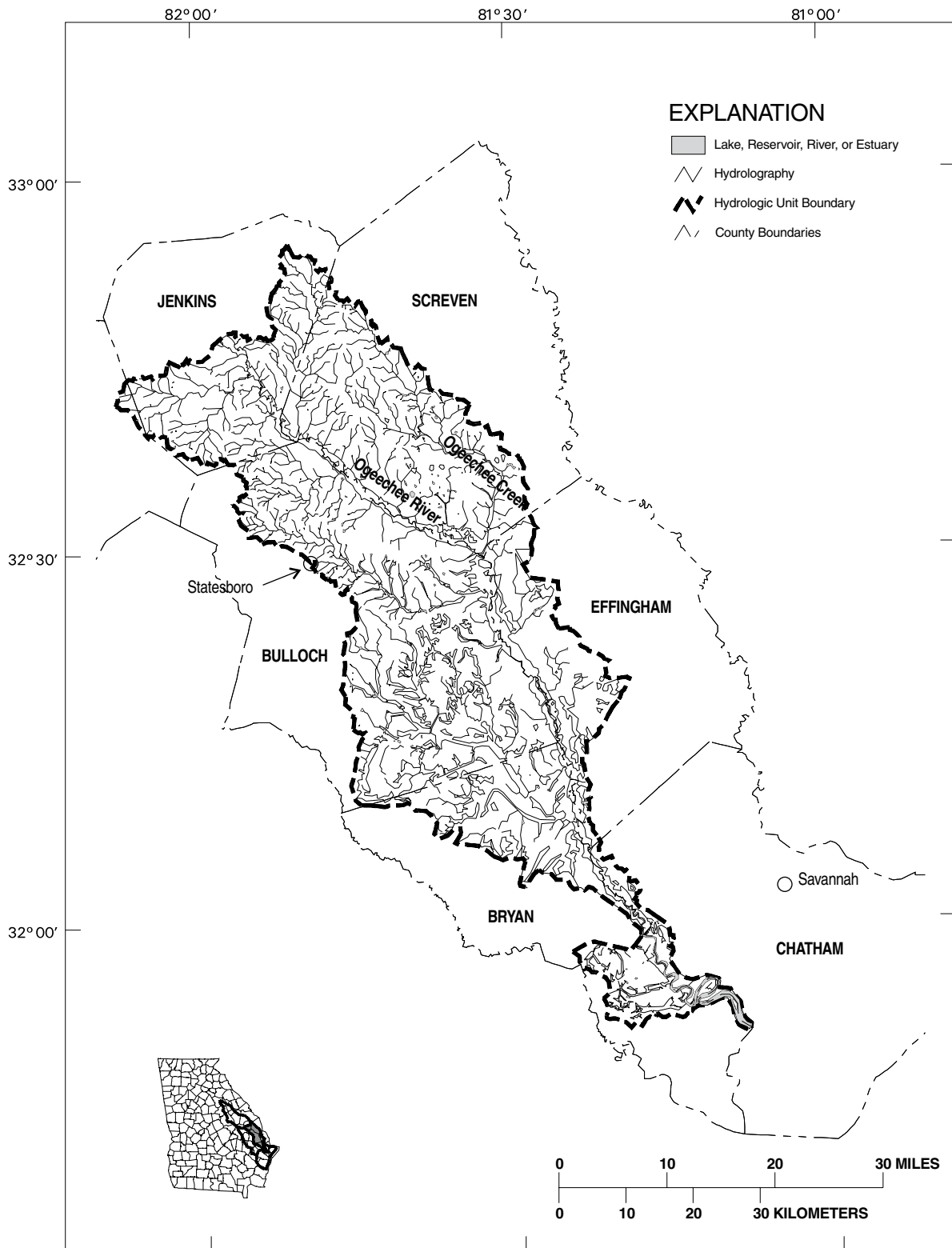


Figure 2-5. Hydrography, Ogeechee River Basin, HUC 03060202

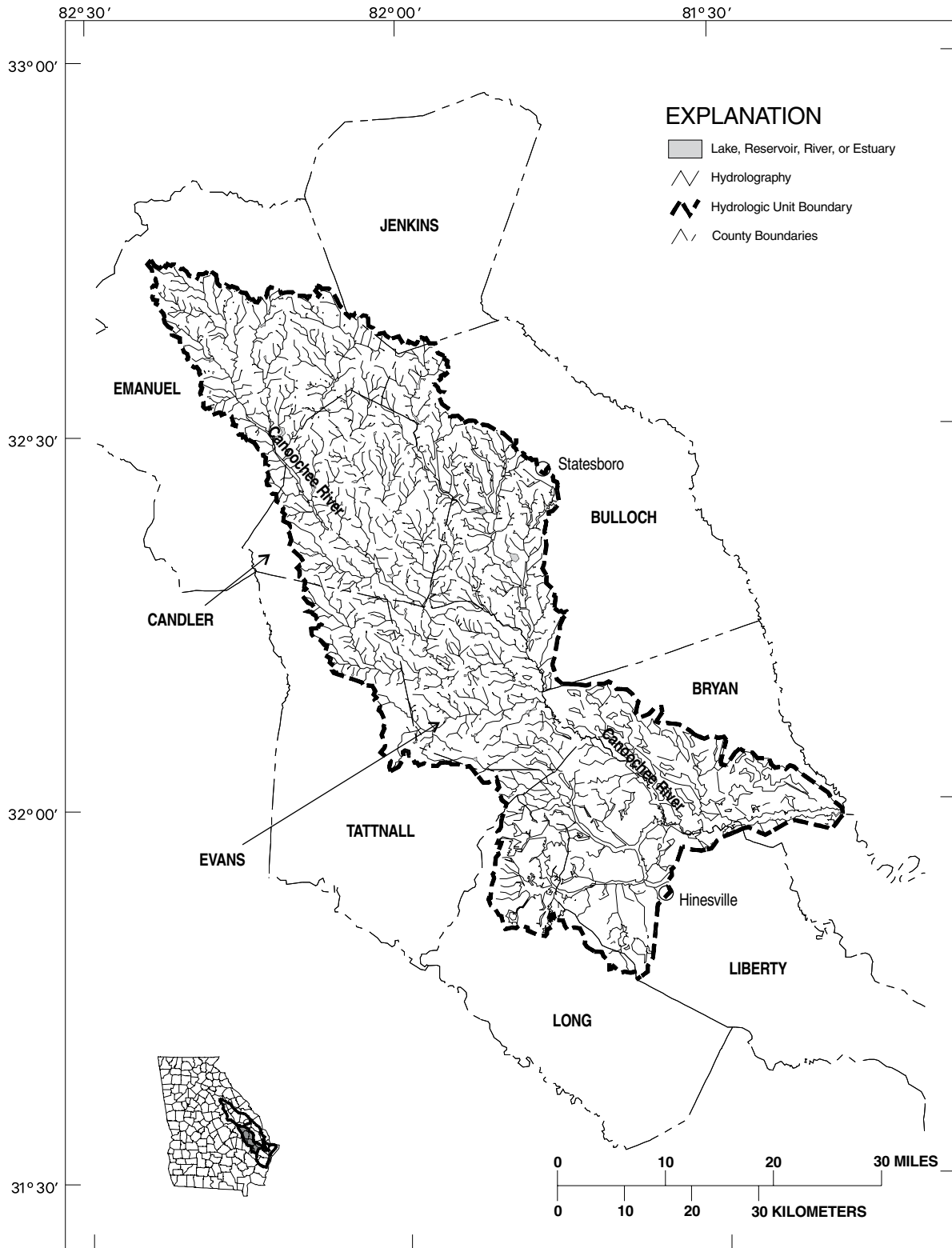


Figure 2-6. Hydrography, Ogeechee River Basin, HUC 03060203

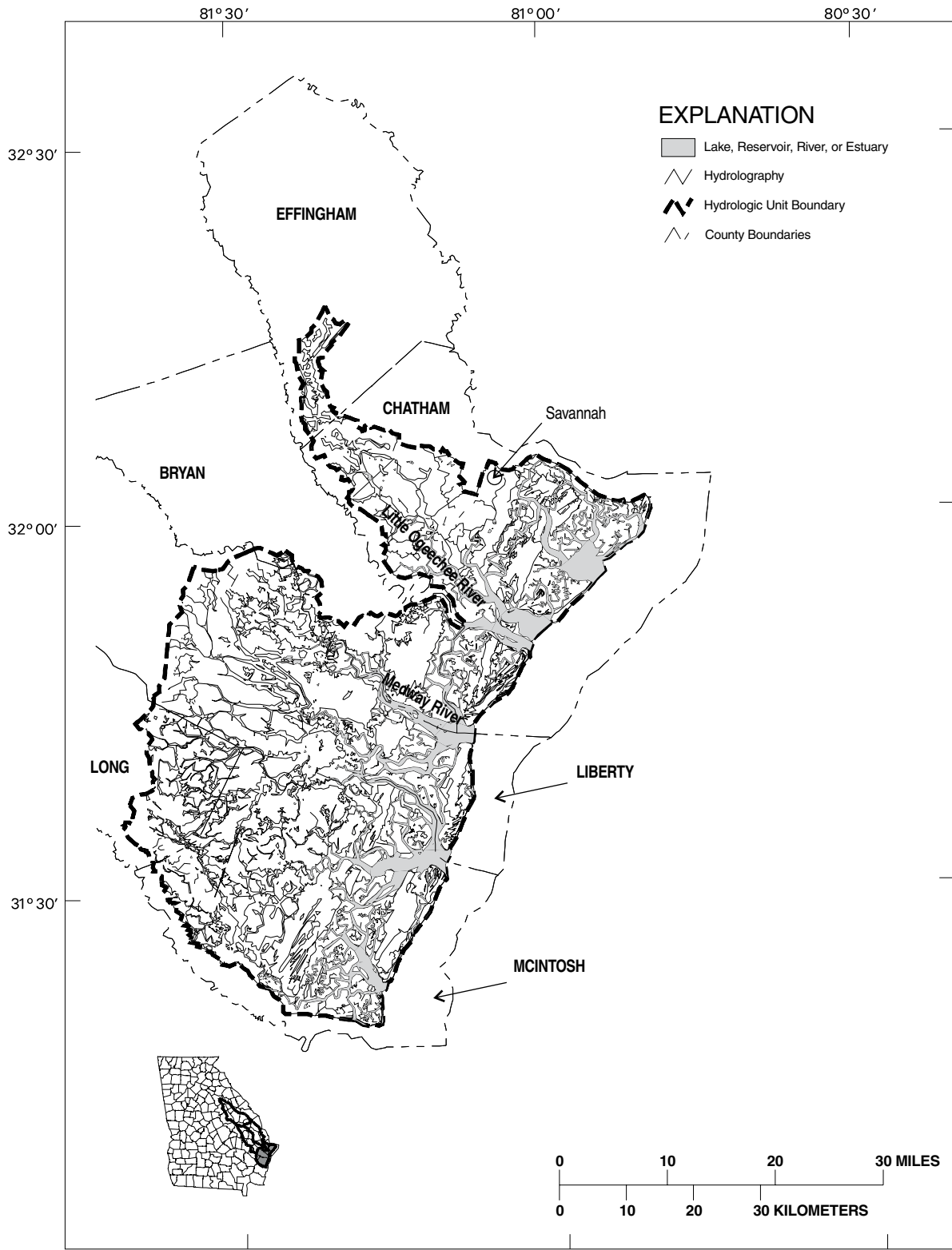


Figure 2-7. Hydrography, Ogeechee River Basin, HUC 03060204

2.1.5 Ground Water Resources

In the Ogeechee River basin, groundwater occurrence is related to two distinct physiographic provinces. Abundant groundwater supplies are concentrated in the lower half of the basin in the Coastal Plain province. Generalized outcrop areas of major aquifers for the Ogeechee River basin are shown in Figure 2-8. Traveling south in the basin, the areas are as follows:

Crystalline rock aquifers

In the upper half of the basin, from Greene County south to the Fall Line between Macon and Augusta, the crystalline rock formations that underlie the Piedmont province greatly restricts groundwater availability. Some studies have shown that there may be contact zones, fractures, and shear planes capable of producing water yields as high as 400 gallons per minute (GPM) in the Piedmont, though the common range of production is nearer 50 GPM or less. Some wells have found on the order of 1 GPM. Techniques for locating these reliable sources have improved greatly over the past 10 years, and will likely continue to do so.

Cretaceous sand aquifers

The Cretaceous sand aquifer system, located along the northern edge of the Coastal Plain, outcrops in a band of terrain about 40 miles wide across the central part of the Basin, mainly in Washington and Jefferson Counties, are part of the Kaolin Belt of Georgia. Dewatering operations at the clay pits, plus the extensive amount of process water necessary for processing the kaolin can lead to localized drawdowns within the Cretaceous aquifer. This can mean some domestic wells or other operations can lose the use of their wells. Generally the kaolin companies then redrill or deepen the wells to provide water to the impacted folks. The Cretaceous aquifer is made up of the Dublin-Midville aquifers, a clastic aquifer containing water in sandy intervals. Overlying this is the Gordon Aquifer, a thin sand and shale unit of Eocene age. The Cretaceous aquifer consists of interbedded sands and clays that begin at the Fall Line and is as thick as several hundred feet farther to the south. Groundwater occurs in the pore spaces of the somewhat unconsolidated sand layers, which are composed of largely angular to subangular quartz grains. The interbedded clay layers act as confining beds causing the deeper groundwater to occur under artesian conditions. Well yields in the portions of the Cretaceous sand aquifer underlying the Ogeechee River basin have been found to exceed 1,000 GPM. Recharge occurs through the sandy soil in the outcrop area. In the northern portion of the basin this unit is seen as one single aquifer and can be called either the Cretaceous Aquifer or the Dublin-Midville Aquifer. As you move to the south, an intervening clay layer becomes apparent, and divides the aquifer into two distinct units. Below is the Midville Aquifer of definite Cretaceous age. Overlying the confining shale unit is the Dublin Aquifer, which is of Cretaceous-Early Tertiary age.

Gordon aquifer

The Gordon Aquifer system, of Eocene age, overlies the Cretaceous sand aquifer in the Coastal Plain portion of the basin, and consists of saturated permeable sands. It is confined above and below by clay-rich layers, and ranges in thickness from about 20 feet in Washington County to about 150 feet to the south. Generally well yields of up to 500 GPM are possible in the southern portions of the basin. Gordon Aquifer recharge occurs mainly through the outcrop areas in Washington and Jefferson Counties.

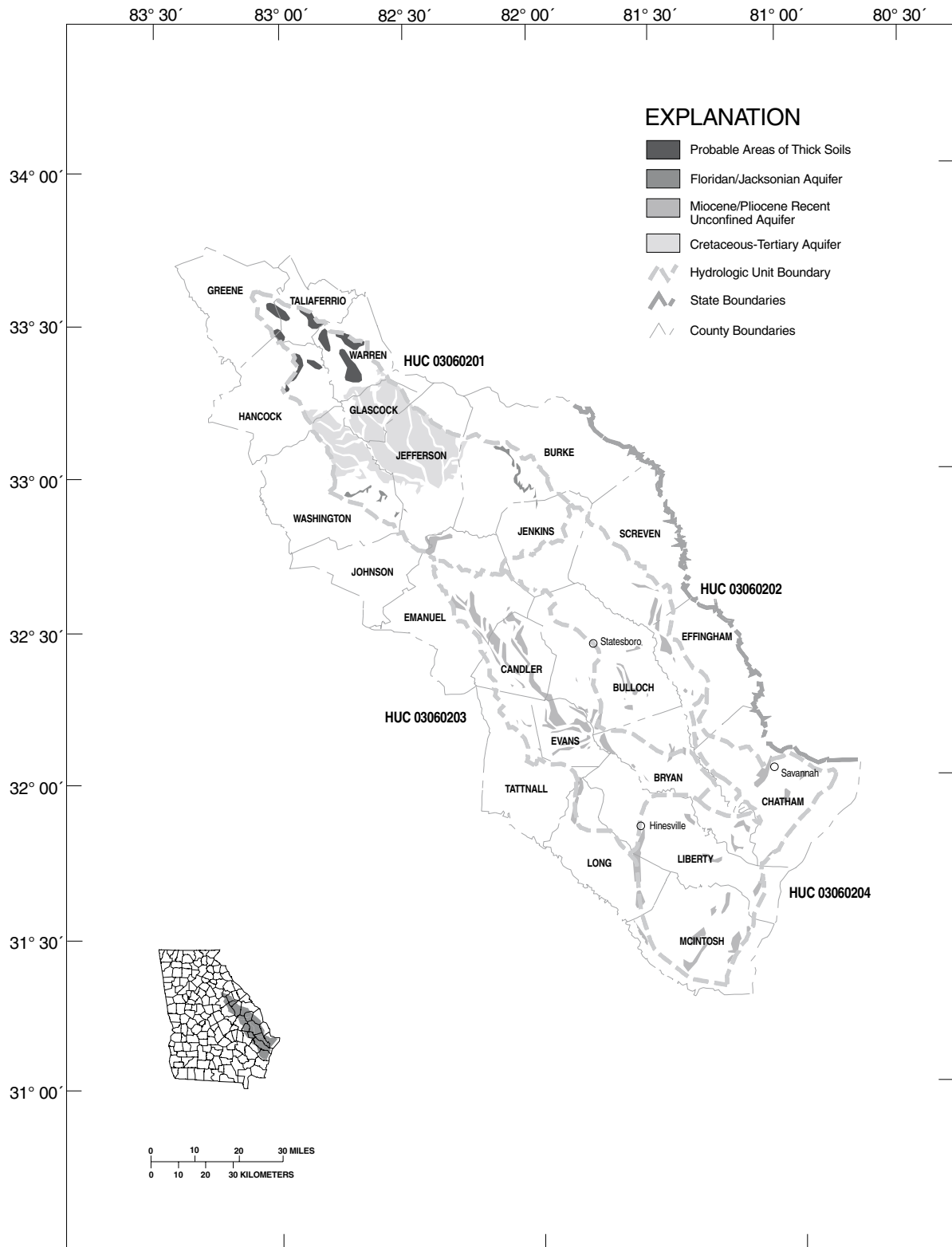


Figure 2-8. Hydrogeologic Units Underlying the Ogeechee River Basin

Floridan aquifer

The Floridan aquifer underlies the rest of the southern portion of the Basin. The aquifer is overlain by approximately 25-125 feet of sandy clay residuum derived from chemical weathering of the underlying rock. The total thickness of the Floridan aquifer in the basin ranges from a few tens of feet in the north to more than 400 feet in the extreme southern portion of the basin. Clastic grains of sand and shale comprise the main units in the northern portions of this aquifer, while to the south the aquifer becomes ever more carbonate (limestone) in content. In the south the aquifer consists of three thick beds of limestone (i.e., Tampa limestone, Suwannee limestone, and Ocala limestone). Well yields can range from about 40 GPM in the north to more than 10,000 GPM in the thickest, southern most portions of the Floridan aquifer. The Floridan serves as the main aquifer from Emanuel and Burke Counties to the coast.

2.1.6 Biological Resources

The Ogeechee River basin supports a diverse and rich mix of terrestrial and aquatic habitats and is home to several federally and state-protected species. The basin encompasses parts of five major land resource areas. Some of the biological resources of the basin are summarized below.

Terrestrial Habitats

The Ogeechee River is one of Georgia's few remaining free flowing streams. The river drains over 14,000 km² and contains excellent habitat for numerous freshwater fish species. It's headwaters are formed in Greene county Georgia at 198 meters above sea level and flow southeasterly 425 kilometers to Ossabaw Island and the Atlantic Ocean (Schmitt 1988). The river traverses portions of two physiographic regions on its journey to the ocean. The headwaters begin in the Piedmont Region, but the majority (95 percent) of the Ogeechee River basin lies in the Outer Coastal Plain Mixed Forest Province and is comprised of forests (48%), agricultural lands (36%) and wetlands (13 %) (Bailey, 1995). The Outer Coastal Plain is a temperate rainforest (or temperate evergreen forest or laurel forest) ecoregion characterized by lower species diversity, but a greater abundance of individuals than equatorial or tropical rainforests. The Ogeechee River is a typical blackwater coastal stream, which is a result of tannins from decaying tree roots and other organic materials passing through the sandy soil and staining the water. However, unlike other black water rivers, the Ogeechee has a high pH (near 7.0) due to a large input of carbonate-rich water from Magnolia Springs.

Common species of trees include evergreen oaks and species of the laurel and magnolia families. Typically these habitats include a well-developed lower stratum of vegetation consisting of tree ferns, small palms, shrubs, and herbaceous plants. At the higher elevations, the trunks and branches of trees are often covered in moss. At the lower elevations, trees such as Evangeline oaks, baldcypress and others are covered by the epiphyte commonly known as Spanish moss (Bailey, 1995).

The lower reaches of the Ogeechee River basin flow through the extensive coastal marshes and interior swamps of Georgia's coastal region and are dominated by gum and cypress. The upland areas are covered by subclimax pine forests, which have an understory of grasses and sedges referred to as savannas. Undrained shallow depressions in savannas form upland bogs or pocosins, in which evergreen shrubs predominate.

Fauna

Terrestrial Fauna

The habitat diversity in this region supports a wide variety of wildlife. Although small numbers of black bears may be found in isolated areas, the white-tailed deer is the only large indigenous mammal in this region (Bailey, 1995). Populations of feral hogs have become quite prevalent and their destructive foraging habits have made them a nuisance species in agricultural locales. Small mammals that are common to the basin include raccoons, opossums, flying squirrels, rabbits and numerous species of ground-dwelling rodents.

The bobwhite quail, eastern wild turkey and mourning dove are the primary game birds. Migratory nongame bird species, as well as waterfowl are numerous in this region. The red-cockaded woodpecker, which inhabits mature longleaf pine stands, is a federally-listed endangered species.

Fish Fauna

The diverse fish fauna of the Ogeechee River basin includes 59 species representing 23 different families. The largest group of species in the Ogeechee River basin belongs to the sucker family Catostomidae. Even though suckers are not highly prized by most fishermen, they are ecologically important because they often account for the largest fish biomass in Georgia streams. In a 1988 survey conducted by the Fisheries Section of the Georgia Department of Natural Resources on the Ogeechee River, spotted suckers comprised 28 percent of the total sample by weight. Other families with large numbers of species are the sunfish and bass family (Centrarchidae) and the catfish family (Ictaluridae).

Striped bass are spawned and raised to intermediate size at Richmond Hill Hatchery for stocking when late spring and early summer flows drop below 30 percent of average annual discharge. Research has shown that flows less than 800 cfs during this period result in poor recruitment of striped bass to juvenile stage. Artesian cool water refuges (springs) are critical to the survival of adult striped bass during summer months. The Ogeechee River offers excellent fishing for redbreast sunfish, largemouth and striped bass, catfish, redear sunfish, spotted sunfish, black crappie and chain pickerel.

The Canoochee River is the largest tributary to the Ogeechee River and is home to many freshwater fish species and offers excellent fishing for redbreast sunfish, largemouth bass, catfish, redear sunfish, and spotted sunfish.

2.2 Population and Land Use

2.2.1 Population

As of 1995, about 419,800 people lived in the Ogeechee watershed (DRI/McGraw-Hill, 1996). Population distribution in the basin at the time of the 1990 census by census blocks is shown in Figure 2-9. Population centers in the Ogeechee watershed include the development surrounding Savannah and the City of Statesboro.

Between 1975 and 1995, the population in the Ogeechee River basin increased by 1.3 percent per year (DRI/McGraw-Hill, 1996). Basin population is projected to increase at an average growth rate through 2050.

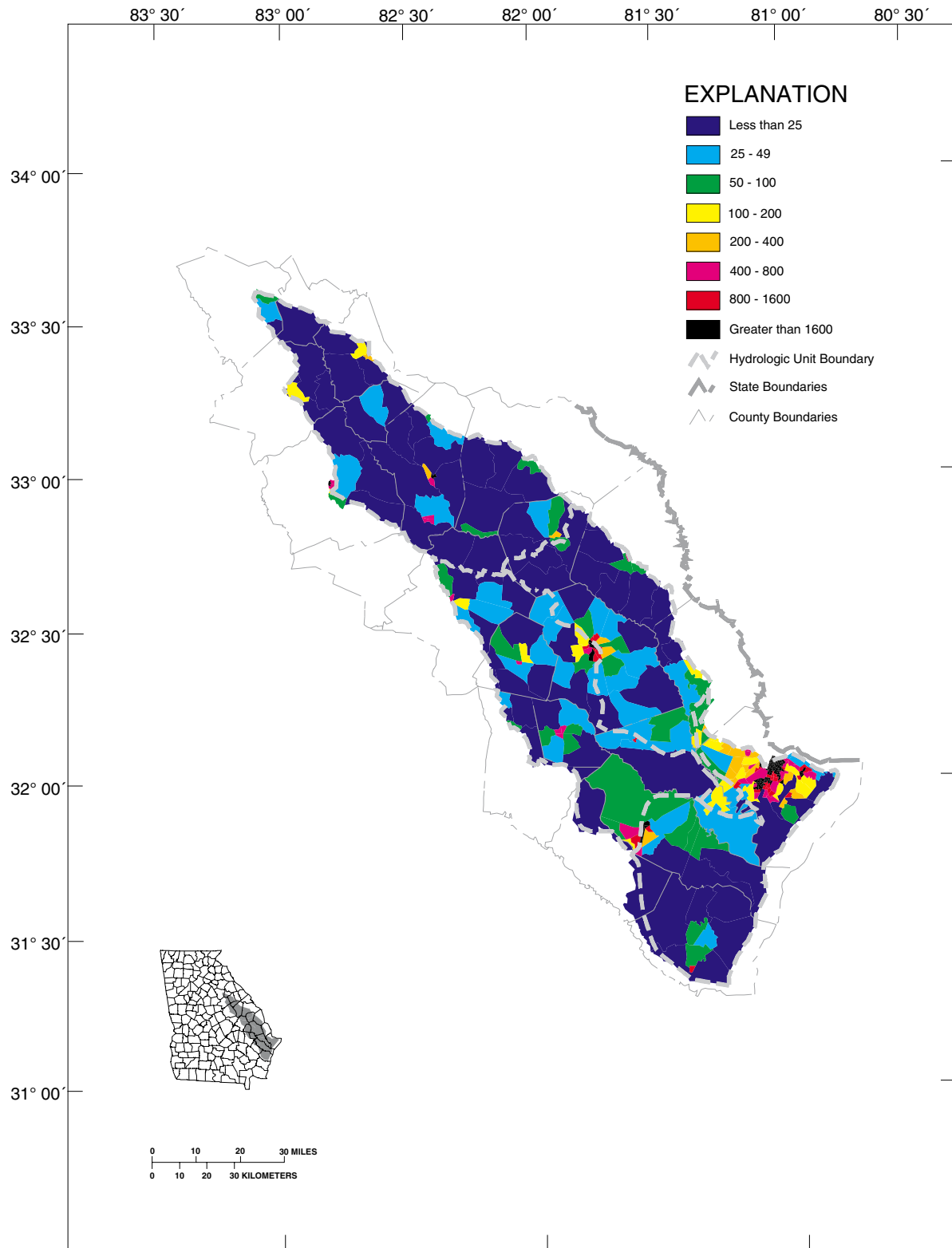


Figure 2-9. Population Density in the Ogeechee River Basin, 1990

One area in which this river basin will differ slightly from state trends, is an age cohort of 0-16 year olds which will keep its share of total population above 26 percent through 2050. This is in contrast with the 22 percent share this cohort is forecasted to comprise in Georgia by 2050. The river basin will mirror state trends in terms of its elderly population with the 65 and older age group showing the largest gains in share through 2050, at which time 19 percent of the population will be in this age cohort. Large youth and elderly populations will mean a decline in the working age population, down 43 percent in 2050 from 63 percent today.

2.2.2 Employment

The Ogeechee River basin supported 182,100 jobs in 1995. It is moving from a manufacturing- to a service-based economy. In the coming years, a decrease in jobs is expected in manufacturing and durable goods, offset by an increase in jobs in the service and trade sectors.

The Ogeechee River basin has historically been less dependent on manufacturing industries than is the rest of Georgia. In 1975, only 21 percent of the river basin's jobs were in industrial sectors, as compared with 24 percent statewide. As manufacturing sectors have declined across the state, Georgia as a whole is beginning to look more like Ogeechee in terms of industrial mix. In fact, by 2050, only 4 percent of jobs, both within the river basin and within the state, are forecast to be in manufacturing sectors. One important sector for Ogeechee is paper, in which the river basin's 4,800 jobs constitute 14 percent of the state's paper industry. In terms of job losses between 1995 and 2050, however, the most significant sector is durable goods, in which more than one-half of the 28,800 jobs will no longer be present in 2050. This decline accounts for 47 percent of all employment losses in industrial sectors. The nonmanufacturing sectors, in particular the service sector, will offset these job losses. By 2050, services will account for 40 percent of river basin employment, growing at an annual rate of 1.9 percent. The trade sector will also remain important for the area, keeping a nearly constant employment share of 24 percent until the end of the 55-year forecast horizon.

2.2.3 Land Cover and Use

Land use/land cover classification was determined for the Ogeechee River Basin based on high-altitude aerial photography for 1972-76 (U.S. Geological Survey, 1972-78). Subsequently in 1991 land cover data were developed based on interpretation of Landsat TM satellite image data obtained during 1988-90, leaf-off conditions. These two coverages differ significantly. Aerial photography allows identification of both land cover and land uses. Satellite imagery, however, detects primarily land cover, and not land use, such that a forest and a wooded subdivision may, for instance, appear similar. Satellite interpretation also tends to be less accurate than aerial photography.

The 1972-76 classification (Figures 2-10 through 2-13) indicates that 54 percent of the basin land areas was forest, 19 percent wetlands, 12 percent agriculture, and 1 percent urban.

The 1988-90 land cover interpretation showed 39 percent of the basin in forest cover, 24 percent in wetlands, 1 percent in urban land cover, and 17 percent in agriculture (Figures 2-14 through 2-17). Statistics for 15 landcover classes in the Georgia portion of the Ogeechee River basin for the 1988-90 coverage are presented in Table 2-2 (GA DNR, 1996).

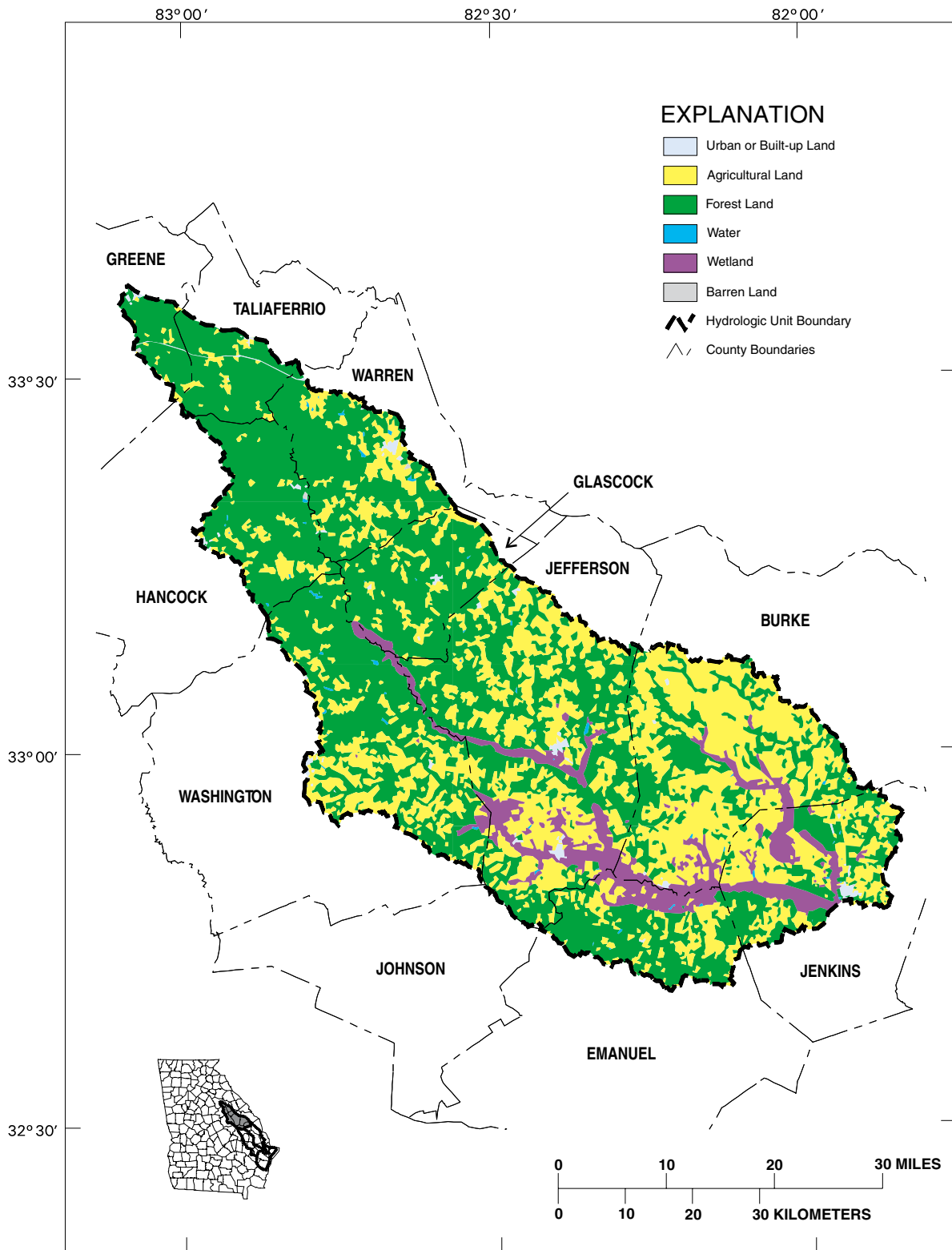


Figure 2-10. Land Use, Ogeechee River Basin, HUC 03060201, USGS 1972-76 Classification Updated with 1990 Urban Areas

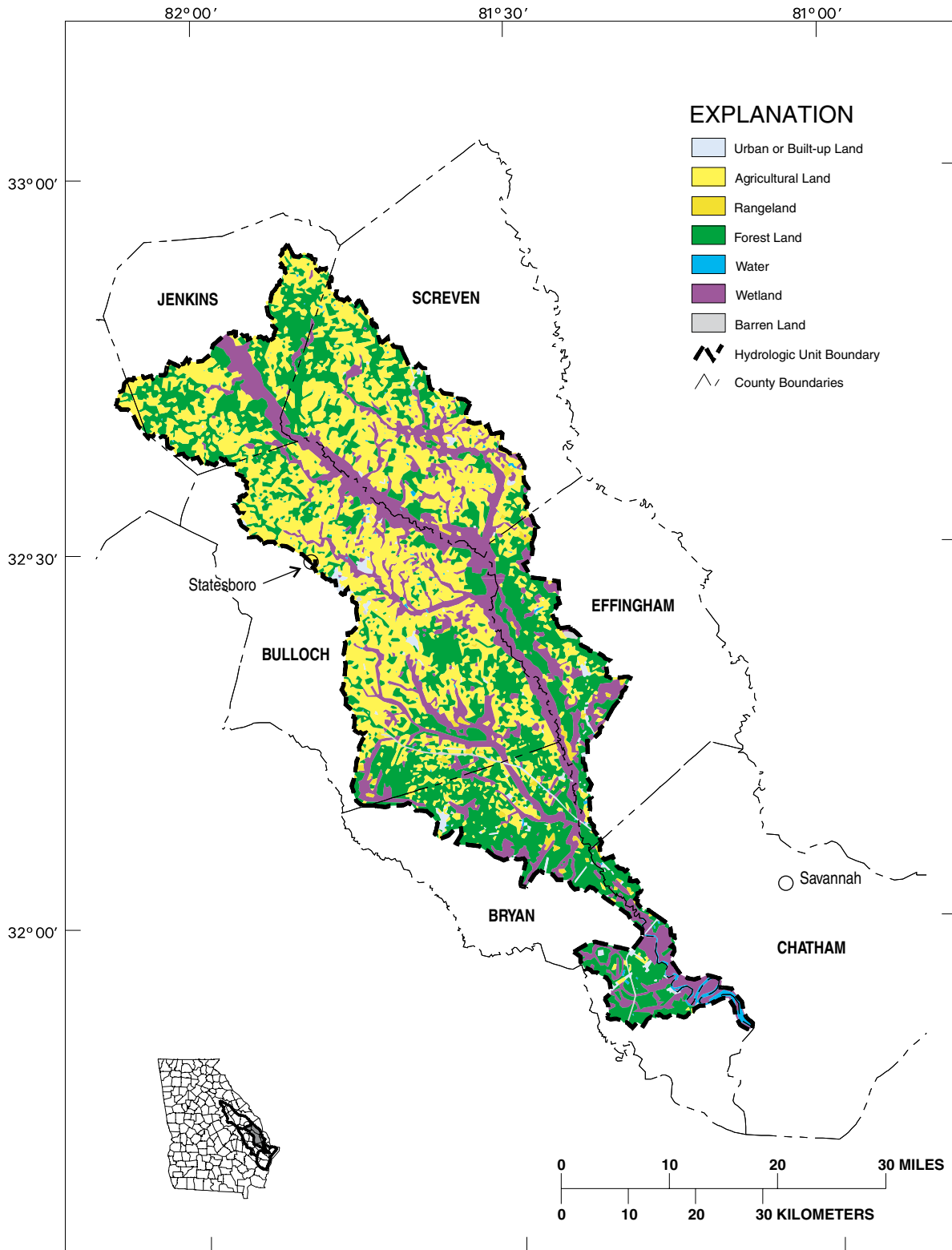


Figure 2-II. Land Use, Ogeechee River Basin, HUC 03060202, USGS 1972-76 Classification Updated with 1990 Urban Areas

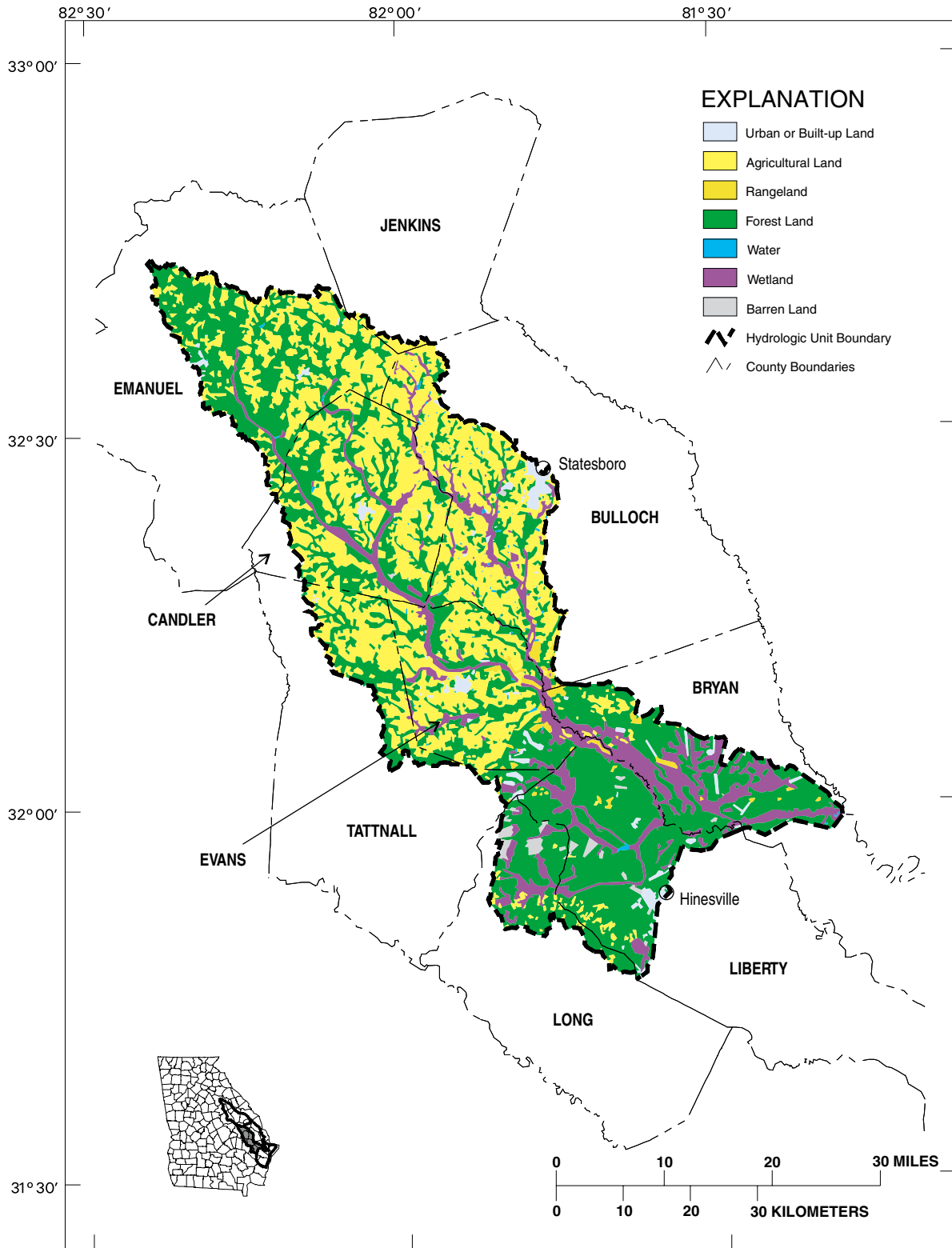


Figure 2-12. Land Use, Ogeechee River Basin, HUC 03060203, USGS 1972-76 Classification Updated with 1990 Urban Areas

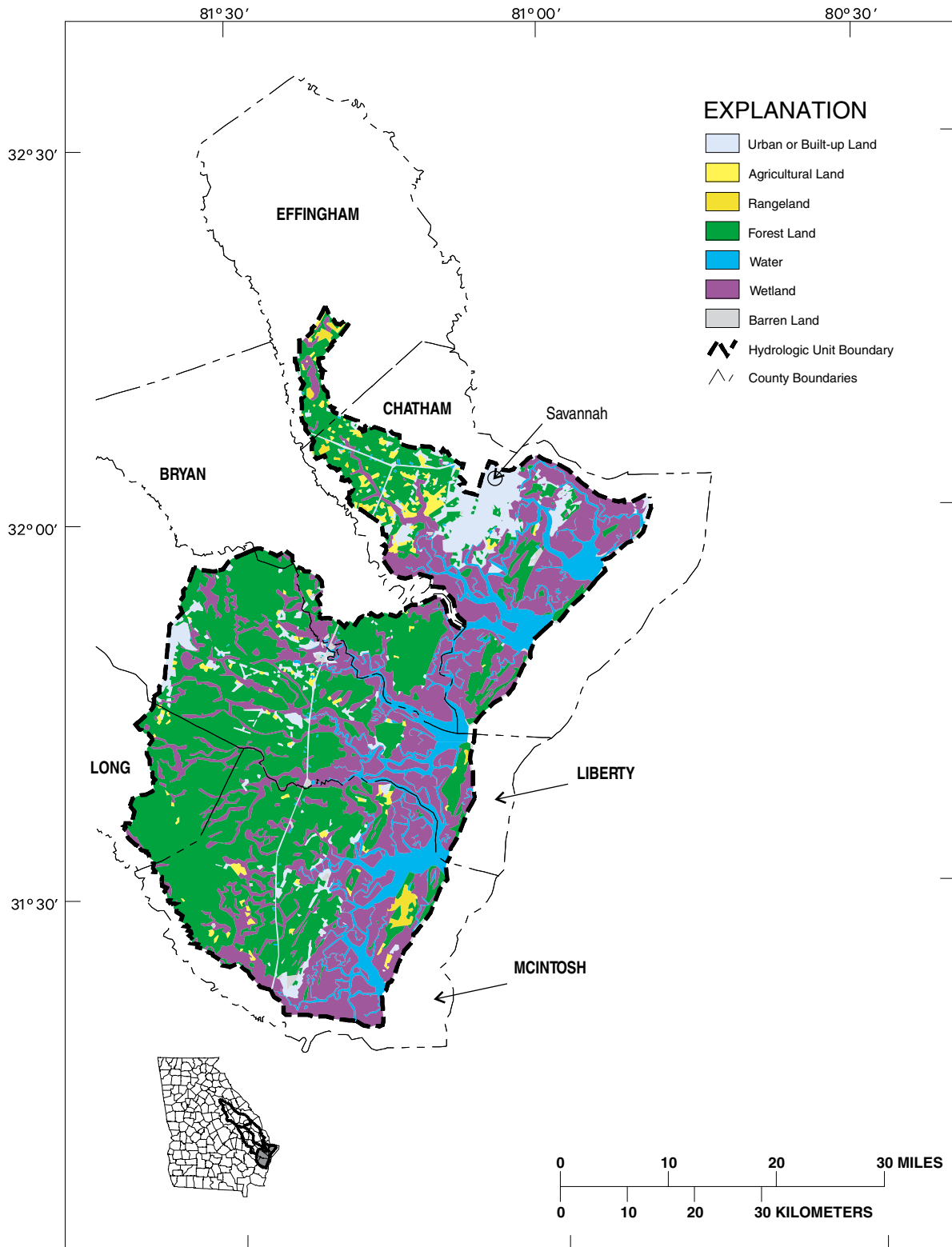


Figure 2-13. Land Use, Ogeechee River Basin, HUC 03060204, USGS 1972-76 Classification Updated with 1990 Urban Areas

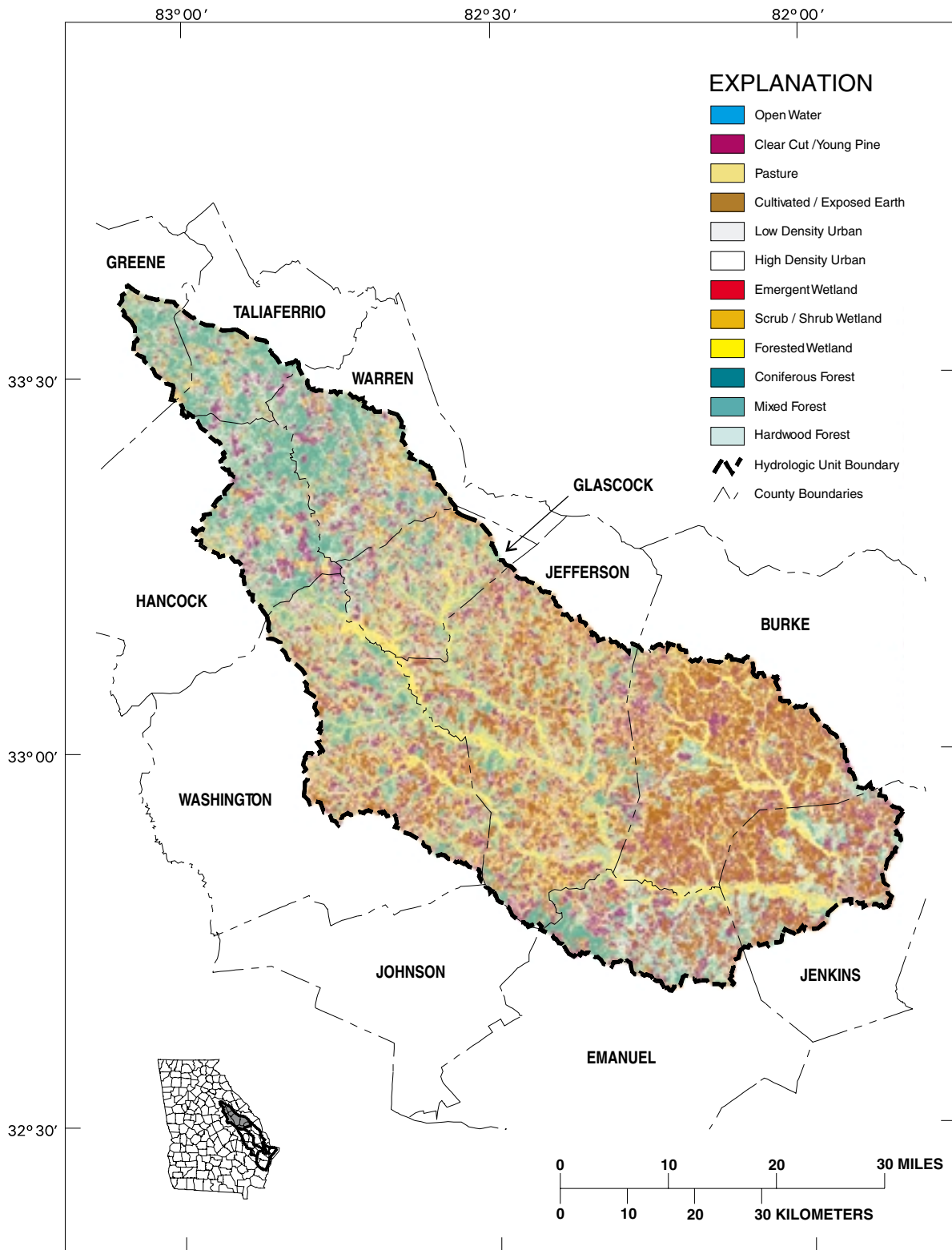


Figure 2-14. Land Cover 1990, Ogeechee River Basin, HUC 03060201

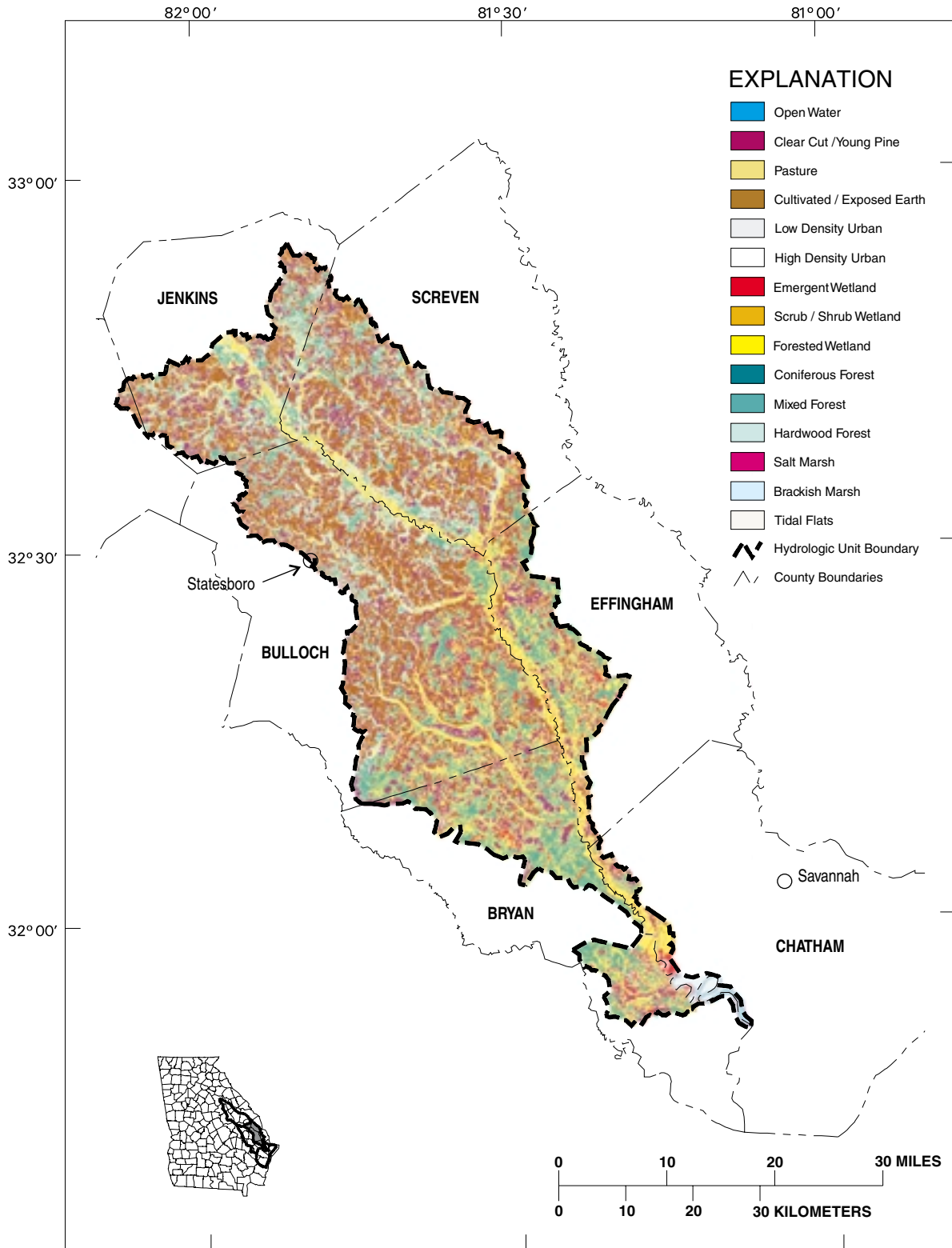


Figure 2-15. Land Cover 1990, Ogeechee River Basin, HUC 03060202

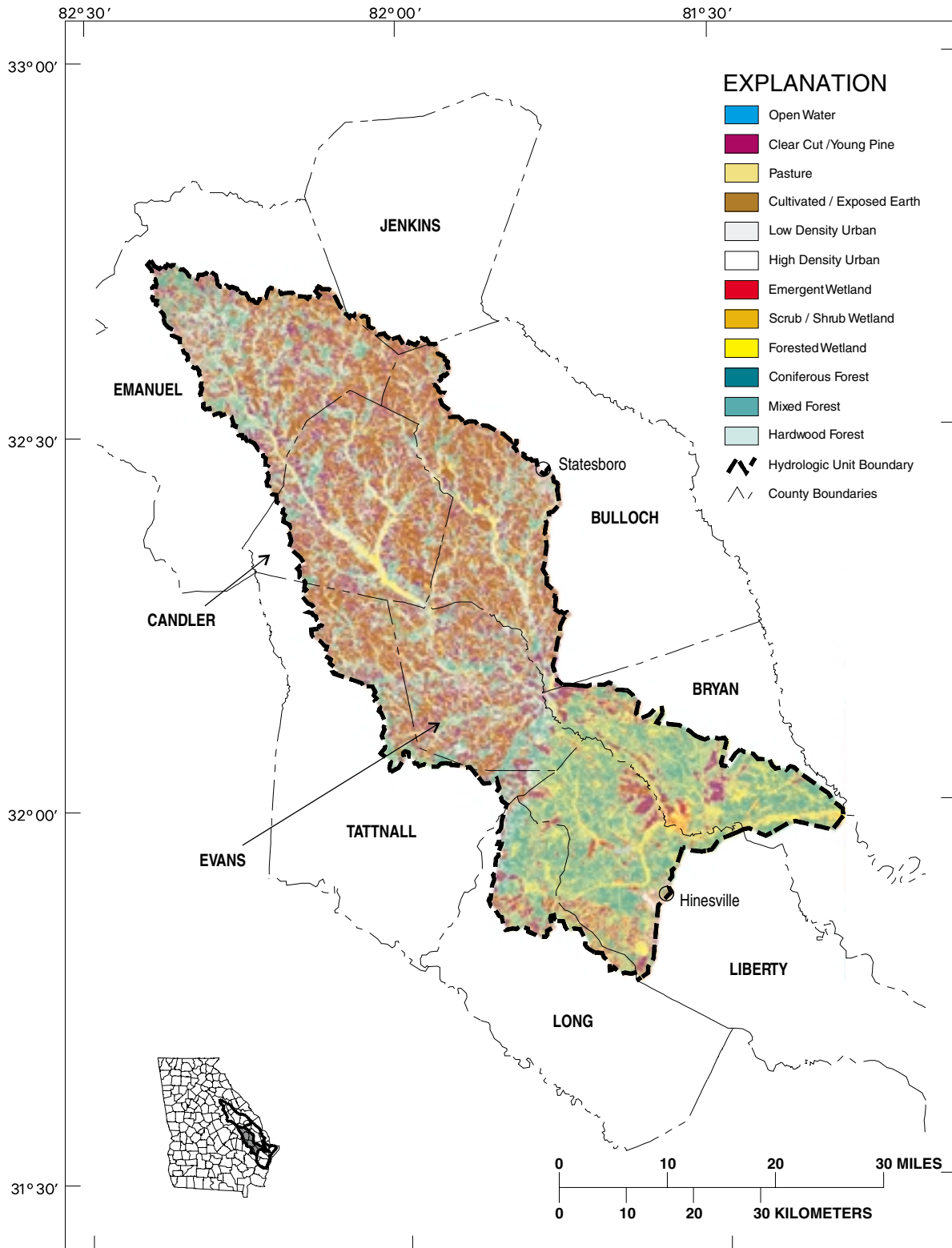


Figure 2-16. Land Cover 1990, Ogeechee River Basin, HUC 03060203

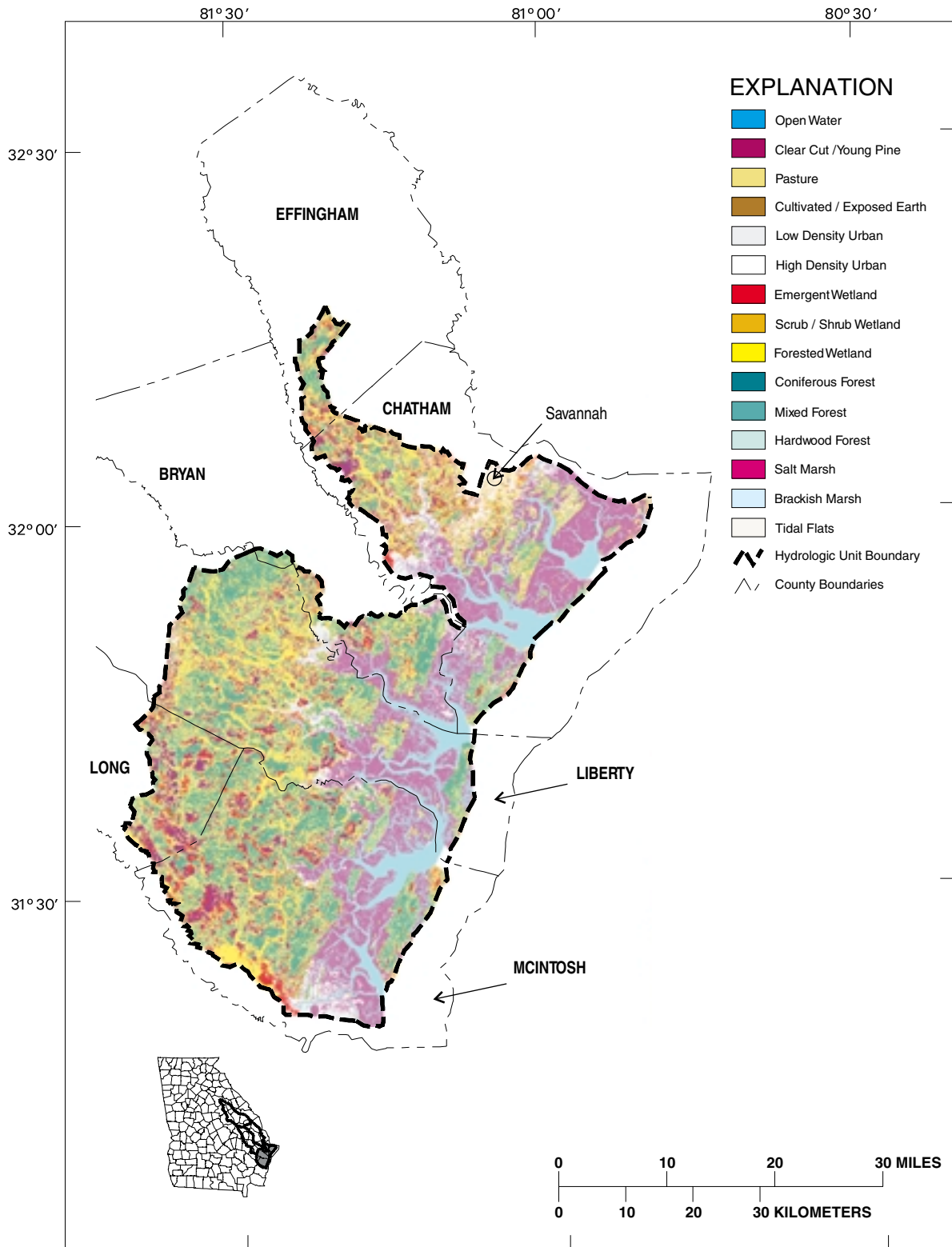


Figure 2-17. Land Cover 1990, Ogeechee River Basin, HUC 03060204

Table 2-2. Land Cover Statistics for the Ogeechee Basin

Class Name	%	Acres
Open Water	2.6	94,974.7
Clear Cut/Young Pine	15.5	569,760.8
Pasture	5.5	202,741.0
Cultivated/Exposed Earth	12.0	441,752.0
Low Density Urban	0.9	34,706.3
High Density Urban	0.4	14,465.6
Emergent Wetland	1.3	46,261.9
Scrub/Shrub Wetland	1.0	34,730.2
Forested Wetland	17.0	623,070.5
Coniferous Forest	15.9	584,877.5
Mixed Forest	12.8	468,934.9
Hardwood Forest	9.9	362,531.3
Salt Marsh	4.1	151,728.8
Brackish Marsh	1.0	37,876.2
Tidal Flats/Beaches	0.1	4,985.3
<i>Total</i>	<i>100.0</i>	<i>3,674,407.0</i>

Forestry

Forestry is a major part of the economy within the basin. Markets for forest products afford landowners excellent investment opportunities to manage and sell their timber, pine straw, naval stores, etc., products. Statewide, the forest industry output for 1997 grew to approximately \$19.5 billion dollars. The value added by this production, which includes wages, profits, interest, rent, depreciation and taxes paid into the economy reached a record high \$9.3 billion dollars. Georgians are benefited directly by 177,000 job opportunities created by the manufacture of paper, lumber, furniture and various other wood products as well as benefiting the consumers of these products. Other benefits of the forest include hunting, fishing, aesthetics, wildlife watching, hiking, camping and other recreational opportunities as well as providing important environmental benefits such as clean air and water and wildlife habitat.

According to the US Forest Service's Forest Statistics for Georgia, 1989 report (Thompson, 1989), there is approximately 2,192,000 acres of commercial forest land in the basin representing approximately 69 percent of the total land area in the basin. Private landowners account for 62 percent of the commercial forest ownership while the forest industry companies account for 25 percent. Governmental entities account for about 13 percent of the forest land. Figure 2-18 depicts silvicultural land use in the Ogeechee basin. Forestry acreage in the Ogeechee River basin is summarized in Table 2-3.

The pine type is composed of 493,600 acres of planted pine and 564,400 acres of natural pine stands.

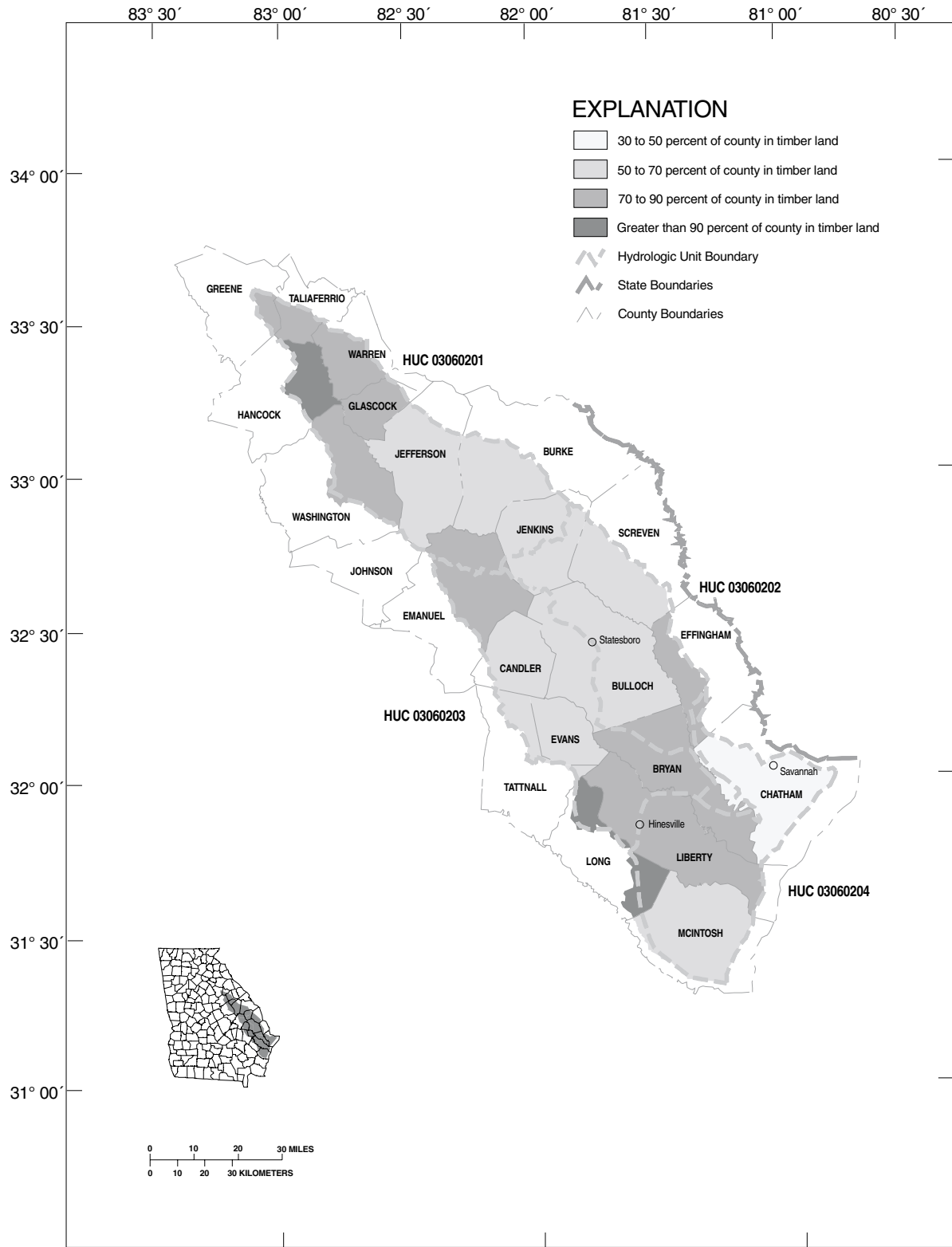


Figure 2-18. Silvicultural Land in the Ogeechee River Basin

Table 2-3. Forestry Acreage in the Ogeechee River Basin

County	Commercial Forest			Upland Hardwood	Lowland Hardwood
	Pine	Oak-pine			
Bryan	233,900	134,100	25,200	8,500	66,000
Bulloch	218,700	59,000	49,800	27,200	82,500
Burke	47,800	16,000	12,700	19,100	0
Candler	82,100	30,100	4,700	18,900	28,400
Chatham	76,200	29,900	8,200	20,200	18,000
Effingham	80,200	55,900	0	8,400	15,800
Emanuel	168,300	75,300	25,900	26,900	40,100
Evans	68,000	33,300	3,200	9,800	21,700
Glascock	65,500	26,700	8,400	17,500	13,000
Greene	23,200	15,800	3,700	0	3,700
Hancock	97,800	69,600	7,000	17,700	3,600
Jefferson	170,700	42,300	16,100	68,500	43,800
Jenkins	102,100	55,000	5,800	11,200	30,100
Johnston	2,600	0	0	0	2,600
Liberty	246,300	163,100	16,100	13,100	53,800
Long	44,800	35,900	3,200	0	5,600
McIntosh	58,800	33,600	2,300	11,400	11,600
Screven	122,400	29,900	20,700	31,500	40,200
Taliaferro	56,500	21,600	17,500	17,500	0
Tattnall	38,100	18,000	0	6,100	14,000
Warren	67,000	29,500	6,000	28,500	3,000
Washington	120,900	83,200	7,700	22,300	7,700
Total	2,192,000	1,058,000	244,300	384,300	505,400

For the period from 1982 to 1989, for the entire counties within the basin, the area classified as commercial forest land increased approximately 2 percent. The area classified as pine type increased 5 percent. The area classified as oak-pine type decreased 13 percent. The area classified as upland hardwood decreased 5 percent, and the area classified as bottomland hardwood increased 10 percent.

Agriculture

Agriculture in the Ogeechee River basin is a varied mixture of animal operations and relatively intensive commodity production. Agriculture land comprises some 37 percent of the land use within the basin, and over 76 percent of the land use within HUC 03060201 (Upper Ogeechee River) watershed.

Total farmland in the basin, approximately 1,477,607 acres (Figure 2-19), has declined rather steadily since 1982. Almost 75 percent of this farmland is in pasture. The remaining 25 percent is dedicated to growing cotton, peanuts, tobacco, and small grain (wheat, sorghum, soybean, millet). Commodity producers applied an average of 6.63 inches per acre of supplemental irrigation to over 81,000 acres during 1995. Burke and Jefferson Counties contain the largest number of irrigated acreage in the basin. Irrigation application, along with the number of acres actually harvested among these crops, varies from year to year in response to market conditions, government subsidy and conservation programs, and weather.

Livestock and poultry production is less intense in the Ogeechee River basin than in river basins with large acreage in the Piedmont MLRA. Approximately 88,000 head of cattle, 96,000 head of swine, and 16,000,000 broilers and layers are raised on animal operations in the basin (Table 2-4). Greene and Jenkins Counties, with 7,100 head of dairy cows, are among Georgia's top ten animal production counties for dairy cows. Bulloch and Tattnall Counties produce 63,000 head of swine ranking them among the State's top ten counties for swine production.

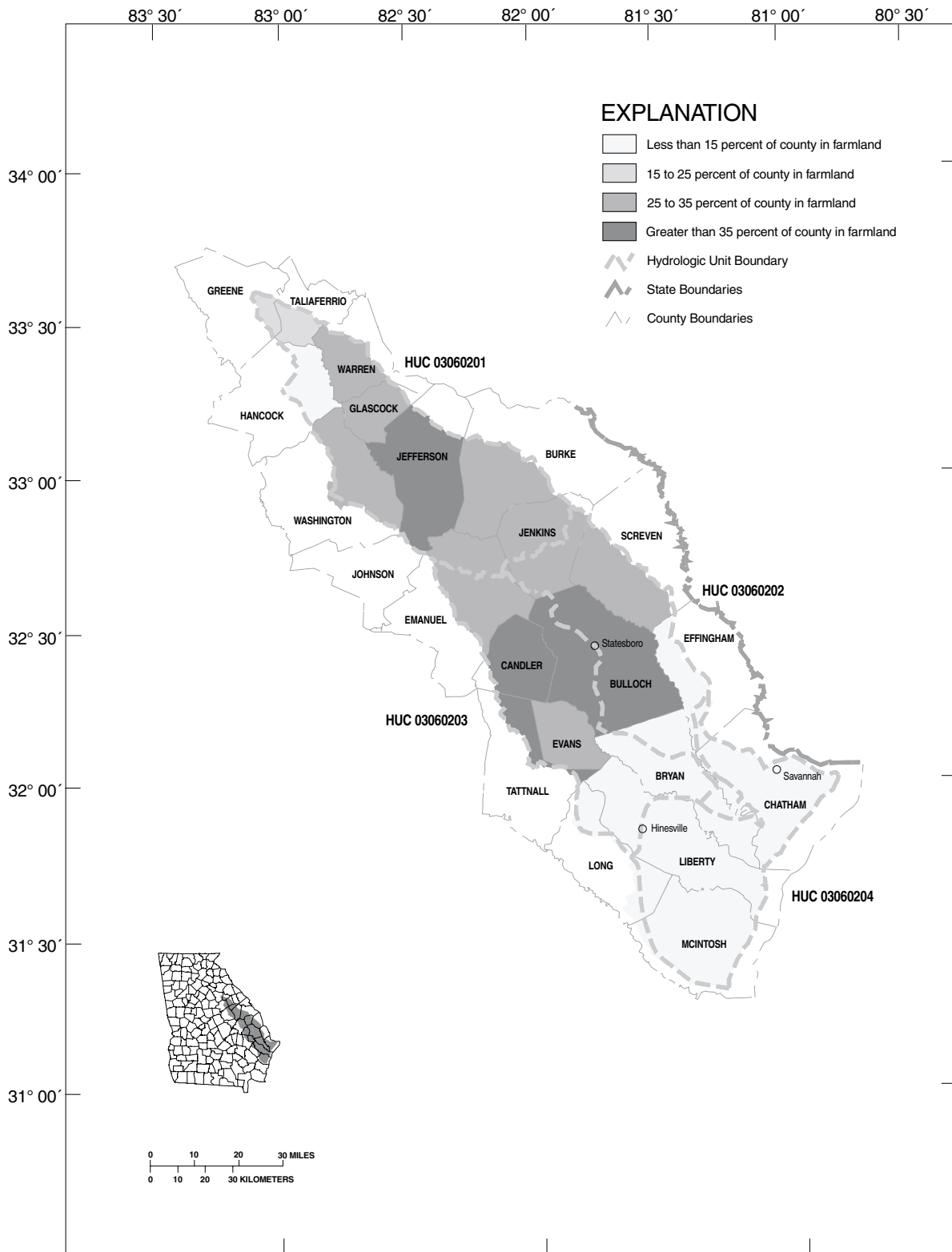


Figure 2-19. Agricultural Land in the Ogeechee River Basin

Table 2-4. Agricultural Operations in the Ogeechee River Basin (data supplied by NRCS)

Element	Watershed 3060201	Watershed 3060202	Watershed 3060203	Watershed 3060204	Ogeechee Basin Total
Acres	1,279,461	970,543	758,223	890,407	3,898,634
Number of Farms (1992)	899	911	630	130	2,570
Number of Dairies (1997)	30	8	1	-	39
Dairy Cattle (Head 1997)	4,983	1,495	77	-	6,555
All Cattle and Calves (Head 1997)	41,268	26,892	17,658	2,320	88,138
Hogs and Pigs (Head 1997)	10,257	58,791	26,837	342	96,227
Boilers (thousands, 1997)	445	1,198	13,921	430	15,994
Layers (thousands, 1997)	107	354	212	-	673
Irrigated Acres (1995)	37,389	30,250	12,207	1,205	81,051
Irrigated Water Use (MGD 1995)	15.63	13.41	7.59	3.71	40
Harvested Cropland (Acres 1992)	140,178	142,278	72,395	2,832	357,683
Total Agriculture Acres (1989-1997)	978	312,273	166,079	20,483	1,477,607

2.3 Local Governments and Planning Authorities

Many aspects of basin management and water quality protection depend on decisions regarding zoning, land use, and land management practices. These are particularly important for the control of nonpoint pollution—pollution that arises in storm water runoff from agriculture, urban or residential development, and other land uses. The authority and responsibility for planning and control of these factors lies with local governments, making local governments and jurisdictions important partners in basin management.

The Department of Community Affairs (DCA) is the state's principal department with responsibilities for implementing the coordinated planning process established by the Georgia Planning Act. Its responsibilities include promulgation of minimum standards for preparation and implementation of plans by local governments, review of local and regional plans, certification of qualified local governments, development of a state plan, and provision of technical assistance to local governments. Activities under the Planning Act are coordinated with the Environmental Protection Division (EPD), Regional Development Centers (RDCs), and local governments.

2.3.1 Counties and Municipalities

Local governments in Georgia consist of counties and incorporated municipalities. As entities with constitutional responsibility for land management, local governments have a significant role in the management and protection of water quality. The role of local governments includes enacting and enforcing zoning, storm water and development ordinances; undertaking water supply and wastewater treatment planning; and participating in programs to protect wellheads and significant ground water recharge areas. Many local governments are also responsible for operation of water supply and wastewater treatment facilities.

The Ogeechee River basin includes part or all of 21 Georgia counties (Table 2-5 and Figure 2-2); however, only four are entirely within the basin, and two counties have a small fraction (<20 percent) of their land area within the basin. Thus there are a total of 19 counties with significant jurisdictional in the basin. Municipalities or cities are communities officially incorporated by the General Assembly. Georgia has more than 530 municipalities. Table 2-6 lists the municipalities in the Ogeechee River basin.

Table 2-5. Georgia Counties in the Ogeechee River Basin

Counties Entirely Within the Ogeechee River Basin	Counties Partially Within the Ogeechee River Basin	Counties With Less Than 20% Area Within the Basin
Bulloch, Bryan, Evans, Liberty	Burke, Candler, Chatham, Effingham, Emanuel, Glascock, Hancock, Jefferson, Jenkins, Long, McIntosh, Screven, Taliaferro, Washington, Warren	Greene, Tattnall

2.3.2 Regional Development Centers

Regional Development Centers (RDCs) are agencies of local governments, with memberships consisting of all the cities and counties within each RDC’s territorial area. There are currently 17 RDCs in Georgia. RDCs facilitate coordinated and comprehensive planning at local and regional levels, assist their member governments with conformity to minimum standards and procedures, and can have a key role in promoting and supporting management of urban runoff, including watershed management initiatives. RDCs also serve as liaisons with state and federal agencies for local governments in each region.

Funding sources include members’ dues and funds available through DCA. Table 2-7 summarizes the RDCs and the associated counties within the Ogeechee River basin.

2.4 Water Use Classifications

2.4.1 Georgia’s Water Use Classification System

The Board of Natural Resources was authorized through the Rules and Regulations for Water Quality Control promulgated under the Georgia Water Quality Control Act of 1964, as amended, to establish water use classifications and water quality standards for the surface waters of the State.

Table 2-6. Georgia Municipalities in the Ogeechee River Basin

HUC 03060201				
Avera	Gibson	Mayfield	Powelton	Wadley
Bartow	Gough	Midville	Riddleville	Warrenton
Colemans Lake	Grange	Millen	Rosier	Warthen
Culverton	Hadden	Mitchell	Shoals	
Davisboro	Herndon	Moxley	Summertown	
Edgehill	Jewell	Munnerlyn	Union Point	
Emmalane	Louisville	Perkins	Vidette	
HUC 03060202				
Altman	Denmark	Guyton	Newington	Stilson
Arcola	Dover	Halcyondale	Oliver	Thrift
Blitchton	Eden	Hunters	Pineora	Tusculum
Brooklet	Egypt	Kildare	Richmond Hill	Woodcliff
Burroughs	Eldora	Lanier	Rocky Ford	
Butts	Ellabell	Marlow	Scarboro	
HUC 03060203				
Aline	Daisy	Hagan	Pembroke	Twin City
Bellville	Excelsior	Manassas	Portal	Wade
Canoochee	Garfield	Metter	Pulaski	
Claxton	Groveland	Modoc	Register	
Cobbtown	Gum Branch	Nevils	Statesboro	
HUC 03060204				
Allenhurst	Dorchester	McIntosh	Ridgeville	Thunderbolt
Ashintilly	Eulonia	meldrim	Sandfly	Townsend
Belfast	Fleming	Meridian	Sapelo Island	Valona
Bloomington	Flemington	Midway	Savannah	Vernon View
Carnigan	Halfmoon Landing	Montgomery	Seabrook	Vernonburg
Coffee Bluff	Hinesville	Pine Harbor	Shellman Bluff	Walthourville
Crescent	Isle of Hope	Pooler	Silk Hope	Wilmington
Cross Roads	Jones	Retreat	South Newport	
Darien	Keller	Riceboro	Sunbury	

Table 2-7. Regional Development Centers in the Ogeechee River Basin

Regional Development Center	Member Counties with Land Area in the Ogeechee Basin
Heart of Georgia	Candler, Evans, Tattnall
Central Savannah	Burke, Emanuel, Glascock, Jefferson, Jenkins, Screven, Taliaferro, Warren, Hancock, Washington
Coastal Georgia	Bryan, Chatham, Liberty, Long, Bullock
Northeast Georgia	Greene

The water use classifications and standards were first established by the Georgia Water Quality Control Board in 1966. Georgia was the second state in the nation to have its water use classifications and standards for intrastate waters approved by the federal government in 1967. For each water use classification, water quality standards or criteria were developed which established a framework to be used by the Water Quality Control Board and later the Environmental Protection Division in making water use regulatory decisions.

The water use classification system was applied to interstate waters in 1972 by the EPD. Georgia was again one of the first states to receive federal approval of a statewide system of water use classifications and standards. Table 2-8 provides a summary of water use classifications and criteria for each use.

Congress made changes in the CWA in 1987 that required each state to adopt numeric limits for toxic substances for the protection of aquatic life and human health. To comply with these requirements, the Board of Natural Resources adopted 31 numeric standards for protection of aquatic life and 90 numeric standards for the protection of human health. Appendix B provides a summary of toxic substance standards that apply to all waters in Georgia. Water quality standards are discussed in more detail in Section 5.2.1.

Table 2-8. Georgia Water Use Classifications and Instream Water Quality Standards for Each Use

Use Classification ¹	Bacteria (fecal coliform)		Dissolved Oxygen (other than trout streams) ²		pH	Temperature (other than trout streams) ²	
	30-Day Geometric Mean ³ (no/100 ml)	Maximum (no./100ml)	Daily Average (mg/l)	Minimum (mg/l)		Std. Units	Maximum Rise above Ambient (°F)
Drinking Water requiring treatment	1,000 (Nov-April) 200 (May-October)	4,000 (Nov- April)	5.0	4.0	6.0- 8.5	5	90
Recreation	200 (Freshwater) 100 Coastal)	--	5.0	4.0	6.0- 8.5	5	90
Fishing Coastal Fishing ⁴	1,000 (Nov-April) 200 (May-October)	4,000 (Nov- April)	5.0	4.0	6.0- 8.5	5	90
Wild River	No alteration of natural water quality						
Scenic River	No alteration of natural water quality						

¹ Improvements in water quality since the water use classifications and standards were originally adopted in 1972 provided the opportunity for Georgia to upgrade all stream classifications and eliminate separate use designations for "Agriculture", "Industrial", "Navigation", and "Urban Stream" in 1993.

² Standards for Trout Streams for dissolved oxygen are an average of 6.0 mg/l and a minimum of 5.0 mg/l. No temperature alteration is allowed in Primary Trout Streams and a temperature change of 2°F is allowed in Secondary Trout Streams.

³ Geometric means should be "based on at least four samples collected from a given sampling site over a 30-day period at intervals not less than 24 hours." The geometric mean of a series of N terms is the Nth root of their product. Example: the geometric mean of 2 and 18 is the square root of 36.

⁴ Standards are same as fishing with the exception of dissolved oxygen which is site specific.

In the latter 1960s through the mid-1970s there were many water quality problems in Georgia. Many stream segments were classified for the uses of navigation, industrial, or urban stream. Major improvements in wastewater treatment over the years have allowed the stream segments to be raised to the uses of fishing or coastal fishing which include more stringent water quality standards. The final two segments in Georgia were upgraded as a part of the triennial review of standards completed in 1989. All of Georgia's waters are currently classified as either fishing, recreation, drinking water, wild river, scenic river, or coastal fishing.

2.4.2 Water Use Classifications for the Ogeechee River Basin

Waters in the Ogeechee River basin are classified as fishing, recreation, drinking water, or wild and scenic. Most of the waters are classified as fishing. Those waters explicitly classified in Georgia regulations are shown in Table 2-9; all waters not explicitly classified are classified as fishing.

Table 2-9. Ogeechee River Basin Waters Classified in Georgia Regulations¹

Waterbody	Segment Description	Use Classification
Ogeechee River	U.S. Highway 17 Bridge to Open Sea and littoral waters of Skidaway, Ossabaw, Sapelo, and St. Catherines Islands	Recreation
Little Ogeechee River	South end of White Bluff Road near Carmelite Monastery to Open Sea and littoral waters of Skidaway and Ossabaw Islands	Recreation

¹ Rules and Regulations for Water Quality Control, Chapter 391-3-6(13). Waters within the Ogeechee River basin not explicitly classified and listed above are classified as Fishing.

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