INTRODUCTION

The Apalachicola River Quality Assessment was initiated in 1978 as part of a national river-quality assessment program of the U.S. Geological Survey. The primary purpose of this assessment was to investigate river and flood-plain processes which influence the yield of nutrients and detritus to the productive, estuarine Apalachicola Bay (Mattraw and Elder, 1980). As part of the assessment, the purpose of this report is to provide tree distribution data for estimating both leaf-litter productivity of the flood plain and detritus transport to the bay. In addition, it provides a general survey of flood-plain tree communities and the hydrologic conditions associated with each. The area mapped is limited to the flood plain associated with the Apalachicola River, excluding adjacent flood plains of the Chipola and Jackson Rivers and Lake Wimico. Ground surveys and mapping were conducted over a 2-year period from 1979 to 1981.

The Apalachicola River flood plain is also being mapped at 1:100,000 and 1:24,000 scale by the National Wetland Inventory (NWI) program of the U.S. Fish and Wildlife Service as a part of a nationwide wetlands mapping project. This map and the NWI map will differ with respect to the mapping categories. The NWI classification system (Cowardin and others, 1979) contains mapping categories designed to apply to wetland types in the entire conterminous United States plus Alaska. Mapping categories for this map were developed solely for use on the Apalachicola River flood plain and, accordingly, are more detailed and specific in describing the tree communities and hydrologic conditions on this river system.

Appreciation is expressed to the following individuals for assistance in botanical field work at various times in 1979, 1980, and 1981: Ann Redmond of Northwest Florida Water Management District; Lawrence Vinzant of National Wetlands Inventory, U.S. Fish and Wildlife Service; Leslie Grossman of National Wetlands Inventory, Martel Laboratories; Charles Wharton of the University of Georgia; and Patricia Gammon of the U.S. Geological Survey. Appreciation is also extended to Jon Becker and William Kuyper of the Florida Department of Transportation for guidance in acquiring and interpreting aerial photographs, and to Donald Foose, U.S. Geological Survey, for planimetering the areas of each mapping category.

METHODS AND MATERIALS

The forest map (fig. 1) was prepared with the aid of aerial photographs in conjunction with field surveys. The primary photographs used were 1:65,000 scale color infrared taken by the National Aeronautical and Space Administration (NASA) on November 15, 16, and 17, 1979. Color infrared photographs taken by the Florida Department of Transportation on October 24, 1979, at a scale of 1:24,000 were used to supplement the higher altitude NASA photographs. Both sets of photographs showed fairly good differentiation in community types because they were taken during the period of heavy leaf fall in the autumn. A third set of 1:80,000 scale color infrared photographs taken by Mark Hurd Aerial Surveys[1] on February 11, 1973, were occasionally referred to because they provided a very different perspective of the forest cover during a flood in midwinter.

The base map was prepared for this mapping project by the U.S. Geological Survey. It is a black and white orthophotomosaic of the Apalachicola River area at a scale of 1:100,000 that meets National Map Accuracy Standards. The base map and all overlays used in the mapping process were registered on scale-stable material.

Six forest types, modified from those defined by Leitman and others (1983), and three nonforest types (marsh, open water, and unidentified areas) were mapped. Areas of each mapped type were planimetered using an electronic digital planimeter. The minimum mapping unit was between 1 and 2 acres. The limitations of mapping at 1:100,000 scale were most obvious with respect to the long and narrow pioneer (black willow) zones on the river margins, most of which were too narrow to be mapped.

The flood-plain boundary was established where a sudden rise in ground levels or an obvious change from flood plain to upland vegetation occurred. In unclear areas, delineation of the boundary was conservative. An area predominated by pines was usually interpreted to be outside the flood plain except where islands or patches of pines were surrounded by bottom-land hardwoods. Cleared areas were generally considered to be outside the flood plain except where they were surrounded by bottom-land hardwoods. No attempt was made to estimate historic vegetation cover in areas that were cleared or altered at the time of the photography (November 1979).

PHYSIOGRAPHY OF THE APALACHICOLA RIVER REGION

The Apalachicola River is formed by the confluence of the Chattahoochee and Flint Rivers (fig. 2). The three rivers drain 19,600 square miles in Georgia, Alabama, and Florida. The Chattahoochee flows about 400 miles from its source in north Georgia to Lake Seminole at the Florida-Georgia State line. The Flint River originates south of Atlanta, Ga., and flows about 350 miles before it joins the Chattahoochee River. The Apalachicola River is 106 miles long and falls about 40 feet from its head at Jim Woodruff Dam near Chattahoochee, Fla., to the Apalachicola Bay in the Gulf of Mexico. The Apalachicola River downstream from Jim Woodruff Dam drains 2,400 square miles, 50 percent of which is drained by its major tributary, the Chipola River.

Navigation miles shown on the forest map were established by the U.S. Army Corps of Engineers and are used here to indicate locations on the river. They range from mile 0 at the U.S. Highway 98 bridge at the city of Apalachicola, to mile 106.3 at Jim Woodruff Dam. The three major reaches of the river (upper, middle, and lower) are identified on the forest map and are described in the next few paragraphs.

The upper river corridor from Chattahoochee to Blountstown cuts through sediments of Miocene age. Steep bluffs on the east side of the upper river form the western boundary of the Tallahassee Hills physiographic province (fig. 3), where altitudes are as high as 325 feet. The land west of the upper river is gently rolling and rises gradually from the flood plain to the Grand Ridge region where altitudes are as high as 125 feet. West of the Grand Ridge area, the land drops slightly to the Marianna Lowlands, a karst plain drained by the Chipola River (the major tributary of the Apalachicola). The flood plain of the upper river is 1 to 2 miles wide; and the river has long, straight reaches and wide, gentle bends. Natural riverbank levees range from 400 to 600 feet wide and can be as much as 15 feet higher than the remainder of the flood plain. Flood-plain cross sections at two locations in the upper river are shown in figure 4.

The middle river from Blountstown to Wewahitchka lies in Holocene and Pleistocene deposits. For the first few miles, it is bounded on the east by the Beacon Slope physiographic region (fig. 3), where altitudes are as high as 150 feet. The Gulf Coastal Lowlands, which are below 100 feet in altitude, lie to the south and west of the Beacon Slope. The flood plain, wider than that of the upper river, is 2 to 3 miles across (fig. 4). The river channel meanders with large loops in the Beacon Slope area and with many small tight bends farther south. Natural riverbank levees range from 200 to 400 feet wide and 8 to 12 feet higher than the remainder of the flood plain. Dead Lake, just north of Wewahitchka, was formed when natural levees of the Apalachicola River impounded the Chipola River. According to Vernon (1942), formation of this lake was due to a much greater sediment load and a more rapid rate of alluviation in the Apalachicola than in the Chipola.

The lower river from Wewahitchka to the city of Apalachicola lies completely in the Gulf Coastal Lowlands (fig. 3) with surrounding land-surface altitudes less than 50 feet. The Chipola River joins the Apalachicola River at mile 28. The flood plain is widest in this reach, 2.5 to 4.5 miles across; and the river is characterized by long straight reaches with a few small bends. Natural riverbank levees range from 50 to 150 feet wide and rise 2 to 8 feet above the flood-plain floor (fig. 4). The upstream limit of tidal influence in the flood plain probably does not extend above mile 35. Near the city of Apalachicola, the tidal river empties into bays and estuaries bounded by barrier islands and spits.

RIVER AND FLOOD-PLAIN HYDROLOGY

The Apalachicola River is 21st in magnitude of the rivers of the conterminous United States and is the largest river in Florida. The mean annual flow at Chattahoochee from 1958 to 1980 was 24,400 ft³/s. The mean annual high was 104,900 ft³/s and the mean annual low was 9,050 ft³/s. Seasonal fluctuations in stage and discharge are large (fig.5). Peak floods are most likely to occur in January through April; low flow generally occurs in September, October, and November. Flood patterns vary greatly from year to year and may not always conform to the average seasonal trends illustrated in figure 5.

Fluctuations in stage vary greatly from upper to lower river. Figure 6 shows hydrographs for the 1980 water year (October 1, 1979, through September 30, 1980) at the four long-term gaging stations on the river. At the most upstream station, near the town of Chattahoochee, the stage fell 24 feet from the peak on March 31 to the low for the year at the end of September; while the stage at the most downstream station, near Sumatra, ranged less than 8 feet from the peak to the low.

Hydrologic conditions in the flood plain can be extremely variable from one site to the next and may or may not be affected by stage fluctuations in the adjacent river channel. Figures 7 and 8 compare river stage and flood-plain water levels at different locations on the river. Flood-plain sites 1 and 2 in figure 7 are located near mile 86 on the forest map (fig. 1). Flood-plain sites 3 and 4 in figure 8 are located near mile 20 on the forest map. At the upper river location (fig. 7), flood-plain water levels at site 1 are independent of river stage except during high floods because water is permanently ponded by high natural riverbank levees surrounding the swamp. However, the small flood-plain stream at site 2 is strongly influenced by fluctuations in river stage, except when the stream is ponded at low flows. At sites 3 and 4 in the lower river (fig. 8), river stage is almost always higher than water levels in the flood plain. This condition is opposite that of the upper river location, where river stages are usually lower than flood-plain water levels. At this lower river location, water levels at any particular time (except during flood peaks) are highest on the east side of the flood plain and lowest on the west side. This is because of a relatively high levee on the west bank of the river, a gradual drop in flood-plain ground levels from the west bank to the western edge of the flood plain, and more rapid drainage conditions in the large flood-plain stream (Brothers River) at site 4 than in the Apalachicola River.

THE FLOOD-PLAIN FOREST

The forested flood plain of the Apalachicola River is the largest in Florida. It is 71 miles long and covers approximately 122,000 acres. If the nonforested areas, marsh, open water, and unidentified areas are included, total flood-plain area is 144,000 acres. Of the 211 different species of trees growing in the north Florida area, about 60 are found on the Apalachicola River flood plain. It is dominated by the general forest type, oak-gum-cypress, defined by the U.S. Forest Service as bottom-land forest in which 50 percent or more of the stand is tupelo, blackgum, sweetgum, oak, and cypress, singly or in combination (U.S. Forest Service, 1969, p. 9). The oak-gum-cypress type is very common on the flood plains of southeastern alluvial rivers; however, this type general forest type has been divided into numerous specific types that various authors define differently from river to river.

Table 1 lists most of the tree species found in the Apalachicola River flood plain. Relative basal area and density are given for the 25 most significant species. Relative basal area is the percentage of the total cross-sectional stem area comprised by each species. Relative density is the percentage of the total number of trees comprised by each species. Water tupelo is the most common tree in the flood plain in both basal area and density. Six wet-site species (water tupelo, Ogeechee tupelo, baldcypress, Carolina ash, swamp tupelo, and planertree) dominate the flood plain with a combined relative basal area of 64.8 percent. Their combined relative density is 47.8 percent. Of the remaining 39 species, sweetgum has the highest basal area (4.8 percent) and possumhaw (a deciduous holly) accounts for 10.5 percent of the density.

Leitman and others (1983) defined five major forest types (A, B, C, D, and E) in the Apalachicola River flood plain and listed composition of each in terms of relative basal area and density for each species. The types were defined based on sampling results from eight cross sections of the flood plain at approximately equally spaced intervals from Jim Woodruff Dam to Apalachicola Bay. After thorough examination of photographs and numerous additional field surveys, it was determined that color infrared signatures for types A and B were indistinguishable and signatures for types D and E were also indistinguishable. Therefore, those four forest types were lumped into two types for purposes of mapping: type AB and type DE. In addition, there were three minor forest types apparent in the photographs that were not sampled by Leitman and others (1983). The six forest and three nonforest categories used on the map are fully described in the explanation including a description of hydrologic conditions associated with each forest type.

Table 2 gives the individual and total acreages of each mapping category for five reaches of the river. As illustrated by figure 9, the major forest types are AB, C, and DE. Considering that types C and DE are both tupelo-dominated forest types, nearly half (46 percent) of the flood-plain forest is dominated by tupelo; and 51 percent is dominated by a variety of mixed bottom-land hardwoods.

Figure 10 shows how the relative proportion of cover types changes from upper to lower river. Type AB is the major type in the upper and middle river and decreases in importance downstream of Wewahitchka nearly disappearing in the tidal reaches of the river from Sumatra to the mouth. The tupelo-dominated types, C and DE, are significant but minor in the upper and middle river and are dominant in the lower river. Marshes dominate the flood plain in the lower 10 miles of the river and are insignificant in the other 96 miles.

Water in the flood plain influences the distribution of trees because the availability of oxygen is severely restricted in saturated and inundated soils. Water-logging tolerance varies with each species and with environmental conditions and increases with the age of the plant (Whitlow and Harris, 1979). In continuously saturated soils, the only trees that will survive are those that have developed numerous anatomical and physiological adaptations to grow in a soil environment low in oxygen. Flooding during the dormant season has little or no effect because the oxygen requirements of plants are very low, but as little as 3 days of flooding during the growing season can affect seedlings of certain intolerant species such as yellow poplar (Southeastern Forest Experiment Station, 1958). Seedlings of many species can survive soil saturation much longer than they can survive inundation (Hosner, 1960; Hosner and Boyce, 1962). Flooding can also influence the many other factors that affect tree distribution, such as seed dispersal and germination, seed predation by animals, type of soil, availability of nutrients, competition, temperature, salinity, fire, and man's activities.

Soil in the flood plain has a wide range of textures and colors because it consists of a variety of sediments derived from many different soils. At two locations near Blountstown and Wewahitchka, Leitman (1978) found soils in the flood plain to be predominantly clay with some silty clay and minor clay loam. Sands on point bars in that study were predominantly fine and very fine sands and were of the micaceous type whereas most Florida sands are siliceous. Cation exchange capacity and organic carbon content at those two locations were higher than in most Florida soils except peats and mucks. The soil pH was acid (4.8 to 5.0) but not as acid as most Florida soils.

Most of the flood plain is owned by lumber and paper companies and is managed for timber harvesting. Almost all of the flood-plain forest was first cut between 1870 and 1925 (Clewell, 1977, p. 11) and has been logged once or twice since that time. Regrowth has been rapid and much of the flood plain has the general aspect of a mature forest. Other extensive uses are beekeeping for tupelo honey production, commercial and sport fishing, and hunting. A few areas on the flood plain have been cleared for agriculture (row crops and improved pasture) and residential developments. Population and development in the area are relatively sparse. A large part of the flood plain in the lower reaches of the river was recently purchased by the State of Florida under its Environmentally Endangered Lands Program.

[1]The use of company or brand names in this report is for identification purposes only and does not constitute endorsement by the U.S. Geological Survey.

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CONVERSION FACTORS

For those who may prefer to use the International System of units (SI) rather than inch-pound units, the conversion factors for the terms used in this report are listed below:

Multiply inch-pound unit	*By*	*To obtain SI unit*
foot (ft)	0.3048	meter (m)
mile (mi)	1.609	kilometer (km)
acre	4,047	square meter (m²)
square mile (mi²)	2.59	square kilometer (km²)
cubic foot per second (ft³/s)	0.02832	cubic meter per second (m³/s)
square foot per acre (ft²/acre)	0.2296	square meter per hectare (m²/ha)
trees per acre	2.471	trees per hectare

National Geodetic Vertical Datum of 1929 (NGVD of 1929) is a geodetic datum derived from a general adjustment of the first-order level nets of both the United States and Canada, formerly called mean sea level. Sea level is referred to as NGVD of 1929 in this report and this datum is understood when the term altitude is used.

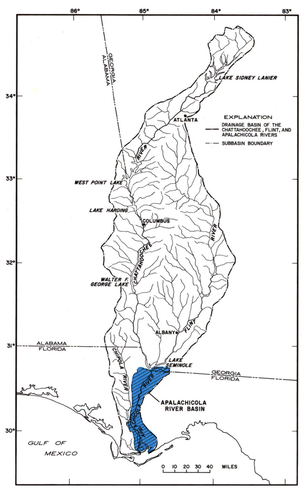

Figure 2.—Drainage basin of the Apalachicola, Chattahoochee, and Flint Rivers in Florida, Georgia, and Alabama.

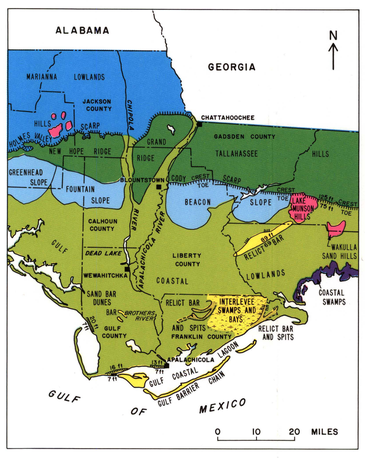

Figure 3.—Physiography of the Apalachicola River region (modified from Puri and Vernon, 1964, fig. 5).

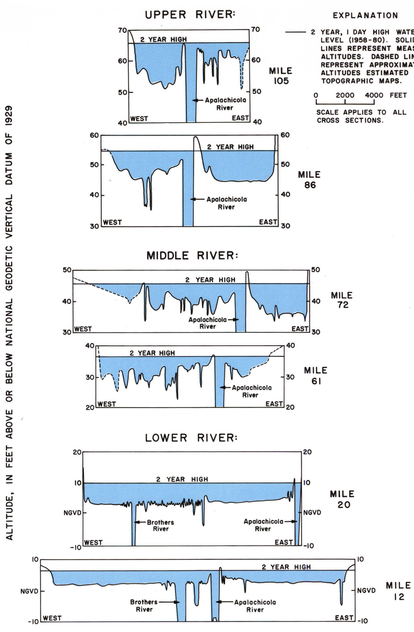

Figure 4.—Topography and 2-year, 1-day high water levels (1958-80) for six cross sections across the Apalachicola River flood plain (modified from Leitman and others, 1983, fig. 34). The 2-year, 1-day high is the average annual flood. Locations of the cross sections are shown on figure 1.

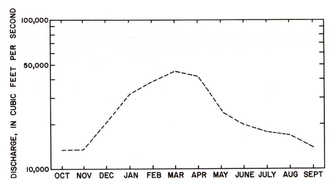

Figure 5.—Average monthly discharge of the Apalachicola River at Blountstown, 1958-80.

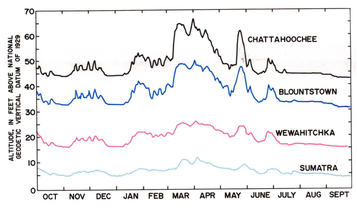

Figure 6.—Water levels at four gaging stations on the Apalachicola River for water year 1980. See figure 1 for exact location of gaging stations.

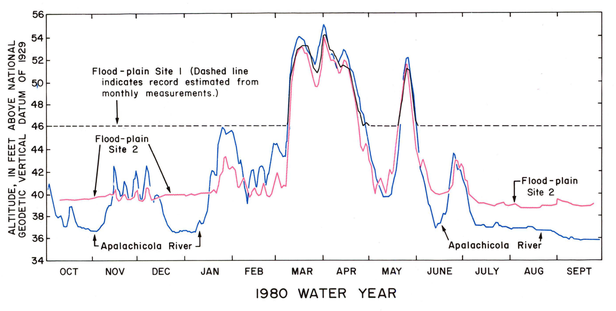

Figure 7.—River stage and flood-plain water levels for the 1980 water year at mile 86 in the upper river. See figure 1 for exact location of sites 1 and 2. Flood-plain site 1 is 1 mile east of the river in a large tupelo-cypress swamp that is permanently ponded with 1 to 2 feet of water. Flood-plain site 2 is about ½ mile west of the river in a flood-plain stream with high flow velocity during floods, but which is ponded during low flows. (Modified from Leitman and others, 1983, fig. 23.)

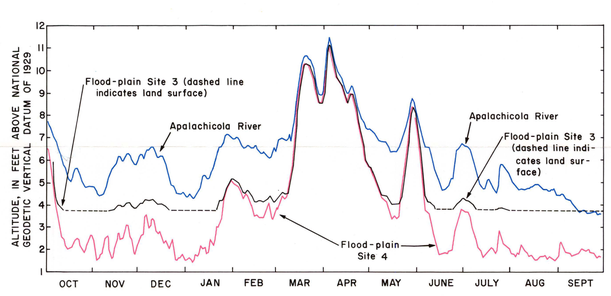

Figure 8.—River stage and flood-plain water levels for the 1980 water year at mile 20 in the lower river. See figure 1 for exact location of sites 3 and 4. Flood-plain site 3 is approximately ¼ mile west of the river in a tupelo-cypress swamp with heavy clay soils that remain saturated all year round. Flood-plain site 4 is about 2 miles west of the river in the Brothers River, a large flood-plain stream which is tidally influenced when stages fall below 3 feet. (Modified from Leitman and others, 1983, fig. 24.)

Table 1.—*Tree species on the Apalachicola River flood plain*

[Modified from Leitman and others, 1983, table 8. Nomenclature follows Kurz and Godfrey (1962), unless otherwise indicated]

Species are ranked in order from most important to least important in terms of basal area. Absolute basal area and density upon which these percentages are based are 201 square feet per acre (46.2 square meters per hectare) and 623 trees per acre (1,540 trees per hectare), respectively. Because of rounding, percentages given will not necessarily total 100.

Species	Relative basal area, in percent	Relative density, in percent
Water tupelo *(Nyssa aquatica)*	29.9	12.8
Ogeechee tupelo *(Nyssa ogeche)*	11.0	6.6
Baldcypress *(Taxodium distichum)*	10.6	5.5
Carolina ash *(Fraxinus caroliniana)*	5.4	11.5
Swamp tupelo or blackgum *(Nyssa biflora[1])*	5.0	2.0
Sweetgum *(Liquidambar styraciflua)*	4.8	3.2
Overcup oak *(Quercus lyrata)*	3.2	2.0
Planertree[2] *(Planera aquatica)*	2.9	9.4
Green ash *(Fraxinus pennsylvanica)*	2.9	2.7
Water hickory *(Carya aquatica)*	2.9	0.8
Sugarberry or hackberry *(Celtis laevigata)*	2.8	2.1
Diamond-leaf oak *(Quercus laurifolia)*	2.5	1.4
American elm *(Ulmus americana)*	2.4	1.2
American hornbeam *(Carpinus caroliniana)*	2.0	4.7
Pumpkin ash *(Fraxinus profunda)*[3]	1.9	4.4
Water oak *(Quercus nigra)*	1.8	0.5
Red maple *(Acer rubrum)*	1.5	4.8
Sweetbay *(Magnolia virginiana)*	1.0	0.5
River birch *(Betula nigra)*	0.8	0.7
Possumhaw *(Ilex decidua)*	0.8	10.5
American sycamore *(Platanus occidentalis)*	0.6	0.3
Swamp cottonwood *(Populus heterophylla)*	0.4	0.4
Black willow *(Salix nigra)*	0.4	0.4
Swamp chestnut oak *(Quercus prinus[4])*	0.3	0.1
Box elder *(Acer negundo)*	0.3	0.8
Other species found:		
Green haw *(Crataegus viridis)*		
Cabbage palmetto *(Sabal palmetto)*		
Water locust *(Gleditsia aquatica)*		
Red mulberry *(Morus rubra)*		
Swamp-privet *(Forestiera acuminata)*		
Winged elm *(Ulmus alata)*		
Slippery elm *(Ulmus rubra)*		
Cherrybark oak *(Quercus falcata* var. *pagodaefolia)*		
Stiffcornel dogwood *(Cornus foemina)*[5]		
Chinaberry *(Melia azedarach)*[6]		
Black tupelo or sourgum *(Nyssa sylvatica[7])*		
Buttonbush *(Cephalanthus occidentalis)*		
Spruce pine *(Pinus glabra)*		
Loblolly pine *(Pinus taeda)*		
Laurel oak *(Quercus hemisphaerica[8])*		
Buckthorn bumelia *(Bumelia lycioides)*		
Parsley haw *(Crataegus marshallii)*		
Common persimmon *(Diospyros virginiana)*		
Black walnut *(Juglans nigra)*		
Titi *(Cyrilla racemiflora)*		
Witherod viburnum *(Viburnum cassinoides)*		
Little silverbell *(Halesia tetraptera[9])*		
Total of 22 other species	2.0	10.7

[1]*Nyssa sylvatica* var. *biflora* according to Little (1979).
[2]Water elm according to Little (1979).
[3]Some trees identified as pumpkin ash may have been Carolina ash or green ash. Samaras (winged seeds) had dropped from the trees and seeds of all three species were mixed on the ground beneath the trees.
[4]*Quercus michauxii* according to Little (1979).
[5]Swamp dogwood *(Cornus stricta)* according to Little (1979).
[6]Introduced exotic species.
[7]*Nyssa sylvatica* var. *sylvatica* according to Little (1979).
[8]Little (1979) does not recognize *Quercus hemisphaerica* as a separate species from *Quercus laurifolia*.
[9]*Halesia parviflora* according to Little (1979).

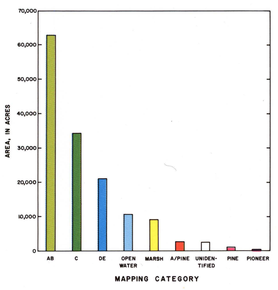

Figure 9.—Area, in acres, of each mapping category for the entire flood plain.

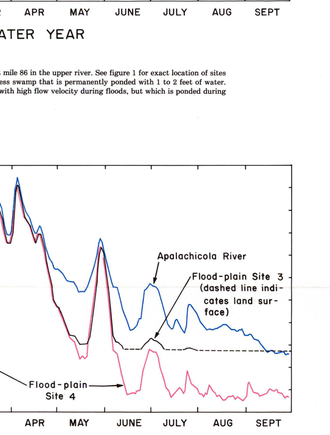

Figure 10.—Area, in percent, of each mapping category, excluding open water, for five reaches of the Apalachicola River.

Table 2.—*Area, in acres, of each mapping category for five reaches of the river*
[Totals have been rounded to three significant figures]

Mapping category	Upper river	Middle river	Lower river from Wewahitchka to Sumatra	Lower river from Sumatra to mile 10	Lower river from mile 10 to mouth	Total
Pine	136	672	0	204	0	1,010
A/Pine	642	1,440	154	474	0	2,710
AB	12,500	32,200	15,800	1,770	48.0	62,300
C	1,170	1,860	8,310	15,800	6,920	34,100
DE	2,420	2,270	6,240	10,300	456	21,700
Pioneer	0	150	19.2	0	0	169
Marsh	0	0	0	0	9,030	9,030
Open water	2,730	3,110	1,540	2,010	1,260	10,700
Unidentified	1,020	748	81.3	76.8	19.2	1,950
Total	20,600	42,500	32,100	30,600	17,700	144,000

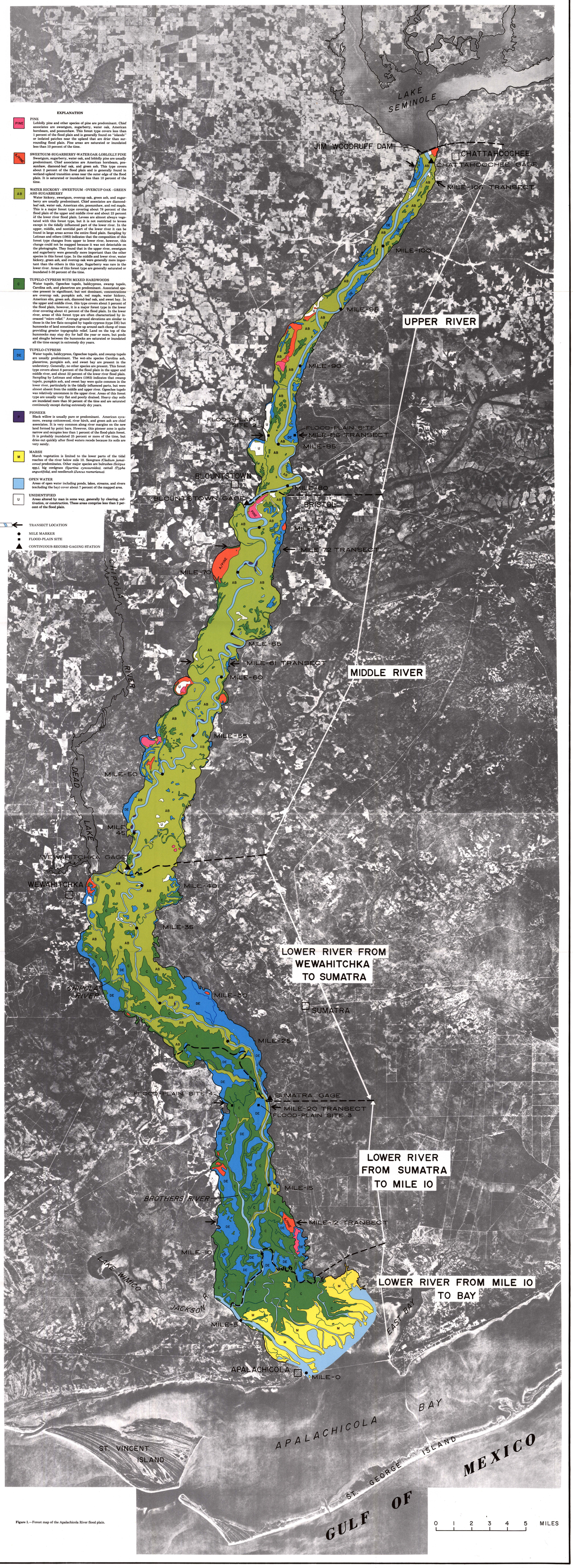

Figure 1.—Forest map of the Apalachicola River flood plain.

FOREST MAP AND HYDROLOGIC CONDITIONS, APALACHICOLA RIVER FLOOD PLAIN, FLORIDA

By
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1984

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