Hydrology, Vegetation, and Soils of Four North Florida River Flood Plains with an Evaluation of State and Federal Wetland Determinations

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CONTENTS

FIGURES

TABLES

CONVERSION FACTORS, SEA LEVEL DATUM, AND ACRONYMS

All data in this report are presented in SI/metric units; however, river stage and elevations above gage datum are presented in both feet and meters on figures to allow direct comparisons to U.S. Geological Survey hydrologic records, which are reported in inch-pound units. Units used in this report may be converted using the following conversion factors:

Multiply	By	To obtain
millimeter (mm)	0.03937	inch
centimeter (cm)	0.3937	inch
meter (m)	3.281	foot (ft)
kilometer (km)	0.6214	mile
square meter (m^2)	10.76	square foot
square kilometer (km^2)	0.3861	square mile
meter per second (m/s)	3.281	foot per second
cubic meter per second (m^3/s)	35.31	cubic foot per second
meter per kilometer (m/km)	5.28	foot per mile
degree Celsius (°C)	(1)	degree Fahrenheit

[1]Temp °F = 1.8 temp °C + 32.

SEA LEVEL: In this report "sea level" refers to the National Geodetic Vertical Datum of 1929 (NGVD of 1929)--a geodetic datum derived from a general adjustment of the first-order level nets of both the United States and Canada, formerly called "Sea Level Datum of 1929."

ACRONYMS:

F.A.C. = Florida Administrative Code
NWI = National Wetland Inventory
FDER = Florida Department of Environmental Regulation
SCS = Soil Conservation Service
USDA = U.S. Department of Agriculture
USFWS = U.S. Fish and Wildlife Service
USGS = U.S. Geological Survey

GLOSSARY

DURATION OF FLOODING is expressed for a given stage or elevation in two ways, consecutive and total:

(1) AVERAGE ANNUAL LONGEST FLOOD represents the typical amount of consecutive flooding. It is calculated by determining the duration (in days) of each individual flood event that exceeds a given elevation in the entire period of record, selecting the longest event of each water year, and averaging the durations (in days) of all the annual longest events over the period of record.

(2) PERCENT STAGE DURATION represents the total amount of flooding. It gives the total amount of time, in percent, that a given stage was equaled or exceeded in the period of record, without regard to the number of consecutive days that flooding persisted.

FEDERAL VEGETATION CODES are the national indicator categories for region 2--southeastern United States (Reed, 1988) and corresponding ecological indices (Wentworth and others, 1988):

Code	Name	Ecological Index	Definition (%, percent)
OBL	Obligate wetland	1	Occur almost always (estimated probability >99%) under natural condtitions in wetlands
FACW	Facultative wetland	2	Usually occur in wetlands (estimated probability 67-99%), but occasionally found in nonwetlands
FAC	Facultative	3	Equally likely to occur in wetlands or nonwetlands (estimated probability 34-66%)
FACU	Facultative upland	4	Usually occur in nonwetlands (estimated probability 67-99%), but occasionally found in wetlands (estimated probability 1-33%)
UPL	Obligate upland	5	Occur almost always (estimated probability >99%) under natural conditions in nonwetlands in the region specified
NA	Not assigned		Not assigned to any of the above categories because species identification was uncertain and likely possibilities for species identification fell into more than one of the above categories. (If species identification was uncertain, but all likely possibilities for species identification fell into one of the above categories, that category was used instead of NA.)
+	Positive sign		Indicates a frequency of occurrence in the higher end of the category (more frequently found in wetlands)
-	Negative sign		Indicates a frequency of occurrence in the lower end of the category (less frequently found in wetlands)

GROWING SEASON has two different meanings in this report:

(1) FREEZE-FREE GROWING SEASON dates are specific for each site and are the mean dates (50% probability) of first and last freeze (0 degrees Celsius) for the 30-year period from 1951-80 at the closest weather stations for each site, according to Koss and others (1988):

Ochlockonee	-	March 12 through November 14
Aucilla	-	March 9 through November 16
Telogia	-	March 8 through November 19
St. Marks	-	March 4 through November 24

(2) U.S. Soil Conservation Service (SCS) GROWING SEASON is February 1 through October 31 for north Florida and other locations in the thermic region of the United States, according to Hydric Soils of the United States (U.S. Soil Conservation Service, 1987). SCS growing season is used for making wetland hydrology determinations using the 1989 Federal Manual (Federal Interagency Committee for Wetland Delineation, 1989).

STATE VEGETATION CODES are derived from the indicator categories used by the Florida Department of Environmental Regulation according to Chapter 17-301, F.A.C. No definition exists for most of these categories other than the lists of species that are associated with each category:

Code	Name	Definition
SUB	Submerged	Species listed in Sections 17-301.200(3) and 17-301.400(2), F.A.C.
TRANS	Transitional	Species listed in Sections 17-301.200(3) and 17-301.400(3), F.A.C.
UPL	Upland	All species not considered to be submerged, transitional, or invisible (Section 17.301.400(4), F.A.C.)
INV	Invisible	Five species that are not considered submerged, transitional, or upland (Section 17-301.400(5), F.A.C.). In areas vegetated by invisible species, jurisdiction is based on remaining species
NA	Not assigned	Not assigned to any of the above categories because species identification was uncertain and likely possibilities for species identification fell into more than one of the above categories. (If species identification was uncertain but all likely possibilities for species identification fell into one of the above categories, that category was used instead of NA.)

2-YEAR, 1-DAY HIGH (flow or stage) is used in this report to approximate the median of the annual highest flood. It corresponds to the highest 1-day mean flow or stage that typically occurs once every 2 years and has a 50% chance of occurring in any given year.

2-YEAR, 1-DAY LOW (flow or stage) is used in this report to approximate the median of the annual lowest flow or stage. It corresponds to the lowest 1-day mean flow or stage that typically occurs once every 2 years and has a 50% chance of occurring in any given year.

WATER YEAR is the 12-month period beginning October 1 and ending September 30 which is used for analysis of USGS gage data. The beginning and ending dates usually coincide with the normal low-flow period of north Florida streams. The water year is designated by the calendar year in which it ends and which includes 9 of the 12 months. Thus, the year ending September 30, 1990, is called the 1990 water year.

SELECTED SCIENTIFIC AND COMMON PLANT NAMES

[Selected names in this list include all names used in text and tables but not all species in appendices. Consult Plant Species Index for complete list of scientific names in this report. Nomenclature follows Godfrey (1988) for woody plants, Godfrey and Wooten (1979, 1981) for herbaceous wetland species, and Clewell (1985) for herbaceous upland species unless otherwise indicated.]

Scientific name	Common name
Acer rubrum	red maple
Agrostis perennans	autumn bentgrass
Bignonia capreolata	cross-vine
Brunnichia ovata (synonymous with *Brunnichia cirrhosa)*	ladies' eardrops
Campsis radicans	trumpet-creeper
Carpinus caroliniana	ironwood
Carex cherokeensis	sedge
Carex joorii	sedge
Cephalanthus occidentalis	buttonbush
Chaptalia tomentosa	sun-bonnet
Chasmanthium laxum	spikegrass
Cornus florida	flowering dogwood
Cornus foemina	swamp dogwood
Cyperus virens	flat sedge
Cyrilla racemiflora	titi
Diospyros virginiana	persimmon
Erechtites hieracifolia	fireweed
Erianthus strictus	narrow plumegrass
Eupatorium semiserratum	boneset
Fraxinus caroliniana	Carolina ash
Fraxinus profunda	pumpkin ash
Gelsemium sempervirens	Carolina jessamine
Gentiana pennelliana	wiregrass gentian
Hymenocallis duvalensis [1]	spiderlily
Hypoxis leptocarpa	yellow star-grass
Ilex decidua	possum-haw
Ilex opaca	American holly
Laportea canadensis	wood nettle
Leersia lenticularis	catchfly grass
Liquidambar styraciflua	sweetgum
Magnolia grandiflora	southern magnolia
Magnolia virginiana	sweetbay
Myrica cerifera	wax-myrtle
Nyssa aquatica	water tupelo
Nyssa sylvatica var. biflora	swamp tupelo
Nyssa ogeche	Ogeechee tupelo
Osmunda regalis	royal fern
Panicum dichotomum (synonymous with *Dichanthelium dichotomum*)	panic grass
Panicum rigidulum	redtop panicum
Pinus glabra	spruce pine
Pinus taeda	loblolly pine
Planera aquatica	planer-tree
Pluchea camphorata	camphor weed
Quercus falcata var. pagodaefolia	cherrybark oak
Quercus laurifolia	swamp laurel oak
Quercus nigra	water oak
Quercus virginiana	live oak
Sabal minor	blue-stem palmetto
Sebastiania fruticosa	Sebastian-bush
Serenoa repens	saw palmetto
Smilax bona-nox	greenbrier
Smilax laurifolia	bamboo-vine
Smilax rotundifolia	bullbrier
Smilax walteri	coral greenbrier
Taxodium distichum	bald-cypress
Toxicodendron radicans	poison-ivy
Trillium sp.	wake-robin
Ulmus americana	American elm
Vaccinium corymbosum	highbush blueberry

Scientific name	Common name
Vaccinium arboreum	sparkleberry
Viburnum obovatum	small viburnum
Viola esculenta	violet
Viola sp.	violet
Vitis aestivalis	summer grape
Vitis rotundifolia	muscadine
Zephyranthes sp.	rain-lily

[1]Gerald Smith, High Point College, N.C., written commun., 1989

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Abstract

A study of hydrologic conditions, vegetation, and soils was made in wetland forests of four north Florida streams from 1987 to 1990. The study was conducted by the U.S. Geological Survey in cooperation with the Florida Department of Environmental Regulation to support State and Federal efforts to improve wetland delineation methodology in flood plains.

Plant communities and soils were described and related to topographic position and long-term hydrologic conditions at 10 study plots located on 4 streams. Detailed appendixes give average duration, frequency, and depth of flooding; canopy, subcanopy, and ground-cover vegetation; and taxonomic classification, series, and profile descriptions of soils for each plot. Topographic relief, range in stage, and depth of flooding were greatest on the alluvial flood plain of the Ochlockonee River, the largest of the four streams. Soils were silty in the lower elevations of the flood plain, and tree communities were distinctly different in each topographic zone. The Aucilla River flood plain was dominated by levees and terraces with very few depressions or low backwater areas. Oaks dominated the canopy of both lower and upper terraces of the Aucilla flood plain. Telogia Creek is a blackwater stream that is a major tributary of the Ochlockonee River. Its low, wet flood plain was dominated by *Nyssa ogeche* (Ogeechee tupelo) trees, had soils with mucky horizons, and was inundated by frequent floods of very short duration. The St. Marks River, a spring-fed stream with high base flow, had the least topographic relief and lowest range in stage of the four streams. St. Marks soils had a higher clay content than the other streams, and limestone bedrock was relatively close to the surface.

Wetland determinations of the study plots based on State and Federal regulatory criteria were evaluated. Most State and Federal wetland determinations are based primarily on vegetation and soil characteristics because hydrologic records are usually not available. In this study, plots were located near long-term gaging stations, thus wetland determinations based on plant and soil characteristics could be evaluated at sites where long-term hydrologic conditions were known. Inconsistencies among hydrology, vegetation, and soil determinations were greatest on levee communities of the Ochlockonee and Aucilla River flood plains. Duration of average annual longest flood was almost 2 weeks for both plots. The wetland species list currently used (1991) by the State lacks many ground-cover species common to forested flood plains of north Florida rivers. There were 102 ground-cover species considered upland plants by the State that were present on the nine annually flooded plots of this study. Among them were 34 species that grew in areas continuously flooded for an average of 5 weeks or more each year. Common flood-plain species considered upland plants by the State were: *Hypoxis leptocarpa* (yellow star-grass), and two woody vines, *Brunnichia ovata* (ladies' eardrops) and *Campsis radicans* (trumpet-creeper), which were common in areas flooded continuously for 6 to 9 weeks a year; *Sebastiania fruticosa* (Sebastian-bush), *Chasmanthium laxum* (spikegrass), and *Panicum dichotomum* (panic grass), which typically grew in areas flooded an average of 2 to 3 weeks or more per year; *Vitis*

rotundifolia (muscadine) and *Toxicodendron radicans* (poison-ivy), usually occurring in areas flooded an average of 1 to 2 weeks a year; and *Quercus virginiana* (live oak) present most often in areas flooded approximately 1 week a year.

Federal wetland regulations (1989) limited wetland jurisdiction to only those areas that are inundated or saturated during the growing season. However, year-round hydrologic records were chosen in this report to describe the influence of hydrology on vegetation, because saturation, inundation, or flowing water can have a variety of both beneficial and adverse effects on flood-plain vegetation at any time of the year. These effects can occur because: (1) Soil temperatures in north Florida are probably high enough in winter for anaerobic conditions to develop in saturated soils. (2) Many plants in the flood plains of north Florida are active in the nongrowing season and might be adapted to anaerobic conditions in winter. (3) Other effects of standing water, such as decreased light penetration, prevention of seed germination, and protection of seeds from herbivores; and effects of flowing water, such as scouring and deposition of sediments, seed dispersal, and mechanical injury, can occur any time of year.

INTRODUCTION

River flood plains perform many vital functions in maintaining the ecological integrity of regional environments. Flood plains provide storage and filtration of surface water, diverse habitats for plants and animals, corridors for the movements of animals and dissemination of plants, and a supply of nutrients to bays and marine environments. Flood-plain functions and values have been described by many authors, and the need for protection is generally acknowledged by the scientific community (Greeson and others, 1979; Brinson and others, 1981; Clark and Benforado, 1981; Wharton and others, 1982; Mitsch and Gosselink, 1986; Gosselink and others, 1990; Chescheir and others, 1991).

Protection of wetlands by State and Federal regulatory agencies depends on simple and consistent identification of wetland boundaries. Although hydrology is the driving force in the creation of wetlands, evidence of long-term hydrologic conditions is rarely available to regulatory staff attempting to delineate wetland boundaries. Hydrologic conditions observed at the time of site inspection are unreliable in estimating long-term conditions. An inspection of the soils yields better information about the long-term "wetness" of the site, but can be costly and time consuming. Thus vegetation is the most practical indicator for wetland identification. Lists of species with indicator categories are used by Federal and State regulators with formulas for deciding whether a site has wetland (hydrophytic) vegetation. These lists have been developed using the experience and observations of many people, but in most cases, without knowledge of long-term hydrologic conditions. Studies of wetland vegetation and soils are needed at sites where data has been collected on long-term hydrologic conditions.

This study was undertaken to support State and Federal efforts to improve wetland delineation methodology in flood plains. It was conducted by the U.S. Geological Survey (USGS) in cooperation with the Florida Department of Environmental Regulation (FDER), Jurisdictional Evaluation Section. Funding for this study came primarily from the FDER Coastal Zone Management Section with funds provided by the National Oceanic and Atmospheric Administration under the Federal Coastal Zone Management Act of 1972 as amended. Partial funding for collection of botanical data on the Ochlockonee River was also received from the Florida Game and Fresh Water Fish Commission with funds derived from the Nongame Wildlife Trust Fund.

Purpose and Scope

This report describes and relates hydrologic conditions to vegetation and soils on the forested flood plains of four north Florida streams. The major objectives of this report are:

1. To present background information on hydrologic factors known to influence flood-plain vegetation and to describe seasonal differences in those hydrologic effects.

2. To measure and describe hydrologic conditions, soils, and vegetation of flood plains at sites where long-term river stage data were available.

3. To describe and compare current State (1991) and Federal (1989) wetland determinations at flood-plain sites where long-term hydrologic conditions are known.

Study sties were located on the Ochlockonee River, Aucilla River, Telogia Creek, and St. Marks River in north Florida (fig. 1). Field work began in September 1987 and continued through August 1990.

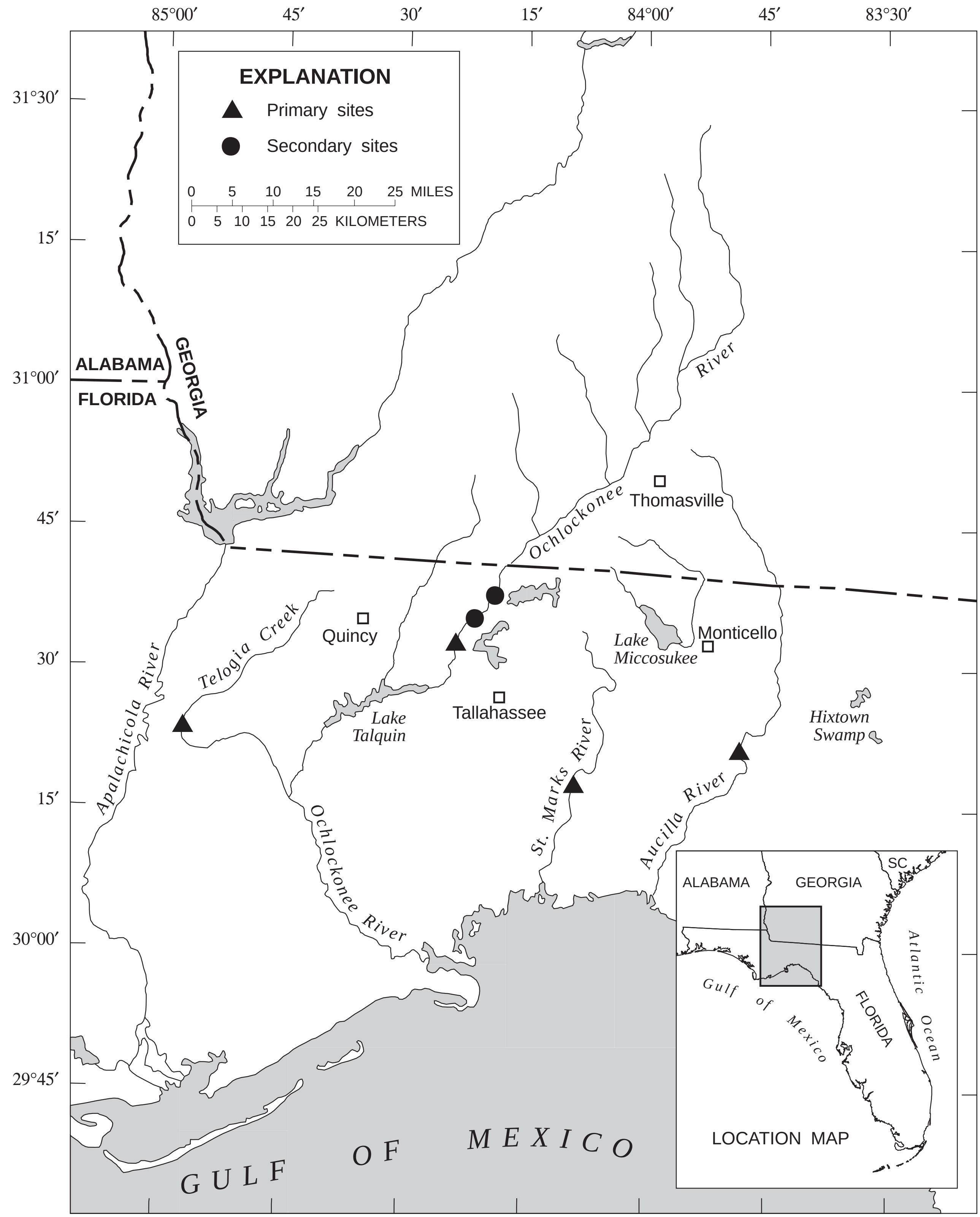

Figure 1. Location of the study sites.

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INFLUENCE OF HYDROLOGY ON VEGETATION OF RIVER FLOOD PLAINS

Flood plains are unique environments that are subjected to saturation, inundation, and flow of surface water. All three of these hydrologic conditions are important factors in the regeneration of flood-plain species as well as the survival of established vegetation. Although flooded conditions are generally unfavorable for terrestrial plant growth, tolerant species can benefit by the reduction of competition from flood-intolerant species. Other effects could be directly beneficial, such as the protection of submerged seeds from predation by terrestrial animals. Many different effects of saturation and flooding on plant species selection and distribution are summarized in table 1 and described in the first three parts of this section.

Seasonal changes in the anaerobic effects of saturation are discussed in the fourth part of this section. Temperature conditions and plant dormancy information specific to north Florida are described for the purposes of understanding possible effects of anaerobiosis at the study sites in the winter.

In the last part of this section, different effects of hydrologic conditions on vegetation are reviewed to explain the hydrologic analysis used in this report. Federal wetland regulations (Federal Interagency Committee for Wetland Delineation, 1989) limited wetland jurisdiction to only those areas that are inundated or saturated during the growing season. However, year-round (water year) hydrologic records were selected for this report to describe the influence of hydrology on vegetation because flooding at any time of year has important effects on the structure and function of plant communities.

Soil Saturation

During flooding, soils become saturated when pore spaces fill with water, and gas exchange between the soil and the atmosphere is virtually eliminated. Anaerobic conditions develop when dissolved oxygen in soil water is consumed by respiration of roots and microorganisms. Seasonal differences in temperature and respiration rates have a marked effect on the rate of oxygen depletion and on many other chemical and biological changes that take place in the soil in response to flooding and anaerobic conditions (Ponnamperuma, 1972).

Anaerobic conditions result in the death of root tips of many plants. Without oxygen, mitosis ceases to occur, aerobic respiration ceases, toxic substances begin to accumulate, and meristematic tissues die. The death of root tips affects the entire plant in many ways: decreased nitrogen uptake, other nutrient deficiencies, accelerated senescence and loss of leaves, and stomatal closure. Some of these effects are due to the absence of hormones which are produced in root tips. Other effects might be due to an excess of toxic chemicals in plant tissues (Jackson and Drew, 1984).

Saturation acts as a selective factor for species which have specialized adaptations or avoidance mechanisms which enable them to survive anaerobic periods (Hosner and Boyce, 1962; Broadfoot and Williston, 1973). Only those species which have special adaptations to anaerobiosis can continue to use their original root systems. In these species, either anaerobic metabolism is possible or emergent plant parts are able to supply the root system with sufficient oxygen to prevent necrosis. Some plants respond to the loss of their primary root system by the production of new roots which differ morphologically from the orginal roots. The new roots are better adapted to flooded conditions but rarely are numerous or efficient enough to perform all the functions of the original root system (Kozlowski, 1984).

Table 1. Effects of hydrologic factors on flood-plain vegetation
[References are cited at end of table]

Hydrologic factor	Physical effects	References	Effects on regeneration of flood-plain vegetation	References
Saturation	Causes anaerobic conditions to develop which are generally unfavorable for plant growth	18, 22	Selects for plants with either adaptations to anaerobic conditions or avoidance mechanisms which enable plant species to survive in areas where anaerobic conditions exist for at least part of the year	3, 4, 6, 9,13,15, 19,26
Inundation	Mechanical injury to plant tissues such as bark and leaves, interference with stomatal function	5, 7,9, 17,19,23, 24,25	Selects for species with seeds and seedlings that can withstand submersion	3,14,19,21, 22,23,27
			Selects for species which produce seeds and seedlings at favorable times of the year	25,27,28, 29
	Limits light penetration to ground cover plants	7		
	May prolong dormancy in spring	16, 20	Protects submerged seeds and seedlings from predation from terrestrial animals such as squirrels	4, 17
	Replenishes ground water	2, 3	Limits competition for flood-tolerant species established during drought	5
			May select against species which cannot prolong dormancy	1, 3, 26
Flowing water	Transports and deposits debris, sediment, ice	1,16,17, 23,28,30	Disperses seeds and root pieces	10, 27
	High velocities may bend or break vegetation	21, 28	Exposes mineral soil creating areas suitable for germination of seeds of some species	26, 28
	Scours surface substrates, uprooting plants or exposing root systems	30	Selects for species which can resprout after flood damage	8,23,25,28, 29,30
	Lessens the effects of anaerobiosis by providing freshwater to submerged plants	3,11,12, 13	Selects against species with shallow, poorly anchored root systems	17, 25, 28

1 Barnes, 1978
2 Broadfoot, 1967
3 Broadfoot and Williston, 1973
4 Crawford, 1989
5 Demaree, 1932
6 Dickson and others, 1965
7 Gill, 1970
8 Hall and others, 1946
9 Hall and Smith, 1955
10 Hardin and Wistendahl, 1983
11 Harms, 1973
12 Hook and others, 1970
13 Hook and Scholtens, 1978
14 Hosner, 1960
15 Hosner and Boyce, 1962
16 Howard and Penfound, 1942
17 Huenneke and Sharitz, 1990
18 Jackson and Drew, 1984
19 Jones and others, 1989
20 Kennedy, 1970
21 Kennedy and Krinard, 1974
22 Kozlowski, 1984
23 Lindsey and others, 1961
24 Loucks, 1987
25 McBride and Strahan, 1984
26 Menges and Waller, 1983
27 Schneider and Sharitz, 1988
28 Sigafoos, 1964
29 Streng and others, 1989
30 Ware and Penfound, 1949

Other adaptations to saturation are more efficient internal gaseous exchange systems and the production of specialized structures, such as lenticels or pneumatophores. Adaptations that might serve as avoidance mechanisms are delayed or reduced activity, food storage structures, shallow root systems, and small plant size (Crawford, 1989).

Inundation

Inundation by flood waters has effects on plants beyond those due to saturation of soils. *Quercus falcata var. pagodaefolia* was strongly affected by inundation but little affected by saturation (Jones and others, 1989). Loucks (1987) reported extensive freeze damage to trees which had been completely submerged by a fall flood. Inundation appeared to have interfered with the normal hardening process, and when freezes followed the recession of the flood, above-ground plant tissues were killed. The same trees had survived floods of similar duration in early spring and summer.

Depth of flooding might be an important limiting factor for flood-plain species (Kennedy, 1970). Decreased light penetration and interference with stomatal function might be responsible for damage to deeply flooded vegetation (Gill, 1970). Complete submergence of the crowns of nondormant plants has been reported as more damaging than partial submergence (Demaree, 1932; Hall and Smith, 1955).

Floods which begin in winter and continue into the growing season might prolong dormancy, thereby acting as a selective factor for those species which can delay leaf expansion until floods have receded (Howard and Penfound, 1942). These floods could extend well into the growing season, yet they appear to have less effect than shorter floods that begin after trees have leafed out (Conner and others, 1981; Broadfoot, 1967).

Inundation is especially important in the regeneration of the flood-plain community and can have beneficial as well as adverse effects on plants. Seeds of some plant species are not viable after being submerged for short periods. Seeds of other plant species germinate during or shortly after floods and benefit from the reduction of competition (Kozlowski, 1984). Huenneke and Sharitz (1990) reported that inundation can provide protection for seeds from predation by terrestrial animals. They reported negligible damage to submerged nylon net bags of *Nyssa aquatica* seeds, whereas seeds in bags that were attached to emergent objects such as tree trunks received heavy predation. The main predator was thought to be fox squirrels. Inundation can also protect surviving seedlings from herbivores (Crawford, 1989, p. 107). Inundation acts as a positive selective factor for a few species of trees that seem well adapted to very long periods of standing water by limiting competition from less tolerant species. Tree species on the Apalachicola River flood plain which tolerated annual flood durations exceeding 50 percent included *Taxodium distichum, Nyssa aquatica, Planera aquatica, Nyssa ogeche, Fraxinus caroliniana, and Cephalanthus occidentalis* (Leitman and others, 1983).

Variation in the timing of inundation is probably significant to the maintenance of species diversity in southern flood-plain forests (Streng and others, 1989). Occasional variations in the flood regime, such as late floods or years with no flooding, provide opportunities for other species to produce seedlings or allow slower-growing species of trees time to grow taller before the next flood. Periods of extreme drought might be required for trees to become established in the wettest areas of the flood plain. Because *Taxodium distichum* seeds cannot germinate underwater, *Taxodium distichum* growing at the lowest elevations on flood plains probably germinated in periods of extremely low water levels.

Water on inundated flood plains infiltrates soils and replenishes ground water. Higher ground water levels can persist well after floods recede (Broadfoot, 1967), resulting in longer periods of inundation or saturation in depressional areas. This affects vegetation by excluding certain saturation-intolerant species and enhancing the growth and vigor of others.

Flowing Water

Flowing water can be an important selective factor and seed-dispersal agent for flood-plain vegetation. Flowing water can scour flood-plain surfaces, expose mineral soils, transport sediments and debris, and distribute seeds, root pieces, and small plants throughout the flood plain.

Flood-plain surfaces receive a continuous supply of vegetative matter that is dropped from the trees and transported during floods. At three different locations on the Ochlockonee River flood plain, the amount of leaf litter, branches, limbs, and rotten logs decreased after the flood season, indicating that velocities during the annual flood were sufficient to move debris downstream to receiving water bodies or to depositional sites in other areas of the flood plain (Leitman and others, 1991).

Annual flood velocities in north Florida streams are generally much lower than in other regions of the United States. Main channel velocities during annual floods in the four streams in this study and the adjacent Apalachicola River are generally between 0.3 and 1.2 m/s, with maximum velocities rarely exceeding 1.5 m/s (unpublished data, U.S. Geological Survey, Tallahassee, Fla., 1957-89). Velocities in flood-plain forests are usually much lower than in main river channels. In north Florida flood plains, velocities usually average less than 0.3 m/s. Maximum velocities in flood plains generally do not exceed 0.5 m/s, except in limited areas for short periods when rising flood waters first rush into the flood plain through constricted passageways or narrow breaks in a berm or levee. Typical flood velocities measured on the Ochlockonee flood plain were 0.2 m/s, with maximum velocities measured at 0.5 m/s (Leitman and others, 1991). Flood velocities measured on the St. Marks River flood plain averaged 0.2 m/s with a maximum of 0.3 m/s (unpublished data, U.S. Geological Survey, Tallahassee, Fla., 1973 and 1984). Flood velocities on the Apalachicola River flood plain were within the same range, averaging about 0.2 m/s (Leitman and others, 1983).

The probability of injury to plants from flowing waters increases with the duration of flooding and the velocity of flow. Ware and Penfound (1949) described sandflats on the South Canadian River in Oklahoma where floods that sweep away most of the vegetation could occur at any time of the year. Despite these harsh conditions, 85 species of plants were surveyed which either briefly colonized exposed flats or persisted from flood to flood. Ice carried by flowing water causes significant damage in some systems (Lindsey and others, 1961). Species that can resprout from the roots have an obvious advantage over those that cannot (Hall and others, 1946). Seedlings and plants with shallow root systems are especially vulnerable to mechanical injury (Huenneke and Sharitz, 1990; McBride and Strahan, 1984; Sigafoos, 1964). For some species, disturbance might have positive effects. Hardin and Wistendahl (1983) observed plants of *Laportea canadensis* floating in floodwaters of the Hocking River in Ohio and other plants of *Laportea* canadensis initiating new growth after being deposited with litter and debris.

Flow is important in the dispersion of seeds and the preparation of flood-plain surfaces for the subsequent germination of seeds. Seeds of *Nyssa aquatica* and *Taxodium distichum* dropped on the inundated flood plain of the Savannah River floated for approximately 6 to 9 weeks before sinking. Flowing waters effectively dispersed the seeds throughout the flooded areas (Schneider and Sharitz, 1988). Some flood-plain seeds will only germinate on mineral soils and might be dependent on flow to remove humus and debris (Sigafoos, 1964). These newly swept surfaces are also suitable for the germination of annuals which can be intolerant of submersion but are able to grow and reproduce before subsequent floods (Menges and Waller, 1983).

Flow can ameliorate the effect of inundation when destructive velocities are not involved. Harms (1973) reported that *Nyssa aquatica* seedlings grew significantly better in deep moving water than in deep stagnant water. Higher concentrations of oxygen and lower concentrations of carbon dioxide in the moving water were thought to be factors.

Seasonal Changes in Anaerobic Effect of Saturation in North Florida

Federal wetland regulations (1989) limited wetland jurisdiction to only those areas that are inundated or saturated during the growing season. Records or observations of flooded or saturated conditions in the nongrowing season are not considered in deciding whether a site meets wetland hydrology criteria. These criteria were based on general agreement in the literature that saturated or flooded conditions in winter have little effect on dormant trees (Brink, 1954; Hall and Smith, 1955; McAlpine, 1961; Gill, 1970; Whitlow and Harris, 1979). The current (1991) hydrology criterion used by the State of Florida (regular and periodic inundation) does not limit evidence to the growing season only. However, efforts to standardize wetland delineation methodologies in Florida and possibly assume Federal delegation of wetland regulatory authority could lead to adoption of parts of the Federal methodology. If so, the appropriateness of limiting hydrologic evidence (in Florida) to the growing season might be reconsidered.

Of the many effects of hydrology on vegetation summarized in table 1, the anaerobic effect of saturation has most often been used to support the concept of a growing season limitation on hydrology criteria for wetland delineation. In the discussion that follows, temperature conditions and plant-dormancy information specific to north Florida are described for the purposes of understanding seasonal changes in the effects of anaerobiosis at the study sites.

Air and soil temperatures in the nongrowing season.-- In the warm, temperate climate of north Florida, winters are still cold enough to cause a noticeable slowing of biological activity for most organisms. The average winter air temperature for Tallahassee (11.5 °C for December, January, and February) is 15.5 °C cooler than the average summer temperature (June, July, and August). Temperatures on most cold winter days warm above freezing during the day, yet even the warmest winters can include at least 20 days in which the daily minimum air temperature drops below freezing during the night. Cold winters may have 50 or more days of daily minimums below 0 °C (U.S. Department of Commerce, Monthly Summaries, 1961-90).

Temperatures are generally not cold enough, however, for biological activity in the upper 20 to 30 cm of soil to cease except for short periods of a few days. Although each species of plant or soil microorganism has its own temperature requirements, an approximate minimum temperature for biological activity suggested by U.S. Soil Conservation Service (Soil Survey Staff, 1975) is 5 °C. Minimum soil temperatures taken at a depth of 20 cm at Quincy, Fla., were 5 °C an average of 5 days per year in a 19-year period (U.S. Department of Commerce, Monthly Summaries, 1971-73, 1975-90). Soil temperatures at a depth of 50 cm probably never are as low as 5 °C. Brasfield and Carlisle (1975) summarized 13 months of daily soil temperature readings that were taken at three north Florida locations at a depth of 50 cm. The lowest soil temperature recorded in that study was 8.9 °C at Monticello, Fla., on January 12, 1970. That month was one of the three coldest Januarys for that location in a 30-year period (U.S. Department of Commerce, Annual Summaries, 1951-80).

Soil temperatures at the Quincy and Monticello locations were measured in unshaded upland soils. Temperatures of saturated soils in shaded flood plains are probably warmer than upland soils in open areas because of the insulating effect of moisture and tree cover. "Moisture can be exceedingly important in reducing [daily] fluctuations in soil temperature [because] the specific heat of water is roughly five times that of soil minerals" (Soil Survey Staff, 1975, p. 58). Vegetation also has an insulating effect on soil temperatures (Brasfield and Carlisle, 1975; Soil Survey Staff, 1975).

Flooded soils take longer to lose oxygen and become anaerobic in the winter when temperatures are low and respiration rates are slowed (Jackson and Drew, 1984). However, at least in north Florida, anaerobic conditions in flooded soils can probably occur any time of the year. Temperatures in north Florida are warm enough that it is safe to assume that biological activity in the root zone of the soil occurs year-round, especially in flood-plain soils which may be protected from winter temperature extremes by the insulating effect of water and vegetation.

Seasonal changes in plant activity in north Florida.-- Generally, there is a noticeable slowing of plant activity in the winter in north Florida. Anaerobic conditions in the nongrowing season (mid-November to early March) can have little effect on deciduous species that are dormant in the winter. However, there are many tree, shrub, vine, and ground-cover species that have active growth periods that do not coincide with commmonly used growing season dates. Some species have green leaves in the winter and are probably growing during warm periods. Winter can even be a peak growth period for some species that are dormant part of the summer.

- Evergreens are probably more active throughout fall and winter than deciduous plants (Daubenmire, 1965). Examples of some common trees, shrubs, and vines on north Florida flood plains that are evergreen are *Cyrilla racemiflora, Gelsemium sempervirens, Ilex opaca, Magnolia virginiana, Pinus glabra, Sebastiania fruticosa*, and *Smilax laurifolia.* Three common flood-plain oaks which retain some green leaves through most of the winter are *Quercus nigra, Q. laurifolia*, and *Q. virginiana*.
- Nine ground-cover species with green leaves were collected on the Ochlockonee flood plain in mid-December, 1987 (*Agrostis perennans, Carex joorii, Chasmanthium laxum, Cyperus virens, Erechtites hieracifolia, Eupatorium semiserratum, Leersia lenticularis, Panicum rigidulum*, and *Pluchea camphorata*). Temperatures at the Quincy and

Tallahassee weather stations were below freezing prior to the collection date. Two of these species, *Panicum rigidulum* and *Chasmanthium laxum,* were among the four most common ground-cover species on all Ochlockonee plots (Leitman and others, 1991).

- Members of the genus *Carex,* which were present on the four flood plains in this study and commonly occur in wetlands of temperate climates, include some species which overwinter as green shoots, with those same shoots continuing growth in the next year through the summer (Bernard and Gorham, 1978).
- Some wetland plants are dormant during a substantial part of the warm season. *Hymenocallis duvalensis,* a spiderlily that was present on the Ochlockonee River flood plain, blooms in late spring and is usually dormant by late summer.
- Other native perennials that sometimes occur in wet soils such as *Chaptalia tomentosa, Gentiana pennelliana, Viola sp.,* and *Zephyranthes sp.* grow and bloom in the winter season in north Florida (Clewell, 1985).
- Croom (1834) created a floral calendar that listed blooming times in 1833 for North Florida plants. Most of his observations were made in Gadsden County. This calendar listed at least 34 species of native plants in bloom before March 1 in a year when at least one hard freeze (-3.3 °C) occurred in January.

Analysis of Vegetation-Hydrology Relations Using Year-Round Hydrologic Records

All of the seasonal differences in temperature, plant growth, and hydrologic effects described previously were considered in the analysis and presentation of vegetation-hydrology relations in this report. Hydrologic descriptions were based primarily on year-round rather than growing season conditions because most hydrologic effects are not limited to the growing season. Year-round (water year) hydrologic records provide the most complete description of the influence of hydrology on vegetation for the following reasons:

- Soil temperatures in north Florida are warm enough that it is safe to assume that biological activity in the soil occurs year-round. Therefore, saturation probably causes anaerobic conditions in the nongrowing season.
- Many trees, shrubs, vines, and ground-cover plants that are common in north Florida flood plains are not fully dormant in the winter. Those species may be adapted to anaerobic stress caused by flooding in the nongrowing season.
- The anaerobic effect of saturation is only one of many hydrologic effects on flood-plain vegetation. There are many other effects of inundation and flowing water that are not controlled by temperature or metabolic rates and can occur any time of year (table 1). A few effects take place primarily in the nongrowing season, such as the seed dispersal function of flowing water for species that produce and drop their seeds in the late fall.

Growing season hydrologic conditions have been presented in addition to water year conditions in appendices IIB, IIC, VA, and VB to provide information on flood tolerance for particular deciduous species that are dormant in the non-growing season, and to help describe the seasonal distribution of flooding in a typical year.

METHODS OF STUDY

Study sites were located in forested flood plains of four north Florida streams near long-term stream-gaging stations. Ten study plots were established to represent different flood-plain community types. Three plots represented Ochlockonee River flood-plain types: Ochlockonee depressions; Ochlockonee low terraces; and Ochlockonee high terraces. Data on each Ochlockonee plot represented combined information from plots at three sites (the primary site and two secondary sites, fig. 1). Two plots were located on the Aucilla River flood plain: Aucilla low terrace and Aucilla high terrace. Two plots were located on the Telogia Creek flood plain: Telogia slough and Telogia low plain. Three plots were established on the St. Marks River flood plain: St. Marks low plain; St. Marks lower slope; and St. Marks upper slope. Detailed descriptions of the study sites and plots are presented in later sections of the report. In this section, methods used for collection and analysis of hydrology, soils, and vegetation data are described.

Hydrologic Data Collection and Analysis

Surface-water hydrologic conditions were well defined in this study because sites were selected near established surface-water gaging stations with long-term stage records. Station names, identification numbers, and periods of record are listed in appendix I. Proximity to the gaging station determined whether gage records could be used directly, or whether water-level measurements at the site were needed to establish stage-to-stage relations between gage records and water levels at the study site. Study plots on the Aucilla River, Telogia Creek, and St. Marks River were located close enough to the gaging stations that stage records could be directly related to plot elevations. However, Ochlockonee River sites were located at some distance from the gage and required additional river-level measurements to relate gage records to the sites. Main river channel levels periodically were measured near each of the three Ochlockonee River flood-plain sites during the study. Near one of the secondary sites, an observer recorded river levels once a day from November 1987 through August 1989. Stage-to-stage ratings were developed by relating river stage at each of the three flood-plain study sites to river stage at the gaging station. These ratings were used to estimate long-term stage records at each of the three Ochlockonee sites.

A similar period of record consisting of all available stage data from 1957 to 1989 was used for each stream to allow comparisons to be made among the four streams. The hydrologic record was examined for possible trends and unusual events. Long-term gage records were summarized in terms of duration, frequency, and depth of flooding. (See glossary for definition of selected hydrologic terms.)

Duration of flooding was calculated for flood-plain elevations in two different ways. Average annual longest flood is the average length in days of the longest annual flood event at a given elevation. Duration of all flood events combined is expressed in total percent of time that stages equaled or exceeded a given elevation and does not distinguish between frequent short floods and less frequent long floods. Both types of duration were calculated using water year, freeze-free growing season, and sometimes, SCS growing season. Frequency of flooding is reported as the average number of flood events per year. Depth of flooding during the 2-year, 1-day high flood represents the maximum flood depth that typically occurs each year.

Elevations above sea level for all flood-plain and main channel water-level measuring points were established by surveying from the nearest known vertical-control benchmark. On Ochlockonee, Aucilla, and Telogia sites, elevations were rounded to tenths of feet. Accuracy to hundredths of feet was needed at the St. Marks site, which had the smallest range in stage of all four streams. The median elevation for each plot was the median ground elevation at the bases of the canopy trees present on that plot.

Depressional areas with poorly drained soils held standing water and remained saturated longer than river stage durations indicated. Water-level measurements in flood-plain sloughs and depressions were measured periodically during low water when they were isolated from the main river channel.

Limited water-level measurements in the root zone were made at the sites to collect information about soil saturation. The root zone was considered to be the upper 30 cm of soil. Montague and Day (1980) reported that 76 to 90 percent of the root biomass occurred within 30 cm of the soil surface in four Great Dismal Swamp plant communities. On the St. Marks plots, water levels in eight shallow wells were measured 19 times from November 1988 through September 1990. One shallow well was installed on the Ochlockonee primary site and was measured through the recession of a flood in February and March 1990. Occasional water-level measurements were made in freshly dug holes in the ground at all plots. Water-level elevations were used in conjunction with soil morphology, ground elevations, topography, and river-stage durations to make general estimates of the duration of root-zone saturation at the plots. In this study, soils were considered "wet to the surface" if free water could be extracted by manually squeezing a surface sample of the soil.

Federal wetland hydrology determinations were made for each plot based on Part 2.9 of the 1989 Federal Manual (Federal Interagency Committee for Wetland Delineation, 1989).

Soil Sampling and Analysis

Soil pits selected for sampling and analysis were located in areas judged to be representative of plot topography and vegetation. In most cases, soil pits were excavated by shovel to the depth of the water table and were sampled by soil auger to a depth of 200 cm. Drainage classes and taxonomic classifications according to "Soil Taxonomy" (Soil Survey Staff, 1975, 1990) were based on standard SCS field determinations of soil characteristics (Soil Survey Staff, 1981). Occasional field observations were made of surface soil moisture at all plots.

State and Federal hydric soil determinations were made for each plot. State determinations were based on field characteristics as used by FDER and SCS in Florida, according to Hurt and others (1990). Federal determinations were based on field characteristics as used by the 1989 Federal Manual (Parts 2.6, 2.7, and 3.8 through 3.28, Federal Interagency Committee for Wetland Delineation, 1989).

Vegetation Sampling and Analysis

Vegetation at each site was sampled and analyzed by stratum. Three strata were used: canopy; subcanopy; and ground cover. Trees with 10 cm or greater diameter at breast height (dbh) were considered canopy trees. Canopy trees were tagged with numbered aluminum tags, identified to species, measured for dbh, and surveyed for ground elevation around the base. Dbh's of trees with swollen bases were measured for diameter above the swelling.

Root systems for mature trees can extend well beyond the driplines of their crowns (Gilman, 1990). The range from the lowest to the highest elevation within the root network can be substantial on some trees, particularly those growing on mounds or slopes. On the St. Marks site where range in river stage is small, numerous hummocks and other irregularities in the ground surface on the two lower plots were correlated with large differences in hydrologic conditions. Because the extent and position of the active roots for each tree were unknown, descriptions of hydrologic conditions for individual canopy trees on these two plots were probably not as accurate as those for trees at the other plots.

Line transects were established through the middle of each topographic zone on the plots and surveyed for ground elevation. All subcanopy trees (2.5-10 cm dbh) in a 4-m-wide belt transect extending 2 m on either side of the line transects were identified to species and assigned a ground elevation. All ground-cover vegetation (woody vegetation less than 2.5 cm dbh and all herbaceous vegetation) intersecting an imaginary vertical plane along the line transect (line intercept method, Mueller-Dombois and Ellenberg, 1974) was identified to species, given a specific location on the line transect, and measured for horizontal extent along the line. Measurements of ground-cover vegetation were made once in the fall-winter and once in the spring-summer to characterize seasonal variation. Elevations for ground-cover vegetation were calculated from the line transect survey. Additional species on the plot not sampled by the line or belt transects were recorded.

Because the age of individual plants were variable, the 28- to 33-year period of hydrologic record used in this study might be too long or too short to represent conditions during the lives of those plants. For example, most of the *Liquidambar styraciflua* canopy trees in this study were probably between 15 and 50 years in age based on growth rates reported in Fowells (1965). Subcanopies were composed of trees of various ages, including young canopy species and older sub-canopy species. For annual and biennial plant species in the ground cover, hydrologic conditions in the preceeding year or two may be the most pertinent; however, perennials were by far more common than annuals or biennials on study plots. Perennials sometimes reproduce by root sprouts and runners and may be much older than their appearance suggests (Bernard and Gorham, 1978; Clewell, 1986, p. 281).

State and Federal wetland vegetation determinations were made for each plot. State determinations were based on the plant lists and formulas in Section 17-301.400(1), F.A.C. A separate State determination was calculated for each stratum (canopy, subcanopy, ground cover in spring-summer, and ground cover in fall-winter) as well as for the overall plot. Federal determinations for overall plots (combining all strata) were based on indicator categories for the southeastern United States (Reed, 1988) and hydrophytic vegetation criteria set forth in Part 2.3(1) of the 1989 Federal Manual (Federal Interagency Committee for Wetland Delineation, 1989). Sampling methods used in this study are most similar to the Comprehensive Quadrat Sampling Procedure recommended in Part 4.18 of the Federal Manual in which only the dominant species from each stratum are used to determine whether a plot meets the hydrophytic vegetation criterion. Weighted averages were used to assess wetland status for each separate stratum based on the national list (Reed, 1988). Weighted average is the average ecological index, weighted by importance value (Wentworth and others, 1988). (See Federal vegetation codes in the glossary for definitions of ecological indexes.)

Plant nomenclature used in this report follows that by Godfrey (1988) for woody plants, Godfrey and Wooten (1979, 1981) for herbaceous wetland species, and Clewell (1985) for herbaceous upland species unless otherwise indicated. Common names of selected plants are listed in the front of this report. A complete list of all scientific names used with authors is in the plant index at the back of this report. Synonyms for species listed under a different scientific name by Reed (1988) are also included in the plant index. For two species, *Persea palustris* and *Scirpus lineatus*, our references did not agree with the synonyms in Reed (1988).

HYDROLOGY AND TOPOGRAPHY OF THE STUDY SITES

Hydrology and topography were examined at study sites located on forested flood plains of four north Florida streams: Ochlockonee River, Aucilla River, Telogia Creek, and St. Marks River (fig. 1). Streams were chosen to represent the most common stream types of north Florida: alluvial (Ochlockonee), blackwater (Telogia), and spring-fed (St. Marks). The Aucilla River did not appear to fit any single stream type. Discharge and range in stage in relation to drainage area are described at gaging stations on each of the four streams (table 2). Typical flood season and basic characteristics of the flood regime are presented in hydrographs of the four streams in figures 2 and 3. Mean monthly river stages during the study period compared to long-term means showed that conditions were drier than normal during the study period for all streams except St. Marks (fig. 3).

Sites were chosen to be representative of plant communities and topographic relief commonly encountered on the flood plains of those streams. Other considerations were: proximity to long-term stream-gaging stations, maturity of tree canopy, lack of recent human disturbance, and accessibility. Two or three plots were located at each stream site. Topographic features represented by the 10 study plots are described in table 3. Levees, ridges, and terraces are used in this report to refer to topographic features in the flood plain from which flood waters drain shortly after floods recede. Depressional areas hold water after floods recede and after heavy local rains, but are normally dry part of each year during periods of low water. Sloughs serve as passageways through riverbank levees for flood waters to enter and exit the flood plain, and they might contain isolated pools of water during dry periods.

Descriptions of the hydrologic conditions at each of the study plots are based on long-term surface-water gage records, field observations of soil saturation and depressional ponding, and occasional measurements of water-table levels during the study period.

Table 2. Geographic and hydrologic characteristics of four north Florida streams near the study sites

[These characteristics represent conditions in the vicinity of the study sites at the gaging stations. To provide comparisons among the four rivers, all available hydrologic data from 1957 to 1989 (listed in appendix I) were used to calculate hydrologic parameters, unless otherwise indicated; km^2, square kilometers; m^3/s, cubic meter per second; m, meters]

Gaging station	Drainage area[1], (km^2)	Average discharge, (m^3/s)	2-year, 1-day high flow, (m^3/s)	2-year, 1-day low flow, (m^3/s)	Typical range in stage[2], (m)
Ochlockonee River near Havana	2,953	32	263	1.8	5.0
Aucilla River at Lamont	1,935	12	61	.4	2.7 (pre-dam) 1.7 (post-dam)[3]
Telogia Creek near Bristol	326	7	69	1.6	1.7
St. Marks River near Newport	1,386[4]	20	51	11.5	.9

[1] Includes area upstream of gaging station only (not the entire drainage basin).

[2] Difference between 2-year, 1-day low stage and 2-year, 1-day high stage.

[3] Two ranges are given because a low-level dam, installed in 1963, raised low stages by approximately 1 m. The pre-dam range is based on 7 years of stage records from 1957 to 1963. The post-dam range is based on 22 years of available stage records from 1964 to 1989. (See appendix I.)

[4] Includes 622 km^2 of Lake Miccosukee, which contributes at high stages to the St. Marks River.

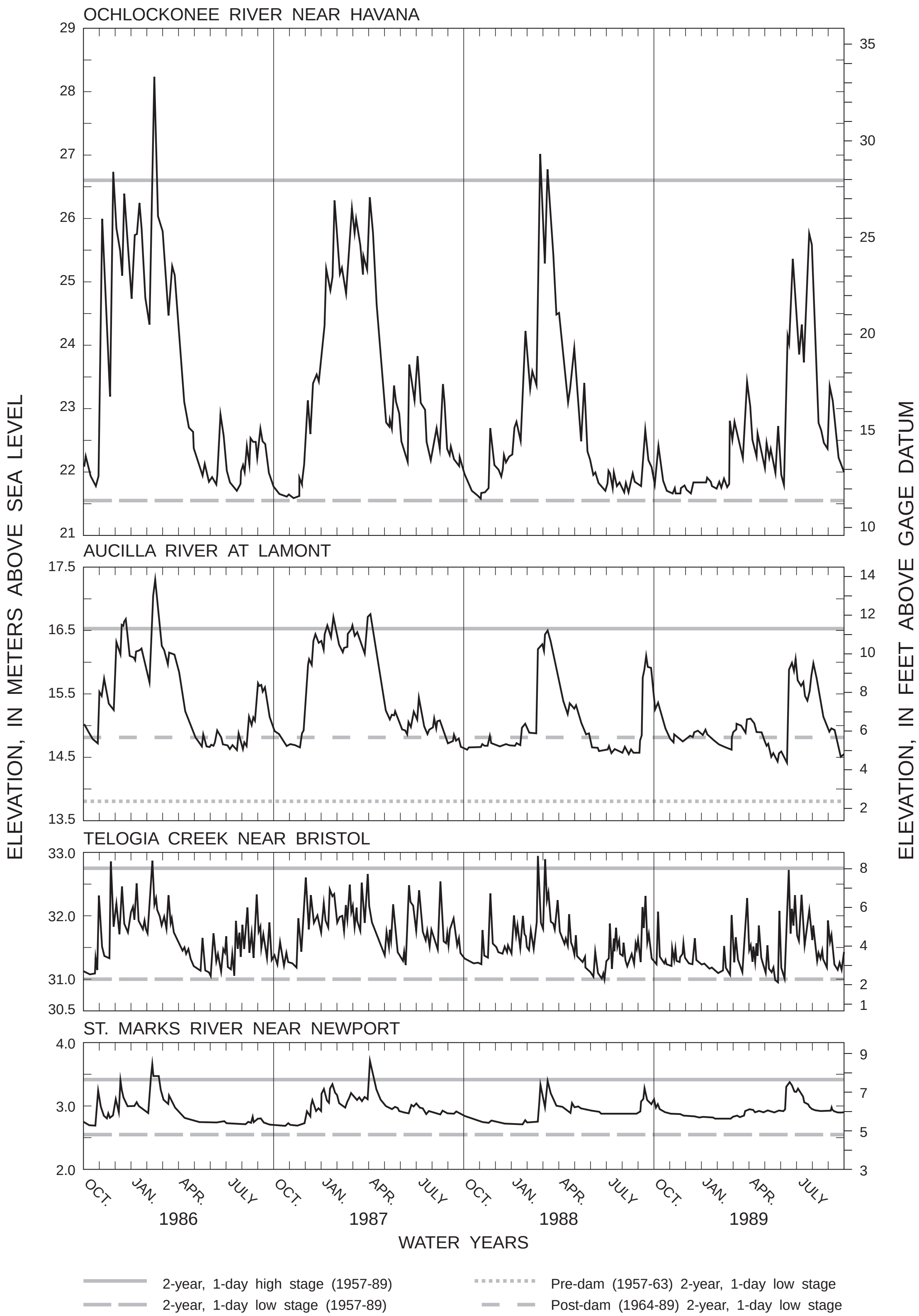


Figure 2. Mean daily stage for four water years (1986-89) at the four stream-gaging stations. The 2-year, 1-day high stage approximates the median of the annual highest stages. Periods of record given in the explanation include some missing record. (See appendix I for a list of the individual years of record used in each case.)

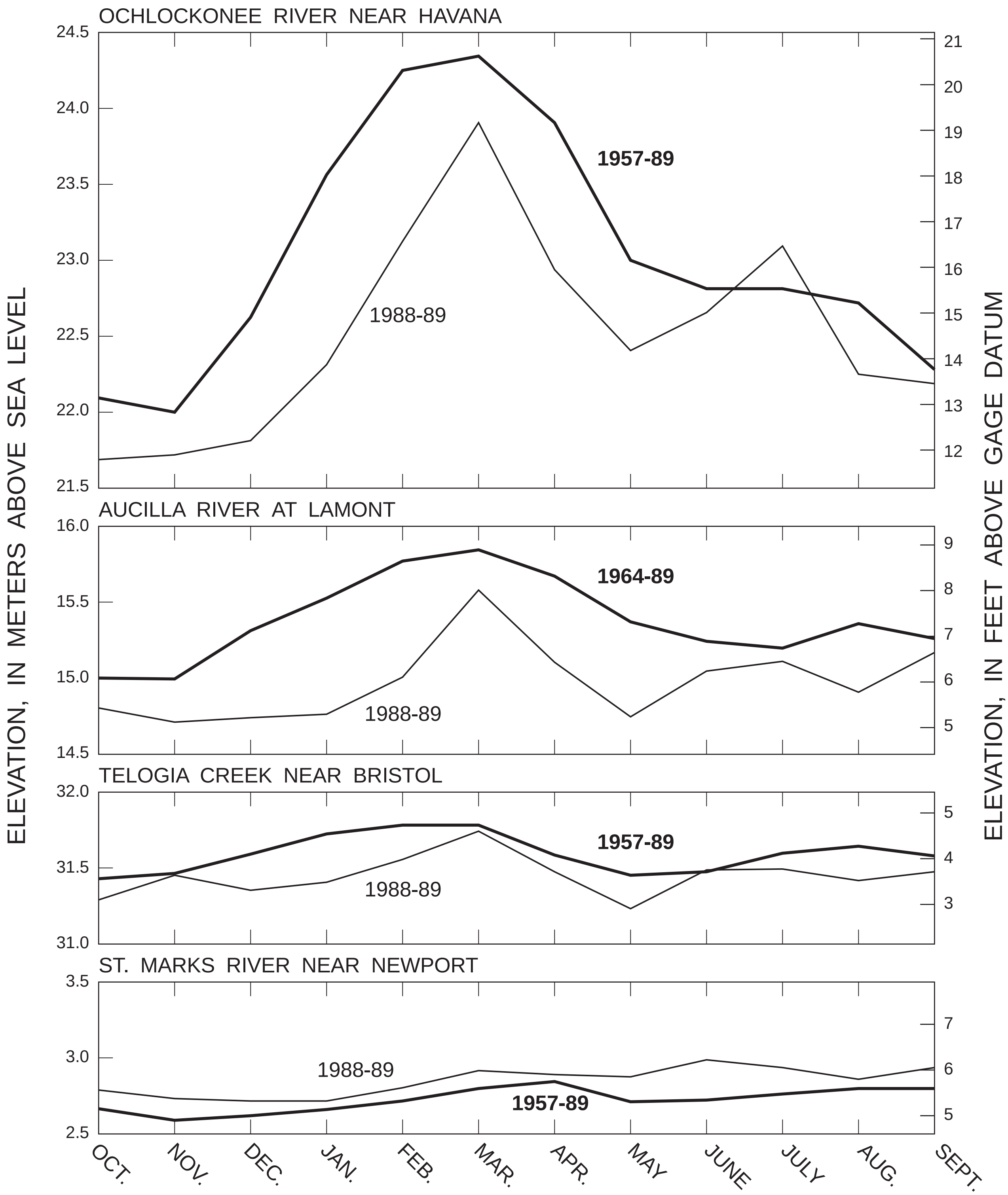


Figure 3. Mean monthly river stage for a long-term period of record and the 2-year study period at the four gaging stations. (See appendix I for listing of available record from 1957 to 1989 that was used in every case except Aucilla River at Lamont. Mean monthly stages at that station were based on the period beginning in 1964 because of the installation of a low-head rock and concrete dam in August 1963 that affected gage records at low stages.)

Table 3. Topographic features represented at ten flood-plain study plots on four north Florida streams.

Topographic feature		Flood-plain study plot
Slough	Elongated depression in flood plain; serves as passageway through levee for floodwaters to enter or exit the flood plain; sometimes retains isolated pools of standing water during dry season.	Telogia slough
Depression	Low area in flood plain that holds water for weeks after floodwaters recede, but is usually dry during the dry season.	Ochlockonee depressions
Low terrace or low plain	Level or gently sloped area at relatively low elevations in flood plain. Surface water drains off quickly after floods recede.	Ochlockonee low terraces Aucilla low terrace Telogia low plain St. Marks low plain
High terrace	Level, gently sloped, or ridged area at relatively high elevations in the annual flood plain that drains quickly after floods recede.	Ochlockonee high terraces Aucilla high terrace
Seepage slope	Gently sloping area along outer edge of flood plain downslope of adjacent upland; ground water is often near the surface.	St. Marks lower slope
Rarely flooded slope (transitional to upland)	Rarely flooded area adjacent to and upslope of annual flood plain.	St. Marks upper slope

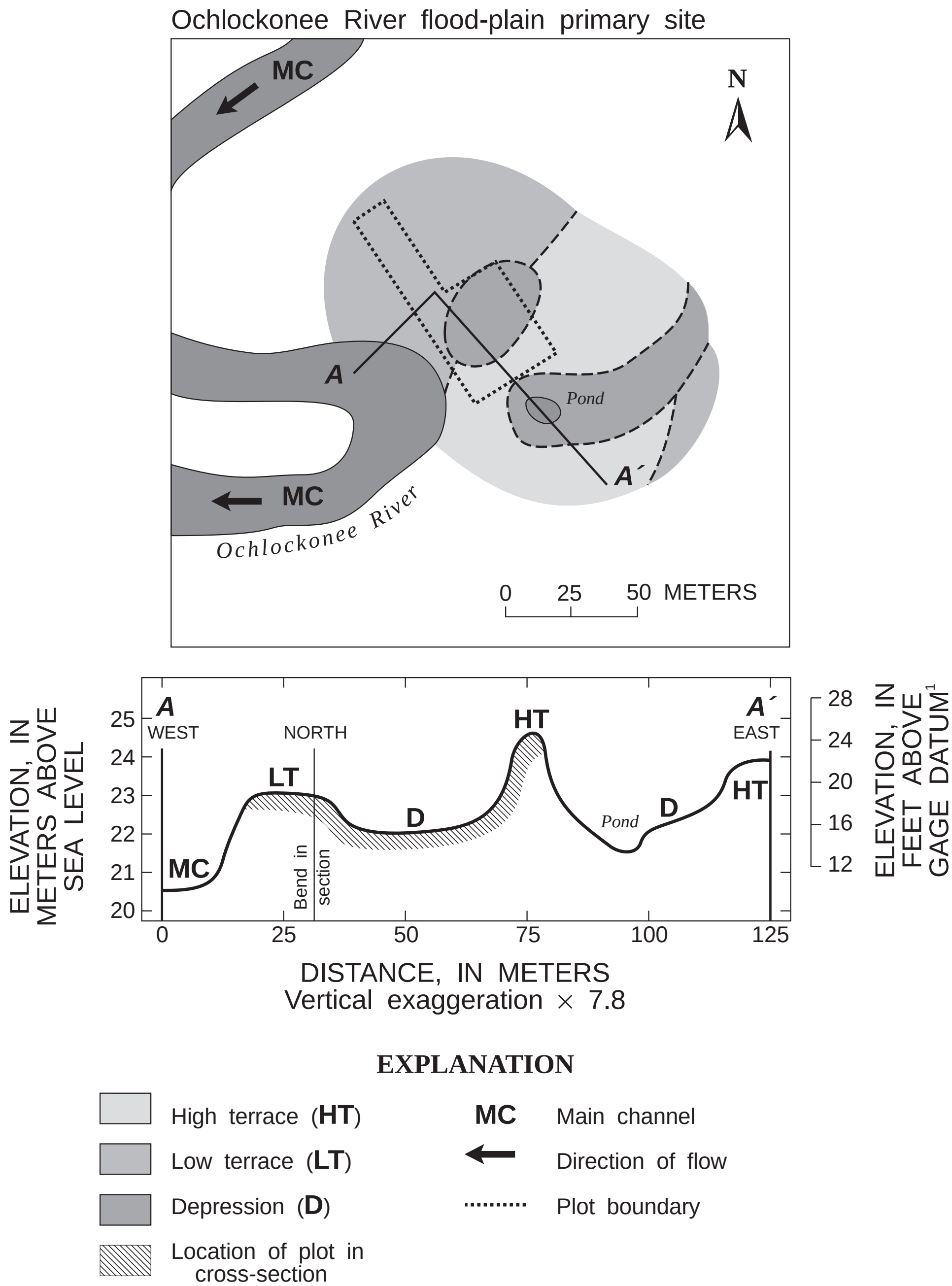
Ochlockonee River Flood Plain

The Ochlockonee River drains approximately 5,827 km^2 of the Gulf Coastal Plain in southwest Georgia and north Florida (fig. 1). The river traverses three physiographic regions, the Tifton Upland District in Georgia (Clark and Zisa, 1976), and the Tallahassee Hills and Gulf Coastal Lowlands in Florida (Puri and Vernon, 1964). The Ochlockonee River is the largest of the four streams described in this report with regard to drainage area, average discharge, 2-year, 1-day high flow, and range in stage (table 2). It ranks sixth in magnitude with respect to the average discharge of all Florida rivers. However, in comparison to the adjacent Apalachicola (Florida's largest river), the Ochlockonee is a relatively small stream. Average discharge of the Apalachicola River is 14 times that of the Ochlockonee (Heath and Conover, 1981).

The annual flood season of the Ochlockonee River typically occurs from January to April of each year. Low flow generally occurs in October and November. Flood patterns vary from year to year and might not conform to these seasonal trends in any given year. The first 3 years (1986, 1987, and 1988) shown in figure 2 were typical with regard to timing of the annual flood; highest levels occurred in January, February, March, or April. Flood patterns in 1989 were unusual because the highest flood of the year occurred in summer (June and July) rather than in winter and spring.

The forested flood plain of the Ochlockonee River in Florida ranks eighth in size relative to other flood plains in Florida. The flood plain is 51 km long and encompasses approximately 124 km^2 in Florida (Wharton and others, 1977). The Ochlockonee River flood plain in the study area averages 600 m in width and has many topographic features characteristic of alluvial rivers (Leopold and others, 1964). Natural levees border the river channel with the remaining flood plain consisting of a mosaic of ridges, terraces, depressions, sloughs, oxbow lakes, and ponds of various sizes. The Ochlockonee River flood plain has more topographic relief than the other three flood plains. A 2.5-m rise from the floor of a depressional area to the top of a high terrace 5 m away is common on this flood plain.

The location of one primary and two secondary flood-plain study sites on the Ochlockonee River is shown in figure 1. The primary site was located in the Ochlockonee River Wildlife Management Area on the east side of the river. Topographic features of the primary site are illustrated in figure 4. The site included a high terrace that dropped steeply to a depression that was about 10 m from the main river channel and separated from it by a low berm. From the depression, the site sloped gradually up into a low terrace to the northwest. Southeast of the site was a pond bound on three sides by a high terrace. After floods, the pond held water above the level of the river; and at the pond's lowest recorded level, water was perched approximately 0.4 m above the water level in the main channel. Secondary sites, located on the west side of the river, were 13 and 24 km upstream from the primary site. Both secondary sites included high terraces, low terraces, and depressions that appeared fairly similar to the primary site with one exception: depressional areas



[1] This site was 4.8 kilometers downstream from the gaging station at U.S. Highway 27. Elevations are related to gage datum by a stage-to-stage rating table

Figure 4. Location, study-plot boundaries, and elevation of flood-plain features at the Ochlockonee River primary site.

were located 40 to 50 m from the the main river channel at the secondary sites, but were about 10 m from the main channel at the primary site.

Terraces and depressions in the Ochlockonee River flood plain were at elevations that were relatively high above the low water channel, particularly the high terraces, which were approximately 4 m above the 2-year, 1-day low stage. Depressions were approximately 1 m above the 2-year, 1-day low stage. However, all the study plots were below the elevation of the 2-year, 1-day high stage. Flood frequencies ranged from a long-term average of two floods per year for the higher elevations on the high terraces to five floods per year for the lower elevations in the depressions (app. II.A). Flood depths were greater on the Ochlockonee River flood plain than on the other three river flood plains. During the 2-year, 1-day high stage, depths ranged from approximately 1 m on the high terraces to almost 4 m on the lower elevations in the depressions.

Ochlockonee depressions had the longest flood duration of all 10 study plots with respect to annual flood events (app. II.A). The average annual longest flood ranged from 2 to 3 1/2 months. Maximum events of 5 months of continuous flooding occurred twice (1965 and 1984) in the 33-year period of record (app. II.C). Durations of average annual longest floods ranged from 5 to 11 weeks on Ochlockonee low terraces and from 1 to 3 weeks on high terraces.

Water was commonly ponded in Ochlockonee depressions after flood waters receded. Standing water was observed in the lowest areas of these plots 3 weeks or more after floods receded, and sometimes, those areas did not dry before the next flood occurred. Average annual longest period of inundation considering both river overflow and depressional ponding was estimated to be 4 1/2 months or longer for the lower elevations on these plots. Depressional ponding was rarely observed on low terraces and never observed on high terraces.

Water levels in a shallow well on the high terrace were measured through the recession of a flood in February and March 1990. The elevation of the water table in the root zone (upper 30 cm) decreased almost as fast as the river level. As the flood receded, the delay in water levels matching river stage was less than 24 hours.

Aucilla River Flood Plain

The Aucilla River drains approximately 2,466 km^2 of the Gulf Coastal Plain in southwest Georgia and north Florida (fig. 1). The river traverses three physiographic regions, the Tifton Upland District in Georgia (Clark and Zisa, 1976), and the Tallahassee Hills and Gulf Coastal Lowlands in Florida (Puri and Vernon, 1964).

A low-level dam of rock and concrete approximately 1 km downstream of the study site has been in place since August 27, 1963. Jefferson and Madison Counties installed similar dams at seven locations on the Aucilla River in 1963 to improve fishing. The gaging station used in this study was located at the upper end of the pool of this dam. Mean daily stages from 1950 to 1989 show the effect of the dam on stage fluctuations over time (fig. 5). The dam raised low stages at the gaging station by approximately 1 m. However, the influence of the dam on the plots was probably minor because ground elevations on the plots averaged 1.0 to 1.5 m above pool level. The dam has been slowly degrading over time and annual low stages have been dropping gradually since it was constructed. The four lowest annual 1-day low stages since 1963 occurred in the last 5 years (1985-89). An even lower annual 1-day low stage occurred after the study period ended; river stage was 14.21 m above sea level (3.70 ft gage datum) in late September 1990. The typical minimum stage before the dam was constructed was 13.80 m above sea level (2.34 ft gage datum), as depicted in fig. 2.

The average discharge; 2-year, 1-day high flow; and 2-year, 1-day low flow of the Aucilla River in relation to drainage area is the lowest of the four streams described in this report (table 2). A relatively low stream gradient (0.4 m/km; Bridges, 1982) and high evapotranspiration from extensive areas of swamps and numerous lakes in the basin upstream of the study site may result in little runoff reaching the stream. The drainage basin has many large lakes with no outlet streams, including Hixtown Swamp (surface area, 40 km^2), the largest lake in the Aucilla, Ochlockonee, and St. Marks river basins combined (Florida Department of Environmental Regulation, 1975). Substantial amounts of runoff do not appear to be reaching the river by way of springs or ground-water inflow. The Aucilla has the lowest base flow of the four streams in this report and many days of zero flow were recorded in 1955, 1957, and 1963. The annual

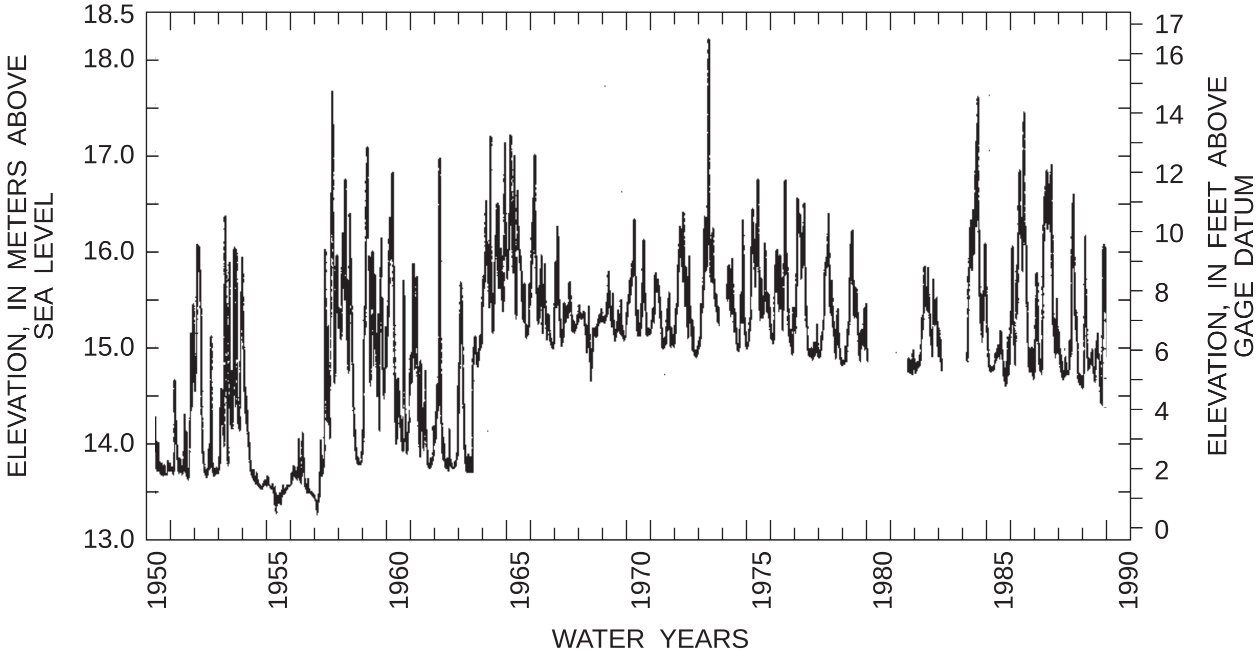


Figure 5. Mean daily stage for 40 years (1950-89) on the Aucilla River at Lamont, Florida.

flood season typically occurs from January to April of each year; however, the 1989 annual flood occurred in summer as it did on the Ochlockonee River (fig. 2).

The forested flood plain of the Aucilla River in Florida is 43 km long, encompasses approximately 44 km^2 (Wharton and others, 1977), and is dominated by levees and terraces in the study area. Sloughs meander through the flood plain behind the riverbank levees, breaching them at irregular intervals to enter and exit the flood plain. Aucilla River flood-plain sloughs are smaller and narrower than those in the Ochlockonee River flood plain, and appear to make up a relatively small proportion of the overall flood-plain area. Low, depressional areas are relatively uncommon, and backwater ponds and lakes appear to be rare or absent in the vicinity of the study site.

The Aucilla River study site was located on the west side of the river, just downstream from U.S. Highway 27. Topographic features of this site are illustrated in figure 6. The high-terrace plot was approximately 50 m from the main channel. Elevations gently sloped down to an intermittent slough that nearly encircled the high terrace. The low-terrace plot was located between two high terrace areas approximately 35 m from the river. This area was not depressional, but served as a wide passageway for flood waters to enter and exit the flood plain, connecting the slough to the main channel. Secondary flow channels indicated that water sometimes flowed fast enough across the low terrace to scour and deposit surface sands.

The average annual longest flood on the low terrace is 47 days; however, an unusually long flood occurred on the low terrace the year before the study period began. The low terrace was flooded longer in 1987 (142 days) than in any other year on record (app. II.C). Floods lasting 70 days or longer have occurred intermittently (1965, 1966, 1973, and 1984).

Low and high terraces on the Aucilla River flood plain were at elevations that were approximately 2 to 2.5 m above the pre-dam low water channel and approximately 1 to 1.5 m above the low-water pool of the dam. Both study plots were below the elevation of the 2-year, 1-day high stage. Flood frequencies ranged from a long-term average of 1 to 3 floods per year for both plots (app. II.A). Flood depths during the 2-year, 1-day high stage were less than one meter on the low-terrace plot and less than one-third meter on the high-terrace plot.

Aucilla low and high terraces were similar to those on the Ochlockonee River flood plain with respect to duration of average annual longest floods -- 5 to 8 weeks for Aucilla low terrace and 2 weeks for the high terrace (app. IIA). Average durations may be somewhat misleading on streams like the Aucilla River with relatively unpredictable flooding patterns.

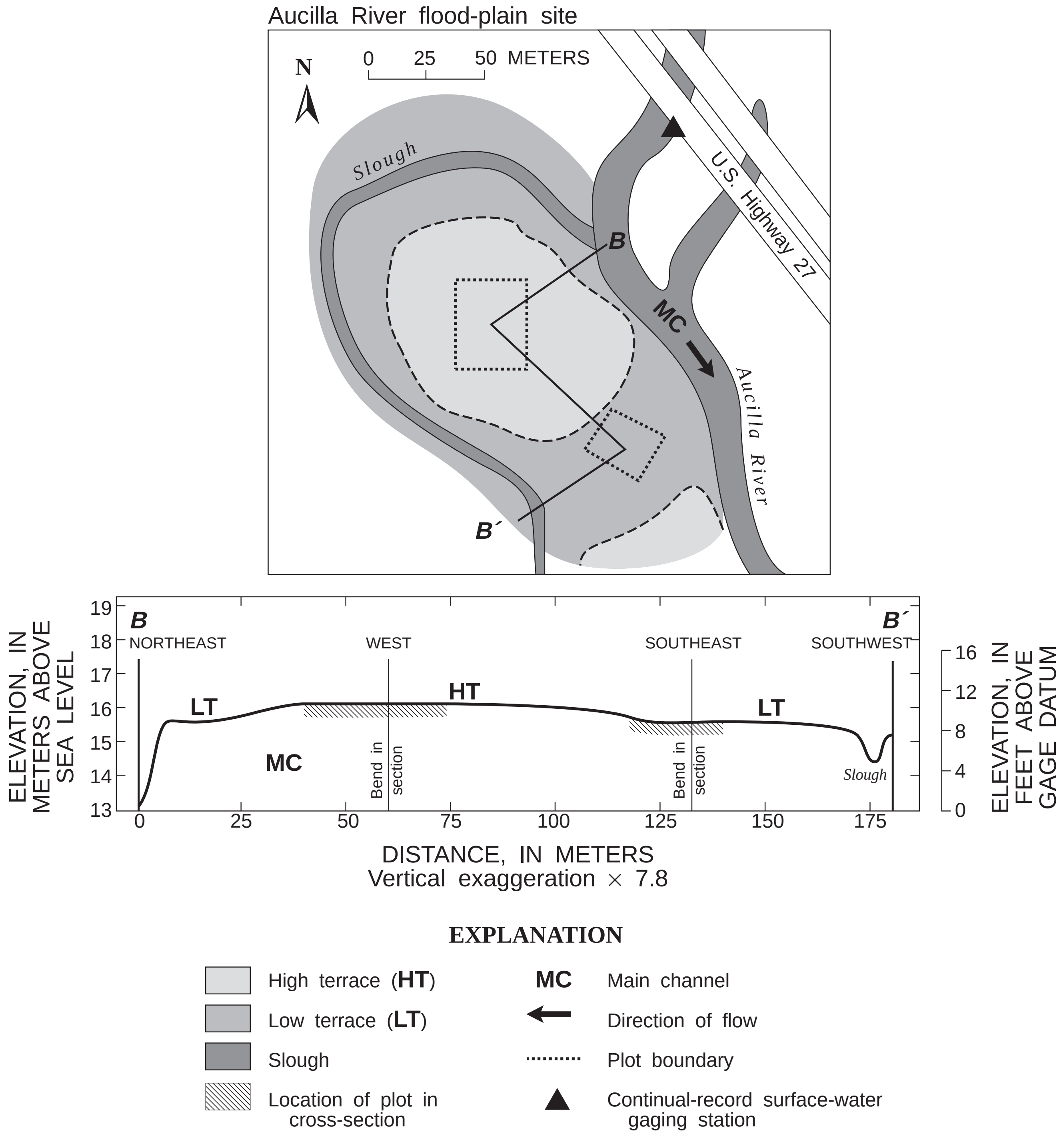


Figure 6. Location, study-plot boundaries, and elevation of flood-plain features at the Aucilla River site.

Maximum individual events during the period of record were considerably longer for the Aucilla high terrace than for the Ochlockonee high terraces. Seven flood events lasting 4 consecutive weeks or longer occurred since 1957 on the Aucilla high terrace. On the Ochlockonee high terraces, floods of that length occurred only twice between 1957 and 1989. The Aucilla high terrace had 10 years of no flooding between 1957 and 1989; whereas Ochlockonee high terraces had only 3 years of no flooding during the same period (app. II.C). Field observations indicated that standing water did not remain on Aucilla River flood-plain plots after floods receded.

Telogia Creek Flood Plain

Telogia Creek is a major tributary of the Ochlockonee River. Its junction with the Ochlockonee River is 23 km downstream of the dam at Lake Talquin and 81 km upstream of the river's mouth. Telogia Creek drains approximately 660 km^2 of the Gulf Coastal Plain in north Florida (fig. 1), and traverses two physiographic regions, the Tallahassee Hills and the Gulf Coastal Lowlands (Puri and Vernon, 1964).

Considering the size of the Telogia Creek drainage basin at the study site, the discharge of this river is relatively large. It has the highest ratio of average discharge and 2-year, 1-day flow to drainage area of the four streams (table 2). A relatively steep stream gradient (1.0 m/km; Bridges, 1982) may contribute to the large amount of runoff reaching the stream. Another contributing factor could be that some areas in the basin upstream of the gaging station have soils with high infiltration rates (U.S. Soil Conservation Service, written commun., 1978). Infiltrated precipitation passes through porous surface sands and flows into the stream by way of subsurface drainage with minimal losses to evaporation or transpiration by plants.

Although floods might occur at any time during the year, highest floods typically occur in January, February, and March of each year, and lowest stages generally occur in October and November. The summer floods of 1989 were the exception to this pattern, as they were on the other three streams (fig. 2).

The forested flood plain of Telogia Creek is larger than would be expected for a stream of its size. In the vicinity of the study area, the flood plain is as wide as that of the Ochlockonee River flood plain, yet the Ochlockonee River is 5 times the size of Telogia Creek in terms of average discharge. Relict geologic features formed in Pleistocene times might explain why this flood plain is as large as it is. Barrier islands, coastal lagoons, and offshore flats, formed when the sea level was higher than it is today, are still preserved on some of the high marine terraces in this region. Telogia Creek and other present-day streams which run parallel to the old shoreline probably are flowing through the deepest parts of old coastal lagoons (Gremillion and others, 1964).

Telogia Creek flood plain is relatively flat and low. The low, narrow levees (approximately 5 m in width) along the riverbank are typical of blackwater creeks (Wharton and others, 1977). Nonalluvial streams do not transport enough sediment to build the large levees common on the banks of alluvial streams. Behind the levee is a low plain that is not depressional, but appears to have waterlogged soils with much organic matter that supports a wet forest type. Low-plain topography is variable with patches of slightly higher land supporting drier flood-plain species, as well as sloughs with channels that are nearly as low in elevation as the main channel of the creek.

The Telogia Creek site was located on the west side of the creek, just downstream from U.S. Highway 20. Topographic features of this site are illustrated in figure 7. The low-plain plot was located very close to the main channel; a small part of the plot fell on the low, narrow riverbank levee, and the remainder was located on the low plain. Variable deposits of sand and secondary flow channels indicated that water sometimes flowed fast enough across the plot to erode and deposit surface sands. The slough plot included part of a slough and some of the adjacent low plain on either side of the slough. The banks of the slough were well defined, and vegetation in the slough was very sparse except for trees with large, swollen bases.

Study plots on the flood plain of Telogia Creek were inundated by frequent floods of short duration because of the rapid rise and fall of stream levels in response to rainfall. Streams of this type are referred to as "flashy." The sharp and closely spaced peaks in the Telogia Creek hydrograph are typical in hydrographs of flashy streams. The length of the average annual longest flood on Telogia low plain was 4 to 8 days. This duration was shorter than on most other plots in this study in spite of the fact that duration of all flood events combined on Telogia low plain (4-11 percent) was similar to durations on Ochlockonee high terraces, Aucilla high terrace, and St. Marks low plain. Ground elevations in some of the lower parts of the slough plot were below median creek stage (50 percent stage duration) and were inundated by average annual longest floods that exceeded 3 continuous months. With regard to frequency of flooding, the slough plot (flooded 13-16 times a year) and the low-plain plot (flooded 6-10 times a year) were more frequently flooded than other plots in this study.

On the Telogia slough plot, water was frequently observed standing in the slough, but it was usually at levels similar to the water level in Telogia Creek. Although the shape of the slough plot was depressional, water was usually not held in

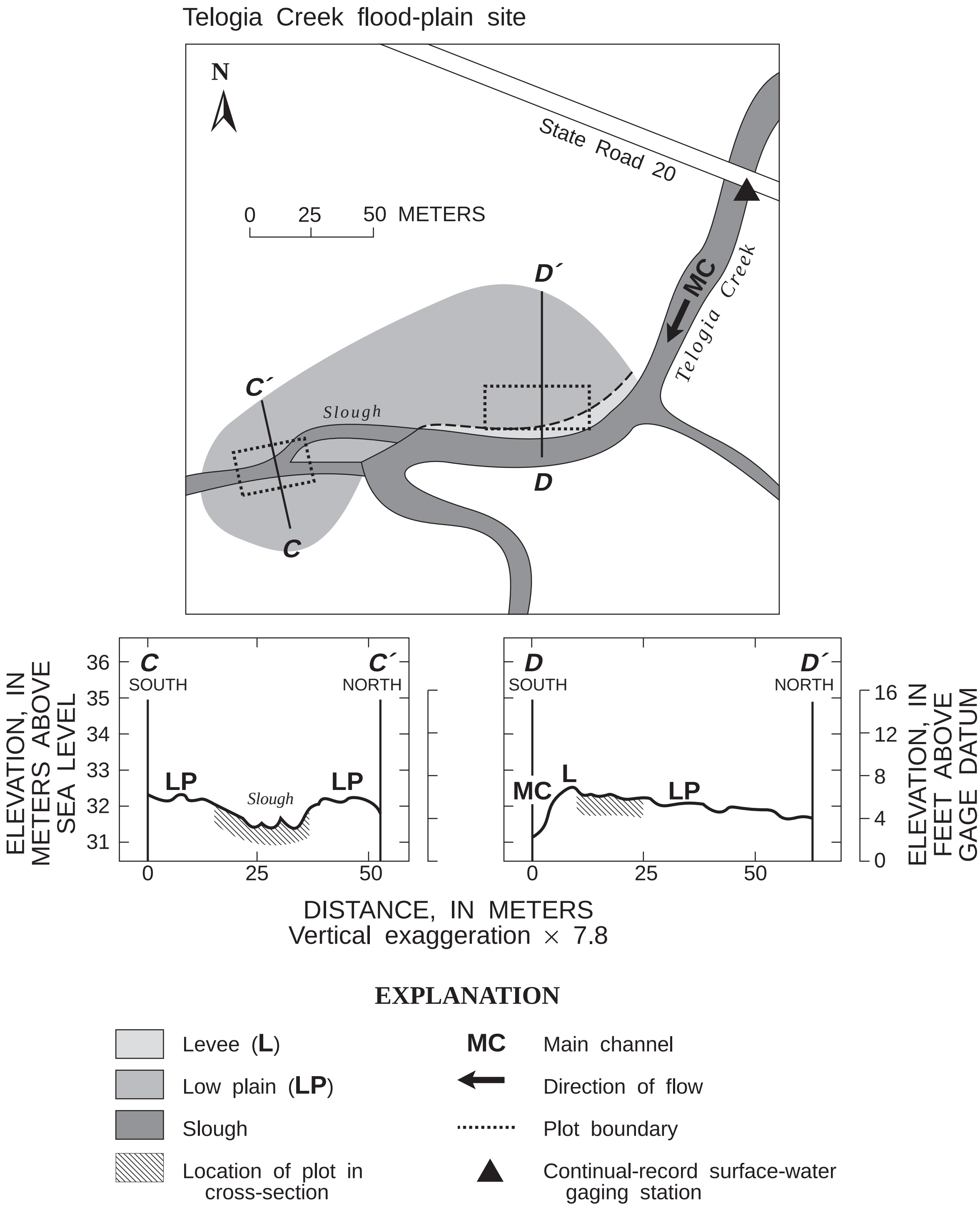


Figure 7. Location, study-plot boundaries, and elevation of flood-plain features at the Telogia Creek site.

those depressions above creek levels, probably because of sandy layers in the soil. The low-plain plot was not depressional, and field observations indicated that standing water did not remain on the surface of the low plain after floods receded.

St. Marks River Flood Plain

The St. Marks River drains approximately 2,260 km^2 of the Gulf Coastal Plain in southwest Georgia and north Florida (fig. 1). Its drainage basin, which includes Lake Miccosukee, lies in three physiographic regions, the Tifton Upland District in Georgia (Clark and Zisa, 1976), and the Tallahassee Hills and Gulf Coastal Lowlands in Florida (Puri and Vernon, 1964). The forested flood plain of the St. Marks River in Florida covers approximately 40 km^2 (Wharton and others, 1977).

The St. Marks River has the highest 2-year, 1-day low flow of the four rivers described in this report (table 2). A high base flow is typical of spring-fed streams because of a high proportion of ground-water input that is relatively steady year-round. Typical range in stage (0.9 m) is much lower than the other three streams for the same reason. Reduced seasonal fluctuations in relation to the other streams are evident in both the mean daily stage hydrographs (fig. 2) and the mean monthly stage hydrographs (fig. 3).

Long-term record indicates that river stages are usually highest in April, but high stages also occur in March, August, and September (fig. 3). All four of these high months are in the freeze-free growing season on this stream. This differs substantially from the other three streams having flood seasons that typically begin in the winter (January) and end in the early part of the growing season (March or April). Lowest stages on the St. Marks River generally occur in November and December.

On the St. Marks River, conditions during the study period were wetter than normal. Mean monthly river stages were higher than long-term means in all 12 months of the year (fig. 3). This differed from conditions on the other three streams, which were drier than normal during the study period.

In its upper reaches, the St. Marks River is poorly defined until it receives flow from Horn Spring about 6 km upstream of the study area. Approximately 2 km upstream of the study area, the St. Marks River flows underground at Natural Bridge. About 1 km south of Natural Bridge at St. Marks Spring, the river returns to the surface as a well-defined channel, forming a long pool averaging 120 m in width and extending more than a kilometer in length. The study site was located on the west side of this pool (fig. 8). The pool ends at a submerged natural sill where it narrows into a stream channel about 40 m wide that continues downstream to the Gulf of Mexico.

A low plain adjacent to the river with no perceptible riverbank levee made up the major portion of the study site. Low or nonexistent riverbank levees and a lack of large topographic relief is typical of the St. Marks flood plain because the river is primarily fed by springs and carries little or no sediment. On a small scale, however, the low plain had much relief in the form of hummocks (mounds around the bases of trees) and occasional sloughs. Because a slight rise in elevation on this flood plain can mean a substantial decrease in soil moisture, this small scale relief created a variety of habitats that were quite hydrologically diverse.

Approximately 100 m from the main channel, the low plain ended and elevations rose gradually toward the upland. The lower part of this slope appeared to be just as wet or wetter than the low plain. Seepage from the adjacent upper slope was suspected as the source of water that kept the lower slope wet much of the time during the study period.

The low-plain plot was the lowest plot in the study in relation to the elevation of the low water channel. The low-plain plot was approximately one-half meter above the 2-year, 1-day low stage and one-third meter above median river stage (50 percent stage duration). The low plain and the lower slope were flooded approximately 1 to 4 times per year (app. II.A). Flood depths during the 2-year, 1-day high stage were typically less than one-half meter on these two plots. Average annual longest floods lasted 1 to 4 weeks on the low plain and less than a week on the lower slope.

The upper slope was mostly above the elevation of the 5-year recurrence interval flood. It was the only plot in the study above the elevation of the 2-year, 1-day high stage.

Water-table levels were usually similar to river stage in the low plain. Porous limestone bedrock close to the surface probably allowed for good hydrologic connections between the river and the surrounding ground water. Water-table levels were higher than the river in the lower and upper slopes, with highest water-table levels usually at the greatest distance from the stream (fig. 9). Sometimes, water-table levels were closer to the land surface in the lower slope than they were in the other two plots. Water-table measurements indicated that for both the low plain and the lower slope, water-table levels were within 45 cm of the surface most of the time from December 1988 to September 1990. However, mean monthly river stages in that period were above normal for all months except for August and September 1990.

Measurements in a shallow well in the low plain (32 cm deep and 28 m from the main channel, not shown in fig. 9) indicated that slowly permeable clayey soil horizons were holding water above the underlying limestone water table. Occasional observations of shallow puddles of water and frequent observations of saturated soils on the surface in low areas of the low plain supported this assumption.

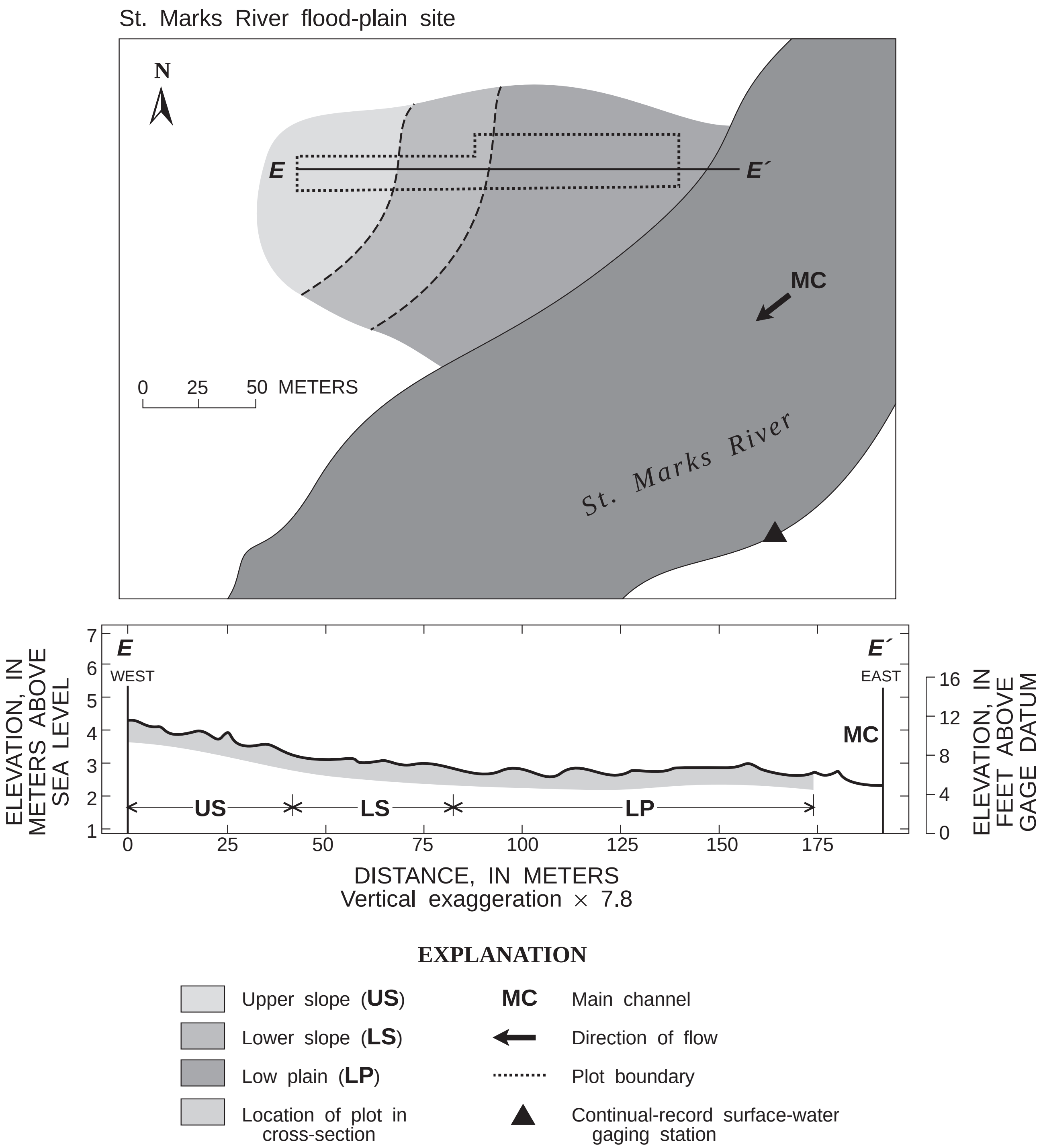


Figure 8. Location, study-plot boundaries, and elevation of flood-plain features at the St. Marks River site.

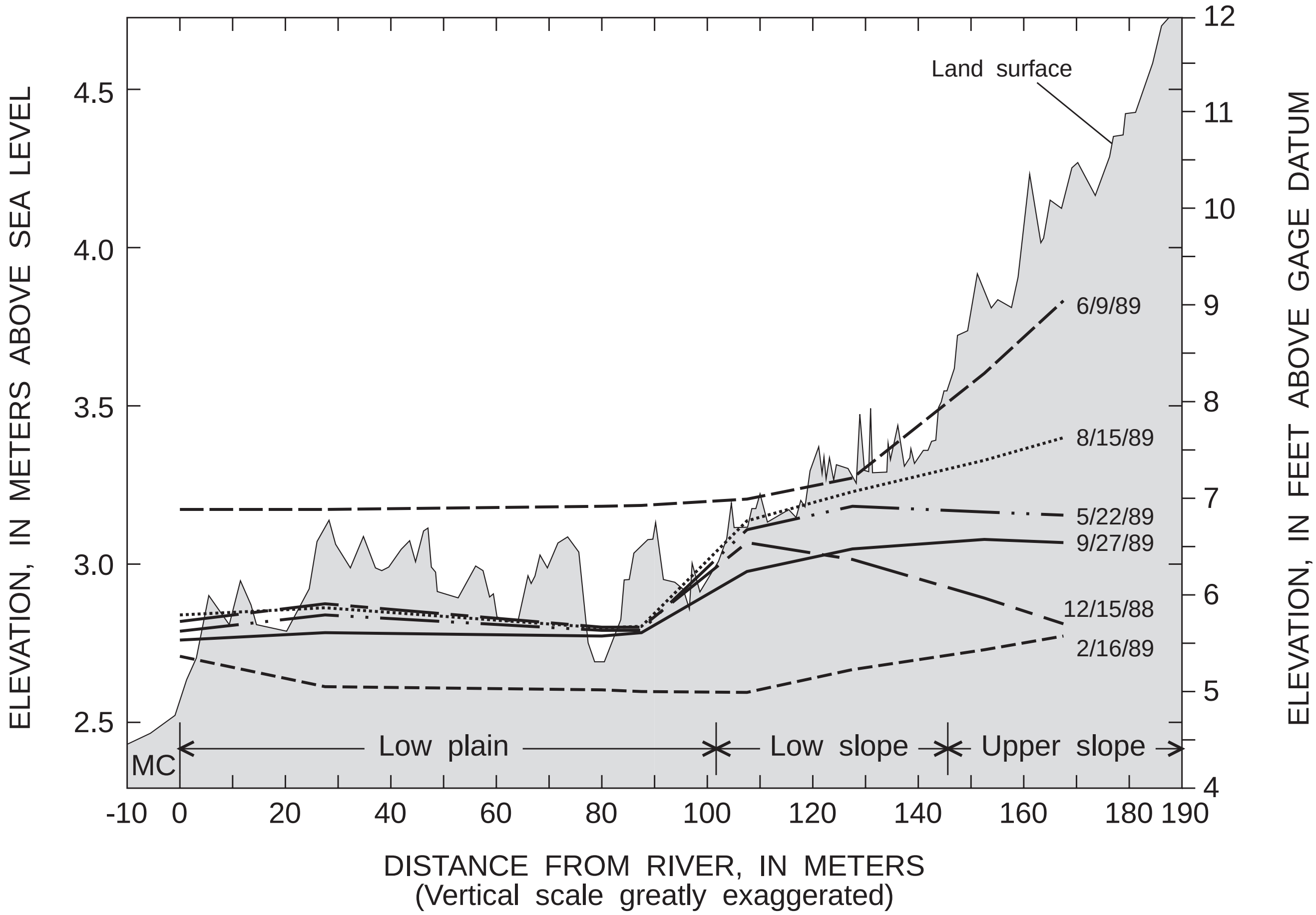


Figure 9. Selected measurements of ground-water and surface-water levels at the St. Marks site in relation to land surface. Six of nineteen measurements taken from November 28, 1988, to September 13, 1990, were selected as representative of ground-water and surface-water conditions at this site. (MC is main channel.)

FLOOD-PLAIN SOILS AND VEGETATION

Table 4 summarizes soil and vegetation descriptions for each of the flood-plain plots. Soils at each site had different compositions with Ochlockonee depressions and low terraces having silt loams, Ochlockonee high terraces and Aucilla River flood plain soils having sandy loams, Telogia Creek flood plain soils having high muck content, and St. Marks River flood plain soils containing the most clay. Vegetation varied on each flood plain, but was most similar on the Aucilla and the Ochlockonee River flood plains.

Ochlockonee River Flood Plain

Alluvial sediments on lower elevations in the Ochlockonee River flood plain contained more silt than did sites on the other three streams (table 4). Generally, depressional soils contained the highest percentage of silt and high-terrace soils contained the highest percentage of sand. There were exceptions to this; for example, coarse sand was present at a depth of 55 cm underlying silty horizons in a depression at one of the secondary sites. That area was probably part of the main river channel in recent geologic time, and silty soils covered the coarse riverbed sands after the river changed course.

Table 4. Summary of soils and vegetation at ten study plots on four north Florida streams

[Taxonomic classifications of soils give subgroups only in this table; families are listed in appendix III. The active root zone of most plants is probably within the upper 30 cm of the soil, but soil textures are given for the upper 45 cm to convey a general impression of the drainage and water-holding capacity immediately below the root zone. Common plant species are those species that are 12 percent or more by relative basal area in the canopy, by relative density in the subcanopy, and by percentage of all vegetative ground cover measurements in the ground cover. cm, centimeters; c, canopy; sc, subcanopy; gc, ground cover; ss, spring/summer; fw, fall/winter]

Plots	Primary soil textures in upper 45 cm	Drainage class and Soil classification	Common plant species
OCHLOCKONEE Depressions[1]	Silt loam Silt Fine sandy loam	Very poorly drained, Typic Haplaquents	*Nyssa ogeche* (c) *Taxodium distichum* (c) *Fraxinus caroliniana* (sc,gc-ss&fw) *Panicum rigidulum* (gc-ss&fw) *Brunnichia ovata* (gc-ss&fw)
OCHLOCKONEE Low terraces[1]	Silt loam Fine sandy loam Loam	Poorly drained, Typic and Humic Haplaquepts	*Quercus laurifolia* (c) *Acer rubrum* (c) *Ilex decidua* (sc) *Fraxinus caroliniana* (sc) *Brunnichia ovata* (gc-ss) *Panicum rigidulum* (gc-ss&fw)
OCHLOCKONEE High terraces[1]	Fine sandy loam Loamy fine sand	Moderately well drained, Typic Udipsamments and Typic Dystrochrepts	*Pinus glabra* (c) *Liquidambar styraciflua* (c,sc) *Quercus virginiana* (c) *Quercus nigra* (c) *Ilex opaca* (sc) *Ilex decidua* (sc) *Vaccinium arboreum* (sc) *Panicum dichotomum* (gc-ss&fw) *Chasmanthium laxum* (gc-ss&fw)
AUCILLA Low terrace	Sandy loam Mucky sandy loam Loamy sand Sand	Very poorly drained, Aeric Fluvaquents	*Quercus laurifolia* (c) *Liquidambar styraciflua* (c) *Fraxinus caroliniana* (sc) *Ilex decidua* (sc) *Hypoxis leptocarpa* (gc-ss&fw) *Osmunda regalis* (gc-ss&fw) *Panicum rigidulum* (gc-fw) *Quercus sp.* (gc-fw)
AUCILLA High terrace	Sandy loam Loamy sand Sand	Poorly drained, Grossarenic Paleaquults	*Quercus laurifolia* (c,sc) *Quercus nigra* (c) *Quercus virginiana* (c) *Ilex decidua* (sc) *Sebastiania fruticosa* (gc-ss&fw) *Sabal minor* (gc-fw)
TELOGIA Slough	Sand Mucky sand	Very poorly drained, Typic Psammaquents	*Nyssa ogeche* (c) *Fraxinus caroliniana* (sc) *Acer rubrum* (sc) *Fraxinus sp.* (sc) *Smilax walteri* (gc-ss&fw) *Cyrilla racemiflora* (gc-ss&fw)

Table 4. Summary of soils and vegetation at ten study plots on four north Florida streams--Continued

Plots	Primary soil textures in upper 45 cm	Drainage class and Soil classification	Common plant species
TELOGIA Low plain	Sand Mucky loamy sand	Very poorly drained, Typic Psammaquents	*Nyssa ogeche* (c,sc) *Quercus laurifolia* (c,gc-ss&fw) *Liquidambar styraciflua* (sc) *Acer rubrum* (sc) *Smilax rotundifolia* (gc-ss&fw) *Fraxinus sp.* (gc-ss)
ST. MARKS Low plain	Sandy clay loam Clay loam Clay (Depth to limestone ~60 cm)	Very poorly drained, Mollic Ochraqualfs	*Carpinus caroliniana* (c) *Liquidambar styraciflua* (c) *Cornus foemina* (sc) *Viburnum obovatum* (sc) *Toxicodendron radicans* (gc-ss) *Carex cherokeensis* (gc-fw)
ST. MARKS Lower slope	Fine sandy loam Sandy loam Sandy clay loam Loamy sand (Depth to limestone ~140 cm)	Very poorly drained, Typic Ochraqualfs	*Liquidambar styraciflua* (c) *Magnolia virginiana* (c) *Carpinus caroliniana* (c,gc-ss&fw) *Taxodium distichum* (sc) *Cornus foemina* (sc) *Toxicodendron radicans* (gc-ss)
ST. MARKS Upper slope	Sand Fine sandy loam Sandy clay Sandy clay loam (Depth to limestone ~80 cm)	Somewhat poorly drained, Aeric Albaqualfs	*Pinus taeda* (c) *Liquidambar styraciflua* (c,sc) *Carpinus caroliniana* (c,sc) *Vitis rotundifolia* (sc) *Vitis aestivalis* (sc) *Magnolia grandiflora* (gc-fw) *Toxicodendron radicans* (gc-ss) *Cornus florida* (gc-fw)

[1]Ochlockonee River plots represent combined measurements from three different sites.

Soil characteristics indicated that low-terrace and depression soils had a much wetter root-zone environment than did high-terraces soils (app. III. A,B,C). Soil matrix colors in the root zone were grayer in low terraces and depressions (with chromas of 1 and 2) than were matrix colors in high terraces (with chroma of 3). Mottles were much higher in profiles of low-terrace and depression soils (5 cm) than were mottles in the high-terrace profile (100 cm). Low-terrace and depression soils were both taxonomically classified with aquic suborders; high-terrace soils were not. Low-terrace and depression soils were considered to be poorly drained and very poorly drained, respectively; high-terrace soils, which were moderately well drained, were the best drained soils of all 10 plots in this study. Visual observations of the soil surface on high terraces were made within a day after floods receded and shortly after heavy local rains, and high-terrace soils were never observed to be wet to the surface.

Tree communities in the Ochlockonee River flood plain were distinctly different in each topographic zone. Depressions were visually dominated by the knobby, swollen trunks of *Nyssa ogeche* trees, many of which had broken or missing main stems and numerous suckers and secondary trunks. This species made up over 58 percent of the total basal area of the canopy in depressions (app. IV.A) and was also common along the edges of ponds and sloughs. Although large *Nyssa aquatica* trees were present in the flood-plain pond at the primary site, this species did not occur on any of the study plots. *Taxodium distichum* trees with skirt-like flared bases were about half as common as *Nyssa ogeche* in the canopy of depressions. Occasional individuals of *Taxodium distichum* were of large diameter; one tree had a diameter of 88 cm above the flared base. Subcanopy trees were commonly mature specimens of *Fraxinus caroliniana*. Only two subcanopy trees in the depressions, one *Nyssa ogeche* and one *Taxodium distichum,* belonged to species which were important in the canopy.

Although the range of elevations in depressions overlapped those of low terraces, *Quercus laurifolia*, which dominated the low terraces, was absent in depressional zones. *Acer rubrum* was second in importance to *Quercus laurifolia* in the low-terrace canopy (table 4). The subcanopy was sparse. Small groups of *Ilex decidua* trees occurred on low terraces, making it the most common subcanopy species with *Fraxinus caroliniana* the second most common.

High terraces were more densely forested with a greater variety of species than either the depressions or low terraces. Three of the four most important canopy species on the high terraces (*Pinus glabra, Quercus virginiana*, and *Quercus nigra*) were absent in depressions and low terraces. The fourth species, *Liquidambar styraciflua*, was present on all zones but decreased in importance with increasing depth and duration of flooding.

The ground cover on depressions and low terraces was especially sparse, probably because flooding was particularly long and deep on those plots. In fall-winter only 6 percent of the line transects in either zone was intercepted by ground cover. Although *Brunnichia ovata* was present only at the primary site, its habit of producing prostrate runners that crisscrossed the ground surface gave it the highest coverage of any ground-cover species on both depression and low-terrace line transects.

High terraces were much more densely vegetated with ground cover than were lower zones. Two-thirds of the line transects sampled in spring on high terraces were intercepted by ground-cover plants. Nearly half of this ground cover was perennial grasses (*Gramineae*), primarily *Panicum dichotomum* and *Chasmanthium laxum*. *Panicum rigidulum* was the most important herbaceous plant in the ground cover of both depressional areas and low terraces, but was insignificant or absent on the high terraces. Perennial grasses, constituting more than 30 percent of ground cover measured on all plots combined, were a more important component of the flood-plain ground-cover vegetation of the Ochlockonee River than that of the other three streams.

Aucilla River Flood Plain

Sandy loam, loamy sand, and sand were the dominant textures in the upper 45 cm on both plots (table 4). Percentage of sand in the profiles was quite variable from one location to another on each of the plots, which is typical of alluvial deposits.

Soils on both low and high terraces were classified taxonomically with aquic suborders; however, soil characteristics indicated that low-terrace soils had a wetter root-zone environment than high terraces (app. III.D,E). Soils in the low-terrace plot had higher organic matter content than in the high-terrace plot, as evidenced by a 10-cm layer of mucky sandy loam in the root zone and somewhat darker soil colors overall. On the low-terrace plot, soil matrix colors in the root zone had chromas of 1 and 2 only; the high-terrace plot contained a horizon of chroma 3 in the root zone. Organic stains and streaks were prominent in the low-terrace profile, but faint in the profile of the high terrace. The low terrace was very poorly drained; the high terrace was poorly drained. Field observations indicated that soils of both plots did not remain wet to the surface after floods receded.

The Aucilla low terrace was more similar in plant composition to Ochlockonee low terrace than to other plots in the study (table 4). *Quercus laurifolia* strongly dominated the canopy of both plots, and the two most common subcanopy species, *Fraxinus caroliniana* and *Ilex decidua*, were the same on both. However, density of subcanopy trees and ground-cover vegetation on the Aucilla low terrace was much greater than that on Ochlockonee low terraces.

Three species of oaks, *Quercus laurifolia*, *Quercus nigra*, and *Quercus virginiana*, dominated the canopy of the high terrace. The largest individual was a *Quercus virginiana*, with a diameter of 64 cm. Important subcanopy species were *Ilex decidua* and *Quercus laurifolia*.

Panicum rigidulum produced the greatest amount of ground cover in the fall survey of the low terrace at Aucilla, but was unimportant in the summer survey (app. IV.D). On all Aucilla and Ochlockonee plots where significant amounts of this species were observed, its importance diminished in the spring-summer survey. *Panicum rigidulum* is a fall-blooming plant and the late season growth and bloom stalks increase coverage on fall-winter transects. This plant was absent on the Aucilla high terrace.

In the fall survey of the Aucilla low terrace, *Hypoxis leptocarpa* was significant, contributing 12 percent of the total vegetation; but in the summer survey this percentage rose to 36 percent, making it the most important plant in the ground cover. In the summer survey, the large, light-green fronds of *Osmunda regalis* made it the most visually conspicuous ground-cover species on the low terrace and second in actual coverage. Herbaceous species constituted over 70 percent of low-terrace ground cover. This contrasted strongly with high-terrace ground cover, which was nearly 95 percent woody species.

The Aucilla high terrace was covered with shrubs approximately 1 to 1.5 m in height, most notably *Sebastiania fruticosa.* Although not encountered on the line transect, *Toxicodendron radicans* growing on this plot also had a tall, shrubby, growth habit. The ground surface underneath these shrubby ground-cover plants was virtually bare. Woody vines on both high and low terraces were relatively uncommon (4 percent of total cover). This contrasted with much higher densities of woody vines (19 to 32) percent on flood plains of the other three streams.

Telogia Creek Flood Plain

Soils of Telogia Creek flood plain had the highest organic matter content of all four river flood plains (table 4). In the upper 45 cm, Telogia Creek flood-plain soils were dominated by sand, mucky sand, and mucky loamy sand. Muck was below the mineral horizons on both plots.

Soil characteristics indicated that the root-zone environment of both plots was relatively wet (app. III.F,G). Soils on both plots were classified taxonomically with aquic suborders and were very poorly drained. However, conditions on the low plain were variable depending upon the thickness of surface sands over mucky subsurface horizons. In areas with a thick surface layer of sand, such as along the narrow riverbank levee, drier soil conditions existed on the surface, creating slightly drier microhabitats for shallow-rooted ground-cover vegetation. Where surficial sand layers were thin, the root-zone environment was considerably wetter because of the high water-holding capacity of the mucky loamy sands just below the surface. Soils on the low plain were never observed to be wet to the surface during numerous field visits. Surface sands on the low plain appeared to drain quickly after floods receded. However, most of the root zone (except along the riverbank levee) was probably saturated much of the time because of mucky subsurface soils that were frequently rewetted by short floods occurring 6 to10 times per year. Field observations indicated that soils in the slough were frequently saturated, as would be expected from the high water table and frequent flooding in the slough.

Nyssa ogeche dominated the canopy of both plots on Telogia Creek (table 4); however, in visual appearance the two plots were very different. In the slough, *Nyssa ogeche* trees were larger, with more swollen bases and often with multiple trunks similar to those in Ochlockonee sloughs and depressions. *Nyssa ogeche* on the low-plain plot were generally single-trunked, with smaller, less swollen bases. Oaks were uncommon on the low plain and absent in the slough. *Fraxinus caroliniana* was the most common tree in the subcanopy of the slough plot. Young *Nyssa ogeche* trees were frequent in the subcanopy of the low plain. *Taxodium distichum* stumps were present on both plots, indicating that logging may have altered the composition of the forest.

Woody plants constituted over 92 percent of the ground cover of both plots (app. IV.F,G). *Smilax* vines were much more common on Telogia plots (16-26 percent) than they were on plots on the other three river flood plains (0.1-4 percent). *Smilax walteri* was the dominant vine along the banks and in the shallower parts of the slough; whereas *Smilax rotundifolia* was the dominant vine on the low plain. On the low plain, much of the other woody vegetation in the ground cover was young trees such as *Quercus laurifolia, Fraxinus sp.*, and *Acer rubrum*. Shrubs such as *Cyrilla racemiflora* were important in the ground cover of the slough plot.

St. Marks River Flood Plain

Soils of the St. Marks River plots had a higher clay content than those of the other three streams, which made them the finest textured soils of the study (table 4). The low-plain soils had the highest clay content; the lower-slope soils had the lowest. Limestone bedrock was close to the surface at the St. Marks site. Depth to the underlying limestone was least in the low plain (approximately 60 cm) and greatest in the lower slope (approximately 140 cm).

Soils on all three plots were classified taxonomically with aquic suborders; however, hydric soil characteristics in the upper 45 cm were absent in the upper-slope plot (app. III.H,I,J). In the two lower plots, gray colors and high organic matter content provided evidence of a wet root-zone environment. The two lower plots were very poorly drained; the upper-slope plot was somewhat poorly drained.

Field observations indicated that soils in low areas of the low plain and throughout the lower slope remained wet to the surface for several weeks after flooding or local rains. In one instance, soils in the lower slope were wet to the surface with the water table at a depth of 66 cm (app. III,I). At the time of that observation (end of the 1989 growing season), conditions were dry; no rain had occurred in 3 to 4 weeks and the most recent flood had receded 4 months earlier. Because water is seldom raised to a height of 66 cm by capillary forces alone, another source of water was suspected, probably seepage from the adjacent upland.

Carpinus caroliniana and *Liquidambar styraciflua* were important in the canopy and present in the subcanopy of all three plots (table 4). Seedlings and saplings of *Carpinus caroliniana* were common in the ground cover of all plots, and had the greatest percentage of cover of any species on the lower slope in both spring-summer and fall (app. IV.H,I,J).

Magnolia virginiana was the second most important canopy species on the lower slope. *Magnolia virginiana* was present in the canopy and subcanopy on the low plain and lower slope but not on the upper slope. *Cornus foemina*, a subcanopy species, was the most common subcanopy plant on the low plain, shared importance in the subcanopy of the lower slope with *Taxodium distichum*, and was absent on the upper slope. *Viburnum obovatum*, a small colonial tree, was the second most common subcanopy species on the low plain.

Pinus taeda was the dominant tree of the upper slope. This species was present on the lower slope (one large individual on a hummock), but was absent on the low plain. *Vitus rotundifolia* vines were the dominant subcanopy species on the upper slope. This was the only plot in the study with a stratum dominated by a woody vine.

The St. Marks plots had the most dense ground-cover vegetation of the four river flood plains. Total vegetative measurements were 110 to 180 percent of the transect length compared to 6 to 73 percent for all other plots. Two trends were evident in comparing the three St. Marks plots to each other: the percentage of cover by sedges (*Cyperaceae*) decreased and the percentage of woody vegetation increased from the low plain to the upper slope. Sedges constituted over 21 percent of the ground cover on the low plain compared to 7 percent of the upper slope. Woody plants were 57 percent of the cover on the low plain and 83 percent of the cover on the upper slope.

Spring-summer surveys of the site produced markedly different results from the fall surveys due to the dormancy of *Toxicodendron radicans* in fall and winter. During the spring-summer surveys, a carpet of *Toxicodendron radicans* covered all topographic zones. It was the most important ground-cover species overall with coverage of 22 percent of the line transect. In the fall survey, each *Toxicodendron radicans* plant was reduced to a mere upright twig and total coverage decreased to 5 percent.

STATE AND FEDERAL WETLAND DETERMINATIONS

State wetland determinations at the study sites were based on regulations in use in 1991 (Section 17-301 of the F.A.C., and Chapter 403 of the Florida Statutes). Federal determinations were based on wetland delineation methodology in the 1989 Federal manual (Federal Interagency Committee for Wetland Delineation, 1989). Hydrology, soils, and vegetation data are presented in detail in appendixes so that updated wetland determinations can be made for the study sites whenever changes in the regulations occur.

Wetland determinations made without the benefit of long-term hydrologic data were tested in the first part of this section to determine how well they coincided with known hydrologic conditions. This comparison was made because long-term hydrologic data are not usually available at most sites. Inconsistencies were greatest at the two levee communities, Ochlockonee and Aucilla high terraces. Both plots failed to meet State wetland criteria based on plant and soil evidence (primarily canopy vegetation), but met wetland criteria when hydrologic records were consulted. Only one plot, Ochlockonee high terrace, had a Federal nonwetland determination that was reversed when hydrologic records were consulted. Duration of average annual longest flood was almost 2 weeks for both plots.

In the second part of this section, wetland indicator status of canopy, subcanopy, and ground-cover strata is evaluated. State wetland indicator status of the ground-cover stratum was often inconsistent with indicator status of the two upper strata.

In the third part, common flood-plain species considered upland by the State are discussed and hydrologic conditions associated with these species are reported. Most were ground-cover species and one-third were vines. Including all common as well as uncommon species, a total of 102 ground-cover species on annually flooded plots of this study were not on the State wetland species list.

In the fourth part, the accuracy of National Wetland Inventory (NWI) classifications at the study sites is addressed. The water regime and vegetation type indicated on NWI maps were compared with known hydrologic conditions and vegetation at each plot.

Wetland Determinations Made With and Without the Benefit of Long-Term Surface-Water Records

State and Federal wetland determinations are based upon the presence or absence of (1) wetland vegetation, (2) hydric soils, and (3) wetland hydrology. In many wetlands, hydrologic conditions vary with the seasons, and water might not be present at the time the site is visited and the wetland determination is made. Records indicating the amount of annual flooding or saturation that typically occurs at the site are desirable, but are usually not available. Hydrologic conditions are assessed indirectly by noting the presence or absence of field indicators of wetland hydrology, except in rare cases when hydrologic data are available. Thus wetland determinations are based primarily on vegetation and soils. In this study, State and Federal wetland determinations made without the benefit of hydrologic records were tested at sites where long-term hydrologic records were available (tables 5 and 6).

Two plots on Ochlockonee and Aucilla high terraces were called nonwetland by the State when determinations were made without the benefit of hydrologic records, but met wetland criteria when hydrologic conditions were known (table 5). All vegetative strata on both plots were considered nonwetland by the State. Hydric soil characteristics were absent in the moderately well-drained soils of Ochlockonee high terraces. Soils were marginally hydric on the Aucilla high-terrace plot, where evidence of hydric conditions was limited to faint mottles in the A2 horizon and organic streaks below the A2 horizon. When long-term hydrologic records showing regular and periodic inundation were considered, jurisdictional determinations were reversed and both plots met State wetland criteria. Average annual longest flood was almost 2 weeks and duration of all flood events combined was approximately 7 percent on both plots.

Only one plot, Ochlockonee high terrace, had a Federal nonwetland determination that was reversed when hydrologic records were consulted (table 6). Ochlockonee high-terrace vegetation met Federal wetland criteria, but soils failed to indicate the 8 to 19 days of flooding that occurs annually on that plot.

Vegetation on all 10 plots was considered to be hydrophytic by Federal criteria, even in the case of the St. Marks upper slope which was flooded infrequently (once every 5-40 years). There was a very high percentage of facultative species in the canopy (93 percent) and subcanopy (100 percent) on that plot. The St. Marks upper slope lacked hydric soils or other indicators, thus the final determination of "nonwetland" for that plot was consistent with hydrologic records.

Federal wetland hydrology criteria were only marginally met at the Telogia low-plain plot despite the fact that strong evidence of wet conditions were present in the soils and vegetation of this plot. Mucky soil in the root zone of the Telogia plot appeared to be saturated much of the year and an obligate wetland species, *Nyssa ogeche*, made up 62 percent of the relative basal area of the canopy vegetation. This site only marginally met Federal wetland hydrology criteria for two reasons. First, hydrologic criteria require a minimum flood duration of 7 consecutive days, but have no provisions for shorter floods that occur many times a year. Individual flood events are frequent on this plot (6-10 times per year) but typically less than a week in duration. Second, the intent with regard to the saturation criteria is for soils to be saturated to the surface (Sections 2.8 and 2.9, Federal Interagency Committee for Wetland Delineation, 1989). Flood-deposited sands of variable thickness cover the surface of this plot. The narrow riverbank levee has the deepest sand deposits (as much as 40 cm). Most of the plot lies behind this levee and has a shallower layer of sand on the surface (0-10 cm) with mucky subsoils in the root zone. These mucky buried layers remain wet for long periods, but wetness to the surface is relatively brief because the sandy surface layer dries out quickly after floods recede.

Wetland Indicator Status of Vegetative Strata

Federal wetland determinations give equal weight to canopy, subcanopy and ground-cover strata. Current State methodology requires use of the uppermost stratum. Under certain conditions, however, State wetland determinations may be based on the dominant plant species in one of the two lower strata. For example, in flood plains that have been selectively harvested for timber leaving a predominance of upland canopy species, a lower stratum could be used to make a wetland determination when strong evidence of regular and periodic inundation exists. Ground-cover species could also play a greater role in wetland determinations if future changes in the regulations require equal consideration of all three strata.

State wetland indicator status of the ground-cover stratum was often inconsistent with indicator status of the two upper strata. On 5 of the 10 plots, canopy vegetation met State wetland criteria but ground cover did not (table 7). On the basis of the national list (Reed, 1988), all five of these plots had wetland ground-cover vegetation. Weighted averages, which are calculated using indicator categories from the national list, were less than 2.4 at four of the five plots, and ranged from 2.36 to 2.62 at the fifth plot (St. Marks lower slope). Wentworth and others (1988), considered a weighted average of 3.0 to be the breakpoint between wetland and upland; however, a score less than 2.5 was considered a more definitive indicator that the site was a wetland. The Federal manual gives a range from 3.0 to 3.5 as the breakpoint between wetland and upland for "prevalence indexes," which are based on the same indicator categories as weighted averages and are calculated in a similar manner (Federal Interagency Committee for Wetland Delineation, 1989).

Seasonal changes in composition of the ground cover were large at many plots, and on one plot, Aucilla low terrace, State wetland vegetation determinations reversed with the seasons (table 7). The ground-cover stratum on that plot met State wetland vegetation criteria in the fall but failed to meet criteria in the summer, primarily because of seasonal changes in coverage of *Hypoxis leptocarpa*.

Hydrologic Conditions Associated with Individual Plant Species

Hydrologic conditions associated with individual plant species are reported in table 8 and appendix V. Twenty-one common flood-plain species that the State classifies as "upland" or "invisible" are listed in table 8 with long-term duration of inundation for each species. Long-term flood durations for the most common flood-plain plant species at ~~each site (regardless of their Sta~~te or Federal wetland indicator status) are presented in appendix V. Durations are not reported separately for each plot; durations at plots on the same river are combined and reported by site. Caution is needed in interpreting flood durations for individual species for three reasons. First, these numbers represent duration of surface-water flooding only. Duration of soil saturation in the root zone strongly influences the plant communities at the Telogia and St. Marks sites, but it was not numerically quantified in this study. Flood durations for species at those two sites are sometimes misleading because the numbers do not account for the long periods of soil saturation that occur there. For example, whole-year flood durations for *Liquidambar styraciflua* averaged 16 days for Ochlockonee and 34 days for Aucilla where this species grew mostly on unsaturated soils, and averaged 6 days for Telogia, and 4 days for St. Marks where the root zone of this species was saturated much of the time (app. V.A).

Second, it is important to recognize that mean or median flood durations for individual species might be skewed by plot size, transect length, and location. Sampling plots were not located along a gradient from wetland to upland except on the St. Marks River. Plots varied in size at all sites, and a limited range of flood durations were sampled by each plot. Thus, caution should be used in making comparisons among mean and median durations. For example, on the Ochlockonee River, *Quercus virginiana* and *Vaccinium arboreum* might have had considerably shorter mean flood durations if sampling had included an adjacent nonwetland as it did on the St. Marks River. Conversely, mean flood durations for *Nyssa ogeche* on Telogia Creek would have been much longer if more of the slough habitat had been sampled. The flood durations for each species should be used in conjunction with ranges of flood durations for each site (app. V) to account for this limitation of the data.

Table 5. State jurisdictional wetland determinations on four north Florida river flood plains with and without the benefit of hydrologic records

[Vegetation is the primary evidence and, in most cases, the only evidence used by the State in jurisdictional wetland determinations. Soils are usually not checked; but if they are, hydric soils must be present "to corroborate the finding of jurisdiction based on vegetation" (Section 403.913 (3), Florida Statutes). See appendixes II, III, and IV for detailed information upon which these determinations are based]

Plots	Does indicated plot: Meet wetland vegetation criterion?[1]	Does indicated plot: Meet hydric soil criterion?	Without the benefit of hydrologic data, would indicated plot: Have other indicators of inundation?[2]	Without the benefit of hydrologic data, would indicated plot: Be determined to be a jurisdictional wetland?	With known elevations and hydrologic records, would indicated plot: Be determined to be a jurisdictional wetland?
OCHLOCKONEE Depressions	Yes (a)	Yes	Yes	YES	YES
OCHLOCKONEE Low terraces	Yes (a)	Yes	Yes	YES	YES
OCHLOCKONEE High terraces	No	No	Yes[3] (faint)	NO	YES[5]
AUCILLA Low terrace	Yes (b)	Yes	Yes	YES	YES
AUCILLA High terrace	No	Yes[4] (marginal)	No	NO	YES[5]
TELOGIA Slough	Yes (a)	Yes	Yes	YES	YES
TELOGIA Low plain	Yes (a)	Yes	Yes	YES	YES
ST. MARKS Low plain	Yes (a)	Yes	Yes	YES	YES
ST. MARKS Lower slope	Yes (a)	Yes	Yes	YES	YES
ST. MARKS Upper slope	No	No	No	NO	NO

[1] The letters (a) and (b) in this column indicate whether wetland vegetation criterion are met for paragraph (a) or (b) in section 17-301.400(1), F. A. C. If vegetation meets the (a) criterion, no additional evidence is required for the area to be considered a jurisdictional wetland. If the vegetation meets the (b) criterion, other indicators of inundation must be present for the area to be determined to be a jurisdictional wetland.

[2] Other indicators of inundation included one or more of the following: hydric soil characteristics which indicate saturation to the surface, swollen tree bases, cypress knees, adventitious roots, prop roots, water marks (resulting from either lichen lines, moss or liverwort lines, or discoloration), water-borne debris, sediment on trunks, drift lines, secondary flow channels, and crayfish chimneys.

[3] Faint water marks were present on a few trees. Some surface scouring and drift lines were evident for a short period after annual flooding, but were not obvious during most of the year.

[4] Faint mottles in the A2 horizon and organic streaks below the A2 horizon were the only evidence of hydric conditions.

[5] State wetland regulations are intended to cover areas that are regularly and periodically inundated (Section 403.817 (2), Florida Statutes). According to Section 403.913 (2), Florida Statutes, areas flooded annually by rivers or other recognizable water bodies are considered to be jurisdictional wetlands by the State regardless of the plants and soils present in those areas because they are in fact regularly and periodically inundated (R.W. Cantrell, Florida Department of Environmental Regulation, oral commun., 1991). Because long-term gage records indicate that floods occur 1 to 3 times per year on the Ochlockonee and Aucilla high terraces with annual longest floods lasting 2 consecutive weeks on the average, both plots would be determined to be jurisdictional wetlands based on recorded hydrologic evidence.

Table 6. Federal jurisdictional wetland determinations on four north Florida river flood plains with and without the benefit of hydrologic records

[Criteria are from 1989 Federal Manual (Federal Interagency Committee for Wetland Delineation, 1989). See appendixes II, III, and IV for detailed information upon which each determination is based]

Plots	Does indicated plot meet hydrophytic vegetation criterion?	Without the benefit of hydrologic records, would indicated plot:			With known elevations and hydrologic records, would indicated plot:	
		Meet hydric soil criterion?	Have field indicators of wetland hydrology?	Be determined to be a jurisdictional wetland?	Meet wetland hydrology criterion?	Be determined to be a jurisdictional wetland?
OCHLOCKONEE Depressions	Yes	Yes	Yes	YES	Yes	YES
OCHLOCKONEE Low terraces	Yes	Yes	Yes	YES	Yes	YES
OCHLOCKONEE High terraces	Yes	No	Yes[2] (faint)	NO	Yes	YES[3]
AUCILLA Low terrace	Yes	Yes	Yes	YES	Yes	YES
AUCILLA High terrace	Yes	Yes[4] (marginal)	No[5] (presumed)	YES[5]	Yes	YES
TELOGIA Slough	Yes	Yes	Yes	YES	Yes	YES
TELOGIA Low plain	Yes	Yes	Yes	YES	Yes[6] (marginal)	YES
ST. MARKS Low plain	Yes	Yes	Yes	YES	Yes	YES
ST. MARKS Lower slope	Yes	Yes	Yes	YES	Yes	YES
ST. MARKS Upper slope	Yes	No	No	NO	No	NO

[1] Field indicators of wetland hydrology included one or more of the following indicators described in Section 3.37 of the 1989 Federal Manual: swollen tree bases, cypress knees (pneumatophores), adventitious roots, shallow or exposed roots, water marks, water-borne sediment deposits, drift lines, and surface-scoured areas.

[2] Faint water marks were present on a few trees. Some surface scouring and drift lines were evident for a short period after annual flooding, but were not obvious during most of the year.

[3] With an average annual longest flood duration known to be 13 days in the Soil Conservation Service growing season, this plot is presumed to have hydric soils (Section 2.7, paragraph 4 of 1989 Federal Manual) and thus meets all three criteria for a jurisdictional wetland.

[4] Faint mottles in the A2 horizon and organic streaks below the A2 horizon were the only evidence of hydric conditions.

[5] There were no apparent field indicators of wetland hydrology, but according to Section 3.36 (page 17) of the Federal Manual: "In the absence of visible evidence of significant hydrologic modification, wetland hydrology is presumed to occur in an area having hydrophytic vegetation and hydric soils." (The "significant hydrologic modification" intended here is a lowered water table that is not yet reflected in the soils. Hydric characteristics can remain in the soil long after an area has been drained. The low level dam present at this site is a hydrologic modification but would not affect this determination because it raised rather than lowered water levels.)

[6] Duration of average annual longest flood was 4 to 8 days. Soils just under the surface were wet for extended periods of time but were covered by shallow sands that dried out rapidly after floods receded. Thus criteria requiring "saturation to the surface" were not fully met and this plot was considered to marginally meet hydrology criteria.

Table 7. Summary of State wetland vegetation determinations, Federal wetland vegetation determinations, and weighted averages based on national indicator categories for four north Florida river flood plains

[These determinations are based on detailed vegetation data presented in appendix IV. The letters (a) and (b) in the State section of the table indicate whether wetland vegetation criterion are met for paragraph (a) or (b) in Section 17-301.400(1), F.A.C. The Federal determination in the center column was derived using methods similar to the Comprehensive Quadrat Sampling procedure in Part 4.18 of the 1989 Federal Manual in which dominant species from each stratum are used to determine whether or not the overall plot meets hydrophytic vegetation criterion. Weighted averages were included to provide an assessment of the wetland status of each separate stratum based on indicator categories on the national list (Reed, 1988). Weighted average is the average ecological index, weighted by importance value (Wentworth and others, 1988). See Federal vegetation codes in the glossary for definitions of ecological indexes]

Plots	Is State wetland vegetation criterion met for:					Is 1989 Federal hydrophytic vegetation criterion met for overall plot?	Weighted averages			
	Canopy	Sub-canopy	Ground cover, spring-summer	Ground cover, fall-winter	Overall plot		Canopy	Sub-canopy	Ground cover, spring-summer	Ground cover, fall-winter
OCHLOCKONEE Depressions	Yes(a)	Yes(a)	Yes(a)	Yes(a)	YES(a)	YES	1.06	1.08	1.91	1.72
OCHLOCKONEE Low terraces	Yes(a)	Yes(a)	No	No	YES(a)	YES	2.15	1.75	2.14	2.02
OCHLOCKONEE High terraces	No	No	No	No	NO	YES	2.71	2.90	2.66	2.58
AUCILLA Low terrace	Yes(b)	Yes(a)	No	Yes(a)	YES(b)	YES	2.16	1.34	1.81	1.78
AUCILLA High terrace	No	No	No	No	NO	YES	2.60	2.15	2.31	2.32
TELOGIA Slough	Yes(a)	Yes(a)	Yes(a)	Yes(a)	YES(a)	YES	1.05	1.87	1.80	1.88
TELOGIA Low plain	Yes(a)	Yes(a)	No	No	YES(a)	YES	1.43	2.00	2.38	2.36
ST. MARKS Low plain	Yes(a)	Yes(a)	No	No	YES(a)	YES	2.37	2.16	2.34	2.22
ST. MARKS Lower slope	Yes(a)	No	No	No	YES(a)	YES	2.49	2.36	2.62	2.54
ST. MARKS Upper slope	No	No	No	No	NO	YES	3.00	3.00	3.02	2.99

Table 8. Duration of average annual longest floods for selected flood-plain species considered upland or invisible by the State of Florida

[Species are ranked approximately from wettest to driest. Durations for each species were based on data from the single stratum having the greatest sample size with one exception: subcanopy was used for *Vitis rotundifolia* because seedlings less than 1 year old were very common in ground cover. Medians were reported for canopy and subcanopy species. Means weighted by coverage were reported for ground cover species. Most ground-cover data were from spring-summer transects, but data from fall-winter were used when sample size was larger. Asterisk (*) indicates very small sample size of less than 5 occurrences for canopy and subcanopy species or less than 5 occurrences and less than 1 m of line transect coverage for ground cover species. A period of record of approximately 30 whole water years was used to calculate average annual longest floods. Refer to appendix I for exact period of record for each site. CAUTION: Interpretation of the data in this table is limited because: 1) duration of soil saturation is not included, 2) vegetation data are not normalized for plot size, transect length, nor topographic position, and 3) period of record is not adjusted for age of the plants nor for the fact that some plants are more sensitive to hydrologic conditions in the germination and seedling stage than they are as mature individuals. DER codes: UPL, upland; INV, invisible. Federal codes: FACU, facultative upland; FAC, facultative; FACW, facultative wetland; OBL, obligate wetland; +, indicates trend of wetter habitats; -, indicates trend of drier habitats.]

	DER Code	Federal Code	Duration of average annual longest flood, in days (range in parentheses)			
			Ochlockonee	Aucilla	Telogia	St. Marks
Brunnichia ovata	UPL	FACW-	65.8 (11.1-112.6)			
Hypoxis leptocarpa	UPL	FACW	59.0 (18.5-77.2)	53.8 (12.8-66.4)	31.3*	18.4 (2.5-104.0)
Dyschoriste humistrata	UPL	FACW	48.0 (8.7-77.2)			
Campsis radicans	UPL	FAC	43.4 (10.2-89.1)	53.7* (51.1-60.8)		
Viola esculenta	UPL	FACW-	30.4* (11.1-61.6)			12.1 (7.9-24.0)
Erianthus strictus	UPL	OBL	17.4 (9.4-62.7)	49.6 (40.3-60.8)		
Sebastiania fruticosa	UPL	FACW	22.1 (9.4-63.9)	16.1 (9.6-51.1)	11.8 (3.7-42.3)	
Chasmanthium laxum	UPL	FACW-	9.0 (6.9-76.7)	34.7 (12.8-54.8)	5.4 (4.4-8.6)	
Panicum dichotomum	UPL	FAC	13.5 (5.8-117.2)	14.5*		8.3 (3.6-22.9)
Smilax bona-nox	UPL	FAC	11.0 (6.9-13.0)	16.2 (10.2-25.8)		26.2 (14.3-34.8)
Vaccinium elliottii	UPL	FAC+	10.9 (10.2-11.3)	14.0 (11.1-28.7)		
Cyrilla racemiflora	INV	FACW	11.5 (9.4-13.0)	12.0*	19.0 (4.0-70.8)	
Smilax rotundifolia	UPL	FAC	10.8*	54.8*	6.4 (3.7-11.5)	
Vitis rotundifolia	UPL	FAC	12.2 (6.6-19.1)	11.1*	2.8*	0.4* (0-0.4)
Toxicodendron radicans	UPL	FAC	10.5 (6.0-18.7)			9.6 (0-50.8)
Diospyros virginiana	UPL	FAC		14.5*		3.8* (3.0-14.3)
Bignonia capreolata	UPL	FAC	11.5 (7.2-13.0)		4.2 (3.7-6.6)	0.9* (0.4-1.0)
Sabal minor	UPL	FACW		10.3 (9.6-19.0)		3.1* (0.6-4.5)
Serenoa repens	UPL	FACU	9.0 (7.2-11.8)			
Quercus virginiana	UPL	FACU+	7.2 (5.8-24.2)	10.2* (8.9-11.1)		
Vaccinium arboreum	UPL	FACU	9.4 (8.0-11.3)			

Third, the age of each plant was unknown. Thus, durations calculated from 30 years of hydrologic record may be inappropriate for some short-lived ground-cover species that may be much younger than the period of record. Also, durations based on 30 years of data do not necessarily reflect conditions existing at the time individual canopy and subcanopy plants became established, but do approximately represent hydrologic tolerances once established.

Most of the flood-plain species in table 8 considered "upland" or "invisible" by the State are ground-cover species; nearly one-third are vines. *Brunnichia ovata* is a deciduous woody vine that grew on the Ochlockonee River flood plain. It was more common in the lower areas, making up approximately 20 percent of the ground cover of both the low-terrace and depression plots. Of the vines checked, all prostrate runners were rooted at approximately the same elevations. This species was among the most flood- tolerant species in the Tennessee Valley, according to Hall and others (1946), who classified 65 flood-plain species into three flood-tolerance groups.

Campsis radicans is a woody vine that grows well in upland habitats where no flooding occurs, but also tolerates long periods of inundation in flood plains. *Campsis radicans* was relatively common on three plots where annual floods lasted 5 to 8 weeks or longer (Ochlockonee depression, Ochlockonee low terrace, and Aucilla low terrace). *Campsis radicans* was among the most flood tolerant species in the Tennessee Valley (Hall and others, 1946).

Vitis rotundifolia, one of the most common vines encountered in this study, was present at all four streams and on 8 of the 10 plots. Although present on wetter plots, such as Ochlockonee depression, the species was more common on high-terrace or levee areas and reached its maximum abundance in the subcanopy of the upland plot at the St. Marks site.

Toxicodendron radicans is a common upland plant that can comprise a large proportion of the ground cover in flood plains in the spring and summer. It was one of the most abundant ground-cover species in spring-summer transects on all three St. Marks plots and the Ochlockonee high terrace, and was present on the other two Ochlockonee plots and both Aucilla plots. Percentage of *Toxicodendron radicans* in the ground cover decreased greatly from the spring-summer survey to the fall survey due to fall and winter dormancy.

Hypoxis leptocarpa, the most common herbaceous species in the study, was present on all four streams and on 9 of the 10 plots. It was also abundant throughout the Apalachicola River flood plain (Leitman, 1978). On all four river flood-plain plots in this study, it reached its greatest abundance on the wettest plots and was common where average annual longest floods lasted a month or longer. Seasonal changes in coverage of *Hypoxis leptocarpa* from 12 percent in the fall to 36 percent in the summer caused the State wetland vegetation determination for ground cover on Aucilla low terrace to be reversed with the seasons (table 7). If this one species were considered transitional by the State, the summer low-terrace ground cover would meet State wetland vegetation criteria and be consistent with all other vegetation, soils, and hydrology determinations on this plot.

Two perennial grasses considered upland by the State, *Panicum dichotomum* and *Chasmanthium laxum*, were the most important ground-cover species on the Ochlockonee high-terrace plot in both seasonal surveys. Together they made up 43 percent of both spring and winter ground cover. *Panicum dichotomum* was also an important ground-cover species on Ochlockonee low terraces and was present in lesser amounts on five other plots. One State upland species, which occurred on both Ochlockonee and Aucilla River flood-plain plots, *Erianthus strictus*, is classified as an obligate on the national list.

Sebastiania fruticosa was a common shrub on Ochlockonee, Aucilla, and Telogia plots, where it grew at low as well as high elevations. On all three streams, lowest individuals were growing where average annual longest floods lasted 3 weeks or longer. The abundance of the shrub was greatest on Aucilla high terrace, where it had the highest percentage of transect coverage of any ground-cover species on any plot (41-46 percent). *Sebastiania fruticosa* was absent on all three St. Marks River plots.

Quercus virginiana was present most often in areas flooded approximately 1 week per year; however, some individuals were growing where average annual longest floods were greater than 3 weeks. *Quercus virginiana* was the single species responsible for the nonwetland vegetation determination by the State on both Ochlockonee and Aucilla high terraces. This species constituted 16 to 18 percent of total basal area of the canopy on both plots. Although average elevation of *Quercus virginiana* was high relative to other canopy species, individuals were mixed with other high-terrace species and were not concentrated in a separate higher community. One large *Quercus virginiana* growing at the primary Ochlockonee site (off the plot) survived continuous flooding for 8 weeks in 1980 and 14 weeks in 1983. (Duration of flooding that occurred within the freeze-free growing season was approximately 8 continuous weeks in both events.) Another Ochlockonee high-terrace species considered upland by the State was *Vaccinium arboreum*. It was mixed with other high-terrace species in the canopy and subcanopy of the Ochlockonee high-terrace plots, but unlike *Quercus virginiana*, it grew only on higher elevations of the plots.

Long-term flood durations for species not included in table 8 or appendix V can be estimated by first using the plant index to determine at which plots they occurred, and then referring to the long-term surface-water flood conditions averaged for each plot in appendix II.

One hundred two ground-cover species present on annually flooded plots of this study were not on the State wetland species list. All species data in appendix IV (including presence-absence data) were examined in this count except data for the nonwetland plot, St. Marks upper slope, which was excluded. Simple presence or absence in areas with long flood durations can be particularly valuable information for assessing flood tolerance of individual species. For example, 34 ground-cover species present on Ochlockonee or Aucilla low terraces or Ochlockonee depressions were considered upland by the State. All of these species grew in areas continuously flooded for an average of 5 or more weeks each year, and 15 of them grew in Ochlockonee depressions where annual floods lasted an average of 8 to 15 weeks.

Where disturbance by flooding is frequent, competitive strategies of flood-plain herbs are to either avoid floods or, conversely, tolerate them (Menges and Waller, 1983). Table 8 lists perennials or long-lived species having certain characteristics that enable them to tolerate floods. Other short-lived species complete their life cycle between flood seasons. They recolonize flood plains annually on bare surfaces of seasonally inundated areas that are exposed during dry periods. *Erechtites hieracifolia*, which appeared in the fall survey of Ochlockonee depressions, may be an example of this type of species. It is considered upland by the State, and might be unable to tolerate flooding, but could be adapted to flood-plain habitats because of a short life cycle that is completed between most floods. Menges and Waller (1983) only considered annual species as examples of plants exhibiting the "flood avoidance" strategy; however, in north Florida, some fast-growing perennials might also belong to this group. *Eupatorium semiserratum* and *Cyperus virens* were growing on the Ochlockonee low-terrace line transect in December 1987; but both species had disappeared from the transect by July 1988 after the normal winter-spring flooding in the intervening period.

National Wetlands Inventory Classifications

Water regime and vegetation type indicated on NWI maps of the study sites were compared with known hydrologic conditions and vegetation at each plot. Although small areas are included in map units that do not match the classification for the larger area, comparing mapped classifications of the study plots to onsite descriptions may be useful in assessing the accuracy of NWI classifications in flood-plain forests.

All plots at the study sites were classified on NWI maps as having a "seasonal nontidal" water regime (modifier C). According to Cowardin and others (1979), a seasonally flooded nontidal water regime means that "surface water is present for extended periods, especially early in the growing season, but is absent by the end of the season in most years. When surface water is absent, the water table is often near the land surface." This classification matches known hydrologic conditions relatively well at 5 of the 10 plots: Ochlockonee depressions, Ochlockonee low terraces, Aucilla low terrace, Telogia slough, and St. Marks low plain. The water regime of Telogia low plain and St. Marks lower slope plots would be more accurately described as "seasonally saturated" (modifier E) because surface water flooding does not occur for extended periods; however, when surface water is absent, the water table is often near the surface. "Temporarily flooded" (modifier A) may be the most appropriate water regime descriptor for Ochlockonee high terrace and Aucilla high terrace because duration of surface water flooding is less than 10 percent of the growing season and the water table lies well below the soil surface for most of the season. St. Marks upper slope floods infrequently (once every 5-40 years) and would be more accurately described as "intermittently flooded" (modifier J) or nonwetland.

All plots were classified as *palustrine* (freshwater wetland) forests but varied with regard to subclass. Ochlockonee plots were mapped as "deciduous/broad-leaved evergreen" (subclass 6/3). All three Ochlockonee plots had common canopy species that were deciduous, most of which were broad-leaved (table 4). There were two species of oak, *Quercus virginiana* and *Quercus laurifolia*, that are semievergreen or tardily deciduous that could appear evergreen on aerial photography. Aucilla plots were similar to Ochlockonee with deciduous trees mixed with the same two species of semievergreen oaks, yet that site received a different classification --- "broad-leaved deciduous" (subclass 1). The Telogia site was mapped as "deciduous" (subclass 6) and both plots were dominated by the broad-leaved deciduous species, *Nyssa ogeche*. St. Marks was classified as "deciduous/broad-leaved evergreen" (subclass 6/3). Most of the common canopy species at St. Marks were broad-leaved deciduous. A broad-leaved evergreen species, *Magnolia virginiana*, was common on the lower slope, and a needle-leaved evergreen, *Pinus taeda*, was common on the upper slope.

SUMMARY AND CONCLUSIONS

A study of hydrologic conditions, vegetation, and soils was made in wetland forests of four north Florida streams from 1987 to 1990. The study was conducted by the U.S. Geological Survey in cooperation with the Florida Department of Environmental Regulation to support State and Federal efforts to improve wetland delineation methodology in flood plains.

The first objective was to present background information on hydrologic factors that affect flood-plain vegetation. Seasonal changes in hydrologic effects were examined to understand how hydrologic conditions influence vegetation in the nongrowing season.

- Flood plains are unique wetland environments that are subjected to saturation, inundation, and flow of surface water. All three conditions affect the established vegetation as well as the regeneration of flood-plain species.
- Saturation causes anaerobic conditions when temperatures and rates of biological activity are sufficiently high. Anaerobic conditions are usually harmful to plants, but some plant species are adapted to anaerobiosis or have avoidance mechanisms which enable them to survive. For these species, saturation can be a positive selective factor.
- Inundation might have both detrimental and beneficial effects on flood-plain vegetation. Harmful effects include decreased light penetration to ground-cover species and mechanical injury to inundated plant tissues. Completely submerged plants often have more damage than those partially submerged. Among the beneficial effects of inundation are: selection for species with seeds and seedlings that can survive submersion, selection for species that produce seeds and seedlings at favorable times of the year, protection of submerged seeds and small plants from herbivores, selection for species that can prolong dormancy, and replenishment of ground water.
- Flowing water can damage or destroy some flood-plain plants, but can benefit others by dispersing seeds, root pieces and small plants. Seeds that require bare mineral soils for germination benefit when flowing water scours the flood-plain surface. Some plants grow better in moving water than in stagnant water. Flowing water with sufficient velocity can select for those plants that can resprout after flood damage or select against species with shallow, poorly anchored root systems.
- Federal wetland regulations (1989) limited wetland jurisdiction to only those areas that were inundated or saturated during the growing season. However, year-round (water year) hydrologic records were chosen in this report to describe the influence of hydrology on vegetation because saturation, inundation, or flowing water can have a variety of both beneficial and adverse effects on flood-plain vegetation at any time of the year. These effects can occur because:
    - Soil temperatures in north Florida are warm enough for biological activity in the soil to occur year-round. Therefore, saturation probably causes anaerobic conditions in the nongrowing season.
    - Many trees, shrubs, vines, and ground-cover plants that are common in north Florida flood plains are not fully dormant in the winter. Those species may be adapted to anaerobic stress caused by flooding in the nongrowing season.
    - The anaerobic effect of saturation is only one of many hydrologic effects on flood-plain vegetation. Many other effects of standing and flowing water are not controlled by temperature or metabolic rates and can occur any time of year.

The second major objective of this investigation was to measure and describe hydrologic conditions, soils, and vegetation on flood plains of the Ochlockonee River, Aucilla River, Telogia Creek, and St. Marks River.

- The Ochlockonee River flood plain has many topographic features characteristic of alluvial rivers, such as riverbank levees, terraces, depressions, sloughs, oxbow lakes, and ponds. Topographic relief and range in stage was greater on this flood plain than on the other three flood plains. The study plots were flooded an average of 2 to 5 times per year in the 33-year period of record from 1957 to 1989, usually in January, February, March, or April. Average annual longest floods were 8 to 15 weeks in depressions, 5 to 11 weeks on low terraces, and 1 to 3 weeks on high terraces. Soils in depressions and low terraces of the Ochlockonee River flood plain contained more silt than did all other plots. High-terrace soils, which were moderately well drained, were the best drained soils of all 10 plots in the study. Tree communities were distinctly different in each topographic zone. *Nyssa ogeche* and *Taxodium distichum* dominated depressions, *Quercus laurifolia* dominated low terraces, and high terraces supported a mixture of canopy trees including *Pinus glabra*, *Liquidambar styraciflua*, *Quercus virginiana*, and *Quercus nigra*. Perennial grasses such as *Panicum rigidulum*, *Panicum dichotomum*, and *Chasmanthium laxum* were a more important component of Ochlockonee River flood-plain ground-cover vegetation than that of the other three river flood plains.

- The Aucilla River flood plain is dominated by levees and terraces that are occasionally breached by small sloughs. Low, depressional areas and backwater ponds were relatively uncommon in the vicinity of the study site. The high terrace was flooded an average of 1.5 times per year in the 29-year period of record (1957-89). Flood durations had a significant amount of year-to-year variability. Average annual longest flood was 2 weeks on the high terrace, but the period of record included seven flood events lasting 4 consecutive weeks or longer and 10 years when no flood occurred. The low terrace was flooded 2.5 times per year with an average annual longest flood of 5 to 8 weeks. Soils on both Aucilla River plots had sandy, sandy loam, and loamy sand textures with higher organic matter content in the lower plot. Oaks dominated the canopy of both low and high terraces of the Aucilla flood plain. *Quercus laurifolia* was the most important tree species on both plots. In plant composition the low terrace most closely resembled Ochlockonee low terraces, but densities of ground-cover and subcanopy vegetation were much greater on the Aucilla low terrace.
- Telogia Creek is a major tributary of the Ochlockonee River. Its flood plain is wide relative to its drainage area, and is relatively low and wet with narrow riverbank levees and sloughs with well-defined channels that are nearly as low in elevation as the main channel of the creek. Floods on Telogia Creek occur many times throughout the year and are usually short in duration. The study plots were flooded an average of 6 to 16 times per year. Average annual longest flood was of much shorter duration on Telogia low plain (4-8 days) than on Aucilla and Ochlockonee high terraces or the St. Marks low plain, although duration of all flood events combined was similar on the four plots. Soils on both Telogia Creek plots had the highest organic matter content of the four river flood plains. The root-zone environment was relatively wet on both plots due to frequent flooding and high water-holding capacity of mucky subsoils. *Nyssa ogeche* dominated the canopy of both Telogia Creek plots, and *Smilax* vines were more common here than on the other three streams.
- The St. Marks is a spring-fed stream with the highest base flow and smallest range in stage of the four rivers studied in this report. The river carries very little sediment, as evidenced by the low or nonexistent riverbank levees. Much of the low plain adjacent to the river was only slightly higher (0.3 m) than average river stage. The land surface of the low plain was uneven with many hummocks of various sizes and occasional sloughs. The low plain sloped gradually up into the lower slope which had saturated soils during much of the study period, probably from ground-water seepage from the adjacent upland. Water-table measurements made during the study on the St. Marks low plain and lower slope were within 45 cm of the surface most of the time. Floods on the two lower plots occurred 1 to 4 times a year and lasted 1 to 4 weeks on the low plain and less than a week on the lower slope. The upper-slope plot was mostly above the elevation of the 5-year recurrence interval flood and was the only nonwetland plot in the study. Soils at the St. Marks site had a greater clay content than soils at the other sites. Limestone bedrock was relatively close to the surface under all three plots (60-140 cm). *Carpinus caroliniana* and *Liquidambar styraciflua* were important in the canopy of all three plots. *Pinus taeda* on the upper slope and *Magnolia virginiana* on lower slope were also important canopy species. The most important ground-cover species overall was *Toxicodendron radicans*, which varied greatly in coverage between the spring-summer and fall surveys because of fall and winter dormancy.

The third objective of this report was to describe and compare current State (1991) and Federal (1989) wetland determinations for the study sites.

- Most State and Federal wetland determinations are based primarily on vegetation and soil characteristics because long-term hydrologic records are usually not available. In this study, plots were located near long-term gaging stations, thus wetland determinations based on plant and soil characteristics could be evaluated at sites where long-term hydrologic conditions were known.

- Inconsistencies among State and Federal vegetation, soil, and hydrology determinations were greatest on two levee communities, Ochlockonee and Aucilla high terraces. Both plots failed to meet State wetland criteria based on plant and soil evidence, but met wetland criteria when hydrologic records were consulted. Only one plot, Ochlockonee high terrace, had a Federal nonwetland determination that was reversed when hydrologic records were consulted. Duration of average annual longest flood was almost 2 weeks for both plots.
- Telogia low plain had vegetation and soils with strong evidence of wet conditions; however, this plot only marginally met Federal wetland hydrology criteria for two reasons. First, surface-water flooding was frequent on this plot (6-10 times per year), but duration of individual flood events was typically less than a week, not long enough to meet criteria. Second, mucky layers in the root zone remain saturated for long periods, but criteria require saturation to the surface. The sandy surface layer over most of this plot dried out quickly after floods recede.
- At many of the plots, the composition and areal coverage of ground-cover species exhibited noticeable seasonal variation. The ground-cover stratum of the Aucilla low terrace plot met State wetland vegetation criteria in the fall but failed to meet criteria in the summer, primarily due to changes in the seasonal abundance of one species, *Hypoxis leptocarpa*.
- The current wetland species list used by the State lacks many ground-cover species common to forested flood plains of north Florida rivers. On 5 of the 10 plots, canopy vegetation met State wetland criteria but ground cover did not. One hundred two ground-cover species considered upland by the State were present on the nine annually flooded plots of this study. Among them were 34 species which grew in areas continuously flooded for an average of 5 weeks or more each year. Common flood-plain species considered upland by the State were: *Hypoxis leptocarpa* and two woody vines, *Brunnichia ovata* and *Campsis radicans*, which were most common in areas flooded continuously for 6 to 9 weeks a year; a woody shrub, *Sebastiania fruticosa*, and two perennial grasses, *Chasmanthium laxum* and *Panicum dichotomum*, which typically grew in areas flooded an average of 2 to 3 weeks or more; and two woody vines, *Vitis rotundifolia* and *Toxicodendron radicans*, usually occurring in areas flooded an average of 1 to 2 weeks a year.
- One important canopy species, *Quercus virginiana*, was considered upland by the State. This species most often was present in areas flooded approximately 1 week a year; however, some individuals were growing where average annual longest floods were greater than 3 weeks.

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APPENDIXES

Appendix I. Periods of record used from surface-water gaging stations near the study sites on four north Florida streams

[Surface-water records were not collected prior to 1957 at St. Marks River near Newport. To make comparisons based on a consistent period of record for each stream, 1957 to 1989 was the period of record used in this report, unless otherwise indicated]

Station name and number	Periods of record used
Ochlockonee River near Havana, 02329000	1957-89 (33 years)
Aucilla River at Lamont, 02326500	For discharge analyses: 1957-79, 1982 (24 years) For stage analyses:[1] Water years - 1957-73, 1975-79, 1982, 1984-89 (29 years) Growing season years - 1957-79, 1982, 1984-89 (30 years)
Telogia Creek near Bristol, 02330100	For discharge analyses: 1957-71, 1975-79, 1981-89 (29 years) For stage analyses: 1957-71, 1975-79, 1981-83, 1985-89 (28 years)
St. Marks River near Newport, 02326900	For discharge analyses: 1957-89 (33 years) For stage analyses: Water years - 1957-73, 1975-89 (32 years) Growing season years - 1957-89 (33 years)

[1] The full period of 29-30 years was used in all stage analyses related to Aucilla study plots and flood-plain vegetation because they were high enough in elevation to be unaffected by the low-head rock and concrete dam installed 1 km downstream in August 1963. However, low stages were significantly affected by the dam; therefore figures 2 and 3 and table 2 which present information on low stages use Aucilla stage record divided as follows:

Pre-dam - 1957-63 (7 years)
Post-dam - 1964-73, 1975-79, 1982, 1984-89 (22 years)

Appendix II. Hydrologic conditions on flood-plain plots on four north Florida streams, with duration, frequency, and depth of surface-water flooding, and State and Federal wetland hydrology determinations

This appendix is divided into the following sections:

A Surface-water flooding - water year
B Surface-water flooding - freeze-free growing season
C Surface-water flooding - individual events
D State and Federal wetland hydrology determinations

[Ochlockonee plots represent combined measurements and observations from 3 different sites; m, meters; cm, centimeters]

A SURFACE-WATER FLOODING - WATER YEAR: long-term averages based on river stage record using water years (October 1 - September 30). Approximate period of record is 1957-89 (see app. I).

[Ranges indicate typical conditions for most elevations on the plots[1]]

Plots	DURATION of average annual longest flood[2]	DURATION of all flood events combined[3]	FREQUENCY of floods, in number of events per year	DEPTH during 2-year, 1-day high stage
OCHLOCKONEE Depressions	57-109 days	29-45%	4.5-5.0	2.9-3.8 m
OCHLOCKONEE Low terraces	37-76 days	19-33%	3.8-4.6	2.2-3.1 m
OCHLOCKONEE High terraces	8-19 days	4-10%	2.2-3.1	0.7-1.4 m
AUCILLA Low terrace	35-55 days	17-24%	2.4-2.6	0.7-0.9 m
AUCILLA High terrace	10-15 days	5-8%	1.3-1.6	0.2-0.3 m
TELOGIA Slough	22-106 days	28-62%	13.4-16.2	1.0-1.4 m
TELOGIA Low plain	4-8 days	4-11%	6.1-10.4	0.5-0.7 m
ST. MARKS Low plain	9-26 days	4-13%	1.9-3.8	0.3-0.5 m
ST. MARKS Lower slope	4-6 days	1-3%	0.8-1.7	0.04-0.2 m
ST.MARKS Upper slope	0-1 days	NA[4]	0-0.2[4]	0 m

[1]Hydrologic conditions were calculated using a range of elevations from one standard deviation below to one standard deviation above the mean tree elevation for each plot. This method was chosen because calculations based on the full range of elevations from the lowest to the highest point on the plot resulted in a range of hydrologic conditions in some cases that were too broad to be helpful in understanding typical conditions. At the other extreme, a single number, such as mean or median, was misleading in cases where elevations varied greatly on a single plot.

[2]Average annual longest flood was calculated by determining the length of each individual flood event occurring in the entire period of record, selecting the longest event of each year, and averaging the lengths of all the annual longest events over the period of record.

[3]Gives total amount of time inundated, not necessarily consecutive.

[4]Most elevations on this plot (as defined in footnote 2) are inundated by floods with recurrence intervals ranging from approximately 5 to 40 years. This means that flooding has a 20 percent chance of occurring in any year at the lower elevations of this plot and a 2.5 percent chance of occurring at the higher elevations.

B SURFACE-WATER FLOODING - FREEZE-FREE GROWING SEASON: long-term averages based on river stage record in the freeze-free growing season only. Approximate period of record is 1957-89 (see app. I)

[Freeze-free growing season (see glossary) was used in computations of duration of average annual longest flood and frequency of floods. However, duration of all flood events combined was calculated using a growing season of March 1 - November 30, because of the inability of the duration analysis program to skip parts of months from the record]

[Ranges indicate typical conditions for most elevations on the plots[1]]

Plots	DURATION of average annual longest flood[2]	DURATION of all flood events combined[3]	FREQUENCY of floods, in number of events per year
OCHLOCKONEE Depressions	29-52 days	25-40%	3.6-4.5
OCHLOCKONEE Low terraces	21-37 days	16-29%	2.6-3.7
OCHLOCKONEE High terraces	5-12 days	3-9%	1.3-2.0
AUCILLA Low terrace	22-31 days	14-21%	1.7-2.2
AUCILLA High terrace	8-11 days	4-6%	0.8-1.0
TELOGIA Slough	17-56 days	25-58%	10.8-11.7
TELOGIA Low plain	3-7 days	4-10%	3.9-6.8
ST. MARKS Low plain	8-22 days	5-14%	1.5-2.9
ST. MARKS Lower slope	3-5 days	1-3%	0.8-1.4
ST.MARKS Upper slope	0-1 days	NA[4]	0-0.2[4]

[1]Hydrologic conditions were calculated using a range of elevations from one standard deviation below to one standard deviation above the mean tree elevation for each plot. This method was chosen because calculations based on the full range of elevations from the lowest to the highest point on the plot resulted in a range of hydrologic conditions in some cases that were too broad to be helpful in understanding typical conditions. At the other extreme, a single number, such as mean or median, was misleading in cases where elevations varied greatly on a single plot.

[2]Average annual longest flood was calculated by determining the length of each individual flood event occurring in the entire period of record, selecting the longest event of each year, and averaging the lengths of all the annual longest events over the period of record.

[3]Gives total amount of time inundated, not necessarily consecutive.

[4]Most elevations on this plot are inundated by growing season floods with recurrence intervals ranging from approximately 5 to 50 years. This means that growing season floods have a 20 percent chance of occurring in any year at the lower elevations of this plot and a 2 percent chance of occurring at the higher elevations.

Appendix II. Hydrologic conditions on the plots...--Continued

C SURFACE-WATER FLOODING - INDIVIDUAL EVENTS: longest flood event of each year in the period of record, calculated for the mean tree elevation of each plot.

[The first number in each column is the length, in days, of the longest flood event occurring in the water year (October 1 - September 30) indicated. The second number, in parentheses, is the length, in days, of the longest flood event occurring in the freeze-free growing season of the calendar year indicated. See glossary for freeze-free growing season dates at each site]

Year	Length of longest flood event, in days									
	OCHLOCKONEE Depressions	OCHLOCKONEE Low terraces	OCHLOCKONEE High terraces	AUCILLA Low terrace	AUCILLA High terrace	TELOGIA Slough	TELOGIA Low plain	ST. MARKS Low plain	ST. MARKS Lower slope	ST. MARKS Upper slope
1957	14 (16)	11 (13)	0 (6)	7 (47)	21 (36)	17 (18)	4 (6)	17 (17)	7 (8)	1 (0)
1958	121 (54)	32 (22)	15 (15)	47 (27)	17 (17)	41 (24)	6 (4)	11 (5)	8 (0)	0 (0)
1959	84 (48)	47 (35)	22 (16)	36 (32)	31 (28)	37 (37)	4 (8)	8 (10)	2 (3)	0 (0)
1960	88 (48)	43 (21)	12 (12)	67 (52)	17 (17)	36 (26)	8 (6)	10 (8)	3 (3)	0 (0)
1961	51 (51)	20 (20)	11 (11)	9 (0)	0 (0)	21 (15)	3 (3)	9 (9)	4 (4)	0 (0)
1962	21 (21)	18 (18)	8 (8)	22 (22)	15 (15)	15 (15)	3 (3)	8 (8)	2 (2)	0 (0)
1963	77 (21)	50 (10)	4 (0)	0 (0)	0 (0)	19 (19)	3 (3)	0 (0)	0 (0)	0 (0)
1964	112 (59)	92 (45)	21 (11)	49 (49)	16 (16)	66 (38)	6 (4)	16 (16)	10 (10)	0 (0)
1965	160 (62)	82 (35)	33 (17)	82 (70)	31 (24)	144 (47)	8 (6)	15 (15)	7 (7)	0 (0)
1966	95 (38)	82 (18)	28 (4)	70 (25)	32 (10)	99 (35)	9 (6)	19 (15)	6 (6)	0 (0)
1967	61 (18)	26 (14)	5 (0)	19 (0)	0 (0)	38 (12)	3 (2)	5 (5)	1 (1)	0 (0)
1968	6 (6)	0 (0)	0 (0)	0 (0)	0 (0)	6 (4)	0 (0)	0 (0)	0 (0)	0 (0)
1969	31 (27)	19 (19)	5 (5)	0 (0)	0 (0)	18 (38)	8 (8)	0 (0)	0 (0)	0 (0)
1970	80 (41)	40 (37)	12 (12)	30 (30)	3 (3)	123 (47)	9 (9)	0 (0)	0 (0)	0 (0)
1971	70 (38)	47 (36)	5 (5)	0 (0)	0 (0)	74 (33)	4 (1)	0 (0)	0 (0)	0 (0)
1972	74 (20)	61 (13)	8 (1)	62 (22)	6 (6)	---	---	5 (5)	0 (0)	0 (0)
1973	139 (70)	68 (65)	18 (18)	71 (71)	27 (27)	---	---	31 (31)	21 (21)	11 (11)
1974	35 (30)	27 (22)	5 (1)	---	---	---	---	---	---	---
1975	139 (80)	53 (28)	17 (13)	55 (53)	15 (15)	24 (20)	7 (7)	17 (17)	6 (6)	0 (0)
1976	64 (34)	27 (27)	12 (12)	26 (26)	13 (13)	26 (26)	4 (4)	0 (7)	0 (3)	0 (0)
1977	143 (31)	79 (18)	12 (8)	65 (26)	26 (9)	119 (33)	6 (6)	7 (0)	3 (0)	0 (0)
1978	81 (24)	69 (18)	11 (8)	59 (24)	5 (5)	114 (30)	6 (6)	1 (1)	0 (0)	0 (0)
1979	81 (64)	65 (29)	8 (7)	38 (8)	0 (0)	72 (41)	8 (8)	9 (9)	0 (0)	0 (0)
1980	130 (83)	60 (58)	16 (16)	---	---	---	---	9 (9)	2 (2)	0 (0)
1981	21 (21)	12 (12)	0 (0)	---	---	13 (9)	3 (3)	3 (3)	0 (0)	0 (0)
1982	79 (31)	27 (9)	4 (0)	5 (3)	0 (0)	29 (29)	5 (5)	5 (5)	0 (0)	0 (0)
1983	114 (64)	105 (58)	20 (20)	---	---	119 (73)	4 (4)	31 (31)	8 (8)	0 (0)
1984	154 (61)	105 (57)	21 (21)	105 (61)	30 (30)	---	---	34 (34)	18 (18)	4 (4)
1985	14 (14)	12 (12)	5 (5)	14 (14)	0 (0)	11 (11)	2 (3)	10 (10)	3 (3)	0 (0)
1986	139 (29)	132 (22)	22 (0)	64 (28)	22 (0)	133 (26)	11 (3)	33 (12)	18 (0)	0 (0)
1987	132 (46)	109 (39)	19 (11)	142 (48)	32 (19)	146 (45)	9 (9)	68 (53)	14 (14)	0 (0)
1988	64 (31)	47 (25)	11 (5)	39 (21)	12 (8)	52 (31)	5 (3)	15 (15)	3 (3)	0 (0)
1989	57 (57)	18 (18)	3 (3)	16 (16)	0 (0)	24 (24)	4 (4)	35 (35)	5 (5)	0 (0)

D STATE AND FEDERAL WETLAND HYDROLOGY DETERMINATIONS

[State wetland regulations are intended to cover areas that are regularly and periodically inundated (Section 403.817 (2), Florida Statutes). Federal wetland hydrology criteria in the 1989 manual require inundation or saturation to the surface for 1 week or more in the growing season under average conditions (Federal Interagency Committee for Wetland Delineation, 1989, p. 7). SCS growing season dates from February 1 through October 31 used in this table differ from the freeze-free growing season dates used in section B of this appendix (see glossary); SCS, Soil Conservation Service; cm, centimeters; m, meters];

Plots	Meets State requirement for regular and periodic inundation?	Meets 1989 Federal wetland hydrology criteria?	Supporting evidence[1 2]
OCHLOCKONEE Depressions	YES	YES	Surface flooding: Average annual longest flood in SCS growing season was 50-80 days.
OCHLOCKONEE Low terraces	YES	YES	Surface flooding: Average annual longest flood in SCS growing season was 30-60 days.
OCHLOCKONEE High terraces	YES	YES	Surface flooding: Average annual longest flood in SCS growing season was 8-18 days.
AUCILLA Low terrace	YES	YES	Surface flooding: Average annual longest flood in SCS growing season was 30-50 days.
AUCILLA High terrace	YES	YES	Surface flooding: Average annual longest flood in SCS growing season was 10-15 days.
TELOGIA Slough	YES	YES	Surface flooding: Average annual longest flood in SCS growing season was 20-70 days.
TELOGIA Low plain	YES	YES (marginal)	Surface flooding: Average annual longest flood in SCS growing season was 4-8 days. Additional saturation: Probably weeks or months in root zone because of high water-holding capacity of mucky soils just below surface combined with a high water table.[3] However, saturation to surface probably did not last much longer than surface flooding because surface sands (of variable thickness on this plot) probably dried out relatively soon after floods receded. Thus, plot marginally met Federal criteria.
ST. MARKS Low plain	YES	YES	Surface flooding: Average annual longest flood in SCS growing season was 9-25 days.
ST. MARKS Lower slope	YES	YES	Surface flooding: Average annual longest flood in SCS growing season was 4-6 days. Additional saturation: Estimated to be weeks or months (based on shallow well readings and field obervations of surface soil moisture).[4]
ST.MARKS Upper slope	NO	NO	Surface flooding: Most elevations on this plot have between a 2 to 20 percent chance of being flooded in any given year. Additional saturation: Negligible (soils were never observed to be wet to the surface during numerous field visits).

[1]Hydrologic conditions were calculated using a range of elevations from one standard deviation below to one standard deviation above the mean tree elevation for each plot. This method was chosen because calculations based on the full range of elevations from the lowest to the highest point on the plot resulted in a range of hydrologic conditions in some cases that were too broad to be helpful in understanding typical conditions. At the other extreme, a single number, such as mean or median, was misleading in cases where elevations varied greatly on a single plot.

[2]Average annual longest flood was calculated by determining the length of each individual flood event occurring in the entire period of record, selecting the longest event of each year, and averaging the lengths of all the annual longest events over the period of record.

[3]Length of time that river stage was at or above a level equivalent to 30 cm below plot ground surface averaged 17 days (10-24 days). It seemed reasonable to assume that long-term river stage could be used to estimate long-term water table levels because plot was very close to main channel (distance from channel averaged 12 m), layers of sand alternated with mucky sand, and water table was at or above river stage every time it was measured (3 measurements made during period of study).

[4]Water table was within 40 cm of surface in 10 out of 13 measurements made in the February-October growing season during study. In one instance, soil was observed to be wet to the surface with the water table at a depth of 66 cm (see app. III, sec. I). Because water cannot be raised to a height of 66 cm by capillary fringe alone, another source of water, probably seepage from adjacent upland, was suspected. At the time of that observation (end of the 1989 growing season), conditions were dry; no rain had occurred in 3-4 weeks and most recent flooding was 4 months earlier.

Appendix III. Soil characteristics at flood-plain plots on four north Florida streams, with taxonomic classifications, soil series, drainage classes, profile descriptions of the soils, and State and Federal hydric soil determinations

This appendix is divided into the following sections:

A Ochlockonee depressions
B Ochlockonee low terraces
C Ochlockonee high terraces
D Aucilla high terrace
E Aucilla low terrace
F Telogia slough
G Telogia low plain
H St. Marks low plain
I St. Marks lower slope
J St. Marks upper slope

[Soil pits were located in areas judged to be representative of plot topography and vegetation. At sites with shallow water-table wells, soil pits were located within 5 meters of the wells. Soil pits were excavated by shovel to the depth of the water table and were sampled by soil auger below that depth, unless otherwise indicated. Taxonomic classifications according to Soil Taxonomy (Soil Survey Staff, 1975, 1990) and drainage classes were based on field estimates of soil characteristics. Soil series were assigned by USDA Soil Conservation Service (SCS) staff in Florida (W. J. Allen, written commun., 1992)]

[Two types of hydric soil determinations were made for each plot:
(1) based on field characteristics as used by Florida Department of Environmental Regulation (FDER) and SCS in Florida, according to Hurt and others (1990).
(2) based on field characteristics as used by Federal Interagency Committee for Wetland Delineation (1989, p. 10). This method of wetland delineation is commonly referred to as the unified Federal method]

[cm, centimeters; %, percent]

Taxonomic classification: Coarse-loamy, mixed, thermic TYPIC FLUVAQUENT

Soil series   - of map unit: Meggett soils, frequently flooded (hydric)
- of this inclusion: Similar to Bibb (hydric).

Drainage class: Very poorly drained.

Profile description (Primary site, November 14, 1989):

A1   0-5 cm; dark gray (2.5Y 4/1) silt loam; strong fine granular structure; very friable; many very fine, fine, and medium roots; clear, smooth boundary.

A2   5-13 cm; dark grayish brown (2.5Y 4/2) silt loam; few fine faint yellowish-brown (10YR 5/4) mottles; weak medium subangular blocky structure parting to moderate fine granular; friable; many fine, medium, and coarse roots; clear, wavy boundary.

Cg1   13-36 cm; gray (10YR 5/1) silt loam; many fine and medium, distinct strong brown (7.5YR 5/6) mottles (25% by volume); weak medium subangular blocky structure; firm; common fine and medium roots; clear wavy boundary.

Cg2   36-76 cm; gray (10YR 5/1) fine sandy loam; many medium and coarse distinct strong brown (7.5YR 5/6) mottles (35-40% by volume); weak very coarse subangular blocky structure; firm; few fine and medium roots.

Cg3   76-114 cm; gray (10YR 5/1) fine sandy loam (more sand than Cg2 horizon); common fine distinct strong brown (7.5YR 5/6) mottles; firm; few medium roots.

Cg4   114-152 cm; light-gray (10YR 7/1) loamy fine sand; texture grades to fine sand at approximately 140 cm; many (30% by volume) coarse distinct dark-gray (10YR 4/1) and common coarse distinct (20% by volume) gray (10YR 5/1) mottles; common, fine roots.

Cg5   152+ cm; light-gray (10YR 7/1) fine sand; common (10% by volume) fine distinct dark-gray (10YR 4/1), and common (5% by volume) fine distinct gray (10YR 5/1) mottles.

Comments: Water table at 53 cm. Sampled by auger below 53 cm in slumping sand; therefore, horizon depths are approximate. Several characteristics of depression soils at the primary site differed from those of depression soils at the two secondary sites. Primary site soils were sandier (primarily silt loam and fine sandy loam instead of silt loam and silt), lighter colored (with values of 5 instead of 4), and had more high chroma mottles in the Cg horizons than secondary site soils. However, taxonomic classification and drainage class were the same for all three sites.

Hydric soil determinations:

Is this a hydric soil based on field characteristics
as used by FDER and SCS in Florida?   YES

Is this a hydric soil based on field characteristics
as used by Federal Interagency Committee
for Wetland Delineation?   YES

Taxonomic classification:

Coarse-loamy, mixed, thermic TYPIC HAPLAQUEPT (for primary site profile described below and for one secondary site)

Coarse-loamy, mixed, thermic HUMIC HAPLAQUEPT (for one secondary site)

Soil series - of map unit: Meggett soils, frequently flooded (hydric)
- of this inclusion: Similar to Bibb (hydric).

Drainage class: Poorly drained.

Profile description (Primary site, November 14, 1989):

A 0-5 cm; dark grayish-brown (10YR 4/1) loam; weak medium platy structure parting to moderate fine granular; very friable; many very fine, fine, and medium roots; clear smooth boundary.

AB 5-18 cm; dark-gray (10YR 4/1) silt loam; common medium distinct strong brown (7.5YR 4/6) mottles; weak medium platy structure parting to strong fine granular; friable; common fine and medium roots; clear smooth boundary.

Bg 18-53 cm; gray (10YR 5/1.5) fine sandy loam; common medium faint gray (10YR 6/1) mottles; weak coarse subangular blocky structure; firm; common medium roots; clear wavy boundary.

Cg1 53-71 cm; gray (10YR 5/1) loamy fine sand; many (40% by volume) coarse distinct patches of gray (10YR 6/1) loamy fine sand; few roots.

Cg2 71-130 cm; gray (10YR 5/1) fine sandy loam grading to gray (10YR 6/1) loamy fine sand.

Cg3 130-165+ cm; light gray (10YR 7/1) fine sand grading to sand at 150 cm.

Comments: Water table at 53 cm. Sampled by auger below 53 cm. Soil slumped considerably below 71 cm, so horizon boundaries below that depth are approximate. Low-terrace soils at the primary site were sandier than low-terrace soils at the two secondary sites.

Hydric soil determinations:

Is this a hydric soil based on field characteristics as used by FDER and SCS in Florida? YES

Is this a hydric soil based on field characteristics as used by Federal Interagency Committee for Wetland Delineation? YES

Taxonomic classifications:

Thermic coated TYPIC QUARTZIPSAMMENTS (for primary site profile described below)

Coarse-loamy, mixed, thermic TYPIC DYSTROCHREPT (for secondary sites)

Soil series - of map unit: Meggett soils, frequently flooded (hydric)
- of this inclusion: Similar to Bigbee (non-hydric).

Drainage class: Moderately well drained. (In lowest areas of plot at the primary site, drainage class was somewhat poorly drained.)

Profile description (Primary site, October 4, 1988):

A1 0-25 cm; dark-brown (10YR 4/3) sandy loam; weak fine subangular, blocky structure; very friable.

A2 25-40 cm; brown (10YR 5/3) sand; single grain structure; loose.

C1 40-75 cm; light-gray (10YR 7/2) sand.

C2 75-100 cm; white (10YR 8/2) sand.

C3 100-145 cm; light brownish-gray (10YR 6/2) loamy fine sand with narrow bands of uncoated sand; strong brown (7.5YR 5/8) mottles.

C4 145-200 cm; light brownish-gray (10YR 6/2), fine sand.

Comments: Water table not observed within 200 cm of surface. Pits were dug to 40 cm with a tile spade and sampled by auger below 40 cm. In the lowest areas of this plot, soils exhibited hydric characteristics in the upper 40 cm (mottled, 2-chroma matrix in horizons of fine sandy loam).

Hydric soil determinations:

Is this a hydric soil based on field characteristics as used by FDER and SCS in Florida? NO

Is this a hydric soil based on field characteristics as used by Federal Interagency Committee for Wetland Delineation? NO

D Aucilla low terrace

Taxonomic classification: Coarse-loamy, mixed, thermic AERIC FLUVAQUENT

Soil series - of map unit: Chaires fine sand (non-hydric)
- of this inclusion: Similar to Bibb (hydric).

Drainage class: Very poorly drained.

Profile description (May 10, 1990):

Oi 1-0 cm; leaf litter mat.

A 0-3 cm; dark gray (10YR 4/1) sandy loam with light-gray (10YR 6/1) bands and blotches occupying 40% by volume; high content of decomposed organic matter; weak fine granular structure; very friable; many very fine and fine roots; abrupt wavy boundary.

C 3-10 cm; light brownish gray (10YR 6/2) sandy loam; many coarse distinct dark-gray (10YR 4/1) organic stains and streaks; weak medium subangular blocky structure; friable; common fine and medium roots; abrupt wavy boundary.

Ab 10-20 cm; very dark gray (10YR 3/1) mucky sandy loam; discontinuous 5-20 mm thick bands of grayish brown sandy loam; weak medium platy and weak medium subangular blocky structure; friable; many roots of all size classes; clear wavy boundary.

Cb 20-36 cm; grayish brown (10YR 5/2) sandy loam; many coarse distinct dark gray (10YR 4/1) stains and streaks; common fine prominent strong brown (7.5YR 5/8) mottles; weak medium subangular blocky structure; friable; few coarse roots; abrupt wavy boundary.

A'b 36-43 cm; very dark gray (10YR 3/1) sandy loam with relatively high organic matter content; weak medium subangular blocky structure; firm; few coarse roots; abrupt wavy boundary.

C'b 43-127 cm; light brownish gray (10YR 6/2) loamy sand; few fine distinct strong brown (7.5YR 5/6) mottles; structureless; friable; no roots; band of light yellowish-brown (10YR 6/4) mottles at bottom of horizon.

2Cgb 127-157+ cm; dark-gray (2.5Y 5/1) sandy clay loam.

Comments: Water table at 69 cm. Soil described from auger samples below 76 cm. Sand deposition was variable on the low terrace both on the surface and at depth; light-gray sand was observed from 0 to 15 cm and grayish-brown, loamy sand was found from 20 to 38 cm at another location on this plot.

Hydric soil determinations:

Is this a hydric soil based on field characteristics as used by FDER and SCS in Florida? YES

Is this a hydric soil based on field characteristics as used by Federal Interagency Committee for Wetland Delineation? YES

E Aucilla high terrace

Taxonomic classification: Coarse-loamy, mixed, thermic GROSSARENIC PALEAQUULT

Soil series - of map unit: Chaires fine sand (non-hydric)
- of this inclusion: Similar to Plummer (hydric).

Drainage class: Poorly drained.

Profile description (May 10, 1990):

Oe 2-0 cm; litter mat; abrupt, smooth boundary.

A1 0-3 cm; very dark gray (10YR 3/1) sandy loam; weak fine granular structure; very friable; many very fine and fine roots; abrupt smooth boundary.

A2 3-25 cm; dark grayish brown (10YR 4/2) sandy loam; weak medium granular structure; friable; few fine faint yellowish brown (10YR 5/6) mottles; many roots of all size classes; clear wavy boundary.

AE 25-53 cm; light brown (7.5YR 6/3) loamy sand; many (40% by volume) distinct and prominent strong brown to reddish-yellow mottles; faint organic streaks (10YR 5/2); weak coarse subangular blocky structure; friable; few medium and coarse roots; gradual wavy boundary.

E 53-119 cm; white (10YR 8/1) loamy sand; massive; friable; few coarse distinct light yellowish-brown (10YR 6/4) mottles; few medium and coarse roots; clear wavy boundary.

Btg1 119-132 cm; light gray (10YR 7/1.5) sandy clay loam; common medium prominent strong brown (7.5YR 5/8) and many medium distinct reddish-yellow (7.5YR 6/6) mottles with few fine oxidized rhizospheres; weak coarse subangular blocky structure; firm.

Btg2 132-152 cm; gray (10YR 5/1) sandy clay loam; common medium distinct yellowish-brown (10YR 5/6) mottles.

C 152-203+ cm; light-gray (10YR 7/2) sandy loam.

Comments: Water table at 119 cm. Soil described from auger samples below 127 cm. At another location on the plot, light gray and white sands were observed from 20 to 79 cm.

Hydric soil determinations:

Is this a hydric soil based on field characteristics as used by FDER and SCS in Florida?	YES (marginal)
Is this a hydric soil based on field characteristics as used by Federal Interagency Committee for Wetland Delineation?	YES (marginal)

F Telogia slough

Taxonomic classification: Sandy, siliceous, thermic THAPTO-HISTIC FLUVAQUENT

Soil series - of map unit: Pickney, Dorovan, Fluvaquents soils, frequently flooded (hydric)
- of this inclusion: This soil is an unnamed inclusion in the map unit; however, all Fluvaquents in this map unit are considered hydric .

Drainage class: Very poorly drained.

Profile description (May 8, 1990):

C 0-5 cm; light gray (10YR 7/1) sand; 5% by volume of black (N 2/0) bands and accumulations of mucky sand and sapric muck (thickness of muck bands ranges from 0-10 mm); weak fine platy structure; very friable; common fine and medium roots; abrupt wavy boundary; (thickness of horizon varies from 0-15 cm.)

Ab 5-10 cm; black (N 2/0) mucky sand; weak medium platy structure; friable; common fine and medium roots; abrupt wavy boundary; discontinuous horizon.

Cb 10-20 cm; light gray (10YR 7/1) sand; 5-10% by volume of black (N 2/0) bands of organic matter and organic-stained sand; structureless; friable; abrupt wavy boundary; discontinuous horizon.

A'b 20-28 cm; black (N 2/0) mucky sand; 0-20% by volume bands of light gray (10YR 7/1) sand; weak fine subangular blocky structure; friable; common roots of all size classes; abrupt wavy boundary.

C'b 28-43 cm; gray (10YR 6/1) sand; 20% by volume dark-gray (10YR 4/1) sand (organic stains); structureless; firm.

2Oa1 43-53 cm; black (N 2/0) sapric muck; many roots; structureless; slightly sticky.

2Oa2 53-76+ cm; black (10YR 2/1) sapric muck; common decomposing large roots.

Comments: Water table at 53 cm; sampled by auger below 53 cm. Soil sloughed out of auger below 76 cm. Soil pit located in one of the lowest areas within the plot. Soil has many discontinuous bands of alternating light gray sand and mucky sand throughout.

Hydric soil determinations:

Is this a hydric soil based on field characteristics as used by FDER and SCS in Florida? YES

Is this a hydric soil based on field characteristics as used by Federal Interagency Committee for Wetland Delineation? YES

G Telogia low plain

Taxonomic classification: Sandy, siliceous, thermic THAPTO-HISTIC FLUVAQUENT

Soil series - of map unit: Pickney, Dorovan, Fluvaquents soils, frequently flooded (hydric)
- of this inclusion: This soil is an unnamed inclusion in the map unit; however, all Fluvaquents in this map unit are considered hydric .

Drainage class: Very poorly drained (poorly drained on higher elevations of the plot)

Profile description (October 13, 1988):

Oi 5-0 cm; root mat.

C 0-5 cm; light gray (10YR 7/1) sand; single grain structure; loose; strongly acid; many fine roots.

Ab1 5-18 cm; very dark brown (10YR 2/2) mucky loamy sand with undecomposed root fibers; weak medium subangular blocky structure; friable; strongly acid; many fine and few medium roots.

Ab2 18-65 cm; very dark brown (10YR 2/2) mucky loamy sand with thin bands of light-gray (10YR 7/2) sand; weak medium subangular blocky structure; friable; strongly acid; few medium roots.

Ab3 65-85 cm; very dark grayish brown (10YR 3/2) mucky loamy sand; strongly acid; sulfurous odor.

2Oa 85-195 cm; very dark brown (10YR 2/2) sapric muck with buried root mats and thin bands of light gray (10YR 7/2) sand.

Comments: Water table at 80 cm. Sampled by auger below 40 cm. Surface sands vary from 0 to 40 cm in depth above horizons with mucky textures. At a higher point on the plot, the profile consisted of 40 cm of light and dark gray fine sand on the surface, with black and very dark gray mucky fine sand horizons at depths of 40 to 65 cm and 165 to 185 cm, and black muck at a depth of 75 to 165 cm.

Hydric soil determinations:

Is this a hydric soil based on field characteristics as used by FDER and SCS in Florida? YES

Is this a hydric soil based on field characteristics as used by Federal Interagency Committee for Wetland Delineation? YES

<u>Taxonomic classification</u>: Loamy, mixed, shallow, thermic MOLLIC OCHRAQUALF

<u>Soil series</u> - of map unit: Tooles-Nutall fine sands, frequently flooded (hydric)
- of this inclusion: Similar to Nutall, frequently flooded (hydric)

<u>Drainage class</u>: Very poorly drained.

<u>Profile description</u> (November 1, 1989):

A1 0-5 cm; black (10YR 2/1) sandy clay loam; strong medium granular structure; friable; many roots of all size classes; abrupt smooth boundary.

A2 5-13 cm; black (N 2/0) clay loam; few fine distinct dark yellowish brown (10YR 3/4) mottles along roots (decomposing roots?); weak coarse subangular blocky structure; firm; common fine and medium roots; clear wavy boundary.

Btg 13-28 cm; very dark gray (N 3/0) clay; thick discontinuous dark bluish gray (5B 4/1) and dark greenish gray (5 BG 4/1) clay films; moderate coarse subangular blocky structure; firm; few fine and medium roots; clear wavy boundary.

Cg1 28-41 cm; very dark gray (5Y 3/1) sandy clay loam; moderate medium subangular blocky structure; friable; few fine and medium roots; abrupt wavy boundary.

Cg2 41-48 cm; light gray (10YR 7/1) fine sandy loam; common medium distinct light yellowish brown (10YR 6/4) mottles; weak medium subangular blocky structure; very friable; no roots; abrupt smooth boundary.

2R 48+ cm; light-gray (2.5Y 7/2) limestone; fractures easily.

Comments: Water table below 48 cm but soil moist throughout. Depths to limestone bedrock at two other locations on this plot were 61 and 76 cm.

<u>Hydric soil determinations</u>:

Is this a hydric soil based on field characteristics
as used by FDER and SCS in Florida? YES

Is this a hydric soil based on field characteristics
as used by Federal Interagency Committee
for Wetland Delineation? YES

I St. Marks lower slope

Taxonomic classification: Coarse-loamy, mixed, thermic TYPIC OCHRAQUALF
Soil series - of map unit: Tooles-Nutall fine sands, frequently flooded (hydric)
- of this inclusion: Similar to Tooles, frequently flooded (hydric).
Drainage class: Very poorly drained.
Profile description (November 1, 1989):

A 0-4 cm; black (N 2/0) mucky sandy loam; weak medium platy structure parting to moderate fine granular; very friable; many roots of all size classes; abrupt smooth boundary.

Eg1 4-13 cm; dark gray (10YR 4/1) fine sandy loam; many coarse distinct gray (10YR 5/1) mottles (30% by volume) and common coarse distinct very dark gray (10YR 3/1) mottles; single grain structure; very friable; common fine and medium roots; clear wavy boundary.

Eg2 13-23 cm; very dark gray (10YR 3/1) fine sandy loam (more silt than Eg1 horizon); many coarse distinct dark gray (10YR 4/1) mottles (40% by volume); weak coarse subangular blocky structure; very friable; common coarse and medium roots and few fine roots; clear wavy boundary.

BEg 23-38 cm; dark gray (10YR 4/1) fine sandy loam; weak coarse subangular blocky structure; friable; common coarse and few fine and medium roots; clear wavy boundary.

Btg 38-76 cm; dark gray (N 4/0) sandy loam (more clay than Bg horizon); common fine faint dark gray (5Y 4/1) mottles; pockets of light olive-gray (2.5Y 6/2) sandy loam; weak coarse subangular blocky structure; friable; few medium and coarse roots.

Cg 76-102 cm; gray (5Y 5/1) sandy loam (more sand than Btg horizon); few coarse and common medium distinct very dark-gray (10YR 3/1) mottles; firm.

2Cg 102-127 cm; gray (5Y 5/1) and greenish-gray (5GY 5/1) loam (each occupying approximately 25% by volume) loam with approximately 35% by volume of white (N 8/0) sea shells; common medium distinct dark gray (10YR 4/1) mottles (15% by volume); firm; few undecomposed roots.

3R 127+ cm; limestone bedrock.

Comments: Water table at 66 cm; excavated by auger below 66 cm. Soil was saturated to the surface (water could be squeezed out when soil compressed in fist). Because water cannot be raised to a height of 66 cm by capillary fringe alone, another source of water, probably seepage from adjacent upland, was suspected. At the time that soils were described, no precipitation had occurred for 3-4 weeks or longer according to local residents, and the most recent flooding was 4 months earlier. Bulk density above 76 cm was low (as evidenced by absence of resistance to soil probe and auger, and slightly sticky, nonplastic consistence under manipulation), suggesting that much water is present in the soil matrix most of the year. Depths to limestone bedrock at two other locations on this plot were 112 and 178 cm. Textures varied somewhat at other locations on the plot: one location had sandy, clay loam from 20-107 cm and another location had 15 cm of loamy sand at the surface.

Hydric soil determinations:

Is this a hydric soil based on field characteristics as used by FDER and SCS in Florida? YES

Is this a hydric soil based on field characteristics as used by Federal Interagency Committee for Wetland Delineation? YES

J St. Marks upper slope

Taxonomic classification: Fine-loamy, mixed, thermic TYPIC ALBAQUALF

Soil series - of map unit: Moriah-Pilgrims fine sands (non-hydric)
- of this inclusion: Similar to Moriah (non-hydric).

Drainage class: Somewhat poorly drained.

Profile description (November 1, 1989):

A1 O-4 cm; dark gray (10YR 4/1) sand organized as "salt and pepper" appearance with 60% white (10YR 8/1) and 30% black (10YR 2/1) uncoated and coated sand grains; common fine distinct, dark yellowish brown (10YR 3/4) root fibers (10% by volume); single grain structure; very friable; many roots of all size classes; abrupt smooth boundary.

A2 4-13 cm; dark gray (10YR 4/1) sand organized as "salt and pepper" appearance with 70% light gray (10YR 7/1) and 20% black (N 2/0) uncoated and coated sand grains; 10% by volume of coarse distinct very dark-gray (N 3/0) mottles; weak medium subangular blocky structure; very friable; common roots of all size classes; clear wavy boundary.

AB 13-28 cm; dark grayish brown (10YR 4/2) fine sandy loam; common (3% by volume) medium distinct dark brown (10YR 3/3) mottles; weak coarse subangular blocky structure; friable; few medium and fine roots; abrupt wavy boundary.

Bt 28-38 cm; dark brown (10YR 3/3) sandy clay; many coarse distinct very dark grayish brown (10YR 3/2) mottles (40% by volume) and common medium distinct dark yellowish brown (10YR 3/4) mottles; weak medium angular blocky structure with very dark gray (10YR 3/1) organic stains on ped faces and in root channels; firm; common fine and very fine and few medium roots; clear wavy boundary.

Btg 38-66 cm; dark gray (10YR 4/1) sandy clay loam; many fine distinct dark brown (10YR 4/3) mottles; weak coarse subangular blocky structure; firm; many very fine few fine and medium roots; abrupt wavy boundary.

Cg1 66-160 cm; light gray (10YR 7/1) fine sandy loam; massive structure; firm; few fine roots.

Cg2 160-170 cm; grayish brown (10YR 5/2) fine sandy loam; firm; no roots.

2Cg 170+ cm; gray (5Y 6/1) and greenish gray (5GY 6/1) sandy clay loam; very firm.

Comments: Water table at 170 cm. Sampled by auger below 99 cm. Depths to limestone bedrock at six other locations on this plot were 36, 46, 51, 66, 69, and 125 cm.

Hydric soil determinations:

Is this a hydric soil based on field characteristics
as used by FDER and SCS in Florida? NO

Is this a hydric soil based on field characteristics
as used by Federal Interagency Committee
for Wetland Delineation? NO

Appendix IV. Vegetation on flood-plain plots on four north Florida streams, with species composition of canopy trees, subcanopy trees, and ground cover plants, weighted averages for each stratum, and State and Federal wetland vegetation determinations

This appendix contains the following sections:

A Ochlockonee depressions
B Ochlockonee low terraces
C Ochlockonee high terraces
D Aucilla low terrace
E Aucilla high terrace
F Telogia slough
G Telogia low plain
H St. Marks low plain
I St. Marks lower slope
J St. Marks upper slope

State indicator categories (Florida Department of Environmental Regulation):

SUB = submerged
TRANS = transitional
UPL = upland
INV = invisible
NA = not assigned to any category

National indicator categories for region 2 - southeastern United States (Reed, 1988) and corresponding ecological indices (Wentworth and others, 1988):

OBL = obligate wetland (ecological index = 1)
FACW = facultative wetland (ecological index = 2)
FAC = facultative (ecological index = 3)
FACU = facultative upland (ecological index = 4)
UPL = obligate upland (ecological index = 5)
NA = not assigned to any category
+ = indicates a frequency of occurrence in the higher end of the category (more frequently found in wetlands)
- = indicates a frequency of occurrence in the lower end of the category (less frequently found in wetlands)

Plants unidentified to species are either assigned no indicator category or are assigned the most upland indicator category of the species which the specimens most closely resembled.

m = meter
m^2 = square meter
n = sample size
* = subcanopy species present on the plot but off the belt transect

Weighted average = average ecological index, weighted by importance values (Wentworth and others, 1988), calculated on total importance values excluding species with no assigned category (NA)

Summaries of State indicator categories:
Total percent SUB, TRANS, and UPL are based on total importance values excluding invisible species (INV) and unidentified species with no assigned category (NA)

State wetland vegetation criteria:
YES(a) = wetland vegetation criterion is met according to formula in Section 17-301.400(1)(a), Florida Administrative Code
YES(b) = wetland vegetation criterion is met according to formula in Section 17-301.400(1)(b), Florida Administrative Code

Summaries for overall plot:

State - The uppermost (canopy) stratum was used in every case to represent the overall plot in state wetland vegetation criterion, according to Section 17-301.400(1) Florida Administrative Code.

Federal - Percent of dominant species in all strata that are OBL, FACW, FAC, FACU, and UPL are listed and hydrophytic vegetation criterion is tested for each plot according to Part 2.3(1) of Federal Manual for Identifying and Delineating Jurisdictional Wetlands (Federal Interagency Committee for Wetland Delineation, 1989). Sampling methods used are most similar to Comprehensive Quadrat Sampling Procedure recommended in part 4.18 of the aforementioned manual in which dominant species from each stratum are used to determine whether the overall plot meets hydrophytic vegetation criterion.

Nomenclature follows Godfrey (1988) for woody plants, Godfrey and Wooten (1979, 1981) for aquatic or wetland herbaceous species, and Clewell (1985) for ferns and other herbaceous species unless otherwise indicated.

A Ochlockonee depressions

Canopy/ subcanopy species	Indicator category: State	Indicator category: National (Region 2)	Canopy: Relative basal area, in percent (total basal area = 10.0 m^2) n = 115	Subcanopy: Relative density, in percent n = 26
Nyssa ogeche	SUB	OBL	58.4	3.9
Taxodium distichum	SUB	OBL	27.1	*
Planera aquatica	SUB	OBL	5.8	*
Fraxinus caroliniana	SUB	OBL	4.8	88.5
Liquidambar styraciflua	TRANS	FAC+	1.8	
Acer rubrum	TRANS	FAC	1.2	*
Crataegus aestivalis	SUB	OBL	.8	*
Brunnichia ovata	UPL	FACW		7.7
Campsis radicans	UPL	FAC		*
Ilex decidua	TRANS	FACW-		*
Vitis rotundifolia	UPL	FAC		*
Total			100.0	100.0

Ground cover species	Indicator category: State	Indicator category: National (Region 2)	Ground cover, in percent of total vegetative measurements (t.v.m.); Total line transect length = 106.60 m: Summer (7-12-88) t.v.m. = 12.55 m	Fall (12-18-87) t.v.m = 6.74 m
Panicum rigidulum	SUB	FACW	22.2	36.8
Brunnichia ovata	UPL	FACW	21.4	23.2
Fraxinus caroliniana	SUB	OBL	20.0	26.4
Campsis radicans	UPL	FAC	8.9	3.1
Boehmeria cylindrica [1]	TRANS	FACW+	7.3	.2
Panicum dichotomum	UPL	FAC	3.3	
Quercus laurifolia	TRANS	FACW	2.4	
Carex sp.	TRANS	NA	2.2	
Ampelopsis arborea	TRANS	FAC+	1.9	.2
Carex joorii	TRANS	OBL	1.8	6.1
Hypoxis leptocarpa	UPL	FACW	1.4	.2
Onoclea sensibilis	UPL	FACW	1.0	.2
Sebastiania fruticosa	UPL	FACW	1.0	
Planera aquatica	SUB	OBL	.9	.2
Viola esculenta	UPL	FACW-	.7	
Nyssa ogeche	SUB	OBL	.6	1.2
Liquidambar styraciflua	TRANS	FAC+	.6	.2
Chasmanthium laxum	UPL	FACW-	.6	
Dyschoriste humistrata	UPL	FACW	.6	
Crataegus aestivalis	SUB	OBL	.4	
indeterminate	NA	NA	.4	
Acer rubrum	TRANS	FAC	.3	.3
Nyssa sp.	SUB	OBL	.2	
Smilax sp.	UPL	FACU	.1	
Erechtites hieracifolia	UPL	FAC-		1.9
Taxodium distichum	SUB	OBL		.2
Total			100.0	100.0

Additional species present on the plot but off the line transect:

Asclepias perennis	UPL	OBL
Axonopus furcatus	UPL	OBL
Justicia ovata var. lanceolata	SUB	OBL
Leersia lenticularis	SUB	OBL
Leersia virginica	SUB	FACW
Pluchea camphorata	TRANS	FACW
Quercus lyrata	SUB	OBL
Toxicodendron radicans	UPL	FAC
Trachelospermum difforme	UPL	FACW
Vitis rotundifolia	UPL	FAC

Summaries:

State regulatory categories	Canopy	Subcanopy	Ground cover: Summer	Ground cover: Fall	Overall plot
Total percent SUB	96.9	92.4	44.5	64.7	
Total percent TRANS	3.0	0	16.6	6.8	
Total percent UPL	0	7.7	39.0	28.5	
IS STATE WETLAND VEGETATION CRITERION MET?	YES(a)	YES(a)	YES(a)	YES(a)	YES(a)

National indicator categories	Canopy	Subcanopy	Ground cover: Summer	Ground cover: Fall
Total percent OBL	96.9	92.4	23.9	34.0
Total percent FACW	0	7.7	58.4	60.4
Total percent FAC	3.1	0	15.0	5.6
Total percent FACU	0	0	.1	0
Total percent UPL	0	0	0	0
Total percent NA	0	0	2.6	0
Weighted averages	1.06	1.08	1.91	1.72

Federal regulatory categories	Canopy, subcanopy, and summer ground cover	Canopy, subcanopy, and fall ground cover
Total percent of dominant species in all strata that are OBL	66.7	66.7
Total percent of dominant species in all strata that are FACW	33.3	33.3
IS FEDERAL HYDROPHYTIC VEGETATION CRITERION MET FOR OVERALL PLOT?	YES	YES

B Ochlockonee low terraces

Canopy/ subcanopy species	Indicator category State	Indicator category National (Region 2)	Canopy: Relative basal area, in percent (total basal area = 6.3 m²) n = 77	Subcanopy: Relative density, in percent n = 20
Quercus laurifolia	TRANS	FACW	56.3	*
Acer rubrum	TRANS	FAC	20.3	5.0
Liquidambar styraciflua	TRANS	FAC+	8.2	
Nyssa ogeche	SUB	OBL	6.3	*
Quercus lyrata	SUB	OBL	4.5	5.0
Taxodium distichum	SUB	OBL	2.4	*
Betula nigra	SUB	FACW	1.1	
Planera aquatica	SUB	OBL	.5	
Ilex decidua	TRANS	FACW-	.3	65.0
Fraxinus caroliniana	SUB	OBL	.2	15.0
Crataegus aestivalis	SUB	OBL		10.0
Campsis radicans	UPL	FAC		*
Viburnum obovatum	TRANS	FACW+		*
Total			100.0	100.0

Ground cover species	Indicator category State	Indicator category National (Region 2)	Ground cover, in percent of total vegetative measurements (t.v.m.), Total line transect length = 108.50 m: Summer (7-12-88) t.v.m. = 14.51 m	Fall-winter (12-21-87) t.v.m = 7.02 m
Brunnichia ovata	UPL	FACW	19.7	7.4
Panicum rigidulum	SUB	FACW	18.8	26.6
Dyschoriste humistrata	UPL	FACW	7.7	4.0
Panicum dichotomum	UPL	FAC	7.2	11.8
Boehmeria cylindrica [1]	TRANS	FACW+	6.6	7.8
Sebastiania fruticosa	UPL	FACW	4.8	7.4
Smilax sp.	UPL	FACU	4.4	
Carex joorii	TRANS	OBL	3.8	7.4
Erianthus strictus	UPL	OBL	3.6	2.9
Campsis radicans	UPL	FAC	3.2	
Commelina virginica	UPL	FACW	3.0	
Carex reniformis	TRANS	FACW	2.7	6.0
Pluchea camphorata	TRANS	FACW	2.5	6.1
Betula nigra	SUB	FACW	1.7	.1
Acer rubrum	TRANS	FAC	1.7	.1
Hypoxis leptocarpa	UPL	FACW	1.3	
Ampelopsis arborea	TRANS	FAC+	1.2	.4
Diospyros virginiana	UPL	FAC	1.2	.3
Liquidambar styraciflua	TRANS	FAC+	1.2	
Onoclea sensibilis	UPL	FACW	1.0	
Justicia ovata var. *lanceolata*	SUB	OBL	.7	
Mikania scandens	SUB	FACW+	.6	.6
Planera aquatica	SUB	OBL	.6	.4
indeterminate	NA	NA	.5	
Carex sp.	TRANS	NA	.3	
Nyssa sp.	SUB	OBL	.3	
Eupatorium semiserratum	UPL	FACW-		5.6
Cyperus virens	UPL	FACW		4.4
Viola sp.	UPL	FAC		.6
Total			100.0	100.0

Ground cover species	Indicator category: State	Indicator category: National (Region 2)
Additional species present on the plot but off the line transect:		
Arundinaria gigantea	TRANS	FACW
Asclepias perennis	UPL	OBL
Axonopus furcatus	UPL	OBL
Gleditsia sp.	UPL	FAC
Helenium autumnale	UPL	FACW
Hymenocallis duvalensis[2]	SUB	NA
Hypericum galioides	UPL	OBL
Ilex decidua	TRANS	FACW-
Leersia lenticularis	SUB	OBL
Lobelia flaccidifolia	UPL	OBL
Phytolacca americana	UPL	FACU+
Quercus laurifolia	TRANS	FACW
Quercus lyrata	SUB	OBL
Taxodium distichum	SUB	OBL
Toxicodendron radicans	UPL	FAC
Vernonia sp.	UPL	FAC
Viola affinis	UPL	FACW
Viola esculenta	UPL	FACW-
Vitis rotundifolia	UPL	FAC

Summaries:

State regulatory categories	Canopy	Subcanopy	Ground cover: Summer	Ground cover: Fall-winter	Overall plot
Total percent SUB	15.0	30.0	22.8	27.7	
Total percent TRANS	85.1	70.0	21.3	28.1	
Total percent UPL	0	0	56.3	44.1	
IS STATE WETLAND VEGETATION CRITERION MET ?	YES(a)	YES(a)	NO	NO	YES(a)

National indicator categories	Canopy	Subcanopy	Ground cover: Summer	Ground cover: Fall-winter
Total percent OBL	13.8	30.0	8.9	10.7
Total percent FACW	57.7	65.0	71.5	76.4
Total percent FAC	28.5	5.0	14.4	13.0
Total percent FACU	0	0	4.4	0
Total percent UPL	0	0	0	0
Total percent NA	0	0	.8	0
Weighted average	2.15	1.75	2.14	2.02

Federal regulatory categories	Canopy, subcanopy, and summer ground cover	Canopy, subcanopy, and fall-winter ground cover
Total percent of dominant species in all strata that are OBL	0	11.1
Total percent of dominant species in all strata that are FACW	71.4	66.7
Total percent of dominant species in all strata that are FAC	28.6	22.2
IS FEDERAL HYDROPHYTIC VEGETATION CRITERION MET FOR OVERALL PLOT?	YES	YES

C Ochlockonee high terraces

Canopy subcanopy species	Indicator category: State	Indicator category: National (Region 2)	Canopy: Relative basal area, in percent (total basal area = 7.3 m^2) n = 115	Subcanopy: Relative density, in percent n = 48
Pinus glabra	TRANS	FACW	22.6	4.2
Liquidambar styraciflua	TRANS	FAC+	20.3	14.6
Quercus virginiana	UPL	FACU+	16.1	
Quercus nigra	TRANS	FAC	15.8	2.1
Ilex opaca	TRANS	FAC-	7.8	16.7
Quercus laurifolia	TRANS	FACW	5.6	2.1
Nyssa sylvatica var. biflora	SUB	OBL	4.9	2.1
Taxodium distichum	SUB	OBL	3.6	
Acer rubrum	TRANS	FAC	1.3	*
Carpinus caroliniana	TRANS	FAC	1.3	10.4
Vaccinium arboreum	UPL	FACU	.6	14.6
Nyssa ogeche	SUB	OBL	.4	
Ilex decidua	TRANS	FACW-		14.6
Vitis rotundifolia	UPL	FAC		10.4
Campsis radicans	UPL	FAC		4.2
Toxicodendron radicans	UPL	FAC		2.1
Gelsemium sp.	UPL	FAC		2.1
Brunnichia ovata	UPL	FACW		*
Cyrilla racemiflora	INV	FACW		*
Total			100.0	100.0

Ground cover species	Indicator category: State	Indicator category: National (Region 2)	Ground cover, in percent of total vegetative measurements (t.v.m.); Total line transect length = 165.53 m: Spring (5-5-88) through 6-7-88) t.v.m. = 109.06 m	Winter (1-11-88 through 2-11-88) t.v.m = 60.89 m
Panicum dichotomum	UPL	FAC	27.5	21.5
Chasmanthium laxum	UPL	FACW-	15.5	21.8
Toxicodendron radicans	UPL	FAC	8.4	1.5
Vitis rotundifolia	UPL	FAC	7.6	3.6
Serenoa repens	UPL	FACU	5.3	10.1
Carex reniformis	TRANS	FACW	4.8	6.1
Erianthus strictus	UPL	OBL	3.7	5.0
Cyrilla racemiflora	INV	FACW	2.9	5.1
Sebastiania fruticosa	UPL	FACW	2.6	2.3
Smilax bona-nox	UPL	FAC	2.5	3.4
Quercus nigra	TRANS	FAC	2.0	2.8
Carex sp.	TRANS	NA	1.8	2.3
Ilex decidua	TRANS	FACW-	1.5	2.7
Vaccinium elliottii	UPL	FAC+	1.4	2.3
Brunnichia ovata	UPL	FACW	1.2	
Panicum rigidulum	SUB	FACW	1.1	1.2
Carex intumescens	TRANS	FACW	1.1	1.7
Campsis radicans	UPL	FAC	1.1	1.3

Ground cover species	Indicator category: State	Indicator category: National (Region 2)	Ground cover, in percent of total vegetative measurements (t.v.m.); Total line transect length = 165.53 m: Spring (5-5-88) through 6-7-88) t.v.m. = 109.06 m	Winter (1-11-88 through 2-11-88) t.v.m = 60.89 m
Carex complanata	TRANS	FAC+	.9	.6
Liquidambar styraciflua	TRANS	FAC+	.9	.9
Carex crebriflora	TRANS	FACW	.8	.8
Bignonia capreolata	UPL	FAC	.7	.2
Ampelopsis arborea	TRANS	FAC+	.7	
Smilax sp.	UPL	FACU	.6	.2
Rubus trivialis	UPL	FAC	.6	.1
Carpinus caroliniana	TRANS	FAC	.3	
Carex debilis	TRANS	FACW	.3	.6
Agrostis perennans	UPL	FACU	.3	.6
Smilax glauca	UPL	FAC	.3	.2
Trachelospermum difforme	UPL	FACW	.2	
Dyschoriste humistrata	UPL	FACW	.2	
Hypoxis sp.	UPL	FAC	.2	.1
Lobelia flaccidifolia	UPL	OBL	.2	
Vaccinium arboreum	UPL	FACU	.2	.6
Quercus sp.	NA	NA	.1	.0
Pinus glabra	TRANS	FACW	.1	
Hypoxis leptocarpa	UPL	FACW	.1	.3
Viola affinis	UPL	FACW	.1	
Viola esculenta	UPL	FACW-	.1	
Hypericum hypericoides	UPL	FAC	.1	.0
Nyssa sp.	SUB	OBL	.0	
Justicia ovata var. *lanceolata*	SUB	OBL	.0	
Acer rubrum	TRANS	FAC	.0	
Elephantopus nudatus	UPL	FAC	.0	
Mitchella repens	UPL	FACU+	.0	.0
Smilax pumila	UPL	UPL	.0	
Vaccinium sp.	UPL	FACU	.0	
Vitis sp.	UPL	FAC	.0	
indeterminate	NA	NA	.0	.1
Quercus lyrata	SUB	OBL		.1
Gelsemium sp.	UPL	FAC		.1
Aster sp.	NA	NA		.1
Smilax rotundifolia	UPL	FAC		.0
Total			100.0	100.0

Additional species present on the plot but off the line transect:

Amsonia rigida	UPL	FACW
Baccharis halimifolia	UPL	FAC
Berchemia scandens	UPL	FACW
Callicarpa americana	UPL	FACU-
Carex joorii	TRANS	OBL
Crataegus sp.	NA	NA
Helenium sp.	UPL	NA
Hypericum galioides	UPL	OBL
Ilex opaca	TRANS	FAC-
Leucothoe racemosa	TRANS	FACW
Lygodium japonicum	TRANS	FAC
Melothria pendula	UPL	FACW-
Quercus laurifolia	TRANS	FACW
Ruellia caroliniensis	UPL	UPL
Sabal minor	UPL	FACW
Sapium sebiferum	UPL	FAC
Scleria triglomerata	TRANS	FACU+
Vaccinium myrsinites	UPL	FACU
Viburnum obovatum	TRANS	FACW+

Summaries:

State regulatory categories	Canopy	Subcanopy	Ground cover Spring	Ground cover Winter	Overall plot
Total percent SUB	8.9	2.1	1.2	1.4	
Total percent TRANS	74.7	64.7	15.7	19.6	
Total percent UPL	16.7	33.4	83.1	79.0	
IS STATE WETLAND VEGETATION CRITERION MET?	NO	NO	NO	NO	NO

National indicator categories	Canopy	Subcanopy	Ground cover Spring	Ground cover Winter
Total percent OBL	8.9	2.1	3.9	5.1
Total percent FACW	28.1	20.8	32.5	42.4
Total percent FAC	46.4	62.5	55.0	38.4
Total percent FACU	16.6	14.6	6.5	11.6
Total percent UPL	0	0	0	0
Total percent NA	0	0	2.0	2.5
Weighted average	2.71	2.90	2.66	2.58

Federal regulatory categories	Canopy, subcanopy, and spring ground cover	Canopy, subcanopy, and winter ground cover
Total percent of dominant species in all strata that are FACW	30.0	30.0
Total percent of dominant species in all strata that are FAC	50.0	40.0
Total percent of dominant species in all strata that are FACU	20.0	30.0
IS FEDERAL HYDROPHYTIC VEGETATION CRITERION MET FOR OVERALL PLOT?	YES	YES

D Aucilla low terrace

Canopy subcanopy species	Indicator category State	Indicator category National (Region 2)	Canopy Relative basal area, in percent (total basal area = 2.1 m^2) n = 42	Subcanopy Relative density, in percent n = 32
Quercus laurifolia	TRANS	FACW	64.9	3.1
Liquidambar styraciflua	TRANS	FAC+	13.7	*
Acer rubrum	TRANS	FAC	11.9	6.3
Taxodium distichum	SUB	OBL	8.0	
Fraxinus caroliniana	SUB	OBL	1.5	68.8
Ilex decidua	TRANS	FACW-		18.8
Nyssa sylvatica var. biflora	SUB	OBL		3.1
Crataegus sp.	NA	NA		*
Total			100.0	100.0

Ground cover species	Indicator category State	Indicator category National (Region 2)	Ground cover, in percent of total vegetative measurements (t.v.m.); Total line transect length = 36.04 m; Summer (7-18-89) t.v.m. = 22.3 m	Fall (11-23-88) t.v.m = 16.7 m
Hypoxis leptocarpa	UPL	FACW	36.3	12.0
Osmunda regalis	SUB	OBL	12.1	13.0
Quercus sp. [3]	TRANS	FAC	9.8	16.5
Fraxinus caroliniana	SUB	OBL	7.0	5.9
Erianthus strictus	UPL	OBL	5.8	5.0
Carex joorii	TRANS	OBL	4.8	5.7
Sebastiania fruticosa	UPL	FACW	4.7	8.7
Campsis radicans	UPL	FAC	3.9	.1
Carex intumescens	TRANS	FACW	3.6	3.1
Woodwardia areolata	TRANS	OBL	3.3	7.0
Axonopus sp.	UPL	FACW-	3.2	1.0
Quercus laurifolia	TRANS	FACW	1.4	.1
Rhynchospora caduca	UPL	OBL	1.4	2.0
Panicum rigidulum	SUB	FACW	.7	17.2
Acer rubrum	TRANS	FAC	.5	.1
Ampelopsis arborea	TRANS	FAC+	.4	
Ilex decidua	TRANS	FACW-	.3	
Panicum sp.	UPL	NA	.3	.1
Ulmus sp.	TRANS	FACU	.1	.1
Carex sp.	TRANS	NA	.1	1.8
Smilax sp.	UPL	FACU	.1	
Gramineae sp.	NA	NA	.1	
indeterminate	NA	NA	.1	
Chasmanthium laxum	UPL	FACW-		.7
Justicia ovata var. *lanceolata*	SUB	OBL		.2
Smilax rotundifolia	UPL	FAC		.1
Total			100.0	100.0

Ground Cover Species	Indicator category State	Indicator category National (Region 2
Additional species present on the plot but off the line transect:		
Aster sp.	NA	NA
Berchemia scandens	UPL	FACW
Carpinus caroliniana	TRANS	FAC
Clematis crispa	UPL	FACW+
Commelina virginica	UPL	FACW
Crataegus sp.	NA	NA
Hydrocotyle umbellata	TRANS	OBL
Hypericum galioides	UPL	OBL
Itea virginica	SUB	FACW+
Liquidambar styraciflua	TRANS	FAC+
Osmunda cinnamomea	TRANS	FACW+
Pluchea sp.	NA	NA
Sabal minor	UPL	FACW
Spiranthes sp.	UPL	NA
Styrax americana	TRANS	FACW
Taxodium distichum	SUB	OBL
Toxicodendron radicans	UPL	FAC
Vaccinium elliottii	UPL	FAC+

Summaries:

State regulatory categories	Canopy	Subcanopy	Ground cover Summer	Ground cover Fall	Overall plot
Total percent SUB	9.5	71.9	19.9	36.3	
Total percent TRANS	90.5	28.2	24.3	34.2	
Total percent UPL	0	0	55.8	29.5	
IS STATE WETLAND VEGETATION CRITERION MET?	YES(b)	YES(a)	NO	YES(a)	YES(b)

National indicator categories	Canopy	Subcanopy	Ground cover Summer	Ground cover Fall
Total percent OBL	9.5	71.9	34.4	38.7
Total percent FACW	64.9	21.9	50.1	42.7
Total percent FAC	25.6	6.3	14.6	16.8
Total percent FACU	0	0	.3	.1
Total percent UPL	0	0	0	0
Total percent NA	0	0	.7	1.9
Weighted average	2.16	1.34	1.81	1.78

Federal regulatory categories	Canopy, subcanopy, and summer ground cover	Canopy, subcanopy, and fall ground cover
Total percent of dominant species in all strata that are OBL	40.0	33.3
Total percent of dominant species in all strata that are FACW	40.0	50.0
Total percent of dominant species in all strata that are FAC	20.0	16.7
IS FEDERAL HYDROPHYTIC VEGETATION CRITERION MET FOR OVERALL PLOT?	YES	YES

E Aucilla high terrace

Canopy/ subcanopy species	Indicator category: State	Indicator category: National (Region 2)	Canopy: Relative basal area, in percent (total basal area = 2.0 m ^{2}) n = 36	Subcanopy: Relative density, in percent n = 20
Quercus laurifolia	TRANS	FACW	50.1	30.0
Quercus nigra	TRANS	FAC	20.1	
Quercus virginiana	UPL	FACU+	17.9	*
Liquidambar styraciflua	TRANS	FAC+	8.1	10.0
Nyssa sylvatica var. biflora	SUB	OBL	3.8	5.0
Ilex decidua	TRANS	FACW-		45.0
Diospyros virginiana	UPL	FAC		5.0
Vitis rotundifollia	UPL	FAC		5.0
Acer rubrum	TRANS	FAC		*
Vaccinium elliottii	UPL	FAC+		*
Total			100.0	100.0

Ground cover species	Indicator category: State	Indicator category: National (Region 2)	Ground cover, in percent of total vegetative measurements (t.v.m.); Total line transect length = 38.60 m: Summer (6-23-89) t.v.m. = 25.44 m	Fall (11-23-88) t.v.m = 28.19 m
Sebastiania fruticosa	UPL	FACW	46.4	41.5
Sabal minor	UPL	FACW	11.2	14.4
Vaccinium elliottii	UPL	FAC+	9.5	8.2
Ilex decidua	TRANS	FACW-	8.8	6.1
Liquidambar styraciflua	TRANS	FAC+	7.4	5.1
Quercus nigra	TRANS	FAC	5.2	5.3
Vitis rotundifolia	UPL	FAC	2.5	5.1
Quercus sp.	NA	NA	1.8	4.0
Scleria triglomerata	TRANS	FACU+	1.6	1.4
Hypoxis leptocarpa	UPL	FACW	1.4	.2
Panicum sp.	UPL	NA	1.3	1.9
Smilax bona-nox	UPL	FAC	.9	3.6
Gelsemium sp.	UPL	FAC	.6	.3
Chasmanthium sp.	UPL	FAC	.6	.1
Quercus laurifolia	TRANS	FACW	.3	
Styrax americana	TRANS	FACW	.2	
Cyperaceae sp.	NA	NA	.2	.4
Gramineae sp.	NA	NA	.1	
Carex intumescens	TRANS	FACW	.0	.5
Mitchella repens	UPL	FACU+	.0	.0
Erianthus strictus	UPL	OBL		.7
Carex sp.	TRANS	NA		.4
Hypericum hypericoides	UPL	FAC		.3
Axonopus sp.	UPL	FACW-		.2
Chasmanthium laxum	UPL	FACW-		.2
Gelsemium sempervirens	UPL	FAC		.1
Panicum dichotomum	UPL	FAC		.1
Cyrilla racemiflora	INV	FACW		.0
Acer rubrum	TRANS	FAC		.0
Total			100.0	100.0

Ground Cover Species	Indicator category: State	Indicator category: National (Region 2)
Additional species present on the plot but off the line transect:		
Axonopus furcatus	UPL	OBL
Campsis radicans	UPL	FAC
Carya glabra	UPL	FACU
Diospyros virginiana	UPL	FAC
Hypericum galioides	UPL	OBL
Itea virginica	SUB	FACW+
Nyssa sylvatica var. biflora	SUB	OBL
Quercus virginiana	UPL	FACU+
Sphenopholis sp.	UPL	NA
Toxicodendron radicans	UPL	FAC

Summaries:

State regulatory categories	Overall Canopy	Subcanopy	Ground cover: Summer	Ground cover: Fall	Overall plot
Total percent SUB	3.8	5.0	0	0	
Total percent TRANS	78.3	85.0	24.1	19.6	
Total percent UPL	17.9	10.0	76.0	80.5	
IS STATE WETLAND VEGETATION CRITERION MET?	NO	NO	NO	NO	NO

National indicator categories	Canopy	Subcanopy	Ground cover: Summer	Ground cover: Fall
Total percent OBL	3.8	5.0	0	.7
Total percent FACW	50.1	75.0	68.3	63.0
Total percent FAC	28.2	20.0	26.7	28.2
Total percent FACU	17.9	0	1.6	1.4
Total percent UPL	0	0	0	0
Total percent NA	0	0	3.4	6.7
Weighted average	2.60	2.15	2.31	2.32

Federal regulatory categories	Canopy, subcanopy, and summer ground cover	Canopy, subcanopy, and fall ground cover
Total percent of dominant species in all strata that are OBL	0	0
Total percent of dominant species in all strata that are FACW	83.3	83.3
Total percent of dominant species in all strata that are FAC	16.7	16.7
IS FEDERAL HYDROPHYTIC VEGETATION CRITERION MET FOR OVERALL PLOT?	YES	YES

F Telogia slough

Canopy/ subcanopy species	Indicator category: State	Indicator category: National (Region 2)	Canopy: Relative basal area, in percent (total basal area = 1.9 m^2) n = 32	Subcanopy: Relative density, in percent n = 30
Nyssa ogeche	SUB	OBL	93.3	3.3
Fraxinus caroliniana	SUB	OBL	4.4	36.7
Acer rubrum	TRANS	FAC	2.3	26.7
Fraxinus sp.	SUB	FACW		16.7
Styrax americana	TRANS	FACW		10.0
Cyrilla racemiflora	INV	FACW		6.7
Ilex opaca	TRANS	FAC-		*
Viburnum nudum	TRANS	FACW+		*
Total			100.0	100.0

Ground cover species	Indicator category: State	Indicator category: National (Region 2)	Ground cover, in percent of total vegetative measurements (t.v.m.); Total line transect length = 45.12 m: Summer (7-13-89) t.v.m. = 27.92 m	Fall (12-13-88) t.v.m = 19.63 m
Smilax walteri	SUB	OBL	23.9	22.4
Cyrilla racemiflora	INV	FACW	13.8	16.2
Viburnum nudum	TRANS	FACW+	11.5	6.8
Fraxinus sp.	SUB	FACW	10.6	6.1
Styrax americana	TRANS	FACW	4.9	6.7
Leucothoe racemosa	TRANS	FACW	4.6	6.7
Itea virginica	SUB	FACW+	4.5	4.0
Acer rubrum	TRANS	FAC	4.3	4.0
Vaccinium corymbosum	UPL	FACW	4.0	1.4
Chasmanthium laxum	UPL	FACW-	3.7	4.2
Clethra alnifolia	TRANS	FACW	3.5	4.3
Woodwardia areolata	TRANS	OBL	2.5	.1
Rhododendron canescens	UPL	FACW-	2.3	2.6
Gelsemium sp.	UPL	FAC	1.7	7.1
Sebastiania fruticosa	UPL	FACW	1.1	1.0
Hypoxis leptocarpa	UPL	FACW	1.0	.3
Smilax rotundifolia	UPL	FAC	.8	.1
Nyssa ogeche	SUB	OBL	.6	1.0
Smilax sp.	NA	NA	.5	2.9
Smilax laurifolia	SUB	FACW+	.4	1.2
Bignonia capreolata	UPL	FAC		.8
Fraxinus caroliniana	SUB	OBL		.3
Total			100.0	100.0

Additional species present on the plot but off the line transect:

Carex folliculata	TRANS	OBL
Ilex opaca	TRANS	FAC-
Mitchella repens	UPL	FACU+
Panicum rigidulum	SUB	FACW
Polygonum sp.	SUB	FACU
Quercus laurifolia	TRANS	FACW
Rubus sp.	UPL	NA
Taxodium distichum	SUB	OBL
Vaccinium elliottii	UPL	FAC+
Xyris difformis	SUB	OBL

F Telogia slough--Continued

Summaries:

State regulatory categories	Overall Canopy	Subcanopy	Ground cover Summer	Ground cover Fall	Overall plot
Total percent SUB	97.7	60.7	46.7	43.1	
Total percent TRANS	2.3	39.3	36.4	35.6	
Total percent UPL	0	0	17.0	21.5	
IS STATE WETLAND VEGETATION CRITERION MET?	YES(a)	YES(a)	YES(a)	YES(a)	YES(a)

National indicator categories	Canopy	Subcanopy	Ground cover Summer	Ground cover Fall
Total percent OBL	97.7	40.0	27.0	23.7
Total percent FACW	0	33.3	65.7	61.5
Total percent FAC	2.3	26.7	6.8	11.9
Total percent FACU	0	0	0	0
Total percent UPL	0	0	0	0
Total percent NA			.5	2.9
Weighted average	1.05	1.87	1.80	1.88

Federal regulatory categories	Canopy, subcanopy, and summer ground cover	Canopy, subcanopy, and fall ground cover
Total percent of dominant species in all strata that are OBL	42.9	42.9
Total percent of dominant species in all strata that are FACW	42.9	28.6
Total percent of dominant species in all strata that are FAC	14.3	28.6
IS FEDERAL HYDROPHYTIC VEGETATION CRITERION MET FOR OVERALL PLOT?	YES	YES

G Telogia low plain

Canopy/ subcanopy species	Indicator category: State	Indicator category: National (Region 2)	Canopy: Relative basal area, in percent (total basal area = 2.4 m^2) n = 45	Subcanopy: Relative density, in percent n = 45
Nyssa ogeche	SUB	OBL	62.1	35.6
Quercus laurifolia	TRANS	FACW	14.4	4.4
Quercus nigra	TRANS	FAC	9.6	2.2
Taxodium distichum	SUB	OBL	7.2	2.2
Liquidambar styraciflua	TRANS	FAC+	3.0	26.7
Nyssa sylvatica var. biflora	SUB	OBL	2.2	
Ilex opaca	TRANS	FAC-	1.2	*
Acer rubrum	TRANS	FAC	.7	15.6
Fraxinus caroliniana	SUB	OBL		8.9
Cyrilla racemiflora	INV	FACW		2.2
Vitis rotundifolia	UPL	FAC		2.2
Magnolia virginiana	SUB	FACW+		*
Total			100.0	100.0

Ground cover species	Indicator category: State	Indicator category: National (Region 2)	Ground cover, in percent of total vegetative measurements (t.v.m.); Total line transect length = 44.94 m: Summer (6-27-89) t.v.m. = 21.40 m	Fall (10-13-88) t.v.m = 20.09 m
Quercus laurifolia	TRANS	FACW	17.4	16.5
Smilax rotundifolia	UPL	FAC	15.8	12.6
Fraxinus sp.	SUB	FACW	15.2	
Acer rubrum	TRANS	FAC	9.9	9.5
Liquidambar styraciflua	TRANS	FAC+	9.9	10.6
Cyrilla racemiflora	INV	FACW	8.5	6.7
Styrax americana	TRANS	FACW	8.5	11.7
Sebastiania fruticosa	UPL	FACW	2.5	3.1
Magnolia virginiana	SUB	FACW+	2.1	2.3
Itea virginica	SUB	FACW+	1.7	1.4
Vaccinium sp.	UPL	FACU	1.6	2.1
Vitis rotundifolia	UPL	FAC	1.6	10.1
Woodwardia areolata	TRANS	OBL	1.5	1.7
Nyssa ogeche	SUB	OBL	1.4	1.4
Bignonia capreolata	UPL	FAC	1.1	2.1
Cephalanthus occidentalis	SUB	OBL	.8	.5
Gelsemium sp.	UPL	FAC	.4	.2
Smilax glauca	UPL	FAC	.1	1.7
Arundinaria gigantea	TRANS	FACW	.1	.2
Fraxinus caroliniana	SUB	OBL		9.1
Gelsemium sempervirens	UPL	FAC		.3
Rubus betulifolius	UPL	FAC		.1
Smilax sp.	UPL	FACU		.1
Total			100.1	100.0

Additional species present on the plot but off the line transect:

Chasmanthium laxum	UPL	FACW-
Ilex opaca	TRANS	FAC-
Panicum rigidulum	SUB	FACW
Smilax laurifolia	SUB	FACW+
Wisteria frutescens	UPL	FACW

Summaries:

State regulatory categories	Canopy	Subcanopy	Ground cover Summer	Ground cover Fall	Overall plot
Total percent SUB	71.5	47.7	23.2	14.3	
Total percent TRANS	28.6	50.0	51.5	53.7	
Total percent UPL	0	2.3	25.3	32.0	
IS STATE WETLAND VEGETATION CRITERION MET?	YES(a)	YES(a)	NO	NO	YES(a)

National indicator categories	Canopy	Subcanopy	Ground cover Summer	Ground cover Fall
Total percent OBL	71.5	46.7	3.7	11.3
Total percent FACW	14.1	6.7	55.9	41.8
Total percent FAC	14.4	46.7	38.8	46.8
Total percent FACU	0	0	1.6	.1
Total percent UPL	0	0	0	0
Total percent NA	0	0	0	0
Weighted average	1.43	2.00	2.38	2.36

Federal regulatory categories	Canopy, subcanopy, and summer ground cover	Canopy, subcanopy, and fall ground cover
Total percent of dominant species in all strata that are OBL	25.0	28.6
Total percent of dominant species in all strata that are FACW	25.0	28.6
Total percent of dominant species in all strata that are FAC	50.0	42.0
IS FEDERAL HYDROPHYTIC VEGETATION CRITERION MET FOR OVERALL PLOT?	YES	YES

H St. Marks low plain

Canopy/ subcanopy species	Indicator category State	Indicator category National (Region 2)	Canopy Relative basal area, in percent (total basal area = 6.2 m^2) n = 109	Subcanopy Relative density, in percent n = 19
Carpinus caroliniana	TRANS	FAC	35.7	5.3
Liquidambar styraciflua	TRANS	FAC+	14.7	5.3
Fraxinus profunda	SUB	OBL	11.2	
Celtis laevigata	TRANS	FACW	7.7	5.3
Quercus laurifolia	TRANS	FACW	5.8	5.3
Ulmus americana	TRANS	FACW	5.4	
Nyssa sylvatica var. biflora	SUB	OBL	5.2	
Acer rubrum	TRANS	FAC	4.6	5.3
Quercus michauxii	TRANS	FACW	4.2	
Taxodium distichum	SUB	OBL	3.0	
Diospyros virginiana	UPL	FAC	1.3	
Magnolia virginiana	SUB	FACW+	1.1	10.5
Cornus foemina	TRANS	FACW-		36.8
Viburnum obovatum	TRANS	FACW+		15.8
Cephalanthus occidentalis	SUB	OBL		5.3
Vitis cinerea var. cinerea	UPL	FAC+		5.3
Morus rubra	UPL	FAC		*
Myrica cerifera	UPL	FAC+		*
Parthenocissus quinquefolia	UPL	FAC		*
Toxicodendron radicans	UPL	FAC		*
Vitis rotundifolia	UPL	FAC		*
Total			100.0	100.0

Ground cover species	Indicator category State	Indicator category National (Region 2)	Ground cover, in percent of total vegetative measurements (t.v.m.); Total line transect length = 87.80 m; Spring (5-11-89) t.v.m. = 157.94 m	Fall (11-1-88) t.v.m = 97.93 m
Toxicodendron radicans	UPL	FAC	23.6	4.6
Carex amphibola	TRANS	FACW	11.6	9.8
Hypoxis leptocarpa	UPL	FACW	9.6	4.9
Cornus foemina	TRANS	FACW-	5.8	8.7
Carex cherokeensis	TRANS	FACW-	5.4	16.2
Celtis laevigata	TRANS	FACW	5.1	5.3
Quercus laurifolia	TRANS	FACW	4.0	4.4
Carex granularis	TRANS	FACW	4.0	1.7
Viola esculenta	UPL	FACW-	3.5	2.0
Carpinus caroliniana	TRANS	FAC	2.8	4.8
Viburnum obovatum	TRANS	FACW+	2.6	3.6
Justicia ovata var. lanceolata	SUB	OBL	1.8	2.4
Ilex opaca	TRANS	FAC-	1.7	3.4
Liquidambar styraciflua	TRANS	FAC+	1.7	2.2
Aster sp.	NA	NA	1.4	.7
Cephalanthus occidentalis	SUB	OBL	1.3	1.4
Polygonum sp.	SUB	FACU	1.3	
Panicum sp.	UPL	NA	1.3	3.3
Ulmus americana	TRANS	FACW	1.2	2.7
Magnolia virginiana	SUB	FACW+	1.1	1.6
Acer rubrum	TRANS	FAC	1.0	1.0
Vitis aestivalis	UPL	FAC	1.0	
Myrica cerifera	UPL	FAC+	.9	1.5
Taxodium distichum	SUB	OBL	.8	1.0

Ground cover species	Indicator category: State	Indicator category: National (Region 2)	Ground cover, in percent of total vegetative measurements (t.v.m.); Total line transect length = 87.80 m: Spring-summer (5-11-89) t.v.m. = 157.94 m	Fall (11-1-88) t.v.m = 97.93 m
Parthenocissus quinquefolia	UPL	FAC	.8	.0
Conoclinium coelestinum	UPL	FAC	.6	1.2
Ruellia caroliniensis	UPL	UPL	.4	.6
Saururus cernuus	SUB	OBL	.3	.0
Quercus nigra	TRANS	FAC	.3	1.9
Carex sp.	TRANS	NA	.3	
Chasmanthium nitidum	UPL	FACW+	.3	1.3
Panicum dichotomum	UPL	FAC	.3	.4
Euonymus americanus	UPL	FAC-	.2	.9
Elephantopus carolinianus	UPL	FAC	.2	1.1
Dichondra carolinensis	UPL	FACW-	.2	.3
Fraxinus sp.	SUB	FACU	.2	.1
Panicum rigidulum	SUB	FACW	.1	.0
Samolus parviflorus	SUB	OBL	.1	.0
Mikania scandens	SUB	FACW+	.1	
Ulmus sp.	TRANS	FACU	.1	
Hydrocotyle verticillata	UPL	OBL	.1	.0
Oplismenus setarius	UPL	FACU+	.1	.5
Clematis crispa	UPL	FACW+	.1	.0
Desmodium sp.	UPL	NA	.1	
Smilax bona-nox	UPL	FAC	.1	.2
Hypericum hypericoides	UPL	FAC	.1	.3
Senecio glabellus	UPL	FACW+	.1	.0
Hydrocotyle sp.	UPL	OBL	.1	
indeterminate	NA	NA	.1	
Aster carolinianus	SUB	OBL	.0	
Muhlenbergia schreberi	SUB	FAC	.0	.1
Hymenocallis rotata	SUB	OBL	.0	.0
Salix nigra	SUB	OBL	.0	.4
Carex stipata	TRANS	OBL	.0	
Sambucus canadensis	TRANS	FACW-	.0	
Diospyros virginiana	UPL	FAC	.0	.0
Sabatia calycina	TRANS	OBL	.0	
Thelypteris sp.	TRANS	FACU	.0	
Aristolochia serpentaria	UPL	FACU	.0	.1
Pinus sp.	NA	NA	.0	
Smilax sp.	UPL	FACU	.0	.0
Polygonum punctatum	SUB	FACW+		1.6
Mitchella repens	UPL	FACU+		.5
Hydrocotyle umbellata	TRANS	OBL		.4
Fraxinus caroliniana	SUB	OBL		.3
Berchemia scandens	UPL	FACW		.3
Matelea gonocarpos[4]	UPL	FACW		.1
Egeria densa	SUB	OBL		.0
Total			100.0	100.0

Additional species present on the plot but off the line transect:

Ambrosia sp.	UPL	NA
Ampelopsis arborea	TRANS	FAC+
Aster dumosus	UPL	FAC
Aster lateriflorus	UPL	FAC
Bidens mitis	SUB	OBL
Boehmeria cylindrica [1]	TRANS	FACW+
Bumelia reclinata	UPL	FAC
Carex albolutescens	TRANS	FAC+
Carya sp.	UPL	FAC
Cicuta mexicana	SUB	OBL
Crataegus viridis	TRANS	FACW
Decumaria barbara	UPL	FACW
Diospyros virginiana	UPL	FAC
Eichhornia crassipes	SUB	OBL
Elytraria carolinensis [5]	UPL	FACW
Eupatorium perfoliatum	UPL	FACW+
Galium sp.	UPL	UPL
Hyptis alata	UPL	OBL
Ilex cassine	SUB	FACW

Ground cover species	Indicator category: State	Indicator category: National (Region 2)
Ilex vomitoria	UPL	FAC
Itea virginica	SUB	FACW+
Juncus coriaceus[1]	SUB	FACW
Ligustrum sinense	UPL	FAC
Lobelia cardinalis	SUB	FACW+
Ludwigia repens	SUB	OBL
Melothria pendula	UPL	FACW-
Morus rubra	UPL	FAC
Nyssa sylvatica var. biflora	SUB	OBL
Peltandra virginica	SUB	OBL
Persea palustris	SUB	UPL
Pinus glabra	TRANS	FACW
Platanthera flava	UPL	FACW
Polypodium polypodioides	UPL	NA
Pontederia cordata	SUB	OBL
Ptilimnium capillaceum	UPL	OBL
Quercus michauxii	TRANS	FACW
Rhynchospora caduca	UPL	OBL
Rubus trivialis	UPL	FAC
Sabal palmetto	INV	FAC
Scirpus divaricatus	UPL	OBL
Scirpus lineatus	UPL	UPL
Smilax laurifolia	SUB	FACW+
Smilax smallii	UPL	FACU
Smilax tamnoides	UPL	FAC+
Spiranthes cernua	UPL	FACW
Vitis cinerea var. cinerea	UPL	FAC+
Vitis rotundifolia	UPL	FAC

Summaries:

State regulatory categories	Canopy	Subcanopy	Ground cover: Spring-summer	Ground cover: Fall	Overall plot
Total percent SUB	20.5	15.8	7.3	9.1	
Total percent TRANS	78.1	79.1	48.2	66.6	
Total percent UPL	1.3	5.3	44.5	24.4	
IS STATE WETLAND VEGETATION CRITERION MET?	YES(a)	YES(a)	NO	NO	YES(a)

National indicator categories	Canopy	Subcanopy	Ground cover: Spring-summer	Ground cover: Fall
Total percent OBL	19.4	5.3	4.6	6.0
Total percent FACW	24.3	73.7	56.1	64.7
Total percent FAC	56.3	21.1	35.2	23.7
Total percent FACU	0	0	.5	1.0
Total percent UPL	0	0	.4	.6
Total percent NA	0	0	3.3	4.1
Weighted average	2.37	2.16	2.34	2.22

Federal regulatory categories	Canopy, subcanopy, and spring-summer ground cover	Canopy, subcanopy, and fall ground cover
Total percent of dominant species in all strata that are FACW	62.5	63.6
Total percent of dominant species in all strata that are FAC	37.5	36.4
IS FEDERAL HYDROPHYTIC VEGETATION CRITERION MET FOR OVERALL PLOT?	YES	YES

I St. Marks lower slope

Canopy/ subcanopy species	Indicator category: State	Indicator category: National (Region 2)	Canopy: Relative basal area, in percent (total basal area = 1.4 m^2) n = 37	Subcanopy: Relative density, in percent n = 11
Liquidambar styraciflua	TRANS	FAC+	28.2	9.1
Magnolia virginiana	SUB	FACW+	16.4	9.1
Carpinus caroliniana	TRANS	FAC	14.6	9.1
Pinus taeda	UPL	FAC	10.2	9.1
Celtis laevigata	TRANS	FACW	9.4	
Fraxinus profunda	SUB	OBL	9.2	
Ulmus americana	TRANS	FACW	4.5	
Diospyros virginiana	UPL	FAC	4.5	9.1
Myrica cerifera	UPL	FAC+	2.0	9.1
Salix nigra	SUB	OBL	1.0	*
Taxodium distichum	SUB	OBL		18.2
Cornus foemina	TRANS	FACW-		18.2
Vitis aestivalis	UPL	FAC		9.1
Ampelopsis arborea	TRANS	FAC+		*
Berchemia scandens	UPL	FACW		*
Quercus laurifolia	TRANS	FACW		*
Viburnum obovatum	TRANS	FACW+		*
Vitis cinerea var. cinerea	UPL	FAC+		*
Total			100.0	100.0

Ground cover species	Indicator category: State	Indicator category: National (Region 2)	Ground cover, in percent of total vegetative measurements (t.v.m.); Total line transect length = 42.12 m: Spring-summer (6-21-89) t.v.m. = 73.69 m	Fall (11-10-88) t.v.m = 56.85 m
Carpinus caroliniana	TRANS	FAC	24.7	32.2
Toxicodendron radicans	UPL	FAC	22.3	8.8
Carex cherokeensis	TRANS	FACW-	8.0	8.8
Quercus laurifolia	TRANS	FACW	5.1	7.3
Myrica cerifera	UPL	FAC+	3.9	7.0
Carex granularis	TRANS	FACW	3.6	.9
Hypoxis leptocarpa	UPL	FACW	3.5	1.8
Magnolia virginiana	SUB	FACW+	2.1	2.4
Cornus foemina	TRANS	FACW-	2.0	2.6
Carex amphibola	TRANS	FACW	1.9	.1
Ilex opaca	TRANS	FAC-	1.8	.5
Liquidambar styraciflua	TRANS	FAC+	1.6	2.2
Panicum dichotomum	UPL	FAC	1.6	.8
Rhynchospora caduca	UPL	OBL	1.5	1.9
Ulmus americana	TRANS	FACW	1.4	1.6
Elephantopus carolinianus	UPL	FAC	1.1	1.5
Aster sp.	NA	NA	1.1	.6
Arundinaria gigantea	TRANS	FACW	.9	1.3
Berchemia scandens	UPL	FACW	.8	.3
Parthenocissus quinquefolia	UPL	FAC	.8	
Juncus coriaceus	SUB	FACW	.8	.8
Chasmanthium nitidum	UPL	FACW+	.8	2.2
Cephalanthus occidentalis	SUB	OBL	.7	1.7
Muhlenbergia schreberi	SUB	FAC	.7	.1
Celtis laevigata	TRANS	FACW	.7	1.6

Ground cover species	Indicator category: State	Indicator category: National (Region 2)	Ground cover, in percent of total vegetative measurements (t.v.m.); Total line transect length = 42.12 m: Spring-summer (6-21-89) t.v.m. = 73.69 m	Fall (11-10-88) t.v.m = 56.85 m
Baccharis glomeruliflora	UPL	FACW	.7	1.9
Ampelopsis arborea	TRANS	FAC+	.5	.5
Decumaria barbara	UPL	FACW	.5	1.1
Juniperus virginiana	UPL	FACU-	.5	.6
Sabal minor	UPL	FACW	.5	.2
Oplismenus setarius	UPL	FACU+	.4	.5
Panicum sp.	NA	NA	.4	.8
Ruellia caroliniensis	UPL	UPL	.3	.1
Viola esculenta	UPL	FACW-	.3	
Ulmus alata	TRANS	FACU+	.2	
Acer rubrum	TRANS	FAC	.2	.1
Desmodium sp.	UPL	NA	.2	.0
Euonymus americanus	UPL	FAC-	.2	.3
Aristolochia serpentaria	UPL	FACU	.2	.2
Smilax tamnoides	UPL	FAC+	.2	.2
indeterminate	NA	NA	.2	
Carex sp.	TRANS	NA	.1	1.1
Diospyros virginiana	UPL	FAC	.1	.1
Hydrocotyle verticillata	UPL	OBL	.1	
Conoclinium coelestinum	UPL	FAC	.1	.3
Polypodium polypodioides	UPL	NA	.1	
Viola sp.	UPL	FAC	.1	.0
Hyptis alata	UPL	OBL	.1	
Rubus trivialis	UPL	FAC	.1	
Hydrocotyle sp.	UPL	OBL	.1	
Hypericum sp.	NA	NA	.1	
Cyperaceae sp.	NA	NA	.1	
Bidens mitis	SUB	OBL	.0	.1
Mikania scandens	SUB	FACW+	.0	
Pinus glabra	TRANS	FACW	.0	
Sanicula sp.	UPL	NA	.0	
Dichondra carolinensis	UPL	FACW-	.0	.2
Pinus sp.	NA	NA	.0	
Viburnum obovatum	TRANS	FACW+		1.7
Fraxinus profunda	SUB	OBL		1.1
Pinus taeda	UPL	FAC		.5
Aster lateriflorus	UPL	FAC		.4
Mitchella repens	UPL	FACU+		.1
Gramineae sp.	NA	NA		.1
Justicia ovata var. *lanceolata*	SUB	OBL		.0
Aster carolinianus	SUB	OBL		.0
Polygonum sp.	SUB	FACU		.0
Hydrocotyle umbellata	TRANS	OBL		.0
Total			100.0	100.0

Additional species present on the plot but off the line transect:

Bignonia capreolata	UPL	FAC
Bumelia reclinata	UPL	FAC
Carex stipata	TRANS	OBL
Clematis crispa	UPL	FACW+
Cyrilla racemiflora	INV	FACW
Elytraria carolinensis[5]	UPL	FACW
Hypericum hypericoides	UPL	FAC
Ilex vomitoria	UPL	FAC
Itea virginica	SUB	FACW+
Ligustrum sinense	UPL	FAC
Panicum rigidulum	SUB	FACW
Persea palustris	SUB	UPL
Quercus michauxii	TRANS	FACW
Ranunculus sp.	UPL	FAC
Rosa sp. (cultivated)	UPL	NA
Sabatia calycina	TRANS	OBL
Sambucus canadensis	TRANS	FACW-
Samolus parviflorus	SUB	OBL
Smilax bona-nox	UPL	FAC
Taxodium distichum	SUB	OBL
Thelypteris sp.	TRANS	FACU
Vitis cinerea var. cinerea	UPL	FAC+
Vitis rotundifolia	UPL	FAC

Summaries:

State regulatory categories	Canopy	Subcanopy	Ground cover Spring-summer	Ground cover Fall	Overall plot
Total percent SUB	26.6	27.3	4.5	6.3	
Total percent TRANS	56.7	36.4	53.4	61.9	
Total percent UPL	16.7	36.4	42.1	31.8	
IS STATE WETLAND VEGETATION CRITERION MET?	YES(a)	NO	NO	NO	YES(a)

National indicator categories	Canopy	Subcanopy	Ground cover Spring-summer	Ground cover Fall
Total percent OBL	10.2	18.2	2.6	4.
Total percent FACW	30.4	27.3	33.6	35.6
Total percent FAC	59.5	54.6	59.9	55.5
Total percent FACU	0	0	1.3	.8
Total percent UPL	0	0	3	.1
Total percent NA	0	0	2.4	3.1
Weighted average	2.49	2.36	2.62	2.54

Federal regulatory categories	Canopy, subcanopy, and spring-summer ground cover	Canopy, subcanopy, and fall ground cover
Total percent of dominant species in all strata that are OBL	6.7	6.3
Total percent of dominant species in all strata that are FACW	26.7	31.3
Total percent of dominant species in all strata that are FAC	66.7	62.5
IS FEDERAL HYDROPHYTIC VEGETATION CRITERION MET FOR OVERALL PLOT?	YES	YES

J St. Marks upper slope

Canopy/ subcanopy species	Indicator category State	Indicator category National (Region 2)	Canopy Relative basal area, in percent (total basal area = 2.7 m^2) n = 36	Subcanopy Relative density, in percent n = 7
Pinus taeda	UPL	FAC	56.9	
Liquidambar styraciflua	TRANS	FAC+	17.3	14.3
Carpinus caroliniana	TRANS	FAC	12.2	14.3
Magnolia grandiflora	UPL	FAC+	3.5	
Quercus michauxii	TRANS	FACW	2.8	
Ilex opaca	TRANS	FAC-	2.7	*
Cornus florida	UPL	FACU	2.3	*
Prunus serotina	UPL	FACU	1.7	
Fraxinus profunda	SUB	OBL	.6	
Vitis rotundifolia	UPL	FAC		57.1
Vitis aestivalis	UPL	FAC		14.3
Cercis canadensis	UPL	FACU		*
Ilex vomitoria	UPL	FAC		*
Juniperus virginiana	UPL	FACU-		*
Myrica cerifera	UPL	FAC+		*
Quercus laurifolia	TRANS	FACW		*
Quercus nigra	TRANS	FAC		*
Total			100.0	100.0

Ground cover species	Indicator category State	Indicator category National (Region 2)	Ground cover, in percent of total vegetative measurements (t.v.m.); total line transect length = 41.80 m — Spring-summer (6-22-89) t.v.m. = 42.99 m	Fall (11-10-88) t.v.m = 36.15 m
Toxicodendron radicans	UPL	FAC	14.3	.8
Ilex opaca	TRANS	FAC-	11.1	11.6
Magnolia grandiflora	UPL	FAC+	10.4	14.9
Cornus florida	UPL	FACU	10.1	12.9
Parthenocissus quinquefolia	UPL	FAC	9.9	
Carpinus caroliniana	TRANS	FAC	8.4	9.5
Arundinaria gigantea	TRANS	FACW	5.4	5.0
Celtis laevigata	TRANS	FACW	4.5	8.5
Quercus sp.	NA	NA	3.6	2.9
Carex amphibola	TRANS	FACW	2.8	5.6
Quercus nigra	TRANS	FAC	2.3	2.5
Cercis canadensis	UPL	FACU	2.1	
Mitchella repens	UPL	FACU+	2.0	4.2
Oplismenus setarius	UPL	FACU+	1.5	3.7
Prunus serotina	UPL	FACU	1.4	.9
Ilex vomitoria	UPL	FAC	1.3	1.5
Carex cherokeensis	TRANS	FACW-	1.2	2.0
Arisaema triphyllum	UPL	FACW-	1.1	
Aster sp.	NA	NA	.9	.8
Carya sp.	TRANS	NA	.7	
Elephantopus carolinianus	UPL	FAC	.7	
Quercus michauxii	TRANS	FACW	.6	.3
Ulmus sp.	TRANS	FACU	.5	
Dioscorea sp.	UPL	NA	.5	
Chasmanthium sp.	UPL	FAC	.4	
Smilax sp.	UPL	FACU	.4	.1

Ground cover species	Indicator category: State	Indicator category: National (Region 2)	Ground cover, in percent of total vegetative measurements (t.v.m.); Total line transect length = 41.80 m: Spring-summer (6-22-89) t.v.m. = 42.99 m	Fall (11-10-88) t.v.m = 36.15 m
Pinus glabra	TRANS	FACW	.3	.9
Carex granularis	TRANS	FACW	.2	.2
Sanicula sp.	UPL	NA	.2	
Smilax smallii	UPL	FACU	.1	.0
Bignonia capreolata	UPL	FAC	.1	.7
Cornus foemina	TRANS	FACW-	.1	.1
Viburnum obovatum	TRANS	FACW+	.1	.9
Euonymus americanus	UPL	FAC-	.1	.1
Galium hispidulum	UPL	UPL	.1	1.2
Ruellia caroliniensis	UPL	UPL	.1	.6
Vitis rotundifolia	UPL	FAC	.1	.1
indeterminate	NA		.1	
Pinus sp.	NA	NA	.1	
Aristolochia serpentaria	UPL	FACU	.0	
Desmodium sp.	UPL	NA	.0	
Sabal sp.	NA	FAC	.0	
Ulmus americana	TRANS	FACW		2.4
Quercus laurifolia	TRANS	FACW		1.4
Carya glabra	UPL	FACU		1.0
Carex sp.	TRANS	NA		.6
Chasmanthium nitidum	UPL	FACW+		.5
Berchemia scandens	UPL	FACW		.4
Sanicula canadensis	UPL	FACU		.2
Vaccinium sp.	UPL	FACU		.2
Panicum dichotomum	UPL	FAC		.2
Panicum sp.	UPL	NA		.2
Persea palustris	SUB	UPL		.1
Magnolia virginiana	SUB	FACW+		.1
Sabal minor	UPL	FACW		.1
Total			100.0	100.0

Additional species present on the plot but off the line transect:

Acer rubrum	TRANS	FAC
Ampelopsis arborea	TRANS	FAC+
Arisaema dracontium	UPL	FACW
Asplenium platyneuron	UPL	FACU
Baccharis glomeruliflora	UPL	FACW
Bumelia lanuginosa subsp. *lanuginosa*	UPL	FACU
Callicarpa americana	UPL	FACU-
Conoclinium coelestinum	UPL	FAC
Decumaria barbara	UPL	FACW
Diospyros virginiana	UPL	FAC
Elytraria carolinensis[5]	UPL	FACW
Fraxinus sp.	SUB	FACW
Hydrocotyle sp.	UPL	OBL
Hypoxis leptocarpa	UPL	FACW
Juncus coriaceus[1]	SUB	FACW
Justicia ovata var. *lanceolata*	SUB	OBL
Ligustrum sinense	UPL	FAC
Liquidambar styraciflua	TRANS	FAC+
Lonicera sempervirens	UPL	FAC
Matelea sp.	UPL	FACW
Monotropa uniflora	UPL	FACU-
Morus rubra	UPL	FAC
Muhlenbergia schreberi	SUB	FAC
Myrica cerifera	UPL	FAC+
Nandina domestica	UPL	UPL
Passiflora lutea	UPL	UPL
Polymnia uvedalia	UPL	UPL
Salvia lyrata	UPL	FAC-
Sambucus canadensis	TRANS	FACW-
Serenoa repens	UPL	FACU
Smilax pumila	UPL	UPL
Thelypteris sp.	TRANS	FACU
Vaccinium corymbosum	UPL	FACW
Viola sp.	UPL	F

Summaries:

State regulatory categories	Canopy	Subcanopy	Ground cover: Spring-summer	Ground cover: Fall	Overall plot
Total percent SUB	.6	0	0	.2	
Total percent TRANS	35.0	28.6	39.5	53.6	
Total percent UPL	64.4	71.4	60.6	46.2	
IS STATE WETLAND VEGETATION CRITERION MET ?	NO	NO	NO	NO	NO

National indicator categories	Canopy	Subcanopy	Ground cover: Spring-summer	Ground cover: Fall
Total percent OBL	6	0	0	0
Total percent FACW	2.8	0	16.4	28.4
Total percent FAC	92.7	100.0	60.3	41.7
Total percent FACU	4.0	0	18.2	23.4
Total percent UPL	0	0	.2	2.0
Total percent NA	0	0	4.9	4.5
Weighted average	3.00	3.00	3.02	2.99

Federal regulatory categories	Canopy, subcanopy, and spring-summer ground cover	Canopy, subcanopy, and fall ground cover
Total percent of dominant species in all strata that are FACW	0	14.3
Total percent of dominant species in all strata that are FAC	85.7	71.4
Total percent of dominant species in all strata that are FACU	14.3	14.3
IS FEDERAL HYDROPHYTIC VEGETATION CRITERION MET FOR OVERALL PLOT?	YES	YES

[1](Clewell, 1985)
[2](Gerald Smith, High Point College, N.C., written commun., 1989)
[3]either *Quercus laurifolia* or *Q. nigra*
[4](Nicolson, 1986)
[5](Harvard University, 1968)

Appendix V. Duration of average annual longest flood for selected flood-plain plant species on four north Florida streams.

A Canopy and subcanopy species

[Species are ranked for each site by average annual longest flood from shortest to longest. Each species had a minimum sample size of nine occurrences in canopy and subcanopy combined. Refer to glossary for growing season dates. A period of record of approximately 30 years was used to calculate average annual longest floods. Refer to appendix I for exact period of record for each site. CAUTION: Interpretation of the data in this table is limited because: 1) duration of soil saturation has not been included, 2) vegetation data has not been normalized for plot size or topographic position, and 3) period of record has not been adjusted for age of the plants or for the fact that some plants are more sensitive to hydrologic conditions in the germination and seedling stage than they are as mature individuals]

Species	Sample size	Average annual longest flood, in days: Median			Range		
		Water year	SCS growing season	Freeze-free growing season	Water year	SCS growing season	Freeze-free growing season
OCHLOCKONEE RIVER SITE					**4.8 -145.2**	**4.8 -105.3**	**3.2 - 73.8**
Quercus virginiana	(13)	7.2	7.2	5.0	5.8 - 24.2	5.8 - 23.2	3.8 - 16.5
Vaccinium arboreum	(10)	8.7	8.7	5.8	7.2 - 11.3	7.2 - 11.1	5.0 - 7.5
Nyssa sylvatica var. *biflora*	(11)	9.4	9.4	6.2	6.6 - 28.2	6.6 - 27.2	4.5 - 18.3
Ilex opaca	(25)	10.2	10.2	6.8	4.8 - 38.9	4.8 - 34.4	3.2 - 22.6
Pinus glabra	(17)	11.1	10.9	7.4	5.8 - 14.8	5.8 - 14.2	3.8 - 10.0
Carpinus caroliniana	(12)	12.4	12.2	8.5	11.3 - 21.0	11.1 - 19.9	7.5 - 14.2
Quercus nigra	(19)	13.5	13.0	9.2	6.0 - 34.8	5.9 - 30.2	4.0 - 19.9
Liquidambar styraciflua	(51)	15.5	14.7	10.3	6.6 - 82.2	6.6 - 63.7	4.5 - 39.9
Ilex decidua	(23)	38.1	33.7	21.6	6.9 - 58.2	6.9 - 47.9	4.7 - 30.1
Acer rubrum	(27)	50.9	41.7	25.9	18.7 - 81.7	17.7 - 63.4	12.4 - 39.7
Quercus laurifolia	(43)	51.4	42.1	26.3	13.0 - 81.7	12.7 - 63.4	8.9 - 39.7
Taxodium distichum	(33)	62.7	51.4	31.9	11.8 -109.6	11.7 - 81.4	8.0 - 52.7
Nyssa ogeche	(64)	76.1	59.8	36.6	14.7 -145.2	14.0 -105.3	9.8 - 73.8
Fraxinus caroliniana	(49)	84.3	65.0	40.9	50.9 -139.8	41.7 -102.2	25.9 - 70.8
Planera aquatica	(12)	88.4	66.2	41.8	75.5 -104.2	59.7 - 76.4	36.5 - 48.6
AUCILLA RIVER SITE					**9.3 - 66.4**	**9.1 - 55.7**	**7.4 - 38.2**
Ilex decidua	(15)	19.0	17.4	13.1	12.0 - 63.2	11.8 - 52.4	9.6 - 34.8
Quercus laurifolia	(49)	25.8	23.3	17.2	10.2 - 63.2	10.0 - 52.4	8.0 - 34.8
Liquidambar styraciflua	(13)	34.0	30.5	21.4	11.1 - 60.8	10.9 - 50.4	8.9 - 34.0
Acer rubrum	(11)	40.3	38.0	26.4	34.0 - 63.2	30.5 - 52.4	21.4 - 34.8
Fraxinus caroliniana	(29)	60.8	50.4	34.0	34.9 - 66.4	31.4 - 55.7	22.2 - 38.2
TELOGIA CREEK SITE					**2.4 -132.1**	**2.6 - 89.0**	**2.1 - 74.5**
Liquidambar styraciflua	(17)	5.7	6.1	5.3	2.4 - 9.3	2.6 - 9.5	2.1 - 8.1
Nyssa ogeche	(69)	7.1	7.6	6.6	2.6 -132.1	2.8 - 89.0	2.2 - 74.5
Acer rubrum	(19)	7.8	8.2	6.8	2.4 - 82.0	2.6 - 56.7	2.1 - 42.6
Fraxinus caroliniana	(22)	29.7	25.3	19.0	6.6 -132.1	7.0 - 89.0	6.0 - 74.5
ST. MARKS RIVER SITE					**.0 -108.0**	**.0 -104.5**	**.0 - 98.7**
Pinus taeda	(10)	.2	.2	.2	.0 - 3.3	.0 - 3.2	.0 - 2.7
Liquidambar styraciflua	(32)	3.6	3.5	3.0	.2 - 10.8	.2 - 10.8	.2 - 10.0
Carpinus caroliniana	(88)	9.5	9.4	8.6	.2 - 64.7	.2 - 62.2	.2 - 59.4
Celtis laevigata	(11)	10.8	10.8	10.0	2.3 - 14.3	2.2 - 14.2	2.1 - 13.0
Fraxinus profunda	(15)	14.3	14.2	13.0	.4 -108.0	.4 -104.5	.4 - 98.7
Cornus foemina	(9)	42.2	38.6	35.4	4.5 - 47.0	4.3 - 43.4	3.8 - 40.1

B Ground-cover species

[Species are ranked for each site by average annual longest flood from shortest to longest. Each species had a minimum sample size of 9 occurrences. For each species either spring-summer or fall-winter transect data was used, whichever had the greatest number of individual encounters. If the numbers of encounters were the same, the transect with the greater coverage was used. Means were weighted for amount of coverage along line transect. Refer to glossary for growing season dates. A period of record of approximately 30 years was used to calculate average annual longest floods. Refer to appendix I for exact period of record at each site. CAUTION: Interpretation of the data in this table is limited because: 1) duration of soil saturation has not been included, 2) vegetation data has not been normalized for transect length or topographic position, and 3) period of record has not been adjusted for age of the plants or for the fact that some plants are more sensitive to hydrologic conditions in the germination and seedling stage than they are as mature individuals]

Species	Sample size	Average annual longest flood, in days: Median: Coverage in meters	Median: Water year	Median: SCS growing season	Median: Freeze-free growing season	Range: Water year	Range: SCS growing season	Range: Freeze-free growing season
OCHLOCKONEE RIVER SITE						**5.8 -117.2**	**5.8 - 86.4**	**3.8 - 58.9**
Vitis rotundifolia	(23)	8.25	9.0	8.9	6.0	5.8 - 12.2	5.8 - 11.9	3.8 - 8.2
Chasmanthium laxum	(177)	16.93	9.0	8.9	6.0	6.9 - 76.7	6.9 - 59.9	4.7 - 36.8
Serenoa repens	(18)	5.77	9.0	8.9	6.0	7.2 - 11.8	7.2 - 11.7	5.0 - 8.0
Toxicodendron radicans	(152)	9.13	10.5	10.4	7.1	6.0 - 18.7	5.9 - 17.7	4.0 - 12.4
Smilax bona-nox	(25)	2.69	11.0	10.8	7.4	6.9 - 13.0	6.9 - 12.7	4.7 - 8.9
Cyrilla racemiflora	(10)	3.10	11.5	11.3	7.6	9.4 - 13.0	9.4 - 12.7	6.2 - 8.9
Bignonia capreolata	(13)	.80	11.5	11.3	7.8	7.2 - 13.0	7.2 - 12.7	5.0 - 8.9
Agrostis perennans	(13)	.36	11.6	11.4	7.8	8.5 - 14.7	8.5 - 14.0	5.8 - 9.8
Carex complanata	(11)	.97	12.0	11.7	8.1	9.4 - 13.0	9.4 - 12.7	6.2 - 8.9
Panicum dichotomum	(493)	31.46	13.5	12.7	8.5	5.8 -117.2	5.8 - 86.4	3.8 - 58.9
Carex reniformis	(54)	5.57	14.9	14.0	9.4	7.7 - 52.7	7.7 - 43.3	5.1 - 26.8
Carex crebriflora	(17)	.90	15.6	15.0	10.4	11.6 - 19.1	11.5 - 18.1	7.8 - 12.6
Erianthus strictus	(19)	4.51	17.4	15.9	10.6	9.4 - 62.7	9.4 - 51.4	6.2 - 31.9
Carex intumescens	(11)	1.04	16.4	15.7	10.8	12.2 - 19.9	11.9 - 18.9	8.2 - 12.8
Sebastiania fruticosa	(26)	3.65	22.1	19.7	12.8	9.4 - 63.9	9.4 - 52.8	6.2 - 33.0
Ampelopsis arborea	(9)	1.13	26.6	23.0	14.5	8.0 - 75.5	8.0 - 59.7	5.4 - 36.5
Campsis radicans	(29)	2.75	43.4	35.6	22.4	10.2 - 89.1	10.2 - 66.7	6.8 - 42.1
Dyschoriste humistrata	(31)	1.39	48.0	39.5	24.7	8.7 - 77.2	8.7 - 60.3	5.9 - 37.2
Panicum rigidulum	(45)	6.74	60.6	47.9	30.4	9.4 -112.6	9.4 - 83.9	6.2 - 56.5
Pluchea camphorata	(10)	.43	58.7	48.4	30.4	51.7 - 62.7	42.4 - 51.4	26.6 - 31.9
Brunnichia ovata	(54)	6.85	65.8	51.7	33.2	11.1 -112.6	10.9 - 83.9	7.4 - 56.5
Boehmeria cylindrica	(10)	1.88	84.8	65.4	42.8	50.9 -112.6	41.7 - 83.9	25.9 - 56.5
AUCILLA RIVER SITE						**9.6 - 66.4**	**9.3 - 55.7**	**7.6 - 38.2**
Sabal minor	(9)	4.05	10.3	10.1	8.2	9.6 - 19.0	9.3 - 17.4	7.6 - 13.1
Sebastiana fruticosa	(50)	13.72	16.1	15.2	11.7	9.6 - 51.1	9.3 - 44.6	7.6 - 30.1
Smilax bona-nox	(12)	.31	16.2	15.3	11.9	10.2 - 25.8	10.0 - 23.3	8.0 - 17.2
Hypoxis leptocarpa	(70)	8.44	53.8	45.6	30.7	12.8 - 66.4	12.6 - 55.7	10.3 - 38.2
Panicum rigidulum	(16)	2.88	59.6	49.7	33.4	51.1 - 63.2	44.6 - 52.4	30.1 - 34.8
TELOGIA CREEK SITE						**2.8 -119.6**	**3.0 - 77.3**	**2.4 - 64.1**
Smilax rotundifolia	(10)	3.62	6.4	6.8	5.9	3.7 - 11.5	3.9 - 11.5	3.4 - 9.3
Cyrilla racemiflora	(10)	5.67	19.0	15.9	11.8	4.0 - 70.8	4.3 - 50.6	3.7 - 36.9
Smilax walteri	(19)	4.39	27.8	23.5	17.2	4.4 -119.6	4.6 - 77.3	4.0 - 64.1
ST. MARKS RIVER SITE						**.0 -121.9**	**.0 -114.5**	**.0 -107.8**
Galium hispidulum	(16)	.45	.2	.2	.2	.0 - .3	.0 - .3	.0 - .3
Arundinaria gigantea	(10)	2.99	1.5	1.4	1.4	.8 - 2.5	.8 - 2.4	.8 - 2.2
Mitchella repens	(60)	2.01	2.8	2.8	2.6	.0 - 10.8	.0 - 10.8	.0 - 10.0
Oplismenus setarius	(59)	2.14	3.0	2.9	2.7	.1 - 10.8	.1 - 10.8	.1 - 10.0
Decumaria barbara	(9)	.36	4.0	3.9	3.4	3.3 - 6.8	3.2 - 6.7	2.7 - 5.9
Aster lateriflorus	(13)	.25	4.8	4.7	4.2	2.6 - 8.6	2.5 - 8.5	2.3 - 7.8
Mulhlenbergia schreberi	(10)	.57	5.3	5.2	4.6	2.5 - 21.3	2.4 - 21.2	2.2 - 19.5
Aristolochia serpentaria	(10)	.19	8.0	7.9	7.2	2.0 - 17.3	1.8 - 17.2	1.8 - 15.5
Panicum dichotomum	(27)	1.59	8.3	8.2	7.4	3.6 - 22.9	3.5 - 21.8	3.0 - 19.8
Elephantopus carolinianus	(27)	1.96	8.8	8.7	8.0	2.5 - 14.6	2.4 - 14.5	2.2 - 13.2
Toxidodendron radicans	(232)	59.78	9.6	9.5	8.7	.0 - 50.8	.0 - 47.1	.0 - 43.8
Chasmanthium nitidum	(14)	2.67	10.1	10.0	9.1	.9 - 18.5	.9 - 18.5	.9 - 16.9
Carex cherokeensis	(108)	21.56	10.1	10.1	9.2	.1 - 30.6	.1 - 29.1	.1 - 26.6
Euonymus americanus	(16)	1.07	10.2	10.2	9.4	.4 - 17.3	.4 - 17.2	.4 - 15.5
Ruellia caroliniensis	(19)	.92	10.5	10.3	9.4	.2 - 23.7	.2 - 22.7	.2 - 20.6
Dichondra carolinensis	(13)	.24	11.1	10.9	10.0	3.6 - 24.7	3.5 - 23.7	3.0 - 21.1
Carex granularis	(94)	9.02	11.4	11.3	10.3	2.2 - 25.5	2.0 - 24.5	1.9 - 22.1
Carex amphibola	(102)	20.91	12.1	12.0	11.0	.1 - 30.6	.1 - 29.1	.1 - 26.6
Viola esculenta	(87)	5.74	12.1	12.0	11.1	7.9 - 24.0	7.8 - 22.9	7.0 - 20.8
Hydrocotyle verticillata	(11)	.34	12.4	12.2	11.2	6.8 - 21.3	6.7 - 21.2	5.9 - 19.5
Viburnum obovatum	(15)	4.85	12.6	12.5	11.4	1.0 - 33.5	.9 - 30.3	.9 - 27.6
Hydrocotyle umbellata	(15)	.38	13.6	13.4	12.3	6.8 - 21.3	6.7 - 21.2	5.9 - 19.5
Hypoxis leptocarpa	(185)	17.78	18.4	17.8	16.3	2.5 -104.0	2.4 -100.0	2.2 - 94.0
Conoclinium coelestinum	(27)	1.35	20.8	20.3	18.6	3.9 - 51.4	3.8 - 47.8	3.3 - 44.5
Justicia ovata var. lanceolata	(71)	2.82	29.3	27.8	25.7	7.9 -121.9	7.8 -114.5	7.0 -107.8

Index to Scientific Names

Synonyms used on Federal list (Reed, 1988) are in brackets. Nomenclature follows Godfrey (1988) for woody plants, Godfrey and Wooten (1979, 1981) for herbaceous wetland species, and Clewell (1985) for herbaceous upland species unless otherwise indicated.

[1](Clewell, 1985)

[2](Harvard University, 1968).

[3](Gerald Smith, High Point College, N.C., written commun., 1989).

[4] (Nicolson, 1986)