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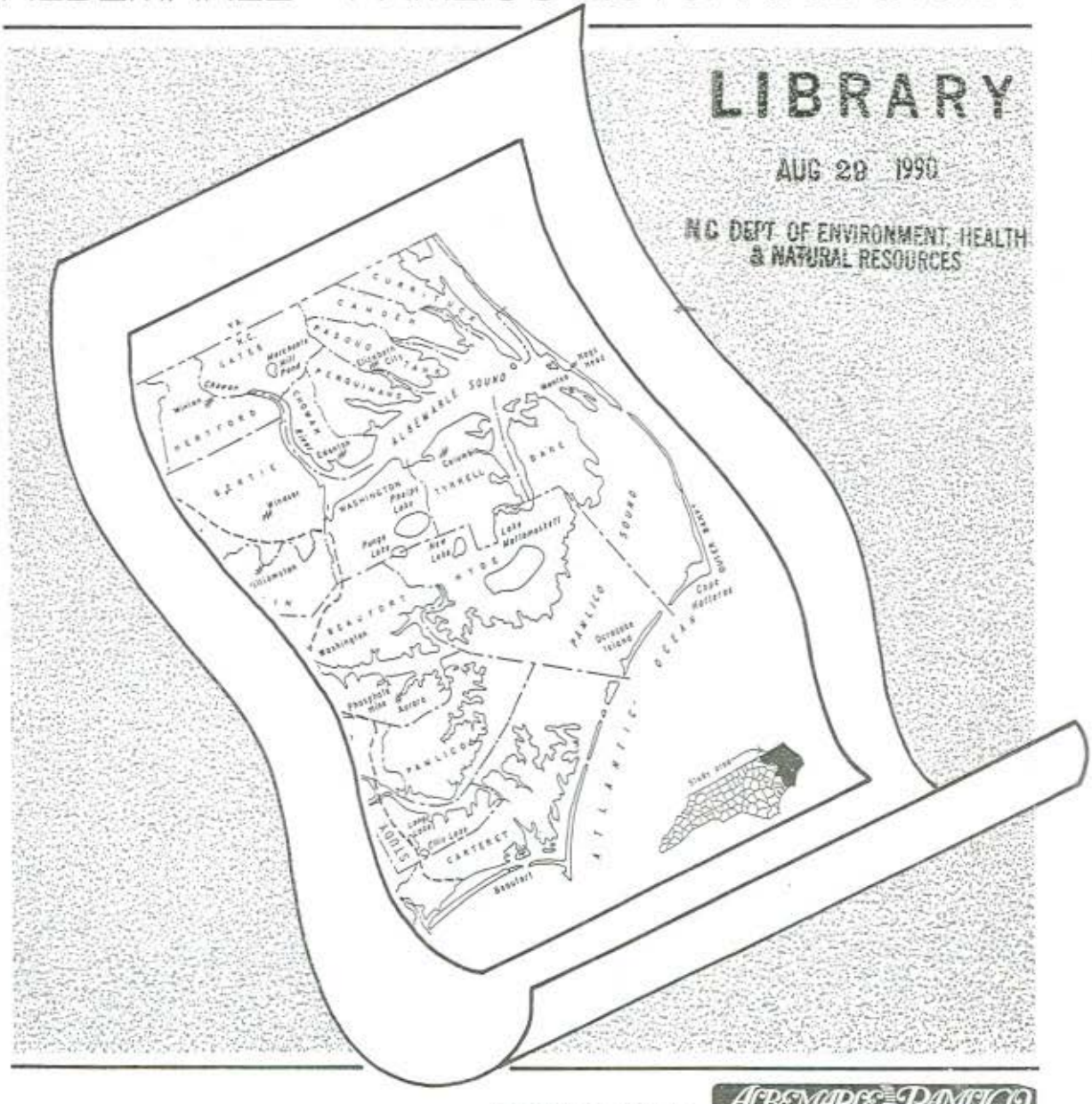
PROJECT NO. 90-01

REGIONAL INVENTORY FOR CRITICAL NATURAL AREAS, WETLAND ECOSYSTEMS, AND ENDANGERED SPECIES HABITATS OF THE ALBEMARLE-PAMLICO ESTUARINE REGION: PHASE I

ALBEMARLE - PAMLICO ESTUARINE STUDY



Funding Provided By
North Carolina Department of Natural Resources and Community Development
Environmental Protection Agency National Estuary Program

ALBEMARLE-PAMLICO

REGIONAL INVENTORY FOR CRITICAL NATURAL AREAS, WETLAND ECOSYSTEMS, AND ENDANGERED SPECIES HABITATS OF THE ALBEMARLE-PAMLICO ESTUARINE REGION: PHASE 1

By

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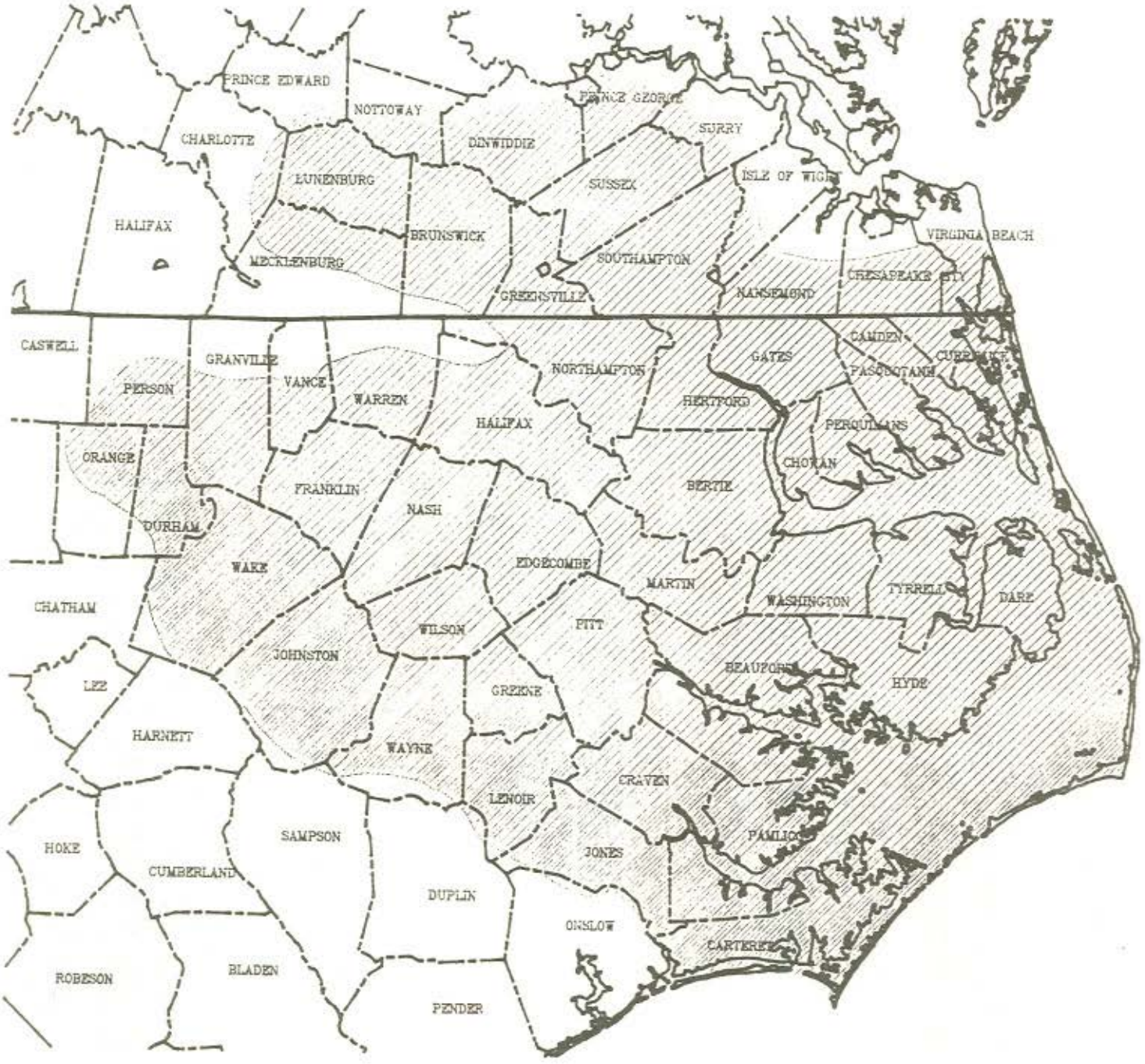
"The research on which the report is based was financed in part by the United States Environmental Protection Agency and the North Carolina Department of Environment, Health, and Natural Resources, through the Albemarle-Pamlico Estuarine Study."

A/P Study Project No. 90-01
January, 1990

ALBEMARLE - PAMLICO ESTUARINE STUDY AREA



ACKNOWLEDGMENTS

The authors wish to thank the staff of the N.C. Natural Heritage Program for guidance and input during the planning stages of this study, as well as during the actual work stages. Alan Weakley and Charles Roe provided much of this input; Roe and Mike Schafale assisted in some field work.

Others who assisted the authors with field work were Vonda Frantz, Michael Lane, and Merrill Lynch. Lynch's previous field work and detailed reports for parts of the Albemarle-Pamlico Estuarine Study area, such as the Roanoke River floodplain and Washington County, were most helpful.

County foresters (with the N.C. Forest Service) provided much input on sites for potential survey work. Particularly helpful were Herb Crase, Leon Hughes, Larry Lawrence, Roger Spivey, and Cullen Swain.

The authors also acknowledge the many landowners who gave permission to have survey work conducted on their property. These landowners were also helpful in providing information about the history of the property, as well as providing comments about potential and real threats to the property. Without such permission, this report would have been difficult to compile and would have been very incomplete.

ABSTRACT

The rapid development of North Carolina's coastal and tidewater regions has caused an urgent need to protect significant natural resources in this part of the state. However, before protection of natural resources and natural areas can be accomplished, it is important to have background information about these resources, such as locations of endangered and rare species and delineation and description of critical natural areas. The North Carolina Nature Preserves Act delegates responsibilities to the N.C. Natural Heritage Program for maintaining the statewide inventory of important natural areas and rare species habitats.

Funding from the Albemarle-Pamlico Estuarine Study has allowed a reconnaissance inventory to identify, describe, map, prioritize, and make protection recommendations for special natural areas, exceptional wetland ecosystems, and endangered and rare species habitats in 10 counties -- Bertie, Camden, Chowan, Currituck, Gates, Hertford, Martin, Pasquotank, Perquimans, and Washington -- adjacent to Albemarle Sound. Biologists contracted by the N.C. Natural Heritage Program have consulted other biologists familiar with these counties, in addition to reviewing soil maps, topographic maps, aerial photos, and other sources to determine sites for survey work for sites that appear to contain significant or critical natural resources.

Approximately 300 sites were identified from these various sources during the preliminary screening. After a visitation to over 100 of these sites, a total of 96 have been identified as containing biological or physiographical significance at the national, state, or regional level.

This report is a compilation of critical natural areas, both those already under protection and those lacking protection, in addition to a discussion of endangered and rare species, wetland ecosystems and other natural communities, and the geomorphology of the 10-county region. Data from the project will be recorded in the Natural Heritage Program's central inventory management system, which is used by many other agencies for environmental impact assessment, land use planning, resource management decisions, and conservation planning. It is hoped that this report will lead to increased protection of the natural heritage of the Albemarle Sound region.

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INTRODUCTION

This report is the first of three regional inventories for critical natural areas, wetland ecosystems, and endangered species habitats in the Albemarle-Pamlico region of North Carolina. Contained in this report are natural area descriptions of 10 counties surrounding or adjacent to Albemarle Sound: Bertie, Camden, Chowan, Currituck, Gates, Hertford, Martin, Pasquotank, Perquimans, and Washington. The second regional inventory will be conducted in 1990 for 7 counties adjacent to Pamlico Sound. The third regional inventory will be conducted in 1991 for the remaining 17 North Carolina counties in the Albemarle-Pamlico Estuarine Study area. The N.C. Natural Heritage Program is administering each of these inventories with funds provided by the U.S. Environmental Protection Agency and the N.C. Department of Environment, Health, and Natural Resources.

This inventory describes the general physiographic and biological features of the 10-county area, the natural communities and rare plants and animals of the area, and (most importantly) the significant natural areas. The inventory also discusses the current protection status for the natural areas.

The 10-county region in the vicinity of Albemarle Sound lies in the Coastal Plain physiographic province and is relatively young in origin. The flat topography provides for relatively few noteworthy topographic features and relatively few natural communities that are rare on a national scale. Habitat destruction in this area has led to near extirpation of some original natural forest types such as longleaf pine forests, white cedar forests, and oak flats; and habitat for many wildlife species has been reduced nearly to the minimum required for survival. Though urban development is not as severe a problem in this region as in other parts of the state, land clearing for agriculture and silviculture is extreme, especially in non-riverine areas such as pocosins and upland flats. Current protection of significant natural areas in the 10-county region is not adequate. However, great strides appear to have been made in land protection of wetland areas during 1989 in the region. The creation of the Roanoke River National Wildlife Refuge in Bertie and Martin counties, and the acquisition of over 100,000 acres of land in Washington and adjacent counties by The Conservation Fund for future additions to National Wildlife Refuges and State Parks in that area have greatly added protection to wetlands. However, a large percentage of the natural areas identified in this inventory are unprotected, especially those in nonriverine areas and those in counties north of Albemarle Sound.

This inventory should be of considerable use to town and county planning agencies, State and Federal agencies, and private conservation groups in the protection of the natural areas described. It is hoped that many of these sites that are currently unprotected will be afforded protection by acquisition or other means within the coming years. Also, it is hoped that future development can be steered away from significant natural areas, even if these areas are not afforded protection.

Readers should be aware that this is, by no means, a complete inventory. Coverage of such a large area in a single calendar year (1989) is extremely difficult, especially when many sites cannot be surveyed by foot but must instead be visited by boat (or plane). The authors believe that the majority of the truly significant sites, at the national and state level, are incorporated in this report, but additional field work will certainly uncover other significant areas and rare and endangered species.

METHODS

A. DATA SOURCES

The authors held meetings with the staff of the N.C. Natural Heritage Program to begin the inventory of natural areas. They received guidelines from the staff on conducting field work and preparing site reports; the Heritage Program also provided the authors with site report forms for completion, so that all reports would be presented in the same format. The authors and Heritage Program staff, especially Alan Weakley, reviewed the Program's database on rare and endangered plants and animals, natural communities, and identified natural areas for sites to be included in the survey. Topographic maps, soil maps, and orthophoto maps were also reviewed for potential sites for survey work.

The two field biologists for the survey work, Cecil Frost and Richard Schneider, also contacted numerous local citizens, foresters, and other biologists familiar with the 10-county area. These sources suggested additional sites that would be suitable for exploration as possible significant natural areas.

B. FIELD WORK AND COMPILATION OF NATURAL AREAS

Frost and Schneider each compiled a list of sites for potential survey work during the calendar year 1989; these sites were arranged by topographic quad map. Approximately 300 sites were identified in the 10-county area. Frost surveyed Currituck, Camden, Pasquotank, Perquimans, Chowan, Gates, and Washington counties; Schneider surveyed Hertford, Bertie, and Martin counties. County-wide inventories of Gates (Frost 1982) and Washington (Lynch and Peacock 1982) counties had previously been compiled; thus, intensive survey work was not conducted in these two counties. Rather, work consisted mainly of brief surveys of already identified sites in these counties to determine if the sites were still significant natural areas. Field work began in February 1989 and continued into December 1989. Frost and Schneider completed Site Survey Report forms (designed by the N.C. Natural Heritage Program) for all sites newly identified as being significant natural areas. Obviously, not all sites checked in the field were considered to be significant; some sites identified from maps had been cut-over, some were not in a mature forest condition, and others were in a natural condition but judged not to have features of significance.

LeGrand received the survey forms from Frost and Schneider and wrote summary information about the sites for inclusion in this report (see Inventory of Sites). LeGrand also compiled information about the general features of the A/P Study area, the natural communities, and the animal and plant life. He conducted relatively little field work, that being primarily to examine the natural communities of the region and the condition of previously identified natural areas. This report was written primarily by LeGrand.

C. SITE SELECTION AND RANKING OF SIGNIFICANCE

A total of 96 natural areas are described in this report. These areas were chosen because of their ecological significance, in terms of quality and integrity of the natural communities, the population size and condition of rare plants or animals, or the uniqueness or importance of the geomorphic features. For each site selected for inclusion in this report, a level of significance is designated, using National, State, and Regional (denoted A, B, and C, respectively). This designation of significance follows that of the N.C. Natural Heritage Program.

The following are descriptions of the significance categories utilized in this inventory.

A. NATIONAL significance. The natural area is considered to be of national importance. The site is one of the premier (perhaps in the top 5 or 6) natural areas of its kind in the country featuring an exemplary natural community, rare or endangered species population, or outstanding geomorphic feature. Usually such a site is in relatively undisturbed condition and is often extensive in size, or the population sizes of the significant plants and animals are large and healthy. Such a natural area is given an extremely high priority for protection.

B. STATE significance. The natural area is considered to be of statewide importance. The site contains one the best 5 or 6 examples of a given natural community, rare or endangered species population, or outstanding geomorphic feature in the state. However, there are other natural areas with similar ecological features that are more significant elsewhere in the state or in other states (i.e., of National significance). Usually the community is relatively undisturbed and the populations of the rare species are fairly large. Such a natural area is given a very high priority for protection.

C. REGIONAL significance. The natural area is considered to be of regional importance; that is, it is one of the most significant sites in that portion of the physiographic province in the state. For this report, it is one of the most significant sites in the northeastern portion of the Coastal Plain. However, there are other natural areas with similar ecological features that are more significant elsewhere in the Coastal Plain of North Carolina (or elsewhere within the same region if they are of National or State significance). Such a natural area is given a high priority for protection.

It should be emphasized that the priority rankings of the natural areas in this inventory are based solely on their biological and geomorphic significance, and not on the degree of threat or on the amount of protection afforded them. For many of the sites, the threats are not known.

This report is thus intended to present the biology and geomorphology of the 10-county A/P Study area and its natural areas, and the significance of these areas, especially in relation to the State of North Carolina as a whole.

Many of the sites are contiguous with others, and the contiguous sites taken collectively as a larger natural area would likely have a higher significance level than those of the individual sites. For example, several of the contiguous sites in the Northwest River section of Currituck County are collectively of National Significance, as are contiguous sites along the North River in Currituck and Camden counties. For further information of such "complexes" of sites, see the Discussion.

GENERAL FEATURES

A. SURVEY AREA

This report covers a 10-county region centered on Albemarle Sound in northeastern North Carolina. The 10 counties are Bertie, Camden, Chowan, Currituck, Gates, Hertford, Martin, Pasquotank, Perquimans, and Washington (Figure 1). This portion of the state lies in the Embayed Region of the Coastal Plain physiographic province. The survey area includes all portions of these counties with the exception of Currituck Banks and Knotts Island in Currituck County. Albemarle Sound, proper, is also excluded from the survey.

These 10 counties are relatively sparsely populated, with no county having more than a population of 30,000 as of 1980 (see Table 1). The largest town, Elizabeth City, had a 1980 population of 13,784. The population of the 10-county region is growing rather slowly, with a few counties losing population; however, mainland Currituck County is undergoing rather rapid population growth.

B. TOPOGRAPHY AND PHYSIOGRAPHY

Because these 10 counties lie on the lower terraces of the Coastal Plain, and especially as they lie near tidal waters, the topography of the landscape is very subdued. Elevations range from sea level (in most of the counties) to nearly 100 feet west of Murfreesboro in Hertford County. More than 95% of the region can be considered flat; however, there are several areas with steep slopes. Elevation differences of more than 50 feet are found on north-facing slopes along the southern edge of the Roanoke River floodplain, generally in Martin County, and along the Meherrin River near Murfreesboro in Hertford County. Bluffs in northwestern Martin County are approximately 65 feet high. Highly significant topographic features include a series of north-south trending scarps that were former shorelines when the Atlantic Ocean was higher and extended much farther inland than at present. Most such scarps show only a 10- to 15-foot drop in elevation from the higher terrace on the west to the lower terrace on the east. The major remnant shoreline is the Suffolk Scarp, which extends from southeastern Virginia south through eastern Gates County to western Washington County and southward out of the Albemarle-Pamlico Estuarine Study area (hereafter, A/P Study). Elevation changes from west to east at the scarp show a drop from approximately 40 feet above sea level to about 6 feet above sea level.

There are approximately 7 terraces in the North Carolina Coastal Plain. Of these 7 terraces, only the lower four (Wicomico, Penholoway, Talbot, and Pamlico) are present in the A/P Study area. The Wicomico Terrace has an average elevation of 90-100 feet mean sea level and is present in the western tip of Martin County, as well as near Murfreesboro in Hertford County. The Penholoway Terrace average about 70 feet, the Talbot Terrace about 42 feet, and the Pamlico Terrace about 25 feet (Stuckey 1965). The Suffolk Scarp divides the Pamlico Terrace on the east from the Talbot Terrace. Each terrace was formed in shallow seas when the scarp to the west was the shoreline at that time. With the lowering of sea level, the terraces became exposed.

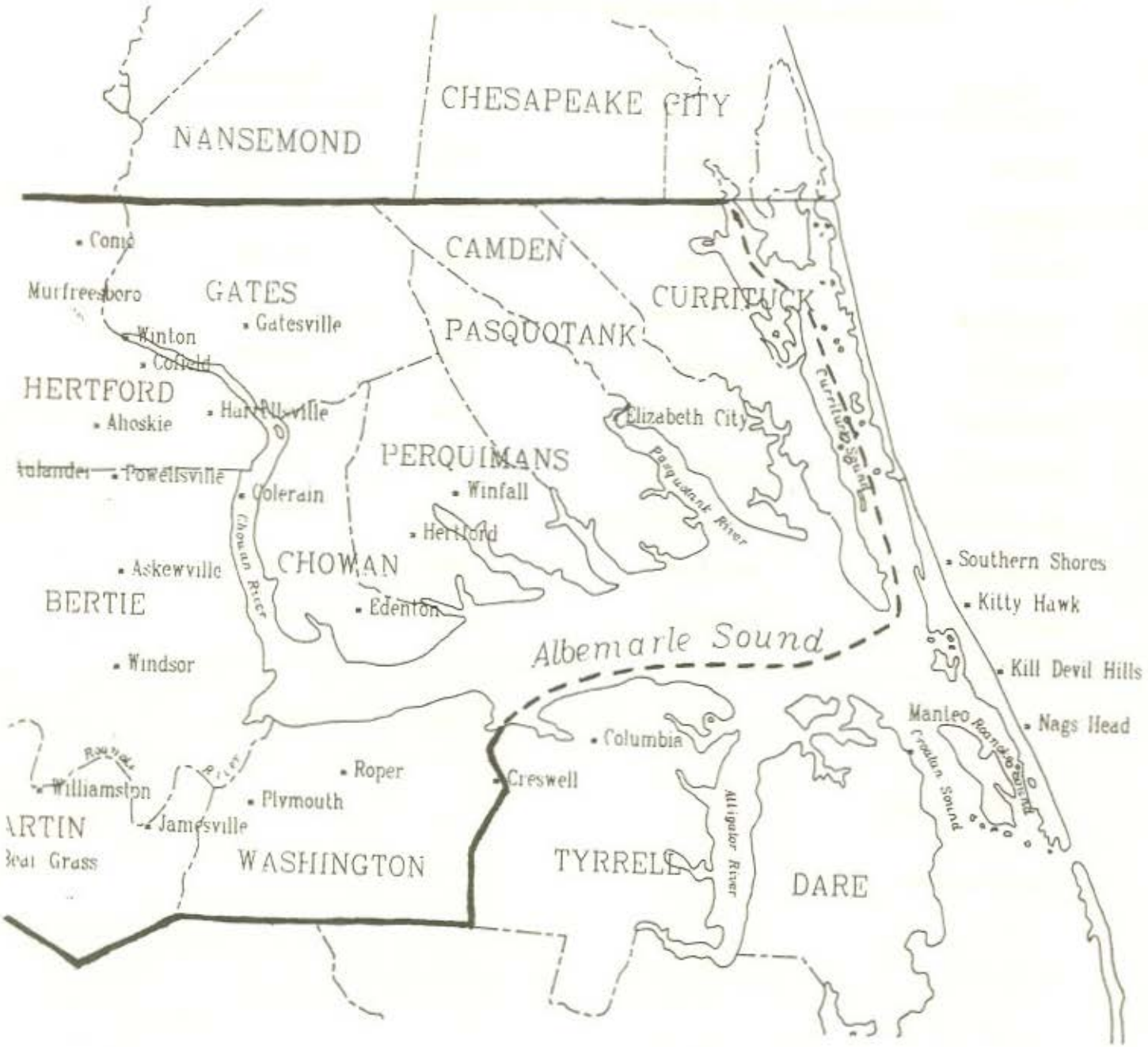


Figure 1. Counties and major towns in the 10-county Albemarle-Pamlico Estuarine Study region.

Table 1. Counties, county seats, area, and population of the 10-county Albemarle-Pamlico Estuarine Study region.

County	County Seat	Area [1]	Population [2]
Bertie	Windsor	701	21,024
Camden	Camden	240	5,829
Chowan	Edenton	192	12,558
Currituck	Currituck	256	11,089
Gates	Gatesville	338	8,875
Hertford	Winton	356	23,368
Martin	Williamston	461	25,948
Pasquotank	Elizabeth City	228	28,462
Perquimans	Hertford	246	9,486
Washington	Plymouth	332	14,801
	Total	3,340	161,440

[1] square miles

[2] 1980 census

The major topographic feature of the A/P Study area is Albemarle Sound, which is a body of slightly brackish water oriented east-west. It extends approximately 56 miles in length and varies from 5 to 12 miles in width (see Figure 2). This is an embayed river, being the drowned lower portion of the Roanoke River and its floodplain. Many of the tributary streams have also been flooded by the Holocene rise in sea level, so that much of the North River, Pasquotank River, Perquimans River, Chowan River, and others are extensions of the sound rather than free-flowing rivers. Most of the tides on the sound and rivers are less than a foot; wind-driven tides are more significant than lunar ones. Currituck Sound, forming the eastern boundary of the A/P Study area, is connected to Albemarle Sound. Its waters vary from nearly fresh in wet years to nearly 1/10th the salinity of sea water after one or 2 years of drought.

There are relatively few rivers in the A/P Study area that are longer than 30 miles in length. The most prominent is the Roanoke River, which begins in the mountains of southwestern Virginia and flows for several hundred miles to the Albemarle Sound. This river has a wide floodplain in the A/P Study area, in places nearly 5 miles in width. The other primary river is the Chowan, which is embayed for over 30 miles and extends northwestward into the extreme eastern edge of the Piedmont of Virginia. The Meherrin River is a major tributary of the Chowan, extending into the central Piedmont of Virginia.

Natural lakes are extremely rare in northeastern North Carolina. In fact, only two are present -- both in Washington County at the southeast corner of the study area. Both Lake Phelps and Pungo Lake are believed to have been formed by fires that burned deeply into the peat layer. The depressions caused by the fires eventually became water-filled by rainfall and by the high water table present throughout the A/P Study area. Natural lakes in the form of limesink ponds or Carolina bay lakes are absent in the area, unlike in the southern half of the North Carolina Coastal Plain. With the exception of a small natural pond formed by semiment barricading of a creek (see Menzie's Pond, Site PE3), the only other bodies of water are man-made, and most of these are old millponds. Merchants Millpond, in Gates County, was constructed in 1811, and it is the best known of the man-made lakes in the region.

One other physiographic feature of interest are the terraces that underlie the entire region. These extensive flat "plateaus" are the former sea floors, with the terraces to the east being younger in age. Some of the terraces have slight basins covering several hundred square miles, in which there is very poor drainage. These basins, such as those vegetated today by the Great Dismal Swamp, East Dismal Swamp, and Van Swamp, are actually common in the state's Coastal Plain. Most lie just east of a major scarp and receive ground water flow from the higher ground on the west of the scarp.

C. GEOLOGY

The geology of the A/P Study area is rather complex. However, all of the surficial materials in the region are sediments deposited in shallow waters of the Atlantic Ocean when the area was submerged, or are recently deposited riverine sediments in floodplains. Essentially all of the sediments have been

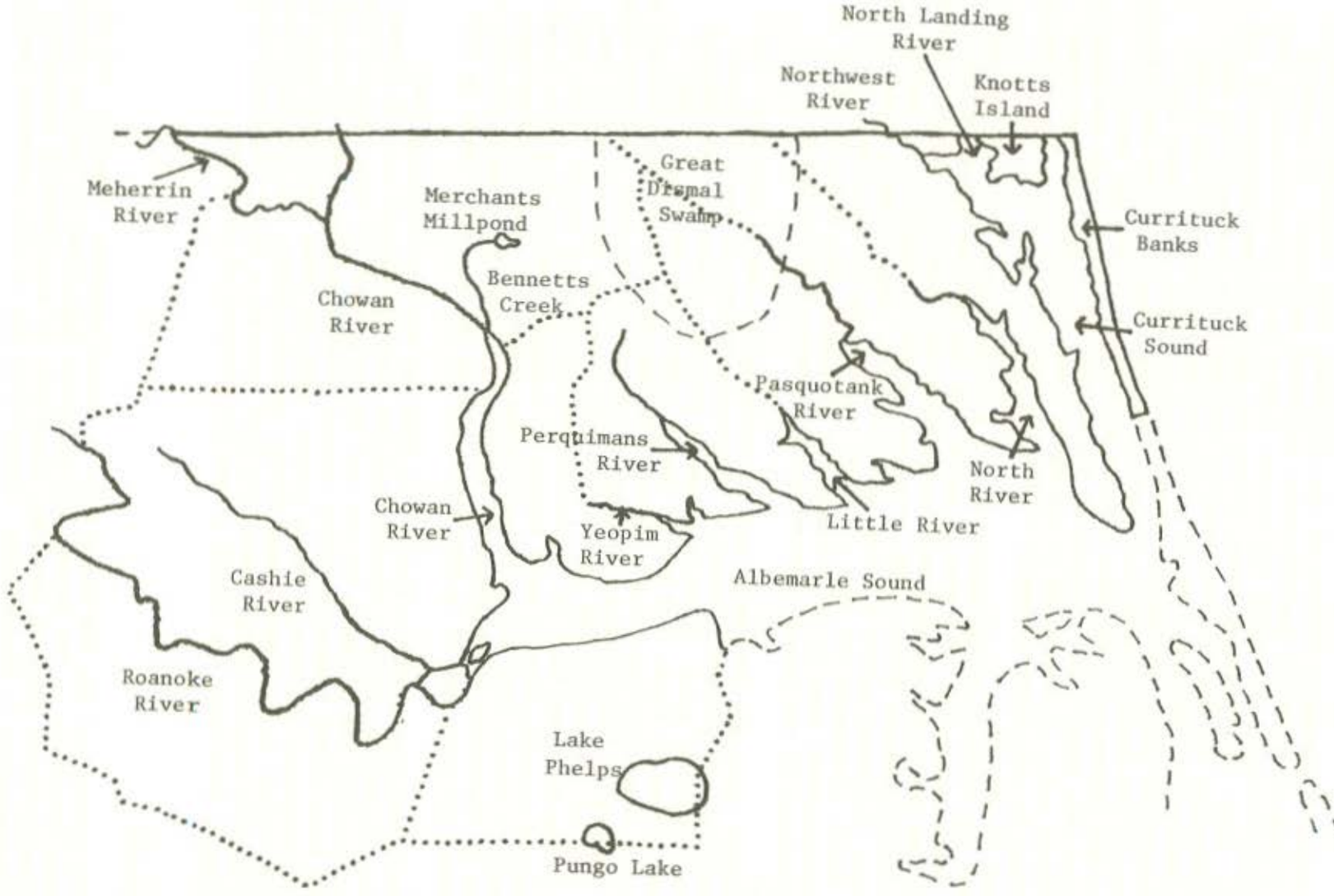


Figure 2. Major physiographic features in the 10-county Albemarle-Pamlico Estuarine Study region.

deposited in the Cenozoic Era (Tertiary and Quaternary periods) during the last 63 million years. The Cape Fear formation of the state's Coastal Plain was deposited in the Cretaceous Period prior to 63 million years ago. Some Cape Fear sediments are present at the surface in extreme western Bertie County (see Figure 3), but elsewhere the sediments are of younger age. Sediments west of the Suffolk Scarp are mainly those of the Yorktown Formation, which is late Miocene or Pliocene Epoch in origin. This formation is "fossiliferous clay with varying amounts of fine grained sand, bluish gray, shell material commonly concentrated in lenses" (North Carolina Geological Survey 1985). East of this scarp, mineral surficial deposits of virtually all of Perquimans, Pasquotank, Camden, Currituck and Washington counties are only about 40,000 years old, having been laid down by the receding sea that covered the entire area (Oaks and DuBar 1974). These deposits, called "Surficial Deposits, undivided" by the North Carolina Geological Survey (1985) are "sand, clay, gravel, and peat deposited in marine, fluvial, eolian, and lacustrine environments" (North Carolina Geological Survey 1985).

Albemarle Sound, the dominant physical feature of the A/P Study area, was formed more recently than the terraces and represents the embayed portion of the Roanoke River floodplain that was flooded when the seas began to rise after the close of the Wisconsin glacial period (Ice Age). Eight to ten thousand years ago, Albemarle Sound extended west only to the approximate present-day location of eastern Perquimans County (Copeland et al. 1983), and the tributary rivers were not embayed. Copeland et al. (1983) indicate that 1,000 years in the future, the increase in sea level will flood much of mainland Currituck County, the Great Dismal Swamp, and other low-lying areas in the eastern portion of the A/P Study area.

The formation of several other geomorphic features of the region is unclear. The Chowan Sand Banks in western Gates County is apparently not a former shoreline, despite the abundance of sand deposits. It does not lie along a scarp, but instead is positioned on the Talbot Terrace, running somewhat parallel (on the east) to the Chowan River. It appears that many of the sediments were deposited by overflow from the river as sand bars and low dunes, but Frost (1982, p. 206) states that:

> "The deposits of the Chowan Sand Ridge are a complex feature, ranging in elevation from near sea level to 47 ft., and in time from recent to 80,000 years ago, and cannot be explained by a single geologic event."

Additional information on the formation of the Chowan Sand Banks is presented in the individual site description (GA1).

A scattering of Carolina bays are located in the A/P Study are heaviest concentrations in Chowan and Currituck counties. However, this number of bays is miniscule compared to the many thousands present in the southern half of the state's Coastal Plain. The origin of these geomorphic features has long been controversial, and no conclusive explanations have been presented. Probably the most widely "accepted" theory is that the bays, which are elliptical in shape and oriented generally in a northwest-southeast direction, were formed when the receding seas left behind shallow pools of water, which were shaped into elliptical bodies by wind action on the water.

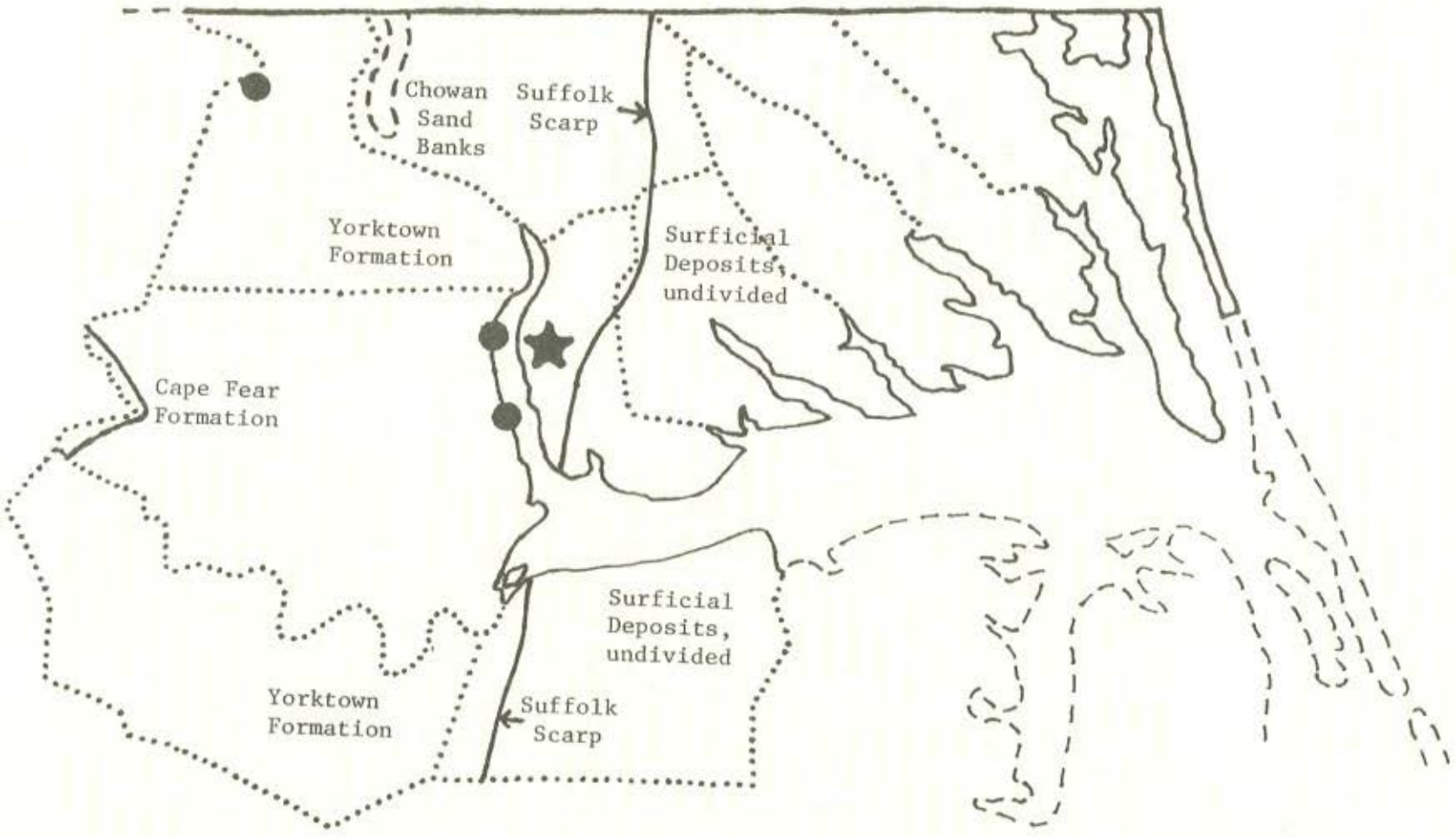
Figure 3. Generalized view of the geologic formations and significant geologic features in the 10-county Albemarle-Pamlico Estuarine Study region. The dots are locations of major fossil outcrops of the Yorktown Formation, as identified in Carter et al. (1988). The star denotes the location of several excellent examples of Carolina bays; a moderate number of Carolina bays are scattered over the region but are not shown on the figure. Other features on the figure are discussed in the text.

Geologic Formations

Cape Fear Formation: Cretaceous age; "sandstone and sandy mudstone, yellowish gray to bluish gray, mottled red to yellowish orange, indurated, graded and laterally continuous bedding, blocky clay, faint cross-bedding, feldspar and mica common" (North Carolina Geological Survey 1985)

Yorktown Formation: late Miocene or Pliocene age; "fossiliferous clay with varying amounts of fine-grained sand, bluish gray, shell material commonly concentrated in lenses" (North Carolina Geological Survey 1985)

Surficial Deposits, Undivided; Pleistocene age; "sand, clay, gravel, and peat deposited in marine, fluvial, eolian, and lacustrine environments" (North Carolina Geological Survey 1985)


Chowan
Sand
Banks
Suffolk
Scarp
Yorktown
Formation
Surficial
Deposits,
undivided
Cape Fear
Formation
Surficial
Deposits,
undivided
Yorktown
Formation
Suffolk
Scarp

There are several sites in the region where fossils are easily visible in outcrops. These sites are mostly at somewhat vertical banks, where the marine sediments containing the fossils are more exposed than elsewhere. Several such sites are present along the west bank of the Chowan River in Bertie County and along the Meherrin River near Murfreesboro (see Figure 3). Carter et al. (1988) provide more detail about these sites.

D. LAND USE

The 10-county A/P Study area contains somewhat equal amounts of wooded and non-wooded land. The North Carolina Atlas (Clay et al. 1975) indicates that, in 1974, Gates and Bertie counties contained at least 70% forest cover, whereas Currituck, Pasquotank, and Chowan each had less than 50% forest cover. Much of Currituck County's lack of forests is due to the considerable acreage of marshland or sand/maritime shrub. Currently, there is probably considerably less forested land in the A/P Study area than in 1974. Much of the "forest land" in counties such as Bertie, Martin, and Washington is now in pine plantations; this is likely still considered as forested land. Major timber companies own tens of thousands of acres, especially in the western half of the study area. The great majority of the land has now been timbered within the past 30 years and exists as plantations of loblolly pine (Pinus taeda) for future harvest, or has been left fallow to revegetate naturally. Timber harvest has been heavy in the poorly drained, nonriverine pocosins and swamps of Washington, Martin, and Bertie counties.

Extensive forests, in reasonably natural condition, still remain in some areas. The Roanoke River floodplain is mostly forested, as are most of the floodplains of the Chowan and Meherrin rivers. The Great Dismal Swamp is forested in natural vegetation but shows a heavy influence of former cutting, as comparatively few bald cypresses (Taxodium distichum) and Atlantic white cedars (Chamaecyparis thyoides) remain in the Dismal Swamp. Currituck County also has considerable swamp forests remaining.

The 10-county region contains extensive cleared lands used for agriculture. Crops such as soybeans, peanuts, corn, and wheat are commonly grown. Livestock are not prevalent in the region, and thus relatively little of the land is in pasture. Peat mining has occurred in former pocosin land in eastern Washington County near Lake Phelps, but such an activity has nearly ceased by the late 1980's.

The A/P Study area is largely rural. Only one town -- Elizabeth City -- has a population of over 10,000. In fact, several of the counties (Currituck, Camden, and Gates) contain no towns over 1,000 people. Tourism is not a major industry, though the mainland of Currituck County is beginning to show signs of development of the tourist trade, particularly along US 158. A number of new housing developments have been built in the last 10 to 20 years along portions of the shores of the region, such as along the Chowan River and the northern shore of Albemarle Sound.

Hunting and fishing are major pastimes. Waterfowl hunting is popular in Currituck County where marshes are extensive. Hunting is also very popular in the Roanoke River floodplain, and to a lesser extent in other forest lands; turkey, deer, and other game animals are quite numerous in these forests.

E. PRESENT-DAY NATURAL COMMUNITIES

E. 1. General Comments

A general summary of the natural communities found in the 10-county A/P Study area is presented in Table 2. The names of the communities on the table, as well as in the text, are taken from Classification of the Natural Communities of North Carolina, Second Approximation (Schafale and Weakley 1985), with a few exceptions. Several of the exceptions are those communities that are expected to be listed in the third approximation of that reference that are not already listed in the second approximation (Mike Schafale, pers. comm.). These are generally "splits" of "new" community types from types that were listed in the second approximation. For the purpose of this study, some of the community types were further divided into subtypes or types not recognized by Schafale and Weakley (1985).

Determination of natural communities is often a difficult task. Some sites of natural vegetation appear to represent mosaics of two or more communities, as with most of the marshes in the study area and with many sites featuring a mix of bay, pocosin, and swamp vegetation. In other cases, sites are easily determined to be a given natural community, but the margins usually grade into other communities in an indistinct manner. Perhaps most difficult in the determination of communities are the relationships of fire and the water table in shaping the long-term community structure. Several difficult questions remain unanswered. Are pocosin habitats from which fire is excluded for many decades able to maintain themselves, or do they succeed into bay forest or swamp forest habitats? How numerous were fire-dependent communities such as pine savannas, pine flatwoods, and canebrakes in the 18th and 19th centuries? How does lowering of the water table, by drainage canals or other means, affect the community type?

Some of the natural communities extend over several thousand acres, whereas others occur as small pockets of just a few acres. Generally speaking, most of the wetland (palustrine and estuarine) communities can occur in extensive stands of over 1000 acres, and some swamp habitats exist in tracts as large as 5000 acres. Upland (terrestrial) communities in good condition are much more limited in the 10-county A/P Study area, most of the upland forests having long ago been converted to cultivated fields, commercial development, or pine plantations. The upland communities that are reasonably intact tend to occur along slopes, bluffs, or other sites that are inaccessible or unsuitable for agriculture.

E. 2. Terrestrial Communities

E. 2. a. Dry-Mesic Oak-Hickory Forest. The most common upland natural community, at least in the western half of the A/P Study area, is probably the Dry-Mesic Oak-Hickory Forest. However, very few examples can be found in a climax state, especially with hickories (Carya spp.) present. Unlike the Piedmont, where there are still numerous natural areas containing mature oak-hickory forests, in the Coastal Plain nearly all have been cleared for agriculture, development, or timber production. If left alone for 80 years or more, many of the uplands that have been clearcut or thinned would grow into a

Table 2. Remnant natural communities, their abundance, and their locations, in the 10-county Albemarle-Pamlico Estuarine Study region. Names of the communities are from Schafale and Weakley (1985), with the following exceptions:
* = community that will be described in the Classification of the Natural Communities of North Carolina, Third Approximation (Mike Schafale, pers. comm.)
$ = community that is described in this A/P Study report.

Community, Abundance, Condition, and General Location	Exemplary Sites
TERRESTRIAL COMMUNITIES	
Dry-Mesic Oak-Hickory Forest Uncommon to fairly common in western third of A/P Study area, but poorly known in eastern portion; likely abundant in pre-civilization times; on clayey or sandy-clay uplands	BE1,GA3,GA5,GA7,HE10, MA3,PE2
Dry Oak-Hickory Forest Rare to uncommon, and few in good condition; mainly in xeric, clayey uplands, such as ridges or tops of bluffs; mostly in western half of A/P Study area	CU16,MA3
Oak-Hickory Sandhill ($) A fire-suppression community, thus not completely natural; rare and poorly known; on sandy soils, mainly on Chowan Sand Banks	GA1
Pine/Scrub Oak Sandhill Rare and in rather poor condition; essentially limited to Chowan Sand Banks, where it was once extensive on sandy soils; marginal examples elsewhere	CH6,GA1,GA3,HE10
Xeric Sandhill Scrub Very rare; marginal example on Chowan Sank Banks, on deep sands	GA1
Coastal Fringe Evergreen Forest (*) Rare and restricted in A/P Study area, probably only in Currituck County; a mainland maritime forest type, on sandy soils near sounds	CU18

Table 2. (continued)

Community, Abundance, Condition, and General Location	Exemplary Sites
Mesic Mixed Hardwood Forest, Upland Flats subtype ($) Uncommon today, with no tracts of large size; originally fire-influenced and formerly common; on flat terraces, where soil moist but not wet, over most of the A/P Study area	BE6,CA5,CH1,CH8,CU1, CU2,CU7,CU10,GA5,HE6, PE2,PE4
Mesic Mixed Hardwood Forest, Bluff/Slope subtype ($) Uncommon in terms of total land area, but many still in good condition; mostly on floodplain and scarp margins, primarily in western half of A/P Study area	BE1,BE5,BE7,BE8,BE9, CH4,CH7,CH8,GA7,HE3, HE6,HE10,MA1,MA3,MA4, MA5,MA9,PE2,PE3
Mesic Mixed Hardwood Forest, Swamp Island subtype ($) Rather rare to uncommon, but many still in good condition; in floodplains or swamps, scattered over much of A/P Study area	BE10,BE15,CA1,CA4,GA3, HE7,MA5,PE1
Piedmont/Coastal Plain Heath Bluff (*) Rather rare, but often in good condition where found; steep slopes and bluffs, mainly in Martin and Hertford counties	HE3,HE6,MA1,MA3
PALUSTRINE COMMUNITIES	
Coastal Plain Levee Forest, Brownwater subtype Mainly limited to the Roanoke River, where present along most of its length in the A/P Study area except near its mouth; some good examples remain	BE12,BE13,BE17,BE18, HE2,MA2,MA3,MA8
Coastal Plain Bottomland Forest, Brownwater subtype Fairly common to common along the Roanoke River, but infrequent elsewhere; mainly on low ridges (former levees) in floodplains; some examples in good condition	BE12,BE13,BE15,HE3, MA4,MA8

Table 2. (continued)

Community, Abundance, Condition, and General Location	Exemplary Sites
Cypress-Gum Swamp, Brownwater subtype: Very common along the Roanoke River, with many in good condition; fairly common elsewhere in the western half of the A/P Study area	BE13,BE16,BE17,BE18, BE19,HE2,HE4,MA6,MA8
Coastal Plain Levee Forest, Blackwater subtype: Rare to practically absent; blackwater streams in this part of N.C. Coastal Plain have poor or no development of levees	
Coastal Plain Bottomland Forest, Blackwater subtype: Uncommon to rare, as most blackwater floodplains contain only swamp forest with no levees or bottomlands; probably scattered throughout	BE3
Cypress-Gum Swamp, Blackwater subtype: Very common, with many still in good to excellent condition; throughout the A/P Study area	BE11,BE19,BE20,CH4, CU12,GA7,MA7
Coastal Plain Small Stream Swamp, Blackwater subtype: Very common, scattered over the A/P Study area; many in good condition; floodplains of small streams	BE5,BE7,BE11,BE14,CH1, HE6,HE7,HE10,MA9,WA3
Oxbow Lake: Only a few such geomorphic features in A/P Study area, along Roanoke River and several other rivers; not well studied	
Nonriverine Wet Hardwood Forest: Common to abundant in pre-settlement times, but mostly destroyed today; a few very good examples remain; poorly drained flats throughout the area	CA5,CU1,CU4,CU6,CU7, CU10,CU11,CU12,GA5,GA6, PA1,PA2,PE3,WA5

Table 2. (continued)

Community, Abundance, Condition, and General Location	Exemplary Sites
Nonriverine Swamp Forest Formerly common, especially in eastern half of area; some good examples still present, but rapidly being destroyed; very poorly drained flats and basins	BE2,CA1,CA2,CA3,CH5, CU11,CU14,GA2,GA6,WA4, WA5,WA(6)?
Low Pocosin Possibly fairly common until several decades ago, but mostly destroyed today; now rare, scattered over A/P Study area on deep peat deposits	CA2,WA8,WA9
High Pocosin Formerly common, but uncommon today; on peat deposits in poorly drained flats; more abundant than Low Pocosin	CA1,CA2,WA8,WA9
Pond Pine Woodland Formerly common to very common, but now uncommon; on peat deposits, mainly in poorly drained flats, but also in blackwater and estuarine floodplains; the most abundant pocosin type today in the region	CA1,CA3,CA6,CH6,CU2, WA1,WA4
Bay Forest Well-defined examples uncommon, mostly in combination with Nonriverine Swamp Forest or Pond Pine Woodland; few in good condition; scattered over A/P Study area, in poorly drained peaty sites	BE20,CH2,CH5,CU14, CU16,WA2,WA8
Atlantic White Cedar Forest Formerly extensive, but good examples are now rare in the A/P Study area, being found mainly in Dismal Swamp; generally in blackwater and nonriverine wetlands	CA1,CA2,CA3,CA4,CU3, CU12,HE5,WA2
Small Depression Pond Extremely rare; a few small, marginal examples in Hertford County on upland flats; most in poor condition; origin unknown, but possibly limesinks	HE1

Table 2. (continued)

Community, Abundance, Condition, and General Location	Exemplary Sites
Coastal Plain Semipermanent Impoundment (*) Uncommon to fairly common; mostly old millponds, but also large beaver ponds; scattered over A/P Study area	BE3,BE13,BE14,GA7, PE3
Natural Lake Shoreline Rare; essentially only the shorelines of Lake Phelps and Pungo Lake, primarily the former; mainly herbaceous and shrub zone around the lakes	WA7,WA8
Oligohaline Marsh ($) Slightly brackish marshes, common along the margins of Currituck Sound, North River, and other rivers and bays in the eastern portion of the A/P Study area; most in good condition	CA6,CA7,CU2,CU3,CU5, CU6,CU7,CU8,CU9,CU11, CU13,CU15,CU17,PA1,PA2
Tidal Freshwater Marsh In the strict sense, limited mainly to Chowan River area, especially along tributary streams; a rare community in the state; few sites, but generally in good condition	CA4,CH4,GA3,GA4,HE9
Tidal Cypress-Gum Swamp Common to very common, with many swamps in good condition; generally along margins of Albemarle Sound, but ranging many miles up larger tributary rivers (e.g., Chowan River)	BE1,BE20,CA4,CH3,CH6, CH7,CH8,CU7,CU11, CU14,CU15,GA3,GA4,HE4, PA2,PE1,PE2,WA1
Estuarine Fringe Loblolly Pine Forest (*) Extent and abundance poorly known, but reproduction and maintenance originally dependent on fire; not uncommon along upland margins of many of the tidal marshes; mainly in Currituck and Camden counties	CA6,CA7,CU6,CU8,CU13, CU18,PA1
Low Elevation Seep (*) Rare to uncommon; small areas at bases of mesic slopes where seepage from slopes occurs; perhaps limited to western half of A/P Study area	HE3

Table 2. (continued)

Community, Abundance, Condition, and General Location	Exemplary Sites
Pine Flatwoods and Pine Savanna Likely present in some frequency prior to 1900, but essentially absent today, as a result of fire suppression; on a few flats, floodplain islands, and other low sites	CA6,CH6,CH7,GA1,GA5, GA6,HE10

hardwood forest of this natural community (first passing through stages of pine forests before the hardwoods begin to attain prominence). This community occurs on dry or mesic, clay or sandy-clay soils; it may occur on the higher flats or on upper slopes or ridges. Loblolly pine (Pinus taeda) is almost the only canopy species in the intermediate-aged stands after logging, but the pines are replaced in the mature forest by hardwoods such as white oak (Quercus alba) as the dominant, with southern red oak (Q. falcata) and black oak (Q. velutina) also usually present, among a variety of other tree species. Eventually, in the climax stands, hickories reach the canopy, with mockernut hickory (Carya tomentosa) expected to be a common component. The understory layer is moderate in density, with flowering dogwood (Cornus florida) often very numerous. The shrub layer is usually sparse, with few ericaceous (Family Ericaceae) shrubs.

E. 2. b. Dry Oak-Hickory Forest. On slightly drier sites, such as on ridge tops and on the crest of bluffs, a Dry Oak-Hickory Forest natural community may be present. Because the northeastern section of North Carolina is quite flat and poorly drained, with much being in wetlands, dry forests such as this type are rare. As with the Dry-Mesic Oak-Hickory Forest, most such stands have long ago been cleared or cut-over. Typical canopy species include post oak (Q. stellata), southern red oak, and white oak, along with various hickories. Blackjack oak (Q. marilandica) is a good indicator of this community, though it is not common. This community type usually features a shrub layer dominated by ericaceous plants, particularly blueberries (Vaccinium spp.). Dry Oak-Hickory Forests may also occur on sandy ridges, as well, but most such communities on sandy substrates are probably best considered as one of the three communities below.

E. 2. c. Pine/Scrub Oak Sandhill, Xeric Sandhill Scrub, and Oak-Hickory Sandhill. Sites that are sandy rather than clayey and that have (at least formerly) a fairly frequent natural fire regime generally feature Pine/Scrub Oak Sandhill or Xeric Sandhill Scrub communities. These are among the most endangered communities in the A/P Study area. As late as the 19th Century, such communities were fairly common in portions of the western half of the area, particularly on sand ridges such as Chowan Sand Banks in Gates County. However, logging of the longleaf pine (Pinus palustris) damaged many such sites, and these uplands were among the first to be cleared and farmed (Frost 1982). Suppression of natural fire is also contributing to the demise of "Sandhills" forests. Sandhills communities, in the long absence of fire, tend to become vegetated by more mesic species of trees. Eventually, the longleaf pines disappear, and loblolly pines and (later) southern red oaks dominate. The most xeric sites, in the long absence of fire, become dominated by dense stands of turkey oak (Quercus laevis), among other oaks, and the herbaceous layer nearly disappears. In each case, no matter the moisture of the soil, the longleaf pine seedlings compete poorly in comparison with the more vigorous loblolly pine and oak saplings. Hickory species may also be prevalent in the canopy, since this genus of trees normally enters the succession spectrum very late, after oaks are already well established. Such a fire suppression community has been termed "Oak-Hickory Sandhill" in Carter and LeGrand (1989); however, in this A/P Study report, this community is not considered completely natural, in the sense that it appears as a result of the

supression of the former frequent fire regime present until a few decades ago. This "community" is present at the Chowan Sand Banks and perhaps elsewhere in the A/P Study area.

The primary example of Pine/Scrub Oak Sandhill in the study area appears to be along the Chowan Sand Banks near the community of Storys. The canopy is dominated by longleaf and/or loblolly pine, with the former being more prevalent in sandier sites. The understory consists primarily of oaks, with turkey oak and southern red oak being most numerous. Bluejack oak (Q. incana) and scrub post oak (Q. margaretta) are also frequently found with turkey oak. Ericaceous species are very common in the shrub layer, especially dangleberry (Gaylussacia frondosa) and early lowbush blueberry (Vaccinium vacillans). A marginal example of the Xeric Sandhill Scrub natural community exists at present in the A/P Study area at the Chowan Sand Banks. This community, in an exemplary state, would have turkey oak as the only hardwood in the subcanopy beneath a longleaf pine canopy, and there would usually be patches of bare sand, with clumps of lichens and xeric herbs in the ground layer. There are no obvious examples of this community in reasonably intact condition today in the A/P Study area, whereas many examples occur in the southern Coastal Plain of the state on rims of Carolina bays and in the Sandhills.

E. 2. d. Coastal Fringe Evergreen Forest. A community of very limited occurrence in the A/P Study area is the Coastal Fringe Evergreen Forest, which can be colloquially considered a "mainland maritime forest". One small site was found during the inventory along a sandy ridge near North River on the Currituck County peninsula. This community will be newly described in the third approximation of the Natural Communities of North Carolina (Mike Schafale, pers. comm.), based on descriptions of sites located south of the A/P Study area. Such a community typically has live oak (Q. virginiana), sand live oak (Q. geminata), wild olive (Osmanthus americana), and other maritime species. This community type was likely present historically at a number of places in southern Currituck County, but since they occurred on the few sites of high ground suitable for settlement along the shorelines, nearly all have been destroyed.

E. 2. e. Mesic Mixed Hardwood Forest, Upland Flats subtype. The Mesic Mixed Hardwood Forest natural community is subdivided into three subtypes in this study -- an Upland Flats subtype, a Bluff/Slope subtype, and a Swamp Island subtype. The Upland Flats subtype occurs on terraces and other nonriverine sites. (The drier terraces and flats contain mainly Dry-Mesic Oak-Hickory Forests, whereas the wetter ones contain mostly Nonriverine Wet Hardwood Forest [discussed later]). The flats of moderate moisture content are hereby considered as Mesic Mixed Hardwood Forest, Upland Flats subtype natural communities. This subtype features a great range of vegetation, including a few xeric species and a few hydric species growing essentially together with the mesic species. This community was formerly very common over most of the A/P Study area, but intact examples are relatively rare today. The most typical trees include American beech (Fagus grandifolia), swamp chestnut oak (Quercus michauxii), cherrybark oak (Q. pagoda), southern red oak, and white oak. Mesic species such as flowering dogwood are frequently present with the more hydric American hornbeam (Carpinus caroliniana) and giant cane (Arundinaria gigantea).

E. 2. f. Mesic Mixed Hardwood Forest, Bluff/Slope subtype. The Bluff/Slope subtype of Mesic Mixed Hardwood Forest occurs primarily on the walls of the floodplains of brownwater rivers, such as the Roanoke and the Meherrin, but is also present on the gentler slopes of blackwater rivers in the eastern portion of the A/P Study area. Such sites are limited in terms of acreage but generally are in good to excellent condition because the slopes have hindered clearing of the land. American beech is the most characteristic canopy tree, but tuliptree (Liriodendron tulipifera), white oak, northern red oak (Quercus rubra), and bitternut hickory (Carya cordiformis) are also found in many such communities. The understory or shrub layer is composed of species such as redbud (Cercis canadensis), flowering dogwood, and painted buckeye (Aesculus sylvatica). On slopes along brownwater rivers, in the western portion of the study area, the herb layer may be rich and tends to be somewhat Piedmont-like in character. Slopes in the eastern portion of the study area, especially those along blackwater rivers, are usually much less diverse.

E. 2. g. Mesic Mixed Hardwood Forest, Swamp Island subtype. The Mesic Mixed Hardwood Forest, Swamp Island subtype occurs on slight ridges within a floodplain or swamp and which are elevated above flood levels. The mesic forests on these islands tend to have American beech as the characteristic canopy tree, as do the mesic forests on slopes. Tuliptree and several oak species are also often present. An uncommon shrub in the state -- silky camellia (Stewartia malacodendron) -- is a characteristic species of such mesic islands, and the rare southern twayblade (Listera australis) may often be found on these islands. However, the herbaceous flora is only moderately well developed and is decidedly Coastal Plain in affinity, with very few species typical of Piedmont slopes.

E. 2. h. Piedmont/Coastal Plain Heath Bluff. A distinct terrestrial community in the A/P Study area is the Piedmont/Coastal Plain Heath Bluff (called the Acidic Cliff natural community in Schafale and Weakley 1985). Such a community occurs on very steep slopes and bluffs, often where the slope is greater than 45 degrees. These very acidic sites generally feature beech and other hardwoods in the canopy, but the understory is invariably a dense stand of mountain laurel (Kalmia latifolia), which is more typical of the Piedmont and mountains. An herb frequently found on such bluffs is galax (Galax aphylla), another typically piedmontane/montane species. This community type is often in good to excellent condition, again because the steep topography limits timber cutting and other human disturbances. These sites are restricted mainly to north-facing slopes along the Roanoke River in Martin County, and the Meherrin and Chowan rivers in Hertford County.

E. 3. Palustrine and Estuarine (Wetland) Communities

E. 3. a. Overview of Wetland Communities. Wetland natural communities dominate the A/P Study area, especially the eastern half. Some of the eastern counties consisted primarily of wetlands, before canals and drainage ditches dried out the land. More than 20 palustrine (fresnwater) and estuarine (tidal)

natural communities are present, based on the classification of communities in Schafale and Weakley (1985).

Many of the palustrine communities are separated by their occurrence in brownwater river systems, blackwater river systems, or on poorly drained flats (nonriverine systems). Brownwater rivers extend into the Piedmont and carry much mineral sediments; they are often muddy and reddish in color, especially after heavy rains. The high sediment load is deposited on the banks or in backwaters, and natural levees are common. Blackwater rivers originate within the Coastal Plain and are generally much shorter in length than brownwater streams. The sediments are mainly organic in nature, and the waters are typically dark brown to blackish in color. Natural levees are rare or are poorly developed. Nonriverine areas are poorly drained basins or flats with no major stream outlets; they were once shallow areas flooded by seawater during higher stages of the ocean.

E. 3. b. Coastal Plain Levee Forest, Brownwater subtype. The Coastal Plain Levee Forest, Brownwater subtype, is common along the banks of the Roanoke River in the study area, except for the lowest few miles, where the banks are negligible. However, few other rivers in the study area, with the possible exception of the Meherrin, are brownwater in nature, and thus natural levees outside the Roanoke Basin are quite scarce. The vegetation on the natural levees often features tree species that are not found elsewhere in the floodplain forests. These trees are capable of establishing themselves on sand bars and grow well in sunlight or light shade. As the river course changes and the levee ages and becomes farther removed from the river channel, other trees (such as oaks) replace the levee species. Characteristic canopy species of the levees include sugarberry (Celtis laevigata), American sycamore (Platanus occidentalis), green ash (Fraxinus pennsylvanica), sweetgum (Liquidambar styraciflua), and American elm (Ulmus americana). The understory is also rich, with boxelder (Acer negundo) being characteristic. The shrub and herb layers are also rich, and feature species typically found on circumneutral to basic soils. Common shrubs are painted buckeye, common pawpaw (Asimina triloba), and spicebush (Lindera benzoin).

E. 3. c. Coastal Plain Bottomland Forest, Brownwater subtype. As the river channel migrates, some levees are eroded away, whereas those on the opposite bank become farther removed from the channel and receive less sediment during flooding than formerly. They also take on a different set of canopy trees. The Coastal Plain Bottomland Forest, Brownwater subtype, occurs on such former levees, now being considered floodplain ridges. Bottomland forests also occur on terraces at the edges of the floodplains. These forests characteristically have oaks in the canopy, featuring species such as cherrybark oak, swamp chestnut oak, willow oak (Q. phellos), and overcup oak (Q. lyrata), the last species being found in the wetter sites. Sweetgum and American beech also occur frequently, as do several hickory species in the climax forest. The understory layer is fairly well developed, and American hornbeam is often present. The shrub and herb layers are rather sparse, giving most mature bottomlands a rather park-like appearance.

E. 3. d. Cypress-Gum Swamp, Brownwater subtype. The Cypress-Gum Swamp, Brownwater subtype, is common along the Roanoke River, and some stands

cover several thousand acres. These swamps may occur as backswamps (extensive flat basins behind the natural levees that are covered in floodwater for much of the year), or in the old river channels (sloughs), which are narrow and lie between ridges in the floodplain. These swamps have a relatively low plant species diversity and are dominated in the canopy by bald cypress (Taxodium distichum) and either water tupelo (Nyssa aquatica) or swamp tupelo (N. biflora). The former tupelo dominates where the water flow is greater, such as nearer the river channel; the latter prefers more stagnant or acidic waters. Most swamps contain no other canopy species. A common understory tree is water ash (Fraxinus caroliniana); swamp cottonwood (Populus heterophylla) also is commonly present in the understory or canopy. These swamps contain water for such long periods through the year that shrubs and herbs tend to be scarce, except where bare ground is exposed.

E. 3. e. Coastal Plain Levee Forest, Blackwater subtype. The levee forest, bottomland forest, and cypress-gum swamp have counterparts found on blackwater rivers, but in the A/P Study area these rivers contain almost no levees or bottomlands. Most of the blackwater rivers in the northeastern corner of the state are too short in length to have enough of a sediment load for the creation of natural levees. Others are streams that empty directly into Albemarle Sound and whose floodplains have been inundated by the rising sea waters. Thus, most blackwater stream floodplains contain only swamp forests. No good examples of Coastal Plain Levee Forest, Blackwater subtype, have been reported during the study; notable examples occur along the Waccamaw River in the southern part of the state's Coastal Plain.

E. 3. f. Coastal Plain Bottomland Forest, Blackwater subtype. The Coastal Plain Bottomland Hardwood Forest, Blackwater subtype, is rare in the A/P Study area, and no outstanding examples have been found. Based on work done along the Waccamaw River floodplain (Schafale et al. 1986), plus results from a few sites in the A/P Study area, typical canopy species include laurel oak (Quercus laurifolia), water oak (Q. nigra), loblolly pine, red maple, and sweetgum. The understory and shrub layers generally feature a somewhat more evergreen or "bay" composition than found in brownwater floodplains, with redbay (Persea borbonia), titi (Cyrilla racemiflora), and sweet pepperbush (Clethra alnifolia) often present.

E. 3. g. Cypress-Gum Swamp, Blackwater subtype. The Cypress-Gum Swamp, Blackwater subtype is common in the A/P Study area, with many sites in excellent, mature condition. Bald cypress, water tupelo, and swamp tupelo generally form the canopy, with the latter tupelo preferring the slower and more stagnant water sites. Pumpkin ash (Fraxinus tomentosa) is often present, but seldom in large numbers, in the canopy. Atlantic white cedar (Chamaecyparis thyoides), characteristic of blackwater and nonriverine swamps, may also be present. In fact, perhaps 50% of the areas now classified as cypress-gum swamp is successional forest from repeated logging of former white cedar stands. The understory is dominated by water ash or red maple in most cases. The shrub and herb layers are usually sparse and may be absent in constantly flooded sites, except for floating aquatic herbs. However, aquatic herbs may be numerous in this community and in other types of cypress-gum swamps.

E. 3. h. Coastal Plain Small Stream Swamp, Blackwater subtype. Somewhat similar to the last-named community is the Coastal Plain Small Stream Swamp, Blackwater subtype. Such a community is quite common in the Coastal Plain of North Carolina, including the study area. This community occurs in narrow floodplains of streams with so little sediment flow that no topographic or geomorphic features are present within the floodplain. Such floodplains are seldom more than 100 or 200 yards wide on either side of the stream. The same canopy and understory species are present as in the above community, though in some cases bottomland hardwoods such as oaks can be mixed with the cypresses and tupelos. Generally speaking, the main differences are geomorphic and hydrologic (more irregular flooding) rather than vegetative. However, these small swamps often have a greater abundance and diversity of herbs and shrubs than are found in the larger swamps.

E. 3. i. Oxbow Lake. Another community that is primarily geomorphic in significance is the Oxbow Lake. One to several such lakes are present in the A/P Study area, with the best example along the Roanoke River just north of Hamilton. However, no community descriptions have been made from such lakes. Because the water in such a lake is standing rather than flowing, there is the potential for the community to contain floating aquatic herbs that are absent in most floodplain communities. The canopy in and along the margins of the lake contain cypress and the two tupelo species.

E. 3. j. Nonriverine Wet Hardwood Forest. Certainly one of the most endangered natural communities in North Carolina is the Nonriverine Wet Hardwood Forest. Such forests undoubtedly covered many thousands of acres in pre-settlement times, but the great majority been cleared for agriculture, as the sites (when drained) provide rich soils for farming. Timber harvest and conversion to pine plantations has also been a major factor in the destruction of this community. Few good examples remain. Examples at the drier end of the spectrum often merge into Mesic Mixed Hardwood Forest, Upland Flats subtype natural community, whereas examples at the wetter end of the spectrum merge with Nonriverine Cypress-Gum Swamp community. The Nonriverine Wet Hardwood Forest community occurs on flats with no obvious drainage, but where water stands for only brief periods. The mature canopy is rather similar to that of the Bottomland Hardwood Forest on brownwater rivers in that various oaks predominate. Such forests usually contain cherrybark oak and swamp chestnut oak as dominants in the canopy, with willow oak, tuliptree, sweetgum, American beech, and a variety of other species also in the canopy. The main difference in flora between a nonriverine and "riverine" hardwood forest appears to be that nonriverine forests have the potential to contain more elements of swamp or bay forests (more "acidic-soils" plant species) and may feature swamp tupelo, red maple, and pocosin shrubs more frequently than a site in a brownwater floodplain. On the other hand, floodplain forests may feature more circumneutral conditions and often contain levee species such as sugarberry, sycamore, buckeye, and a variety of maple species. Also, there are differences in hydrology and nutrient dynamics between these communities, as bottomland forests often receive floodwaters and mineral sediments from farther upstream.

E. 3. k. Nonriverine Swamp Forest. The Nonriverine Swamp Forest was also formerly widespread in the region, but unfortunately much more acreage has been drained and timbered than remains today. The East Dismal Swamp, Van Swamp, and Hall Swamp, located in Washington and eastern Martin counties, contain probably only 10% of the natural vegetation that was present 50 years ago, owing to drainage and clearing of the vegetation for pine plantations. On the other hand, some of the nonriverine portions of the A/P Study area that were formerly Atlantic White Cedar Forests or pocosin types (in pre-settlement times) have now reverted to Nonriverine Swamp Forest by cutting of the cedars, drainage, and exclusion of fire. The Great Dismal Swamp is, by far, the best example remaining in the A/P Study area of Nonriverine Swamp Forest, though several hundred years ago most of the refuge was in cedar, pocosin, and canebrakes. Bald cypress and water tupelo are the dominant canopy trees of some Nonriverine Swamps, but the cutting and draining of the swamp forests has led to a domination now by red maple, which prefers somewhat drier soils than do the other two species. Swamp tupelo is also a dominant in many places. Another tree characteristic of this community -- Atlantic white cedar -- has been extensively timbered, and only small stands of mature trees still exist. Nonriverine Swamps tend to be less wet than riverine ones and generally feature more diverse understory, shrub, and herb layers. Pocosin and bay species such as sweetbay (Magnolia virginiana), titi, sweet pepperbush, and inkberry (Ilex glabra) are often common in Nonriverine Swamp Forests.

E. 3. l. Low Pocosin. Various types of pocosins formerly occurred over most of the A/P Study area, generally on terrace flats and basins. Pocosins are now rather uncommon, and most have been cleared for pine plantations, large-scale agriculture, or peat mining. Pocosins have been segregated into 3 or 4 natural communities. The Low Pocosin features a deep peat layer, often more than 3 feet in depth, and a very dense shrub layer generally no more than 3 feet in height, so that an observer can see over the vegetation for hundreds of yards. There are few trees, these usually being widely scattered pond pines (Pinus serotina). The dominant species are fetterbush (Lyonia lucida), inkberry, titi, honeycup (Zenobia pulverulenta), and sweet pepperbush. Tangles of bamboo-vine (Smilax laurifolia) are often very common. Low Pocosins generally feature open pools or other openings where sphagnum and other non-woody vegetation grows. In some settings, Low Pocosins are clearly an early seral stage of a other pocosin or swamp forest communities and becomes established after a severe fire. However, in other settings (such as over deep peat layers), Low Pocosins seem to be self-perpetuating in the absence of fire.

E. 3. m. High Pocosin. The High Pocosin natural community is more common in North Carolina than Low Pocosin, but the majority of this community in the A/P Study area has been cleared in the past few decades. High Pocosins feature a dense shrub or small tree zone, usually not more than 10 to 15 feet tall. In addition to the shrubs found in the low pocosin, small trees such as sweetbay, redbay, and loblolly bay (Gordonia lasianthus) also are characteristic. Scattered pond pines are almost invariably present, but as with the Low Pocosin, the pines are generally small (25 feet or less tall). High Pocosins usually are devoid of openings where herbs dominate.

E. 3. n. Pond Pine Woodland. The Pond Pine Woodland natural community features a closed or relatively closed canopy of pond pines, generally 25 or more feet tall. Peat deposits are present but are thinner in depth than in High or Low Pocosins. This pocosin type, as with the above two, occurs on broad flats and poorly drained basins and in Carolina bays. Some Pond Pine Woodlands occur in floodplains of tidal rivers adjacent to cypress-gum forests or even adjacent to marshes. Most of this community type in the A/P Study area has been converted to silviculture, agriculture, or peat production. In addition to the various pocosin/bay species of trees and shrubs, red maple and Atlantic white cedar can often be present. In some situations, Pond Pine Woodlands are successional to Nonriverine Swamp Forest or Bay Forest in the absence of fire. However, in other situations, even in the long absence of fire, this community apparently maintains itself.

E. 3. o. Bay Forest. The Bay Forest natural community is a rather heterogeneous and poorly defined community, though by definition in Schafale and Weakley (1985), it must be dominated by bay species -- redbay, sweetbay, or loblolly bay. (What some ecologists would call a "bay forest", others would call a "pond pine woodland". Other sites called "bay forests" by some ecologists would likely be called "nonriverine swamp forests" by others.) The communities called "bay forests" in this report tend to have elements of both of these other communities. Bay Forest communities are uncommon in the A/P Study area, and they occur mainly in large flat areas in conjunction with other pocosin and swamp forest vegetation. Broadleaf evergreen trees such as redbay, sweetbay, and loblolly bay dominate in the canopy, but species as varied as red maple, pond pine, bald cypress, swamp tupelo, or Atlantic white cedar may occur in the canopy or in the understory. Invariably, Bay Forests have a dense shrub layer of pocosin species such as fetterbush, inkberry, sweet gallberry (Ilex coriacea), sweet pepperbush, and others. The successional relationship of Bay Forests is complex. Many may succeed to Nonriverine Swamp Forest in the absence of fire. Some Atlantic white cedar stands, in the absence of fire, succeed to Bay Forests (Schafale and Weakley 1985).

E. 3. p. Atlantic White Cedar Forest. The Atlantic White Cedar Forest natural community is now rather rare in the 10-county region. Extensive logging has removed most of this type from the area. The best and most extensive stands occur in Dismal Swamp National Wildlife Refuge, where less than 1% remains of the acreage originally dominated by this species. This community features a nearly solid canopy of white cedar, though other wetland species such as bald cypress, loblolly pine, swamp tupelo, and red maple are often present. Though the interior of such a forest is usually dark, a variety of pocosin shrubs are usually present. White cedar generally depends on severe fires to regenerate. Fire suppression has played a major role in the decline of white cedar. In the absence of fire, this community type is succeeded by bay forest or swamp forest. This succession process was greatly accelerated by typical white cedar logging methods, which removed cedar but left understory shrubs and canopy trees such as swamp tupelo and bay species largely intact.

E. 3. q. Small Depression Pond. One of the rare communities in North Carolina is the Small Depression Pond. Most such communities occur in and along the margins of limesink ponds, which range northward to Onslow and Carteret counties. Small Depression Ponds in the northern Coastal Plain are exceedingly rare; whether they are underlain by limestone or marl is apparently not known. A few such depressions are located in northern Hertford County. One such depression, which holds water for part of the year, contains swamp tupelo in the canopy, with highbush blueberries (Vaccinium corymbosum and V. atrococcum) in the shrub layer. Sphagnum is generally present on the damp ground as a carpet.

E. 3. r. Coastal Plain Semipermanent Impoundment. Another aquatic/palustrine natural community is the Coastal Plain Semipermanent Impoundment. These ponds may be created naturally, primarily in the form of beaver ponds, or may be man-made, generally as old millponds. There is also one natural pond in the A/P Study area created by the natural damming of a creek by sedimentation. These impoundments, no matter the origin, feature much open water with a widely scattered canopy of bald cypress, with swamp tupelo or water tupelo also present. Typically, there is little understory or shrub vegetation, but floating aquatic plants (including duckweeds [Lemna spp.] and water lily [Nymphaea odorata]) are common.

E. 3. s. Natural Lake Shoreline. The Natural Lake Shoreline natural community is rare in the A/P Study area and is confined primarily to portions of the shores of Lake Phelps and Pungo Lake. Portions of the shores of these natural lakes are dominated by stands of cypress and tupelo, but the most significant features of this community are the naturally occurring marsh and shrub zones. Strong winds and high water create enough tides on the shorelines that trees are killed or are otherwise not able to become established, and these zones contain some of the few naturally occurring non-estuarine marshes. Typical marsh species include broad-leaf cattail (Typha latifolia), common three-square (Scirpus americanus), and lamp rush (Juncus effusus); several herbaceous species occur in the marsh fringe at Lake Phelps that are very rare or absent elsewhere in North Carolina. A shrub zone is usually present, particularly behind the herb zone, with buttonbush (Cephalanthus occidentalis), waxmyrtle (Myrica cerifera), and elderberry (Sambucus canadensis) often common.

E. 3. t. Oligohaline Marsh. Naturally occurring marshes in the A/P Study area are primarily limited to the shorelines of Albemarle Sound and Currituck Sound and their larger tributaries, with smaller marshes along streams entering into the Chowan River. When the last inlet on Currituck Banks closed in 1828, the former brackish marshes along the shores of Currituck and Albemarle sounds gradually became more fresh and less tidally influenced. These marshes in the eastern portion of the area along Currituck and Albemarle sounds and their larger tributaries (such as North River) can rightfully be called Brackish Marsh communities, but they are considered to be Oligohaline Marshes in this report. Oligohaline Marsh natural community is intermediate in plant species (and water salinity) between Brackish Marsh and Tidal Freshwater Marsh communities as defined in Schafale and Weakley (1985). These very slightly brackish marshes feature species typical of the brackish

marshes found along the coast (such as the shores of Pamlico Sound and along much of the Outer Banks); however, a great many typical freshwater plants are present. The marshes tend to be dominated by sawgrass (Cladium jamaicense), several species of cattails (Typha spp.), big cordgrass (Spartina cynosuroides), and common reed (Phragmites communis). A very high diversity of plant species, both herbs and shrubs, is often present, especially where the marshes are burned at frequent intervals. These Oligohaline Marshes are common in the A/P Study area, show relatively little damage other than a few drainage ditches and canals, and may cover several hundred acres in extent.

E. 3. u. Tidal Freshwater Marsh. Marshes located along the Chowan River system, primarily found along the margins of tributary streams, are botanically distinct from the "semi-brackish" marshes farther east. Not only are the Chowan marshes rather limited in size, most being less than 100 acres and rather linear because they border streams, but they feature very few species typically found in brackish marshes, as the water in the Chowan River and its tributaries is essentially as fresh as drinking water. Instead, these Tidal Freshwater Marshes tend to have a greater frequency of broad-leaved forbs and less grasses, sedges, and rushes than found in brackish/oligohaline marshes. Typical species are southern wildrice (Zizaniopsis miliacea), several sedges (Carex spp.), arrow arum (Peltandra virginica), a few species of arrow-heads (Sagittaria spp.), and a great variety of other species. Tidal fluctuation in the marshes is very slight and barely noticeable, but the structure and composition of the marshes appear to correlate well with tidal freshwater marshes elsewhere in the mid-Atlantic states, where tidal amplitude is much greater (Odum et al. 1984).

E. 3. v. Tidal Cypress-Gum Swamp. Associated with the marshes are the Tidal Cypress-Gum Swamps, common along the shores of Albemarle Sound, the Chowan River, and other large tributaries. The ground and shrub layers tend to be poorly developed or absent, and the predominant feature is the canopy of bald cypress, water tupelo, and swamp tupelo.

E. 3. w. Estuarine Fringe Loblolly Pine Forest. A very poorly understood natural community, and one not included in the Classification of the Natural Communities of North Carolina, Second Approximation (Schafale and Weakley 1985), is a pine forest community along the inner margins of many of the marshes in the region. This community will be named the Estuarine Fringe Loblolly Pine Forest community in the third approximation of this classification (Mike Schafale, pers. comm.). The canopy, often stunted and open, is dominated by loblolly pine, with the pines generally small near the marsh edge. Occasional red maple, sweetgum, and swamp tupelo may be present in the canopy. Red maple and redbay are common in the understory, and waxmyrtle is a characteristic shrub. Groundsel tree (Baccharis halimifolia) often occurs along the pine/marsh boundaries, and greenbriers (Smilax spp.) are found in most stands. Marsh vegetation is often present in openings of this forest.

E. 3. x. Low Elevation Seep. The Low elevation Seep is a wetland community type that is closely tied to bluffs and slopes. Such communities are very small in size, generally less than an acre, and they occur near and

at the bases of steep slopes, especially the more mesic ones. In the A/P Study area, they are found primarily in Hertford and Martin counties, as these counties contain the majority of steep slopes. Seeps are often recognized by dense stands of ferns of several species, such as cinnamon fern (Osmunda cinnamomea) and royal fern (O. regalis), as well as other wetland herbs such as lizard's-tail (Saururus cernuus) and jewelweed (Impatiens capensis). Shrubs of wetlands, such as southern wild-raisin (Viburnum nudum) and highbush blueberry (Vaccinium corymbosum), are also characteristic.

E. 3. y. Pine Flatwoods and Pine Savanna. A discussion of natural communities would not be complete without mention of several types that likely existed in pre-settlement days when extensive and frequent fires shaped the landscape. As pointed out above, longleaf pine was quite widespread in the northern Coastal Plain of the state several hundred years ago, as fires prevented establishment or retarded the growth of other competing tree species. It is likely that some of the flats, both upland and wetland, were originally Pine Flatwoods or Pine Savanna natural communities, with a canopy of longleaf or mixed longleaf/shortleaf/loblolly pines with little understory. Some of these sites would likely have looked like existing natural areas that are present south of the Neuse River. There appear to be no known sites existing today in the 10-county A/P Study area that would be considered, by this inventory, to be Pine Savannas, and very few considered (marginally) as Pine Flatwoods. Frost has identified several sites that he believes contained longleaf pine or mixed pine savannas, or pine-oak woodlands maintained by fire, interspersed among other communities (e.g., sites CA6, CH6, CH7, GA1, GA5, GA6, HE10).

F. ORIGINAL FORESTS AND HISTORICAL CHANGES IN NATURAL VEGETATION

F. 1. Introduction

This section is a summary of the original natural vegetation of the A/P Study area. The interpretation is based on a variety of kinds of evidence, including historical documents, field notes, and study plots in remnant fire communities. The 9 principal pre-settlement types are listed below, as distributed along the moisture gradient, beginning with the driest and ending with marshes. Minor types are listed at the end of the section and in Figure 4.

F. 2. Longleaf Pine-dominated Communities

F. 2. a. General Comments. While of more limited extent than some of the communities below, longleaf pine (Pinus palustris) was important on the drier uplands. Two phases are well documented historically.

F. 2. b. Longleaf Pine Savanna and Woodland. This phase occurred on dry-mesic and xeric sand ridges (Pine/Scrub Oak Sandhill and perhaps a very small extent of Xeric Sandhill Scrub natural communities). While longleaf pine has been nearly extirpated from the region, turkey oak (Quercus laevis) and scrub post oak (Q. margaretta) are often found on former longleaf pine

FIRE FREQUENCY

		1-2 YEARS	3-5 YEARS	6-12 YEARS	13-25 YEARS	26-100 YEARS	100 YEARS +
VIRGINIA UPLAND "POCOSINS"	Seasonally wet, fine-textured soil (Myatt series)	Wet prairie, dominated by graminoids CELL 1	Wet prairie with Andropogon virginicus var. glomeratus and Arundinaria CELL 2	Wet prairie with Andropogon, Ilex glabra, Arundinaria CELL 3	Arundinaria, Ilex glabra, Myrica cerifera, other shrubs and red maple. CELL 4	Pinus taeda-Acer rubrum-Quercus alba /Arundinaria or shrubs CELL 5	Pinus taeda-Quercus alba-Acer rubrum/ sparse understory trees and shrubs CELL 6
TYPICAL PEAT BOG POCOSINS	Soils with thin organic epipedons, 10-30 cm thick	Wet prairie and bog graminoids and forbs, patches of Arundinaria and Andropogon CELL 7	Dense canebrake CELL 8	Alternating canebrake and pocosin CELL 9	Pinus taeda or P. serotina-mixed oaks-sweet gum/ Arundinaria CELL 10	Pinus taeda-sweet gum-mixed oaks/open shrub layer with some cane CELL 11	Oak forest with species depending upon texture of underlying mineral soil. CELL 12
	Shallow histosols, 30-100 cm thick	Open bog with dwarf shrubs, graminoids, pitcher plants, short, sparse cane, moss CELL 13	Dense canebrake CELL 14	Alternating canebrake and pocosin CELL 15	Pond pine/canebrake alternating with pond pine-red maple high pocosin, sweet gum/canebrake CELL 16	Pond pine forest, white cedar forest patch mosaic. Sweet gum-Pinus taeda/ Arundinaria CELL 17	White cedar forest or pond pine forest with bay species and Nyssa sylvatica var. biflora CELL 18
	Deep histosols, peat depth greater than 1 meter	Open bog with low shrubs, pitcher plants, other bog forbs, grasses and sedges. CELL 19	Low pocosin with sparse Pinus serotina CELL 20	Low, medium or high pocosin, depending upon site nutrient status CELL 21	High pocosin, Pinus serotina-Acer rubrum forest, or white cedar CELL 22	White cedar forest, or pond pine-red maple forest/Persea borbonia, Magnolia virginiana CELL 23	White cedar, Pinus taeda, Taxodium, Nyssa sylvatica var. biflora/Acer, Persea, Magnolia virginiana CELL 24

Figure 4. Distribution of pyrophytic wetland vegetation of southeastern Virginia and the Albemarle-Pamlico Estuarine Study region along master gradients of fire frequency and depth of organic soil. The characteristic vegetation of each cell was arrived at by examining communities in the field wherever remnants of pyrophytic types could be found, and by determining past fire history. Where no examples remained in Virginia or North Carolina, inferences were made from vegetation elsewhere. Historical records were always used where available.

sites, as are a variety of ericaceous shrubs. The habitat is essentially limited to the Chowan Sand Banks of Gates and Chowan counties and the Suffolk Scarp, from the Virginia line south to Edenton, and in Washington County from Plymouth south to Beaufort County, these being the only deep, well-drained sands of the A/P Study area. Dominants of the original herb layer are unknown in these fire-suppressed forests. Based on a stem count done by Frost in 1989 (disregarding recent small plantations), there may be fewer than 200 stems of longleaf pine left in 7 of the A/P Study area counties. Only 21 trees were counted in the Gates County portion of the Sand Banks. There are about 100 left in Chowan County, mostly young trees along the Chowan River near Arrowhead Beach. There is only one mature native tree in Perquimans County. There are a few scattered trees in Bertie County, 8 known from Martin County, and only one in Hertford. It has been completely extirpated from Currituck, Camden, and Pasquotank counties.

F. 2. c. Longleaf Pine/Bluestem Savanna. This is the Pine Savanna natural community listed in Schafale and Weakley (1985). Longleaf pine-dominated savannas may have occurred locally in slightly drier or more frequently burned uplands in the gently rolling areas dominated by mixed pine savanna (see below). Historical records and remnant tar kilns just over the state line in Suffolk and Chesapeake demonstrate that longleaf pine was once abundant enough for commercial production of tar and pitch, even in some areas without well-drained sands. The most likely areas for this type were central and northern Gates County, parts of northern Currituck County and the low ridge of sandy loam soils of the Currituck mainland peninsula, and the drier uplands of Bertie, Martin, and Hertford counties. Remnant graminoids associated with the few longleaf pines left in the region suggest that the original savanna herb layer was dominated by little bluestem (Schizachyrium scoparium), broomsedge (Andropogon spp.), oat grass (Danthonia spp.), and three-awn (Aristida spp.), but not by wiregrass (A. stricta), a very common grass of the sandhills and savannas of the state's southern Coastal Plain that is not recorded north of Beaufort County.

F. 3. Mixed Pines and Mixed Hardwoods Pyrophytic Woodland-Savanna Mosaic

F. 3. a. General Comments. This was probably the most extensive vegetation type in the region, occurring on the medium to fine-textured soils beginning at the contact between sands of the Gates County Sand Banks and the finer, more fertile soils of the interior, east to Currituck Sound; and extensively on uplands of Bertie, Martin, and Hertford counties. These lands, being the optimal soils for agriculture, have essentially all been cleared long ago. Two major community types can be distinguished, based on small differences in topographic position and fire frequency.

F. 3. b. Mixed Pine Savanna. This savanna type featured a mixture of longleaf, loblolly (P. taeda), shortleaf (P. echinata), and/or pond (P. serotina) pines in the canopy. There is no clear natural community yet defined for this community type. It could be called a Fertile Loam subtype of the Pine Savanna type, but based on soil differences and its great importance

in pre-settlement vegetation, it should be placed in its own category. This phase occurred on fertile loam or sandy loam soils where landscape factors such as fire compartment size led to a fire frequency of around 5 years. Extremely rare now, the only remaining examples known in the state are a few patches around the periphery of the Croatan National Forest and in the Pleasant Grove tract of the Uwharrie National Forest. There are no fire-maintained remnants in the Albemarle Sound region. The Bear Garden natural area (Site GA5), which has a few shortleaf pines and where longleaf pine occurs a mile away, may be the best area with potential for restoration of this type.

F. 3. c. Pyrophytic Woodland. This is a mixed pines/mixed hardwoods type that is not listed as a natural community in Schafale and Weakley (1985). The pines are the same species as in the previous type, but longleaf pine is a minor component; hardwoods, especially white oak (Quercus alba), southern red oak (Q. falcata), post oak (Q. stellata), and mockernut hickory (Carya tomentosa), are co-dominant with pines. This community is continuous with the Mixed Pine Savanna, on similar mesic, medium to fine textured, fertile soils, but with slightly lower, less regular fire frequency (on the order of 6 to 9 years). Pyrophytic Woodland fire frequency is lower because of smaller fire compartment size or topographic position slightly downslope or slightly more moist than Mixed Pine Savanna.

F. 4. Beech-dominated Communities

F. 4. a. General Comments. Communities dominated by American beech (Fagus grandifolia) in the pre-settlement landscape were apparently limited to the most fire-protected sites. These sites are steep slopes, islands and peninsulas, and portions of wet oak flats.

F. 4. b. Steep Slope Beech Forest. This is the Mesic Mixed Hardwood Forest natural community in Schafale and Weakley (1985). On the Pamlico Terrace, which only ranges from sea level to about 25 feet, the steep slope community was largely limited to the band of low rolling slopes along tributary streams of the Albemarle Sound, the sound shorelines themselves often being high-energy, wave-cut bluffs with little vegetation. This type is best developed along drainages cut into the Talbot and Wicomico terraces of Gates, Hertford, Bertie, and Martin counties, with the largest stands on slopes bordering the Roanoke River bottomlands.

F. 4. c. Mesic Island Beech Forest. This is also listed as Mesic Mixed Hardwood Forest natural community in Schafale and Weakley (1985). This phase is found on protected islands like those in Chowan Swamp, Great Dismal Swamp, and the swamps along the Pasquotank River. In the absence of fire or other disturbance, beech appears to be the ultimate successional species on nearly all upland soils of the region, its seedlings being the most shade tolerant of the species available. Ware (1978) has shown a general increase of beech in the region, where, with modern fire exclusion, it is escaping from its mesic island and steep slope fire refugia onto uplands formerly occupied by oak forests and pine savannas.

F. 4. d. Beech Flats. This community occurs on moist clay soils and is included in the Mesic Mixed Hardwood Forest, and perhaps the Nonriverine Wet Hardwood Forest, natural community in Schafale and Weakley (1985). This is a rare community, increasing with elimination of fire in the landscape, but natural examples occurred on fire protected upland peninsulas such as occur at Merchants Millpond in Gates County. Dynamics in relation to fire and associated oak forests are discussed below.

F. 5. Oak Flats

F. 5. a. General Comments. The oak flats were originally extensive on the large areas of circumneutral whitish clay soils about 40,000 to 50,000 years old that were deposited in portions of the shallow estuary that covered all of the region from Currituck Sound to the Suffolk Scarp in the late Sangamon Interglacial. There are 4 phases, 3 of which are based almost entirely on moisture differences due to slight differences in elevation. The fourth phase -- the last listed below -- may be related to former fire regime.

F. 5. b. Cherrybark Oak-dominated Stands. This type is listed as a Nonriverine Wet Hardwood Forest natural community in Schafale and Weakley (1985). These stands are dominated by cherrybark oak (Quercus pagoda) and occur on the slightly drier sites, usually with swamp chestnut oak (Q. michauxii) and often with scattered shagbark hickory (Carya ovata). American beech is nearly absent in stands that have been occasionally burned; light ground fires in the shallow and somewhat ephemeral litter appear to have been the norm in pre-settlement stands in these otherwise fuel-less forests. Occasional fires would maintain oak stands by preventing succession or with natural reduction in fire frequency due to topographic features. A perfect continuum can sometimes be seen in sites where open, fire-exposed oak flats without any beech lead to nearly pure beech stands on upland peninsulas bordered by non-pyrophytic swamps or water. The typical soil series for this type is Roanoke (clayey Ochraquult).

F. 5. c. Swamp Chestnut Oak/Cherrybark Oak Stands. This is another type listed as Nonriverine Wet Hardwood Forest natural community (Schafale and Weakley 1985). This phase occurs on slightly wetter sites and in patches in slightly wetter depressions in communities dominated by the previous phase (Cherrybark Oak). These stands often have an understory of giant cane (Arundinaria gigantea), especially in areas transitional to large, fire-exposed flats that may have originally supported canebrake or wet prairie depending on substrate (see Figure 4). The same fire dynamics with respect to beech apply as in the Cherrybark Oak phase. The typical soil series is Cape Fear.

F. 5. d. Laurel Oak Slough. This type is marginally included as Nonriverine Wet Hardwood Forest natural community in Schafale and Weakley (1985), but it perhaps is a separate community. This is a rare community in the A/P Study area and is included in this listing because it was only seen within Nonriverine Wet Hardwood Forests. It is found in long, winding stands,

apparently at old swamp or salt marsh meander channels formed in a shallow-water environment during recession of the Sangamon Sea. These sites are wetter than the previous phase and differ in that they have pooled water in the wet season. This type is sometimes also found in simple round depressions in clay flats. Swamp chestnut oak and sweetgum (Liquidambar styraciflua) are often present, and one site also had overcup oak (Quercus lyrata). Giant cane is usually the understory dominant. Examples of this type were found in the study only in sites CH1, CU1, CU4, and GA5. The typical soil series is similar to Cape Fear but is completely inundated in wet seasons; it is possibly an undescribed minor soil series.

F. 5. e. White Oak/Red Maple/Loblolly Pine/Canebrake. This phase occurs with Nonriverine Wet Hardwood Forest. The canopy may be partially open, pine is sometimes sparse, and the cane understory can be quite dense. It is presumed that this type originally occurred as a community transitional to canebrake or wet meadow (wet prairie) in the fire-exposed interiors of larger flats where a combination of seasonal moisture stress on dense clayey soils and high fire frequency led to substantial treeless areas (see discussion of Belle Meadow "Pocosin" natural area, Isle of Wight County, Virginia, in Frost [1989gg]). In some areas where fire frequency was slightly lower, such treeless areas may have been lacking and there may have been large areas of this type (e.g., the area historically called White Oak Pocosin in Gates County). While cane is a natural component of these communities, the great density of cane sometimes found in the understory of remnant stands is likely a result of 20 to 40 years of fire exclusion which leads, on these moist mineral soils, to accumulation of a histic layer from partially decomposed litter. This serves as substrate for a dense mat of cane rhizomes. Recent experimental burns at the Blackwater Ecological Preserve demonstrated that a single growing-season fire may remove this anthropogenic layer, greatly reducing cane density. The typical soil series for this type are Roanoke and Cape Fear.

F. 6. Canebrake

While there is no fire-maintained remnant of canebrake in the A/P Study area, this community type was once extensive wherever there were shallow organic soils with frequent fire. The largest canebrake documented historically was the Green Sea (Site CA3) in northern Camden and Currituck counties mentioned by William Byrd in 1728 and by George Washington in his diary of a trip around the Great Dismal Swamp in 1763:

> "There is one remarkable part of the Dismal, lying to the south of the Line, that has few or no Trees growing on it, but contains a large Tract of tall Reeds. These being green all the Year round, and waveing with every Wind, have procur'd it the Name of the Green Sea."

This was a sea of cane about 25 to 50 square miles in extent, judging from the extent of suitable soils at the site on the Camden-Currituck county line, just south of the State line. Byrd's 1728 transect of this area indicates that

some of the Green Sea extended into Virginia. Other large canebrakes probably occurred in Bear Swamp (Chowan-Perquimans counties), with numerous smaller stands elsewhere. In Bertie, Martin, and Hertford counties cane occurred in small, non-alluvial stream bottomlands and sloughs on shallow muck soils swept by fires from adjacent pyrophytic woodland and savanna.

Original vegetation of canebrake and other wetland types of the region was complicated and dynamic, with more than one community being possible at a given site, depending upon recent fire history and random variables such as depth of water table at the time of the last fire. These relationships have never been explained satisfactorily, mostly because of underestimation of the importance of fire. Most variations can be understood in terms of 2 master gradients, fire frequency and depth of organic soil. Figure 4 is a first approximation of the relationships of fire-dependent wetland vegetation along these gradients (Frost 1989gg). (A second approximation for North Carolina, including a lesser fertility axis, is in preparation by Frost).

As indicated by cells 8 and 14 on Figure 4, optimal conditions for canebrake occur on organic soils 10 to 100 centimeters deep, burned at a frequency of 3 to 5 years. Most deeper peat soils appear to be too infertile for cane, while mineral soils are not conducive to formation of the dense rhizome mat underlying pure canebrake. As discussed above, while canebrake increases in density following fire on Terric and Typic Medisaprists, it may be much reduced after fire on moist mineral soils. Annual fire intervals longer than about 6 to 12 years allow establishment of resprouting pocosin shrubs and trees that compete with cane and quickly replace it after fire exclusion. Most of the existing areas of pond pine/pocosin on shallow, moderately fertile organic soils, such as Wasda and Ponzer, are former canebrakes. The typical soil series for canebrakes are Ponzer, Wasda, wetter phases of Cape Fear, and the shallower portions of Pungo and Dare.

F. 7. Pond Pine Communities

F. 7. a. Pond Pine/Canebrake. This type is perhaps of the Pond Pine Woodland natural community in Schafale and Weakley (1985). Pond pine is subject to much of the same dynamics as canebrake and reaches its best development on the same somewhat fertile, shallow organic soils (see cells 10 and 16 in Figure 4). Lower fire frequency is the only substantially different environmental variable, the two communities often forming a patch mosaic ranging from treeless canebrake to closed pond pine with dense cane understory. With fire exclusion these stands succeed to dense, tall pond pine forest with an understory of pocosin and bay species in 10 to 20 years. The best examples of pond pine forest originated this way, as succession from canebrake, but most now have been logged or cleared for agriculture. Logging of successional pine stands then leads to Bay Forest natural community on these soils.

F. 7. b. Pond Pine/High Pocosin and Pond Pine/Low Pocosin. These two types correspond to the High Pocosin and Low Pocosin natural communities in Schafale and Weakley (1985). Pond pine is much more tolerant of infertile conditions than cane and is not excluded by competition with pocosin shrubs under lower fire frequencies. Under these conditions, this tree species

occurs in its more picturesque, twisted, and variously stunted forms with low or high pocosin shrubs (see cells 20 through 24 in Figure 4), where it may persist indefinitely without fire. The typical soil series for pond pine pocosin types are Dare and Pungo; however, many large areas of swamp forest in the region mapped as Dorovan may also have large unmapped areas of Dare and Pungo that originally supported pocosin and some canebrake).

F. 8. Atlantic White Cedar Forests

This single type is the Atlantic White Cedar Forest natural community in Schafale and Weakley (1985). Vast stands of white cedar (Chamaecyparis thyoides) once covered much of Washington County, including East Dismal Swamp and Van Swamp; the North River and Great Swamp wetlands; and Chowan and Great Dismal swamps. W.W. Ashe in 1894 reported 20,000 acres of white cedar in Chowan Swamp, of which today more than 99% has been removed and converted to various kinds of cypress-gum swamp. Akerman (1923) estimated the original cover of white cedar in the Dismal at 125,000 acres. Other estimates which included stands in peripheral swamps along streams like the Perquimans and Pasquotank rivers range as high as 250,000 acres. Today the largest acreage remaining in the range of the species is found in the Great Dismal Swamp, where total acreage in Virginia and North Carolina is about 5,000 acres. Historical records or remnant trees are found almost everywhere that peat soils occur in the region. In many places such as the interior of Great Swamp in Camden and Currituck counties and swamps near Camden Point, the only evidence of former large stands are cedar stumps and single trees.

White cedar typically occurs in dense, pure stands dating to a past fire and depends upon catastrophic fires at long intervals (25 to 100+ years) that completely clear an area of swamp, allowing a dense new stand to regenerate. In the A/P Study area, white cedar occurred on wet sands with high organic matter content at the toes of scarps, on shallow organic soils, or on deep peats, where fire return interval was more than about 20 years. In some areas these stands occurred adjacent to frequent-fire communities but were protected from most fires by a stable high water table or by a wet zone such as that at the toe of the Suffolk Scarp in Gates County.

Cedar typically occurs with less valuable swamp timber around the periphery so that logging methods, which have customarily taken just the cedar, allowed swamp forest to close in around the edges. Logging slash often prevents regeneration of cedar, and resprouting or uncut stems of understory trees like redbay (Persea borbonia), sweetbay (Magnolia virginiana), red maple (Acer rubrum), and swamp tupelo (Nyssa biflora) often form a closed canopy suppressing any new cedar that may germinate. Historically, any small patches of cedar that did regenerate after logging were specifically sought out 30 or 40 years later and logged again, each time the cedar stand losing ground to swamp or bay forest. Since early settlement, white cedar was the most valuable tree in the region, and all cedar stands have been logged twice, and some 3 or 4 times. Under the original fire regime, cedar would regenerate after each fire, perhaps losing some area to swamp, but always with the potential to invade additional fire-cleared areas of swamp forest around the periphery of the stand where a seed bank of white cedar had accumulated in the peat. With repeated logging, however, a large portion of the stand is lost

each time. Logging history of some areas like Chowan Swamp indicates that essentially no stands regenerate after the third logging. A very large acreage of swamp forests, perhaps 50% of those in the region, are replacement communities for white cedar. White cedar is most common on the following soil series: Pungo, Dare, Belhaven, and Scuppernong.

F. 9. Cypress-Gum Swamps

These swamps include the following natural communities in Schafale and Weakley (1985): Tidal Cypress-Gum Swamp; Cypress-Gum Swamp, Brownwater subtype; Cypress-Gum Swamp, Blackwater subtype; and Coastal Plain Small Stream Swamp. In pre-settlement forests, swamps of cypress (Taxodium distichum) and gum (Nyssa aquatica and N. biflora) would have been limited to naturally fire-protected habitats. In interior localities like the Great Dismal Swamp, such sites occurred along the toe of the Suffolk Scarp which, before construction of US 158, was the headwaters of the Perquimans River, and along the margins of nearly all of the streams draining the Dismal and other interior wetlands.

Another important habitat for cypress-gum forests was the alluvial bottomlands with wet mineral soil along much of the Roanoke and Meherrin rivers, where fire seems to have played little or no role in determining vegetation. A third habitat, probably the most extensive, was in marginal bands, some 50 to 200 yards wide, along the river and sound borders of large tidal freshwater swamps at sea level, the interiors of which were white cedar, pocosin, or other fire-related types. One of the rare localities where natural fire zonation of tidal wetland vegetation can still be seen is along the east side of the Alligator River (outside of the A/P Study area). There, a well-developed margin of cypress-gum swamp changes in the interior to a patch mosaic of cypress and fingers of white cedar that outline the ultimate extent of which past fires originating in interior pocosins were able to penetrate down into swamps on the permanently-saturated muck soils near the river.

In the region today, Tidal Cypress-Gum Swamps appear to be the most extensive natural vegetation type. At least half of these, however, are replacement communities for extirpated white cedar and fire-suppressed pocosin and other vegetation. Cypress is naturally limited to marginal bands in these swamps and is slow to invade the peaty soils of the interior. Where cedar stumps or other evidence is lacking, a scarcity of cypress and dominance by swamp tupelo and red maple is good evidence of conversion from a former pyrophytic wetland. Redbay is often also a good indicator of former white cedar stands. Typical soils for cypress-gum swamps are Dorovan and Chowan.

F. 10. Marshes

F. 10. a. General Comments. Marshes represent the least disturbed of the major vegetation categories of the A/P Study area. While rising sea level and channel migration may have shifted some marsh boundaries since pre-settlement times, total acreage is probably little changed. Perhaps 10% of marshes has been lost in the 20th Century to red maple, cypress, loblolly pine, and shrub invasion following fire suppression. Nearly all marshes

investigated showed evidence of past fires, particularly those bordering the entire North River, Northwest River, North Landing River, and Currituck Sound. Marshes are highly flammable, accumulating a dense thatch from foliage that dies back each fall and consequently can burn at any time of year. With the exception of marshy islands, most marshes in the area would have burned frequently under a natural fire regime, as fires swept in from the uplands.

Moisture stress is the primary gradient preventing marsh succession to woody species, but a fire-effect gradient is perhaps the second most important factor, since elimination of fire appears to lead to vegetative changes, with eventual dominance by nearly pure stands of tall marsh species like big cordgrass (Spartina cynosuroides), common reed (Phragmites communis), broad-leaf cattail (Typha latifolia), and black needlerush (Juncus roemerianus). Species diversity may be as much as 3 times higher in burned versus unburned marshes. The most important fire effects noted during this study were:

1. maintenance of high species diversity;
2. maintenance of certain rare marsh community types (rattlesnake-master [Eryngium aquaticum] marsh, beaked spikerush [Eleocharis rostellata] marsh) and certain rare species that occur in them, such as twig-rush (Cladium mariscoides) and winged seedbox (Ludwigia alata);
3. maintenance of the swamp forest/marsh ecotone where some rare communities (such as joint grass [Manisurus sp.]/sedge marsh) occur;
4. prevention of woody succession in marshes with salinity low enough to permit growth of shrubs and trees.

Based on effects of salinity (the third most important environmental gradient in these marshes), 2 distinct classes of marshes were seen. These are the strictly freshwater marsh and the slightly oligohaline marsh. There are no true salt marshes in the A/P Study area, as the last Currituck Banks inlet having closed in 1828. Salinity in Currituck Sound and the lower Albemarle Sound is derived from occasional input from Oregon Inlet via Pamlico Sound, and then Croatan and Roanoke sounds, probably during wind events from the south. Wind circulates and mixes these waters, which in multiple drought years can reach salinity 1/10 that of sea water. The sounds in the study area are presently returning to relatively fresh conditions after one such event several years ago.

F. 10. b. Fresh Marsh. This is listed as Tidal Freshwater Marsh natural community in Schafale and Weakley (1985). Strictly fresh marshes are a rare community, limited in the A/P Study area to the Chowan River basin, with only 5 well-developed examples being known. While fire may have played a minor part in maintenance of these, by retarding succession of red maple (which is visible in all of these marshes), it appears to be much less significant than in coastal marshes. Four of the 5 marshes are located on swamp fringes and downstream-pointing spits of land at the mouths of Wiccacon, Sarem, Bennetts, and Catherine creeks. All, including the fifth -- a small marsh on lower Dillard Creek, are underlain by a similar, very soft unconsolidated ooze. It may be that these diverse marshes represent primary succession on sediments prograding downstream through some unknown dynamics of fine sediment accumulation in this sluggish river system.

F. 10. c. Nearly Fresh to Oligohaline Marsh. This type is a mixture of the Tidal Freshwater Marsh and Brackish Marsh natural communities described in Schafale and Weakley (1985). This group constitutes the remaining 99% of the marshes of the A/P Study area. All of the marshes must have shifted in geographic location, along the salinity gradient, following closure of New Currituck Inlet 162 years ago. All marsh types observed, however, are probably natural communities that also occurred in the pre-settlement landscape but which would have been confined to less saline areas upstream in the tributaries of the sounds, with typical salt marsh bordering the sounds themselves. Oligohaline marshes of the region are characteristically bowl-shaped, with very tall species along shorelines, then irregular zones of species of intermediate height such as narrow-leaf cattail (Typha angustifolia) and, in the centers of the largest marshes, low, lawn-like meadows of beaked spikerush. The following 10 oligohaline marsh "subtypes", arranged from fringing tall marsh into interior low types, were consistently encountered:

1. shoreline mixed tall marsh;
2. Spartina cynosuroides marsh;
3. Typha latifolia marsh;
4. Phragmites communis marsh;
5. Typha angustifolia marsh;
6. Scirpus americanus [common three-square] marsh;
7. Juncus roemerianus marsh;
8. low broadleaf marsh (Sagittaria falcata [coastal arrow-head], Pontederia cordata [pickerelweed], Peltandra virginica [arrow arum], Nymphaea odorata [water lily], and Eleocharis fallax [creeping spikerush]) in the wettest interior sites;
9. Eryngium aquaticum marsh (rare);
10. Eleocharis rostellata marsh (rare).

F. 11. Minor Pre-Settlement Vegetation Types

The following natural communities or vegetation types were apparently rare several hundred years ago, and they are also a minor component of the present-day vegetation of the region.

1. Estuarine Fringe Loblolly Pine Flatwoods (Loblolly Pine/Sedge savanna). The Estuarine Fringe Loblolly Pine Forest natural community was presumably this type during pre-settlement times.
2. Bay Forest. Most of the existing examples are artifacts of fire suppression and logging of former canebrake, pond pine woodland, or white cedar forest.
3. Wet Prairie. See the discussion under Section F.5.e. above.
4. Vegetation of Carolina Bays.
5. Aquatic Communities. Several important types are discussed in the individual site reports.

G. PLANT LIFE

G. 1. Rare and Endangered Plant Species

The A/P Study area is relatively depauperate in endangered, threatened, or otherwise rare plants. Though Table 3 contains a moderate list of species, this list is that for a 10-county area. Some counties in the southern Coastal Plain of North Carolina, such as Brunswick and Pender, probably contain more rare species than are presently known for all 10 counties in the A/P Study area.

There are no Federally Endangered or Threatened plant species known for the A/P Study area. In fact, only 2 species are presently candidates for Federal listing -- Carolina lilaeopsis (Lilaeopsis carolinensis) and least trillium (Trillium pusillum). The former plant grows in shallow fresh water in marshes or shores of pools or ponds and is known from a number of sites in the area, including a few of which were discovered during this study. The trillium is known from two sites in the A/P Study area, one each in Gates and Camden counties. It blooms in early April and grows in moist hardwood forests. Two additional species were formerly Federal candidates, but they have been dropped from further consideration (3C status). Pondspice (Litsea aestivalis) was discovered in the A/P Study area in 1989 by a State government employee doing wetland survey work. This shrub was previously known in North Carolina only north to Carteret County; it is typically found growing on the margins of limesink ponds. Ginseng (Panax quinquefolius) is very rare in the state east of the Fall Line, and there is only one known site from the A/P Study area. This plant's roots are collected for the medicinal market; it grows in rich woods on moderate slopes.

The remaining rare plants reported from the study area in the past are reasonably widespread in eastern North America. The majority of the rare species grow in shallow fresh water, either along the margins of ponds or pools (approximately 10 species), or in marshes (approximately 5 species). Only a few are associated with wooded habitats. Three are found primarily on wooded slopes in rich soil, three in bottomlands and natural levees, and just two in pocosin-like margins or boggy spots. Only one plant, the coast jointweed (Polygonella articulata), is typically found in upland woods in dry situations. Several of these species are no longer known to occur in North Carolina (SH state rank on Table 3), and coast jointweed is recorded from just a single site in the state, in the A/P Study area. Of those still known to be extant in the state, the magnolia vine (Schisandra glabra) deserves special mention. This woody vine is known from just one site north of South Carolina, on rich wooded slopes in Martin County; the population was verified during the study, and 2 new sub-populations were found less than a mile from the original population.

G. 2. Significant Botanical Habitats

Habitats where rare plant species or high diversities of plant species occur are important to identify and protect. As indicated in the preceding section, the majority of the rare plants occur in water or very damp

Table 3. Endangered, threatened, and rare plant species in the 10-county Albemarle-Pamlico Estuarine Study region. Where a species occurs in an identified natural area, the Site Number is given; otherwise, the county of occurrence is listed.

Scientific and Common Names	Status 1 NC	2 US	5 state rank	3 global rank	Habitat	Locations
Bacopa cyclophylla water-hyssop	SR		SH	G3G5	muddy banks; shallow water	Chowan
Brachythecium rotaeanum Rota's feather moss	SR		S1	G3?	rich woods on decaying wood	Martin
Cladium mariscoides twig-rush	SR		S1	G5	freshwater marshes	CA7,CU2, CU3,CU17
Cyperus dentatus toothed-leaf flatsedge	PP		S1?	G4	low sandy areas	Currituck
Didiplis diandra water purslane	SR		S1	G5	ponds; sluggish streams	Chowan, Hertford, Perquimans
Eriocaulon septangulare seven-angled pipewort	SR		S2	G5	lakes; ponds; sluggish streams	WA7, Perquimans
Heteranthera multiflora multiflowered mud-plantain	SR		S1	GU	mudflats; shallow water	BE18, Martin, Pasquotank, Perquimans
Isoetes riparia riverbank quillwort	SR		S1	G4	shallow water	Currituck
Lilaeopsis carolinensis Carolina lilaeopsis	T	C2	S2	G4	marshes; shallow water	CU6,CU13, CU14,PA2, PE3,PE4, WA1
Listera australis southern twayblade	SR		S2	G4	mesic woods; bottomlands	GA3,GA7, GA9

Table 3. (continued)

Scientific and Common Names	Status 1 NC	2 US	5 state rank	3 global rank	Habitat	Locations
Litsea aestivalis pondspice	SR	3C	S2	G4G5	margins of wooded ponds	GA2
Ludwigia alata winged seedbox	SR		S2?	G3G4	freshwater marshes	CA7,CU2, CU3,CU7, CU13,PA1
Myriophyllum tenellum leafless watermilfoil	PP		S1	G5	shallow water of lakes and ponds	WA7
Oenothera perennis perennial sundrops	SR		S1	G5	moist pine woods	Hertford
Panax quinquefolius ginseng	SC	3C	S4	G4	rich woods	MA5
Polygonella articulata coast jointweed	PP		SH	G5	sandy pine-oak woods	Gates
Potamogeton confervoides Conferva pondweed	PP		S1	G5	shallow water of lakes or ponds	GA7
Ranunculus ambigens water-plantain spearwort	SR		SH	G4G5	ditches; marshes	Bertie, Perquimans
Ranunculus flabellaris yellow water-crowfoot	SR		S1	G5	shallow water of cypress ponds	GA7
Schisandra glabra magnolia vine	T		S1	G4	rich woods	MA5
Spartina pectinata prairie cordgrass	SR		S1	G5	freshwater marshes	GA3,GA4, PA1
Torreyochloa pallida pale mannagrass	SR		S1	G5?	shallow water	Gates

Table 3. (continued)

Scientific and Common Names	Status 1 NC	2 US	5 state rank	3 global rank	Habitat	Locations
Trillium pusillum least trillium	E	C2	S1	G3	moist woods	CA1,GA7
Urtica chamidryoides stinging nettle	SR		S1	G4G5	natural levee forest	BE13
Utricularia resupinata northeastern bladderwort	SR		S1	G4?	shallow water of lakes or ponds	WA7
Vaccinium macrocarpon cranberry	PP		S2	G4	boggy areas; pocosin margins	Currituck

1 From Sutter, R.D., L. Mansberg, and J.H. Moore. 1983. Endangered, threatened, and rare plant species of North Carolina: a revised list. ASB Bulletin 30:153-163, and updated lists of the Natural Heritage and Plant Conservation Programs.

E = Endangered
T = Threatened
SC = Special Concern
PP = Primary Proposed
SRS = Significantly Rare

E,T,and SC species are protected by state law (the Plant Protection and Conservation Act, 1979); the other two categories indicate rarity and the need for population monitoring, as determined by the Plant Conservation and Natural Heritage Programs.

2 From Federal Register, December 15, 1980, Part IV; Federal Register, July 27, 1983; Federal Register, November 28, 1983, Part II. Department of Interior. Established by the Endangered Species Act of 1973, as amended.

E = Taxa currently listed as Endangered
T = Taxa currently listed as Threatened
PE = Taxa currently proposed for listing as Endangered
PT = Taxa currently proposed for listing as Threatened

Taxa under review for possible listing ("candidate species"):

C1 = Taxa with sufficient information to support listing
C2 = Taxa without sufficient information to support listing

3 From the Nature Conservancy, 1985. Global element rank: world-wide status. Unpublished listing.

G1 = Critically imperiled globally because of extreme rarity or otherwise very vulnerable to extinction throughout its range.
G2 = Imperiled globally because of rarity or otherwise vulnerable to extinction throughout its range.
G3 = Either very rare and local throughout its range, or found locally in a restricted area.
G4 = Apparently secure globally, though it may be quite rare in parts of its range (especially at the periphery).
G5 = Demonstrably secure globally, though it may be quite rare in parts of its range (especially at the periphery).
GU = Possibly in peril but status uncertain; need more information.
GX = Believed to be extinct throughout range.
Q = a suffix attached to the Global Rank indicating questionable taxonomic status.
T_ = an additional status for the subspecies or variety; the G rank then refers only to the species as a whole.

4 Taken from Cooper, J.E., S.S. Robinson, and J.B. Funderburg (Eds.). 1977. Endangered and Threatened Plants and Animals of North Carolina. N.C. Museum of Natural History, Raleigh, NC. 444 pages + i-xvi, and updated lists of the Natural Heritage Program.

E = Endangered
T = Threatened
SC = Special Concern
UD = Undetermined

5 From the Nature Conservancy, 1985. Definitions of state ranks are the same as for those of the global ranks, except insert the word "in state" for "globally". One additional state rank used in this report is "SH".

SH = Of historical occurrence in the state, perhaps having not been verified in the past 20 years, and suspected to be still extant.

conditions of ponds and marshes. Swamps and other wooded habitats do not provide the habitat for as many rare or significant species in the A/P Study area as do the more open, sunny wet places.

The fresh to slightly brackish marshes in the Albemarle and Currituck sounds vicinity are important botanical habitats, especially if the marshes are burned every 3 to 5 years. Burning of marshes promotes plant species diversity, in addition to killing back woody species such as red maple (Acer rubrum) that might eventually overtake portions of a marsh. Frequently burned marshes often have many dozens of herbaceous plant species, including many with showy flowers.

Lakes and ponds, including old millponds, also are important botanical habitats. The marshy shoreline along portions of Lake Phelps is a very significant habitat. Merchants Millpond contains numerous rare plant species, including floating aquatic plants, and has a high diversity of wetland species. Many rare species inhabit standing water of small pools and even roadside ditches and canals. Such pools, ditches, and canals are not likely to be acquired for protection, but they are often significant habitats with a high species diversity. The significance of the occurrence of rare species in these man-made habitats appears to be that they mimic the sunny, stable shallow water habitat found in beaver ponds, the original natural habitat for many of these species.

The wetter swamps, especially the tidal cypress-gum swamps, are usually not significant botanical sites, except along muddy shores, where species such as Carolina lilaeopsis have been found. However, the drier swamps and bottomlands often have high woody plant species diversity. Such wooded areas are often poor in herbaceous species diversity because of dark or wet conditions on the ground floor. The most significant bottomland habitats are the low ridges and natural levees of the Roanoke River, but some of the few remaining nonriverine wet hardwood forests and swamps also have a good to excellent diversity of woody species. A special mention must be made of the openings (both natural and man-made) in the forests of the Roanoke River and in other floodplain forests. These openings, such as margins of roads and in utility clearings, often contain a high species diversity. For example, several uncommon or local species grow in the sunny openings along US 13-17 where this highway crosses the Roanoke River floodplain.

Pocosins generally do not have a high plant species diversity, especially those with a tall canopy. Thus, the best diversity is usually found in the low pocosin, or in pocosins where openings are present, such as in powerline clearings or edges of roads. These openings, especially where damp, may provide a "savanna-like" setting for a wide variety of savanna species, such as pitcher plants, sundews, and orchids. Pocosins that are clearcut often provide habitat for savanna species for several years, until shrubs and saplings shade the herbs out after 5 to 10 years.

Several non-wetland natural communities are very important botanical habitats. Quite significant are the moderate to steep slopes occurring along the Roanoke River, the Meherrin River, and their tributaries. These slopes are often quite species-rich, and some contain a great variety of herbaceous species, especially where mountain laurel (Kalmia latifolia) is absent. Not only are such slopes rich in species, many of the plants are typically montane and are rarely found in the Coastal Plain of North Carolina. Other significant habitats for upland plants are located on the Chowan Sand Banks in

Gates County. The sand ridge has relatively few rare plants, but the ridge contains perhaps dozens of species that are rarely found in the northern half of the state's Coastal Plain. The banks are one of the few "sandhills" habitats north of the Neuse River. They also have a remarkable diversity of ericaceous shrubs. On the other hand, the oak-hickory forests in the A/P Study area do not appear to be major botanical habitats, though few excellent examples of these types of forests have been located.

In summary, the most significant botanical habitats are generally marshes and pond and pool margins. Rich wooded slopes and the Chowan Sand Banks are also important for botanical diversity. Man-made openings in wooded wetlands, such as clearcut pocosins or powerline or highway corridors through pocosins or bottomlands, often contain a surprising variety of plant species. Many of these plant species would have been widespread in the pre-settlement landscape with its open, sunny woodlands maintained by fire.

H. ANIMAL LIFE

H. 1. Rare and Endangered Animal Species

The 10-county A/P Study area contains relatively few endangered, threatened, or otherwise rare animals, especially in relation to other regions of the Coastal Plain of North Carolina. There are 14 such rare vertebrate species (see Table 4), of which 4 are mammals, 9 are birds, and just 1 of fishes. The scarcity of rare species is partly due to the lack of "unique" or specialized habitats in the Albemarle Sound region, such as limesink ponds, Carolina bay lakes, or savannas.

Of the rare animal species, 3 of them are Federally listed as Endangered or Threatened. The bald eagle (Haliaeetus leucocephalus), a Federally Endangered species, nests at a site in Washington County and is a rather rare migrant and visitor to waters in the A/P Study area. The red-cockaded woodpecker (Picoides borealis) is also Endangered. This species of open pine woods, especially longleaf pines (Pinus palustris), has declined dramatically throughout its range, paralleling the demise of the longleaf pine in the Albemarle Sound region, which is near the northern periphery of the woodpecker's range. A few breeding pairs still reside in several counties, primarily Bertie, but the species likely will be extirpated from the region by the end of the century because of lack of fire and the harvesting of large pines. The remaining Federally listed species is the Dismal Swamp southeastern shrew (Sorex longirostris fisheri), a Threatened taxon. The southeastern shrew is found over most of the state; however, the listed subspecies is essentially restricted to Dismal Swamp and locales within about 30 miles of the swamp.

Three additional species are C2 Federal candidates -- Rafinesque's big-eared bat (Plecotus rafinesquii), loggerhead shrike (Lanius ludovicianus), and Waccamaw killifish (Fundulus waccamensis). More information about populations and threats to the populations is needed before a proposal for listing of these species can be made. The bat is known from several sites in the region, whereas the killifish is found only at Lake Phelps (and at Lake Waccamaw in the southern Coastal Plain). The shrike is presumed to have occurred into the

Table 4. Endangered, threatened, and rare animal species in the 10-county Albemarle-Pamlico Estuarine Study region. Where a species occurs in an identified natural area, the Site Number is given; otherwise, the county of occurrence is listed.

Scientific and Common Names	Status 4 NC	2 US	5 state rank	3 global rank	Habitat	Locations
MAMMALS						
Condylura cristata star-nosed mole	SC	3C	S4	G5	wetlands, mainly wooded	Currituck, Washington
Plecotus rafinesquii Rafinesque's big-eared bat	SC	C2	S3	G5	bottomland woods; swamps	Bertie, Gates
Sorex longirostris fisheri Dismal Swamp southeastern shrew	T	LT	S1	G5T1T3	mesic to moist thickets	Camden, Currituck, Perquimans
Ursus americanus black bear	SC		S3	G5	extensive moist woods; pocosins	found in all counties; many sites
BIRDS						
Accipiter cooperii Cooper's hawk	T		S2	G5	forests; forest borders	Gates
Ammodramus henslowii Henslow's sparrow	SR		S2	G5	damp clear-cuts or bushy fields	Bertie, Gates, Martin
Aquila chrysaetos golden eagle	SR		S1	G5	extensive open country	WA9
Coragyps atratus black vulture	T		S3	G5	woods; fields	all counties

Table 4. (continued)

Scientific and Common Names	Status 4 NC	2 US	5 state rank	3 global rank	Habitat	Locations
Coturnicops noveboracensis yellow rail	UNK		S3	G4	marshes	Currituck
Dendroica cerulea cerulean warbler	SR		S3	G4	natural levee forests	BE13,BE17, MA2
Haliaeetus leucocephalus bald eagle	E	LE	S1	G3	remote swamps (nest site); open water (foraging)	WA2 (nesting); visits most counties
Lanius ludovicianus loggerhead shrike	SC	C2	S2	G4	fields and pastures	presumably in western counties
Picoides borealis red-cockaded woodpecker	E	LE	S2	G2	open pine woods	BE4,GA1, HE4, Camden, Martin, Washington
FISHES						
Fundulus waccamensis Waccamaw killifish	E	C2	S1	G1	natural lakes	WA7
MOLLUSKS						
Anodonta implicata alewife floater	SC		S2?	G5	rivers	Chowan
Lampsilis ochracea tidewater mucket	SC		S2	G4	tidal rivers	Gates
Ligumia nasuta eastern pondmussel	SC		S1?	G4	rivers	Chowan

Table 4. (continued)

Scientific and Common Names	Status 4 NC	2 US	5 state rank	3 global rank	Habitat	Locations
BUTTERFLIES						
Amblyscirtes reversa reversed roadside skipper	SR		S2	G4	wet woods near cane	Bertie, Martin
Euphyes bimacula two-spotted skipper	SR		S1	G4	marshes near swamps	Gates
Euphyes dion Dion skipper	UNK		S2?	G4	marshes; swamp edges	Camden
Fixsenia ontario northern hairstreak	UNK		S3?	G4	dry to mesic oak/pine woods	Camden
Mitoura hesseli Hessel's hairstreak	SR	3C	S2	G3G4	Atlantic white cedar swamps	Gates, Washington
Poanes aaroni Aaron's skipper	SR		S1	G4	salt or brackish marshes	Currituck
Poanes viator broad-winged skipper	UNK		S3?	G5	brackish or fresh marshes	Currituck
OTHER INVERTEBRATES						
Orconectes virginiensis Chowan River crayfish	S		S?	G?	wooded streams	Hertford, Martin

1 From Sutter, R.D., L. Mansberg, and J.H. Moore. 1983. Endangered, threatened, and rare plant species of North Carolina: a revised list. ASB Bulletin 30:153-163, and updated lists of the Natural Heritage and Plant Conservation Programs.

E = Endangered
T = Threatened
SC = Special Concern
PP = Primary Proposed
SRS = Significantly Rare

E,T,and SC species are protected by state law (the Plant Protection and Conservation Act, 1979); the other two categories indicate rarity and the need for population monitoring, as determined by the Plant Conservation and Natural Heritage Programs.

2 From Federal Register, December 15, 1980, Part IV; Federal Register, July 27, 1983; Federal Register, November 28, 1983, Part II. Department of Interior. Established by the Endangered Species Act of 1973, as amended.

E = Taxa currently listed as Endangered
T = Taxa currently listed as Threatened
PE = Taxa currently proposed for listing as Endangered
PT = Taxa currently proposed for listing as Threatened

Taxa under review for possible listing ("candidate species"):

C1 = Taxa with sufficient information to support listing
C2 = Taxa without sufficient information to support listing

3 From the Nature Conservancy, 1985. Global element rank: world-wide status. Unpublished listing.

G1 = Critically imperiled globally because of extreme rarity or otherwise very vulnerable to exinction throughout its range.
G2 = Imperiled globally because of rarity or otherwise vulnerable to extinction throughout its range.
G3 = Either very rare and local throughout its range, or found locally in a restricted area.
G4 = Apparently secure globally, though it may be quite rare in parts of its range (especially at the periphery).
G5 = Demonstrably secure globally, though it may be quite rare in parts of its range (especially at the periphery).
GU = Possibly in peril but status uncertain; need more information.
GX = Believed to be extinct throughout range.
Q = a suffix attached to the Global Rank indicating questionable taxonomic status.
T_ = an additional status for the subspecies or variety; the G rank then refers only to the species as a whole.

4 Taken from Cooper, J.E., S.S. Robinson, and J.B. Funderburg (Eds.). 1977. Endangered and Threatened Plants and Animals of North Carolina. N.C. Museum of Natural History, Raleigh, NC. 444 pages + i-xvi, and updated lists of the Natural Heritage Program.

E = Endangered
T = Threatened
SC = Special Concern
UD = Undetermined

5 From the Nature Conservancy, 1985. Definitions of state ranks are the same as for those of the global ranks, except insert the word "in state" for "globally". One additional state rank used in this report is "SH".

SH = Of historical occurrence in the state, perhaps having not been verified in the past 20 years, and suspected to be still extant.

1970's or early 1980's in the western portion of the region and might still be present.

All of the remaining rare species of vertebrates are relatively widespread in North America, judging by The Nature Conservancy's global ranks of G4 or G5 (see Table 4). Habitats for these remaining 8 species are highly varied: several occur in farmlands or other types of fields, several are found in swamps and bottomlands, one or two are found in upland woods, and one is found in marshes. Of these species, perhaps the most significant is the black bear (Ursus americanus), a game mammal that is declining because of habitat loss -- clearing and fragmentation of extensive pocosins and swamp forests.

The rare invertebrates are poorly known in terms of range and population size. Most of the rare butterflies are marsh-dwellers, whereas the rare mollusks tend to be restricted to the Chowan River. One rare butterfly, the Hessel's hairstreak (Mitoura hesseli), was formerly a C2 candidate for Federal listing, but many new populations have been found in its overall range. This species frequents Atlantic white cedar (Chamaecyparis thyoides) habitats, and the larvae feed only on this plant.

H. 2. Significant Wildlife Habitats

Wildlife habitats consist of more categories than simply natural communities. Habitats also include edges of two communities and various seral stages within a single community, such as croplands, weedy fields, and pine thickets. The younger stages of communities, such as fields and shrub thickets, often are valuable to wildlife. Weedy fields are home to many birds and mammals, such as sparrows and mice. As a field ages, saplings and shrubs invade the site, and these thickets are home to different species, including game species such as bobwhite (Colinus virginianus) and eastern cottontail (Sylvilagus floridanus). Abandoned fields with saplings and shrubs are favored by many breeding bird species, such as prairie warbler (Dendroica discolor) and yellow-breasted chat (Icteria virens). One old-field habitat of significance is clearcut pocosins. Such clearcuts, especially those 2 to about 8 years old, generally feature a dense ground cover of grasses, forbs, and saplings, as do clearcuts in upland sites, but these wetland clearings may feature rare species such as Henslow's sparrow (Ammodramus henslowii) and Dismal Swamp southeastern shrew.

Clearcuts and abandoned fields eventually (after perhaps 20 years) become pine forests, dominated mainly by loblolly pine (Pinus taeda). The younger pine forests tend to be poor wildlife habitat, but the more mature forests generally have a moderate to dense shrub or understory layer of hardwoods, and they provide habitat for a wide range of species, such as white-tailed deer (Odocoileus virginianus) and pine warbler (Dendroica pinus). Some of the more open stands of pines are home to the red-cockaded woodpecker, but such stands are rare and generally require frequent fires to maintain an open understory. Most of the pine forests (and all pine forests in uplands) eventually succeed to hardwood forests, which do not necessarily provide better habitat for animal species. However, those hardwood forests dominated by mature oaks and hickories are significant in that the trees provide mast for game species such as gray squirrels (Sciurus carolinensis) and wild turkeys (Meleagris gallopavo). The hardwood forests that are the most significant to wildlife

are those in bottomlands, especially along the Roanoke River. Some of the mature hardwoods on the alluvial flats and low ridges along the Roanoke provide excellent habitat for game species as well as for dozens of breeding birds, especially woodpeckers and warblers. Also, nonriverine hardwoods, now rather rare in the A/P Study area, provide exceptional habitat for wildlife, especially breeding birds.

Much of the mature vegetation in the region is swamp forest. Swamps of bald cypress (Taxodium distichum) and gum (tupelo) (Nyssa spp.) are generally less important to wildlife than are oak/hickory dominated forests, at least in terms of bird and mammal species present. However, swamps are home to a wide array of amphibians and reptiles, such as frogs and aquatic snakes. Waterfowl winter in large numbers in some of these swamps. And swamps also feature colonies of inland heronries, which are limited to just a few dozen sites in North Carolina. Several colonies of great blue herons (Ardea herodias) and great egrets (Casmerodius albus) are present in swamps along the Roanoke and Chowan rivers. Swamps are valuable refugia for bears and other large vertebrate species.

Pocosins and bay forests are usually rather depauperate in vertebrate species, especially the pocosins. Such habitats are difficult to sample for wildlife because most are nearly impenetrable, except where crossed by roads, canals, or utility corridors. Pocosins and bays provide crucial habitat for black bears and bobcats (Felis rufus), as do some swamp forests. Notable birds such as worm-eating warblers (Helmitheros vermivorus) are present in the dense broadleaf shrubs of these habitats.

Atlantic white cedar forests are now rather rare in the A/P Study region, and their value to wildlife is only mediocre. Breeding bird populations are fairly impressive in mature stands, especially where other tree species are present to add diversity. Associated with the cedar forests are the canebrakes, now nearly eliminated from the A/P study area by fire exclusion. The wildlife value of canebrakes is likely very poor; however, the uncommon Swainson's warbler (Limnothlypis swainsonii) is an inhabitant of wooded canebrakes.

Estuarine/tidal habitats are primarily swamp forests and marshes. The swamps near Albemarle Sound, including along the major tributaries such as the Chowan River, feature somewhat similar wildlife to those inland, but in general, they seem to be less valuable to wildlife. The tidal action, especially from strong winds, may make such swamps less favorable for amphibians and aquatic reptiles, for example, than are the inland ones, where the pools and shallow water provide safe habitat for laying of eggs by frogs and toads. The most significant estuarine habitats are the marshes. The marshes and associated shallow water along the edges of them provide foraging habitat for thousands of waterfowl each winter. Rails and other marsh birds breed in this habitat, and a number of rare butterflies are associated with the fresh to slightly brackish marshes in the region.

Aquatic habitats include natural lakes and ponds, rivers, and sounds. This survey is not focusing on such habitats, but a few comments about wildlife seem appropriate. Natural lakes and ponds are very rare in the A/P Study area and are limited mainly to Pungo and Phelps lakes. These lakes provide resting habitat for thousands of waterfowl during the colder months. Most of these birds forage in adjacent fields and marshes. The lakes are home to many species of fishes, and the Waccamaw killifish is found only at Lake

Phelps and Lake Waccamaw. There are several rare invertebrate species found in the Chowan River (see Table 4), and many of the rivers in the A/P Study area are spawning grounds for anadromous fishes such as blueback herring (Alosa aestivalis), alewife (A. pseudoharengus), and striped bass (Morone saxatilis).

I. WETLAND ECOSYSTEMS

A considerable proportion of the A/P Study area consists of wetlands. Cowardin et al. (1979) devised a classification system for wetlands that is used by the U.S. Fish and Wildlife Service in mapping wetlands (National Wetlands Inventory). Cowardin et al. (1979, p. 3) state that:

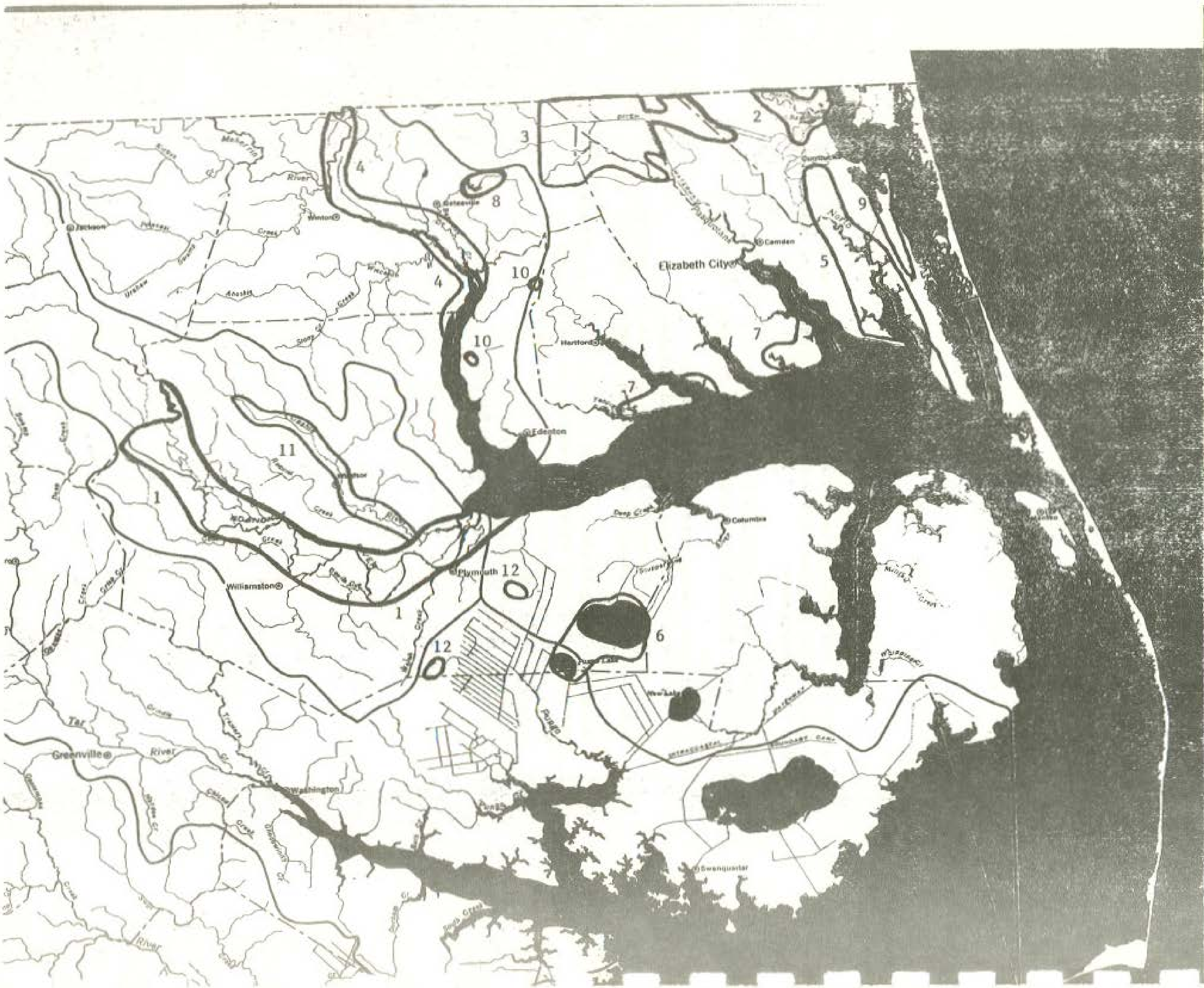
> "Wetlands are lands transitional between terrestrial and aquatic systems where the water table is usually at or near the surface or the land is covered by shallow water. For purposes of this classification wetlands must have one or more of the following three attributes: (1) at least periodically, the land supports predominantly hydrophytes; (2) the substrate is predominantly undrained hydric soil; and (3) the substrate is nonsoil and is saturated with water or covered by shallow water at some time during the growing season of each year."

The N.C. Natural Heritage Program has divided its classification of natural communities into four groupings: Terrestrial, Palustrine, Estuarine, and Aquatic. The Palustrine and Estuarine communities are wetlands. Wetland ecosystems include not only the plants and animals but also non-living components such as soil and water. A number of major wetland ecosystems, or perhaps better called "wetland complexes", are present in the A/P Study area. These complexes are generally larger in areal extent than are the individually described natural areas in this report. For the most part, this inventory considers all natural areas along a river system, for example, as belonging to a single wetland complex. This section describes some of the most significant wetland complexes in the region (see Figure 5). These complexes are, in roughly descending order of significance:

1. Roanoke River floodplain forests -- This river and floodplain are among the most biologically significant sites in the Coastal Plain of the South Atlantic states. The extensive bottomlands and swamps in the floodplain are, for the most part, mature and high in plant and animal species diversity. The Coastal Plain portion of the floodplain contains no reservoirs or other structures that interrupt the flow of water in the river. Some of the nation's best examples of bottomland forests are present on the low ridges in the floodplain. The river is a brownwater stream; rich mineral soils are often present, and the natural levees are very lush in plant species. The lower portion of the river has considerable blackwater input, both from tributary blackwater rivers and from wind tides from Albemarle Sound.
2. Northwest River/North Landing River marshes, forests, and pocosins [includes the portions in Virginia] -- These two rivers lie at the upper end of Currituck Sound, and their waters are essentially fresh.

Figure 5. Significant wetland complexes in the 10-county Albemarle-Pamlico Estuarine Study region. The wetlands are numbered in descending order of significance.

1. Roanoke River floodplain forests
2. Northwest River/North Landing River marshes, forests, and pocosins
3. Great Dismal Swamp forests and pocosins
4. Chowan River floodplain forests and marshes
5. North River/Great Swamp floodplain forests and marshes
6. Lake Phelps and Pungo Lake shoreline forests, marshes, and pocosins
7. Perquimans/Pasquotank hardwood forests on terrace flats
8. Merchants Millpond aquatic communities and forests
9. Maple Swamp and Church Island forests and marshes
10. Chowan County Carolina bays
11. Cashie River floodplain forests
12. East Dismal Swamp and Van Swamp forests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Jackson
Winton
Gatesville
Elizabeth City
Camden
Hertford
Edenton
Columbia
Plymouth
Williamston
Greenville
Washington
Swanquarter
Meherrin
River
Tar
Deep Creek
Pungo
Pasquotank

Extensive marshes almost a mile in width line these rivers. Because the marshes have been frequently burned by local citizens, they are extremely diverse in plant species and provide good habitat for wintering waterfowl. These marshes, in conjunction with the even more expansive marshes (known as Great Marsh) on the eastern side of North Landing River, are among the premier oligohaline marshes along the Atlantic Coast. Also associated with these rivers, especially with Northwest River, are rather unusual pocosins and remnants of white cedar forests. Hardwood forests on flats are also present along the North Carolina -- Virginia line.

3. Great Dismal Swamp forests and pocosins [includes the portion in Virginia] -- This swamp lies in a very large basin just east of the Suffolk Scarp. , It is one of the premier examples of a nonriverine swamp forest in the country, along with Okefenokee Swamp in Georgia and Florida. Though logging has occurred a number of decades ago, the forests are still extensive, covering tens of thousands of acres in Virginia and North Carolina. In addition to the swamps of maples, tupelos, and cypresses, there are stands of white cedar and pocosins. Lake Drummond in Virginia is one of the larger natural lakes in the Southern Atlantic Coastal Plain (outside of Florida).

4. Chowan River floodplain forests and marshes -- This river is drowned at its lower end, and the tidal influence, at least of wind tides, is evident as far upstream as Winton. Extensive swamp forests occur in the river's floodplain, especially in southern Gates County. Several of the tributary streams in southern Gates, western Chowan, and eastern Hertford counties also have tidal freshwater marshes alongside their channels. These marshes are noticeably different in floral character from the slightly brackish marshes in Currituck and Camden counties, with many species found only in these strictly freshwater marshes.

5. North River/Great Swamp floodplain forests and marshes -- This river flows into Albemarle Sound and separates Camden and Currituck counties. Most of the river has been drowned by rising sea level so that it is primarily estuarine in nature. Almost the entire length of the river exists in natural vegetation, with extensive fresh to brackish marshes and swamp forests. The river originates in the Great Swamp, which contains an extensive mosaic of wet oak flats and swampy sloughs. The river is certainly one of the most pristine settings in the state, and the marshes are among the most diverse in plant species.

6. Lake Phelps and Pungo Lake shoreline forests, marshes, and pocosins -- Lake Phelps is the second largest natural lake in the state, with only Mattamuskeet being larger. The waters are home to a rare, endemic fish and to a variety of other wildlife species. Much of the northern shoreline features a mature swamp forest, with several state champion trees. A highly significant marshy fringe, containing several rare plants, is present along parts of the southern shoreline. Behind the marshy fringe is extensive pocosin habitat. Pungo Lake is much smaller than Phelps, but it is also a natural lake with swamp forests and pocosins along its margins.

7. Perquimans/Pasquotank hardwood forests on terrace flats -- This complex is not a continuous band of vegetation, but instead consists of a handful of large but isolated areas featuring mature hardwood forests on wetland and upland flats. Such hardwood flats typically feature a variety of bottomland species of oaks, among many other hardwood species. These natural areas contain remnants of formerly common natural communities (i.e,

Nonriverine Wet Hardwood Forest and Mesic Mixed Hardwood Forest, Upland Flats subtype). Extremely few examples of hardwood flats are protected in the state.

8. Merchants Millpond aquatic communities and forests -- This is one of the premier millpond wetland complexes in North Carolina. A number of rare aquatic and wetland plant species are present; the pond has a remarkably diverse flora. The extensive and mature swamp forest at the head of the millpond along Bennetts Creek is also of statewide significance.

9. Maple Swamp and Church Island forests and marshes -- Maple Swamp extends northward and is continuous with marshes on Church Island in Currituck County. The swamp contains the finest known loblolly bay (Gordonia lasianthus) forest in the state, including the state champion tree, and is the northern extent of the range for this species. Good examples of other types of swamp forests are also present, such as Nonriverine Swamp Forest. The marshes on Church Island are quite diverse and contain several rare plant species. Exemplary estuarine fringe pine forests border the marshes.

10. Chowan County Carolina bays -- Though Carolina bays are common in the southern half of North Carolina's Coastal Plain, these unusual geomorphic features are rare north of Albemarle Sound. Most of those in the A/P Study area have already been destroyed by drainage and conversion to agriculture or silviculture. Several bays, however, still contain natural vegetation in the form of nonriverine swamp forest or bay forest communities. These bays are moderate-sized (less than 500 acres each), are isolated from each other, and arguably do not form a "wetland ecosystem" when taken collectively. However, they are significant wetlands because of their great rarity in the study area.

11. Cashie River floodplain forests -- The Cashie River is a moderate length blackwater river entirely within Bertie County. Though there are one to several old millponds along the length of the river, the floodplain is primarily vegetated in cypress and tupelo swamp forests. A few examples of bottomland forests along a blackwater stream are present.

12. East Dismal Swamp and Van Swamp forests -- Nearly all of the nonriverine forests in the A/P Study area south of Albemarle Sound have been destroyed by timber harvest and conversion to pine plantations or to agriculture. Small remnants of nonriverine swamp forest, bay forest, and pocosin communities remain in East Dismal Swamp in central Washington County and in Van Swamp in the southwestern portion of that county. These forests support very high breeding bird diversity and contain a mix of swamp forest, bottomland forest, and pocosin vegetation.

DISCUSSION

A. THREATS TO NATURAL RESOURCES

As with all parts of North Carolina, a severe strain is being placed on the natural resources of the 10-county A/P Study area. Nearly all of the threats are human-induced. The A/P Study area is relatively sparsely populated, and destruction of natural resources for commercial and residential development is not as great as elsewhere, especially as compared to the immediate coastline. The towns in the area are growing slowly, and some counties appear to be losing population. Two areas of population growth, however, are of great concern. First, the central portion of the Currituck County mainland alongside US 158 and NC 168 is rapidly being developed for the tourist trade. There is a very heavy flow of traffic from the Norfolk, Virginia, area (and elsewhere in Virginia, Maryland, and the District of Columbia) to the N.C. Outer Banks, and motels and others businesses catering to this influx of tourists are greatly increasing. Second, large acreages of land are being developed as retirement or resort communities along the shores of Albemarle Sound, Chowan River, and other large bodies of water. These developments cater to recreational interests, especially boating. Often, 300 or more acres of land per subdivision are developed, and it is now difficult to find upland forests in undisturbed, natural condition that overlook these bodies of water. In all likelihood, the few remaining shoreline stands will almost all be destroyed within the next decade.

The increasing use of highways in the A/P Study area is another concern. In many cases, such usage does not involve travel to or from locales within the area, but rather passage of vehicles in transit to and from towns outside the area. The increasing volume of traffic along US 64 in Martin County has caused the N.C. Department of Transportation to widen this highway and to locate portions of the highway on new alignment. Some of this alignment passes through extensive forests. The same will likely happen along other major highways, such as US 13, US 17, and US 158, where heavy traffic flow is expected to lead to the construction of new bypasses.

The biggest threats to the natural features of the region, however, are not from construction but from timber harvest and agriculture. Table 5 presents the estimated degree of threats to the individual natural communities in the 10-county region, based on the authors' field observations. Timber harvest falls into two main types. The most destructive to the natural features are the large-scale silvicultural operations, generally by major timber companies. These operations often occur in wetlands. Ditches are constructed to drain a site, after which equipment is brought in to harvest the timber. Some companies do not prepare sites for future timber growth, whereas others burn or bulldoze the sites and plant seedlings, usually pines, for future harvest. The second type of timber harvest is the simple cutting, often by a private landowner, of the timber from his property for income. Usually, the tract is left alone and natural revegetation occurs. The site may well return to its original species composition and condition, though this process may require 50 or more years. However, lands that have been ditched and timbered, whether planted in pines or left fallow, seldom return to their natural state.

Table 5. Threats (in unprotected areas) to remaining natural communities in the 10-county Albemarle-Pamlico Estuarine Study region.

Community	Degree of Threat	Major Threats
TERRESTRIAL COMMUNITIES		
Dry-Mesic Oak-Hickory Forest	Very high	timber harvest, development, agriculture
Dry Oak-Hickory Forest	High	timber harvest, development
Oak-Hickory Sandhill	High	timber harvest
Pine/Scrub Oak Sandhill	High	timber harvest, fire suppression
Xeric Sandhill Scrub	Moderate	timber harvest, fire suppression
Coastal Fringe Evergreen Forest	Very high	development
Mesic Mixed Hardwood Forest, Upland Flats subtype	Very high	timber harvest, development, agriculture
Mesic Mixed Hardwood Forest, Bluff/Slope subtype	Moderate	timber harvest
Mesic Mixed Hardwood Forest, Swamp Island subtype	Moderate	timber harvest
Piedmont/Coastal Plain Heath Bluff	Low	timber harvest

Table 5. (continued)

Community	Degree of Threat	Major Threats
PALUSTRINE COMMUNITIES		
Coastal Plain Levee Forest, Brownwater subtype	Moderate to High	timber harvest
Coastal Plain Bottomland Forest, Brownwater subtype	Moderate to High	timber harvest
Cypress-Gum Swamp, Brownwater subtype	Moderate	timber harvest
Coastal Plain Levee Forest, Blackwater subtype	Moderate	timber harvest
Coastal Plain Bottomland Forest, Blackwater subtype	Moderate	timber harvest
Cypress-Gum Swamp, Blackwater subtype	Low to Moderate	timber harvest
Coastal Plain Small Stream Swamp, Blackwater subtype	Moderate	timber harvest
Oxbow Lake	Low	timber harvest
Nonriverine Wet Hardwood Forest	Very high	timber harvest and conversion to pine plantations, agriculture, development
Nonriverine Swamp Forest	Very high	timber harvest and conversion to pine plantations
Low Pocosin	High	draining and clearing for pine plantations, agriculture, peat mining
High Pocosin	High	draining and clearing for pine plantations, agriculture, peat mining

Table 5. (continued)

Community	Degree of Threat	Major Threats
Pond Pine Woodland	High	draining and clearing for pine plantations, agriculture, peat mining
Bay Forest	High	draining and clearing for pine plantations, agriculture
Atlantic White Cedar Forest	Very high	timber harvest
Small Depression Pond	High	timber harvest, draining for agriculture
Coastal Plain Semipermanent Impoundment	Low to Moderate	sedimentation filling in impoundment, eutrophication
Natural Lake Shoreline	Moderate	development
Oligohaline Marsh	Low to Moderate	ditching for boat canals or mosquito control, filling for development, diking for impoundments
Tidal Freshwater Marsh	Low to Moderate	succession to shrub thicket and swamp forest (along drier margins) in the absence of fire
Tidal Cypress-Gum Swamp	Moderate	timber harvest
Estuarine Fringe Loblolly Pine Forest	Low	clearing for development
Low Elevation Seep	Moderate	timber harvest
Pine Flatwoods and Pine Savanna	Very high	timber harvest and conversion to pine plantations, fire suppression

Hundreds of thousands of acres of former wetlands, especially nonriverine wetlands, have been cleared and converted to pine plantations. This is especially true in Bertie, Martin, and Washington counties, and the portion of the Great Dismal Swamp south of US 158. Clearing of land for pine plantations is still occurring, but such conversion of land is likely not as rapid now as it was 10 to 30 years ago, as most of the nonriverine lands have now already been cleared and converted to plantations. Nonetheless, each year thousands of acres are timbered in each county. The authors have noted that approximately 50% of the sites they identified for potential survey work, based on aerial photos taken in the early 1980's, are no longer intact; they have been clearcut or thinned during the past 6 or 7 years and are no longer significant.

Agriculture has long ago removed millions of acres of former natural vegetation. Clearing of forests for farmland is not widespread at present, but several large "superfarms" have, within the past 20 years, cleared hundreds of thousands of acres of pocosin land. The southeastern quarter of Washington County was almost completely cleared for agricultural purposes. Clearing of land for peat mining is also a concern, particularly in this county and in counties farther east on the "Pamlimarle" Peninsula. Runoff from croplands and other cleared lands is another concern, especially to the well-being of the rivers and sounds. Runoff of fertilizers, pesticides, animal wastes, and various chemicals from such lands lead to algal blooms, fish kills, and other environmental crises in the state's waterways.

Exclusion of fire, in both marshes and in certain forested areas, can be considered a type of threat. Some of the pine forests, pocosins, and marshes need occasional or frequent fires to maintain their integrity; lack of fire leads, in these cases, to a conversion of the natural community into a "fire-suppression" community that is not completely natural. Infrequent fire in longleaf pine (Pinus palustris) habitats leads to a more mesic community of loblolly pines (P. taeda), oaks, and hickories. Infrequent fire in marshes, especially oligohaline ones, leads eventually to a dominance of the marsh by only one to several species of grasses, sedges, or rushes. Some freshwater marshes succeed to swamp forests of red maple (Acer rubrum), bald cypress (Taxodium distichum), loblolly pine, or swamp tupelo (Nyssa biflora) in the long absence of fire

Marshes face numerous threats, in addition to those relating to fire exclusion. Ditching of marshes is another threat. Ditches are cut through marshes for mosquito control, for canals for boat passage, and for other reasons. Marshes are occasionally filled in for construction, whereas some are diked for waterfowl impoundments. Fortunately, the threats to the marshes in the A/P Study area do not appear to be severe at the present time.

B. SIGNIFICANCE OF THE NATURAL AREAS

The 10-county A/P Study area contains a number of significant natural areas. The following factors are used in the rating of the significance of natural areas, but the factors and ratings are qualitative and necessarily subjective; no quantitative rating scale is used.

1. Rarity of a natural community, species, or geomorphic feature --
   National: one of the 5 or 6 best examples or largest populations in the nation
   State: one of the best examples or largest populations in the state (North Carolina)
   Regional: one of the best examples or largest populations in the region (northeastern North Carolina)

2. Maturity of the natural area and natural communities --
   National: usually mature or old-growth communities
   State: may be mature or old-growth
   Regional: perhaps middle-aged (seral), but may be mature or old-growth

3. Size (areal extent) of the natural area --
   National: may be extensive, often 1,000 acres or more
   State: variable, but may be extensive
   Regional: variable

4. Disturbances to the natural area --
   National: usually little evidence of disturbances, such as recent logging, ditching, or presence of exotic species
   State: may show some evidence of disturbances
   Regional: variable, but often show some evidence of disturbances

Only several sites would get unanimous support for being of National significance. There is some hesitation to rate a given site of National significance, because it is necessary to know if the features of the natural area are among the best 5 or 6 of their kind in the nation. Thus, there is the need to know the rarity of natural communities, or population sizes of rare species, for example, in neighboring states. Therefore, the significance of some sites may be underestimated. In addition, the significance of sites may increase as other, better examples are destroyed or degraded.

A feature that has a great bearing on the significance of a site is its size. Small sites (under 100 acres) have less likelihood of being significant at the national level than larger ones, because the more extensive the natural communities are, the more significant they become. One problem that manifests itself in this inventory is that individual "small" sites might be hereby considered to be of Statewide or Regional significance, yet when taken collectively with adjacent sites, the collection of sites might be of National significance.

Generally speaking, large sites that were poorly surveyed, perhaps because of difficulty of access by land, were left as one large natural area. Large tracts that were reasonably well surveyed were often divided into individual sites to better describe the vegetation and other features. Such is the case for many of the tracts in the Roanoke River floodplain, especially those in western Martin and western Bertie counties, since the land there is dry enough for rather easy foot access. Taken collectively, the natural areas west of Williamston, in the floodplain, would be of National significance.

The only sites described individually in this report that the authors consider of National significance (whereby the site contains one of the best 5

or so examples of a natural community, or one of the 5 or so largest populations of a rare or endangered species) are Great Dismal Swamp National Wildlife Refuge, Northwest River Marsh Game Land, and Devil's Gut Natural Area. Each of these sites is part of a "wetland complex" of National significance, as well -- the Great Dismal Swamp, the Northwest River/North Landing River complex (at the head of Currituck Sound), and the Roanoke River floodplain, respectively.

There are several additional clusters of natural areas that should be considered of National significance, even if no single site in the cluster rates National significance. These clusters include the Lake Phelps/ Pettigrew State Park/Pungo Lake area; the upper Chowan River floodplain to include Chowan Swamp, Chowan Sand Banks, and possibly Merchants Millpond State Park; and the North River marshes and forests, to include the Mamie and Harbinger marshes.

C. SELECTION OF THE NATURAL AREAS FOR THE INVENTORY

The selection of which sites are to be presented in a natural areas inventory report is always a difficult decision. Certainly, sites considered to be of National or Statewide significance were included. The biggest difficulty concerns the abundance versus rarity of natural communities, and the condition of these communities. For example, there is a general abundance of riverine and estuarine swamp forest communities in the A/P Study area, and many of these forests are in mature condition. The more common the community, even if sites are pristine, the less significant each site becomes, on a National or Statewide scale. On the other hand, certain upland forest types, such as those containing longleaf pine vegetation, are rather rare, and few of those sites are mature, high-quality forests. Thus, a mediocre quality longleaf pine site, of a rather small acreage, might be included in the inventory over a much larger swamp forest that is nearly pristine.

The areal extent of the various natural communities is also important. Some swamp forests and pocosins may occur over several thousand acres, of a single natural community type. Other communities are quite limited in extent, such as a small depression pond or a heath bluff. Swamps or pocosins of very small acreage (i.e., less than 100 acres) are not likely to make an inventory list, whereas a 5- or 10-acre bluff or depression pond would be sufficient in size to be included, assuming that the site has a moderate to high integrity.

The researchers did not make a conscious attempt to include in the inventory representatives of all of the natural communities present in the A/P Study area. A few natural communities known or presumed to be present are not represented in this inventory, such as Oxbow Lake and perhaps Coastal Plain Levee Forest, Blackwater subtype. Nor did the researchers make an attempt to survey for the best quality sites of rare and endangered species. In fact, the researchers attempted to survey sites based on the extent and condition of the natural communities, looking for coherent, defensible natural areas as well as rare communities. There was little effort made to survey for previously-known locations of rare species. In the majority of these instances, the existing location records of such plants and animals were rather vague, making the finding of a previously reported site a difficult task.

D. AREAS FOR FURTHER SURVEY WORK

As with most types of inventory and survey work, there is never enough time and money available to do a complete and thorough survey. A thorough survey of the 10-county A/P Study area would likely require many thousands of hours. In fact, most previous county-wide inventories of natural areas have focused on just one county per year. Obviously, many portions of the 10-county region need better coverage.

The coverage of the shorelines and marshes of Currituck County was adequate, but little time was spent surveying the interior of the county. The same can be said for Camden, Chowan, Pasquotank, and Perquimans counties, in that some coverage along the shores at the southern end of the counties was made, but relatively little field work by foot was made of inland sites. Relatively little time was spent in Gates County, because Frost (1982) had conducted a moderate-intensity county-wide survey in the early part of the decade. Nonetheless, Gates County was considerably under-surveyed in 1989, especially portions of the Chowan Sand Banks in the northwestern corner of the county. Hertford County contains many bluffs and slopes along the Meherrin River and the Wiccacon River; only a handful of these slopes were surveyed, because of time constraints.

Bertie County is a very large county, and partly for that reason alone was under-surveyed. It is felt that much of the Roanoke River floodplain, especially the portions seen from the river, has been surveyed moderately well. However, there are many floodplain ridges and sloughs in the upper reaches of the floodplain (away from the river) that have not been surveyed to any extent, and many of these are presumed to contain significant natural areas. Martin County contains numerous natural areas along the Roanoke River, as does Bertie County. In both counties a moderate amount of time was spent surveying the uplands and nonriverine wetlands, but few natural areas could be located because of extensive damage and destruction to natural communities in those habitats. Washington County, like Gates County, was surveyed for a natural areas inventory earlier in the decade (Lynch and Peacock 1982). The sparse field work in 1989 in the county consisted primarily of reviewing the sites inventoried in 1982. However, it is believed that relatively few significant sites remain undiscovered in this county.

Most of the survey work was botanically oriented. Little work was conducted on animal populations, and the relatively few animals observed were noted in passing during the survey of the vegetation on the sites. Certainly, aquatic surveys in the streams, lakes, and sounds could be done at a later date by other researchers. Surveys for small mammals, amphibians, and reptiles of terrestrial and wetland habitats is also needed. Field work on bird populations is also needed, especially the fauna in the marshes, which is very poorly known. There was no intent in this inventory to describe critical "wildlife habitats" or "wildlife corridors". Such habitats and corridors generally are based on areal extent of forested areas, often without concern whether the forests are mature or cut-over. In some cases, the best wildlife habitats are actually overgrown fields and brushy areas with an abundance of cover, such as hedgerows and brushpiles. The intent of this inventory was to include only those areas of high quality, reasonably mature forests or reasonably intact marshes, rare or uncommon natural communities, or sites of endangered or rare species.

E. RECOMMENDATIONS FOR PROTECTION

E. 1. Agencies and Organizations Involved in Protection

There are no local land conservancy groups in the 10-county A/P Study area, which could purchase or otherwise protect significant natural areas. The major land conservancy group in the state is the N.C. Nature Conservancy, a statewide chapter of The Nature Conservancy, which protects land throughout North and South America. The Nature Conservancy has been involved in the protection of a number of natural areas in the A/P Study area, especially sites along the Roanoke River. This group will undoubtedly play a key role in the protection of other sites in the region in upcoming years.

Several State government agencies are also involved in land protection and will have a role in protection of significant natural areas in the region. The Division of Parks and Recreation has several roles in protection. The N.C. Natural Heritage Program is a State agency located within Parks and Recreation. This program maintains and administers the N.C. Registry of Natural Heritage Areas. These are areas, both in public and in private ownership, that contain significant biological and ecological features which the owners have signed a non-binding agreement to protect. There are approximately 260 such registered areas in the state, including 10 sites in the A/P Study area. In addition, this program administers the Dedicated State Nature Preserve system, whereby non-Federally owned land is protected in perpetuity by the granting of a conservation easement to the State of North Carolina by the owner. There are presently 12 Dedicated Nature Preserves in North Carolina, three of which are located in the A/P Study area (Broadneck Ridge, Company Swamp, and Great and Goodman Islands). The Division of Parks and Recreation also maintains and operates State Parks, State Natural Areas, State Recreation Areas, and State Lakes, Rivers, and Trails. Such facilities in the 10-county region are Merchants Millpond State Park, Pettigrew State Park, Dismal Swamp State Park, Chowan Swamp State Natural Area, and Lake Phelps (a State Lake).

The N.C. Wildlife Resources Commission owns considerable land in the region as Game Lands, especially along the Roanoke River and in Currituck County. Commission-owned lands in the 10-county region are: Broadneck Ridge, Company Swamp, Conine Island, and Great and Goodman Islands (all in Bertie County); Speller-Outlaw tract (Martin County); Chowan Game Land (Chowan County); a small portion of Chowan Swamp (Gates County); and North River Game Land and Northwest River Marsh Game Land (both in Currituck County).

The Division of Coastal Management's Coastal Reserve system currently has no sites in the 10-county region (except for Currituck Banks, which is outside the scope of this inventory). However, the authors hope that their system of reserves will eventually include sites on the mainland in the A/P Study area, such as marshes and swamps in Currituck County. The Division of Forest Resources maintains a series of State Forests, though none are located in the region. This is another agency that is involved in land acquisition and management and might have a future role in protection in the area. A few tracts are owned by colleges and universities, or forestry foundations, at the State level.

There are three major Federal agencies that are concerned with land acquisition and protection in the eastern United States. Two of them

-- the National Park Service and the U.S. Forest Service -- do not have landholdings in the A/P Study area. However, future acquisition of land by these agencies should never be dismissed. Though no site in the 10-county area might qualify as a potential National Park, some sites might qualify as a potential National Monument and be suitable for protection by the Park Service. Likewise, none of the 4 National Forests in North Carolina are located in the region, but the future role of the Forest Service should not be eliminated. The U.S. Fish and Wildlife Service has been involved in land protection in the A/P Study area, especially within the past 2 years. The Service has recently established the Roanoke River National Wildlife Refuge, and though no land acquisitions have been made as of late 1989, up to 30,000 acres are expected to be acquired for the refuge. National Wildlife Refuges in the A/P Study that are already established are Great Dismal Swamp refuge and Pungo refuge. In addition, the Conservation Fund plans to donate 93,000 acres to establish a new refuge in the Phelps/Pungo/New Lake area.

E. 2. Protection Priorities

The authors hope that all of the sites described in this inventory will be afforded some measure of protection in future years. They also hope that future field work will reveal other significant natural areas in the 10-county area which will also be provided protection.

Recommendations for protection are determined by several factors. First, the more significant the natural area, the higher should the priority be for protection. Second, the size of a site is important, so that it is better to preserve large tracts of a given natural community than smaller ones. Third, the contiguity of a site with other sites is important. Sites that are isolated from others are likely to be less important in conserving biological diversity in future years than adjacent sites that are protected as a unit (complex). Fourth, protection should focus on natural communities or rare species that are essentially unprotected, or rather poorly protected, in the A/P Study area, or in the state or nation. There is a more pressing need to preserve a community such as a longleaf pine/sandhills natural area, which presently is unprotected in the 10-county region, than there is to protect a cypress-gum swamp, even if both sites are given the same significance rating.

Protection priorities also needs to take into account, to some extent, the degree of threat to a given site. Sites that appear to be, or are known to be, in immediate threat of destruction might well take priority over sites that have apparently little threat to them. However, in most cases, threats are poorly known, or can only be speculated. Thus, the biological significance of the site is the primary factor involved in the priority of protection.

The suggested priority of protection list groups sites that are adjacent to each other as a "complex", in hopes that protection can be achieved for the entire complex rather than the specific site. The suggested priority of protection (in descending order) for these complexes is listed in Table 6; the locations of the complexes are portrayed on Figure 6. The first 5 complexes are considered to be of National significance, the next 2 of National or State significance (borderline significance level), and the remainder of State significance. This list is by no means a complete list of complexes or sites

Table 6. Overview of the most significant natural area "complexes" in the 10-county Albemarle-Pamlico Estuarine Study region. Complexes are listed in descending order of significance. Sites listed in parentheses are marginally included within the complex.

Natural area "complex"	Site numbers	Degree of protection
NATIONAL significance		
1. Roanoke River floodplain	BE12,BE13,BE14,BE15, BE16,BE17,BE18,BE19, BE20,MA1,MA2,MA3,MA4, MA5,MA6,MA7,MA8,WA1	Partial, as of 1989; other sites expected to be protected in new Roanoke River National Wildlife Refuge
2. Northwest River/North Landing River complex	CU2,CU3,CU4,CU5,CU6, CU7,(CU8)	Mostly unprotected; only CU2 has some protection
3. Great Dismal Swamp	CA1,CA2,CA3,GA8,GA9	Western 75% essentially protected; eastern quarter unprotected
4. Chowan River floodplain	BE1,CH1,CH3,(CH6), GA3,GA4,HE4,HE5,HE9	Perhaps 30% protected (mainly GA3)
5. North River/Great Swamp	CA6,CA7,CU11,CU12, CU15,(CU17),(CU18)	Perhaps 10% protected
NATIONAL/STATE significance		
6. Lake Phelps/Pungo Lake	WA6,WA7,WA8,WA9	Nearly comlete protection
7. Perquimans/Pasquotank hardwood flats	CH8,PA1,PA2,PE2,PE3 PE4	No protection

Table 6. (continued)

Natural area "complex"	Site numbers	Degree of protection
STATE significance		
8. Merchants Millpond area	GA7	Most significant parts protected; perhaps 40% unprotected
9. Chowan Sand Banks	GA1	No protection
10. Maple Swamp/Church Island	CU13,CU14	No protection
11. Chinkapin Creek forest	HE10	No official protection
12. Chowan County Carolina bays	CH2,CH5	No protection
13. Cashie River floodplain	BE3,BE10,BE11	No protection
14. East Dismal Swamp/ Van Swamp	WA4,WA5	No protection

Figure 6. The most significant natural area complexes in the 10-county Albemarle-Pamlico Estuarine Study region. The complexes are numbered in descending order of significance.

1. Roanoke River floodplain
2. Northwest River/North Landing River complex
3. Great Dismal Swamp
4. Chowan River floodplain
5. North River/Great Swamp
6. Lake Phelps/Pungo Lake
7. Perquimans/Pasquotank hardwood flats
8. Merchants Millpond area
9. Chowan Sand Banks
10. Maple Swamp/Church Island
11. Chinkapin Creek forest
12. Chowan County Carolina bays
13. Cashie River floodplain
14. East Dismal Swamp/Van Swamp

Meherrin
River
Jackson
Winton
Gatesville
Camden
Elizabeth City
Hertford
Edenton
Columbia
Plymouth
Williamston
Manteo
Greenville
Tar
River
Washington
Swanquarter
New Lake
INTRACOASTAL
BOUNDARY CANAL
1
2
3
4
5
6
7
8
9
10
11
12
13
14

of State significance. The reader should refer to the Inventory of Sites and Table 7 for the listing of significances of each individual natural area.

1. Roanoke River floodplain -- This complex is considered the most significant one in the A/P Study area and is certainly of National significance. The Nature Conservancy has purchased one tract -- Devil's Gut (Site MA8) -- within this complex, and the N.C. Wildlife Resources Commission currently owns over 12,000 acres along the river. The U.S. Fish and Wildlife Service will seek to acquire nearly 33,000 acres for the Roanoke River National Wildlife Refuge, some of which will be traded to the Commission for land presently in State ownership. This refuge is expected to consist of 21,745 acres in Bertie County, 1939 acres in Halifax County, and 9253 acres in Martin County. The Commission is expected to own approximately 14,000 acres along the river as a result of land exchanges with the Service (Earley 1989). The refuge, plus the lands owned by the Wildlife Commission and The Nature Conservancy, will bring protection to perhaps 75-80% of the floodplain of the river in the A/P Study area.
2. Northwest River/North Landing River complex -- This complex, consisting mainly of slightly brackish marshes with some swamp forests and other forested habitats, continues into Virginia along both of these rivers. Only 1251 acres in North Carolina appears to be protected -- the Northwest River Marsh Game Land owned by the N.C. Wildlife Resources Commission. This is only 10-15% of the significant natural areas in the complex.
3. Great Dismal Swamp -- This complex also includes that portion in Virginia, which is larger in size than the portion in North Carolina. Coupled with Lake Drummond, the largest natural lake in Virginia, this nonriverine forest complex is certainly one of the most famous nationally of the A/P Study area complexes. Nearly all of the swamp that is still in natural condition is protected in the Great Dismal Swamp National Wildlife Refuge, but there are portions south of US 158 and east of US 17 that are still not protected.
4. Chowan River floodplain -- Also considered to be of National significance, this floodplain features extensive swamp forests and exemplary tidal freshwater marshes, among other communities. Protection of the complex is estimated at approximately 30% of the total area, that being primarily the floodplain in Gates County south of Gatesville. Protection of the floodplain upstream of Gatesville is badly needed, and much of the floodplain adjacent to the Chowan Sand Banks has already been timbered and converted to pine plantations. Several sites have been registered with a timber company, but such protection is not long-term.
5. North River/Great Swamp -- This complex, of National significance, is somewhat similar to the Northwest River/North Landing River complex in that an abundance of slightly brackish marshes are present, but this complex features thousands of acres of swamp forests in relatively intact (though not necessarily mature) condition. At best, 10% of the complex is protected -- North

River Game Land owned by the Wildlife Resources Commission and a tract registered with a private landowner. The Camden County portion is completely unprotected, as are the notable marshes at the southern tip of the Currituck County peninsula (sites CU17 and CU18).

6. Lake Phelps/Pungo Lake -- This complex features two of the larger natural lakes in the state, plus associated forests and pocosins in the area. The U.S. Fish and Wildlife Service administers the Pungo National Wildlife Refuge, and the State Division of Parks and Recreation administers Lake Phelps and Pettigrew State Park. The Conservation Fund purchased most of the formerly private land south of Lake Phelps in late 1989 and is expected to donate that land to the Service for addition to Pungo refuge. Most of this Conservation Fund land in Washington County, however, is former pocosin vegetation now in old field habitats.

7. Perquimans/Pasquotank hardwood flats -- Although hardwood flats are scattered over most of the A/P Study area, the majority of the high-quality examples are located in the southern portions of these two counties. Nonriverine Wet Hardwood Forest and Mesic Mixed Hardwood Forest, Upland Flats subtype communities are essentially unprotected in North Carolina, and long-term protection of all or a portion of this complex is critical.

8. Merchants Millpond area -- This complex, primarily being the millpond and Lassiter Swamp, lies mainly within the boundaries of Merchants Millpond State Park. However, portions of the swamp, as well as crucial uplands adjacent to the pond and swamp, are still in private ownership.

9. Chowan Sand Banks -- If any complex in the A/P study area can be considered "unique" in the region, then the sand banks is that natural area. It is essentially an outlier of the sandhills vegetation practically limited, at the present time, to the southern half of the state's Coastal Plain. Unfortunately, not a single acre of the complex is protected, even by registry or easement. Portions of the complex are clearcut or selectively cut nearly every year, and protection, as well as fire management, is an urgent priority.

10. Maple Swamp/Church Island -- Maple Swamp is essentially forested, whereas Church Island is primarily marshland. However, the two sites are contiguous as a single complex. There is no protection of this complex at the present time.

11. Chinkapin Creek forest -- This is likely the largest extent of oak-hickory forest remaining in the A/P Study area. However, a number of other forested communities are present, including several ridges featuring sandhills vegetation. The majority of the complex is under one private ownership. These owners are unofficially protecting the site and have a manager that oversees the property. However, this complex has no long-term, official protection.

12. Chowan County Carolina bays -- Although there are a handful of Carolina bays in the A/P Study area, few contain relatively intact vegetation and none are protected. Snow Hill Bay (Site CH2) and

Gallberry Swamp (Site CH5) are moderately large bays with mature swamp and bay vegetation. Though the latter bay is (or was) an unallocated State property, no agency has requested re-allocation; thus, protection must be considered lacking. It is critical that this bay be re-allocated to a protection agency, such as the Wildlife Resources Commission or Parks and Recreation; selling of the land to a private owner would be a severe blow to conservation and protection of critical natural resources. Snow Hill Bay is privately owned and has no protection.

13. Cashie River floodplain -- This is one of the longest blackwater streams in the region, and it is not embayed at its lower end. Most of its floodplain contains swamp forests. Though overshadowed by the nearby Roanoke River, this floodplain is of State significance. None of the complex is protected.

14. East Dismal Swamp/Van Swamp -- This complex is a remnant of former extensive nonriverine swamps on two terraces in Washington County. The near total destruction of nonriverine swamps in Washington and neighboring counties for conversion to pine plantations, agriculture, and peat mining is alarming; and perhaps only 5% of the total acreage of such swamps remain. None are protected.

It can be seen from the above listing that the majority of the most significant complexes are wetlands. This is not surprising, as most of the upland habitats have been destroyed or altered. On the other hand, the most pressing protection needs are the preservation of upland and nonriverine forests, since these communities are under the heaviest threats. For example, the extensive freshwater to oligohaline marshes in the region, especially in Currituck Sound, are perhaps more significant (on a National scale) than are upland forests, but they appear to be under less immediate threat than the uplands, plus many good examples of marshes are known. Riverine forests face somewhat more threats than do the marshes, but at least some protection is now being given to selected tracts along the Roanoke River and the Chowan River.

The authors hope that agencies and groups involved in protection of natural resources take an active role. Protection involves more than just acquisition of natural areas. Strict enforcement of regulations in regard to the ditching and filling of wetlands is important in the protection of North Carolina's resources. Protection of the waters of Albemarle and Pamlico sounds includes prevention or reduction of runoff from agricultural fields into streams that eventually reach these sounds. Protection of upland forests is also important in this regard, as clearcut sites are poor at controlling erosion. Protection must first center on the wetlands immediately adjacent to the sounds, such as the tidal marshes and tidal swamps, but the wetland sites farther up the rivers and streams, the nonriverine sites, and the upland sites are also very important to North Carolina's natural heritage.

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INVENTORY OF SITES

The major feature of this report is the description of the natural areas and their significance. Table 7 summarizes the sites and briefly gives their significance. Each natural area is given a Site Name and Site Number. The letters in the site numbers are the first 2 digits of the county name. The various sites within each county are generally arranged from west to east or north to south. Thus, the site numbers are not based on significance, but rather on geography. The geographical size (in acres) of the natural area is given; this is not intended to include "buffer" land around the site for additional protection. For many of the sites, the size is poorly known, as it is very difficult to survey the boundaries of wetlands, especially swamps, by boat or by land.

The site significance is given both a letter code (A, B, or C) and a descriptive term. The 7.5 minute U.S. Geological Survey topographic quad maps for each site are listed. Several key significant features of the site are presented. The majority of the information for the site is the description of the biology and geomorphology, including the type of vegetation or natural communities and noteworthy plants and animals. Ownership information, whether public or private, is given, but names of private owners are not listed. The protection status of the natural area, such as whether it is a State Park or a Wildlife Resources Commission Game Land, is presented. Also given is information about how the site should or could be managed to promote or perpetuate the significant features, plus comments on what means of protection appear to be available. Additional comments about the site are also given, such as degree of threat (if known) or completeness of survey. References are also given for each site, though many such references are simply Site Survey Reports completed by the researchers for this project. The N.C. Natural Heritage Program has copies of all Site Survey Reports.

The inventory also provides a map of each natural area, showing approximate boundaries of the site. The maps are to the 1:24,000 scale (7.5 minute U.S. Geological Survey quad maps) unless otherwise indicated; on these 7.5 minute maps, 1 inch equals 2000 feet. In some cases, maps have been reduced so that the natural area can be portrayed on a single page. This information is indicated on the map legend, though no scale is given. Several maps are to the 1:250,000 scale; on these maps, 1 inch equals approximately 4 miles.

Table 7. List of natural areas, and their significance, in the 10-county Albemarle-Pamlico Estuarine Study region. Sites are listed by county and are arranged in a north to south, or west to east, order within each county. Significance levels: A = National; B = State; C = Regional (northeastern Coastal Plain of North Carolina).

County and Site Name	Site No.	Significance Level	Features
BERTIE			
Colerain/Cow Island Swamp and Slopes	BE1	C	Extensive upland forest on slopes and ravines; adjacent swamp forest
Roquist Pocosin	BE2	B	Large expanse of nonriverine swamp forest
Burdens Millpond	BE3	C	Millpond with swamp forest; bottomland forest
Flat Swamp Creek Woodpecker Site	BE4	C	Site for red-cockaded woodpecker in pine-hardwood "flats"
Salmon Creek Swamp	BE5	C	Extensive swamp forest; mesic forest on slopes
Merry Hill Mesic Flats Hardwood Forest	BE6	C	Good example of mesic hardwood forest on upland flat
Black Walnut Swamp	BE7	C	Extensive, mature swamp forest; upland forests
Upper Cashoke Creek Beech Slopes	BE8	C	Mature, beech-dominated forest on relatively steep slopes
Wading Place Creek Swamp and Uplands	BE9	C	High quality upland hardwood forest; mature swamp forest
Roquist Creek/Cashie River Swamp	BE10	C	Mature swamp forest and floodplain islands
Jennette's Swamp	BE11	C	Mature swamp forest along blackwater river
Clark Estate Bottomland Hardwood Forest	BE12	B	Very wide natural levee/ bottomland forest

Table 7. (continued)

County and Site Name	Site No.	Significance Level	Features
Broadneck Ridge	BE13	B	High quality natural levee, backswamp, and bottomland forests; rare species
Rascoe Millpond	BE14	B	Millpond with high quality forest in pond and in floodplain
Coniott Cherrybark Oak Ridge	BE15	B	High quality bottomland forest on low ridge
Broadneck Swamp	BE16	B	One of the largest and best examples of a backswamp forest in the state
Company Swamp	BE17	B	Extensive backswamp forest; cerulean warbler
Conine Island	BE18	B	Extensive backswamp and natural levee forests; large inland heronry
Broad Creek Neck	BE19	B	Very extensive "wilderness area" of cypress-gum forest
Roanoke River Delta Islands	BE20	B	Extensive cypress-gum swamp and pocosin/swamp forest
Roanoke River/NC 11 Alluvial Flats	MA2	B	High quality alluvial flat and bottomland forest
CAMDEN			
Great Dismal Swamp National Wildlife Refuge	CA1	A	Very extensive forest, with swamps, white cedar stands, pocosins
Dismal Swamp State Park	CA2	B	Significant stands of white cedar and pocosins
The Green Sea	CA3	B	Former white cedar and canebrake complex; remnant pond pine and white cedar forests

Table 7. (continued)

County and Site Name	Site No.	Significance Level	Features
Shipyard Landing Natural Area	CA4	C	Mosaic of swamp forests, hardwood forests on mesic islands; freshwater marshes
Whitehall Shores Hardwood Forest	CA5	C	Mature deciduous forest, with good example of Nonriverine Wet Hardwood Forest
Hunting Creek Pocosin and Marsh	CA6	C	Extensive marsh, swamp, and pocosin complex
Broad Creek Marshes	CA7	B	Diverse freshwater marshes, with rare plants
CHOWAN			
Warwick Creek Oak Flats and Slopes	CH1	C	Upland forests with high oak diversity; black bear
Snow Hill Bay	CH2	B	Carolina bay with pocosin/ swamp vegetation
Holiday Island	CH3	C	Island with swamp forest dominated by bald cypress
Lower Indian Creek Swamp and Ravine	CH4	C	Mature hardwood forest on slopes; freshwater marsh
Gallberry Swamp	CH5	C	Carolina bay with mature swamp/bay forest
Reedy Point Swamp	CH6	C	Extensive pocosin/swamp complex; remnant sand ridge communities
Cherry Point Woods	CH7	C	Mixture of swamp forests and upland forests
Drummond Point Woods	CH8	B	Mesic hardwoods on upland flats and slopes; swamps, marshes, and pools with high plant diversity
Catherine Creek Marsh and Swamp	GA4	B	Very diverse freshwater marsh; tidal swamp; unusual turk's-cap lily

Table 7. (continued)

County and Site Name	Site No.	Significance Level	Features
CURRITUCK			
Northwest Backwoods Natural Area	CU1	B	Extensive nonriverine wet hardwood forest on upland flat
Northwest River Marsh Game Land	CU2	A	Pocosins, white cedar stands, swamps, marshes, and upland oak forest
Nellie Bell Ponds, Marsh, and Cedar Swamp	CU3	B	Extensive marsh with rare plants; white cedar swamp and upland forests
Gibbs Woods	CU4	B	Nonriverine hardwood forest, semi-evergreen oak slough; marshes and white cedar stands
Tull Bay Marshes	CU5	B	Extensive and diverse marshes
Troublesome Point Oak Flats and Marsh	CU6	B	Nonriverine wet hardwood forest; extensive marshes
Gibbs Point Forest and Marshes	CU7	B	Nonriverine wet hardwood forest; swamps and marshes
Lower Tull Creek Woods and Marsh	CU8	B	Mosaic of marshes, swamp forests, oak flats, and unusual "bogs"
Bell Point Marsh	CU9	C	Slightly brackish marsh with plant diversity
Sligo Big Trees Natural Area	CU10	C	Upland flats hardwood/pine forest with large trees
Buckskin Creek/Great Swamp Natural Area	CU11	B	Extensive oak flats and swamp forests; tidal marshes
Indiantown Creek Cypress Forest	CU12	B	Virgin stand of cypress; hardwood flats with high oak diversity
Church Island Marsh	CU13	B	Extensive marsh, with rare plants; waterfowl habitat

Table 7. (continued)

County and Site Name	Site No.	Significance Level	Features
Maple Swamp Gordonia Forest	CU14	B	Mature loblolly bay forest; swamps and marshes
North River/Deep Creek Marshes and Forest	CU15	B	Extensive and diverse marshes; tidal swamp forest
Mamie Upland Forest and Carolina Bay	CU16	C	Sandy, upland forest; adjacent Carolina bay
Mamie Marshes and Ponds	CU17	B	Mosaic of marsh, ponds, and swamp; unusual wet meadow
Harbinger Marshes	CU18	C	Extensive slightly brackish marshes with plant diversity
The Green Sea	CA3	B	Former white cedar and canebrake complex; remnant pond pine and white cedar forests
GATES			
Chowan Sand Banks	GA1	B	Sandhills-type vegetation; ericaceous shrub diversity; red-cockaded woodpecker
Horsepen Pocosin	GA2	C	Disjunct population of pondspice; unusual swampy depression
Chowan Swamp	GA3	B	Very extensive swamp forest; exemplary freshwater marshes; mesic hardwood ridges
Catherine Creek Marsh and Swamp	GA4	B	Very diverse freshwater marsh; tidal swamp; unusual form of turk's-cap lily
Bear Garden	GA5	B	Extensive flats and gentle slopes with a wide range of hardwood and pine-hardwood communities

Table 7. (continued)

County and Site Name	Site No.	Significance Level	Features
Black Mingle Pocosin	GA6	C	Poorly-drained "pocosin" with nonriverine hardwood forests; pine-hardwood flats
Merchants Millpond State Park	GA7	B	Small tract of virgin swamp forest; diverse aquatic flora with rare plants; mesic forests
Corapeake Marsh	GA8	C	Unusual freshwater marsh away from tidal influence
Dismal Swamp Shield Fern Natural Area	GA9	B	Richest assemblage of shield ferns (Dryopteris spp.) in the state
Great Dismal Swamp National Wildlife Refuge	CA1	A	Very extensive forest, with swamps, white cedar stands, pocosins
Warwick Creek Oak Flats and Slopes	CH1	C	Upland forests with high oak diversity; black bear
HERTFORD			
The Pot Holes	HE1	C	Small depressions or sinkholes with swamp forest vegetation
Meherrin River Swamp	HE2	C	Extensive swamp with mature brownwater levee forest
Meherrin River/Banks Creek Natural Area	HE3	C	Mature hardwood forests on slopes and floodplain; rare fern
Union Camp -- Chowan River Natural Areas	HE4	B	Old-growth swamp forest; Big Pine Woods natural area; heronry
Chowan River White Cedar Swamp	HE5	C	Atlantic white cedar stand in swamp forest

Table 7. (continued)

County and Site Name	Site No.	Significance Level	Features
Chowan River Bluffs west of Winton	HE6	C	Hardwood forest on upland flats, slopes, and swamp
Upper Wiccacon River Swamp	HE7	C	Mature swamp forest and floodplain "islands"
Wiccacon River Ridges and Swales	HE8	C	Geomorphic features -- ridges, swales, old oxbows
Wiccacon River Freshwater Marsh	HE9	C	Exemplary tidal freshwater marsh (rare in A/P Study area)
Chinkapin Creek Hardwood Forest	HE10	B	Extensive upland hardwood forest; xeric, "sandhill" ridges
Colerain/Cow Island Swamp and Slopes	BE1	C	Extensive upland forest on slopes and ravines; adjacent swamp forest
MARTIN			
Roanoke River Slopes southeast of Palmyra	MA1	C	Several dozen wooded slopes and ravines adjacent to Roanoke River
Roanoke River/NC 11 Alluvial Flats	MA2	B	High quality alluvial flat and bottomland forest
Fort Branch Bluffs and Rainbow Banks	MA3	C	Steep forested slopes and bluffs; Piedmont disjunct plants
Poplar Point Slopes	MA4	C	Hardwood forest on slopes; Piedmontane plants
Conoho Creek Schisandra Slopes	MA5	B	Rich woods; only state site for magnolia vine (Schisandra)
Conoho Creek Swamp	MA6	B	Extensive backwater swamp; heronry

Table 7. (continued)

County and Site Name	Site No.	Significance Level	Features
Sweetwater Creek Swamp Forest	MA7	C	Backwater stream with swamp forest
Devil's Gut Natural Area	MA8	A	High quality old-growth bottomland and swamp forests
Lilley's Swamp	MA9	C	Cypress-gum swamp; mature mesic forests on floodplain islands
PASQUOTANK			
Little Flatty Creek Forests and Marsh	PA1	B	Exemplary, mature nonriverine hardwood flats; fresh/brackish marsh and tidal swamp
Big Flatty Creek Forests and Marshes	PA2	B	Among the most extensive oak flats in the state; unusual tidal freshwater flats
Great Dismal Swamp National Wildlife Refuge	CA1	A	Very extensive forest, with swamps, white cedar stands, pocosins
PERQUIMANS			
Belvidere Natural Area	PE1	C	Floodplain ridges and swamp forest; high species diversity
Yeopim Creek Oak Slopes	PE2	C	Mature oak forest on rolling slopes; swamp forest
Menzie's Pond	PE3	B	Rare natural pond and unusual "quaking bog" with rare plant species; exemplary oak flats and mesic wooded slopes
Perquimans River Cherrybark Oak Flats	PE4	B	Exemplary, mature hardwood forest on mesic flats and gentle slopes

Table 7. (continued)

County and Site Name	Site No.	Significance Level	Features
WASHINGTON			
Bull Neck Swamp	WA1	C	Extensive swamp forests; fresh to slightly brackish marshes
Conaby Creek/Roanoke River Swamp	WA2	B	Extensive swamp forest with some white cedar and pond pine; bald eagle nest
Conaby Swamp Natural Area	WA3	C	Swamp with both brownwater and blackwater features
Van Swamp	WA4	C	Old-growth stand of swamp tupelo; large trees of bay species
East Dismal Swamp	WA5	B	Remnant nonriverine swamp and bottomland forest; high breeding bird diversity
Pettigrew State Park -- Cypress Natural Area	WA6	B	Oldest cypress stand in state on lakeshore; very large trees of several species
Lake Phelps	WA7	B	Second largest natural lake in state; marshy shoreline with rare plants; Waccamaw killifish
Pettigrew State Park -- South Shore Pocosin	WA8	C	Good example of pocosin vegetation
Pungo National Wildlife Refuge Natural Areas	WA9	C	Large natural lake; swamp and pocosin vegetation; waterfowl refuge

Figure 7. General locations of the significant natural areas in the 10-county Albemarle-Pamlico Estuarine Study region. Site numbers are listed on the individual county maps (Figures 8 through 17).

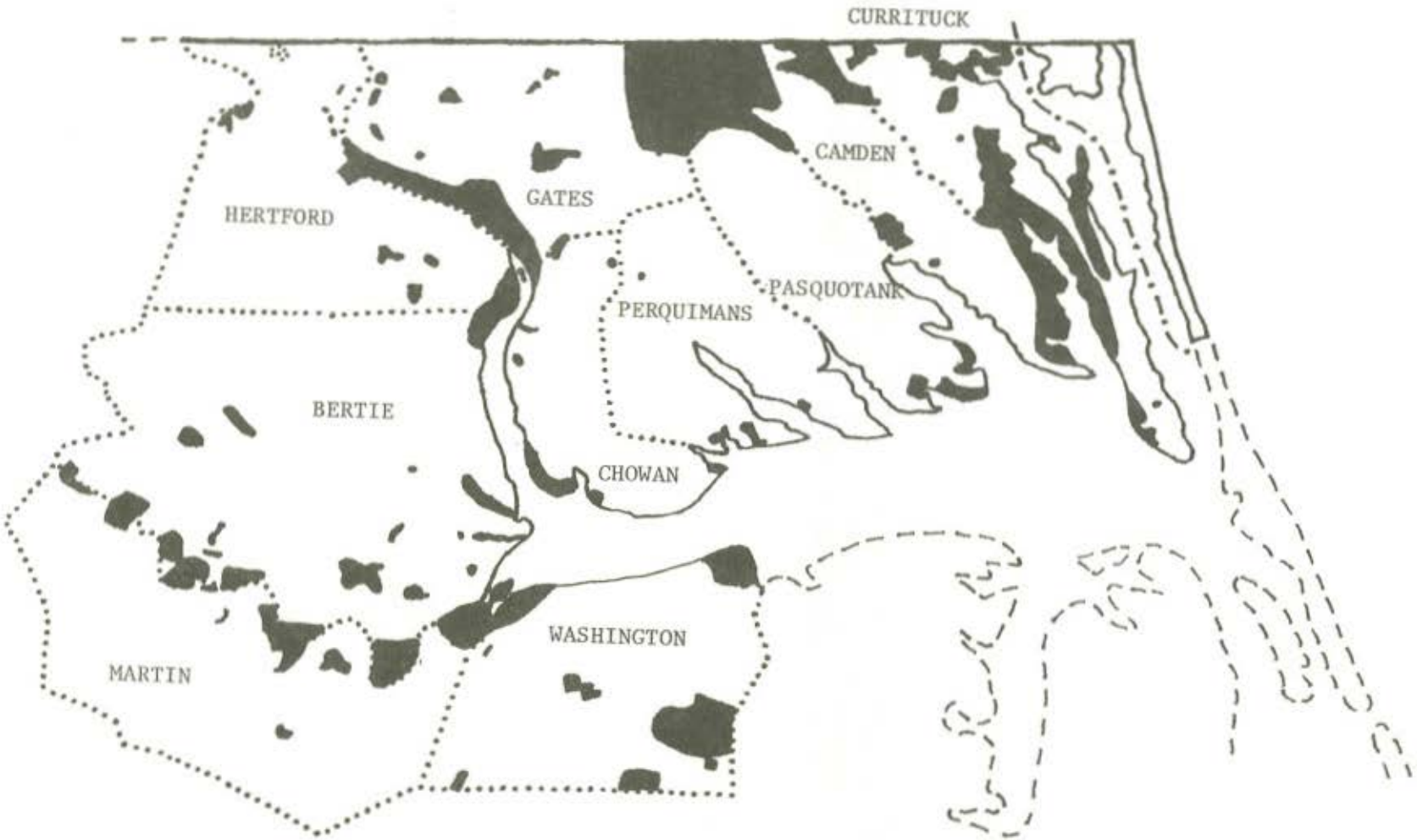
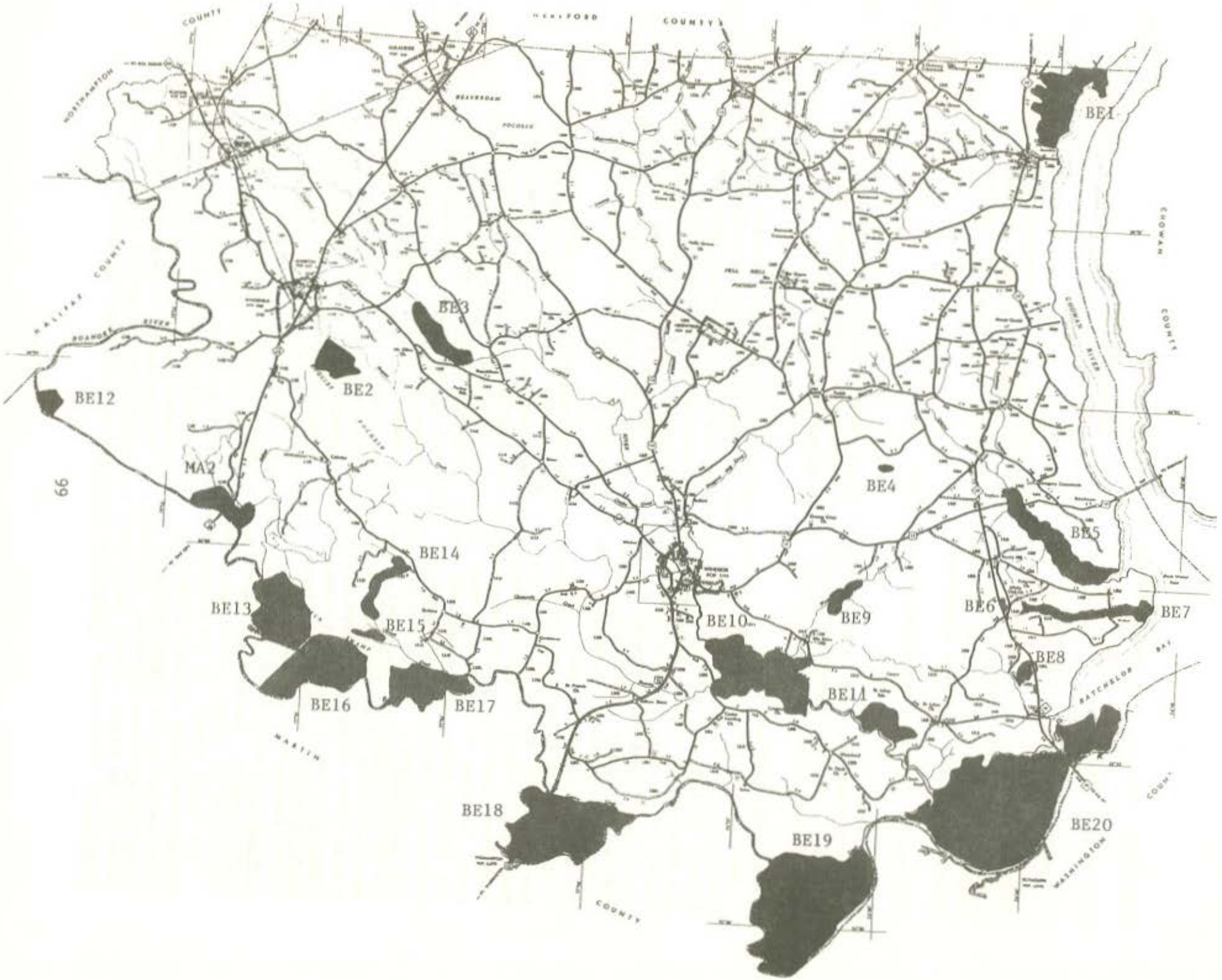

CURRITUCK
CAMDEN
GATES
HERTFORD
PASQUOTANK
PERQUIMANS
BERTIE
CHOWAN
WASHINGTON
MARTIN

Figure 8. Significant natural areas in Bertie County. The areas are numbered generally in a north to south, or west to east, manner; see Table 7 and the Inventory of Sites section for further information.


BE1
BE2
BE3
BE4
BE5
BE6
BE7
BE8
BE9
BE10
BE11
BE12
BE13
BE14
BE15
BE16
BE17
BE18
BE19
BE20
MA2
99

SITE NAME: Colerain/Cow Island Swamp and Slopes

SITE NUMBER: BE1 SIZE: about 3500 acres

SITE SIGNIFICANCE: C (Regional)

LOCATION: Extreme northeastern corner of Bertie County and southeastern corner of Hertford County; the floodplain of the Chowan River and adjacent slopes extending south nearly to Colerain and north to a group of floodplain islands northeast of Lloyd Crossroads.

QUAD MAPS: Colerain, Valhalla, Mintonsville

SIGNIFICANCE:

1. The natural area contains a very large extent of upland forests on slopes. These slopes are located in ravines and extend for over two miles along the western edge of the Chowan River floodplain.

GENERAL DESCRIPTION:

Most of the land in extreme eastern Bertie County and southeastern Hertford County lies on a terrace that is at least 50 feet higher than the Chowan River. Bluffs are located along portions of the river, whereas other portions are more gently eroded in the form of ravines along tributary streams. The latter is the case north of Colerain; not only are there numerous ravines but there is a floodplain between the base of the ravines and the river itself. Thes slopes along the streams extend for at least 8 miles and cover more than a dozen tributaries. Several of the ravines extend nearly a mile to the west of the floodplain.

Many of the forests on the slopes are mature and are rather park-like, as the understory and shrub layers are not dense. The forests contain both Dry-Mesic Oak-Hickory Forest and Mesic Mixed Hardwood Forest natural communities, with the former being more prevalent in the southern portion of the natural area. On some of the slopes near Colerain, white oak (Quercus alba) dominate the canopy; other canopy species include tuliptree (Liriodendron tulipifera), mockernut hickory (Carya tomentosa), black oak (Q. velutina), and southern red oak (Q. falcata). The understory layer features mesic tree species such as sourwood (Oxydendrum arboreum), flowering dogwood (Cornus florida), and American holly (Ilex opaca). The shrub layer, though rather sparse, features a wide array of species, especially ericaceous ones, with blueberries (Vaccinium spp.) being most common. The uncommon silky camellia (Stewartia malacodendron) is present on these slopes. Farther north in the natural area, slopes sampled to the west of Cow Island contain American beech (Fagus grandifolia) as a canopy dominant, along with various oaks and loblolly pine (Pinus taeda). Because of the extensive length of the natural area, featuring many miles of slopes, there is a wide variation on plant species diversity.

The swamp forest in the floodplain east of the slopes is a Tidal Cypress-Gum Swamp natural community. In the southern portion of the natural area, swamp tupelo (Nyssa biflora) is the dominant species, with red maple (Acer rubrum) also numerous, especially in the understory layer. The shrub layer in the swamp is well developed, featuring Virginia willow (Itea virginica), fetter-bush (Leucothoe racemosa), and highbush blueberry

(Vaccinium corymbosum). Swamp forests farther north, near Cow Island, are dominated by bald cypress (Taxodium distichum), along with both swamp tupelo and water tupelo (N. aquatica). Portions of the understory are dominated by sweetbay (Magnolia virginiana); red maple and water ash (Fraxinus caroliniana) are also common. Sweet pepperbush (Clethra alnifolia), maleberry (Lyonia ligustrina), Virginia willow, and fetter-bush are numerous shrub species.

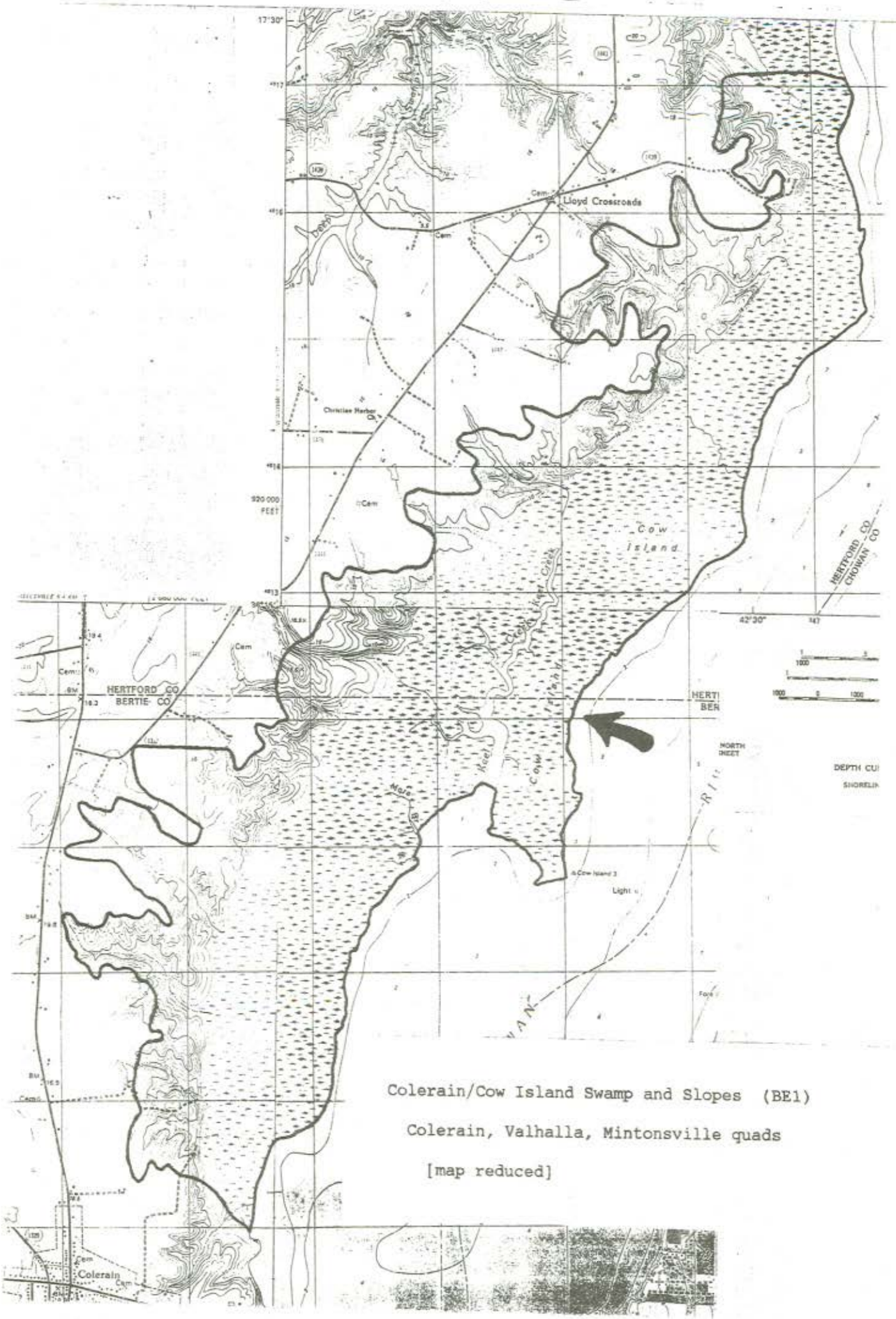
OWNERSHIP: Multiple private owners

PROTECTION STATUS: None

RECOMMENDATIONS FOR MANAGEMENT OR PROTECTION: The site needs to be protected in its present state. Upland tracts are easily timbered, and most such uplands in the A/P Study area have been timbered within the past 30 to 50 years. Because the site is not believed to be of National or State significance, the best protection measures are not acquisition (unless gifts of land are involved) but rather registry or conservation easements with the private landowners.

COMMENTS: This natural area needs further inventory, as only the southern portion, and parts of the central section near Cow Island, were inventoried. The wildlife value of the natural area is poorly known, and further field work in spring and summer is needed to survey for animal populations such as breeding birds, in addition to surveying for spring-blooming wildflowers on the slopes.

REFERENCES: Schneider (1989f), Schneider and Frost (1989d)



Colerain/Cow Island Swamp and Slopes (BE1)

Colerain, Valhalla, Mintonsville quads

[map reduced]

SITE NAME: Roquist Pocosin

SITE NUMBER: BE2 SIZE: about 1000 acres

SITE SIGNIFICANCE: B (State)

LOCATION: Western portion of Bertie County; located about 3 miles southeast of Lewiston Woodville and about 2 miles east-northeast of the intersection of NC 11 and SR 1108.

QUAD MAP: Woodville

SIGNIFICANT FEATURES:

1. Roquist Pocosin features a Nonriverine Swamp Forest. Portions of the "pocosin" are still reasonably intact with mature forests, though such nonriverine forests are highly threatened in the state by timbering and conversion to pine plantations.

GENERAL DESCRIPTION:

Nonriverine swamps and pocosins were formerly common in much of the central and eastern portions of the Coastal Plain of North Carolina. Although a moderate acreage of pocosins still remains in the state, the acreage of nonriverine swamps and bottomlands is only a small fraction of that present in the 1940's or 1950's. Nearly all have been logged, converted to pine plantations, drained for agriculture, or otherwise destroyed. Roquist Pocosin may have contained pocosin vegetation in the past, but the portions that remain in mature forest are Nonriverine Swamp Forest natural communities.

The natural area features a mature swamp forest with numerous large trees. The canopy is dominanted by swamp tupelo (Nyssa biflora) and water tupelo (N. aquatica). Other trees include pond cypress (Taxodium ascendens), willow oak (Quercus phellos), laurel oak (Q. laurifolia), red maple (Acer rubrum), and sweetgum (Liquidambar styraciflua). The understory is fairly well developed, dominated by red maple and sweetgum. The shrub layer is dense; sweet pepperbush (Clethra alnifolia) is the dominant species, but many sapling red maples and sweetgums are present also. The herb layer is sparse. In general, the natural area features a rather low diversity of plant species.

OWNERSHIP: Private; most or all in one ownership

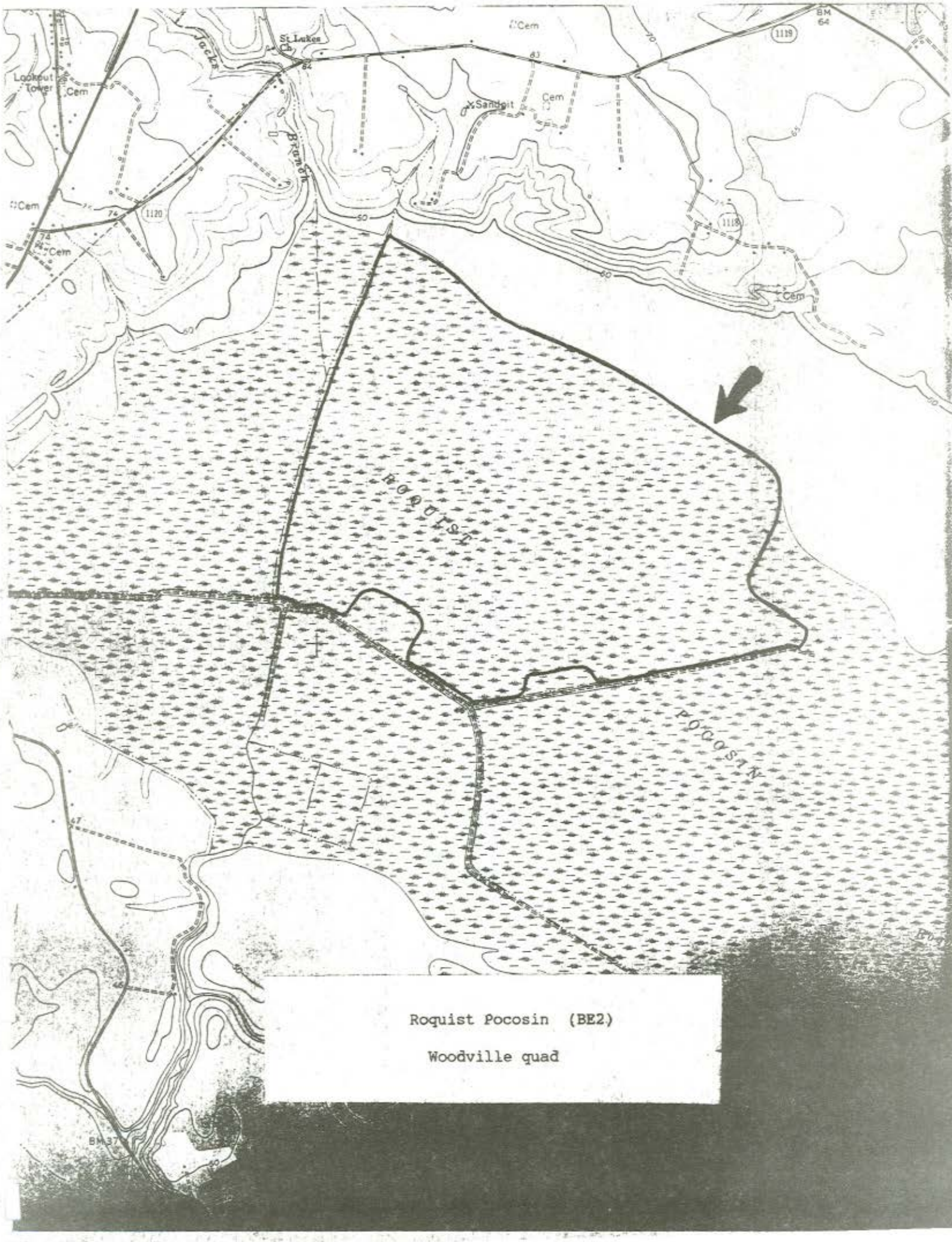
PROTECTION STATUS: None

RECOMMENDATIONS FOR MANAGEMENT OR PROTECTION: Because this natural area is owned by a major timber company, its future is highly threatened. Such nonriverine areas have been timbered heavily in recent decades, and the fate of this site is probably in imminent jeopardy. Portions of the whole "pocosin" have already been cut. Any further timber cutting is detrimental to the natural area. A number of drainage ditches traverse the "pocosin" as a whole, and these ditches lower the water table and dry out the soil, making timber removal easier. Obviously, to protect the natural area, such ditches would need to be blocked, or at the least, no new ditches should be constructed. Registry would not be a feasible protective measure, but a

conservation easement or donation of land to a private conservation group would seem to be a possible protection alternative.

COMMENTS: The survey by Schneider (1989k) was made on foot, rather than by plane. Thus, the extent of the mature forest away from logging roads is poorly known. The natural area might be considerably larger or smaller than the approximately 1000 acres listed. The forest might well be important to large animals such as woodpeckers, hawks, owls, deer, and foxes. A survey of animal populations is warranted.

REFERENCES: Schneider (1989k)



Roquist Pocosin (BE2)

Woodville quad

SITE NAME: Burdens Millpond

SITE NUMBER: BE3 SIZE: about 600 acres

SITE SIGNIFICANCE: C (Regional)

LOCATION: Western portion of Bertie County; in floodplain of the Cashie River, 1 to 2 miles upstream from the SR 1225 bridge crossing over the river.

QUAD MAP: Republican

SIGNIFICANT FEATURES:

1. An old millpond contains a mature stand of swamp forest trees and is an excellent example of a Coastal Plain Semipermanent Impoundment natural community.
2. The bottomland above the pond in the floodplain is a mature forest in good condition.

GENERAL DESCRIPTION:

Along the Cashie River above the community of Republican is an old millpond that has had the gates removed from the dam. This pond (Burdens Millpond) contains a mature stand of canopy trees, dominated by water tupelo (Nyssa aquatica). Many of the tupelos are estimated to have a trunk diameter at breast height of 65 inches, though the bases of the trees are swollen because they are growing in water. Scattered bald cypresses (Taxodium distichum) are also present, as expected at a millpond. The subcanopy in the pond is fairly sparse, with essentially all trees growing in the margin of the pond; red maple (Acer rubrum) and water ash (Fraxinus caroliniana) are dominants.

The floodplain immediately above the millpond is not as wet as one would expect along a blackwater stream such as the Cashie, and a mixture of bottomland tree species is present, along with species typical of swamp conditions. This community is probably a blend of Coastal Plain Bottomland Forest, Blackwater subtype and Coastal Plain Small Stream Swamp, Blackwater subtype natural communities. The mature canopy features no dominants; present are sweetgum (Liquidambar styraciflua), tuliptree (Liriodendron tulipifera), pond cypress (Taxodium ascendens), white oak (Quercus alba), American sycamore (Platanus occidentalis), American beech (Fagus grandifolia), and American elm (Ulmus americana). Red maple dominates the subcanopy, but mesic tree species such as flowering dogwood (Cornus florida) and American holly (Ilex opaca) are present. The shrub layer features sweet pepperbush (Clethra alnifolia) and Virginia willow (Itea virginica) as the most numerous species. Ferns are common in the herb layer.

OWNERSHIP: Private

PROTECTION STATUS: None

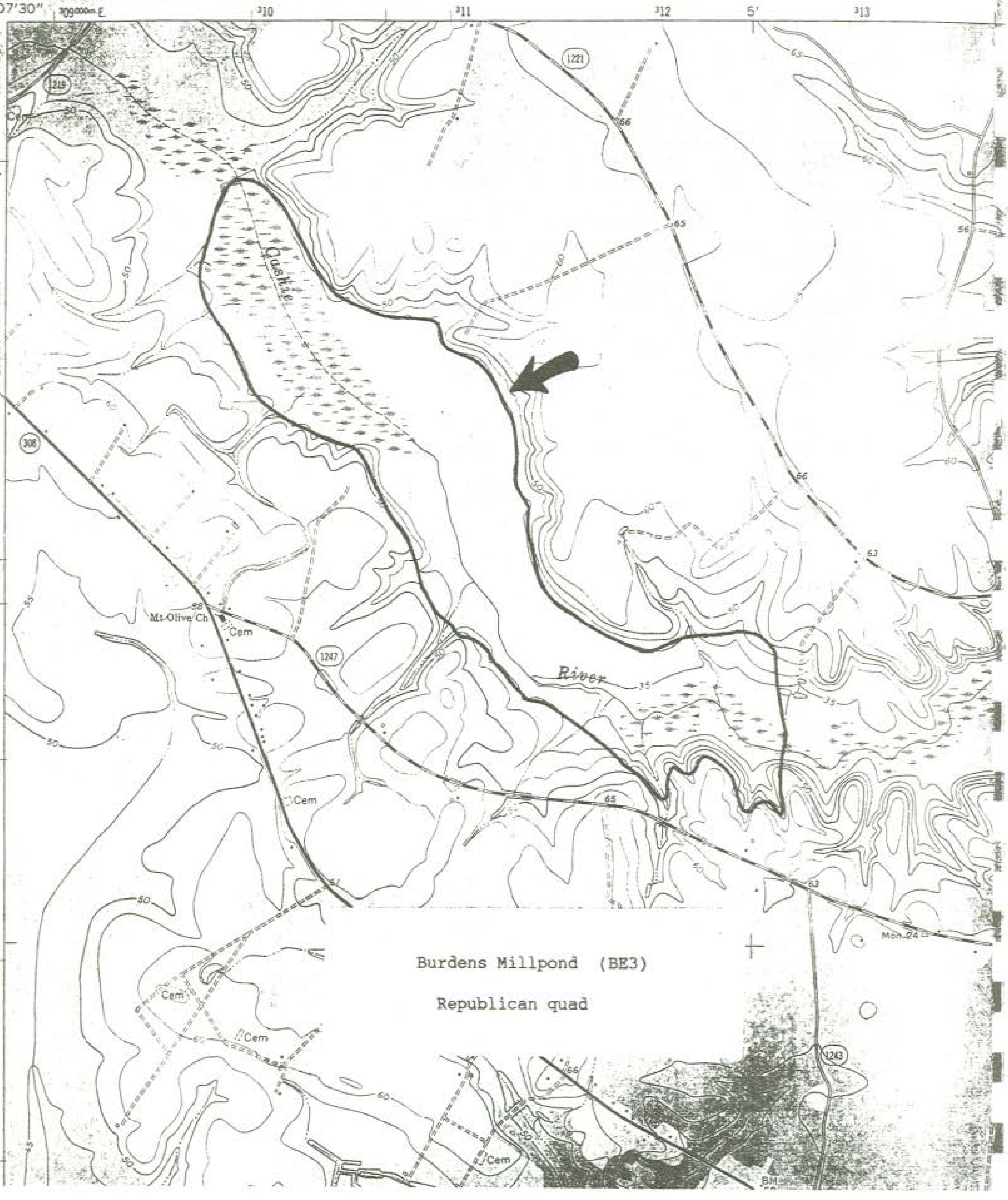
RECOMMENDATIONS FOR MANAGEMENT OR PROTECTION: Schneider (1989i) reports that the site, at least the millpond, has recently been sold to a timber company. If so, protection of the site from logging may be difficult. Obviously, logging would be detrimental to the natural area. The millpond is 4 to 5 feet

below its former level with the gates removed from the dam. It is not clear whether restoring the dam and returning the pond to its former level would be harmful to the natural area, but it would be expected that many trees in the bottomland at the upper end would be killed by such an action. The most feasible protection methods appear to be conservation or management agreements or registry agreements with the owner(s).

COMMENTS: The bottomland portion of the natural area was not surveyed as intensively as would be liked. The composition of tree species in the bottomland is rather bizarre, and it is also unusual that mesic species of trees, such as white oak, beech, and flowering dogwood, would be growing in a floodplain of a blackwater river. Forcing this community into a single natural community type appears to be difficult. Most previously known examples of Coastal Plain Bottomland Forest, Blackwater subtype are found on old ridges (former natural levees) in wide floodplains. This site, however, is not on a former levee but is presumably on a "dryish" portion of the floodplain, without any noticeable fluvial landforms.

REFERENCES: Schneider (1989i)

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY



SITE NAME: Flat Swamp Creek Woodpecker Site

SITE NUMBER: BE4 SIZE: about 40 acres

SITE SIGNIFICANCE: C (Regional)

LOCATION: Eastern portion of Bertie County; located about 1.5 miles southeast of the intersection of SR 1001 and SR 1366, near a tributary stream of Flat Swamp Creek.

QUAD MAP: Merry Hill

SIGNIFICANT FEATURES:

1. The natural area contains an active colony site of red-cockaded woodpecker (Picoides borealis), a Federally Endangered species.

GENERAL DESCRIPTION:

This natural area is a mixed pine-hardwood forest on a broad interstream flat south of Flat Swamp Creek. The soils are clayey and poorly drained, and the site is a remnant of a more extensive forest dominated by loblolly pine (Pinus taeda) and various hardwoods. Most of the surrounding lands are now in pine plantations. The natural community is not a mature, climax one, and it is difficult to categorize because of the abundance of the pines, indicating disturbances perhaps 50 to 80 years ago. It is probably a variant of Nonriverine Wet Hardwood Forest or Mesic Mixed Hardwood Forest, Upland Flats subtype.

Loblolly pine dominates the site, with some swamp chestnut oak (Quercus michauxii) in the canopy also. A scattering of other oaks is also present, including white (Q. alba), willow (Q. phellos), laurel (Q. laurifolia), and water (Q. nigra). American holly (Ilex opaca) is the most numerous understory tree. Common in the shrub layer are inkberry (Ilex glabra) and giant cane (Arundinaria gigantea).

The site is open enough that the Federally Endangered red-cockaded woodpecker (Picoides borealis) is present. This species requires mature and open stands of pines, especially longleaf pines (Pinus palustris), for its survival. Several colonies of this species are still believed to be present in Bertie County, but the woodpecker has been rapidly declining in the state, especially north of the Neuse River, where longleaf pines have nearly disappeared. The near absence of fire has allowed former pine forests to become overgrown with hardwoods, forcing the woodpeckers to abandon colony sites. It is likely that, unless there is fire management or clearing of hardwoods from this natural area, the birds will vanish in several years.

OWNERSHIP: Unknown; probably a timber company

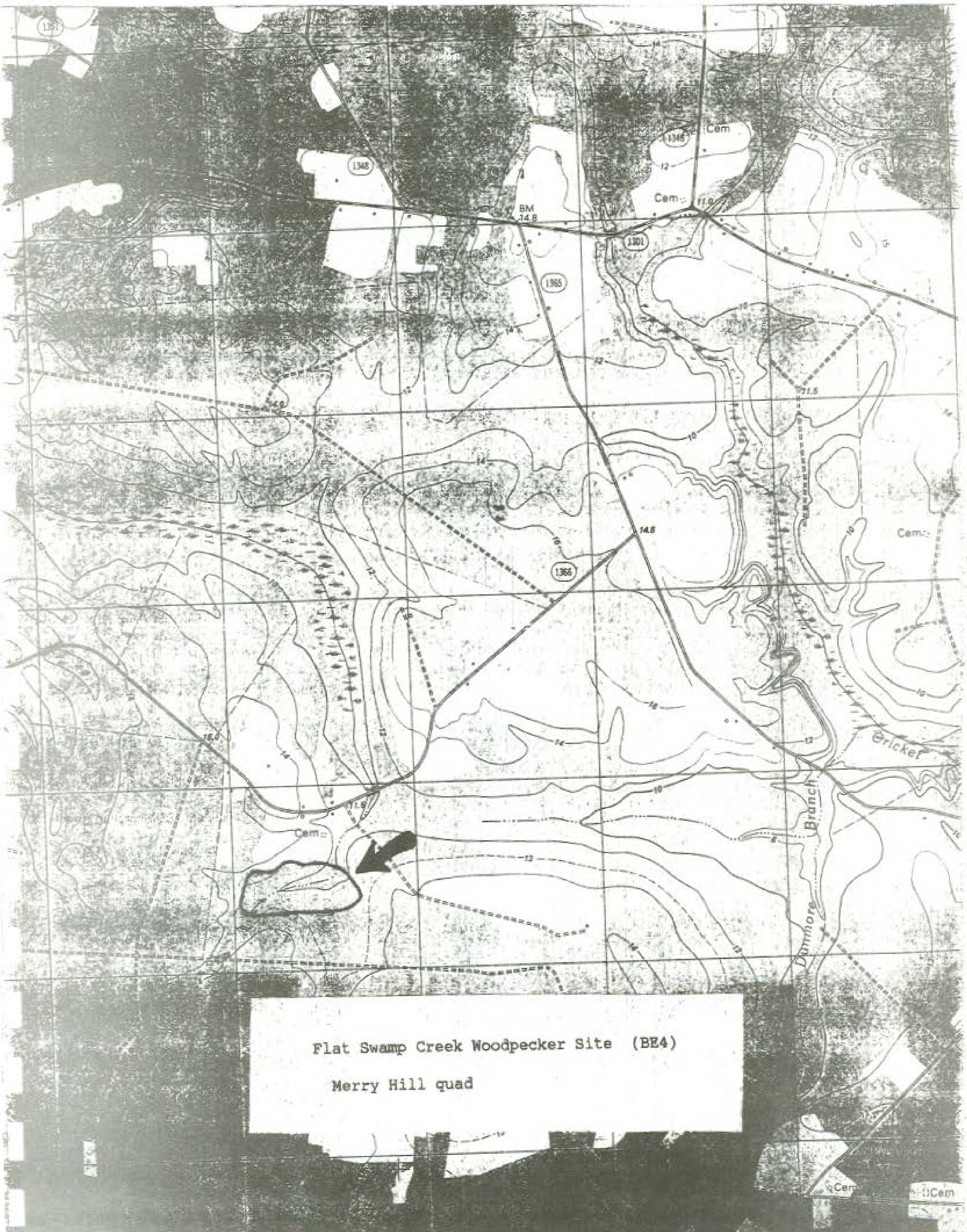
PROTECTION STATUS: None

RECOMMENDATIONS FOR MANAGEMENT OR PROTECTION: The natural area can be assumed to be in great jeopardy of being logged, since adjacent tracts have been clearcut in the past 10 to 20 years. In order for the woodpeckers to survive at the site, hardwoods need to be removed around the active nest cavity trees,

either by burning or by cutting. The landowners need to be contacted about the presence of the birds, if they are not already aware of them. The main protection of the site is likely a registry agreement or a conservation easement, since acquisition of such a small site is not recommended.

COMMENTS: The actual population today of red-cockaded woodpeckers in Bertie County, as well as in the 10-county A/P Study area, is poorly known, but it is certainly less than 10 years ago. Likely, there are a few pairs in Bertie County, one to several pairs in Gates County, and possibly none eleswhere, as of late 1989.

REFERENCES: Lynch (1989b)



Flat Swamp Creek Woodpecker Site (BE4)

Merry Hill quad

SITE NAME: Salmon Creek Swamp

SITE NUMBER: BE5 SIZE: about 1300 acres

SITE SIGNIFICANCE: C (Regional)

LOCATION: Southeastern portion of Bertie County; located south of SR 1501 and north of SR 1502. US 17 crosses the natural area near the upper end, and the lower end is the confluence of Salmon Creek with the Chowan River.

QUAD MAPS: Edenhouse, Merry Hill

SIGNIFICANT FEATURES:

1. The fairly wide floodplain, extending over 1/2-mile in width in some places, contains a mature swamp forest, along with a hardwood forest on the slopes at the edge of the floodplain. This is one of the best examples of a Coastal Plain Small Stream Swamp in the A/P Study area.

GENERAL DESCRIPTION:

Salmon Creek flows in a southeasterly direction for approximately 10 miles and empties into the Chowan River at its confluence with Albemarle Sound. Despite its short length, it has a rather wide floodplain, being over 1/2-mile wide near its mouth. The terrace above the floodplain is 20 to 25 feet higher than the elevation of the floodplain, and the slopes along the edge of the floodplain are rather gentle.

The floodplain contains a Coastal Plain Small Stream Swamp natural community in mature condition. The well-developed canopy is dominated by bald cypress (Taxodium distichum), water tupelo (Nyssa aquatica), and swamp tupelo (N. biflora). The subcanopy features red maple (Acer rubrum), water ash (Fraxinus caroliniana), and American hornbeam (Carpinus caroliniana) as common species. The shrub layer is well developed along the creek but is rather poorly developed in the interior of the swamp. Dominant species are common winterberry (Ilex verticillata), titi (Cyrilla racemiflora), maleberry (Lyonia ligustrina), and sweet pepperbush (Clethra alnifolia). Herb species are scarce and grow mainly on stumps and hummocks.

The slopes at the margins of the floodplain contain some mature hardwood forests, but also contain many cut-over areas. The remaining mature forests are mainly Mesic Mixed Hardwood Forest, Bluff/Slope subtype natural communities. These forests tend to be dominated by white oak (Quercus alba) and American beech (Fagus grandifolia) in the canopy. The subcanopy is dense where there are canopy gaps but only moderate under a solid canopy. Red maple, American holly (Ilex opaca), and beech are the most common subcanopy trees. Various ericaceous shrubs, especially blueberries (Vaccinium spp.), are common on the slopes. The herb layer is sparse, though this may have been a result of the survey being done in late October; a more diverse herb layer might be expected in spring or summer.

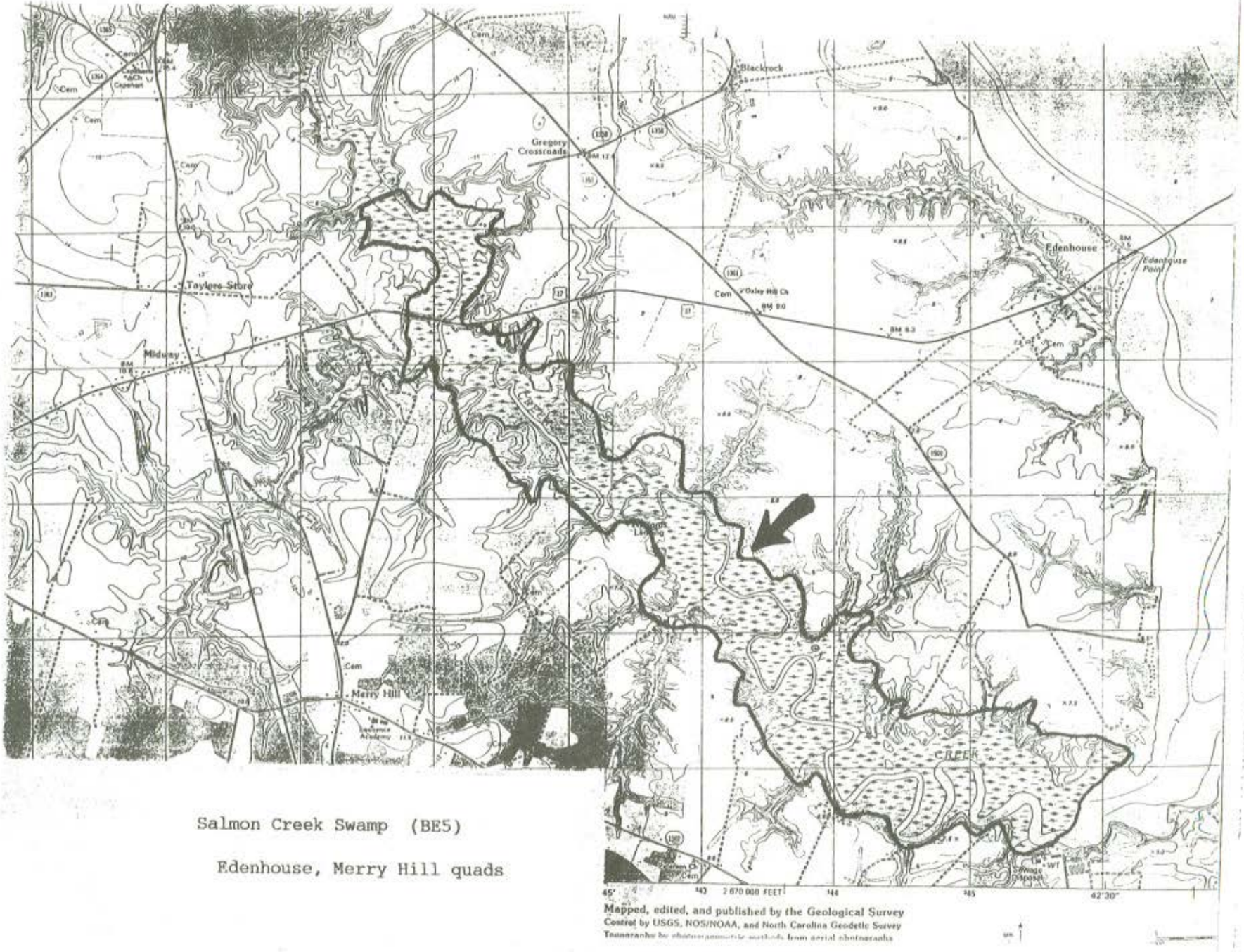
OWNERSHIP: Private; multiple ownership

PROTECTION STATUS: None

RECOMMENDATIONS FOR MANAGEMENT OR PROTECTION: Timber harvest would be detrimental to the natural area, especially as removal of trees might accelerate erosion from adjacent croplands. Along portions of the natural area, cropland reaches to the top of the slopes, and where the slopes are cut-over, erosion of sediment into the creek is expected to be a major concern. This site might best be protected through acquisition by the N.C. Wildlife Resources Commission as a Game Land or by a local government and protected as a natural area.

COMMENTS: As with nearly all swamps in the A/P Study area, further field work is necessary because of difficulty of access in such wetlands. Survey work on the slopes is recommended in spring and summer for herbaceous flora.

REFERENCES: Schneider (1989n)



Salmon Creek Swamp (BE5)

Edenhouse, Merry Hill quads

SITE NAME: Merry Hill Mesic Flats Hardwood Forest

SITE NUMBER: BE6 SIZE: about 50 acres

SITE SIGNIFICANCE: C (Regional)

LOCATION: Southeastern portion of Bertie County; located on the east side of NC 45, just north of the intersection with SR 1540.

QUAD MAP: Woodard

SIGNIFICANT FEATURES:

1. This site contains a good example of a Mesic Mixed Hardwood Forest, Upland Flats subtype natural community. Such communities are uncommon at present in the state and are essentially unprotected.

GENERAL DESCRIPTION:

Much of the Coastal Plain of North Carolina contains exceptionally flat land with almost no drainage; however, nearly all of such land is now under cultivation or has been cut-over. Few upland flats remain in a natural state, especially over 10 or 20 acres in size. This site in southeastern Bertie County, of nearly 50 acres, contains a mature hardwood forest of a wide species variety in the canopy. Such areas of mesic soil conditions feature species of plants characteristic of bottomland forests mixed with species characteristic of upland forests.

The natural area contains no streams or standing water, at least for most of the year. The canopy features white oak (Quercus alba) and swamp chestnut oak (Q. michauxii) as dominants. Also common are red maple (Acer rubrum), American beech (Fagus grandifolia), and loblolly pine (Pinus taeda). Other oak species are present, including cherrybark oak (Q. pagoda), black oak (Q. velutina), southern red oak (Q. falcata), and willow oak (Q. phellos). The understory and shrub layers also feature a mix of upland and lowland species, including sourwood (Oxydendrum arboreum) and flowering dogwood (Cornus florida) at the more "upland" end to giant cane (Arundinaria gigantea) and sweet pepperbush (Clethra alnifolia) at the more "lowland" end of the spectrum.

The site likely has a high wildlife value, though the small size of the natural area may limit its use to the larger species such as deer, hawks, and owls. Several species of woodpeckers and white-breasted nuthatches (Sitta carolinensis) were noted in the natural area during a site visit.

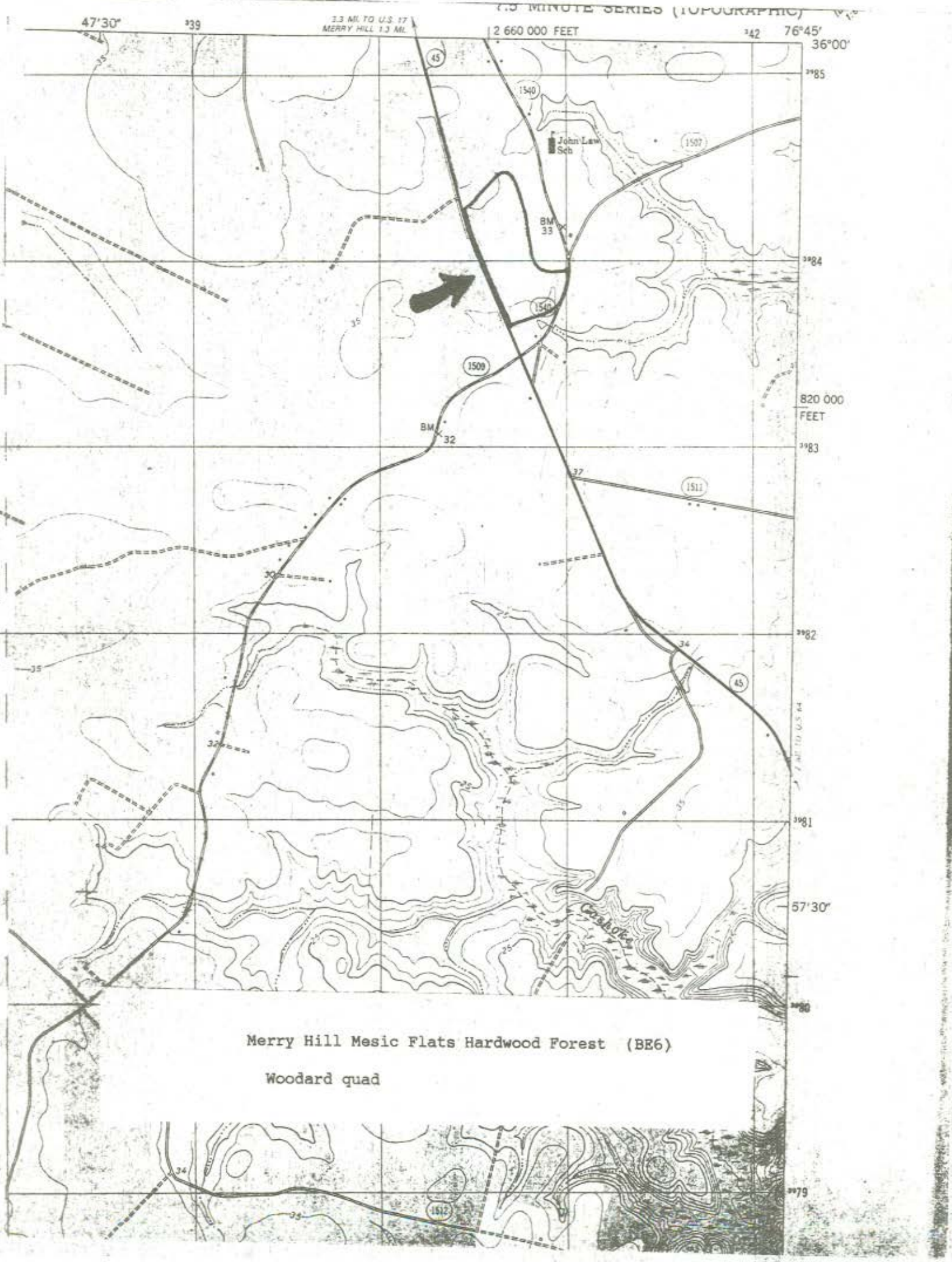
OWNERSHIP: Not known but presumably private

PROTECTION STATUS: None

RECOMMENDATIONS FOR MANAGEMENT OR PROTECTION: No management of the site is necessary. Timber harvest or ditching of the site would be highly detrimental. The small size of the natural area would lend itself best to protection in the form of a registry agreement or conservation easement, rather than acquisition.

COMMENTS: This site is likely in extreme danger of timber harvest, based on the fact that similar sites in the Coastal Plain have already been cut for timber or cleared for agriculture. Some clearcutting has been done in recent years just north of the the natural area. This subtype of Mesic Mixed Hardwood Forest is poorly known in the state because few good examples are still present, at least of any size (over 20 acres). Most examples known appear to have been "discovered" during this A/P Study, particularly at sites immediately north of Albemarle Sound in Pasquotank and Perquimans counties. Essentially none of these upland flats are protected in north Carolina.

REFERENCES: LeGrand (1989d)



Merry Hill Mesic Flats Hardwood Forest (BE6)

Woodard quad

SITE NAME: Black Walnut Swamp

SITE NUMBER: BE7 SIZE: about 735 acres

SITE SIGNIFICANCE: C (Regional)

LOCATION: Extreme southeastern portion of Bertie County; located in the floodplain of Black Walnut Swamp, extending east to Albemarle Sound and west nearly to NC 45.

QUAD MAP: Westover

SIGNIFICANT FEATURES:

1. The natural area is a mature, high quality swamp forest along a blackwater stream. Some mature upland forest is present on adjacent slopes.

GENERAL DESCRIPTION:

Black Walnut Creek is a rather small blackwater stream that flows eastward to Albemarle Sound in southeastern Bertie County. The forest in the floodplain is a good example of a Coastal Plain Small Stream Swamp natural community. The mature canopy is dominated by water tupelo (Nyssa aquatica). The understory layer is rather sparse, with water tupelo and red maple (Acer rubrum) being the dominants. There is considerable standing water, and the shrub and herb layers are poorly developed.

There is a rather narrow band of upland forest between the swamp and agricultural land on the upland flats. This mesic forest is in good condition with a number of large trees, including a Shumard oak (Quercus shumardii) that is 35 inches in trunk diameter (Schneider 1989m). The canopy is dominated by American beech (Fagus grandifolia), tuliptree (Liriodendron tulipifera), and a variety of oaks and hickories. The subcanopy is well developed; dominants include American hornbeam (Carpinus caroliniana), American holly (Ilex opaca), hop hornbeam (Ostrya virginiana), and American beech. The shrub layer is sparse, but Christmas fern (Polystichum acrostichoides) is common in the herb layer. Unfortunately, Japanese honeysuckle (Lonicera japonica) is ubiquitous as a ground cover.

OWNERSHIP: Private; apparently a single ownership

PROTECTION STATUS: None

RECOMMENDATIONS FOR MANAGEMENT OR PROTECTION: Timber cutting would be harmful, especially on the uplands, as cleared land would allow additional runoff from the agricultural lands to the creek and swamp. The fairly small size of the swamp would likely hinder acquisition of it, other than a donation by the owner. A registry agreement or conservation or management easement on the property would likely be the best protection measures.

COMMENTS: The natural area needs additional survey work, especially for animals. Also, no field work was conducted along the Albemarle Sound

shoreline, where the potential for rare species might be higher than farther upstream.

REFERENCES: Schneider (1989m)

Black Walnut Swamp (BE7)

Westover quad

[map reduced]

SITE NAME: Upper Cashoke Creek Beech Slopes

SITE NUMBER: BE8 SIZE: about 125 acres

SITE SIGNIFICANCE: C (Regional)

LOCATION: Southeastern portion of Bertie County; just west of NC 45, opposite the SR 1534 loop road. The slopes are along a tributary stream to Cashoke Creek.

QUAD MAPS: Woodard, Westover

SIGNIFICANT FEATURES:

1. The natural area features a high-quality, climax stand of mesic mixed forest on relatively steep slopes.

GENERAL DESCRIPTION:

Alongside a tributary stream to Cashoke Creek is a mature, climax hardwood forest on moderately steep slopes. The forest is an example of a Mesic Mixed Hardwood Forest, Bluff/Slope subtype. The canopy is dominated by American beech (Fagus grandifolia), with white oak (Quercus alba) also characteristic of the area. The average trunk diameters of the trees is 18 to 20 inches, with some reaching 36 inches in diameter. Other canopy species include cherrybark oak (Q. pagoda), loblolly pine (Pinus taeda), tuliptree (Liriodendron tulipifera), and black gum (Nyssa sylvatica). The subcanopy features American holly (Ilex opaca) and sourwood (Oxydendrum arboreum). The forest is very open and parklike, caused by a very poorly developed shrub layer.

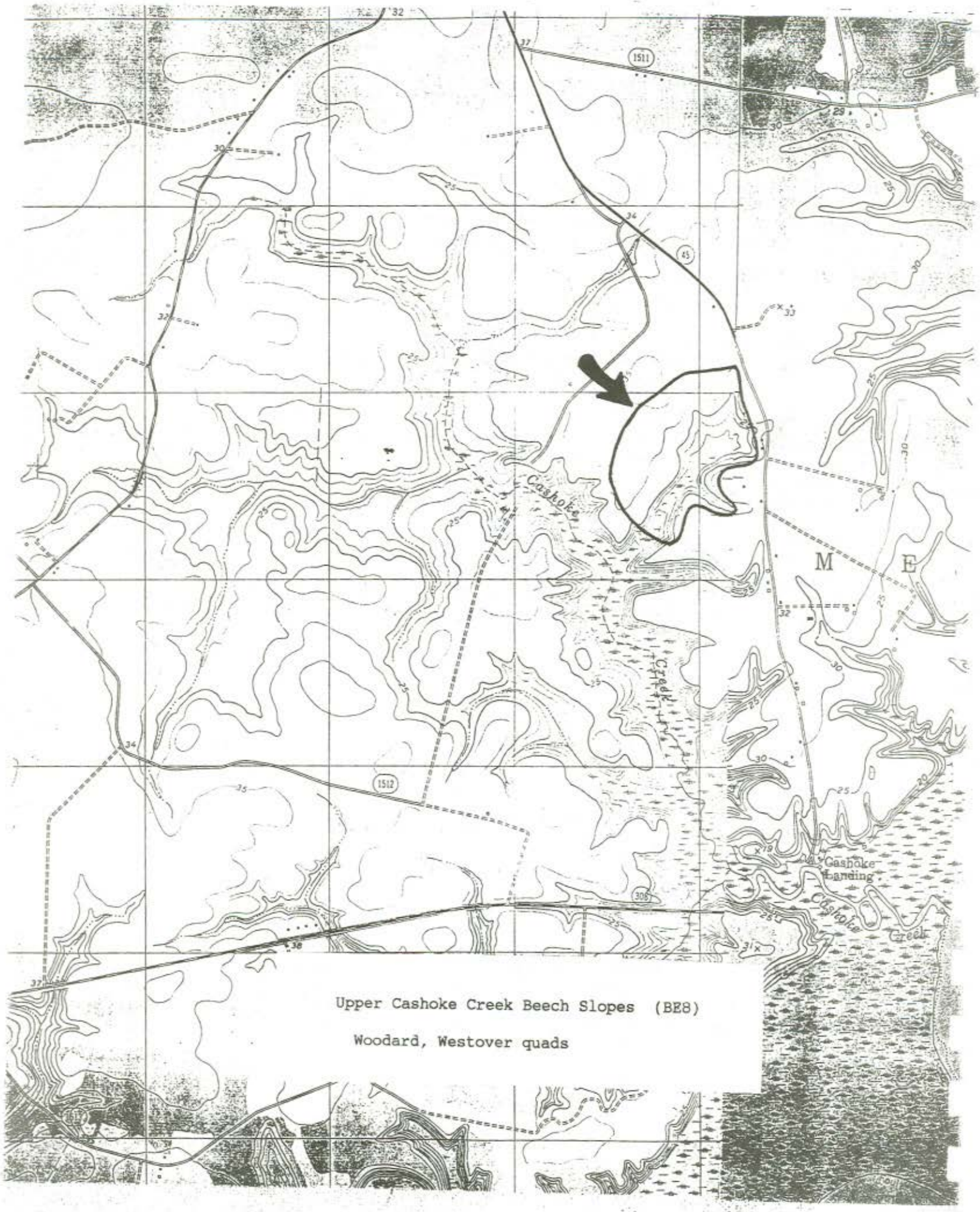
OWNERSHIP: Unknown

PROTECTION STATUS: None

RECOMMENDATIONS FOR MANAGEMENT OR PROTECTION: This natural area requires little or no management. Timber harvest would damage or destroy the quality of the natural area. Further inventory along Cashoke Creek and its tributaries is needed before protection strategies can be firmly made. If, for example, there are several hundred (or more) adjacent acres of mature, high-quality forest, then a State or Federal public agency might wish to become involved in protection. Otherwise, the local county or town governments or nearby colleges might be logical agencies involved in protection as a local park or preserve.

COMMENTS: Considerable additional field work is needed along Cashoke Creek. The survey at this site was brief and was conducted in November, a poor time of year to determine herbaceous flora and animal populations. Portions of Cashoke Creek slopes farther to the south are believed by the N.C. Natural Heritage Program be be quite significant, but lack of time and manpower prevented a thorough inventory of such areas.

REFERENCES: Lynch (1989a)



Upper Cashoke Creek Beech Slopes (BE8)

Woodard, Westover quads

SITE NAME: Wading Place Creek Swamp and Uplands

SITE NUMBER: BE9 SIZE: about 235 acres

SITE SIGNIFICANCE: C (Regional)

LOCATION: Eastern portion of Bertie County; located about 5.5 miles east of Windsor along Wading Place Creek, south of US 17 and north of NC 308.

QUAD MAP: Woodard

SIGNIFICANT FEATURES:

1. The natural area contains some of the best quality upland forests in the A/P Study area; the forests are mature and park-like in appearance.
2. The swamp forest along Wading Place Creek is also mature and intact.

GENERAL DESCRIPTION:

Wading Place Creek, as well as a number of other small streams in Bertie County, contains gently rolling slopes of only 15 to 20 feet in elevation from the crest to the stream. Because of the gentle topography, most of the forests on the slopes have been cut-over, and very few stands remain in mature upland forest. On the eastern slopes of this creek are perhaps 30 to 40 acres of a mature forest that is a Mesic Mixed Hardwood Forest, Bluff/Slope subtype. The well developed canopy is dominated by American beech (Fagus grandifolia) and a mixture of oaks, such as willow oak (Quercus phellos), swamp chestnut oak (Q. michauxii), and white oak (Q. alba), in addition to the rather uncommon Shumard oak (Q. shumardii). American beech, American hornbeam (Carpinus caroliniana), and sourwood (Oxydendrum arboreum) dominate the understory layer. The rather sparse shrub and herb layers give the uplands a park-like appearance typical of many such mesic slopes.

Portions of the floodplain of Wading Place Creek are an old millpond. The forest in the pond is mature and in good condition, with bald cypress (Taxodium distichum) the dominant species. Below the millpond, beavers have created a dam; farther downstream the swamp is not impounded an contains a greater canopy species diversity than present in the ponds. However, this Coastal Plain Small Stream Swamp contains only a handful of tree species, such as red maple (Acer rubrum) and sweetgum (Liquidambar styraciflua).

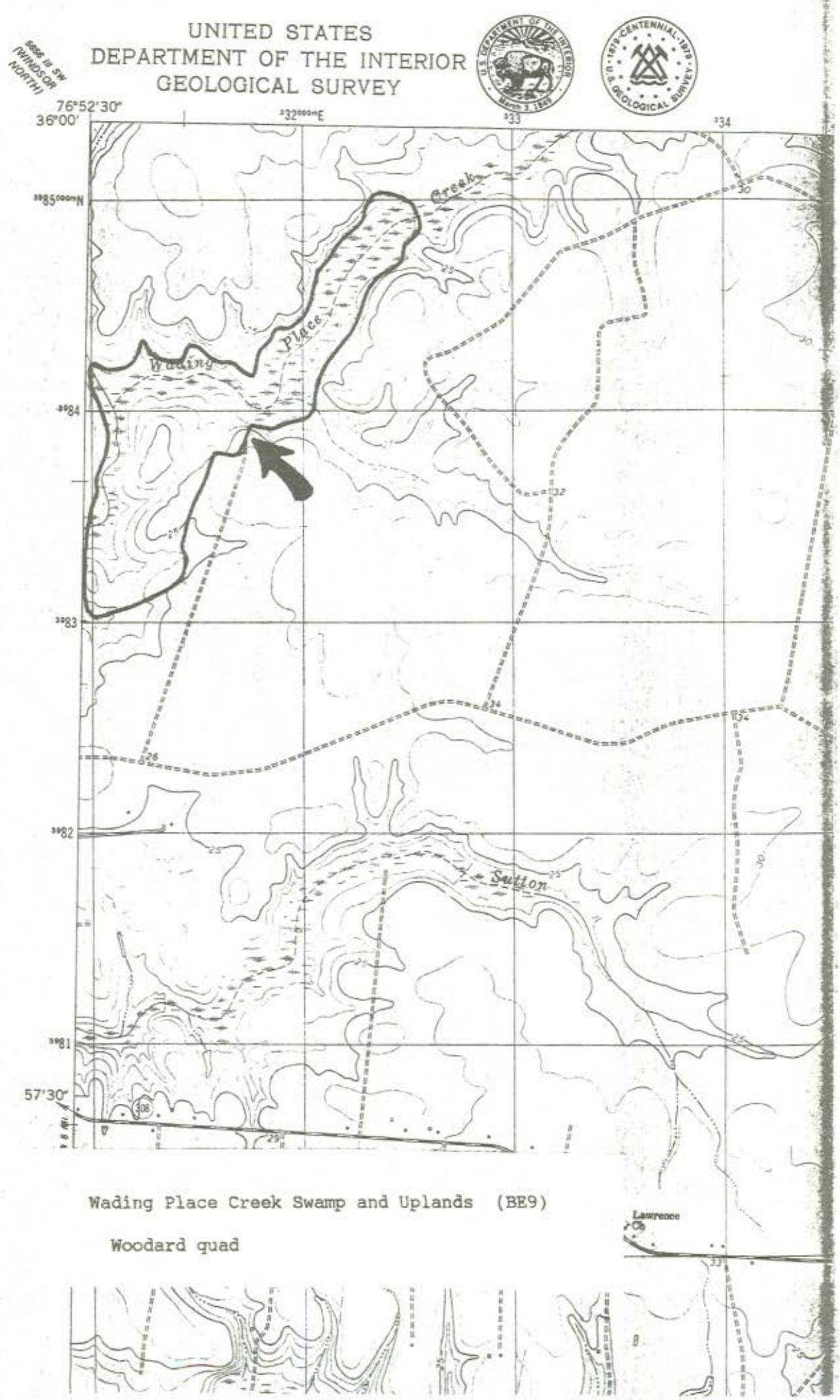
OWNERSHIP: Private; a single ownership

PROTECTION STATUS: None

RECOMMENDATIONS FOR MANAGEMENT OR PROTECTION: Portions of the upland forest were timbered within the past year, and it is certainly possible, and perhaps likely, that the present mature forest will be timbered unless protective measures are enacted. Thus, the site, at least the uplands, are in imminent jeopardy. The best protective measures would likely be a conservation easement or land donation to a private conservation group. The site is too small and isolated from the Roanoke River for the U.S. Fish and Wildlife Service or the N.C. Wildlife Resources Commission to likely have much interest in protection of the natural area.

COMMENTS: This site needs additional field work, especially farther downstream toward NC 308.

REFERENCES: Schneider (1989l)



Wading Place Creek Swamp and Uplands (BE9)

Woodard quad

SITE NAME: Roquist Creek/Cashie River Swamp

SITE NUMBER: BE10 SIZE: about 2400 acres

SITE SIGNIFICANCE: C (Regional)

LOCATION: South-central portion of Bertie County, southeast of Windsor; located in the floodplain of the Cashie River, both upstream and downstream of the confluence with Roquist Creek. The site extends 3 to 4 miles in length along the floodplain.

QUAD MAP: Windsor South

SIGNIFICANT FEATURES:

1. This is one of the largest expanses of mature swamp forest along a blackwater stream in the western portion of the A/P Study area.

GENERAL DESCRIPTION:

The Cashie River southeast of Windsor has a floodplain approximately one mile wide. Though there is little or no evidence of a natural levee or ridges or swales within the floodplain, there are several floodplain islands in the narrower floodplain of Roquist Creek. These islands feature slightly higher ground and a Mesic Mixed Hardwood Forest, Swamp Island subtype natural community, as opposed to a Coastal Plain Small Stream Swamp or Cypress-Gum Swamp natural community that covers the remaining 95% of the floodplain.

The mature swamp forest is dominated by a mixture of water tupelo (Nyssa aquatica), swamp tupelo (N. biflora), and bald cypress (Taxodium distichum). The subcanopy features a dominance of water ash (Fraxinus caroliniana), red maple (Acer rubrum), and American hornbeam (Carpinus caroliniana). The shrub layer is rather sparse except along stream courses, where titi (Cyrilla racemiflora), arrow-wood (Viburnum dentatum), and southern wild-raisin (V. nudum) are quite numerous. Most of the herb species are growing on cypress knees.

In the narrower floodplain of Roquist Creek, just downstream from the SR 1500 bridge, are two floodplain islands of perhaps 10 to 15 acres each. The higher and drier ground on these islands has a canopy dominated by American beech (Fagus grandifolia). The understory layer is patchy, with beech and American holly (Ilex opaca) the most prominent trees.

OWNERSHIP: Private; multiple ownership

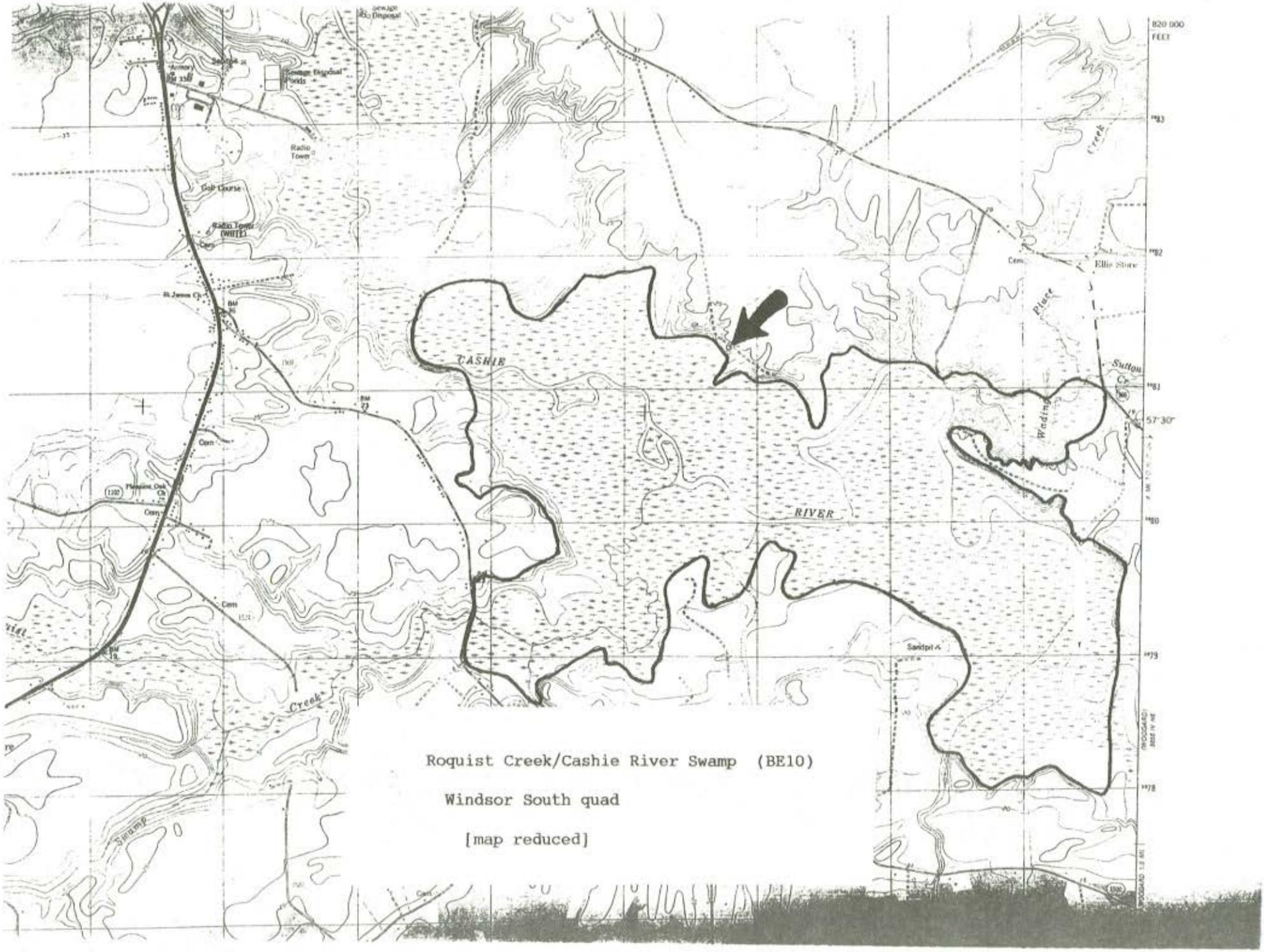
PROTECTION STATUS: None

RECOMMENDATIONS FOR MANAGEMENT OR PROTECTION: Timber cutting would damage or destroy the natural area. There is concern of runoff from adjacent agricultural lands. A buffer of forest land on the slopes at the edge of the floodplain would prevent much runoff, but tributary streams have eroded into the upland terraces where the fields are present. Even though the site is quite large (approximately 4 square miles in size), it is not likely that a Federal or State agency would be interested in acquiring land, unless by

outright donation by owners. The most feasible protection methods would likely be conservation or management agreements/easements or registry agreements with the owners.

COMMENTS: This natural area was poorly surveyed during the study, with most field work being done from a boat. Some of the slopes along the edge of the floodplain might have a significant flora, such as the steeper slopes along Wading Place Creek near the eastern edge of the natural area. The wildlife value of the area is also poorly known but might be fairly high, based on the mature canopy and the extensive wooded floodplain.

REFERENCES: Schneider (1989h)



Roquist Creek/Cashie River Swamp (BE10)

Windsor South quad

[map reduced]

SITE NAME: Jennette's Swamp

SITE NUMBER: BE11 SIZE: about 750 acres

SITE SIGNIFICANCE: C (Regional)

LOCATION: Southeastern portion of Bertie County; located in the floodplain of the Cashie River, north of the river itself, lying west of SR 1500 and due northeast of the end of SR 1518.

QUAD MAP: Woodard

SIGNIFICANT FEATURES:

1. The natural area features a mature swamp forest that, despite being privately owned, is expected to be protected for the immediate future.

GENERAL DESCRIPTION:

The Cashie River is a blackwater stream that flows for only 30 to 35 air miles from the northwestern corner of Bertie County to the southeastern corner of the county, where it joints the "delta" of the Roanoke River as they empty into Albemarle Sound. At the location of the natural area, the floodplain of the river is nearly a mile wide.

The natural area features a mature swamp forest, which is typical of those of other blackwater streams in the A/P Study area. The natural community can be considered either a Cypress-Gum Swamp, Blackwater subtype or a Coastal Plain Small Stream Swamp, depending on whether distinct fluvial features (such as natural levee and backswamp) can be distinguished; if so, then the community is the former type. At any rate, the site visit revealed no obvious fluvial features. The mature canopy is dominated by swamp tupelo (Nyssa biflora), with scattered water tupelo (N. aquatica) and bald cypress (Taxodium distichum). The subcanopy is fairly open, with red maple (Acer rubrum) and water ash (Fraxinus caroliniana) being common, along with transgressives of the canopy species. The shrub layer is very sparse; sweet pepperbush (Clethra alnifolia) is the most numerous species. Despite the site being swampy, the herb layer is quite dense in some areas, being dominated by lizard's-tail (Saururus cernuus) and coastal arrow-head (Sagittaria falcata).

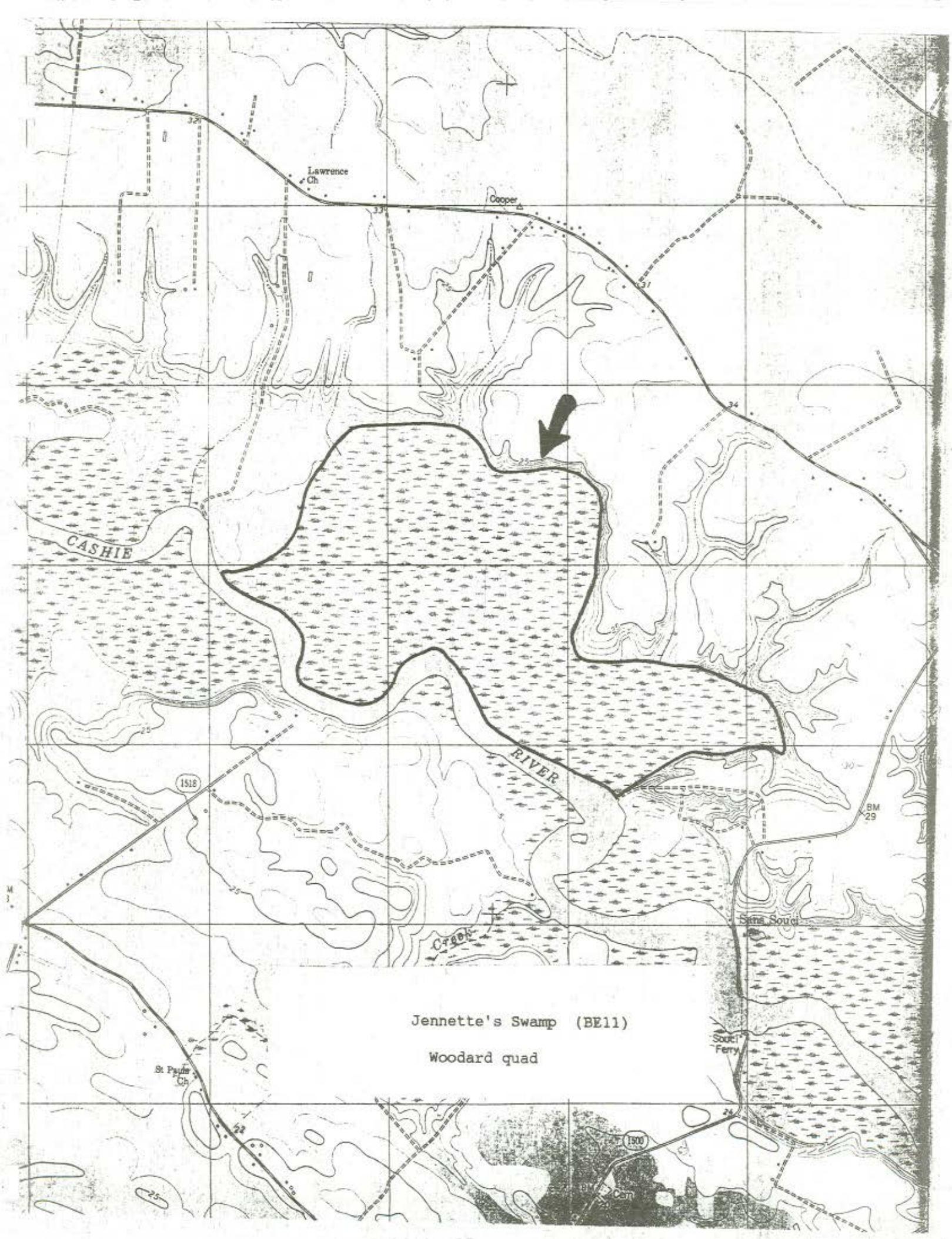
OWNERSHIP: Private; mostly in one ownership

PROTECTION STATUS: No official status. One owner is voluntarily protecting his portion of the swamp.

RECOMMENDATIONS FOR MANAGEMENT OR PROTECTION: Timbering would damage the natural area. This site appears to have had no such disturbances for possibly 75 years. There is some concern for runoff from adjacent farmland. Because of the somewhat small acreage of the swamp forest, and it not being contiguous with other mature stands, the best protection methods are either registry agreements or conservation easements with the owners.

COMMENTS: Further inventory work is suggested for the site. The slopes bordering the swamp are approximately 25 feet high and possibly contain mesic hardwoods of interest; however, the slopes have been cut more recently than the swamp, and much of the uplands are in pine plantations. As indicated earlier, the river does not contain many obvious, distinguishable fluvial features such as levees, ridges, sloughs, and backswamps, despite the width of the floodplain. Thus, the community type is difficult to discern between Small Stream Swamp and Cypress-Gum Swamp, Blackwater subtype.

REFERENCES: Schneider (1989g)


Lawrence Ch
Cooper
CASHIE
RIVER
1518
BM 29
Saint Souci
Creek
St Paul's Ch
South Ferry
1500
Jennette's Swamp (BE11)
Woodard quad

SITE NAME: Clark Estate Bottomland Hardwood Forest

SITE NUMBER: BE12 SIZE: about 155 acres

SITE SIGNIFICANCE: B (State)

LOCATION: Western portion of Bertie County, lying along the Roanoke River just west of Big Swash. The site is approximately 2.5 miles southwest of the end of SR 1128.

QUAD MAP: Palmyra

SIGNIFICANT FEATURES:

1. The hardwood forest is an excellent example of a Coastal Plain Levee Forest, Brownwater subtype. The site is somewhat unusual in that the levee is not narrow, unlike at most other places in floodplains, but it is approximately 1/2-mile wide and becomes a bottomland forest.

GENERAL DESCRIPTION:

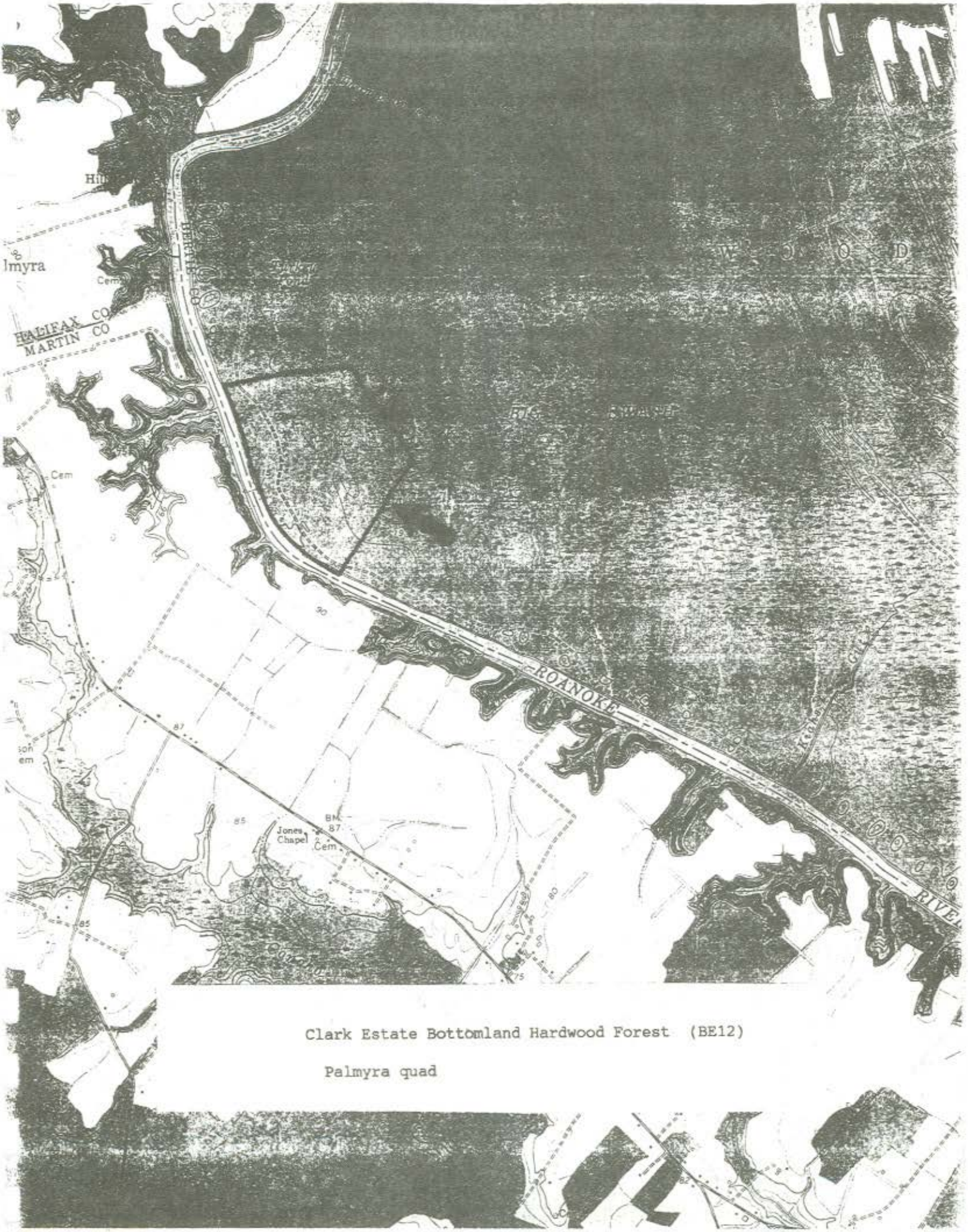
A large westerly bend in the Roanoke River is present in western Bertie County, creating a large neck or peninsula. The natural levee along this bend is unusually wide for a levee, and it reaches 1/2-mile in width west of Big Swash. Unfortunately, most of the levee forests on this neck have been selectively cut or clearcut. However, one tract of over 150 acres is still intact. The entire tract is essentially a bottomland hardwood forest on a very wide natural levee. Most levees along Coastal Plain rivers and creeks are only 100 yards wide or less, with backswamps or ridges and swales immediately behind them. As a result, most bottomland hardwood forests featuring oak canopies occur on slight ridges within the floodplain that were former levees. At the Clark Estate, oaks, especially cherrybark oak (Quercus pagoda), are present in numbers on the levee. Thus, the site has a flora that is a combination of Levee Forest and Bottomland Forest natural communities, of the Brownwater subtype.

The mature canopy, averaging 80 to 100 feet tall, features cherrybark oak as the most numerous tree. Portions of the tract feature this tree as a canopy over common pawpaw (Asimina triloba) in the understory. Other portions feature typical levee species such as American sycamore (Platanus occidentalis) and sugarberry (Celtis laevigata). Giant cane (Arundinaria gigantea) forms dense stands in some areas.

The natural area is very rich in wildlife. The bottomlands of the Roanoke River are generally conceded by wildlife biologists to have among the highest populations of game mammals and breeding bird species of any sites in North Carolina. Wild turkeys (Meleagris gallopavo) are present, as are good populations of woodpeckers and breeding warblers. The "significantly rare" cerulean warbler (Dendroica cerulea) is expected to be present in the breeding season, and the "significantly rare" Mississippi kite (Ictinia mississippiensis) is possibly present.

OWNERSHIP: Private; a single ownership

PROTECTION STATUS: None



Clark Estate Bottomland Hardwood Forest (BE12)

Palmyra quad

RECOMMENDATIONS FOR MANAGEMENT OR PROTECTION: Any timber cutting would be harmful, and the pressure to harvest timber is undoubtedly high, as neighboring tracts have generally been devastated by harvest and converted to pine or hardwood plantations. There is no evidence of logging within the last 50 years, nor has grazing been a problem. The tract is outside of the proposed boundary of the Roanoke River National Wildlife Refuge; however, the U.S. Fish and Wildlife Service does plan to add some sites farther upstream to the refuge. This tract, though isolated by several miles from other proposed acquisitions, would be an excellent addition to the refuge in terms of providing habitat for terrestrial species (as opposed to waterfowl). Another protection option is acquisition by, or lease to, the N.C. Wildlife Resources Commission as a Game Land. Because the tract is under a single ownership, a registry agreement with the N.C. Natural Heritage Program or conservation easement with a private organization are other feasible protection alternatives.

COMMENTS: The major site visit (Lynch and Lynch 1986) occurred in late March, a time that is too early in the season to determine the composition of breeding birds. Site visits in May and June would be needed to gain further knowledge of the fauna and flora of the tract.

REFERENCES: Lynch and Lynch (1986)

SITE NAME: Broadneck Ridge

SITE NUMBER: BE13 SIZE: 2000 acres

SITE SIGNIFICANCE: B (State)

LOCATION: Southwestern portion of Bertie County; located in the Roanoke River floodplain, extending from the river northeastward to where SR 1123 and SR 1122 dead end.

QUAD MAPS: Hamilton, Woodville

SIGNIFICANT FEATURES:

1. The site contains high-quality examples of the following natural communities: Coastal Plain Levee Forest, Brownwater subtype; Cypress-Gum Swamp, Brownwater subtype; Coastal Plain Bottomland Forest, Brownwater subtype; and Coastal Plain Semipermanent Impoundment. Associated geomorphic features include natural levees, point bars, backswamps, and ridge and swale topography (Lynch 1985b).
2. The natural area contains populations of two noteworthy plant species. Stinging nettle (Urtica chamidryoides) is considered "significantly rare" in the state, and Virginia bluebells (Mertensia virginica) is found nowhere else in the North Carolina Coastal Plain.
3. The site has a high wildlife population, especially for wild turkeys (Meleagris gallopavo). The "significantly rare" cerulean warbler (Dendroica cerulea) is present.

GENERAL DESCRIPTION:

Broadneck Ridge lies in the Roanoke River floodplain, which in southwestern Bertie County extends for at least 6 miles in width. A well-developed natural levee, averaging at least 100 yards wide, is present along the river. Behind the levee is a backswamp, and farther from the channel (to the eastern portion of the site) are a series of low ridges and swales.

The soils on the levee are richer (more circumneutral) than those elsewhere in the floodplain. Two rare herbs, both typical of circumneutral soils, are present on the natural levee. Stinging nettle (Urtica chamidryoides), is known in North Carolina, which is at the northeastern edge of its range, from just a few sites on natural levees along the Roanoke River. Virginia bluebells (Mertensia virginica) occurs at scattered sites in the northern Piedmont and northern mountains of the state, but its presence in this natural area is the only known Coastal Plain locale in the state.

Among the common canopy species on the levee are sugarberry (Celtis laevigata), green ash (Fraxinus pennsylvanica), American sycamore (Platanus occidentalis), sweetgum (Liquidambar styraciflua), cherrybark oak (Quercus pagoda), bitternut hickory (Carya cordiformis), and American elm (Ulmus americana). Boxelder (Acer negundo) is the most common understory tree. Numerous in the shrub and understory layers are common pawpaw (Asimina triloba), painted buckeye (Aesculus sylvatica), and spicebush (Lindera benzoin). Woody vines are also abundant, and a diverse herb layer is present also.

The backswamps and swales (sloughs) are vegetated in a Cypress-Gum Swamp community. Water tupelo (Nyssa aquatica) dominates in some areas and is mixed with bald cypress (Taxodium distichum) in other areas. Other numerous canopy trees include swamp cottonwood (Populus heterophylla) and overcup oak (Quercus lyrata); water ash (Fraxinus caroliniana) is common in the understory of the swamps.

The low ridges and alluvial terraces are vegetated in a Coastal Plain Bottomland Forest natural community. The higher and better drained ridges contain cherrybark oak, American beech (Fagus grandifolia), loblolly pine (Pinus taeda), sweetgum, and swamp chestnut oak (Quercus michauxii) in the canopy. The lower ridges contain considerable willow oak (Q. phellos) and laurel oak (Q. laurifolia).

Some of the cypress-gum sloughs have been dammed by beavers, creating Coastal Plain Semipermanent Impoundment natural communities. The canopy is the same as for the cypress-gum sloughs, though standing water is present year-round, providing habitat for certain aquatic animals such as waterfowl that would be rare or absent in the undammed sloughs.

The wildlife value of the site is very high, and wild turkeys (Meleagris gallopavo) are common. The cerulean warbler (Dendroica cerulea) has been found on the tract in the breeding season and undoubtedly nests. This is a rare species in the state, having a small to moderate breeding population along the Roanoke River that is highly disjunct from the population in the state's mountain region.

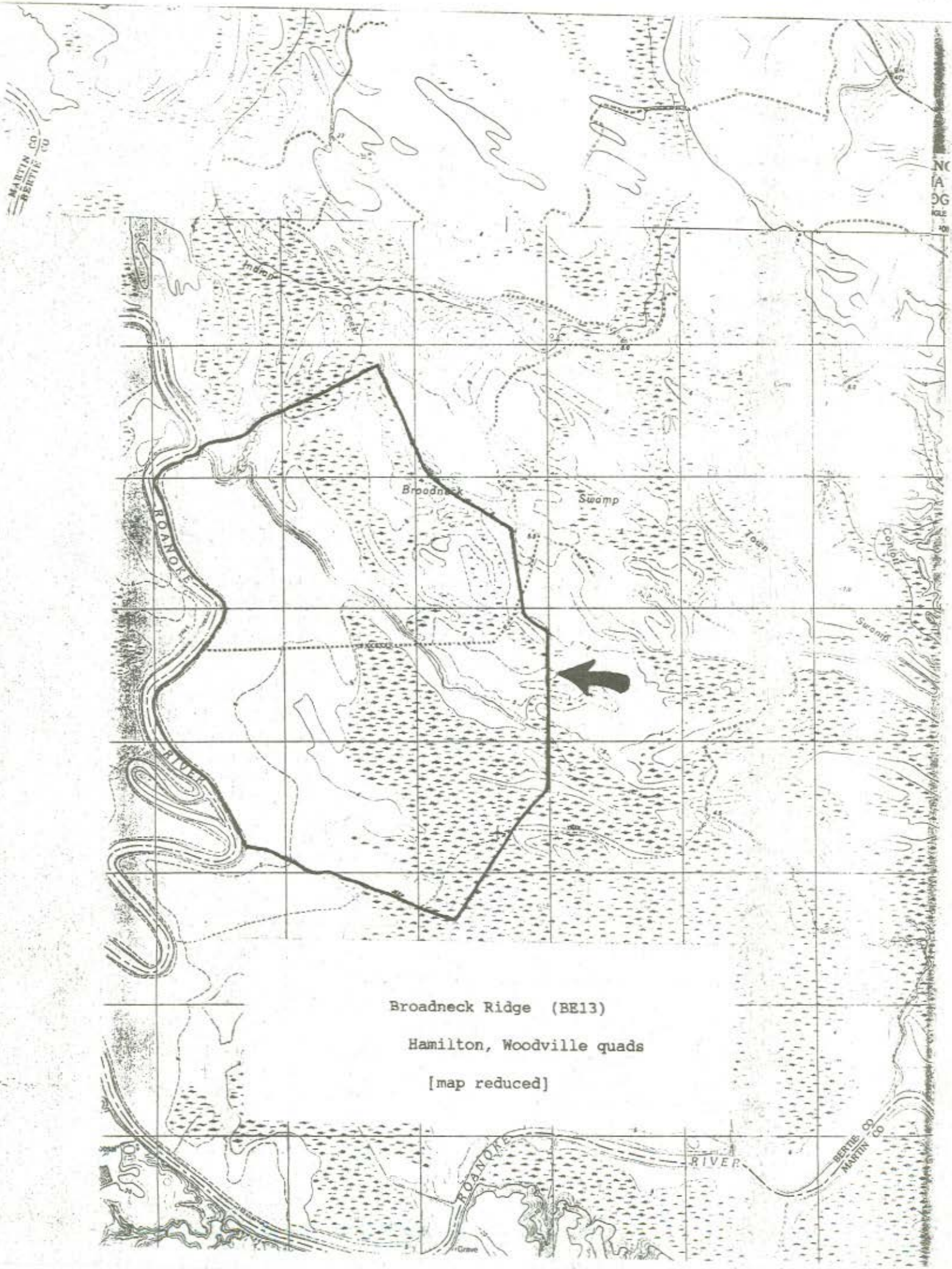
OWNERSHIP: N. C. Wildlife Resources Commission, as of December 1989, but the site is expected to be transferred to the U.S. Fish and Wildlife Service, probably in 1990.

PROTECTION STATUS: Dedicated State Nature Preserve. The site is currently a Wildlife Resource Commission Game Land.

RECOMMENDATIONS FOR MANAGEMENT OR PROTECTION: Approximately 1100 acres of the natural area are considered as "Primary Area" and the remaining 900 acres as "Buffer Area", according to the Dedication Agreement. The Primary Area, considered to be the most mature and highest quality portion of the natural area, is to remain in its natural state. However, the creation of the Roanoke River National Wildlife Refuge in the summer of 1989 will shift the ownership of this natural area from the State to the Federal government. The Dedication will be nullified, but it is hoped that the natural area will be given either a Research Natural Area or Special Interest Area status by the Fish and Wildlife Service.

COMMENTS: The Nature Conservancy purchased the natural area from the True Temper Corporation in 1985; the Wildlife Resources Commission then purchased the site from The Nature Conservancy. The Conservancy surveyed the tract in detail and demarcated the Primary Area and the Buffer Area.

REFERENCES: Lynch (1985b), Earley (1989)



Broadneck Ridge (BE13)

Hamilton, Woodville quads

[map reduced]

SITE NAME: Rascoe Millpond

SITE NUMBER: BE14 SIZE: about 450 acres

SITE SIGNIFICANCE: C (Regional)

LOCATION: Southwestern portion of Bertie County, located along Coniott Creek south of SR 1108, generally west and southwest of SR 1121.

QUAD MAPS: Hamilton, Quitsna

SIGNIFICANT FEATURES:

1. The site contains one of the highest quality millponds in the A/P Study area. The pond contains mature canopy trees, as does the swamp forest both above and below the pond in the floodplain.
2. A fairly narrow band of mature upland forest occurs in the transition zone between upland and wetland at the margin of the floodplain.

GENERAL DESCRIPTION:

This natural area lies in the poorly defined northern portion of the Roanoke River floodplain, in southwestern Bertie County. The floodplain of Coniott Creek is quite narrow (about 0.2-mile wide) and winding, and there is a millpond (Rascoe Millpond) constructed along the creek. The pond is an excellent example of a Coastal Plain Semipermanent Impoundment. The very open, mature canopy consists mainly of pond cypress (Taxodium ascendens) with a scattering of water tupelo (Nyssa aquatica). The subcanopy layer in the pond is very sparse, and the shrubs are found growing mainly on the cypress knees. The surface of the pond is completely covered by duckweed (Lemna spp.). The owners of the pond indicated that the presence of duckweed is a recent phenomenon, apparently a result of fertilizer runoff.

The floodplain above and below the pond is a Coastal Plain Small Stream Swamp, Blackwater subtype. Above the millpond, water tupelo dominates the canopy, whereas below the pond there is a mix of water tupelo, swamp tupelo (N. biflora), pond cypress, red maple (Acer rubrum), and other bottomland species. The canopy is well developed and mature; the subcanopy contains mostly transgressives, especially of red maple. The shrub and herb layers are rather sparse.

The Mesic Mixed Hardwood Forest along the edge of the floodplain is dominated by white oak (Quercus alba), American beech (Fagus grandifolia), tuliptree (Liriodendron tulipifera), and cherrybark oak (Q. pagoda). In the subcanopy are American hornbeam (Carpinus caroliniana), American holly (Ilex opaca), and other species. Giant cane (Arundinaria gigantea) dominates some of the shrub layer in this forest.

OWNERSHIP: Private; apparently a single owner

PROTECTION STATUS: None

RECOMMENDATIONS FOR MANAGEMENT OR PROTECTION: The main management concern is runoff from adjacent agricultural land, especially since the floodplain is narrow and agricultural lands are nearby. The thick bloom of duckweed in the

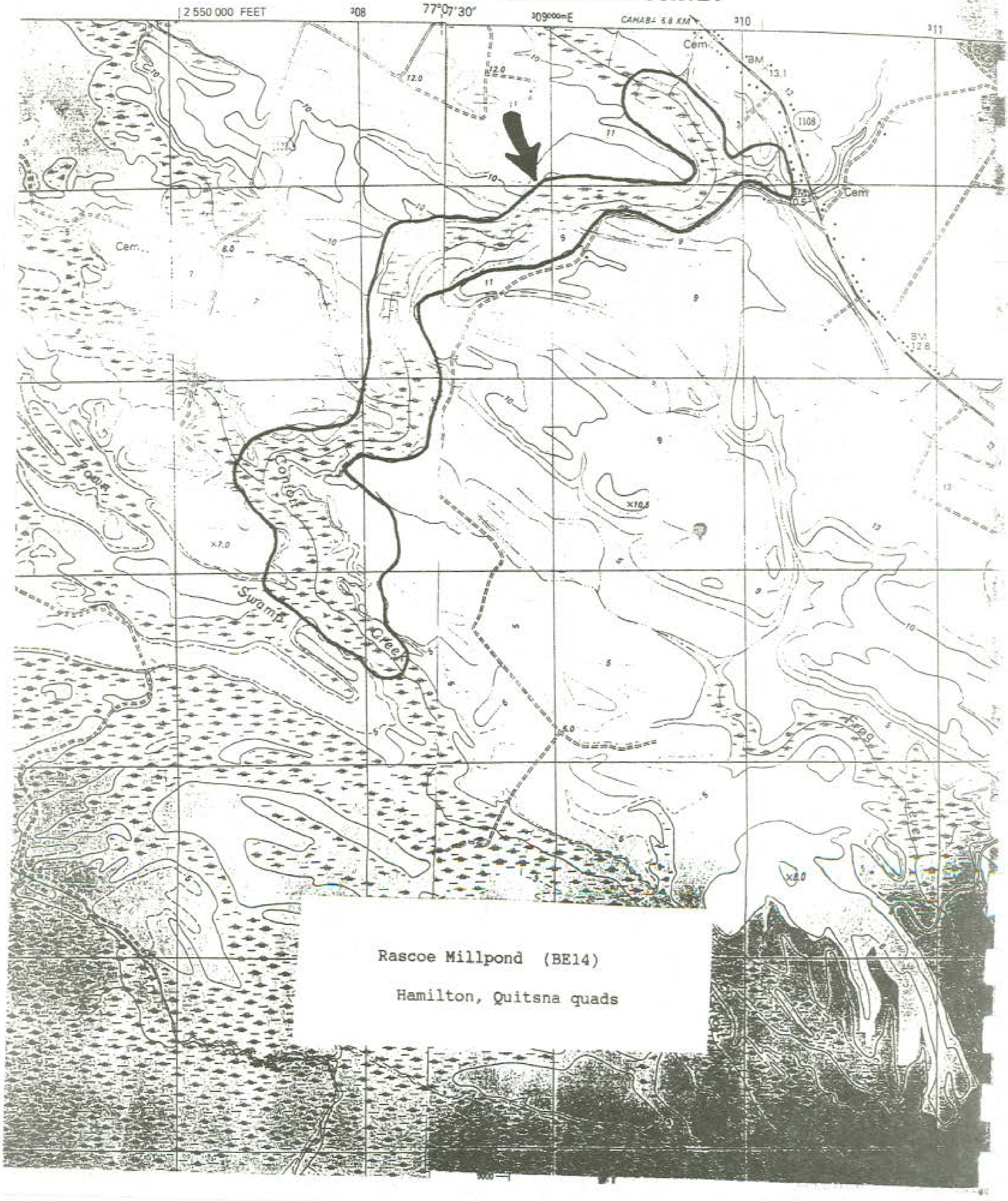
pond might be a result of such runoff. The best protection measure is likely a registry agreement or a conservation easement with the owner. The natural area is not within the proposed boundary of the newly designated Roanoke River National Wildlife Refuge. However, it lies within 2 to 3 miles of both Broadneck Ridge and Company Swamp, properties owned by the N.C. Wildlife Resources Commission that are expected to be traded to the U.S. Fish and Wildlife Service for the creation of the refuge. Thus, acquisition by the Service, or by the Wildlife Commission, are secondary protection measures.

COMMENTS: This site is one of several natural areas or potential natural areas in the floodplain of the Roanoke River in southwestern Bertie County that are not expected to be included within the Roanoke River refuge. Areas to be included in the refuge are primarily swamplands that are good habitat for wintering waterfowl. This is unfortunate, as there are numerous floodplain ridges and sloughs in the vicinity of this natural area (such as Coniott Cherrybark Oak Ridge -- Site BE15) that are in excellent condition and are in need of protection.

REFERENCES: Schneider (1989j)

HAMILTON QUADRANGLE
NORTH CAROLINA
7.5 MINUTE SERIES (TOPOGRAPHIC)
NW/4 WILLIAMSTON 15' QUADRANGLE

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY



Rascoe Millpond (BE14)

Hamilton, Quitsna quads

SITE NAME: Coniott Cherrybark Oak Ridge

SITE NUMBER: BE15 SIZE: about 105 acres

SITE SIGNIFICANCE: B (State)

LOCATION: Southwestern portion of Bertie County; located in Broadneck Swamp, about 1.5 miles south-southeast of the southern end of SR 1122 (just southwest of Coniott Creek).

QUAD MAP: Hamilton

SIGNIFICANT FEATURES:

1. The natural area contains the best example known in North Carolina of a Zone V bottomland hardwood community (see Wharton et al. 1982). Such communities occur on alluvial ridges and upland flats in floodplains.
2. The site undoubtedly contains a high wildlife value because of the abundance of oaks, hickories, and beeches that produce acorns and nuts consumed by animals.

GENERAL DESCRIPTION:

The natural area is a low and narrow fluvial ridge that lies in a west-northwest to east-southeast direction within Broadneck Swamp. The swamp is a large backwater within the floodplain of the Roanoke River. This ridge, one of several in the swamp, is approximately 1.5 miles long and averages 600 feet in width. Surrounding the ridge, which is 4 to 6 feet higher than the adjacent topography, are sloughs that are semi-permanently flooded. Coniott Creek forms the northeastern boundary of the natural area.

The ridge is high and dry enough that two natural communities are present, though intermixed -- the Coastal Plain Bottomland Forest, Brownwater subtype and the Mesic Mixed Hardwood Forest, Swamp Island subtype. The forest on the ridge is a climax one and is dominated by cherrybark oak (Quercus pagoda). Also common on the ridge are swamp chestnut oak (Q. michauxii), sweetgum (Liquidambar styraciflua), and American beech (Fagus grandifolia). A number of additional oak species, plus at least three species of hickories (Carya spp.), are also present. The understory layer contains a mixture of typical bottomland species, such as American hornbeam (Carpinus caroliniana), and mesic upland species, such as flowering dogwood (Cornus florida), American holly (Ilex opaca), and hop hornbeam (Ostrya virginiana). These mesic species, along with trees such as American beech, are typical of the Mesic Mixed Hardwood Forest community, which is less common on such floodplain ridges than is the Bottomland Forest community.

The shrub layer is rather sparse, giving the ridge a park-like appearance. The herb layer is not dense, and it includes a number of ferns, sedges, and grasses. One notable species in the herb layer is lesser ladies' tresses (Spiranthes ovalis), an orchid that is scarce in the state and essentially limited to the Piedmont.

The sloughs that surround the ridge contain a Cypress-Gum Swamp, Brownwater subtype natural community, with bald cypress (Taxodium distichum) and water tupelo (Nyssa aquatica) being the dominant species. Swamp cottonwood (Populus heterophylla) is also numerous.

The animal populations of the site are poorly known. Wild turkeys (Meleagris gallopavo) are present, as they are on many or most Roanoke River floodplain sites; yet the species is rare or uncommon in the state at most other locations.

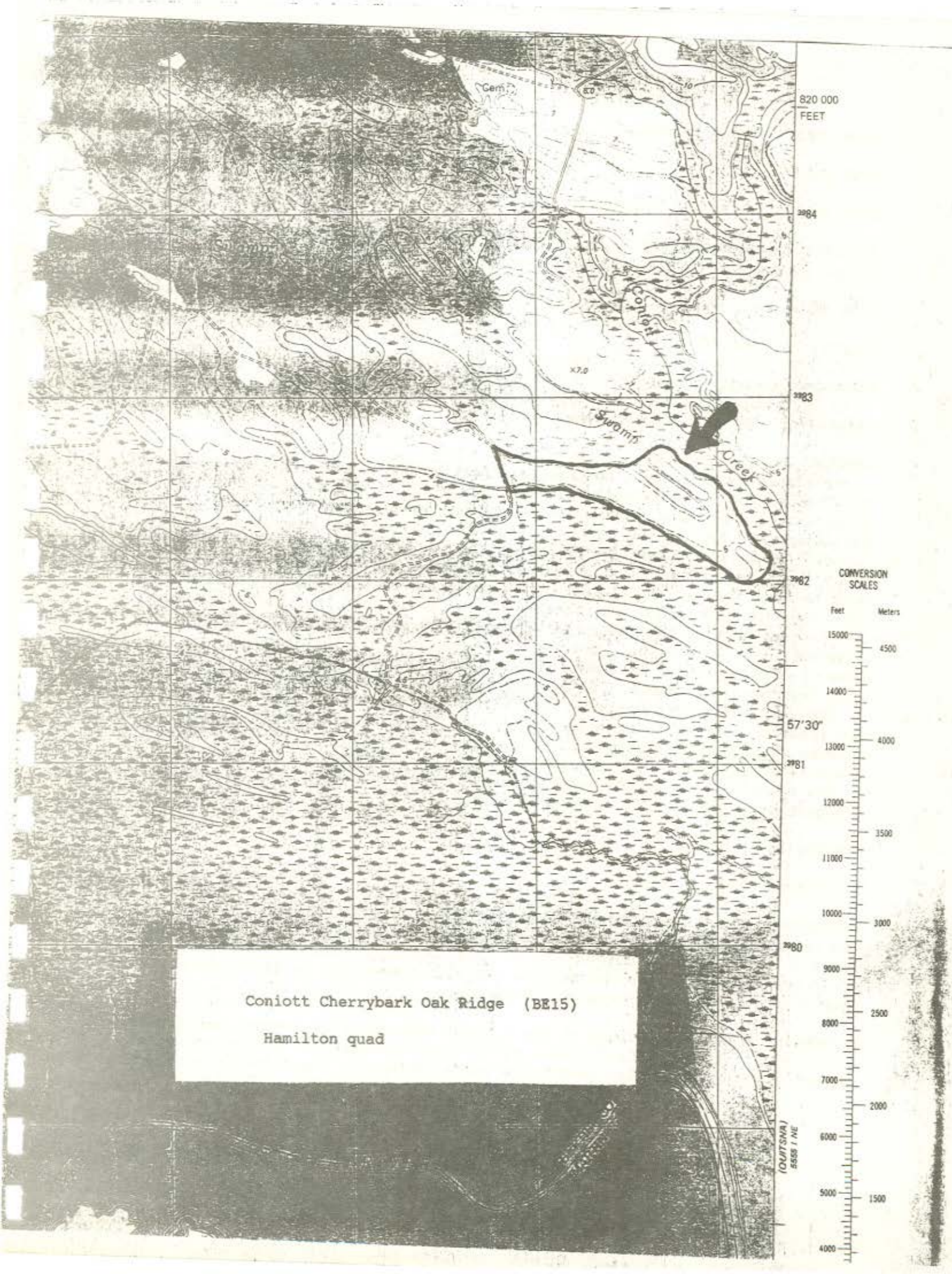
OWNERSHIP: Several private owners

PROTECTION STATUS: None

RECOMMENDATIONS FOR MANAGEMENT OR PROTECTION: This site is contained within the approximately 30,000 acres that is proposed for acquisition by the U.S. Fish and Wildlife Service for the Roanoke River National Wildlife Refuge. It is not certain if the owners would be willing to sell to the Fish and Wildlife Service, but most of the site is owned by a timber company and it is hoped that a gift or a sale could be made to incorporate the site within the refuge. If acquisition by the Fish and Wildlife Service is not achieved, the natural area could be added to the Registry of Natural Heritage Areas and be retained by the owners while, at the same time, voluntarily protecting the land. The natural area should remain in its present, mature state and no timber cutting should be done.

COMMENTS: The N.C. Natural Heritage Program and The Nature Conservancy have contacted at least one owner about the significance of the site and the need to protect the site from timbering.

REFERENCES: LeGrand (1985)



Coniott Cherrybark Oak Ridge (BE15)

Hamilton quad

SITE NAME: Broadneck Swamp

SITE NUMBER: BE16 SIZE: about 2200 acres

SITE SIGNIFICANCE: B (State)

LOCATION: Southwestern portion of Bertie County; located north of the Roanoke River, approximately 3 miles south-southwest of the end of SR 1122.

QUAD MAP: Hamilton

SIGNIFICANT FEATURES:

1. The natural area contains one of the largest and best examples of a backswamp geomorphic landform in North Carolina.
2. The forest in the backswamp is mature and features a Cypress-Gum Swamp, Brownwater subtype natural community.

GENERAL DESCRIPTION:

Broadneck Swamp lies in southwestern Bertie County along the inside curve of a large bend in the Roanoke River. Nearly all of the natural area is a single large backswamp, with a narrow natural levee along the river. Backswamps are typical features of large floodplains, and they receive the floodwaters of the rivers and are the sites for the deposition of the finer, silty or clayey sediments; the coarser sediments are deposited along the river bank to form the natural levees. The levees impede the flow of flood water back into the river once the flooding has subsided, and thus the backswamps are flooded most of the year. In winter and spring, such water depths commonly reach 4 to 8 feet, whereas in summer and fall the swamp may be nearly free of standing water at times. The natural levee at this natural area is well developed and stands 5 to 9 feet higher than the backswamp (Lynch 1981).

The very wet conditions make the swamp unsuitable for growth of all but a few species of trees. The mature canopy is composed essentially of bald cypress (Taxodium distichum) and water tupelo (Nyssa aquatica). The subcanopy contains an abundance of water ash (Fraxinus caroliniana).

The natural levee in the natural area has been selectively cut. It is not a significant feature of the natural area.

OWNERSHIP: Private

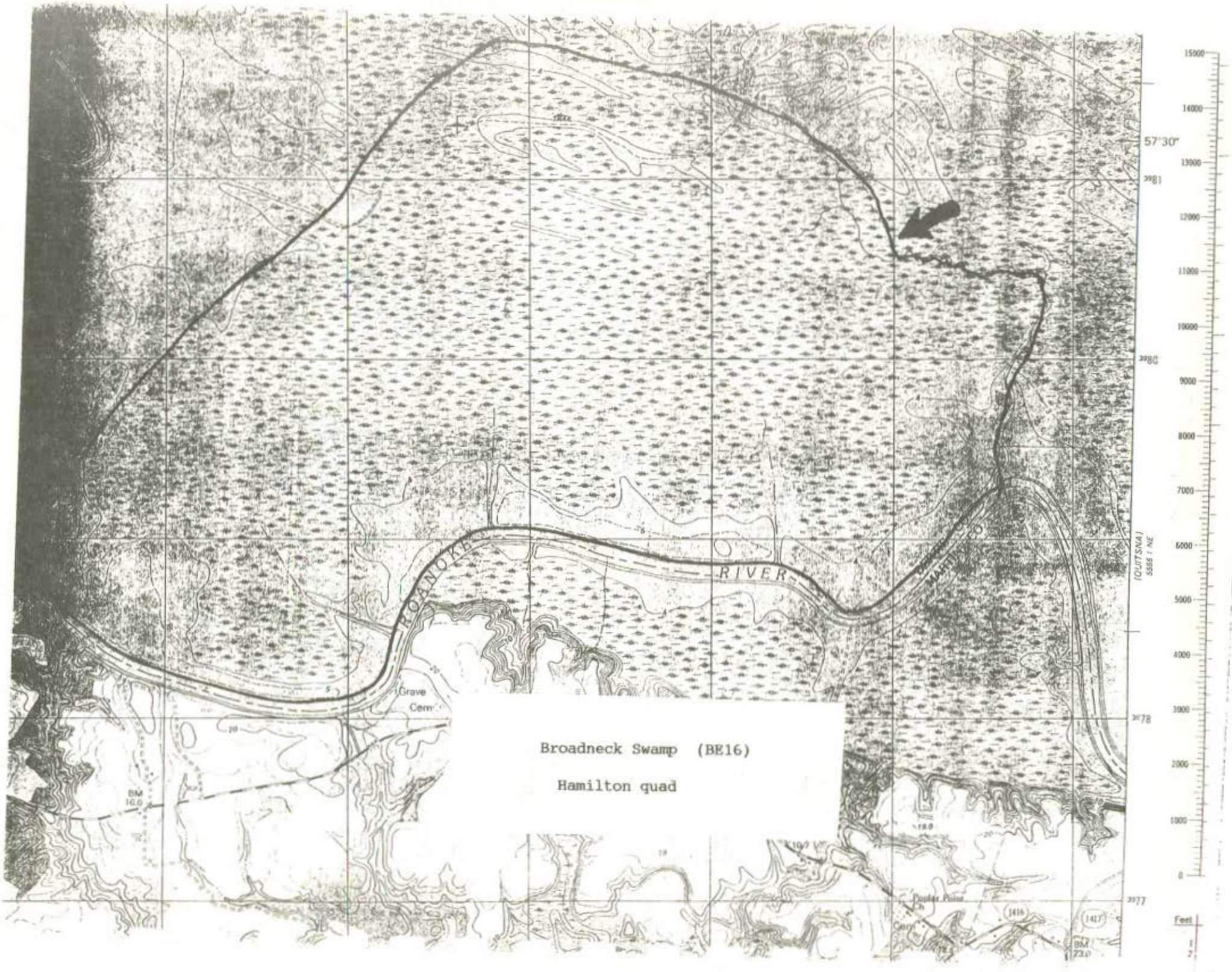
PROTECTION STATUS: None

RECOMMENDATIONS FOR MANAGEMENT OR PROTECTION: This natural area is part of the proposed land acquisition for the Roanoke River National Wildlife Refuge. The U.S. Fish and Wildlife Service is thus hoping to purchase the tract, which is in one ownership, for the refuge. As with almost all hardwood forest tracts, any timber cutting would be harmful.

COMMENTS: A detailed survey of the natural area is still needed, particularly of the flora of the natural levee, where there is expected to be a moderate amount of diversity. Also needed are faunal surveys. The cerulean warbler

(Dendroica cerulea) is likely to occur as a breeder in the natural levee forests, and the Mississippi kite (Ictinia mississippiensis) might also occur. Both are "significantly rare" birds in the state.

REFERENCES: Lynch (1981)



Broadneck Swamp (BE16)

Hamilton quad

SITE NAME: Company Swamp

SITE NUMBER: BE17 SIZE: 1436 acres

SITE SIGNIFICANCE: B (State)

LOCATION: Southwestern portion of Bertie County; located in the Roanoke River floodplain, extending along the river from the southern end of SR 1109 westward for approximately 2.5 miles.

QUAD MAP: Quitsna

SIGNIFICANT FEATURES:

1. The most extensive, climax Cypress-Gum Swamp, Brownwater subtype natural community located in a backswamp in North Carolina occurs in the natural area.
2. The deeply flooded portion of the swamp provides excellent habitat for waterfowl. Several uncommon to rare bird species have been seen in the natural area and are believed to nest, including the "significantly rare" cerulean warbler (Dendroica cerulea).

GENERAL DESCRIPTION:

Company Swamp contains about 4.6 miles of river frontage and is situated on the northern bank of the Roanoke River. The site is dominated by a 700-acre backswamp that is a Cypress-Gum Swamp, Brownwater subtype natural community. The remainder of the site is primarily a natural levee that fronts the river.

The backswamp is one of the best developed ones in the state, and the stand of bald cypress (Taxodium distichum) and water tupelo (Nyssa aquatica) is very mature and likely the finest example of this natural community in a backswamp in North Carolina. The backswamp is semi-permanently flooded and has poor drainage. The bald cypress and water tupelo are essentially the only canopy trees, but water ash (Fraxinus caroliniana) is a common subcanopy tree. The canopy ranges from 70 to 90 feet tall, and diameters of the trees (above the swollen bases) are commonly 16 to 24 inches. The trees are often flooded by 5 to 10 feet of water during the winter and spring.

The levee contains a Coastal Plain Levee Forest, Brownwater subtype natural community. Common canopy species include sugarberry (Celtis laevigata), green ash (Fraxinus pennsylvanica), water hickory (Carya aquatica), American sycamore (Platanus occidentalis), sweetgum (Liquidambar styraciflua), laurel oak (Quercus laurifolia), and American elm (Ulmus americana). Among the understory trees is silver maple (Acer saccharinum), which is somewhat widespread along banks of the Roanoke River but is otherwise a very uncommon tree in North Carolina. The shrub and herb layers are rather dense, with woody vines being prominent. Most portions of the levee were heavily cut-over in 1980, but one section of relatively mature levee forest is present in the southwestern corner of the site.

The backswamp is heavily used by waterfowl in the winter months, and wood ducks (Aix sponsa) also breed commonly. Mallards (Anas platyrhynchos), black ducks (Anas rubripes), and wood ducks are the primary wintering species, among other dabbling ducks. Cerulean warblers (Dendroica cerulea) apparently nest in tall trees on the natural levee.

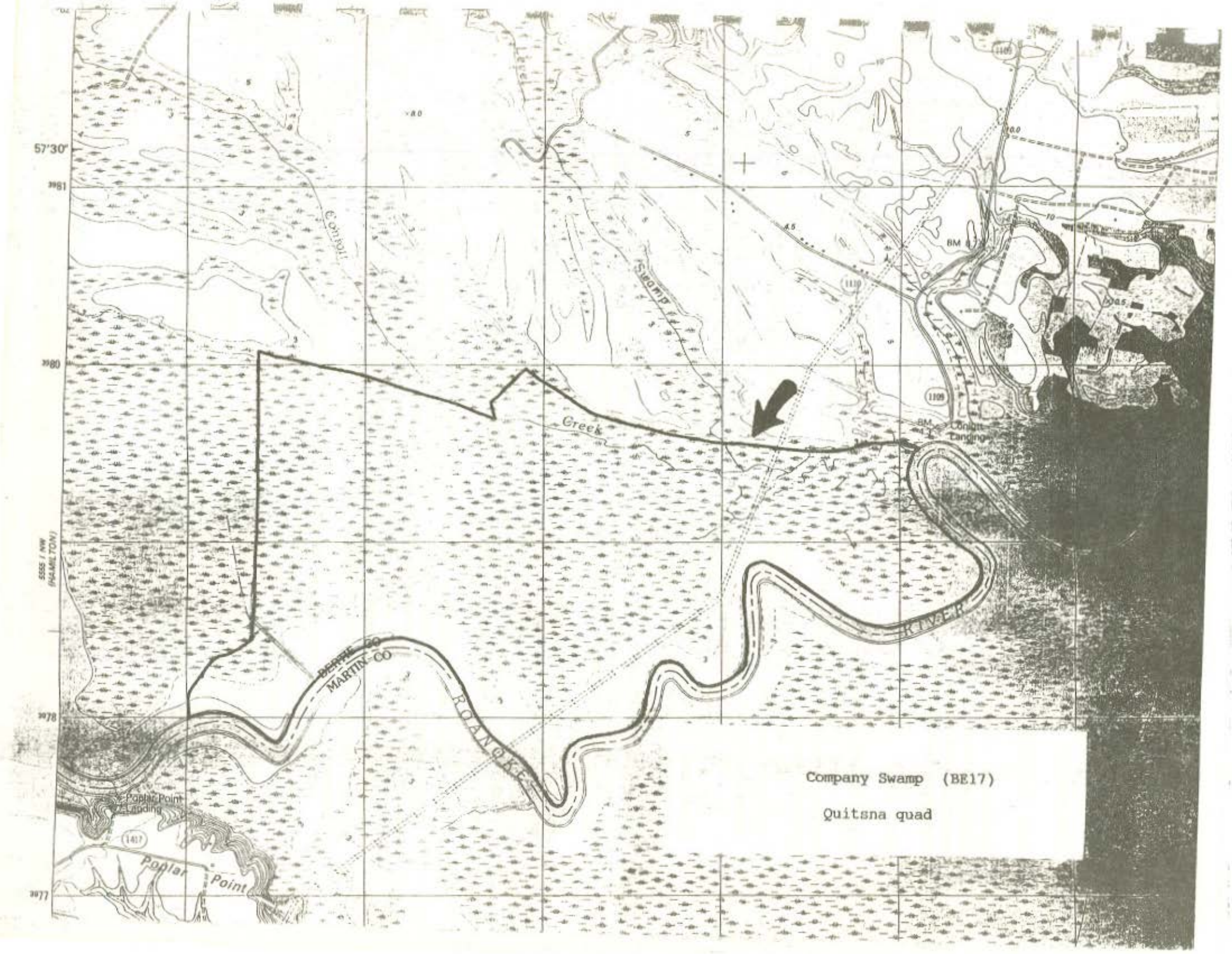
OWNERSHIP: N. C. Wildlife Resources Commission, as of December 1989, but the site is expected to be transferred to the U.S. Fish and Wildlife Service, probably in 1990.

PROTECTION STATUS: Dedicated State Nature Preserve. The site is a Wildlife Resources Commission Game Land.

RECOMMENDATIONS FOR MANAGEMENT OR PROTECTION: Approximately 1030 acres of the natural area are considered as "Primary Area" and the remaining 406 acres as "Buffer Area", according to the Dedication Agreement. The Primary Area, considered to be the most mature and highest quality portion of the natural area, is to remain in its natural state. However, the creation of the Roanoke River National Wildlife Refuge in the summer of 1989 will shift the ownership of this natural area from the State to the Federal government. The Dedication will be nullified, but it is hoped that the natural area will be given either a Research Natural Area or Special Interest Area status by the Fish and Wildlife Service.

COMMENTS: The Nature Conservancy purchased the natural area from the True Temper Corporation in 1985; the Wildlife Resources Commission then purchased the site from The Nature Conservancy. Portions of the natural area have been paid for by the Nongame and Endangered Wildlife Program (within the Wildlife Resources Commission) and by an N.C. Department of Transportation mitigation bank. The Conservancy surveyed the tract in detail and demarcated the Primary Area and the Buffer Area.

REFERENCES: Lynch (1985c), Earley (1989)



Company Swamp (BE17)

Quitsna quad

SITE NAME: Conine Island

SITE NUMBER: BE18 SIZE: 3748 acres

SITE SIGNIFICANCE: B (State)

LOCATION: Southern portion of Bertie County; located in a meander of the Roanoke River, across the river from Williamston, with the river forming the western, southern, and eastern boundaries and Conine Creek forming the northern boundary.

QUAD MAPS: Quitsna, Windsor South, Williamston, Jamesville

SIGNIFICANT FEATURES:

1. The natural area contains good, and extensive, examples of Cypress-Gum Swamp, Brownwater subtype and Coastal Plain Levee Forest, Brownwater subtype natural communities.
2. The area is excellent habitat for wildlife species, especially waterfowl and the larger mammals. Black bears (Ursus americanus) occur occasionally in the area.
3. The site contains the largest inland heronry in North Carolina.
4. A variety of rare to uncommon plants are present in the openings of the floodplain forest alongside US 13-17. The "significantly rare" multiflowered mud-plantain (Heteranthera multiflora) has been reported from the site.

GENERAL DESCRIPTION:

Conine Island lies in a large southerly meander of the Roanoke River. A distributary stream -- Conine Creek -- cuts across this meander on the north side to form an island. The natural area contains 9.75 miles of river frontage along the Roanoke River. Because the site is farther downstream than Broadneck Ridge (Site BE13) and Company Swamp (Site BE17), the topography is more subdued and the natural levee is less prominent than farther upstream. Flooding of the entire site is common, though the levee remains flooded for less time than does the very extensive backswamp, which comprises the bulk of the site.

The backswamp contains a Cypress-Gum Swamp community, with water tupelo (Nyssa aquatica) and bald cypress (Taxodium distichum) composing essentially the entire canopy. Red maple (Acer rubrum) and water ash (Fraxinus caroliniana) form the rather sparse understory. Ground cover is sparse to locally dense, with sedges (Carex spp.), false nettle (Boehmeria cylindrica), lizard's-tail (Saururus cernuus), and smartweeds (Polygonum spp.) being numerous.

The natural levees along the Roanoke River and Conine Creek contain a Coastal Plain Levee Forest natural community. Also, floodplain flats occur within the backswamp that are slightly higher than the swamp. These flats contain a mixture of Levee Forest and Coastal Plain Bottomland Forest communities. These forests feature more hydric species than do the levees farther upstream, since they are less well developed and flood more frequently. Water hickory (Carya aquatica), overcup oak (Quercus lyrata), green ash (Fraxinus pennsylvanica), sweetgum (Liquidambar styraciflua), American elm (Ulmus americana), and laurel oak (Q. laurifolia) are characteristic canopy species.

The understory is well developed, and woody vines are very common; numerous among the vines are crossvine (Bignonia capreolata), peppervine (Ampelopsis arborea), wild grape (Vitis sp.), rattan vine or supplejack (Berchemia scandens), and trumpet creeper (Campsis radicans). The ground cover is also fairly dense, with several species of sedges and grasses, such as giant cane (Arundinaria gigantea), being frequent.

Openings created by the highway (US 13-17) right-of-way that bisects the natural area contain a number of rare or uncommon plants that perhaps require partial sunlight for existence. Notable are honeyvine (Cynanchum laeve), smooth hedgenettle (Stachys tenuifolia), bur cucumber (Sicyos angulatus), and halberd-leaved marsh mallow (Hibiscus militaris). The "significantly rare" multiflowered mud-plantain (Heteranthera multiflora) has been reported from Conine Creek near the highway.

Because of the large size of the tract, Conine Island provides habitat for large mammals that might be rare or absent on smaller tracts. White-tailed deer (Odocoileus virginianus) are very common, and the black bear (Ursus americanus), bobcat (Lynx rufus), river otter (Lutra canadensis), and beaver (Castor canadensis) are known to occur. The largest presently known heronry in inland North Carolina occurs on Conine Island. About 200 pairs each of great blue herons (Ardea herodias) and great egrets (Casmerodius albus) are known to nest. Recent sightings of Cattle Egrets (Bubulcus ibis) in pastures near the river have led to the belief that this species might also be nesting on Conine Island or in other heronries along the river.

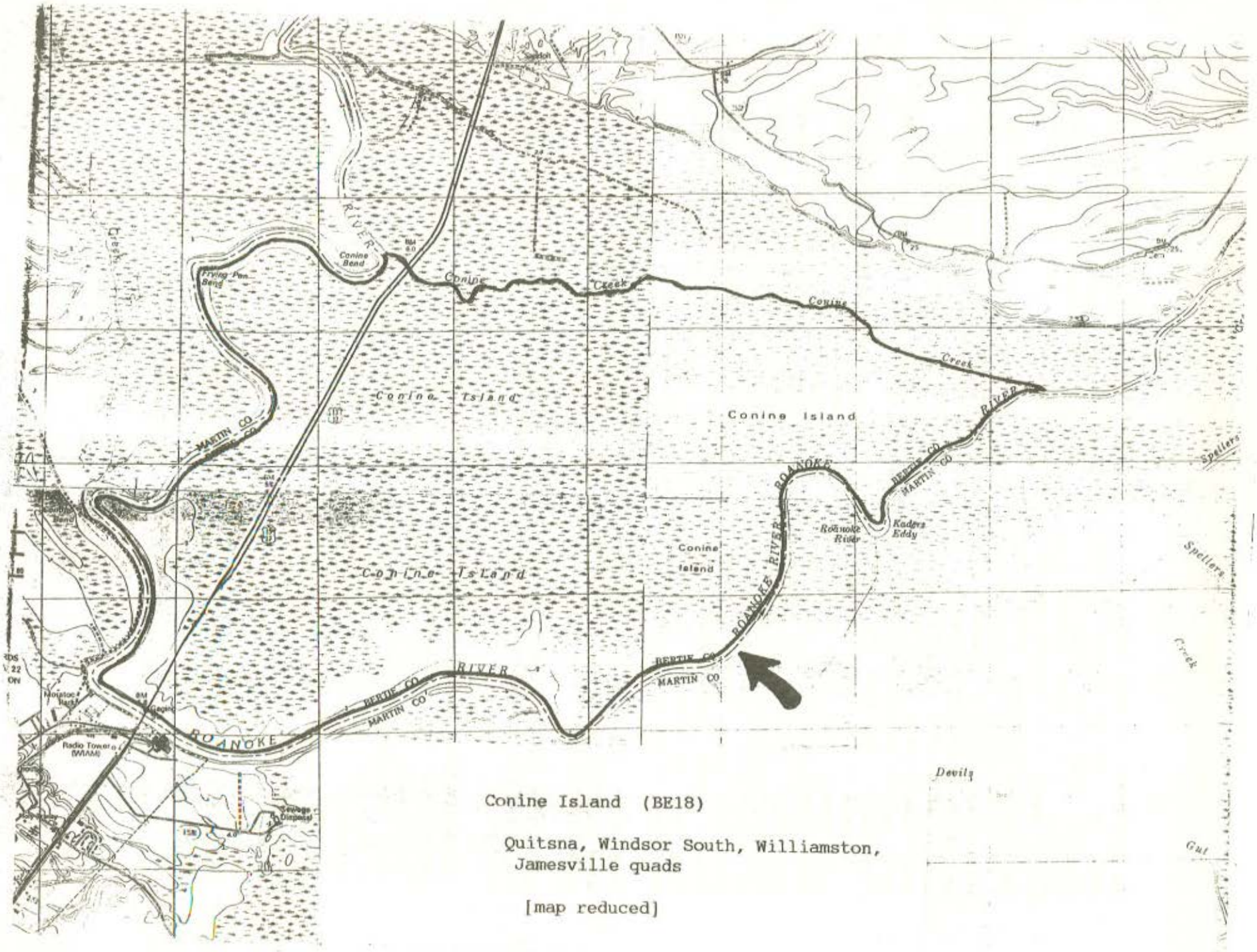
OWNERSHIP: N.C. Wildlife Resources Commission, as of December 1989, but the site is expected to be transferred to the U.S. Fish and Wildlife Service, probably in 1990.

PROTECTION STATUS: The site has been proposed as a Dedicated State Nature Preserve, but no official designation has been made. The area is a State Game Land.

RECOMMENDATIONS FOR MANAGEMENT OR PROTECTION: Approximately 2748 acres of the natural area are considered as "Primary Area" and the remaining 1000 acres as "Buffer Area", according to the proposed dedication agreement. The Primary Area, considered to be the most mature and highest quality portion of the natural area, is to remain in its natural state. However, the creation of the Roanoke River National Wildlife Refuge in the summer of 1989 will shift the ownership of this natural area from the State to the Federal government. The Dedication will be nullified, but it is hoped that the natural area will be given either a Research Natural Area or Special Interest Area status by the Fish and Wildlife Service.

COMMENTS: The Nature Conservancy purchased the natural area from the True Temper Corporation in 1985; the Wildlife Resources Commission then purchased the site from The Nature Conservancy. The Conservancy surveyed the tract in detail and demarcated the Primary Area and the Buffer Area.

REFERENCES: Lynch (1985d)



Conine Island (BE18)

Quitsna, Windsor South, Williamston, Jamesville quads

[map reduced]

SITE NAME: Broad Creek Neck

SITE NUMBER: BE19 SIZE: about 8000 acres

SITE SIGNIFICANCE: B (State)

LOCATION: Southeastern portion of Bertie County; located inside a wide bend of the Roanoke River, opposite the river from Jamesville. The area is bounded by the river on all sides except the north, and it extends northward to Cut Cypress Creek and the mouth of Broad Creek.

QUAD MAPS: Jamesville, Plymouth West

SIGNIFICANT FEATURES:

1. The natural area contains very likely the largest extent of cypress-gum forest in North Carolina.
2. The 8000-acre tract has no evidence of roads, canals, or other man-made disturbances and can be considered a "wilderness area".

GENERAL DESCRIPTION:

Broad Creek Neck lies in the inside curve of a large bend of the Roanoke River, in the lower portion of the river's floodplain. The neck is technically an island, as Cut Cypress Creek flows from one meander bend to another in the river to cut off the neck from areas to the north. Roanoke River and Cut Cypress Creek are brownwater streams carrying much sediment. However, Broad Creek, which drains the neck and flows into the Roanoke River, is a blackwater stream until it meets Cut Cypress Creek, whereby it becomes laden with the sediments carried by the latter creek and becomes visibly brownwater (as seen from the air).

The entire neck contains a mature Cypress-Gum Swamp, Brownwater subtype natural community. The forest is composed of bald cypress (Taxodium distichum), water tupelo (Nyssa aquatica), and swamp tupelo (N. biflora). The majority of the area consists of a mix of the first two species. The predominant understory tree is water ash (Fraxinus caroliniana). There is relatively little shrub layer, but the streams do contain floating and submergent aquatic herbs. The forest is inundated by floodwater most of the year.

OWNERSHIP: Private

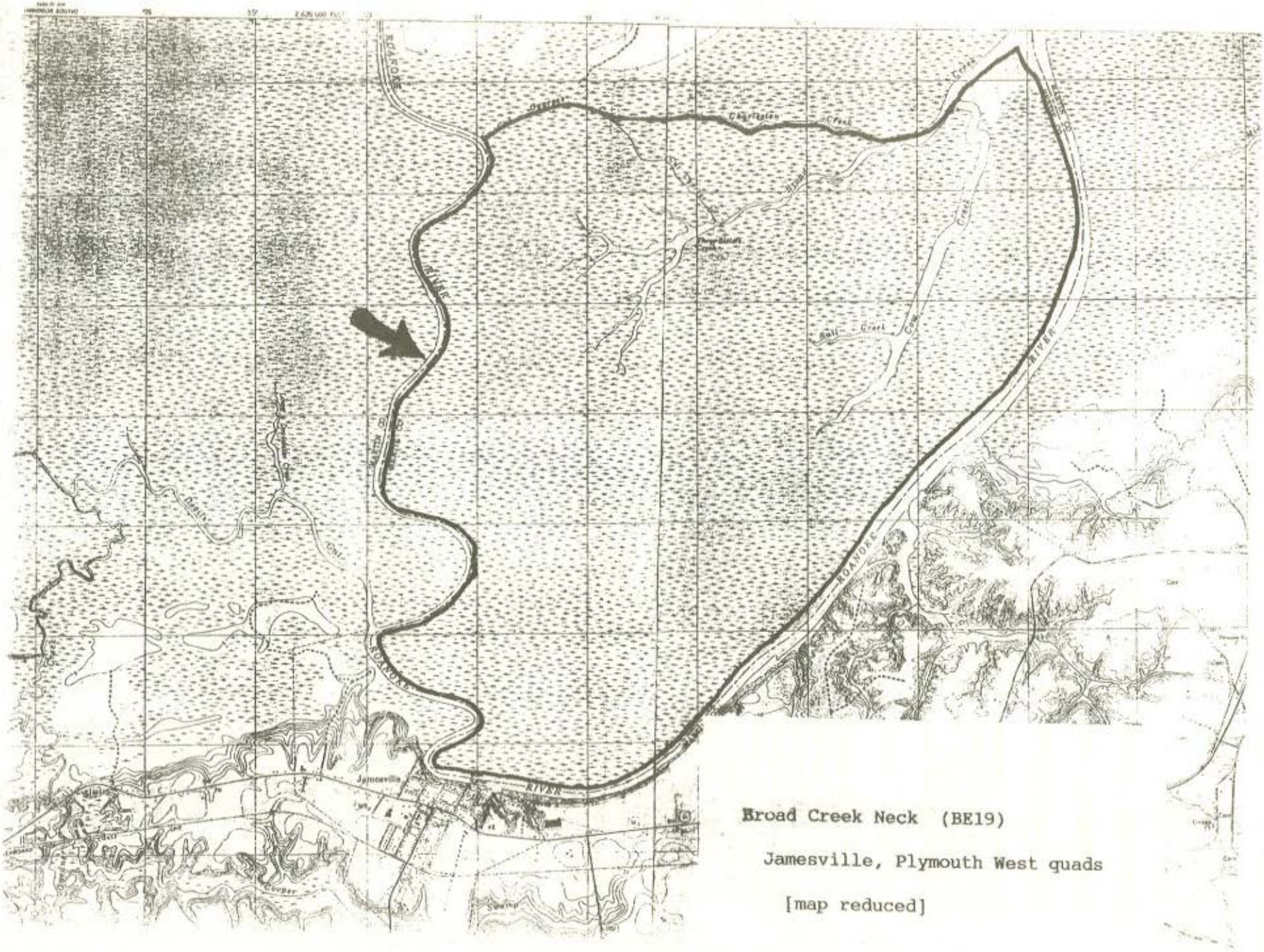
PROTECTION STATUS: None

RECOMMENDATIONS FOR MANAGEMENT OR PROTECTION: No disturbances should be allowed in the natural area, as there are presently no signs of human disturbance. This extensive tract is surprisingly not in the acquisition plans for the Roanoke River National Wildlife Refuge. The refuge is being established to provide wintering habitat for waterfowl, and this swamp is not heavily utilized by these birds. The scarcity of waterfowl is apparently due to the constantly flooded conditions, and herbaceous plants fed upon by waterfowl are not able to become established. Suitable swamps and wetlands for waterfowl foraging must have emergent or submergent vegetation, and swamps

that are dry for parts of the year allow such plants to establish a "footing". Nonetheless, the site is such an extensive roadless area and important natural area that the U.S. Fish and Wildlife Service should look into acquisition of the site as an addition to the refuge.

COMMENTS: A detailed inventory of the natural area has not been made, and essentially all field work has been conducted by boat or from a plane. The area north of the natural area has been logged within the last 10 to 20 years.

REFERENCES: Lynch (1981)



Broad Creek Neck (BE19)

Jamesville, Plymouth West quads

[map reduced]

SITE NAME: Roanoke River Delta Islands

SITE NUMBER: BE20 SIZE: about 9000 acres

SITE SIGNIFICANCE: B (State)

LOCATION: Southeastern portion of Bertie County; located near the mouth of the Roanoke River, lying between the Cashie River on the north, the Thoroughfare on the west, and the Roanoke River on the south. The natural area includes Great, Goodman, Huff, and Rice islands.

QUAD MAPS: Woodard, Westover, Plymouth West, Plymouth East

SIGNIFICANT FEATURES:

1. The natural area contains an extensive cypress-gum swamp forest that is a combination of at least 3 natural communities -- Tidal Cypress-Gum Swamp; Cypress-Gum Swamp, Brownwater subtype; and Cypress-Gum Swamp, Blackwater subtype. In addition, Goodman Island contains many bay forest species and is somewhat pocosin-like, an unusual feature for the Roanoke River system. This bay forest may be due to the fact that Cashie River is a blackwater stream, with very acidic waters, as opposed to the Roanoke River, which is a brownwater stream with a high mineral and sediment load and less acidic waters.
2. The islands are known for a wide variety of wildlife including the black bear (Ursus americanus) and an excellent number of waterfowl. Freshwater fishing is also an important recreational activity in the natural area.

GENERAL DESCRIPTION:

Great, Goodman, Huff, and Rice islands are located in the "delta" of the lower Roanoke River. They lie north of the Roanoke and south of the Cashie River, and distributaries of these rivers have created islands in the combined floodplain of the two rivers. Goodman Island lies just east of the mouth of the Cashie River, alongside Rice Island (to the east). Great Island lies alongside Huff Island (to the east) and is farther upstream of Goodman Island.

The Roanoke River is a brownwater stream with a high sediment load and relatively low acidity water, and it originates in the mountains of Virginia and North Carolina. The Cashie River, on the other hand, originates in the Coastal Plain in northwestern Bertie County, and it is a blackwater stream with relatively silt-free acidic waters. This mixing of waters in the vicinity of the natural area causes a mixture of several canopy types. However, bald cypress (Taxodium distichum), water tupelo (Nyssa aquatica), and swamp tupelo (N. biflora) are the dominants. Red maple (Acer rubrum) and water ash (Fraxinus caroliniana) are the common understory trees. The trees are not exceptionally large, when compared to natural areas farther upstream, though the canopy height is in the 60 to 70 foot range.

Goodman Island contains a notable mixture of bay/pocosin species mixed with the typical deciduous tree species. Sweetbay (Magnolia virginiana) and redbay (Persea borbonia) are present, along with a dense, evergreen shrub layer.

The area has a high wildlife value, and it provides the best black bear (Ursus americanus) habitat remaining in the Roanoke River floodplain. Waterfowl are plentiful, including nesting wood ducks (Aix sponsa). The

streams are locally renowned for freshwater fishing; abundant fish species include warmouth (Lepomis gulosus), pumpkinseed (L. gibbosus), redbreast sunfish (L. auritus), redear sunfish (L. microlophus), and flier (Centrarchus macropterus), among others. Seasonally high numbers of striped bass (Morone saxatilis), white perch (M. americana), and blueback herring (Alosa aestivalis) also are present (N.C. Wildlife Resources Commission 1983).

OWNERSHIP: Goodman Island and most of Great Island, totalling 4481 acres, is owned by the N.C. Wildlife Resources Commission, as of December 1989, but the site is expected to be transferred to the U.S. Fish and Wildlife Service, probably in 1990. Huff and Rice islands are privately owned.

PROTECTION STATUS: The State-owned portions are presently a Dedicated State Nature Preserve and are Wildlife Resources Game Lands.

RECOMMENDATIONS FOR MANAGEMENT OR PROTECTION: The Dedication Agreement calls for the entire acreage (4881 acres) to be left in its present state; no active management will be allowed. However, the creation of the Roanoke River National Wildlife Refuge in the summer of 1989 will shift the ownership of this natural area from the State to the Federal government. The Dedication will be nullified, but it is hoped that the natural area will be given either a Research Natural Area or Special Interest Area status by the Fish and Wildlife Service.

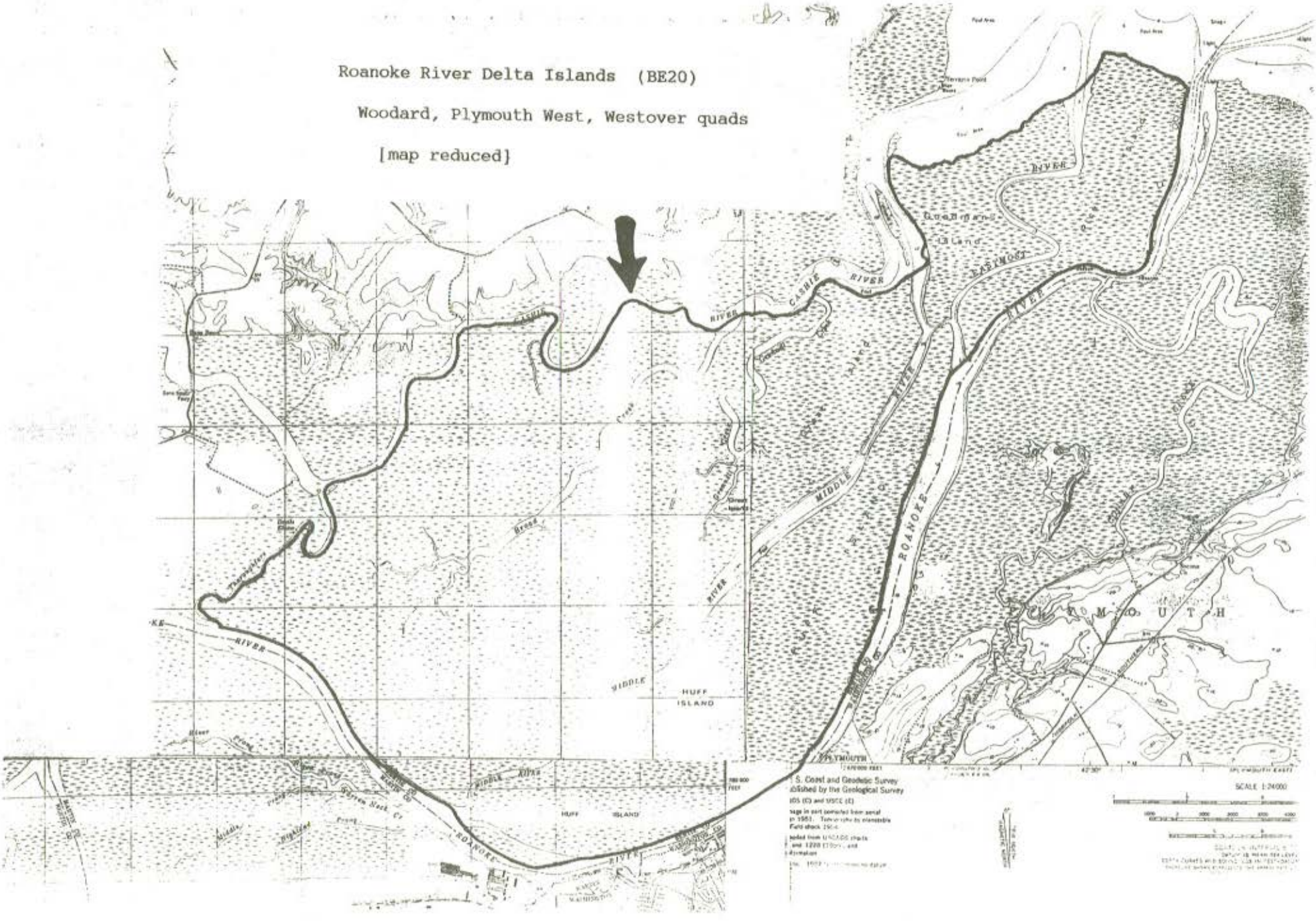
COMMENTS: The Nature Conservancy purchased all of Goodman Island and approximately 80% of Great Island in 1983 from Lyme Timber Company, and they transferred the natural area to the N.C. Wildlife Resources Commission in 1984. The remaining 20% of Great Island (the western portion of the island) is still apparently in private ownership. The adjacent islands -- Rice and Huff -- are apparently equally important as natural areas and are presumed to be in private, unprotected ownership. The privately-onwed portions of this natural area are not within the proposed refuge boundaries, and thus the U.S. Fish and Wildlife Service will apparently not seek acquisition of such areas. However, the Wildlife Resources Commission might wish to seek protection for Huff and Rice islands, if a Federal agency does not offer protection.

REFERENCES: Lynch (1981), N.C. Wildlife Resources Commission (1983), Tingley (1985), U.S. Fish and Wildlife Service (1988), Earley (1989)

Roanoke River Delta Islands (BE20)

Woodard, Plymouth West, Westover quads

[map reduced]



SITE NAME: Roanoke River/NC 11 Alluvial Flats

SITE NUMBER: MA2 SIZE: about 1850 acres

SITE SIGNIFICANCE: B (State)

LOCATION: Roanoke River floodplain in Martin and Bertie counties; located on both sides of NC 11-42 in northwestern Martin County and adjacent southwestern Bertie County, extending northward to SR 1126 (Bertie) and southward to terrace walls at the edge of the Roanoke River floodplain.

QUAD MAPS: Woodville, Hamilton

SIGNIFICANT FEATURES:

1. Portions of the natural area feature perhaps the best examples of Alluvial Flats fluvial landforms/community types in North Carolina. Examples of backswamps, natural levees, sloughs, and ridges are also present in the floodplain.
2. The mature hardwood forest features an excellent diversity of canopy trees, perhaps owing to the many subtle changes in elevation and landforms in the floodplain. Most of the area is a Coastal Plain Bottomland Forest, Brownwater subtype natural community.
3. The area has a high wildlife value, and the "significantly rare" cerulean warbler (Dendroica cerulea) is present in summer.

GENERAL DESCRIPTION:

The floodplain of the Roanoke River is nearly 5 miles wide in southwestern Bertie and northwestern Martin counties. Where NC 11-42 crosses the floodplain, an extensive forest is present that is in excellent condition, especially that on the Martin County side of the river. Although a scan of the topographic maps (Woodville and Hamilton) seem to indicate that the floodplain along the road is almost entirely a backswamp, such is not the case. There are several sloughs oriented in a northwest-southeast direction that cross the road. However, most of the area in Martin County is slightly higher in elevation and functions as an Alluvial Flat, even though technically it may be a backswamp that floods only at infrequent intervals, so that water does not stand on the floor for more than a few days or weeks at a time. A natural levee is present on both banks of the river. In Bertie County, there is a well-developed relict ridge, but it is traversed by SR 1126 and thus shows some disturbance.

The natural levee features typical canopy trees such as sugarberry (Celtis laevigata) and green ash (Fraxinus pennsylvanica), along with silver maple (Acer saccharinum), which is uncommon in North Carolina but is fairly frequent on Roanoke River levees. The slightly drier portions of the floodplain (alluvial flats) contain a large number of canopy species with no dominants. Water hickory (Carya aquatica) is common. Both eastern cottonwood (Populus deltoides) and swamp cottonwood (P. heterophylla) are present and grow side-by-side, a rather unusual situation in the state. American elm (Ulmus americana), overcup oak (Quercus lyrata), swamp chestnut oak (Q. michauxii), cherrybark oak (Q. pagoda), and box elder (Acer negundo) are other trees present. Common pawpaw (Asimina triloba) is numerous in the shrub layer.

Along the sloughs grow bald cypress (Taxodium distichum), water tupelo (Nyssa aquatica), sweetgum (Liquidambar styraciflua), and red maple (Acer rubrum), among other species. The somewhat higher ridge in Bertie County, east of NC 11-42, contains more mesic species such as willow oak (Quercus phellos), cherrybark oak, American beech (Fagus grandifolia), and white oak (Q. alba). Alluvial flats west of NC 11-42 in Bertie County feature an abundance of willow oak.

Wildlife values of the forest are undoubtedly high. Wild turkeys (Meleagris gallopavo) are present. The most noteworthy animal known from the site is the "significantly rare" cerulean warbler (Dendroica cerulea), which inhabits tall trees along the river, generally in natural levees forests.

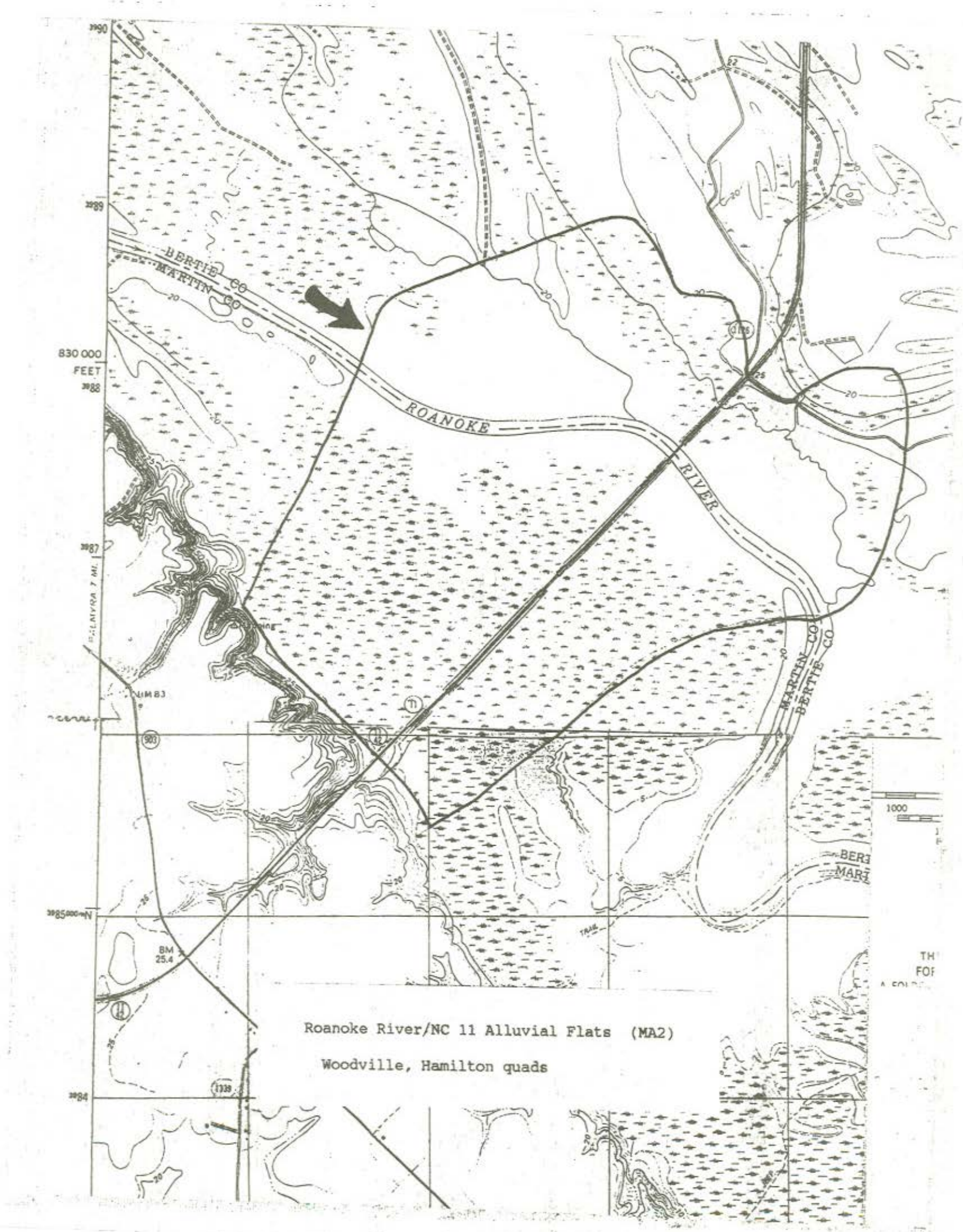
OWNERSHIP: Private; most of the natural area in Martin County is in a single ownership.

PROTECTION STATUS: None

RECOMMENDATIONS FOR MANAGEMENT OR PROTECTION: No management of the natural area is necessary, and timber cutting should not be allowed. The proposed acquisition boundary for the Roanoke River National Wildlife Refuge included most of the natural area, as illustrated in the Final Environmental Assessment (U.S. Fish and Wildlife Service 1988). However, the refuge plan approved by Governor James Martin removes all of the Martin County land from Federal acquisition. A map in local newspapers dated August 11, 1989 show that possibly portions of the Bertie County forests at this site would be acquired by the Fish and Wildlife Service for the refuge, and that possibly portions of the Martin side would be acquired by the Wildlife Service to give to the State of North Carolina as a Game Land. The newspaper maps, however, show little detail. At any rate, it is essential that all of the Martin County portion of the natural area be protected, whether as a Game Land (the most feasible alternative), a nature preserve managed or owned by a private conservation group, or a registered Natural Heritage Area.

COMMENTS: The extent of the natural area away from the highway is poorly known. Fairly mature forests extend to the north of the boundaries shown on the map, but these forests are interspersed with agricultural fields and do not form extensive tracts of 500 or more acres. It is puzzling why this natural area was not included in Lynch's (1981) inventory of the natural areas along the Roanoke River.

REFERENCES: LeGrand (1989a)



Roanoke River/NC 11 Alluvial Flats (MA2)

Woodville, Hamilton quads

Figure 9. Significant natural areas in Camden County. The areas are numbered generally in a north to south, or west to east, manner; see Table 7 and the Inventory of Sites section for further information. The portions of the map indicated in stripes are believed to contain significant natural areas, but they are not included in the inventory.

CA2
CA3
CA1
CA4
CA5
CA6
CA7

SITE NAME: Great Dismal Swamp National Wildlife Refuge

SITE NUMBER: CA1 SIZE: about 24,600 acres

SITE SIGNIFICANCE: A (National)

LOCATION: Northeastern Gates County, extreme northern Pasquotank County, and northwestern Camden County; specifically, bounded on the east by US 17, bounded partly on the south by US 158, and bounded on the west by the Suffolk Scarp. The refuge also extends into adjacent Virginia.

QUAD MAPS: Corapeake, Sunbury, Lynchs Corner, Lake Drummond

SIGNIFICANT FEATURES:

1. The refuge contains some of the most extensive swamp forests on the Atlantic Coastal Plain, though the majority of the forests are not mature.
2. Several extensive stands of Atlantic white cedar (Chamaecyparis thyoides) occur on the refuge; stands of this tree have been and are being logged at a rapid rate in North Carolina, and few protected sites still remain. The stands on the refuge constitute the largest remaining body of white cedar anywhere.
3. Within the swamp forest are a few pocosin/shrub bogs. Also adding diversity to the refuge, on the North Carolina side, are several mesic "islands" of high ground in the southwestern portion of the refuge, vegetated in a Mesic Mixed Hardwood Forest natural community; and an unusual freshwater marsh, of unknown origin, is present just east of the Suffolk Scarp (see Site GA8 [Corapeake Marsh] for further information).
4. The extensive forest provides excellent habitat for a wide variety of animal species, especially the black bear (Ursus americanus). Significant populations of several uncommon warblers are also present.

GENERAL DESCRIPTION:

The Great Dismal Swamp occupies an extensive flat area of very recent origin, apparently being formed less than 9,000 years ago. The Suffolk Scarp, lying along the western boundary of the refuge, was the former shoreline, and the swamp was the nearshore floor of the ocean. As the ocean levels receded, the former ocean floor became "dry land" -- the Great Dismal Swamp.

The swamp originally was dominated by Atlantic white cedar (Chamaecyparis thyoides). Akerman (1923) considered 125,000 acres to be a conservative estimate of the original cover of the species. Bald cypress (Taxodium distichum), water tupelo (Nyssa aquatica), and swamp tupelo (N. biflora) were largely limited to the dendritic system of natural streams draining the swamp, which is now long vanished after canal construction, and to the wet zone along the toe of the Suffolk Scarp. However, extensive logging over the past 200 years, as well as drainage of the land by canals, has converted the majority of the forest to a middle-aged maple forest. Red maple (Acer rubrum) is the dominant tree over thousands of acres, with swamp tupelo also a dominant tree. Most of the cypress occurs near the western portion of the refuge.

The North Carolina portion of the refuge contains several thousand acres of Atlantic white cedar forest, mostly one to two miles south of the state line in the extreme corner of Camden County. Extensive stands of this tree have

become rare, because the wood provides high-quality timber for many uses, especially as poles, fences, and outdoor home construction.

The most diverse habitat in the swamp is the mesic "islands", which are low and narrow east-west trending ridges. These ridges are mainly located in the southeastern corner of the refuge, in Gates County. American beech (Fagus grandifolia) is a characteristic tree on such ridges, along with tuliptree (Liriodendron tulipifera) and various oak species (Quercus spp.). Several noteworthy plant species grow on these ridges, especially the southern twayblade (Listera australis), a "significantly rare" species of orchid. The uncommon and showy silky camellia (Stewartia malacodendron) is also a notable species. Though found in many of the counties in the lower Coastal Plain of the state, it is not common and is most often found growing with American beech on these mesic wooded ridges located within swamps. Log fern (Dryopteris celsa) grows in portions of the refuge, especially in the more mesic sites; this is an uncommon fern with its greatest abundance in the Dismal Swamp vicinity.

An excellent variety of birds nests in the refuge; Meanley (1973) lists 84 species. Probably the most significant are the Swainson's warbler (Limnothlypis swainsonii) and the black-throated green warbler (Dendroica virens). The Swainson's is uncommon throughout its range, and a moderately large population occurs in the swamp, especially on the Virginia side. The black-throated green warbler is a common species of northern coniferous forests, ranging through the Appalachians, but the mid-Atlantic population is quite disjunct. This coastal population extends from Dismal Swamp to the Charleston, South Carolina, area, and is perhaps nowhere more abundant than at Dismal Swamp. The most notable mammals in the refuge are the black bear (Ursus americanus) and the bobcat (Felis rufus). Interestingly the Federally Threatened Dismal Swamp southeastern shrew (Sorex longirostris fisheri) has not been taken from the refuge on the North Carolina side, but it is to be looked for in brushy places, clearcuts, and woodland borders along the refuge boundary.

OWNERSHIP: U.S. Fish and Wildlife Service (Great Dismal Swamp National Wildlife Refuge). There are several private holdings along the western and southern boundary of Federal land that lie within the proposed refuge boundary. Also, the State of North Carolina (Division of Parks and Recreation) owns 13,500 acres at the southeastern corner of Great Dismal Swamp; this is the undeveloped Dismal Swamp State Park (see Site CA2 [Dismal Swamp State Park] for more information).

PROTECTION STATUS: The Federally-owned portion of the refuge is protected as a National Wildlife Refuge. The North Carolina portion is a Registered Natural Heritage Area.

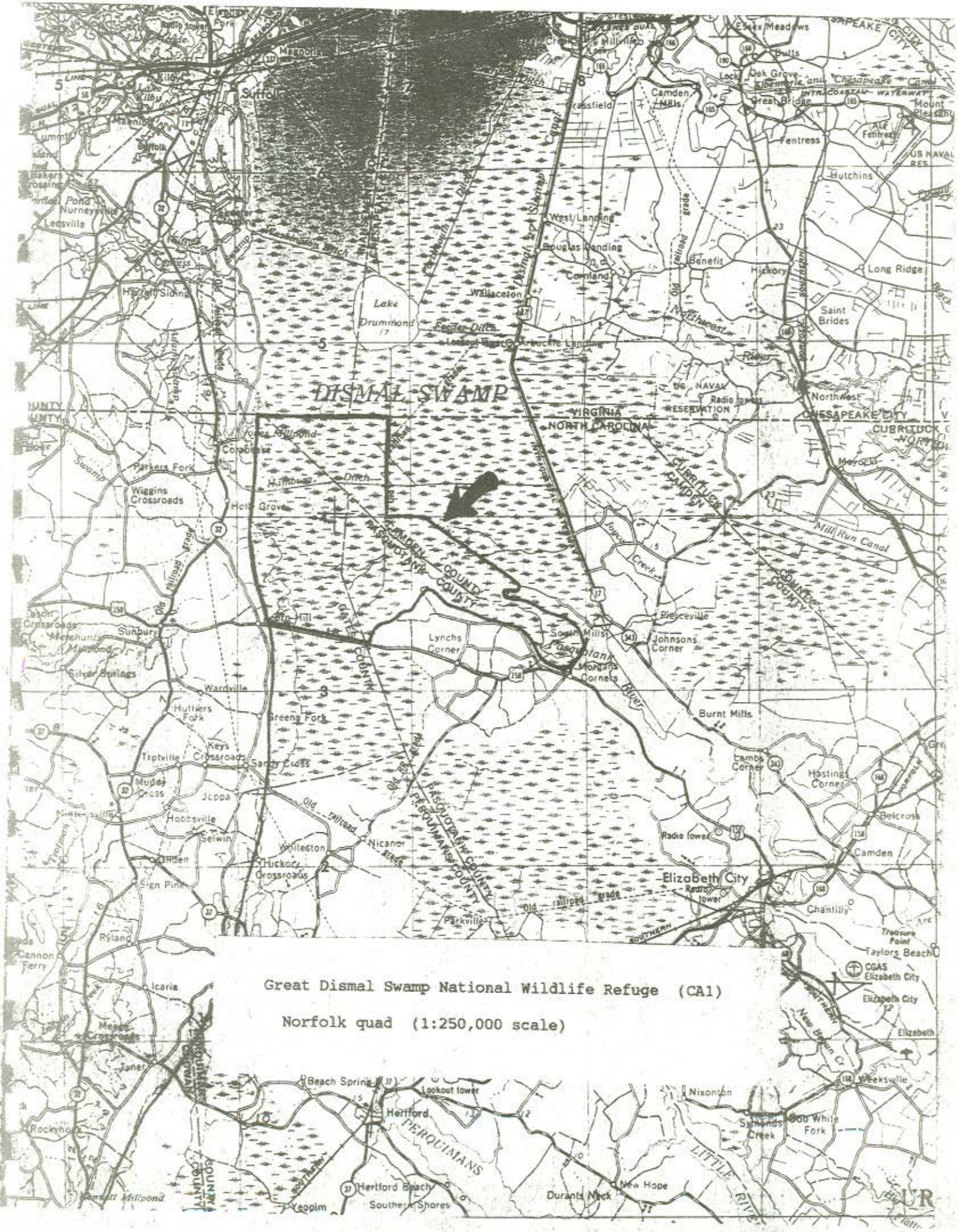
RECOMMENDATIONS FOR MANAGEMENT OR PROTECTION: Little management of the vegetation of the refuge is planned by the staff. The cypress-tupelo forests along the Suffolk Scarp should be allowed to mature. Management should be designed toward the maintenance of the cypress and white cedar communities, at the expense of the maple-gum community, plus restoration of some areas originally occupied by white cedar. Some of the canals and ditches likely will need to be blocked to return the area to a wetter hydrology. Any further

drying of the swamp will be detrimental. Some selective cutting, especially in maple areas, may be beneficial for wildlife populations and the possible re-establishment of white cedar, if the water table is raised by blocking ditches and canals. Efforts of the refuge forester to use controlled burns over the past 2 years for restoration of samples of pond pine (Pinus serotina) pocosin and other natural fire-dependent communities are to be commended.

Acquisition of privately owned tracts should also continue. This is especially important for those tracts that lie at the base of the Suffolk Scarp along the western edge of the refuge, as seepage from the adjacent terrace west of the scarp onto the lower terrace is important is keeping the swamp wet.

COMMENTS: Inventory work on plants and animals has been rather sporadic on the North Carolina side of the refuge. More intensive survey work seems necessary, such as surveys for Dismal Swamp southeastern shrew, dwarf trillium (Trillium pusillum), and shield ferns (Dryopteris spp.), all of which probably occur on the North Carolina side of the refuge.

REFERENCES: Meanley (1973), Musselman et al. (1977), Kirk (1979), United States Department of the Interior (1979), Frost (1982), U.S. Fish and Wildlife Service (1986)


DISMAL SWAMP
Lake Drummond
VIRGINIA
NORTH CAROLINA
Great Dismal Swamp National Wildlife Refuge (CA1)
Norfolk quad (1:250,000 scale)

SITE NAME: Dismal Swamp State Park

SITE NUMBER: CA2 SIZE: about 13,500 acres

SITE SIGNIFICANCE: B (State)

LOCATION: Extreme northwestern Camden County; located just west of US 17, with the Virginia line forming the northern boundary of the area. The western boundary is contiguous with the Great Dismal Swamp National Wildlife Refuge.

QUAD MAPS: Lake Drummond, Lake Drummond SE, Lynchs Corner, South Mills

SIGNIFICANT FEATURES:

1. The state park contains a stand of about 300 acres of fairly mature Atlantic white cedar (Chamaecyparis thyoides), a natural community type that is threatened in North Carolina.
2. Two areas of pocosin vegetation, each several hundred acres in size, are notable within the Dismal Swamp. Generally speaking, well-developed pocosins are uncommon north of Albemarle Sound.

GENERAL DESCRIPTION:

The Dismal Swamp State Park is an undeveloped park, with no facilities. It is under the management of the staff at Merchants Millpond State Park, located farther west in Gates County. The park lies adjacent to Great Dismal Swamp National Wildlife Refuge on the western and northern borders and is included within the acquisition boundaries of the refuge.

Most of the park is dominated by medium-aged red maple (Acer rubrum) and swamp tupelo (Nyssa biflora). The park is believed to originally have been dominated by Atlantic white cedar (Chamaecyparis thyoides), but these stands have been greatly reduced, and with the creation of ditches and canals, the drying of the soil has allowed maple to spread at the expense of the hydric species. Near the western boundary of the park is a stand of Atlantic white cedar, one of the few sizable stands still remaining in the Great Dismal Swamp. Straddling the state line is an area of several thousand acres of pocosin, near the northern end of the range of this vegetation. Trees are rather scarce, and inkberry (Ilex glabra) and other evergreen shrubs dominate the community. Another such pocosin occurs in the southeastern corner of the state park. These are good examples of High Pocosin, and perhaps Low Pocosin, natural communities, which are not common north of Albemarle Sound.

Alongside US 17, at the northeastern corner of the park, several species of rare ferns were "rescued" from a site in Gates County and transplanted here in 1976. Log fern (Dryopteris celsa), crested shield fern (D. cristata), and spinulose shield fern (D. spinulosa) were transplanted, and all three appear to be well established. These species grow naturally near US 158 in the Gates County portion of the Dismal Swamp (Site GA9).

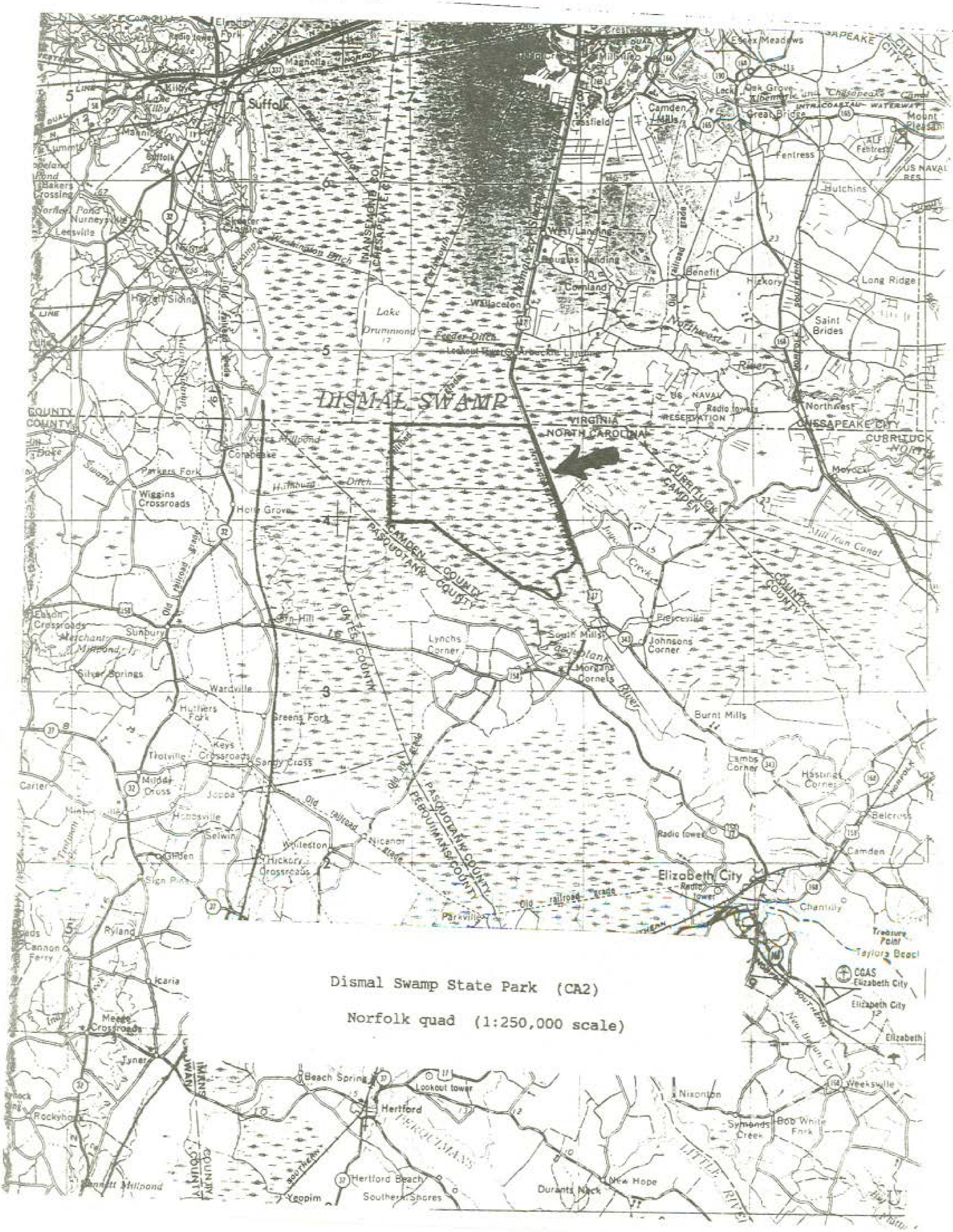
OWNERSHIP: State of North Carolina, Division of Parks and Recreation (Dismal Swamp State Park)

PROTECTION STATUS: Protected as a State Park, according to State Park regulations. The white cedar stand, the pocosin near the state line, and the transplanted fern site have been added to the Registry of Natural Heritage Areas, totalling somewhat over 900 acres of the park.

RECOMMENDATIONS FOR MANAGEMENT OR PROTECTION: The park should remain in its present state, though some fire management of the pocosins might be needed to maintain the vegetation in that stage. There is currently no access to the park, as a canal separates US 17 from the park proper. The State does not plan to give or sell the property to the U.S. Fish and Wildlife Service for inclusion within the Great Dismal Swamp National Wildlife Refuge, but it is considering some type of management agreement with that agency whereby refuge personnel would manage the property. Currently, State Park staff at Merchants Millpond park oversee the property.

COMMENTS: The park is badly in need of inventory work. Little is known of the presence of rare plant and animal species. The Federally Threatened Dismal Swamp southeastern shrew (Sorex longirostris fisheri) may well occur in the park.

REFERENCES: Division of State Parks (no date)


DISMAL SWAMP
Lake Drummond
VIRGINIA
NORTH CAROLINA
Suffolk
Elizabeth City
Hertford
CAMDEN COUNTY
PASQUOTANK COUNTY
GATES COUNTY
PERQUIMANS COUNTY
CURRITUCK COUNTY
South Mills
Corapeake
Sunbury
Great Bridge
Northwest
Moyock
Feeder Ditch
Washington Ditch
Hamburg Ditch
Wallaceton
Camden
Weeksville
Nixonton
Durants Neck
New Hope
Burnt Mills
Lambs Corner
Hastings Corner
Belcross
Morgans Corners
Johnsons Corner
Pierceville
Lynchs Corner
Parkville
Whiteston
Nicanor
Hickory Crossroads
Sandy Cross
Greens Fork
Wardville
Silver Springs
Eason Crossroads
Merchants Millpond
Holly Grove
Wiggins Crossroads
Parkers Fork
Harrell Siding
Saint Brides
Long Ridge
Hickory
Benefit
Fentress
Hutchins
Mount Pleasant
Oak Grove
Magnolia
Kilby
Leesville
Bakers Crossing
Nurneysville
Trotville
Middle Cross
Joppa
Hobbsville
Selwin
Gliden
Sign Pine
Ryland
Icaria
Cannon Ferry
Meads Crossroads
Tyner
Rockyhock
Beach Spring
Lookout tower
Hertford Beach
Southern Shores
Yeopim
Symonds Creek
Bob White Fork
Chantilly
Treasure Point
Taylors Beach
CGAS Elizabeth City
LITTLE RIVER
PERQUIMANS
Pasquotank River
Northwest River
Mill Run Canal
Joyce Creek
Old railroad grade

Dismal Swamp State Park (CA2)

Norfolk quad (1:250,000 scale)

SITE NAME: The Green Sea

SITE NUMBER: CA3 SIZE: about 10,900 acres

SITE SIGNIFICANCE: B (State)

LOCATION: Straddles the boundary between Camden and Currituck counties. The northern border is the Virginia state line, extending east nearly to SR 1218 in Currituck County and west nearly to US 17; the southern border is approximately due west of the Snowden community in Currituck County.

QUAD MAPS: Lake Drummond SE, Moyock, Lambs Corner, South Mills

SIGNIFICANT FEATURES:

1. This natural area is the largest unditched remnant of the Great Dismal Swamp outside of the National Wildlife Refuge (of the same name).
2. There are remnants of Atlantic White Cedar Forest in the natural area, as well as remnants of canebrakes, both of which were extensive types in pre-settlement times. A large extent of Pond Pine Woodland is present in the southern portion of the area, and swamp forests are common.
3. The large size of the area provides habitat for large mammals such as black bear (Ursus americanus).

GENERAL DESCRIPTION:

The Green Sea is the eastern extension of the Great Dismal Swamp. Much of the eastern half of this swamp (east of US 17) has been cleared for agriculture or pine plantations, but over 10,000 acres still remain in relatively natural condition. This site was visited as early as 1728 by William Byrd, who was surveying the line between North Carolina and Virginia. The name comes the former vast areas of giant cane (Arundinaria gigantea), which apparently had no overstory or canopy; these canebrakes were kept nearly free of other woody vegetation by frequent natural fires. Also abundant on portions of the area were extensive stands of Atlantic white cedar (Chamaecyparis thyoides). With the advent of civilization and fire suppression, the cedars were eventually timbered or replaced by other swamp trees more suited to fire-suppressed conditions. Today, red maple (Acer rubrum) is the dominant tree over much of the Green Sea. As a result of fire suppression, the most extensive community is a Nonriverine Swamp Forest featuring maple in the canopy and shrub-sized redbay (Persea borbonia) as an understory tree. These sites were mainly white cedar stands in the 1700's (Frost 1989ff). Sites that were formerly canebrakes are now mostly dominated by red maple, with some sweetgum (Liquidambar styraciflua), swamp tupelo (Nyssa biflora), and loblolly pine (Pinus taeda). Redbay dominates the understory, and sweet pepperbush (Clethra alnifolia) is abundant in the shrub layer.

Small remnants of Atlantic White Cedar Forest communities still persist. Along the eastern boundary of the natural area there appear to be hardwood flats, judging from aerial photos and soil maps, but such sites were not investigated in this inventory. These might be Nonriverine Wet Hardwood Forests. The southern portion of the Green Sea, south of SR 1218, is a pond pine (Pinus serotina) pocosin. Apparently, most of this section was

originally canebrake, but fire suppression on the shallow organic soils has led to a forest of pond pine. A wide variety of pocosin shrubs is present. This is apparently the largest extent of Pond Pine Woodland community in the Albemarle Sound region outside of Great Dismal Swamp National Wildlife Refuge.

The natural area is very important for refuge for larger animals. Black bears (Ursus americanus) are present, as are bobcats (Felis rufus) and red-shouldered hawks (Buteo lineatus). The area likely has a high breeding bird diversity.

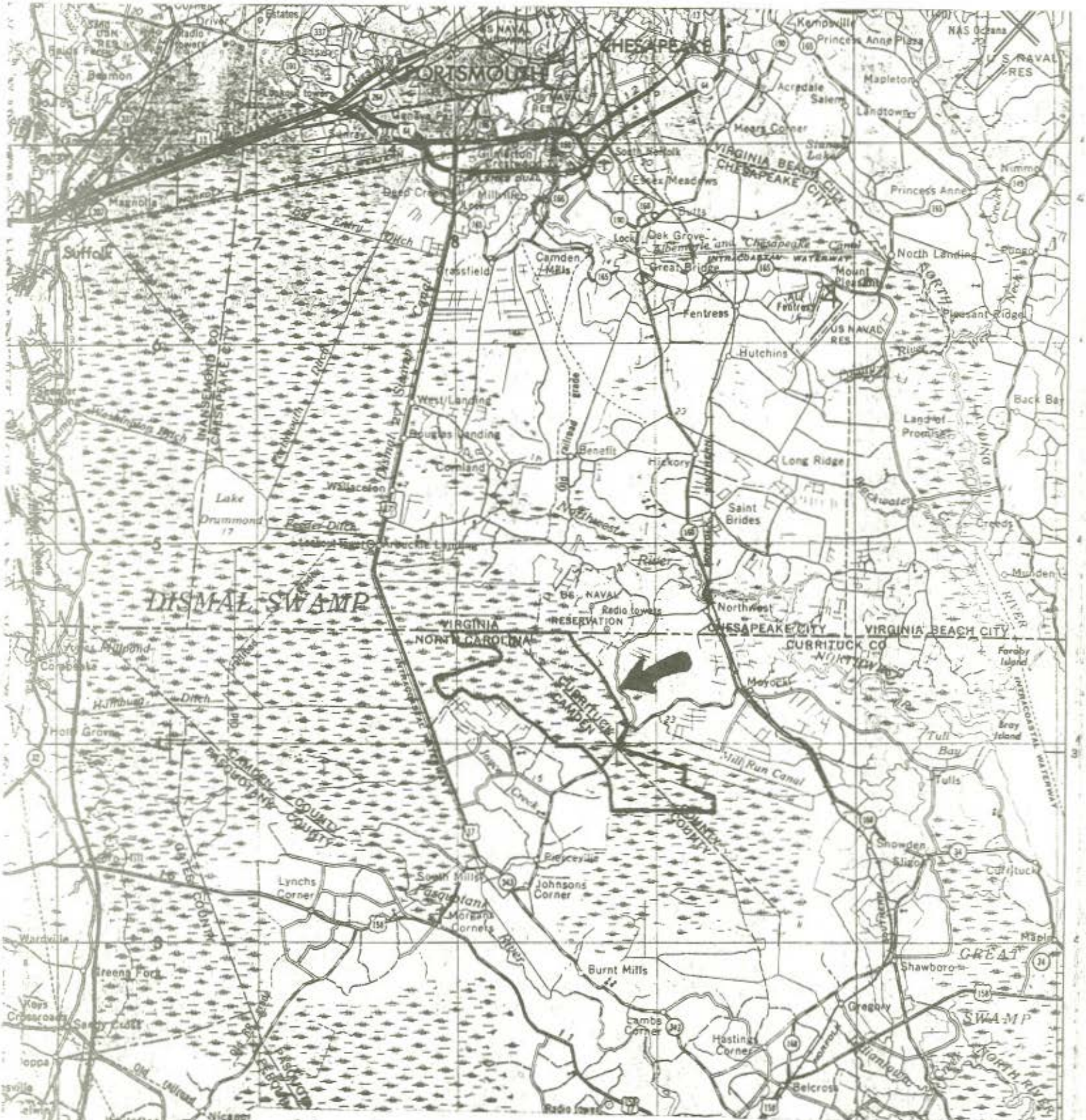
OWNERSHIP: The great majority of the area is in just 3 ownerships. Two are private (a farm operation and a timber company), where portions of the northeastern extremity are owned by the U.S. Navy, which operates a Naval Communication Station on the property.

PROTECTION STATUS: None

RECOMMENDATIONS FOR MANAGEMENT OR PROTECTION: The area should be protected from further logging. This threat is assumed to be very high, since there are many recent clearcuts along the margins of the area. Portions of the natural area should be burned to restore the original canebrake and white cedar communities, which are now replaced by maple swamps that are common in the Great Dismal Swamp region. The U.S. Fish and Wildlife Service, which administers the National Wildlife Refuge to the west of US 17, might wish to acquire this natural area, which extends into Virginia, for addition to the refuge. The N.C. Division of Parks and Recreation owns and administers the undeveloped Dismal Swamp State Park immediately to the west of US 17. Acquisition of the Green Sea by this agency, to add to its state park holdings, is another protection option. The natural area extends into Virginia; both the Virginia Natural Heritage Program and private conservation groups are interested in protection of this portion of the Green Sea. Protection coordination with these agencies is recommended.

COMMENTS: Considerable portions of this vast area still remain unexplored, at least by this inventory team. Sites on Roanoke soils along the eastern margin of the area might well contain oak flats, which are extremely rare in the Dismal Swamp proper. Animal surveys are also needed.

REFERENCES: Frost (1989ff)



The Green Sea (CA3)

Norfolk quad (1:250,000 scale)

SITE NAME: Shipyard Landing

SITE NUMBER: CA4 SIZE: about 1850 acres

SITE SIGNIFICANCE: C (Regional)

LOCATION: Central portion of Camden County; located along the east side of the Pasquotank River, in the floodplain, directly across the river from Elizabeth City.

QUAD MAP: Elizabeth City

SIGNIFICANT FEATURES:

1. The natural area contains a mosaic of many vegetation types, including an unusual freshwater marsh and mesic hardwood stands on floodplain islands.
2. There are extensive remnants of a former dominant white cedar community in the floodplain, but only scattered trees and patches of the Atlantic white cedar (Chamaecyparis thyoides) itself are present today.

GENERAL DESCRIPTION:

The Pasquotank River forms the boundary between Camden and Pasquotank counties. That portion of the floodplain below Elizabeth City is embayed by rising sea level, whereas that portion north of the town still retains a wooded floodplain, more than a mile wide over much of its course. The majority of the floodplain contains forested wetlands (swamps); however, several floodplain islands are present in the northern portion of the natural area.

Much of the floodplain is believed to have been an extensive Atlantic White Cedar Forest natural community. However, the white cedar (Chamaecyparis thyoides) was logged heavily in the last century, and today only scattered trees and stands remain. With removal of the cedar, and with long absence of fire, the swamp is now vegetated primarily in swamp tupelo (Nyssa biflora) and red maple (Acer rubrum) forest that is typical of many swamps in the A/P Study area. The understory is dominated by sweetbay (Magnolia virginiana) and redbay (Persea borbonia). A zone several hundred feet wide along the river is vegetated in a Tidal Cypress-Gum Swamp. Along the immediate shoreline grows both swamp tupelo and water tupelo (Nyssa aquatica), but between the shore and the white cedar swamp is a transitional community from 100 to 300 yards wide, dominated by swamp tupelo and sweetgum (Liquidambar styraciflua). The canopy is rather open in this transitional zone, leading to considerable development in the understory and shrub layers.

The most unusual communities are freshwater marshes that fringe portions of the river and especially small tributary streams such as Matthews Creek. Diversity in the marshes is very low, and they are dominated by American cupscale (Sacciolepis striata), a grass that grows here in dense stands, and by alligator weed (Alternanthera philoxeroides), a noxious and exotic aquatic weed. These unusual marshes are probably best treated as Tidal Freshwater Marshes, rather than Oligohaline Marshes, as defined in this inventory.

The mesic floodplain islands, visible on topographic maps, were not inventoried in this study. Time constraints and difficulty in reaching these islands were main reasons for lack of study.

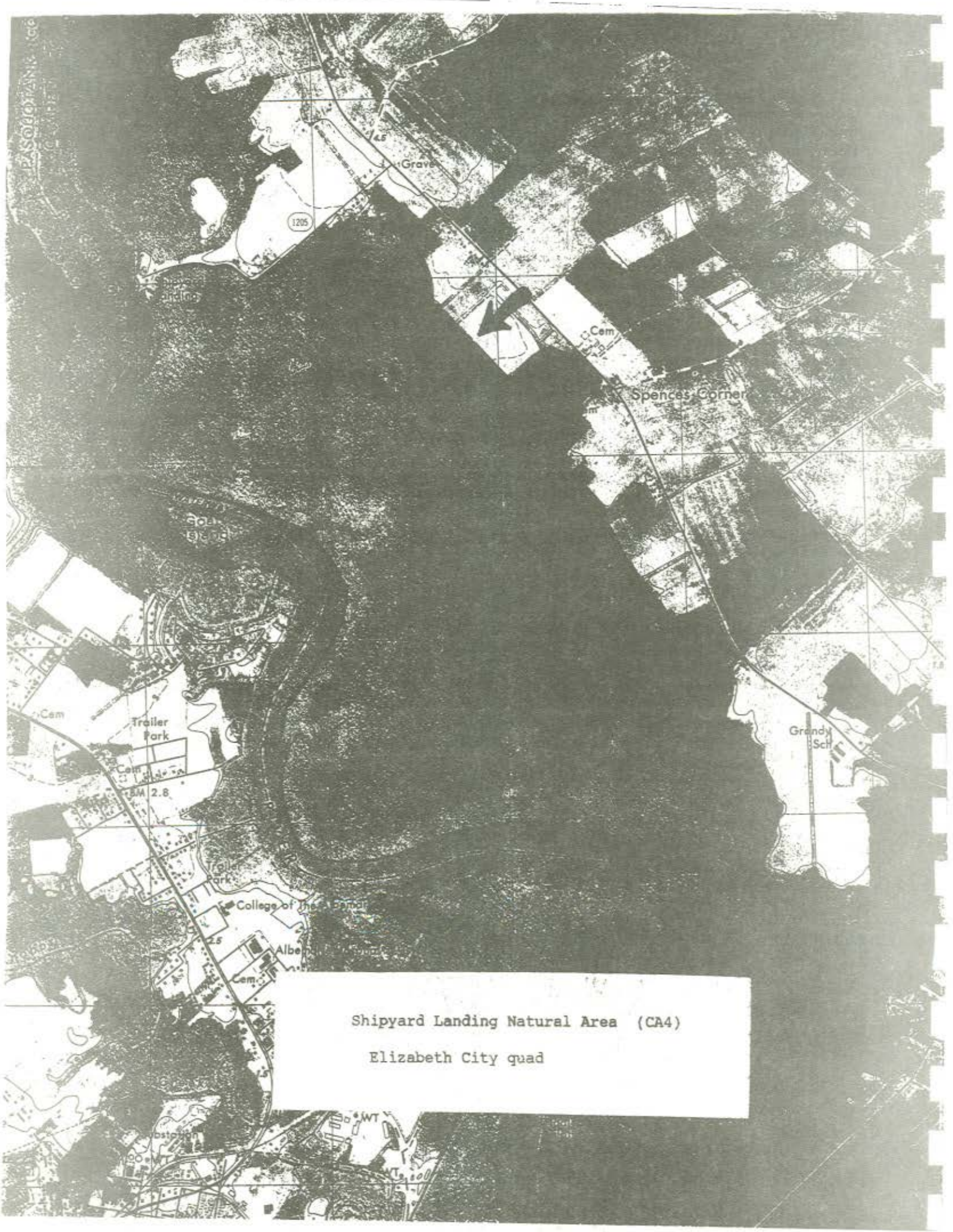
OWNERSHIP: Elizabeth City State University, part of the University of North Carolina system, owns most of the floodplain islands at the northern end of the natural area. The remaining 90+% of the site is in multiple private ownership.

PROTECTION STATUS: No official status

RECOMMENDATIONS FOR MANAGEMENT OR PROTECTION: The area needs to be protected from logging. The swamp should be burned to restore the white cedar, since cedar is gradually replaced, in the long absence of fire, by swamp tupelo, red maple, and other broadleaf species. One of the private owners is willing to donate his 48-acre tract to a conservation agency, provided that other tracts, particularly the university-owned one, can also be protected as a large preserve. It would seem logical that the university should work with private conservation groups or the N.C. Natural Heritage Program in arranging for increased protection of this natural area, in the form of land donations, conservation easements, or registry agreements.

COMMENTS: The authors have had a difficult time in attempting to name the natural communities that have resulted from fire exclusion and replacement by other species after logging of the Atlantic White Cedar Forest. These forests, dominated by swamp tupelo and red maple, with a mix of bay and pocosin species, are often common, especially in the Great Dismal Swamp. Should those in this natural area, in the floodplain of the estuarine Pasquotank River, be called Tidal Cypress-Gum Swamp? Certainly, the fringing forest should be considered this latter type, but the interior portion, formerly a white cedar type, perhaps can be called a Nonriverine Swamp Forest or a Bay Forest community. It is obvious that community classification in the Coastal Plain is very difficult, partly because extremely slight changes in water table and elevation (often just 1 to 2 inches) alter community dynamics and especially because fire was such an important natural factor in determining communities. The 20th Century era of fire suppression is altering communities, making classification of these new "fire-suppression" types a difficult chore.

REFERENCES: Frost (1989bb)



Shipyard Landing Natural Area (CA4)

Elizabeth City quad

SITE NAME: Whitehall Shores Hardwood Forest

SITE NUMBER: CA5 SIZE: about 165 acres

SITE SIGNIFICANCE: C (Regional)

LOCATION: Central portion of Camden County; located on both sides of SR 1132, just north of Whitehall Shores development.

QUAD MAP: Elizabeth City

SIGNIFICANT FEATURES:

1. A moderate extent of mature Nonriverine Wet Hardwood Forest natural community is present, along with Mesic Mixed Hardwood Forest, Upland Flats subtype near the county road. These natural communities have nearly all been destroyed in the A/P Study region, and few mature examples are known.

GENERAL DESCRIPTION:

Most of the flat terrace land in the A/P Study area has long since been cleared for agriculture, development, or timber harvest. Very few stands of 50 or more acres of mature forest on nonriverine sites still remain. One such site consists of over 100 acres of hardwood forest just north of the Whitehall Shores development.

That portion of the forest lying within 100 yards of SR 1132, which somewhat bisects the tract, is slightly higher than the remainder of the land and might not be a wetland. This portion is vegetated in a Mesic Mixed Hardwood Forest, Upland Flats subtype natural community, with American beech (Fagus grandifolia) being common. Loblolly pine (Pinus taeda) and tuliptree (Liriodendron tulipifera) are also numerous in the canopy. The majority of the forest, at least on the northeast side of the road, is a wetland forest with some slight pooling of water. Swamp chestnut oak (Quercus michauxii), cherrybark oak (Q. pagoda), and willow oak (Q. phellos) are common canopy trees, many of which exceed 12 inches in trunk diameter. Also present are scattered individuals of shagbark hickory (Carya ovata), which is uncommon in the A/P Study area. The rather ubiquitous red maple (Acer rubrum) and sweetgum (Liquidambar styraciflua) are other canopy trees. The understory and shrub layers are rather sparse.

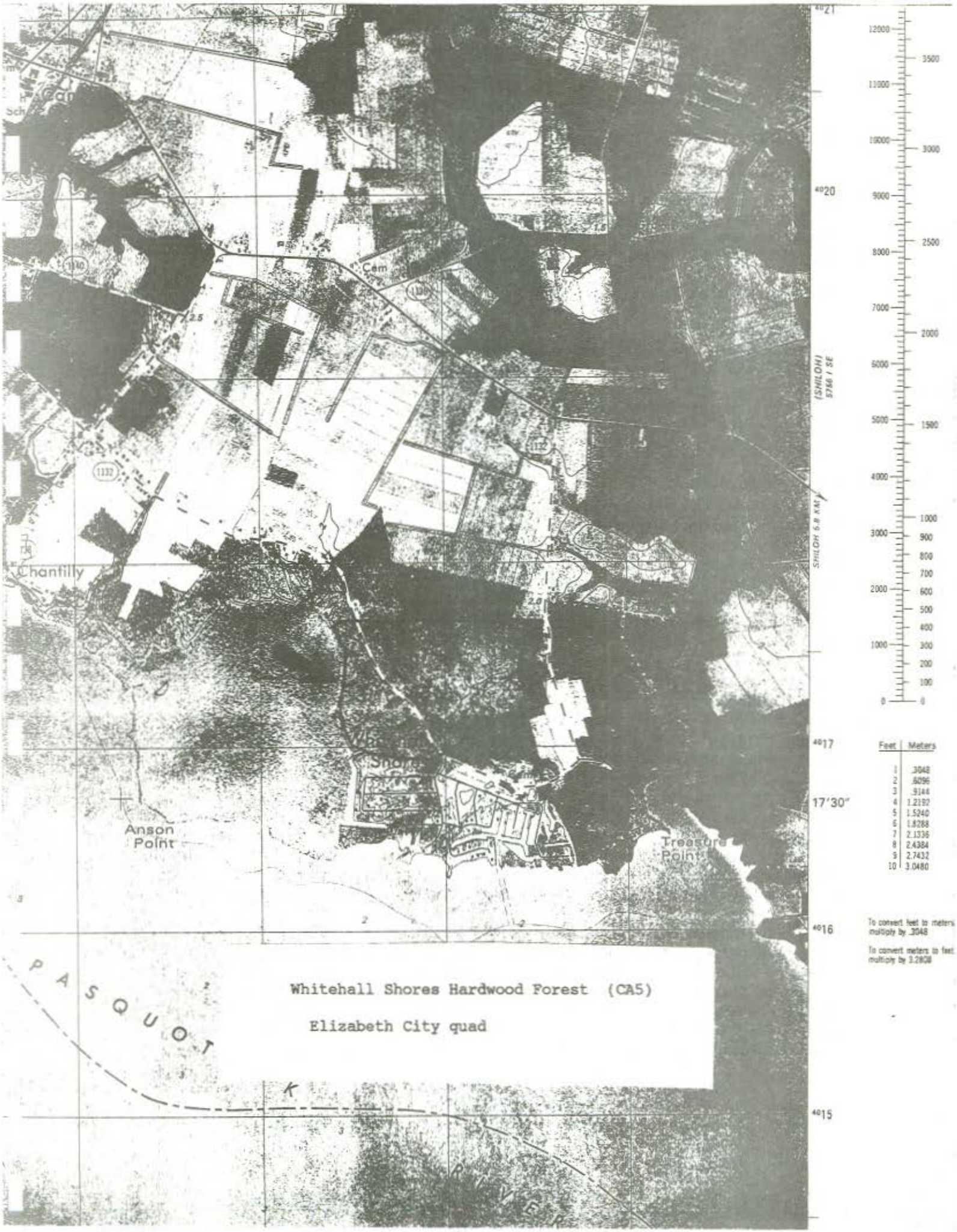
OWNERSHIP: Private

PROTECTION STATUS: None

RECOMMENDATIONS FOR MANAGEMENT OR PROTECTION: This forest, especially that portion alongside the road, is under great threat of development. A few homes have been built in the past several years along the northeastern side of the road, and more can be anticipated in the upcoming years. It might be too wet for home construction in the wetlands farther to the northeast, but timber harvest is always a possibility in mature hardwood stands. The most feasible protection alternatives are acquisition or conservation easement by a private conservation group or a registry agreement by the N.C. Natural Heritage Program.

COMMENTS: There is a crying need for protection of nonriverine hardwood forests, especially on terrace flats like this site. Very few such sites have been protected; most have long ago been cleared for agriculture or have been repeatedly timbered. Additional field work is needed at this site and other tracts in the nearby area. There is the general tendency for inventory work to concentrate on extensive (250+ acres) forested tracts and to overlook tracts of 100 acres or less, depending on the availability of funds and manpower. Nearly all tracts of nonriverine hardwoods still remaining are of 50 acres or less.

REFERENCES: N.C. Natural Heritage Program files



Whitehall Shores Hardwood Forest (CA5)

Elizabeth City quad

Feet	Meters
1	.3048
2	.6096
3	.9144
4	1.2192
5	1.5240
6	1.8288
7	2.1336
8	2.4384
9	2.7432
10	3.0480

To convert feet to meters multiply by .3048

To convert meters to feet multiply by 3.2808

SITE NAME: Hunting Creek Pocosin and Marsh

SITE NUMBER: CA6 SIZE: about 1925 acres

SITE SIGNIFICANCE: C (Regional)

LOCATION: Southeastern portion of Camden County, bounded on the east by the North River, on the south by Broad Creek, and on the north roughly by Abel Creek. The general area is 3 to 4 miles east of Old Trap.

QUAD MAPS: Camden Point, Coinjock

SIGNIFICANT FEATURES:

1. The marsh, pocosin, and swamp forest complex in the natural area is an unspoiled area and is very attractive visually. This area, coupled with other adjacent areas along the North River, is likely the largest unprotected natural area remaining in northeastern North Carolina.
2. At least 7 community types, representing at least 4 natural communities, are present.

GENERAL DESCRIPTION:

The North River, separating the southern portions of Camden and Currituck counties, is bordered by fresh to slightly brackish marshes and various types of forests. Most of the marshes lie alongside tributary streams, and Hunting Creek (a tributary stream of just 1 or 2 miles) contains well-defined marshes along its shoreline and along the shores of channels flowing into the creek. The most extensive plant community in the marsh, which is an Oligohaline Marsh natural community, is a tall marsh dominated by sawgrass (Cladium jamaicense). The marshes near the North River are dominated by big cordgrass (Spartina cynosuroides), but small clones of common reed (Phragmites communis) are also present. This tall zone, often over 6 feet high, gives way upstream to the sawgrass, and in the more interior portions to a shorter marsh featuring beds of common three-square (Scirpus americanus). Royal fern (Osmunda regalis) is a somewhat surprising codominant with the three-square.

The forests surrounding the marsh are generally "piney", with much of the area being a Pond Pine Woodland natural community featuring a canopy dominance of pond pine (Pinus serotina). This community is actually a transitional one between the typical Pond Pine Woodland on more "peaty", non-riverine sites and an oligohaline marsh. The understory and shrub layer is predominantly red maple (Acer rubrum) saplings and waxmyrtle (Myrica cerifera). The pocosin features sawgrass in the herb layer along the marshy fringes. A poorly understood community in North Carolina is that forest dominated by loblolly pine (P. taeda) in an apparently naturally maintained setting. Such forests occur at the upper margins of many of the brackish and oligohaline marshes in the northeastern part of the state, both on the Outer Banks and on the mainland. This natural community -- the Estuarine Fringe Loblolly Pine Forest -- is present in the natural area. Wetland shrubs such as redbay (Persea borbonia), waxmyrtle, and highbush blueberry (Vaccinium atrococcum) also are present under the loblollies. The loblollies apparently prefer sites of more mineral content, as opposed to organic content for the pond pines.

The extensive forests farther west of the pine forests were not examined in the A/P Study because of inaccessibility. Portions of the swamp are believed to contain stands of Atlantic white cedar (Chamaecyparis thyoides), based on aerial photographs.

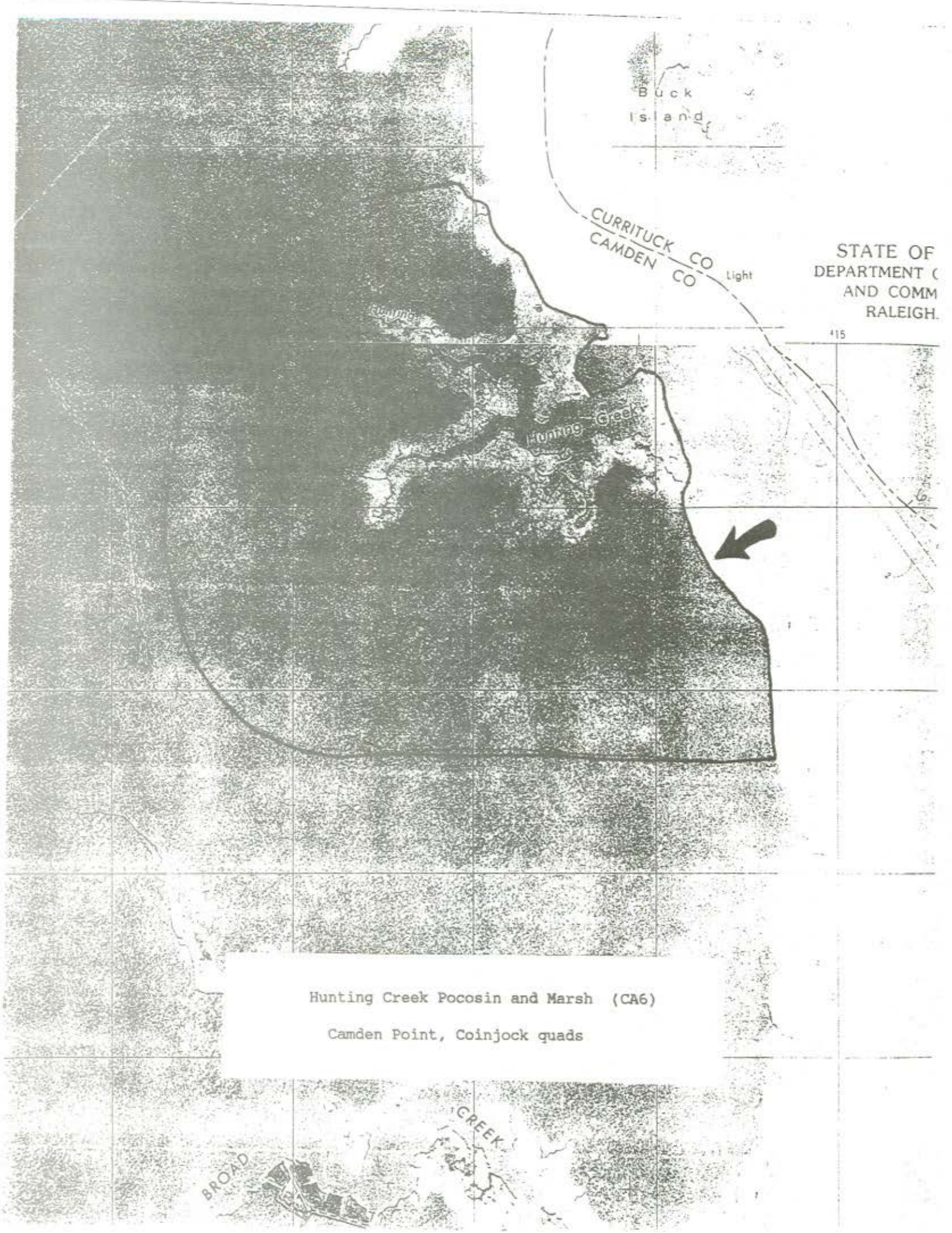
OWNERSHIP: Private

PROTECTION STATUS: None

RECOMMENDATIONS FOR MANAGEMENT OR PROTECTION: The marsh has presumably benefitted by fire, either natural or set by citizens, and the marsh should continue to be burned at 5 to 10 year intervals in order to maintain a diversity of plants and to provide waterfowl foraging habitat. Logging would be detrimental to the site. The Phragmites is an aggressive weed that quickly overtakes marshes; its population sizes should be monitored. Much of the swampland south of Hunting Creek is for sale, as of the summer of 1989, and the seller is looking for a conservation buyer. However, the seemingly very high asking price would likely prevent outright purchase by conservation groups or State or Federal agencies. A nature preserve along both sides of the North River would be highly desirable, because of the pristine natural condition of the vegetation along the margins of the river. The N.C. Wildlife Resources Commission might be interested in acquiring this natural area or obtaining a lease arrangement with the owners for Game Land status.

COMMENTS: Further inventory of the interior the forest is needed. Also needed is further field work both north and south of the natural area to determine boundaries of the highest quality natural communities. This has proven difficult during the A/P Study along this and other rivers that empty into Albemarle and Currituck sounds because of the great extent of vegetation in a natural state. Further inventory work in the natural area and other coastal sites is needed to determine the status of the Estuarine Fringe Loblolly Pine Forest community. Is it a true "climax", or does it succeed to another community?

REFERENCES: Frost (1989f)



Hunting Creek Pocosin and Marsh (CA6)

Camden Point, Coinjock quads

SITE NAME: Broad Creek Marshes

SITE NUMBER: CA7 SIZE: about 2400 acres

SITE SIGNIFICANCE: B (State)

LOCATION: Extreme southeastern portion of Camden County; bounded on the east by the North River and on the south by Camden Point, located approximately 3 to 4 miles southeast of Old Trap.

QUAD MAP: Camden Point

SIGNIFICANT FEATURES:

1. The marshes are quite pristine and very diverse, and they contain at least 2 examples of a rare community type -- a "meadow" of beaked spikerush (Eleocharis rostellata).
2. The marshes contain "significantly rare" plant species -- twig-rush (Cladium mariscoides) and winged seedbox (Ludwigia alata).

GENERAL DESCRIPTION:

Broad Creek is an embayed small stream that flows eastward for only several miles to empty into the North River in southeastern Camden County. Most of the creek is surrounded by fresh to slightly brackish marshes, especially along the lower 1.5 miles. The upper portion of the creek is surrounded by forests, such as pine and pine/cypress swamp.

The waters of Broad Creek have very little vegetation, perhaps because the waters are too dark for flora to grow. Most of the aquatic vegetation is a floating species -- water lily (Nymphaea odorata). Most of the marsh along the channels is a tall marsh composed of zones of either big cordgrass (Spartina cynosuroides) or common reed (Phragmites communis). Slightly farther from the channels is the somewhat shorter sawgrass (Cladium jamaicense). Farther toward the center of the marsh, the vegetation continues to be shorter in statue, with common three-square (Scirpus americanus) and patches of black needlerush (Juncus roemerianus). The central portions of the marsh are the lowest in vegetation height. Normally in such an oligohaline marsh, plant species diversity increases in the shorter vegetation, but in this case, diversity is low because of the dense stands of the three-square. Another significant feature of the central portion of the marsh is the rare "meadow" featuring a low, lawn-like growth of beaked spikerush (Eleocharis rostellata), a species found in calcareous fens in the northern United States. Among the relatively few plants growing with the spikerush are ten-angle pipewort (Eriocaulon decangulare) and marsh mermaid-weed (Proserpinaca palustris).

A few rare plants occur in the natural area. Both the twig-rush (Cladium mariscoides) and the winged seedbox (Ludwigia alata) were noted during the survey in the Eleocharis meadow; however, only a few individuals of each were seen. Both species were also found at additional marshes in the A/P Study. Though the Eleocharis is not monitored by the N.C. Natural Heritage Program as a rare species, it is considered by Radford et al. (1968) to be "rare" in North Carolina. The marsh contains a number of showy flowering species, including rattlesnake-master (Eryngium aquaticum), swamp rosemallow (Hibiscus

moscheutos), seashore mallow (Kosteletzkya virginica), large rose-gentian (Sabatia dodecandra), swamp milkweed (Asclepias incarnata), few-flower milkweed (A. lanceolata), and ten-angle pipewort.

The upper portions of the creek, and the zone behind the marsh, contain a "loblolly pine swamp" community. Schafale and Weakley (1985) do not list such a natural community for North Carolina, but this community will be included in the Third Approximation of this natural community classification (Mike Schafale, pers. comm.) as the Estuarine Fringe Loblolly Pine Forest. Loblolly pine (Pinus taeda) is the primary canopy tree in the swamp, along with scattered bald cypresses (Taxodium distichum). Red maple (Acer rubrum), redbay (Persea borbonia), and waxmyrtle (Myrica cerifera) are the predominant understory species.

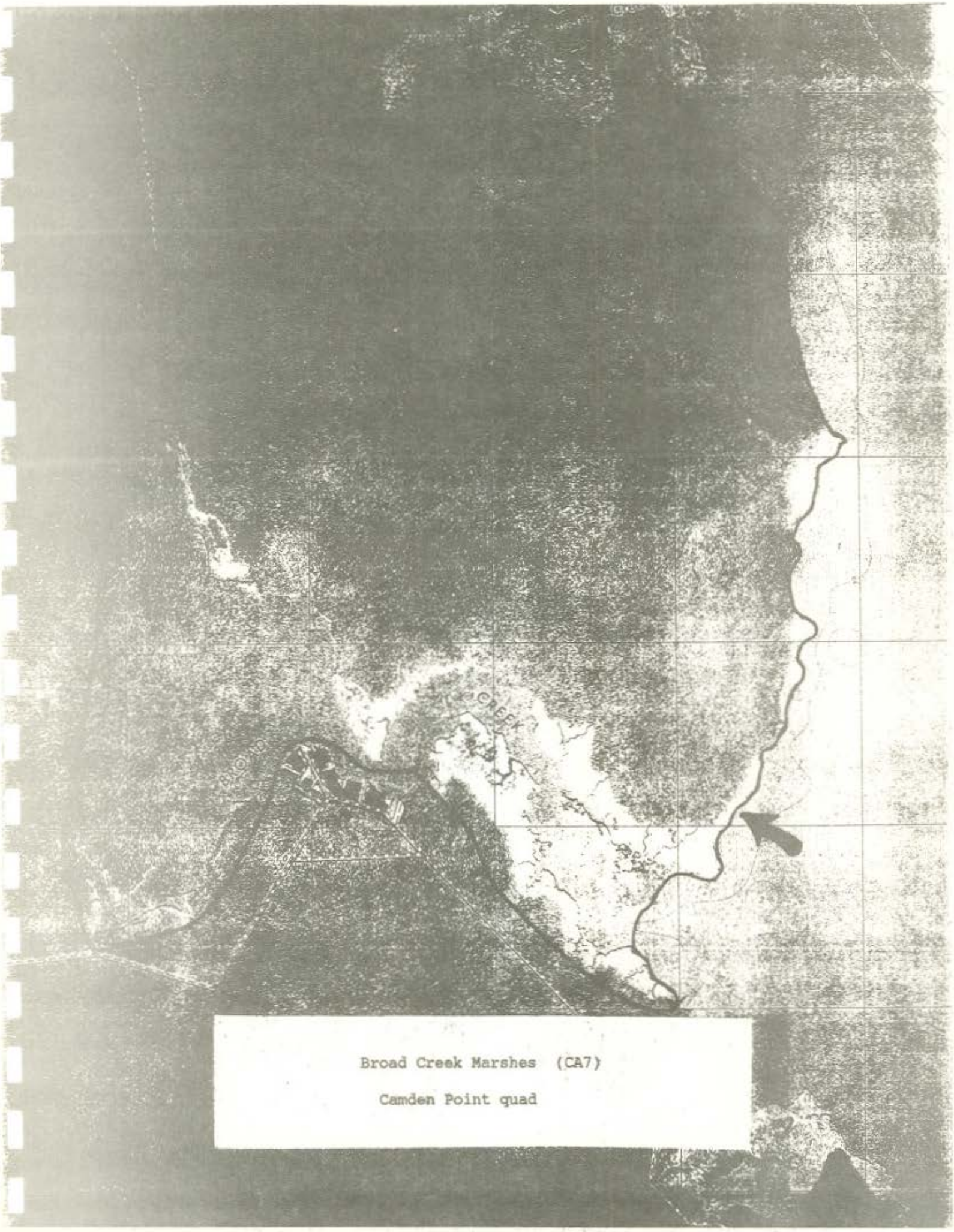
OWNERSHIP: Presumed private

PROTECTION STATUS: None

RECOMMENDATIONS FOR MANAGEMENT OR PROTECTION: The marsh needs to be protected from further shoreline dredge and fill development; such development is occurring just south of the natural area. The marshes should be burned as needed to maintain the excellent diversity. The meadow and other portions of the central sections need to be monitored for invasion by tall marsh species, especially by Phragmites. This site, along with the neighboring site to the north -- Hunting Creek Pocosin and Marsh (Site CA6) -- would best be protected as a single unit, perhaps by acquisition by, or lease to, the N.C. Wildlife Resources Commission as a Game Land. Although the N.C. Division of Coastal Management has, as of the end of 1989, no coastal reserves in the Albemarle Sound vicinity, it would be highly desirable to see this agency begin to acquire properties such as this, in order to protect examples of high-quality freshwater to slightly brackish marshes.

COMMENTS: Further inventory work in the forests surrounding the marshes is needed, including more detailed work on describing the Estuarine Fringe Loblolly Pine Forest community and determining its origins and successional status.

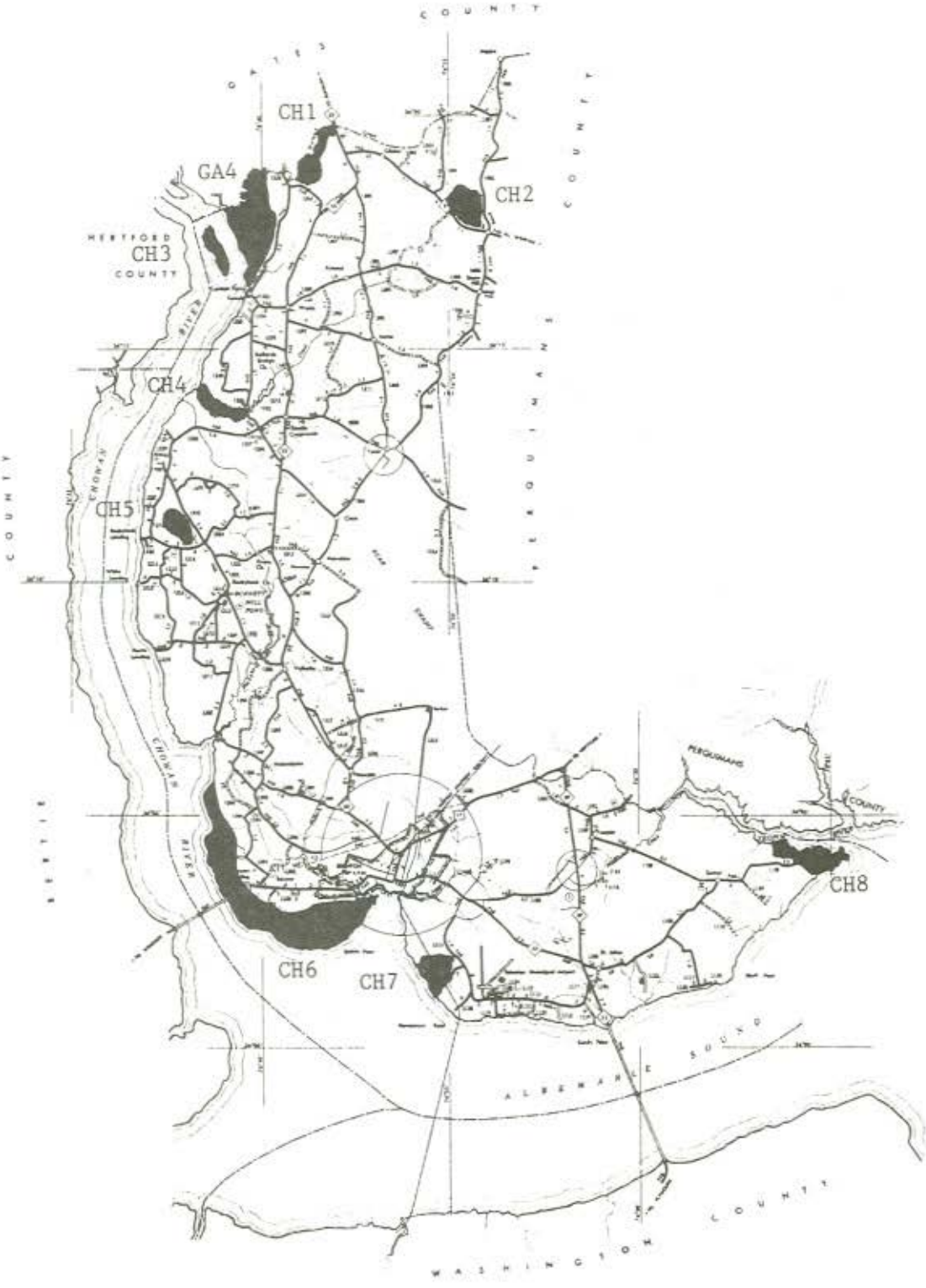
REFERENCES: Frost (1989h)



Broad Creek Marshes (CA7)

Camden Point quad

Figure 10. Significant natural areas in Chowan County. The areas are numbered generally in a north to south, or west to east, manner; see Table 7 and the Inventory of Sites section for further information.


CH1
GA4
CH2
CH3
CH4
CH5
CH6
CH7
CH8
PERQUIMANS COUNTY
PASQUOTANK
ALBEMARLE SOUND
WASHINGTON COUNTY

SITE NAME: Warwick Creek Oak Flats and Slopes

SITE NUMBER: CH1 SIZE: about 475 acres

SITE SIGNIFICANCE: C (Regional)

LOCATION: Along the border of Chowan and Gates counties, lying alongside Warwick Creek, extending from NC 32 on the east nearly to SR 1232 on the west.

QUAD MAP: Mintonsville

SIGNIFICANT FEATURES:

1. The natural area contains swamps and mature upland hardwood stands that have a high diversity of oaks. Such upland hardwood forests are uncommon in the Coastal Plain.
2. Black bears (Ursus americanus) have been seen in this natural area; bears are considered of Special Concern in the state.

GENERAL DESCRIPTION:

Warwick Creek is a small blackwater stream with gently rolling slopes along the margins of its narrow floodplain. A hardwood forest on the flats above the floodplain in the natural area is best considered a Mesic Mixed Hardwood Forest, Upland Flats subtype. American beech (Fagus grandifolia) is dominant in many places; water oak (Quercus nigra) is important on the moister sands; and southern red oak (Q. falcata), shortleaf pine (Pinus echinata), and loblolly pine (P. taeda) are common in the canopy on slightly drier areas. A variety of subcanopy trees are present. Several species of blueberries (Vaccinium spp.) and giant cane (Arundinaria gigantea) are important in the shrub layer. A slight depression in the flats contains somewhat mesic/hydric oaks -- willow oak (Q. phellos) and laurel oak (Q. laurifolia).

The very gentle slopes also contain a mesic forest, perhaps a combination of the former community and the Mesic Mixed Hardwood Forest, Bluff/Slope subtype. American beech is the dominant tree. On the north-facing slopes, elements such as northern red oak (Q. rubra) and black oak (Q. velutina) are present. Flowering dogwood (Cornus florida) and red maple (Acer rubrum) are common in the understory on the slopes.

The wetlands in the floodplain are a Coastal Plain Small Stream Swamp natural community. Water tupelo (Nyssa aquatica) is the dominant canopy tree of the swamp along Warwick Creek, with red maple being the most common understory tree.

The black bear (Ursus americanus) occurs in the natural area. This Special Concern animal requires a large extent of habitat. Likely, the fact that the forest in the natural area is continuous with the very extensive Chowan Swamp area to the west is the reason for the presence of bears along Warwick Creek.

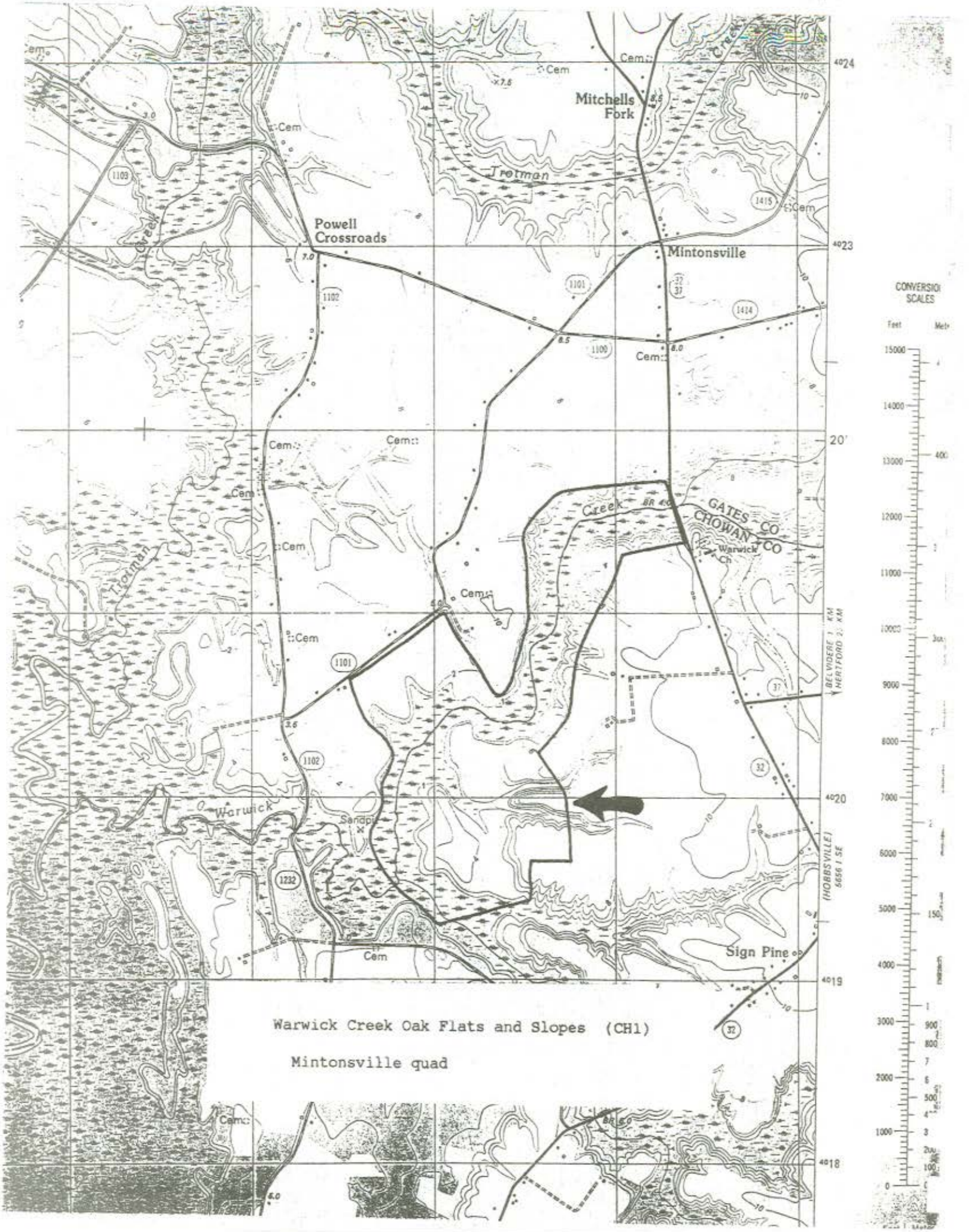
OWNERSHIP: Private

PROTECTION STATUS: None

RECOMMENDATIONS FOR MANAGEMENT OR PROTECTION: The upland forests need protection from logging, since they may provide shelter for the bear and since they are examples of a threatened natural community. The natural area should be designated as a Wildlife Resources Commission Bear Sanctuary. The Wildlife Commission might take in interest in acquisition of the natural area.

COMMENTS: Beaver impoundments within the swamp contain possible habitat for several species of rare plants. Natural community taxonomy of mesic flats and very gentle slopes in the lower Coastal Plain need further survey work. The steep to moderate slopes in the western Coastal Plain often feature many "Piedmontane" species that are rather scarce in the Coastal Plain. The gentle slopes in the lower Coastal Plain do not show such an affinity. The slopes are often so gentle that xeric, mesic, and hydric species may occur practically side-by-side, which is certainly the case on the upland flats.

REFERENCES: Frost (1989p)



Warwick Creek Oak Flats and Slopes (CH1)

Mintonsville quad

SITE NAME: Snow Hill Bay

SITE NUMBER: CH2 SIZE: about 205 acres

SITE SIGNIFICANCE: B (State)

LOCATION: Extreme northeastern corner of Chowan County, located just northwest of the intersection of NC 37 and SR 1002.

QUAD MAP: Hobbsville

SIGNIFICANT FEATURES:

1. The presence of a Carolina bay with natural vegetation still remaining, north of Albemarle Sound, is quite unusual.
2. The natural area has been without fire for over 75 years; thus, the site is one of the few examples in the state of a pocosin or white cedar forest showing fire-suppression climax vegetation of a red maple (Acer rubrum) forest.
3. The forest contains a remnant population of honeycup (Zenobia pulverulenta), rarely found north of Albemarle Sound.

GENERAL DESCRIPTION:

This natural area is a Carolina bay in a rather unusual location. Just east of the bay is the Suffolk Scarp, and the bay is tucked in a slight depression in the otherwise level, moist, sandy lands of the western half of the scarp. The bay is somewhat oddly shaped and might be two or more bays that are overlapping.

The rim of the bay is somewhat sandy but moist and is dominated by loblolly pine (Pinus taeda), with some pond pine (P. serotina). Atlantic white cedar (Chamaecyparis thyoides) and several hardwoods are also present in the canopy. Red maple (Acer rubrum) is the dominant understory tree. The dense shrub layer contains mostly pocosin species, dominated by sweet gallberry (Ilex coriacea). Quite common in this layer is smooth winterberry (Ilex laevigata), which is rather uncommon in the state, being found in scattered pocosins and bay forests in the Coastal Plain. Honeycup (Zenobia pulverulenta) is also present. Though this ericaceous shrub is a common component of the pocosins of the state, it has nearly been extirpated from the northern portion of its range (southeastern Virginia and the area in North Carolina north of Albemarle Sound). The herb layer is depauperate, but vines are common.

The center of the bay was likely a pond pine pocosin or white cedar forest during the era of frequent wildfires, but with the fire suppression the forest has been dominated by the shade-tolerant red maple. On deep peat soil of the interior, maple completely dominates the canopy, much of the area having not a single tree of another species! The trees average about 14 inches in trunk diameter. Even the subcanopy is dominated by maple, with a few redbays (Persea borbonia) and sweetbays (Magnolia virginiana). Sweet pepperbush (Clethra alnifolia) is the main shrub in the interior; herbs are nearly lacking.

The natural communities are hard to define, because of the long absence of fire. The center of the bay can be called a "red maple swamp", whereas the rim is somewhat a mixture of pocosin and pine flatwoods. The peat in the

center of this bay is over 6 feet deep and is saturated with water, with water pooled in low places.

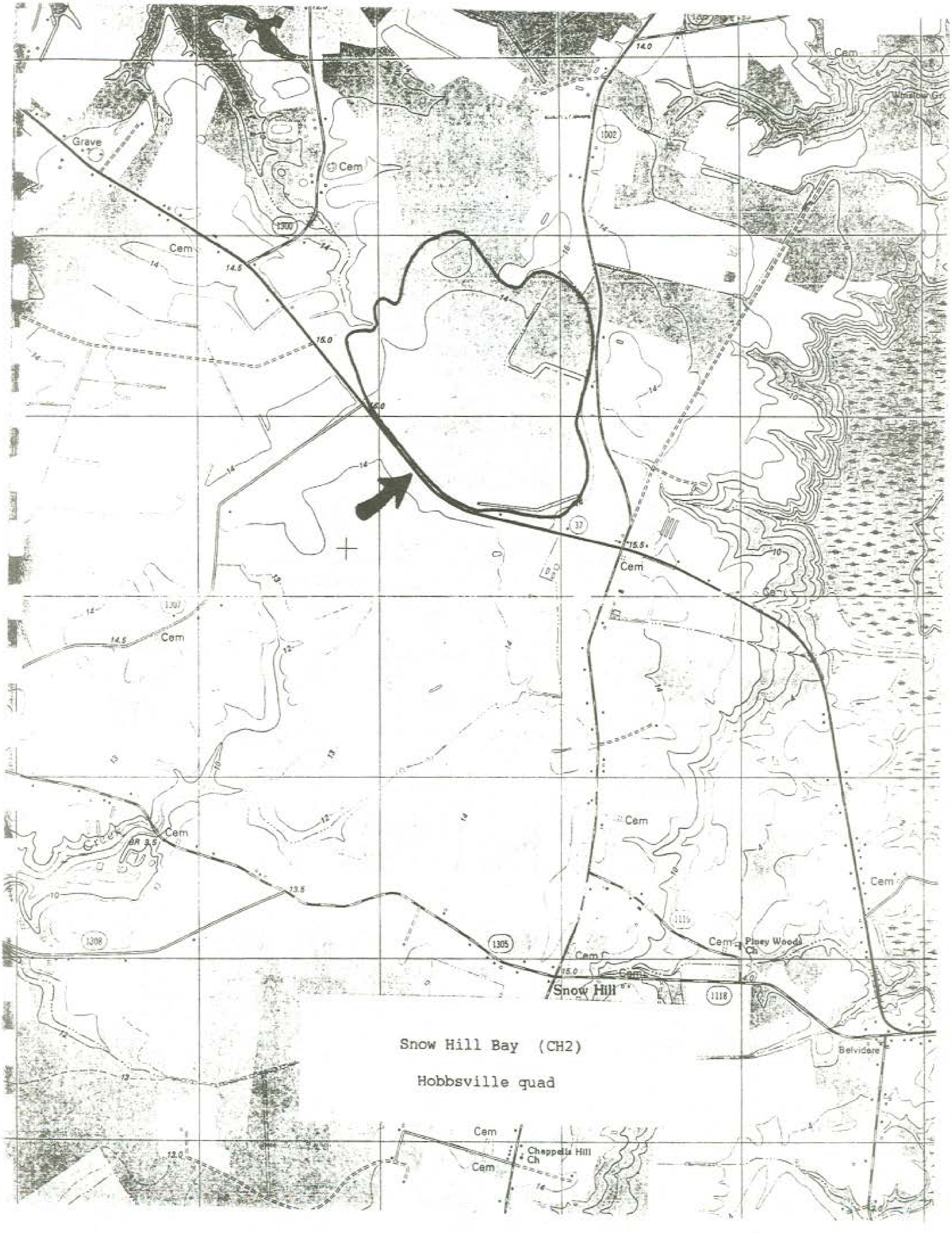
OWNERSHIP: Private

PROTECTION STATUS: None

RECOMMENDATIONS FOR MANAGEMENT OR PROTECTION: Normally, to restore the typical fire-influenced vegetation, burning of the site would be recommended. However, this bay is a valuable study area because of the 75+-year fire suppression, and the long-term succession on organic soils in the Coastal Plain is so poorly known that it would be best to keep fire out of the site. Of course, logging and other disturbances, such as ditching, would also be detrimental. A registry or easement on the property would be the best means of protection. This is an isolated site and would not likely be a high acquisition priority, except as a gift.

COMMENTS: This site is somewhat similar to Gallberry Bay, which is a more obvious, characteristic Carolina bay farther to the south in Chowan County. However, Gallberry Bay has shallower and drier peat deposits, averaging only about 1.5 to 2 feet in depth.

REFERENCES: Frost (1989b)



Snow Hill Bay (CH2)

Hobbsville quad

SITE NAME: Holiday Island

SITE NUMBER: CH3 SIZE: 168 acres

SITE SIGNIFICANCE: C (Regional)

LOCATION: Northwestern portion of Chowan County; an island in the Chowan River located about 1 mile northwest of Cannon Ferry.

QUAD MAP: Mintonsville

SIGNIFICANT FEATURES:

1. This low-lying island consists of a swamp forest dominated by bald cypress (Taxodium distichum). Cypress stands are very uncommon in the Chowan County region, partly as a result of selective logging.

GENERAL DESCRIPTION:

Holiday Island is a rather large island, about 1/4 square mile in size, in the Chowan River. The island must have formed as a shoal or sandbar, but the rising sea level (and/or land subsidence) has now put the island essentially underwater. The island is vegetated in two community types, but both are considered by Frost (1989d) as one natural community -- Tidal Cypress-Gum Swamp. The outer 2/3 of the island contains a rather open but mature stand of bald cypress (Taxodium distichum). Beneath the cypress, red maple (Acer rubrum) is the dominant tree in the subcanopy. Various shrubs are present, but giant cane (Arundinaria gigantea) is the most prevalent plant of the "shrub" zone. Tussocks of sedges, especially upright sedge (Carex stricta), are common.

The central portion of the island was burned about 40 years ago and is covered with giant cane and pocosin-like vegetation. A relatively thin stand of swamp tupelo (Nyssa biflora) is present, with red maple in the subcanopy. Sweetbay (Magnolia virginiana) is common, and an occasional redbay (Persea borbonia) is present. Shrubs are abundant, especially numerous being maleberry (Lyonia ligustrina) and swamp dogwood (Cornus stricta). Giant cane, however, dominates much of the area. Cane is apparently most numerous immediately after fire, but over time and without additional fire, the cane is succeeded or outcompeted by various shrub species.

The wildlife of the island is poorly known. A "colony" of ospreys (Pandion haliaetus) nests on the island. This is the approximate inland limit of nesting by coastal populations. Black bear (Ursus americanus) tracks were seen during the inventory; this is a species of Special Concern in North Carolina.

OWNERSHIP: Private

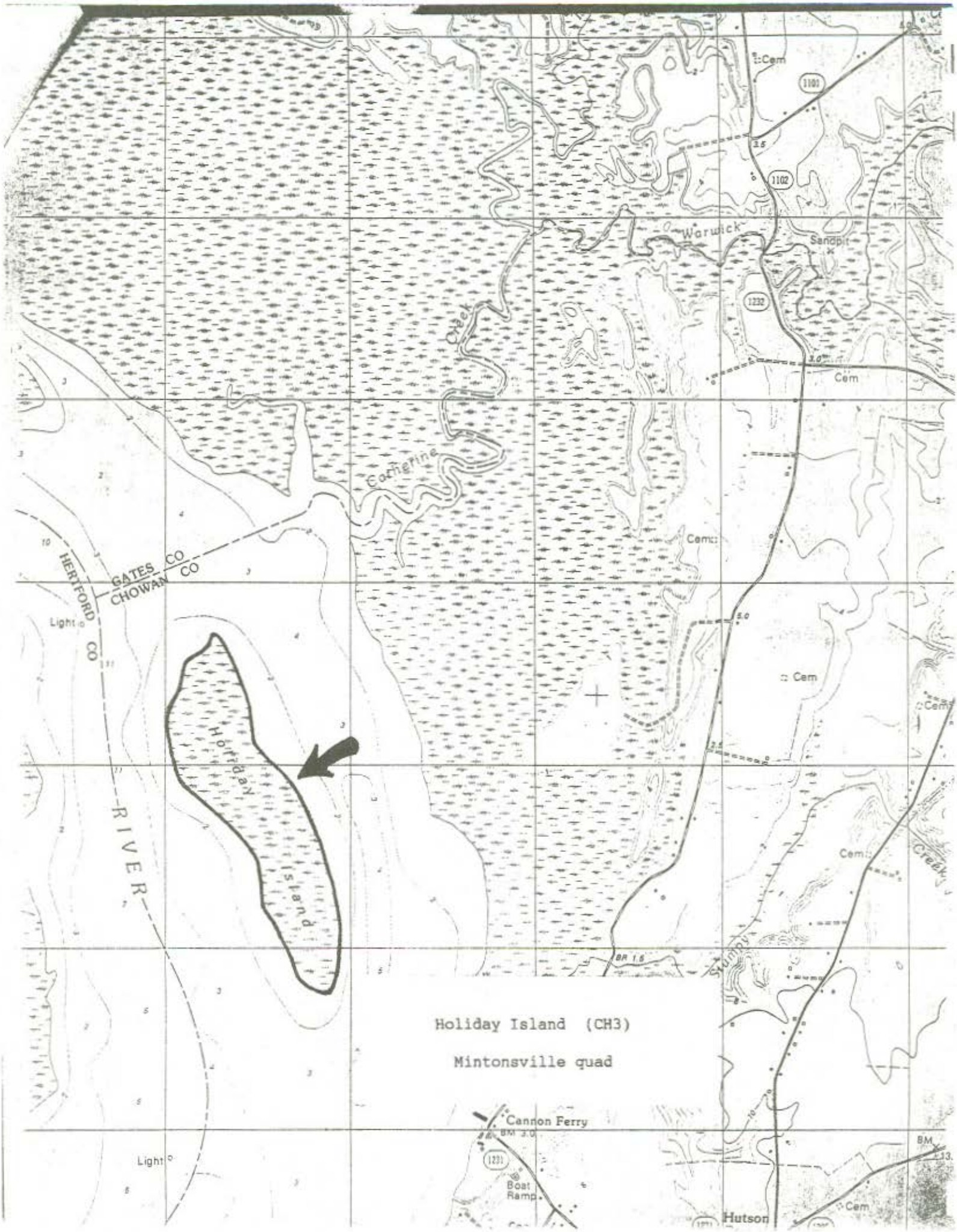
PROTECTION STATUS: None

RECOMMENDATIONS FOR MANAGEMENT OR PROTECTION: No management of the site is necessary. The natural area should be protected from logging, especially since the extent of mature cypresses will likely attract commercial logging

within the next 10 to 20 years. This island should be protected in conjunction with other protected lands in the Chowan Swamp "complex".

COMMENTS: The island had mature stands of loblolly pines (Pinus taeda) several decades ago, but nearly all have been removed by logging.

REFERENCES: Frost (1989d)


Cem
1101
1102
1232
Warwick
Sandpit
Catherine Creek
GATES CO
CHOWAN CO
HERTFORD CO
Light
Holiday Island
RIVER
Cem
Stumpy Creek
BR 1.6
Holiday Island (CH3)
Mintonsville quad
Cannon Ferry
BM 3.0
1231
Boat Ramp
Light
Hutson
BM

SITE NAME: Lower Indian Creek Swamp and Ravine

SITE NUMBER: CH4 SIZE: about 250 acres

SITE SIGNIFICANCE: C (Regional)

LOCATION: Northwestern part of Chowan County, lying along the floodplain of Indian Creek, from SR 1226 on the east to the Chowan River on the west, with the Arrowhead Beach development just southwest of the area.

QUAD MAP: Valhalla

SIGNIFICANT FEATURES:

1. The natural area contains a mature hardwood forest, with the most significant forests being located on the steep slopes along Indian Creek. Oaks up to 48 inches in trunk diameter are present.
2. A freshwater marsh is present along the creek; it may be the only such marsh in the county and is one of just 5 or 6 believed to occur in the Chowan River Embayment.
3. The marsh is one of perhaps 5 or 6 known sites for an unusual form of Turk's-cap lily (Lilium superbum); it may be an undescribed variety or a new species.

GENERAL DESCRIPTION:

Indian Creek, also called Dillard Creek, is a very short stream of approximately 8 miles. It originates in the poorly drained depressions just behind (west of) the Suffolk Scarp and flows westward to the Chowan River. The lower 2 miles, below SR 1226, contains a mature swamp forest within the floodplain, along with a tidal freshwater marsh. Steep slopes as high as 35 feet border the floodplain, particularly on the south.

The majority of the floodplain contains a Cypress-Gum Swamp, Blackwater subtype natural community. Most of the swamp has a tall and closed canopy dominated heavily by water tupelo (Nyssa aquatica); a few bald cypresses (Taxodium distichum) are also present. It is suspected (Frost 1989c) that cypress was originally the dominant tree in this and many other swamp forests of the region, before lumbering removed most of the mature specimens. Lizard's-tail (Saururus cernuus) forms a distinct herb layer. The vegetation alongside Indian Creek is more diverse, with a number of subcanopy, shrub, and herb species present that are absent in the more heavily shaded forest interior. Near the mouth of the creek is a small and even-aged stand of bald cypress with a well developed shrub layer dominated by sweet pepperbush (Clethra alnifolia).

A most notable natural community in the natural area is a freshwater marsh with widely scattered trees; the site is located nearly a mile upstream, rather than at the creek mouth. Although scattered red maples (Acer rubrum) and a few other trees are present, as well as shrubs such as tag alder (Alnus serrulata) and swamp rose (Rosa palustris), most of the marsh is dominated by graminoids, especially upright sedge (Carex stricta). Tall meadowrue (Thalictrum polygamum) is abundant, and there are a variety of other wetland plants such as water-parsnip (Sium suave), mock bishop's-weed (Ptilimnium capillaceum), and lance-leaved violet (Viola lanceolata). The most notable

plant is an apparently undescribed variety of turk's-cap lily (Lilium superbum) or perhaps a new species.

On the steep slopes along Indian Creek, and especially on a north-facing slope of a ravine near Arrowhead Beach, are Mesic Mixed Hardwood Forests. The canopy is dominated by northern red oak (Quercus rubra), white oak (Q. alba), and loblolly pine (Pinus taeda). The subcanopy is well developed, but the shrub and herb layers are rather sparse. Such communities tend to have a flora somewhat like that of Piedmont slopes and ravines.

OWNERSHIP: Private; portions owned by the Arrowhead Beach development

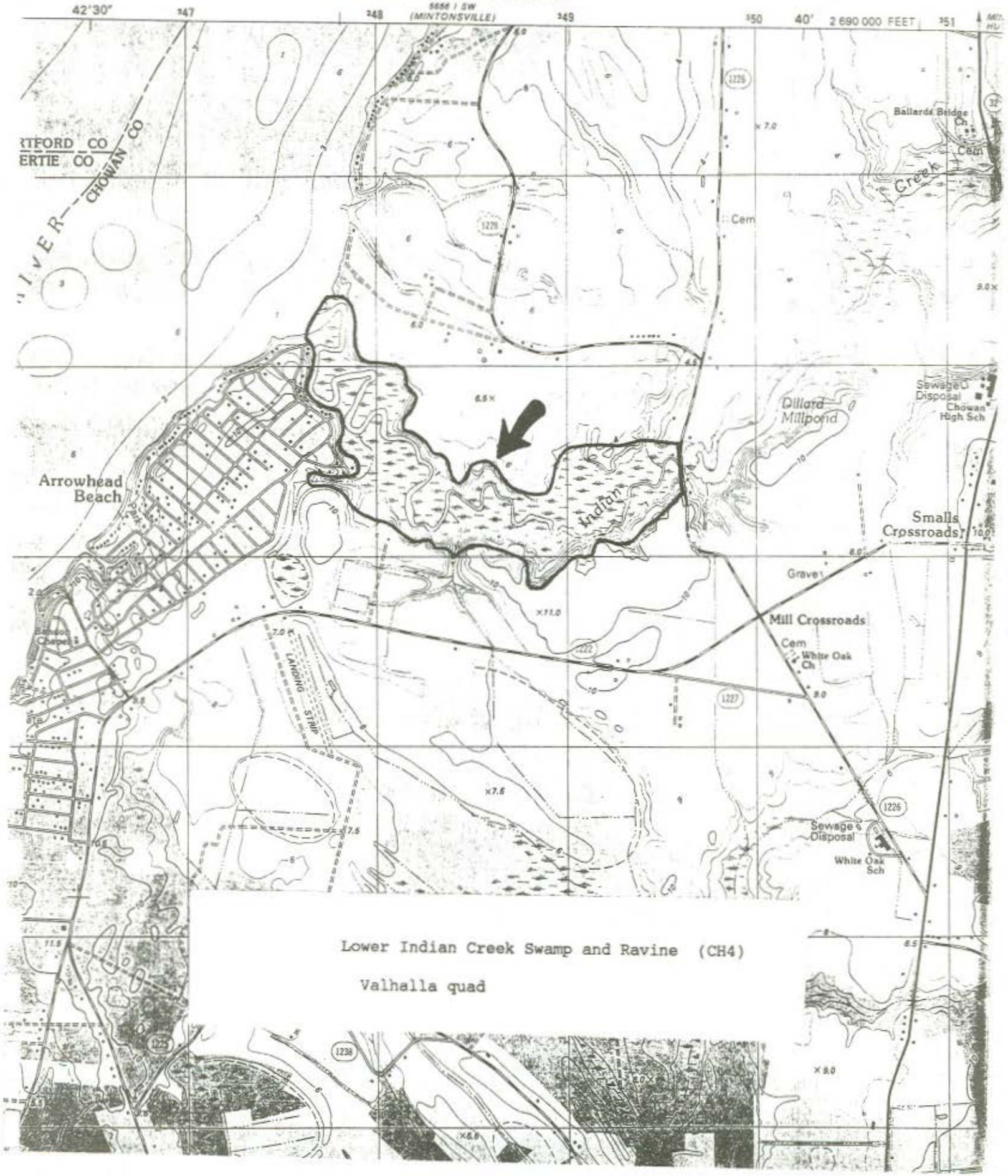
PROTECTION STATUS: None

RECOMMENDATIONS FOR MANAGEMENT OR PROTECTION: The site should be protected from logging or other impacts. Some buffer zones of brush should be left between agricultural fields, which are cleared immediately to the edges of the slopes, and the forests. One protection option would be to have the forest, or at least the portion owned by Arrowhead Beach, be declared and managed as a natural area. Registry or easements on portions of the natural area are other suitable protection options.

COMMENTS: Most of the swamp forest was believed to have been cypress-dominated in its natural state, until logging removed the larger trees. The flat uplands surrounding the forest are primarily in agriculture, with the fields generally being cleared nearly to the slopes. Such clearing often allows weedy species to invade the slopes, plus the forest is less protected from wind, wind-blown soil, and other factors.

REFERENCES: Frost (1989c)

STATE OF NORTH CAROLINA
DEPARTMENT OF NATURAL RESOURCES
AND COMMUNITY DEVELOPMENT
RALEIGH, NORTH CAROLINA



Lower Indian Creek Swamp and Ravine (CH4)

Valhalla quad

SITE NAME: Gallberry Swamp

SITE NUMBER: CH5 SIZE: about 270 acres

SITE SIGNIFICANCE: C (Regional)

LOCATION: Western portion of Chowan County; located about 3/4-mile east of the Chowan River and west of Rockyhock, lying north of SR 1217 and west of SR 1222.

QUAD MAP: Valhalla

SIGNIFICANT FEATURES:

1. The natural area is one of the few well-developed Carolina bays in northern North Carolina with natural vegetation still present. As such, it is a significant physiographic site.
2. The site is a good example of mature nonriverine forested wetland vegetation, which has become highly threatened in North Carolina by clearing for agriculture and for silviculture.

GENERAL DESCRIPTION:

Gallberry Bay is a Carolina bay located in Chowan County near the Chowan River. There is a rather surprising series of Carolina bays in this portion (central Chowan County) of the state, as such bays are generally uncommon north of the Neuse River. Most such bays in the northern half of the state's Coastal Plain have been drained or otherwise cleared for agriculture or for pine plantations. However, Gallberry Bay, also called Gallberry Pocosin and Gallberry Swamp, still retains natural vegetation.

The site is heavily forested with rather mature trees, and some trees exceed 30 inches in diameter. The forest, at least at the southern end, is dominated by swamp tupelo (Nyssa biflora), red maple (Acer rubrum), loblolly pine (Pinus taeda), and Atlantic white cedar (Chamaecyparis thyoides). American holly (Ilex opaca) and sweetbay (Magnolia virginiana) are the most common understory trees. The shrub layer is moderate in density, with some pocosin floral elements. Typical species include titi (Cyrilla racemiflora), Virginia willow (Itea virginica), sweet pepperbush (Clethra alnifolia), and inkberry (Ilex glabra). Various species of greenbriers (Smilax spp.) are abundant.

The ground is wet but apparently not flooded for most of the year. The mixture of tree and shrub species is somewhat unusual and makes classification of the natural communities difficult. In the N.C. Natural Heritage Program's system of community classification (Schafale and Weakley 1985), the forest would best be classified as a Nonriverine Swamp Forest (Schafale 1987).

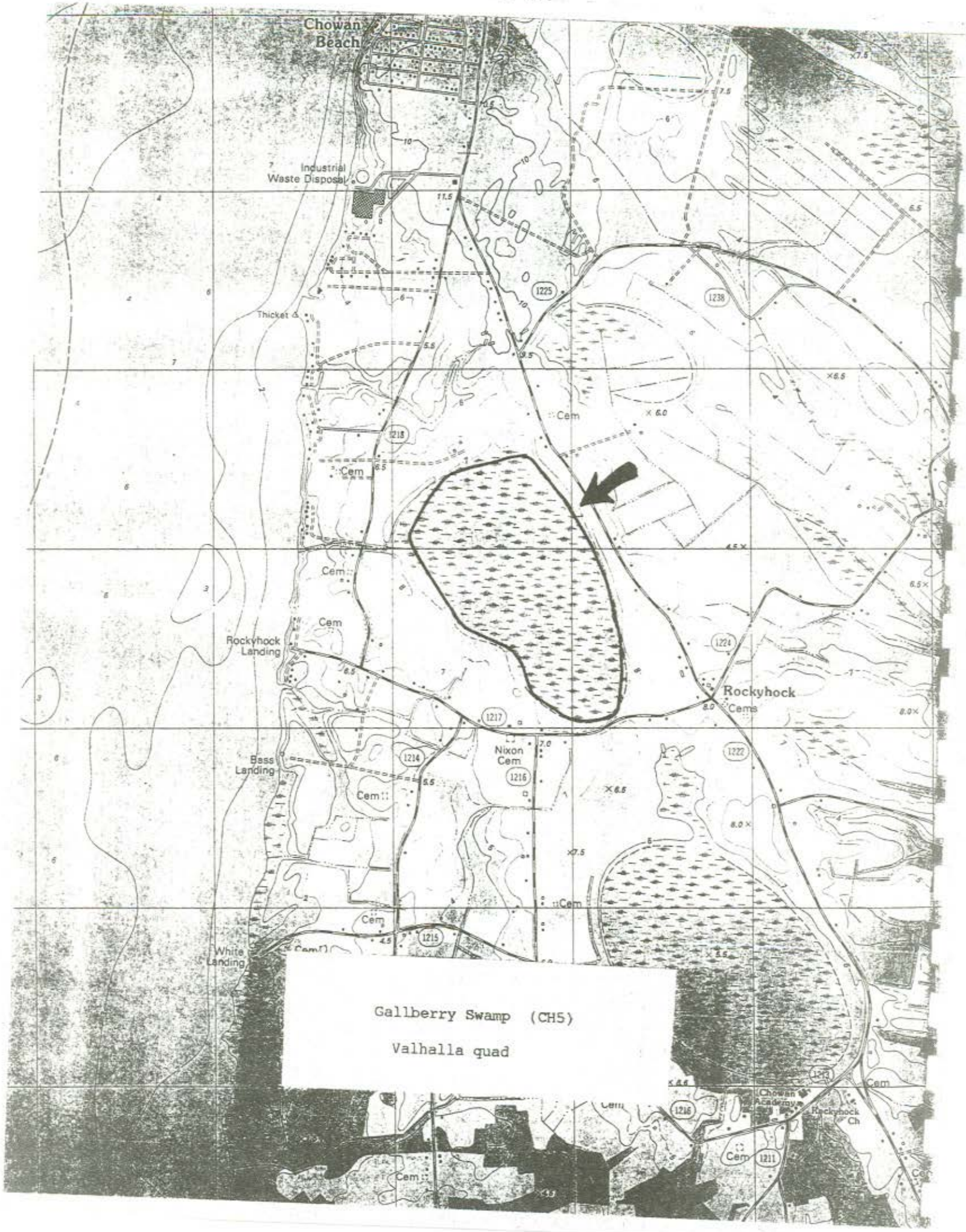
OWNERSHIP: The great majority of the Carolina bay is unallocated land owned by the State of North Carolina, Department of Administration. Portions of the edges of the bay are presumably in private ownership.

PROTECTION STATUS: None

RECOMMENDATIONS FOR MANAGEMENT OR PROTECTION: The site badly needs protection, as it is one of just several examples of a Carolina bay in reasonably pristine condition still remaining in the state north of Albemarle Sound. The N.C. Natural Heritage Program has shown a willingness to see the area protected by having the Department of Administration transfer the site to either the Division of Parks and Recreation (as a State Natural Area) or to the Wildlife Resources Commission (as a State Game Land or State Conservation Area). Neither of these agencies was willing to accept the land because of lack of staff in the vicinity to manage the site or because the site failed to meet standards for natural areas and game lands. At present, the fate of the site is uncertain, although it is unlikely that the Department of Administration will hold the site in perpetuity. A private citizen has made an offer to purchase the site, apparently for timber removal purposes. The natural area should not be timbered but should remain in its natural state and should be transferred to a State agency or private conservation group willing to protect the site.

COMMENTS: Schafale (1987) surveyed a portion of the south end of the bay in February 1985. Frost (1989hh) surveyed the remainder of the natural area in January and July of 1989.

REFERENCES: Schafale (1987), Frost (1989hh)



Gallberry Swamp (CH5)

Valhalla quad

SITE NAME: Reedy Point Swamp

SITE NUMBER: CH6 SIZE: about 1850 acres

SITE SIGNIFICANCE: C (Regional)

LOCATION: Extreme southwestern Chowan County; located along the Chowan River for about 6 miles, extending east to Edenton and north to the vicinity of SR 1205. US 17 bisects the natural area.

QUAD MAPS: Edenhouse, Edenton

SIGNIFICANT FEATURES:

1. The natural area is one of the larger intact swamp forests in the A/P Study area, covering approximately 3 square miles along 6 miles of riverfront.
2. The swamp contains a rather unusual abundance of pocosin features in the floodplain of the Chowan River, with pond pine (Pinus serotina) abundant, and Atlantic white cedar (Chamaecyparis thyoides) formerly so.
3. A small portion of the Chowan Sand Ridge lies along the eastern edge of the floodplain, and there are many elements of sandhills vegetation present.

GENERAL DESCRIPTION:

The floodplain of the Chowan River in southwestern Chowan County has mostly been drowned by the embayed river, but there is still approximately 3/4 mile of floodplain remaining on that side of the river. This natural area extends for approximately 6 river miles, being bisected by US 17. However, this forest is most unusual in that very little is cypress-gum swamp! There is a narrow fringe along the shoreline of the river that is dominated by bald cypress (Taxodium distichum) and water tupelo (Nyssa aquatica), with a few herb species; this is a Tidal Cypress-Gum Swamp community. However, these two tree species are essentially absent over most of the forest away from the shoreline.

Exactly what communities to "label" the remaining 95% of the natural area is a major dilemma. There is a zone of 100-300 yards that was formerly pocosin, marsh, and canebrake, during times of natural fire regime, but is now dominated by red maple (Acer rubrum), with scattered loblolly pines (Pinus taeda) and sweetgum (Liquidambar styraciflua); swamp tupelo (Nyssa biflora) is common in some areas. Sweetbay (Magnolia virginiana) is abundant in the understory; giant cane (Arundinaria gigantea) is quite numerous in the shrub layer. Even though the swamp is located in a floodplain, this community might best be considered a Nonriverine Swamp Forest, based solely on the plant species composition.

The majority of the swamp features a mixed canopy of pond pine (Pinus serotina) and red maple that has not been burned for 35 to 40 years. Most of the site is thus a Pond Pine Woodland natural community, somewhat unusual in a floodplain situation. Unlike typical Pond Pine Woodlands located in nonriverine basins, this forest features scattered swamp elements such as swamp tupelo. The sparse subcanopy contains mainly red maple and sweetbay. Fetterbush (Lyonia lucida) is dominant in the shrub layer, with a few inkberry (Ilex glabra) and sweet gallberry (I. coriacea) individuals present. Large parts of the interior forests have giant cane thickets.

Several parts of the natural area feature former longleaf pine (Pinus palustris) dominated communities. One small floodplain island contains sandy soil and presumably burned every 2 or 3 years; it may have been a flatwoods or savanna community, most likely the former. The Suffolk Scarp and the Chowan Sand Ridge meet along the eastern rim of the natural area, particularly just north of US 17. This sandy ridge is best treated as a Pine/Scrub Oak Sandhill natural community, but frequent natural fire would have given it a "savanna" appearance. Longleaf pine was originally present but has been completely logged from the site. "Sandhills" species found either on the floodplain island or the sand ridge include bluejack oak (Quercus incana), scrub post oak (Q. margaretta), and sandy-woods chaffhead (Carphephorus bellidifolius).

There is a small strip of Atlantic white cedar (Chamaecyparis thyoides) at the toe of the Suffolk Scarp. Some of these trees have trunk diameters of 18 inches.

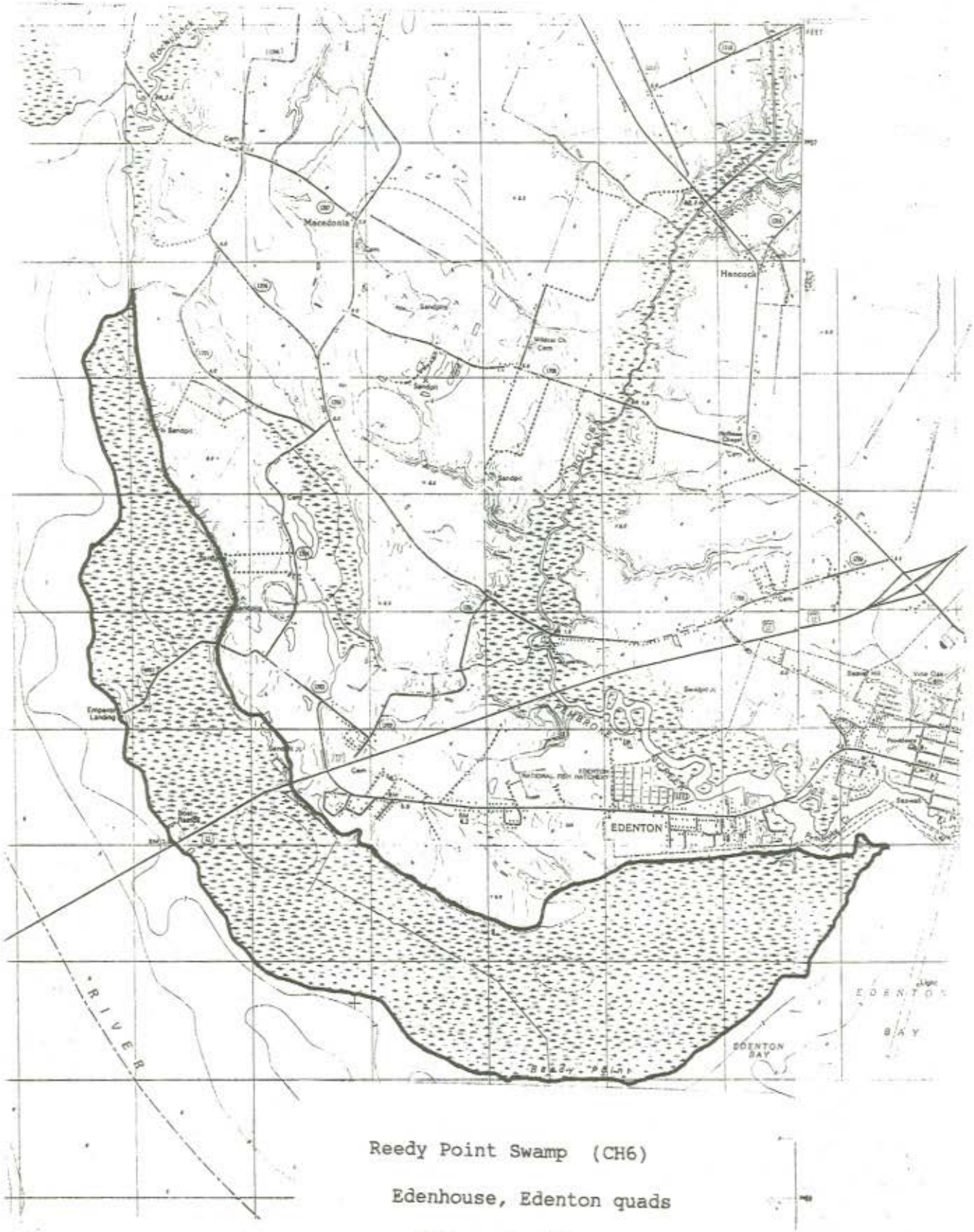
OWNERSHIP: Private; several owners

PROTECTION STATUS: None

RECOMMENDATIONS FOR MANAGEMENT OR PROTECTION: The natural area should be protected from logging, especially the upland portions, most of which have already had the longleaf pines removed. Some of the swamp, as well as the uplands, should be burned on a regular basis, such as every 5 to 10 years, in order to restore a sample of the original vegetation before the fire-suppression era came into being a few decades ago. Much of the swamp should remain unburned. The N.C. Wildlife Resources Commission might be the lead agency and seek acquisition as a Game Land.

COMMENTS: This "modern vegetation" natural area has probably more difficult-to-categorize natural communities than any other site in this inventory. Making categorizing difficult is that some of the communities are fire-suppresion ones, so that there is little evidence today of longleaf pine "barrens" that were almost certainly present a century or two ago.

REFERENCES: Frost (1989w)



Reedy Point Swamp (CH6)

Edenhouse, Edenton quads

[map reduced]

SITE NAME: Cherry Point Woods

SITE NUMBER: CH7 SIZE: about 290 acres

SITE SIGNIFICANCE: C (Regional)

LOCATION: Southern portion of Chowan County; located along Albemarle Sound just northwest of Cape Colony development, with the natural area bisected by a railroad track; site is about 3 miles south-southeast of downtown Edenton.

QUAD MAP: Edenton

SIGNIFICANT FEATURES:

1. The natural area contains a mixture of natural communities, ranging from a tupelo swamp to mesic woodlands on gentle slopes to upland pine-hardwood forests.
2. Fire management by the owners to control understory vegetation has apparently created a forest somewhat similar to the original forest composition during pre-settlement days, when natural fires were a regular feature of the landscape.

GENERAL DESCRIPTION:

Approximately half of the natural area consists of a narrow floodplain that extends to Albemarle Sound on the south. This Tidal Cypress-Gum Swamp natural community is dominated (about 90%) by water tupelo (Nyssa aquatica), with a few willows (Salix nigra?) and pumpkin ash (Fraxinus tomentosa) also present. Red maple (Acer rubrum) is very common in the subcanopy layer. Shrubs are scarce, but herbs such as lizard's-tail (Saururus cernuus) and swamp-loosestrife (Decodon verticillatus) are common.

Much of the natural area consists of upland communities, which are (for the most part) difficult to find in good to excellent quality in the Albemarle Sound vicinity. Rolling slopes and some of the flats on the site contain a Mesic Mixed Hardwood Forest natural community. The canopy is dominated by American beech (Fagus grandifolia), tuliptree (Liriodendron tulipifera), and water oak (Quercus nigra). The understory contains hop hornbeam (Ostrya virginiana), American hornbeam (Carpinus caroliniana), and flowering dogwood (Cornus florida), among many other trees. Sweetleaf (Symplocos tinctoria) and American beautyberry (Callicarpa americana) are common shrubs.

Areas containing Seabrook sand and Wando sand soil types are dominated by mixed loblolly pine (Pinus taeda) and hardwood forests. Because fires were a natural part of the landscape in pre-settlement times, before fire suppression by man, these forests were dominated by loblolly pines and various oaks, along with other species such as longleaf pine (P. palustris) and shortleaf pine (P. echinata). Though the latter two species are very scarce in the county today because of fire suppression, much of the natural area has been burned by the owners to control undergrowth to manage for wildlife, and the resulting forests somewhat resemble those of 1 to 2 centuries ago. The natural communities present on these uplands is difficult to determine and appear to be primarily Mesic Mixed Hardwood Forest, with Pine Flatwoods also present. In addition to loblolly pine, water oak and tuliptree are common in the canopy, along with scattered southern red oaks (Quercus falcata) and willow

oaks (Q. phellos). Frost (1989j) provides further details about the fire history of the forests in the Albemarle Sound vicinity.

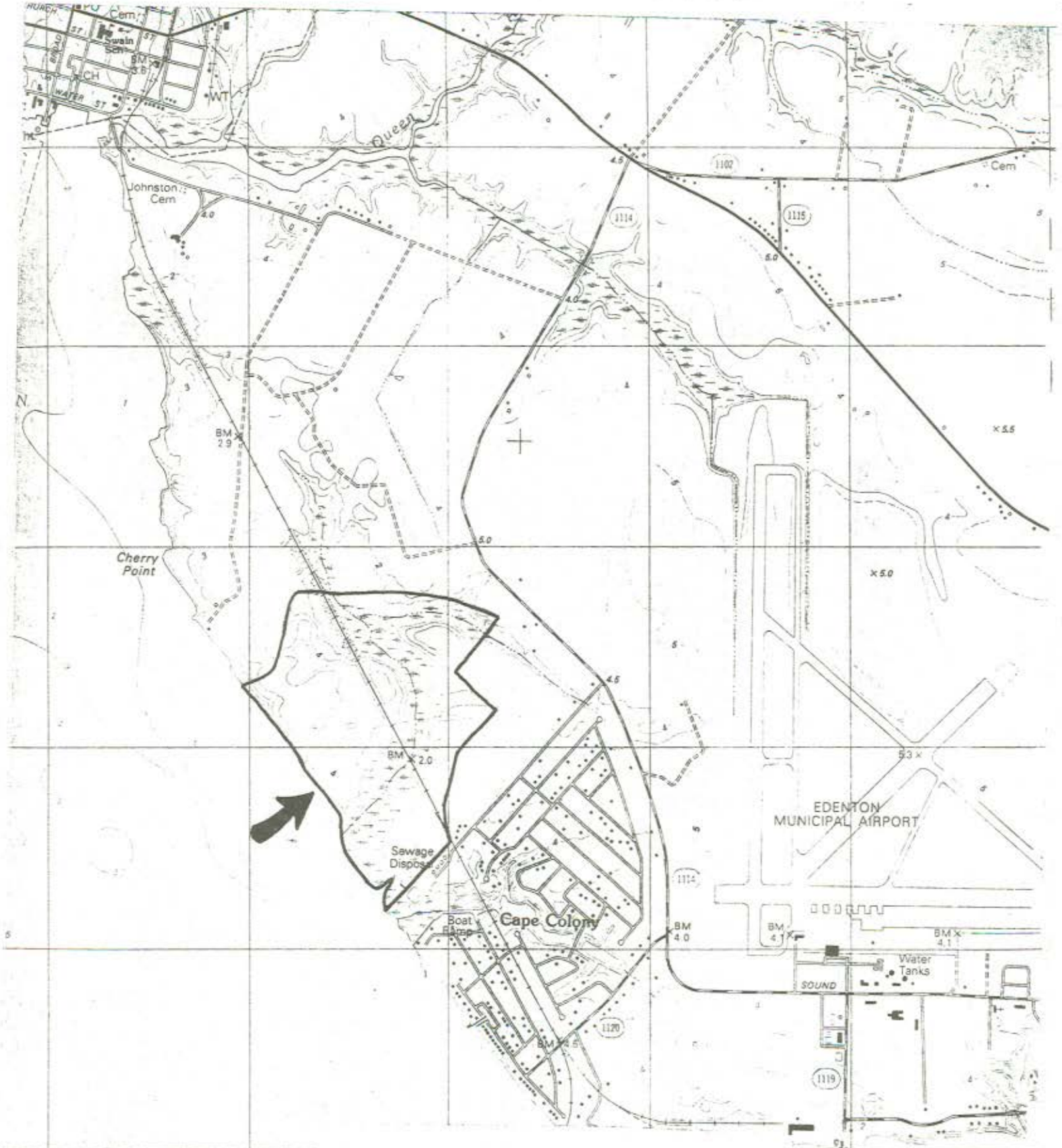
OWNERSHIP: Private

PROTECTION STATUS: None; however, one of the owners is burning portions of the natural area to control undergrowth for better wildlife habitat.

RECOMMENDATIONS FOR MANAGEMENT OR PROTECTION: The burning of the understory should continue, so that the natural pre-settlement aspect of the natural communities on the uplands can be perpetuated. Logging would be harmful to the site. Because the site is somewhat small and not of National or State significance, protection of the natural area would best be accomplished through local efforts at the county level, with registry agreements between the owners and the N.C. Natural Heritage Program, or with management or conservation easements with a private conservation group.

COMMENTS: Classifying natural communities in the Coastal Plain is more difficult than in the Piedmont or mountains of the state because of the often subtle distinctions between wetlands and uplands, often a matter of 1 or 2 inches in elevation. Also, the Coastal Plain has had a history of natural fires influencing the vegetation, so that fire communities were once common, with various pine species such as loblolly pine and longleaf pine forming a canopy and hardwoods restricted to areas of low or intermediate fire frequency. Many of the forests today, especially on flats where the soil is somewhat sandy, feature mosaics of several communities. Some were likely Pine Flatwoods natural communities that were dominated by longleaf pine or stands of mixed longleaf, loblolly, and shortleaf pine, the mix of species dependent upon variations in soil wetness and fire frequency. Such communities today are rarely seen because of fire suppression, as well as timber harvest or conversion to agriculture. Most such "flatwoods" today, if in mature condition, are mixed pine-hardwood forests.

REFERENCES: Frost (1989j)



Cherry Point Woods (CH7)

Edenton quad

SITE NAME: Drummond Point Woods

SITE NUMBER: CH8 SIZE: about 460 acres

SITE SIGNIFICANCE: B (State)

LOCATION: The extreme eastern tip of Chowan County; located north of SR 1100, extending from Drummond Point to approximately 2 miles west of the point, with the Yeopim River forming the northern boundary.

QUAD MAP: Yeopim River

SIGNIFICANT FEATURES:

1. The natural area features a high diversity of aquatic and wetland habitats, with shoreline fringe and marsh types, ranging to swamps with a variety of isolated pools. The flora of the pools is quite diverse, with uncommon plants.
2. Two subtypes of Mesic Mixed Hardwood Forest are present -- the Upland Flats on the terrace and the Bluff/Slope subtype on the slopes. The former subtype is essentially unprotected in North Carolina.

GENERAL DESCRIPTION:

This natural area lies at the tip of a terrace flat located between Albemarle Sound and the embayed portion of the Yeopim River. More than half of the site lies on the upland flats, whereas the remainder lies on slopes and narrow floodplains of tributary streams flowing north to the Yeopim River. Wave-deposited sand bars block the mouths of smaller swamps, which adds variety to a complex landscape with high species diversity.

Along portions of the Yeopim River shoreline lie narrow zones of Oligohaline Marsh communities. No dominant herb species are present, though common reed (Phragmites communis) is dominant as a small patch. Other portions of the Yeopim River shoreline feature low bluffs, mostly 6-10 feet high. A few herbaceous species are apparently limited to this section of the natural area. Loblolly pine (Pinus taeda) is the only canopy tree on the bluffs, whereas American hornbeam (Carpinus caroliniana) and sweetgum (Liquidambar styraciflua) are present in the understory.

Tidal Cypress-Gum Swamp vegetation is present along the tributary streams in the natural area. The dominants vary from place to place, with bald cypress (Taxodium distichum), water tupelo (Nyssa aquatica), and swamp tupelo (N. biflora) all being locally dominant. Swamp cottonwood (Populus heterophylla) is co-dominant with water tupelo in a pool in one of the swamps. Sand bars along the shore of the Yeopim River have partially blocked flow of tributary streams to the river, resulting in strictly freshwater pools with an array of aquatic plants. One pool features a community dominated by Carolina mosquito fern (Azolla caroliniana) and bogmat or mud-midget (Wolfiella floridana). Beneath the surface of this pool is a large colony of prickly hornwort (Ceratophyllum echinatum), an uncommon member of the genus. There are two principal types of swamps in the natural area, one with open channels to the river and one with sand barriers. Water is pooled in most of these swamps by the barriers, giving the impression of a millpond. Spanish

moss (Tillandsia usneoides) is very common in the trees, and there is a diverse understory of shrubs and aquatic plants.

Adding to the diversity of the natural area are the upland flats and slopes vegetated in Mesic Mixed Hardwood Forests. On one flat, the forest is dominated by shagbark hickory (Carya ovata); this species is seldom dominant anywhere in the state. American beech (Fagus grandifolia) is co-dominant is several places. A variety of oaks is present, such as white (Quercus alba), swamp chestnut (Q. michauxii), and post (Q. stellata). The hickory seems to be limited to portions of the site near the shores. This Upland Flats subtype was formerly common to abundant in the A/P Study area, but few significant examples remain, and none are believed to be protected in North Carolina. On the slopes of the tributaries is the Bluff/Slope subtype of mesic forest. Beech is the dominant tree on the slopes, with an open and park-like understory.

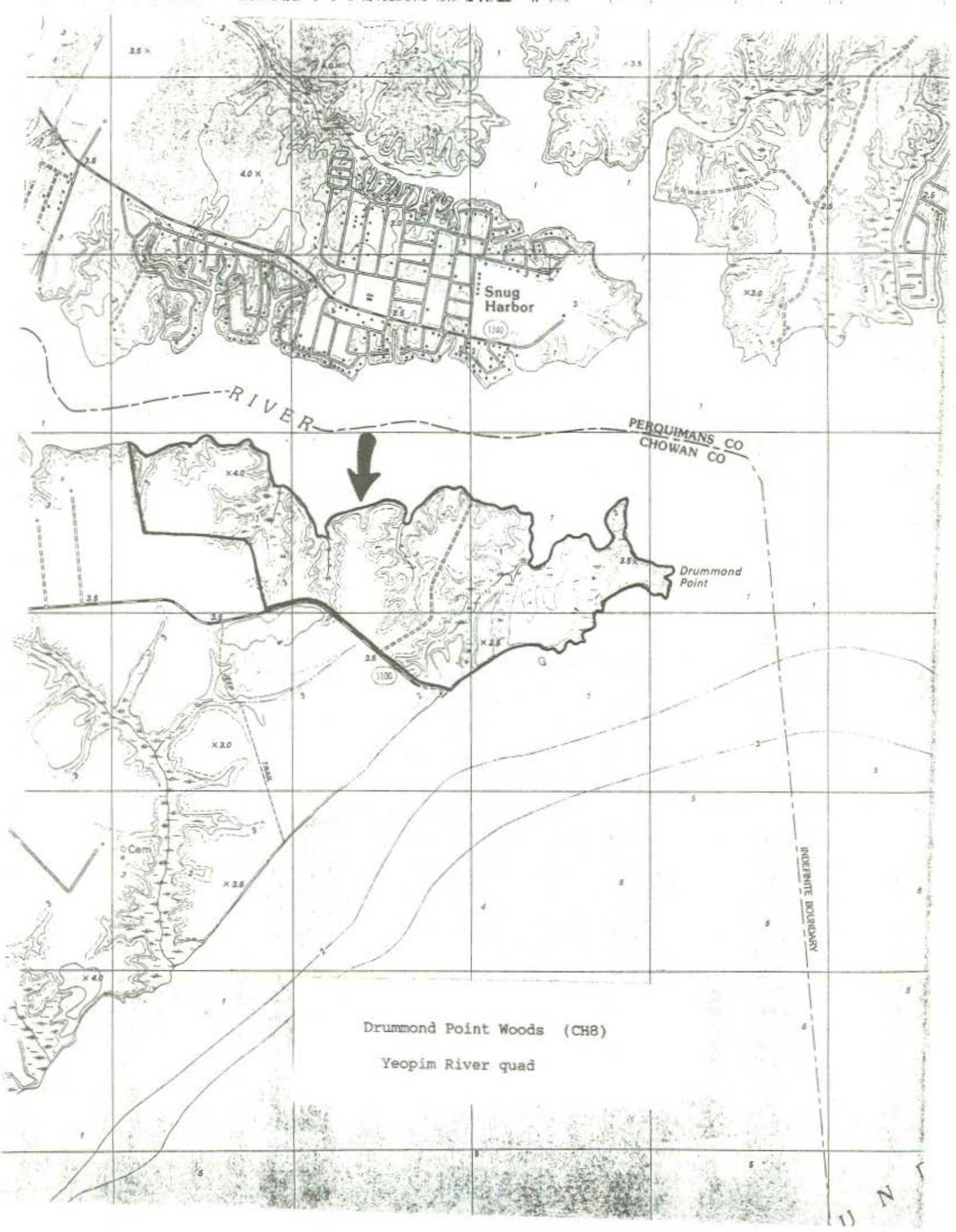
OWNERSHIP: Private; most owned by a single individual

PROTECTION STATUS: None

RECOMMENDATIONS FOR MANAGEMENT OR PROTECTION: The principal landowner is interested in managing his tract for wildlife. The forests should be protected from logging. If the principal owner wishes to retain that tract, a registry agreement or easement on the property would be the most feasible protection options. Because much of the natural area is in uplands, it would be suitable for a state, regional, or county park, with nature trails.

COMMENTS: This site needs additional inventory work, especially in the spring or summer seasons for herbaceous flora and animal populations. Additional flats in the southeastern corner of the county adjacent to Albemarle Sound also need surveying. Though most have been logged in recent decades, a few other upland flats might still feature mature forests. Those flats located adjacent to Albemarle Sound or embayed rivers also face the strong threat of development for recreational purposes, such as second homes. A number of such developments exist in similar sites in Chowan and neighboring counties.

REFERENCES: Frost (1989ee)



Drummond Point Woods (CH8)

Yeopim River quad

SITE NAME: Catherine Creek Marsh and Swamp

SITE NUMBER: GA4 SIZE: about 2000 acres (but continuous with natural area GA6)

SITE SIGNIFICANCE: B (State)

LOCATION: Along the boundary of Gates and Chowan counties. The natural area straddles Catherine Creek and lies west of SR 1232 (Chowan), extending northwestward to near the mouth of Bennetts Creek, with the Chowan River forming the western border of the site.

QUAD MAP: Mintonsville

SIGNIFICANT FEATURES:

1. The tidal freshwater marsh along Catherine Creek contains no evidence of brackish conditions and is quite different from the slightly brackish marshes in Currituck and Camden counties. The marsh is very rich in herbaceous species diversity.
2. Noteworthy species include the rather rare prairie cordgrass (Spartina pectinata), an unusual variety of turk's-cap lily (Lilium superbum), and black bear (Ursus americanus), a Special Concern species.
3. The natural area contains an extensive Tidal Cypress-Gum Swamp.

GENERAL DESCRIPTION:

The Chowan River is a drowned river valley that contains extensive swamp forests along its floodplain. Alongside several tributary streams are found freshwater marshes that contain no evidence of brackish conditions. Such marshes are rare in North Carolina. There is a measurable diurnal tide of approximately 6 inches, but these tides are almost always obscured by wind tides. The lower mile of Catherine Creek is vegetated by a freshwater marsh on both banks. No species is dominant, but the very tall (often over 6 feet) southern wildrice (Zizaniopsis miliacea) is the most conspicuous herb. The rare prairie cordgrass (Spartina pectinata) occurs in small patches. Rhizome hummocks of upright sedge (Carex stricta) and royal fern (Osmunda regalis) provide attachment habitat for many other plants. Conspicuous in the marsh are broad-leaved herbs such as arrow arum (Peltandra virginica), coastal arrow-head (Sagittaria falcata), broad-leaf arrow-head (S. latifolia), and pickerelweed (Pontederia cordata).

Along the inland margins of the marsh, red maple (Acer rubrum) is dominant. It appears that the maple is invading the marsh and might eventually overtake the herbaceous plants, barring fire or other events such as storms that would kill back the maples.

Much of the natural area consists of relatively inaccessible cypress-gum swamps that have a tidal influence. Of more interest, in terms of rarity, is a former extensive stand of Atlantic white cedar (Chamaecyparis thyoides) in the swamp, especially south of Catherine Creek. However, nearly all of the cedar has been removed by logging, so that the remaining area contains a loblolly pine (Pinus taeda) canopy, with some cedar and pond pine (P. serotina).

OWNERSHIP: Portions of the natural area, primarily land southeast of Catherine Creek, are privately owned. The State of North Carolina (N.C. Forestry Foundation, N.C. State University School of Forestry) owns the land northwest of the creek within the natural area.

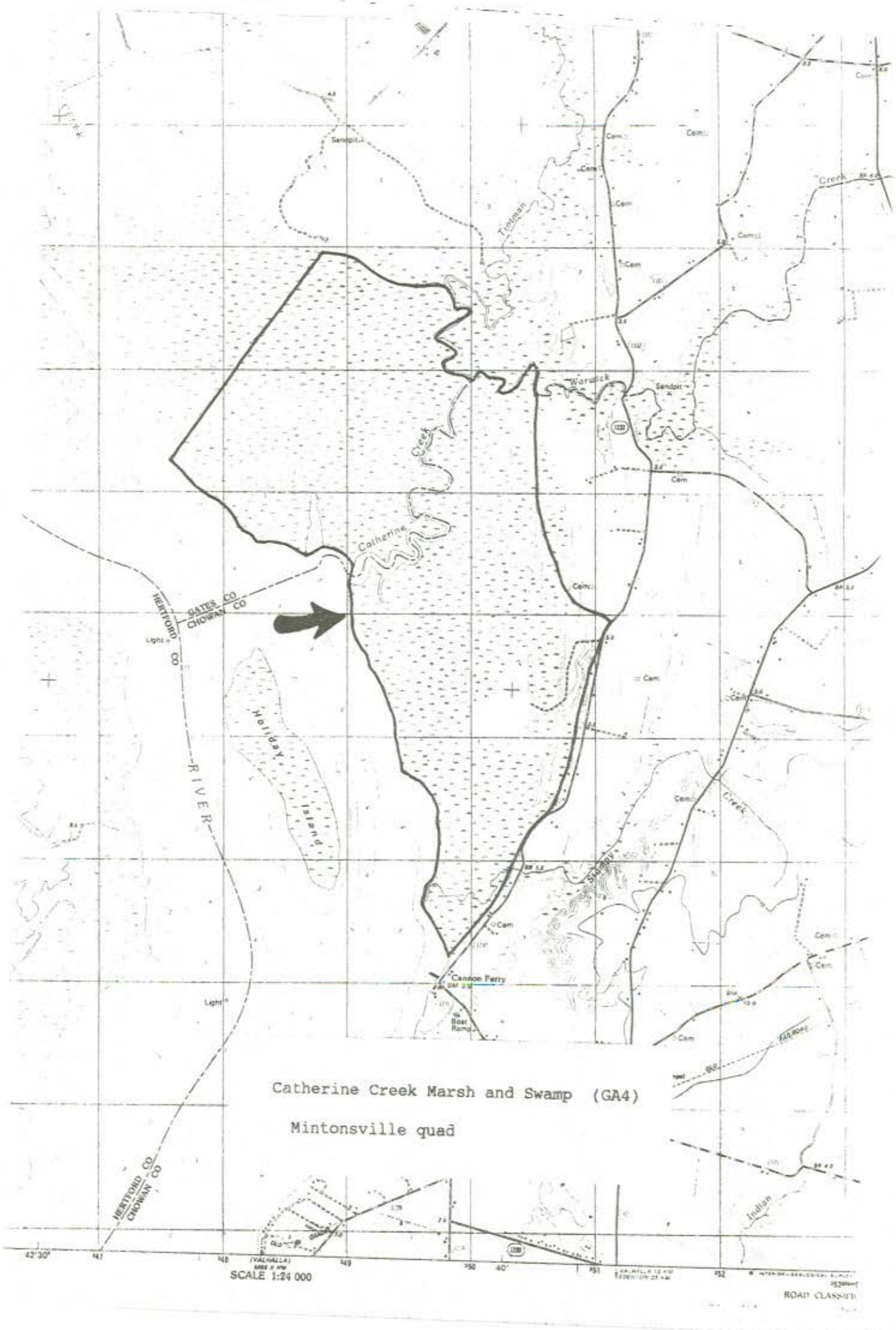
PROTECTION STATUS: No official protection status for either the private portion or the State-owned portion. The portion owned by the Forestry Foundation is undergoing no manipulation and is being maintained, at least for the present time, for eventual use for scientific and educational purposes.

RECOMMENDATIONS FOR MANAGEMENT OR PROTECTION: Succession of the marsh by red maples is taking place in some portions of the marsh, and burning of the marsh every 20-25 years may be necessary to control the maples. Logging of the trees in the swamp has been detrimental, especially to the cedars. In order to regenerate cedars in the swamp, it might be necessary to burn the forest in the hopes of having seedlings gain a foothold in the swamp. This would likely not be a suitable management tool, and it seems best to allow the forest to mature, even at the eventual complete loss of the cedar. The private portion of the site needs protection, and the best method would be by acquisition by the State, such as by the Wildlife Resources Commission for a Game Land or by the N.C. Forestry Foundation at N.C. State University to add to its holding on the opposite side of Catherine Creek.

A privately-owned, 116-acre tract has been placed on the market for sale in late 1989. This tract is adjacent to the Forestry Foundation land. It is suggested that the Foundation inquire about the acquisition of the property for inclusion with their landholdings at Chowan Swamp.

COMMENTS: Frost and Lane (1989) discuss the differences between the Chowan River marshes and the marshes in Currituck and Camden counties. The marshes in the latter counties are slightly brackish and feature a considerable number of graminoids (grasses, sedges, and rushes). The marshes along the Chowan, including this natural area, feature an abundance of broad-leaved herbaceous species with relatively few grasses, sedges, and rushes. The forested portions of the natural area need further inventory, but access is a considerable problem because of water depth.

REFERENCES: North Carolina Natural Heritage Program (1979b), Frost (1982), Frost and Lane (1989)



Catherine Creek Marsh and Swamp (GA4)

Mintonsville quad

Figure 11. Significant natural areas in Currituck County. The areas are numbered generally in a north to south, or west to east, manner; see Table 7 and the Inventory of Sites section for further information. The portions of the map indicated in stripes are believed to contain significant natural areas, but they are not included in the inventory.


CU1
CU2
CU3
CU4
CU5
CU6
CU7
CU8
CU9
CU10
CU11
CU12
CU13
CU14
CU15
CU16
CU17
CU18
CA3
ATLANTIC

SITE NAME: Northwest Backwoods Natural Area

SITE NUMBER: CU1 SIZE: about 900 acres

SITE SIGNIFICANCE: B (State)

LOCATION: Extreme northwestern portion of Currituck County; located north of SR 1227 and east of SR 1218 and extending north to the Virginia state line, about 3 miles northwest of Moyock.

QUAD MAP: Moyock

SIGNIFICANT FEATURES:

1. This site contains the most extensive remnant hardwood forest on an upland flat noted during the A/P Study and may well be the largest remnant in the Albemarle Sound region.
2. The area contains an excellent example of Nonriverine Wet Hardwood Forest natural community, which is essentially completely unprotected in North Carolina.

GENERAL DESCRIPTION:

Most of the upland flats in the A/P Study area have long been cleared for agriculture, as well as for development and timber harvest. Flats that are still wooded, in the eastern counties, generally contain either Nonriverine Wet Hardwood Forest or Mesic Mixed Hardwood Forest, Upland Flats subtype communities, often a mixture of both. Such a mixture is the case with this natural area, though most of the site is wetland and is a Nonriverine Wet Hardwoods.

The slightly drier portions of the flats, leaning to Mesic Mixed Hardwoods, feature a wide variety of canopy species, with American beech (Fagus grandifolia) and tuliptree (Liriodendron tulipifera) the most numerous, along with several species of oaks. The well-developed subcanopy contains beech, American hornbeam (Carpinus caroliniana), and hop hornbeam (Ostrya virginiana) as dominants. Common pawpaw (Asimina triloba), generally scarce in the northeastern corner of the state, is present in the shrub layer.

Most of the site features a very gently undulating topography, not visible on the topographic map. The slightly wetter areas are dominated by the 3 most typical trees of wet hardwood forest -- beech, cherrybark oak (Quercus pagoda), and swamp chestnut oak (Q. michauxii). White oak (Q. alba) is also present in considerable numbers. Small basins and sloughs that hold water in wet weather are dominated by laurel oak (Q. laurifolia), sometimes with loblolly pine (Pinus taeda) and water oak (Q. nigra) around the margins. Giant cane (Arundinaria gigantea) is common in the wetter portions of the natural area. Cane was likely very common throughout the natural area during periods of high fire frequency, but the species, which does well after fires and after disturbances, is presumably much less numerous today.

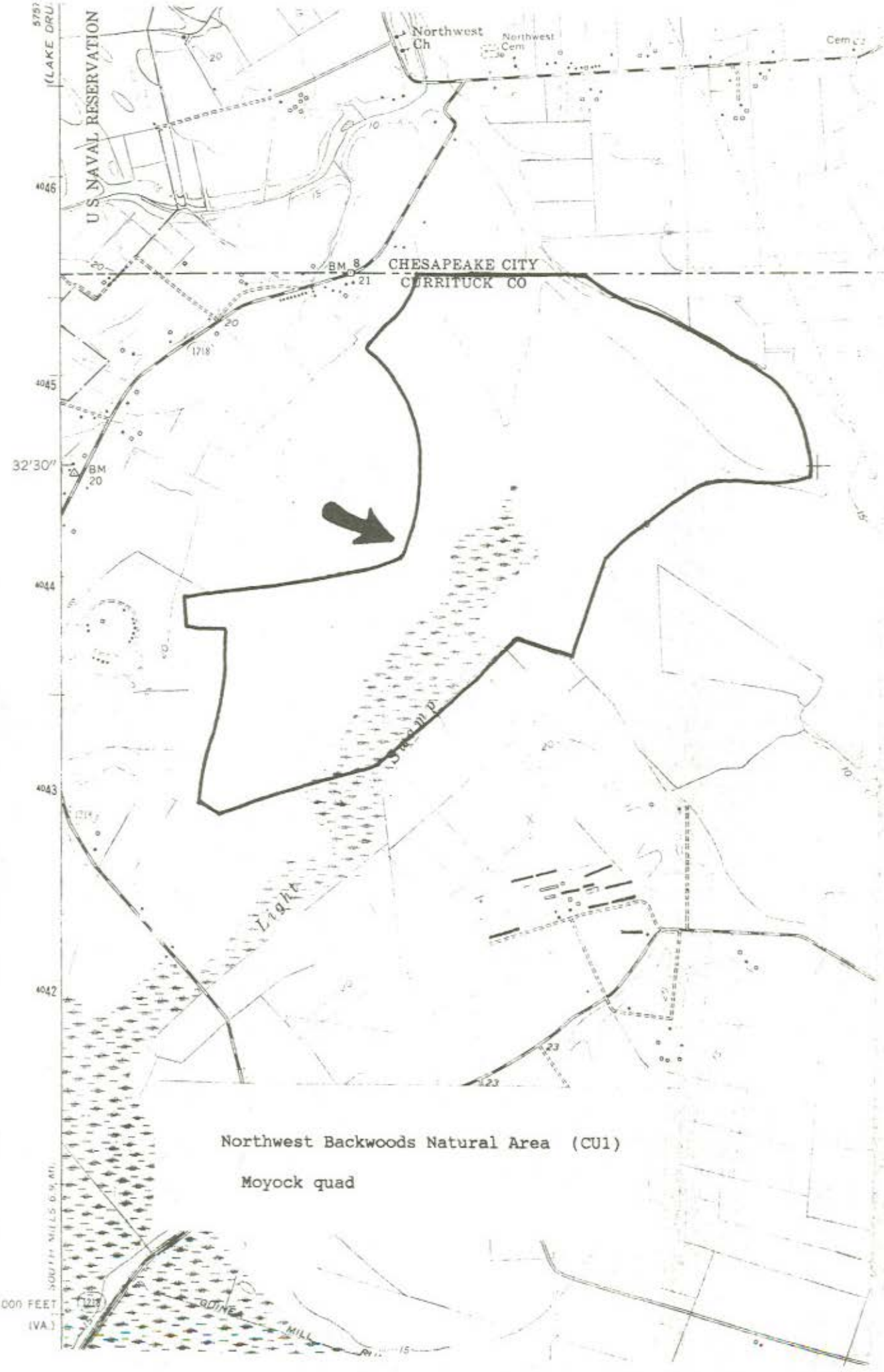
OWNERSHIP: Private, mainly in a single ownership

PROTECTION STATUS: None

RECOMMENDATIONS FOR MANAGEMENT OR PROTECTION: The site is very vulnerable to logging, and any timbering would be very detrimental to the natural area. Frost (1989x) suggests that the site should be burned to restore the former canebreak vegetation in the shrub layer. Private conservation organizations should take the lead in the protection of this site or other similar upland flats with mature hardwood forest, since this and others are considered to be of high significance and because there is essentially no protected upland flat site (of any type) in the state, with the possible exception of a single registered natural area in Croatan National Forest. Sites such as this likely have a high wildlife value because of the abundance of mast-producing trees such as oaks and beeches, and this type of community would be suitable for acquisition by the Wildlife Resources Commission as a Game Land.

COMMENTS: This natural area needs further inventory, as nearly all field work was conducted at the extreme northern end of the area. Boundaries of the natural area were drawn using aerial photos; thus, the recent condition of most of the southern half of the site is not known. This type of forest is very vulnerable to timbering and the site should be assumed to be under great threat.

REFERENCES: Frost (1989x)



Northwest Backwoods Natural Area (CU1)

Moyock quad

SITE NAME: Northwest River Marsh Game Land

SITE NUMBER: CU2 SIZE: about 1550 acres

SITE SIGNIFICANCE: A (National)

LOCATION: Extreme northern Currituck County; lying on the north shore of the Northwest River, extending from the river to the Virginia state line and east nearly to SR 1248.

QUAD MAPS: Moyock, Creeds

SIGNIFICANT FEATURES:

1. The natural area, in conjunction with adjacent natural areas in Virginia and to the east in North Carolina, contains a wide variety of pristine and exemplary natural communities.
2. A pocosin in the natural area features a perhaps unique species composition. Also unusual or possibly unique is a cypress/bulrush community.
3. The site contains an excellent example of a Coastal Plain oak forest on an upland flat (Mesic Mixed Hardwood Forest, Upland Flats subtype natural community).
4. The freshwater to slightly brackish marshes (Oligohaline Marsh community) are extensive and very diverse in plant species composition.
5. Rare species include twig-rush (Cladium mariscoides), winged seedbox (Ludwigia alata), and black bear (Ursus americanus).

GENERAL DESCRIPTION:

The Northwest River flows from southeastern Virginia into northern Currituck County, North Carolina, entering Tull Bay near the northern end of Currituck Sound. The pristine vegetation along most of the shores of the Northwest River includes swamp forests, white cedar forests, pocosins, and extensive freshwater to slightly brackish marshes.

The marshes are probably best called Oligohaline Marsh natural community, as they contain slightly brackish water and several plant species typical of brackish marshes. The plant species diversity is very high, as it is in many other marshes in the county. In portions of the interior of the marsh, where long unburned, tall species such as common reed (Phragmites communis), broad-leaf cattail (Typha latifolia), and sawgrass (Cladium jamaicense) form almost monospecific stands. Other portions of the marshes are dominated by narrow-leaf cattail (T. angustifolia) or black needlerush (Juncus roemerianus), but the latter species is not nearly as dominant at this site as in more saline marshes elsewhere in the state. Where there are small pools or slight depressions in the marsh, broadleaved forbs such as coastal arrow-head (Sagittaria falcata), pickerelweed (Pontederia cordata), arrow arum (Peltandra virginica), and water lily (Nymphaea odorata) are found. A low marsh phase is also present, with a lawn-like appearance, dominated by several species of spikerushes (Eleocharis spp.) and rushes (Juncus spp.). The "significantly rare" twig-rush (Cladium mariscoides) and winged seedbox (Ludwigia alata) are present in this marsh phase/subtype. One other marsh phase is present -- a tall marsh with invasion of woody species, especially red maple

(Acer rubrum) and waxmyrtle (Myrica cerifera). Such woody invasion occurs where fire has been suppressed for a number of decades.

Along the headwaters of the creek running along the state line, there are small stands of scattered bald cypress (Taxodium distichum) over wool-grass (Scirpus cyperinus), providing an unusual plant association. The pocosin vegetation is most unusual and is a variant of the Pond Pine Woodland natural community. Rather than featuring a wide variety of evergreen shrub species typical of deep peat sites farther inland, this pocosin features red maple in the understory (beneath the pond pines [Pinus serotina] in the canopy), waxmyrtle and inkberry (Ilex glabra) in the shrub layer, and royal fern (Osmunda regalis) as the dominant herb. This pocosin is somewhat open and is not nearly as impenetrable as those farther inland. Portions of the forests are Tidal Cypress-Gum Swamp communities, though cypress is mainly absent. Instead, loblolly pine (Pinus taeda) and swamp tupelo (Nyssa biflora) are dominants in the canopy.

A very significant forest type occurs on upland flats near the state line, with the most extensive portion lying in Virginia. Large hickories, oaks, and American beech (Fagus grandifolia) form the canopy. This community type, considered in this report as a Mesic Mixed Hardwood Forest, Upland Flats subtype, is rare in the state, as well as in Virginia, with few good examples remaining.

OWNERSHIP: Primarily owned by the N.C. Wildlife Resources Commission (1,251 acres); the remainder is apparently in private ownership. The Commission owns the western and southern portions; the northeastern 20% is under different ownership.

PROTECTION STATUS: The Wildlife Commission land is the Northwest River Marsh Game Land, and thus is afforded protection by that agency.

RECOMMENDATIONS FOR MANAGEMENT OR PROTECTION: The marshes should be protected from ditching, impounding, or other disruptions of hydrology. The marshes should be burned about every 5 years to maintain plant diversity, waterfowl foraging habitat, and control woody invasion. Acquisition of the private portion of the natural area is important, since most of the mesic hardwood forest appears to be privately owned. Coordination with the Virginia Natural Heritage Program is recommended since most of the hardwood flats lie on the north side of the state line. Because the site is part of an excellent wildlife/natural area corridor, it is imperative that protection of the wetlands be continuous from Indian River Park in Virginia east to Tull Bay and Gibbs Point in North Carolina, and back north to Pungo Ferry Pocosin in Virginia (i.e, both the Northwest River and North Landing River corridors).

COMMENTS: This natural area is considered to be of National significance, especially when taken with other adjacent sites, including those in Virginia.

REFERENCES: Frost (1989l)

Northwest River Marsh Game Land (CU2)

Moyock, Creeds quads

SITE NAME: Nellie Bell Ponds, Marsh, and Cedar Swamp

SITE NUMBER: CU3 SIZE: about 1475 acres

SITE SIGNIFICANCE: B (State)

LOCATION: Extreme northern Currituck County; located immediately south of the Northwest River and north of SR 1222, about 4 miles east of Moyock.

QUAD MAPS: Creeds, Moyock

SIGNIFICANT FEATURES:

1. The natural area contains an excellent example of freshwater/slightly brackish marsh (Oligohaline Marsh natural community) with a high diversity of plant species, with especially large populations of rattlesnake-master (Eryngium aquaticum) and beaked spikerush (Eleocharis rostellata).
2. The marsh contains 2 "significantly rare" plant species -- twig-rush (Cladium mariscoides) and winged seedbox (Ludwigia alata).
3. Good to excellent examples of several forest communities surround the marsh, including a white cedar swamp and upland woodlands.

GENERAL DESCRIPTION:

The natural area is a combination of marsh and forest habitats along the Northwest River in northern Currituck County. Most of the natural habitats along the river are still in pristine condition. This site features an extensive marsh that is fresh to slightly brackish. As with most marshes in Currituck County, there is a tall fringe of marsh vegetation along the river, with shorter marsh vegetation behind the tall plants, decreasing in stature toward the central interior. Big cordgrass (Spartina cynosuroides) is the dominant of the fringe zone. Found in a few places in this zone, but more numerous in the shorter marsh, is twig-rush (Cladium mariscoides). This grass is considered "significantly rare" in North Carolina. Another marsh zone features a black needlerush (Juncus roemerianus) stand that is mixed with other marsh herbs. Quite significant is a stand of rattlesnake-master (Eryngium aquaticum) that gives the marsh a pale blue color when it blooms in late summer; such dominance of a marsh by this species may be unique in the state. The "significantly rare" herb winged seedbox (Ludwigia alata) is present in this stand. Common three-square (Scirpus americanus) often forms dense patches in the marsh. Beaked spikerush (Eleocharis rostellata), rather rare in the state, also forms extensive patches in the marsh, and with several other species, forms a unique community type of which only 2 other locations are known (Sites CA7 and CU17). The wettest sites near shorelines and open patches in the center of the marsh are dominated by broad-leaved species. Common are coastal arrow-head (Sagittaria falcata), pickerelweed (Pontederia cordata), arrow arum (Peltandra virginica), and water lily (Nymphaea odorata). Several natural ponds are present in the center of the marsh, with water lily characteristically floating on the surface.

The forest community adjacent to the marsh is complex. In one area there is a band of pond pine (Pinus serotina) pocosin between marsh and an interior white cedar (Chamaecyparis thyoides) zone; in another the marsh is bordered by gum swamp. Swamp tupelo (Nyssa biflora), red maple (Acer rubrum), and

waxmyrtle (Myrica cerifera) are the dominant woody species. Most significant is a well-developed stand of Atlantic white cedar within the forested area. This stand features a number of pocosin/bay species such as redbay (Persea borbonia), sweetbay (Magnolia virginiana), fetterbush (Lyonia lucida), and inkberry (Ilex glabra).

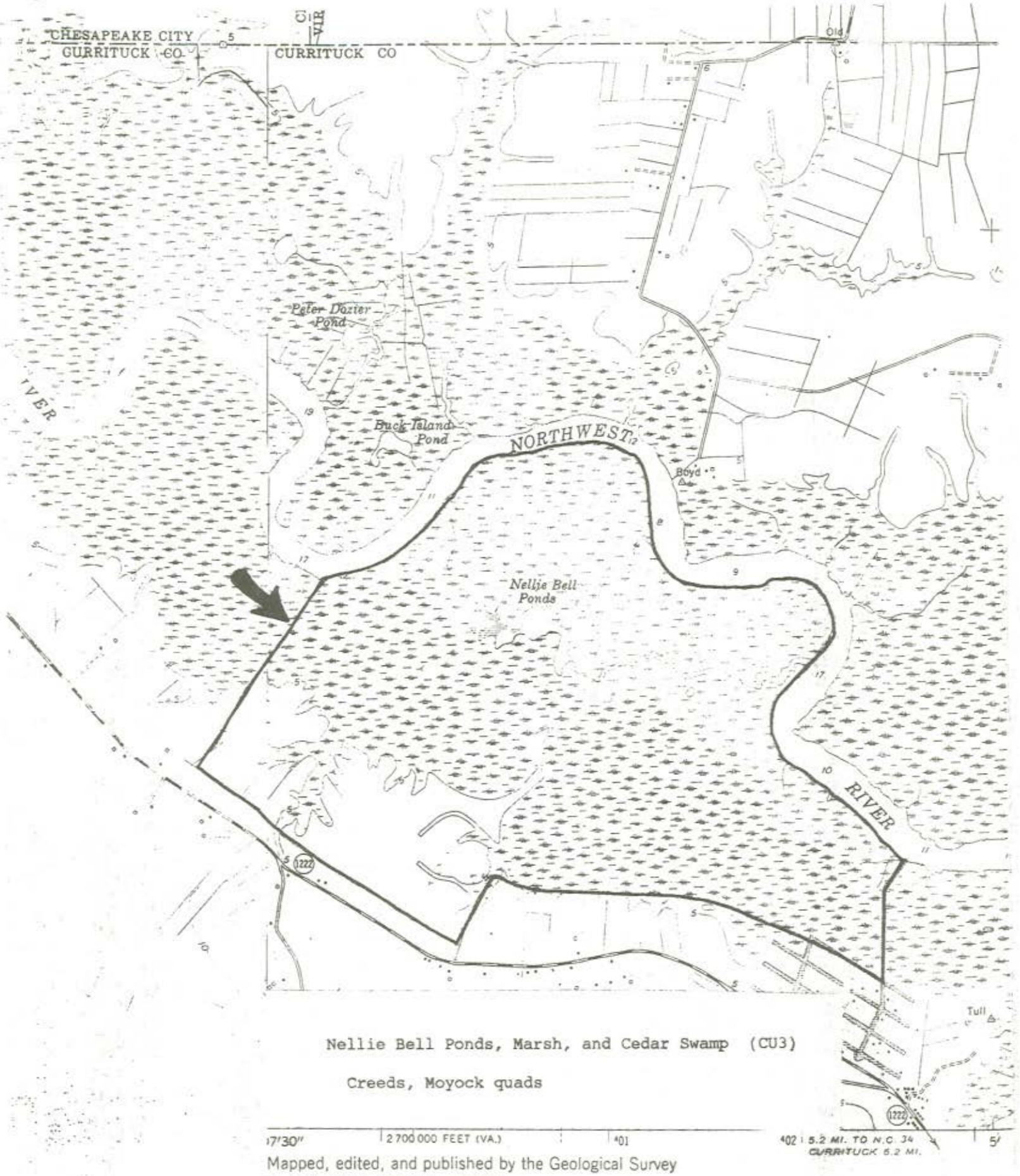
OWNERSHIP: Private

PROTECTION STATUS: None

RECOMMENDATIONS FOR MANAGEMENT OR PROTECTION: Development in the form of vacation homes, along with canals for boats, is springing up in parts of Currituck County, including a site just east of the natural area. The forests need to be protected from such development, and the marshes need to be protected from ditching for canals for boat access to the river. The marshes are apparently burned by citizens or owners every few years, perhaps to enhance waterfowl hunting. It is highly desirable that marsh burning should continue. This site, with adjacent natural areas along the Northwest River, is in strong need of protection. The N.C. Wildlife Resources Commission's Northwest River Marsh Game Land is less than a mile upstream (west) of the natural area, on the opposite side of the river. This agency might be the lead for protection, such as acquisition for game land status.

COMMENTS: Frost (1989i) says that this site "may be the most important natural area still unprotected north of the Albemarle Sound". Certainly, the marshes and associated forests along the entire stretch of the Northwest River and North Landing River are of National significance, when taken collectively, and it seems that protection of many of these marshes should be of high priority.

REFERENCES: Frost (1989i)



Nellie Bell Ponds, Marsh, and Cedar Swamp (CU3)

Creeds, Moyock quads

Mapped, edited, and published by the Geological Survey

Control by USGS, USC&GS, and USCE

Culture and drainage in part compiled from aerial photographs taken 1953. Topography enlarged from 1:62 500 scale map of Moyock quadrangle, 15-minute series. Original map by planetable surveys 1938–1939. Revised 1954

Hydrography from USC&GS charts 830, dated 1951

SITE NAME: Gibbs Woods

SITE NUMBER: CU4 SIZE: about 1325 acres

SITE SIGNIFICANCE: B (State)

LOCATION: Extreme northern portion of Currituck County; located north of the Northwest River and Tull Bay, west of SR 1251, and on both sides of SR 1250.

QUAD MAP: Creeds

SIGNIFICANT FEATURES:

1. The natural area contains a rare community type or subtype -- semi-evergreen oak/cane forest -- in an old meander channel. Much of the northern portion of the area contains a good example of Nonriverine Wet Hardwood Forest, of which the above type or subtype might be included as a variant. This forest is rather unusual in that it is located on an upland divide, rather than being in a single drainage basin.
2. The southern portion of the natural area contains extensive fresh to slightly brackish marshes and swamp forests, including remnant stands of Atlantic white cedar (Chamaecyparis thyoides).

GENERAL DESCRIPTION:

The northern third of the natural area lies on a broad flat terrace that extends for many miles, northward into Virginia, north of Tull Bay. Running along the terrace in the natural area, and separating two upland flats, is a narrow former meander channel. The oaks that dominate this slight depression in the topography are semi-evergreen and feature laurel oak (Quercus laurifolia) and willow oak (Q. phellos) in the canopy, over a shrub layer dominated by giant cane (Arundinaria gigantea). This vegetation type fits no clear natural community in the Schafale and Weakley (1985) classification, but it might be treated as a variant of Nonriverine Wet Hardwood Forest. A small finger of swamp forest is present where SR 1251 crosses this slough or old channel; swamp tupelo (Nyssa biflora) is the dominant canopy tree.

Where SR 1250 bisects the natural area, a mature Nonriverine Wet Hardwood Forest is found on the terrace flats. This is a fairly typical example of this community, though American beech (Fagus grandifolia) is more common than usual in forests of this type in the A/P Study area. Also abundant is cherrybark oak (Quercus pagoda), with swamp chestnut oak (Q. michauxii) being numerous. White oak (Q. alba), red maple (Acer rubrum), and loblolly pine (Pinus taeda) are also present in the canopy. Beech is the main species in the understory layer. Beech tends to increase in frequency on the upland flats where fire has been suppressed, being more susceptible to fire than the oak species. Cherrybark oak tends to dominate on sites that are slightly drier than sites dominated by swamp chestnut oak.

The extensive swamp south of the terrace flats was not examined in detail. Portions contain stands of Atlantic white cedar (Chamaecyparis thyoides). This portion of the marshes that fringe Tull Bay and Northwest River were also not examined to any extent, but the quality of them appear good to excellent.

OWNERSHIP: Private; multiple ownership

PROTECTION STATUS: None

RECOMMENDATIONS FOR MANAGEMENT OR PROTECTION: The site should be protected from logging. Portions, such as the oak flats, should be burned to restore the natural understory composition. This site should be combined with other significant natural areas in the Northwest River/North Landing River area when considering protection measures. The N.C. Wildlife Resources Commission, the N.C. Division of Coastal Management, the U.S. Fish and Wildlife Service, and private conservation groups are agencies that might wish to initiate protection measures, such as acquisition, for this natural area.

COMMENTS: Further field work is needed in the wetlands (swamps and marshes) in the southern half of the natural area. Classification of the semi-evergreen oak "slough" community is puzzling, but this type, although very limited in extent, was found at 5 sites in the Albemarle Sound region during this study.

REFERENCES: Frost (1989cc)

ological Survey

SITE NAME: Tull Bay Marshes

SITE NUMBER: CU5 SIZE: about 1200 acres

SITE SIGNIFICANCE: B (State)

LOCATION: Northern portion of Currituck County, located in the vicinity of the mouth of the Northwest River, Tull Bay, and North Landing River. The primary site is an island in Tull Bay.

QUAD MAP: Creeds

SIGNIFICANT FEATURES:

1. The slightly brackish marshes surrounding, and in, Tull Bay are very diverse and are excellent examples of Oligohaline Marshes. The marshes are among the most extensive in the state.

GENERAL DESCRIPTION:

Some of the most extensive freshwater to slightly brackish marshes in North Carolina are present near the mouth of the Northwest River and in the Tull Bay region. These marshes extend northward along the western margin of North Landing River. They are over a mile wide in some places. Embedded within the marshes are numerous pools, ponds, and a reticulate system of natural channels. The most dominant community type within the marsh is one dominated by broad-leaf cattail (Typha latifolia). This community covers nearly all of the interior of the island in Tull Bay and extensive portions of the marshes on the mainland on the western and northern shores. These marshes are very diverse in herb species; locally common are coastal arrow-head (Sagittaria falcata), salt meadow cordgrass (Spartina patens), black needlerush (Juncus roemerianus), and creeping spikerush (Eleocharis fallax). This type contains hundreds of interspersed pools, ranging in size from 1 square yard to 1/8th acre. Water lily (Nymphea odorata) is very common floating on the surface of these pools.

A mixed tall marsh tends to occur along the shorelines and waterways of the natural area. The dominant species is big cordgrass (Spartina cynosuroides), which forms a narrow zone along the shoreline. A few patches of common reed (Phragmites communis) are present in this tall marsh zone. Small dense patches of black needlerush occur in some places. This species often forms extensive acres of marshes in more saline (brackish) conditions elsewhere in the state. Another community type in the marsh is the common three-square (Scirpus americanus) zone. Beaked spikerush (Eleocharis rostellata) occurs in solid patches in openings among the three-square marshes. This species of Eleocharis is considered "rare" in Radford et al. (1968), but neither the N.C. Plant Conservation Program nor the N.C. Natural Heritage Program monitors the species.

OWNERSHIP: Unknown, but presumed private

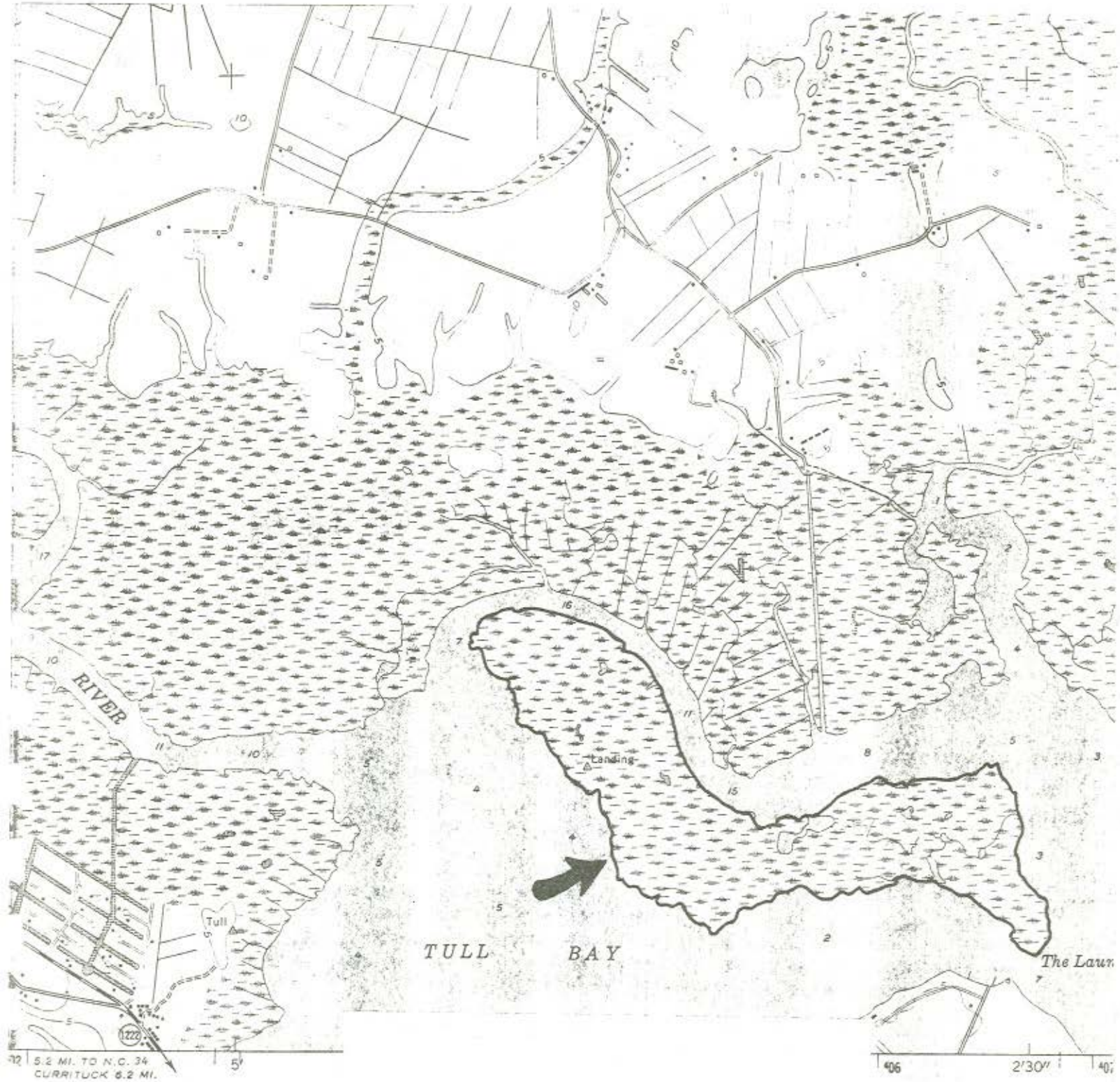
PROTECTION STATUS: None

RECOMMENDATIONS FOR MANAGEMENT OR PROTECTION: The marshes need protection from construction of small boat channels. The island has apparently not been burned for at least 15 to 20 years, based on the sizes of sapling trees. Although fire is not essential to maintain the marshes, it does tend to increase diversity of herb species and kill back shrubs and trees. The Phragmites should be closely watched to see if it is spreading. The species is very vigorous and can eradicate all other vegetation in a marsh.

A major protection venture between Virginia and North Carolina state agencies may be needed to protect the natural features, including swamp forests, along the pristine North Landing River/Tull Bay/ Northwest River complex, since the rivers occur in both states. Farther up the Northwest River, the N.C. Wildlife Resources Commission owns 1,251 acres of land known as Northwest River Marsh Game Land. Thus, it would seem that this agency would be the leading State agency to arrange for protection of the marshes farther downstream in the Tull Bay area. The U.S. Fish and Wildlife Service operates the Mackay Island National Wildlife Refuge on Knotts Island, only 3 miles to the east, on the opposite side of North Landing River. Addition of these marshes to the refuge by acquisition might be a reasonable approach to protect marshes and adjacent forests.

COMMENTS: Inventory of the forests in the vicinity needs to be done. Also, the great extent of marshes along North Landing River have not been fully explored. One sprig of Carolina lilaeopsis (Lilaeopsis carolinensis) was found floating in the area, but it might have been blown in from Currituck Sound, where it is known to be present. However, habitat for this rare plant is suitable in the natural area.

REFERENCES: Frost (1989g)



Tull Bay Marshes (CU5)

Creeds quad

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MN
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ND 1971 MAGNETIC NORTH
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CONTOUR INTERVAL 5 FEET
DATUM IS MEAN SEA LEVEL
SOUNDINGS IN FEET—DATUM IS MEAN LOW WATER
SHORELINE SHOWN REPRESENTS THE APPROXIMATE LINE OF MEAN HIGH WATER
THE MEAN RANGE OF TIDE IS LESS THAN ½ FOOT

THIS MAP COMPLIES WITH NATIONAL MAP ACCURACY STANDARDS
FOR SALE BY U. S. GEOLOGICAL SURVEY, WASHINGTON, D. C. 20242
AND VIRGINIA DIVISION OF MINERAL RESOURCES, CHARLOTTESVILLE, VIRGINIA 22903
A FOLDER DESCRIBING TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST

SITE NAME: Troublesome Point Oak Flats and Marsh

SITE NUMBER: CU6 SIZE: about 1000 acres

SITE SIGNIFICANCE: B (State)

LOCATION: Extreme northern portion of mainland Currituck County; located on a peninsula west of North Landing River and north of Tulls Bay, just beyond the end of SR 1251 and SR 1253.

QUAD MAP: Creeds

SIGNIFICANT FEATURES:

1. The site contains an oak flat, which is vegetated in a mature Nonriverine Wet Hardwood Forest natural community. Good examples of this community are rather rare in the state.
2. The natural area contains extensive slightly brackish marshes that are in pristine condition. This natural area is at the center of a potential "megasite" preserve along the North Landing River and Northwest River.
3. The State Threatened plant Carolina lilaeopsis (Lilaeopsis carolinensis) is present in the natural area.

GENERAL DESCRIPTION:

Troublesome Point lies at the junction of North Landing River and Northwest River, near the head of Currituck Sound. The water is usually slightly brackish, although, like the rest of Currituck Sound, water may fluctuate from nearly fresh after several years of abundant rainfall to brackish, with salinity up to 10% that of seawater after several years of drought and evaporation. Over 80% of the natural area near Troublesome Point consists of marshes, considered Oligohaline Marsh natural community in this report. Big cordgrass (Spartina cynosuroides) forms a tall herb zone along the outer margin of the marsh. A scattering of low, bushy bald cypresses (Taxodium distichum) is present along the water's edge. A notable sub-community is a limited zone of low, semi-evergreen herbs that form mats at the edge of the marsh. Either Carolina lilaeopsis (Lilaeopsis carolinensis) or pale spikerush (Eleocharis flavescens) may be dominant. The interior of the marsh features a more open stand of big cordgrass, along with beggar-ticks (Bidens mitis) and water-parsnip (Sium suave) as showy-flowering species. Narrow-leaf cattail (Typha angustifolia) is common in the interior of the marshes, especially where burned.

A wooded flat is present on the natural area inside the northwestern boundary. The flats are dominated by wetland oak species, especially cherrybark oak (Quercus pagoda), with lesser amounts of swamp chestnut oak (Q. michauxii), laurel oak (Q. laurifolia), and willow oak (Q. phellos). American beech (Fagus grandifolia) is nearly absent. A variety of rather mesic species of understory trees is present. Rimming the flats is a swamp forest dominated by swamp tupelo (Nyssa biflora), and there is a narrow zone of Estuarine Fringe Loblolly Pine Forest.

OWNERSHIP: Unknown, but presumably private

PROTECTION STATUS: None

RECOMMENDATIONS FOR MANAGEMENT OR PROTECTION: No timber cutting should take place in the oak flats. Such forests in the state have been nearly extirpated by timber harvest or drainage for agriculture. The marshes should be burned every 3 years or so to maintain the plant species diversity. Protection of this natural area should be done in conjunction with protection of adjacent natural areas, such as Tull Bay Marshes. It is hoped that, eventually, there will be a megasite preserve that includes both marshlands and wooded lands extending from extreme southeastern Virginia down the North Landing River and then up the Northwest River back into Virginia again. The U.S. Fish and Wildlife Service would likely be the lead agency for such a preserve.

COMMENTS: Because this marsh was surveyed in mid-October, much additional survey work could be done earlier in the season for plant species, as well as for nesting birds.

REFERENCES: Frost and Frantz (1989b)

Troublesome Point Oak Flats and Marsh (CU6)

Creeds quad

SITE NAME: Gibbs Point Forest and Marshes

SITE NUMBER: CU7 SIZE: about 825 acres

SITE SIGNIFICANCE: B (State)

LOCATION: Northeastern corner of Currituck County; located along the Virginia state line (on the north), with North Landing River forming the eastern boundary. An unnamed creek lies along the southern boundary, and SR 1251 lies to the west of the natural area.

QUAD MAP: Creeds

SIGNIFICANT FEATURES:

1. This natural area features a large extent of high-quality oligohaline marshes, which continue in an unbroken expanse from Virginia south to Troublesome Point, and then west along Northwest River.
2. The swamp forests at the site contain remnants of white cedar (Chamaecyparis thyoides) and former pocosin, as well as typical cypress-gum forests. Winged seedbox (Ludwigia alata), a "significantly rare" plant in the state, occurs in the marshes.
3. The uplands support remnant stands of mature nonriverine wet hardwood forests and mesic forests.

GENERAL DESCRIPTION:

This natural area lies adjacent to several other natural areas in the North Landing River/Northwest River section of northern Currituck County. This site is a complex mosaic of marshes and swamp forests on deep, aggrading muck soils. Oak flats and other hardwoods forests lie to the west of the marshes and swamps.

The marsh is rather typical for that of the Currituck Sound vicinity and is an Oligohaline Marsh natural community. It contains taller vegetation along the river and channels and shorter vegetation in the interior, giving the marsh a "bowl-shaped" appearance. Big cordgrass (Spartina cynosuroides) and broad-leaf cattail (Typha latifolia) dominate the shoreline marsh community. The cattail also forms a zone just behind the above stand. Farther toward the interior, common three-square (Scirpus americanus) and narrow-leaf cattail (T. angustifolia) are dominants. Portions of the marsh are dominated by black needlerush (Juncus roemerianus). The rare winged seedbox (Ludwigia alata) occurs in the central interior marshes.

Along a few of the channels inland from the marshes are Tidal Cypress-Gum Swamp communities. Swamp tupelo (Nyssa biflora) is the dominant canopy tree, with pumpkin ash (Fraxinus tomentosa) and loblolly pine (Pinus taeda) also in the canopy. Other streams contain stands of bald cypress (Taxodium distichum) along with the prevailing swamp tupelo. On peaty soils with very little mineral material, red maple (Acer rubrum) swamps are present. Redbay (Persea borbonia) and other bay forest trees occur in the understory. This community is considered to be a fire-suppression "climax" that was formerly High Pocosin or Atlantic White Cedar Forest communities; however, maple appears to dominate in the long absence of fire.

The upland flats in the western portion of the natural area contain primarily Nonriverine Wet Hardwood Forest natural community, as well as elements of Mesic Mixed Hardwood Forest, Upland Flats subtype. The Roanoke soils have no clear dominant species, but cherrybark oak (Quercus pagoda) and swamp chestnut oak (Q. michauxii) are among the most abundant canopy species. This forest type was likely one of the two dominant types on uplands in southeastern Virginia and northeastern North Carolina in pre-settlement days. Shagbark hickory (Carya ovata) is also present. On the slightly drier areas (Augusta soils), cherrybark oak dominates, with red maple also common. A wide variety of hardwood species is present in the canopy. Even slightly drier, the Altavista soils have cherrybark oak and American beech (Fagus grandifolia) as canopy dominants. Hop hornbeam (Ostrya virginiana) is common in the understory, and the ground layer has a surprising abundance of Christmas fern (Polystichum acrostichoides).

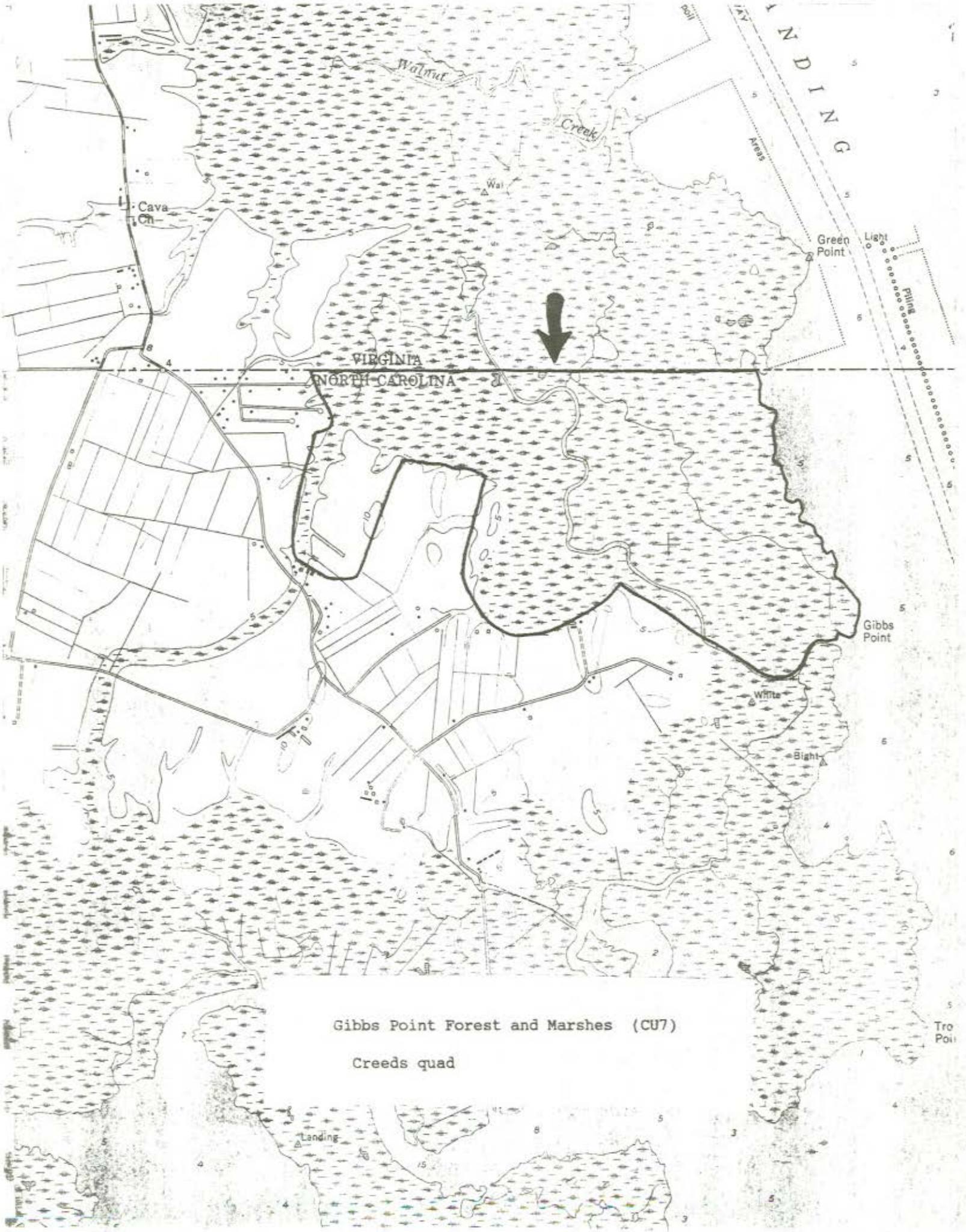
OWNERSHIP: Private; multiple ownership

PROTECTION STATUS: None

RECOMMENDATIONS FOR MANAGEMENT AND PROTECTION: The forests, especially the oak and beech flats, should be protected from logging. The marshes should be burned at intervals of 3 to 5 years to provide herbaceous plant diversity. Protection of this natural area should be done in conjunction with protection of adjacent tracts listed in this inventory, to form a continuous interstate complex. The U.S. Fish and Wildlife Service owns land at Mackay Island National Wildlife Refuge on the opposite (east) side of North Landing River, and this agency might someday wish to add to the refuge, or create a new refuge, incorporating the marshes and forests on the west side of North Landing River. The Division of Coastal Management might also wish to look into acquisition of this or other adjacent tracts for its Coastal Reserve system; and the N.C. Wildlife Resources Commission, which owns Northwest River Marsh Game Land a few miles to the west, is another agency that could become involved in protection.

COMMENTS: The marshes have only been partially explored, and a handful of additional rare plant species might be present. The animal life in the area is also poorly sampled, but the site likely has a high wildlife value, especially the marshes for wintering waterfowl.

REFERENCES: Frost and Frantz (1989c)



Gibbs Point Forest and Marshes (CU7)

Creeds quad

SITE NAME: Lower Tull Creek Woods and Marsh

SITE NUMBER: CU8 SIZE: about 1150 acres

SITE SIGNIFICANCE: B (State)

LOCATION: Northern portion of Currituck County; located along the lower portion of Tull Creek, extending from SR 1222 south to the end of SR 1281 at the Beechwood Shores development.

QUAD MAP: Currituck

SIGNIFICANT FEATURES:

1. The natural area contains a very diverse combination of forests and marshes among the mosaic of islands and flats in the area.
2. The natural area features several unusual bogs that are essentially "shrub-less pocosins", with an abundance of ferns and herbs, and scattered trees, but relatively few shrubs.

GENERAL DESCRIPTION:

Tull Creek is an estuarine tributary stream that is very slightly brackish and has little tidal amplitude. Along its winding course, of just a few miles, are contained numerous fresh to brackish marshes (Oligohaline Marsh natural community) and several types of estuarine/tidal swamp forests, along with flats vegetated in oaks and pines.

Portions of the shores of the creek contain slightly brackish marshes similar to those elsewhere in Currituck County. The shoreline of the marshes features big cordgrass (Spartina cynosuroides) primarily, but a few marshy shores contain a line of bald cypress (Taxodium distichum) with an understory of waxmyrtle (Myrica cerifera). The interior of the marshes is dominated by black needlerush (Juncus roemerianus).

Portions of the forests fringing the marshes are vegetated in an Estuarine Fringe Loblolly Pine Forest natural community. Loblolly pine (Pinus taeda) is the only canopy in some places, and there is little shrub or understory layer. However, wool-grass (Scirpus cyperinus) and other grasses, sedges, and herbs are prevalent. On the other hand, other swamp forests contain bald cypress, swamp tupelo (Nyssa biflora), red maple (Acer rubrum), and sweetgum (Liquidambar styraciflua). The dynamics of these two swamp forests is unclear as to why pine dominates in some places and cypress/tupelo in others; the soils may be slightly different, the pine may be more prevalent in the sites more frequently burned, or perhaps flooding frequency affects the tree composition. Certainly, some of the pine stands that go unburned for several decades are invaded by red maple, sweetgum, and other hardwoods and eventually become hardwood swamps; fires likely knock back most of the hardwoods (and perhaps the pines as well), but the pines are often the first tree species to colonize some marshes.

Near the confluence of Tull Creek and its western branch is a flat area that is vegetated in mixed pine-oak woods. The forest appears to have been logged around 50-60 years ago and thus has numerous pines in the canopy. Surprising is shortleaf pine (Pinus echinata) in such a moist site; pond pine

(P. serotina) is also present. Five species of oaks are present, with cherrybark oak (Quercus pagoda) being the dominant.

The most unusual feature of the natural area is an bizarre community dominated by Virginia chainfern (Woodwardia virginica), having the aspect of a "bog". The site is nearly devoid of shrubs and is spongy, with water pooled in places. A few pond pines and swamp tupelos, of low stature, occur in the bog, and a few shrubs do occur, such as southern wild-raisin (Viburnum nudum), inkberry (Ilex glabra), and waxmyrtle. Frost (1989t) considers this community to be a pocosin variant, noting that the site is slightly east of the known ranges of titi (Cyrilla racemiflora), sweet gallberry (Ilex coriacea), and honeycup (Zenobia pulverulenta). Several such bogs were seen by Frost (1989t), and others may be present; they are located northwest of the junction of Tull Creek and its western branch.

OWNERSHIP: Private; multiple owners

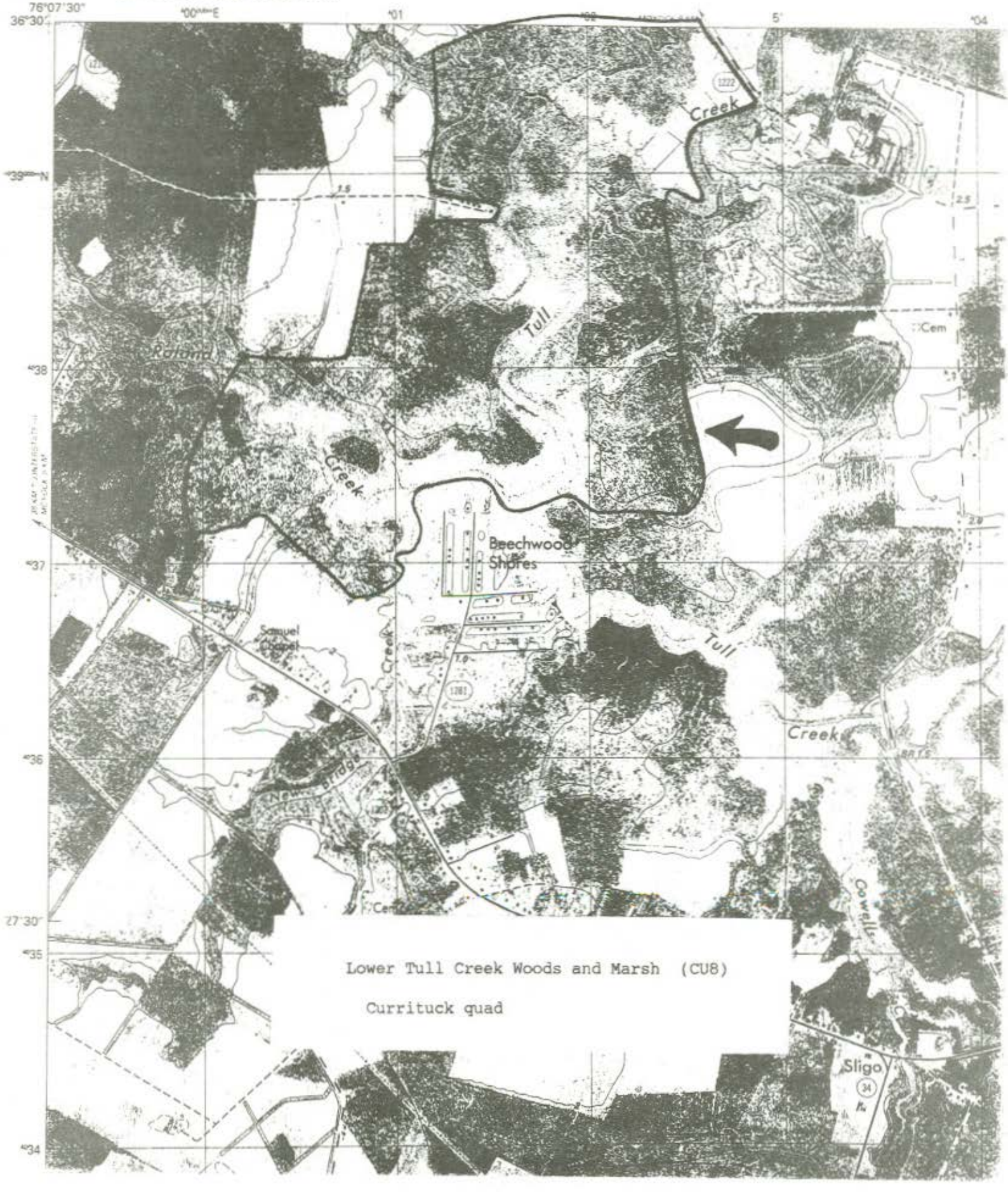
PROTECTION STATUS: None

RECOMMENDATIONS FOR MANAGEMENT OR PROTECTION: The natural area has a few portions within the boundary that have been logged in recent years, and further logging is likely, in the absence of protection. An old subdivision -- Beechwood Shores -- occurs just south of the natural area, and other such developments could follow. Any further clearing or cutting would be detrimental to the site. The marshes need to be burned, especially the bogs to ensure the perpetuation of herb species that inhabit boggy sites. Protection of the natural area is best done in conjunction with that of other natural areas immediately to the north along Northwest River. One large preserve featuring this and other adjacent sites, perhaps through acquisition by the U.S. Fish and Wildlife Service (as a National Wildlife Refuge) or by the N.C. Wildlife Resources Commission (to add to the Northwest River Marsh Game Land), is a protection option. It is hoped that the N.C. Division of Coastal Management will expand its Coastal Reserve system to include sites such as this or others featuring complexes of forests and marshes in tidal freshwater areas of the state.

COMMENTS: This natural area needs much more thorough survey work. The boundaries deliniated are very crude, and the natural area might extend much farther to the west than indicated on the map in this report. Additional "bogs" might be present, as well. Not all of the bog herb species seen were identified, and the site should be examined at various times during the year for additional species. Wildlife values of the area are not well known but are expected to be high. It is likely that a few rare species of plants and the black bear (Ursus americanus) occur at the natural area.

REFERENCES: Frost (1989t)

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY



Lower Tull Creek Woods and Marsh (CU8)

Currituck quad

SITE NAME: Bell Point Marsh

SITE NUMBER: CU9 SIZE: about 250 acres

SITE SIGNIFICANCE: C (Regional)

LOCATION: Northern portion of Currituck County; located on a peninsula separating Coinjock Bay on the south from North Landing River on the north, lying on both sides of SR 1245 (about 2 miles southeast of Currituck village).

QUAD MAP: Barco

SIGNIFICANT FEATURES:

1. The slightly brackish marsh (Oligohaline Marsh natural community) is in good condition, with only a few canals and ditches, and it contains a high diversity of plant species.

GENERAL DESCRIPTION:

The marsh on Bell Island is rather low-lying compared to others along Currituck Sound. Numerous pools and ponds are present within the marsh, and some range in size to 2-3 acres. Canals alongside SR 1245, which bisects the marsh, and a few other drainage ditches are found in the marsh. The ponds are, for the most part, devoid of vegetation, but water lily (Nymphaea odorata) occurs in ponds near the road.

Most of the marsh consists of moderately extensive stands of black needlerush (Juncus roemerianus), interspersed with more open areas dominated by broad-leaved plants. These plants include coastal arrow-head (Sagittaria falcata) and pickerelweed (Pontederia cordata), along with a wide variety of other species. Along the shoreline, the marsh vegetation is taller, a characteristic noted on most marshes in the A/P Study area. Big cordgrass (Spartina cynosuroides) is the dominant along the shore, but clonal stands of common reed (Phragmites communis) also occur in this zone.

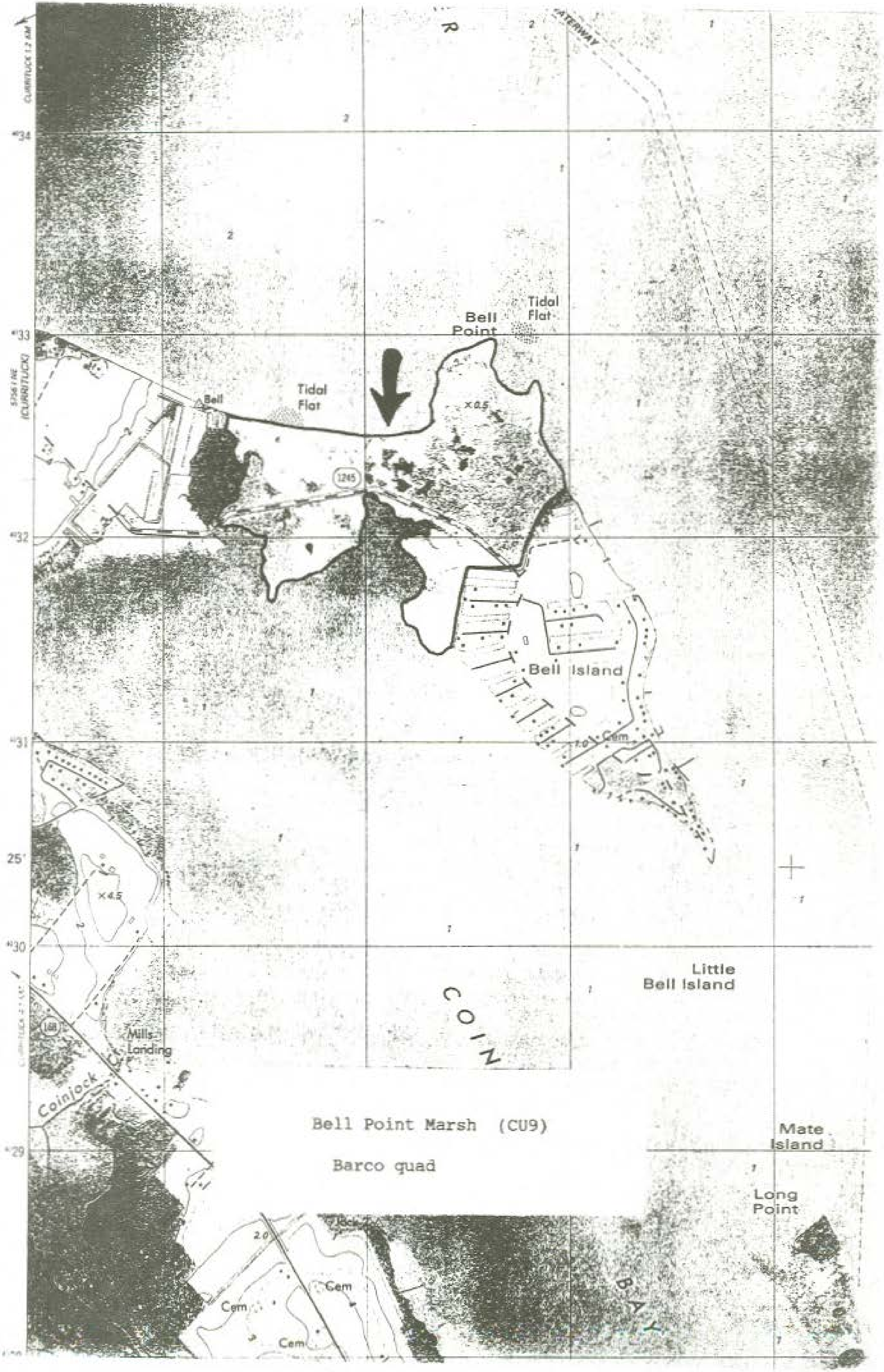
OWNERSHIP: Private

PROTECTION STATUS: None

RECOMMENDATIONS FOR MANAGEMENT OR PROTECTION: The marsh needs protection from further ditching. There are numerous homesites and associated boat canals just west and east of the marsh, and further filling of the marsh is certainly possible. Obviously, no filling of the marsh in this natural area should be allowed. This marsh apparently has not burned as frequently as most others in Currituck County, judging by the abundance of black needlerush. Proper management should be to burn this marsh every 3 to 5 years to increase plant species diversity and to keep any one species from dominating the marsh. Best protection efforts might be done by a local group such as a landowners association, naturalists group, or hunt club. The site is too small and surrounded by development to be of interest to a national or state agency, unless a gift of the land were made to such an agency.

COMMENTS: There are extensive beds of submerged aquatic plants surrounding the marsh and extending for 100-200 yards into Currituck Sound. These aquatic plants are likely used heavily for foraging by waterfowl in the winter months. Because nearly all field work for this study was conducted in the warmer months, importance of this marsh and other marshes to waterfowl could only be speculated or be learned through conversations with local citizens, rather than be observed directly. However, flocks of blue-winged teals (Anas discors) were seen feeding on these submerged aquatics at the time of the survey.

REFERENCES: Frost and Frantz (1989a)



Bell Point Marsh (CU9)

Barco quad

SITE NAME: Sligo Big Trees Natural Area

SITE NUMBER: CU10 SIZE: about 30 acres

SITE SIGNIFICANCE: C (Regional)

LOCATION: Northern portion of Currituck County, located about 1 mile south of Sligo on both side of NC 34.

QUAD MAP: Currituck

SIGNIFICANT FEATURES:

1. The natural area contains some of the largest individual trees on an upland, mesic site north of Albemarle Sound.
2. Though the natural area is quite small, it is a valuable example of a Mesic Mixed Hardwood Forest, Upland Flats subtype natural community, which is rare in the state in a mature condition.

GENERAL DESCRIPTION:

The natural area just south of Sligo is situated on flat to very slightly sloping ground near the head of a tributary swamp of Upper Tull Creek. The upland flats are composed of the Roanoke soil series, which forms extensive, mesic flats in the A/P Study area. Most of the forest on the tract (only 30 acres in size) is very mature, and many of the trees have trunk diameters of greater than 35 inches, with the average diameter of canopy trees being an impressive 30 inches (Frost 1989q).

The majority of the site consists of a Mesic Mixed Hardwood Forest, Upland Flats subtype natural community, with some elements perhaps of Nonriverine Wet Hardwood Forest community. An Upland Flats community would be common in the state had there been no clearing of land for agriculture or timber harvest, but such sites in good condition are rare today. Loblolly pine (Pinus taeda) and cherrybark oak (Quercus pagoda) dominate the canopy. Also common in the canopy are swamp chestnut oak (Q. michauxii), pignut hickory (Carya glabra), shagbark hickory (C. ovata), and tuliptree (Liriodendron tulipifera). The subcanopy is dominated by hop hornbeam (Ostrya virginiana); smaller numbers of American beech (Fagus grandifolia), American hornbeam (Carpinus caroliniana), and American holly (Ilex opaca) are also present. With the exception of giant cane (Arundinaria gigantea), the shrub layer is sparse. Ferns compose most of the herb layer.

The easternmost portion of the natural area, running in a north-south strip, is a swamp forest with a somewhat unusual plant composition. The mature canopy features bald cypress (Taxodium distichum) as the dominant, with green ash (Fraxinus pennsylvanica var. subintegerima) and American elm (Ulmus americana) being numerous in the canopy. The thin subcanopy features American hornbeam, red maple (Acer rubrum), and an occasional red mulberry (Morus rubra). Large clumps of common pawpaw (Asimina triloba) are present in the shrub layer.

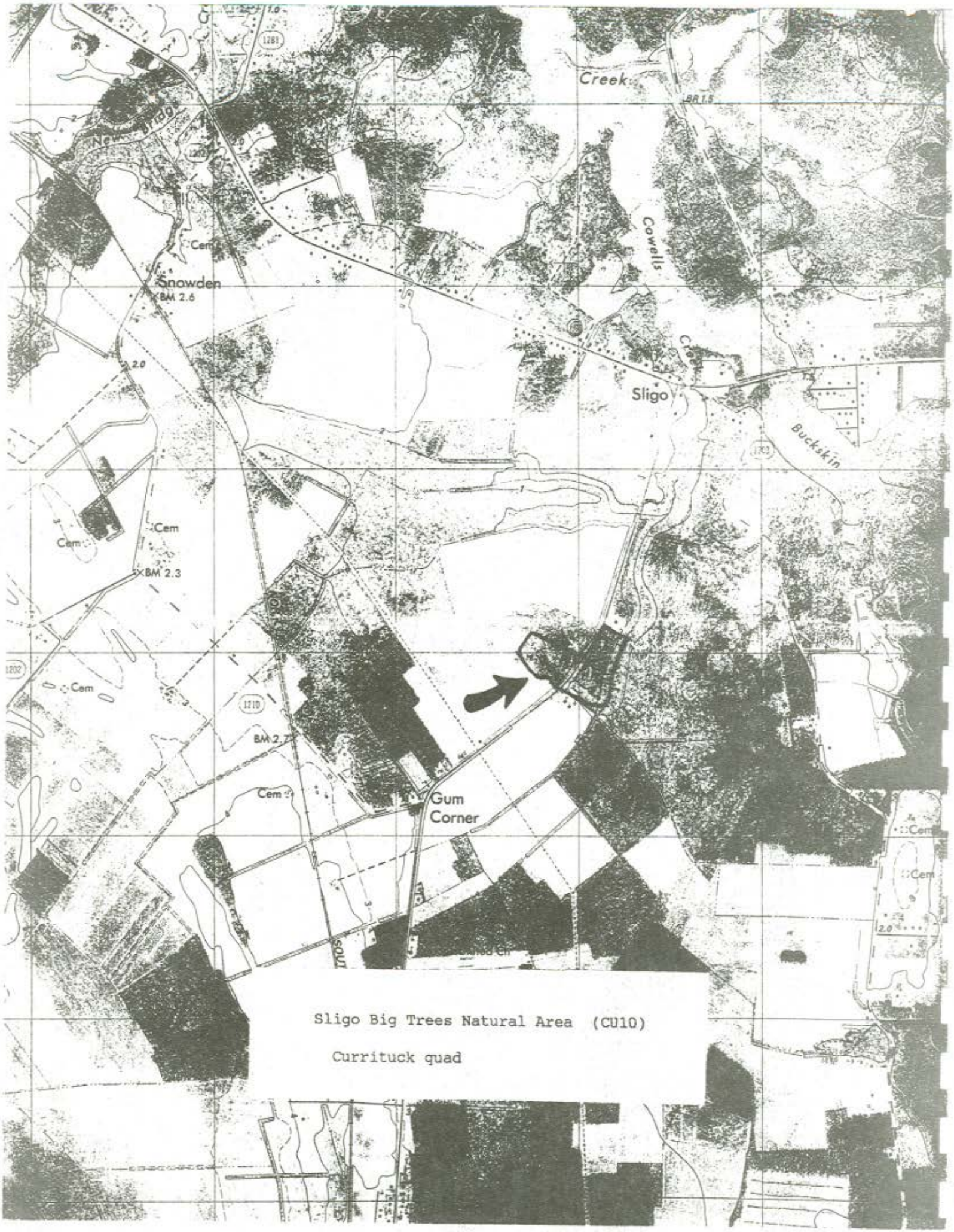
OWNERSHIP: Private; a single owner

PROTECTION STATUS: None

RECOMMENDATIONS FOR MANAGEMENT OR PROTECTION: No management is necessary, though removal of weedy species such as Japanese honeysuckle (Lonicera japonica) and Chinese privet (Ligustrum sinense) would be beneficial. Timber cutting, of course, would be detrimental. Because of the small size of the natural area, the best protection measures are likely registry with the N.C. Natural Heritage Program or a conservation easement or donation to a private conservation group.

COMMENTS: The presence of pines in the canopy indicates that portions of the site are not completely mature, despite that large size of the trees. Virgin forests on this soil type in Currituck County likely featured cherrybark and swamp chestnut oaks, plus pignut and shagbark hickories, in the canopy. Beech seems surprisingly scarce at the site.

REFERENCES: Frost (1989q)



Sligo Big Trees Natural Area (CU10)

Currituck quad

SITE NAME: Buckskin Creek/Great Swamp Natural Area

SITE NUMBER: CU11 SIZE: about 4700 acres

SITE SIGNIFICANCE: B (State)

LOCATION: North-central portion of Currituck County; located north of US 158 and south of NC 34, east of SR 1203 and west of NC 34, in the northern half of Great Swamp.

QUAD MAP: Currituck

SIGNIFICANT FEATURES:

1. Extensive oak forests on low, wet flats are present in the northern portion of the natural area. Oak forests are also found on flats and islands within the swamp to the south.
2. Buckskin Creek is lined with a slightly brackish marsh, and there are areas along the marsh fringe that are succeeding to swamp forest. Most of the natural area is composed oa a mosaic of Nonriverine Swamp Forest and Nonriverine Wet Hardwood Forest, with portions near the marshes being Tidal Cypress-Gum Swamp community.
3. The very extensive forests provide habitat for the black bear (Ursus americanus), considered Special Concern in the state.

GENERAL DESCRIPTION:

Great Swamp is one of the largest swamps remaining in North Carolina. It is a combination nonriverine-estuarine swamp, with features of both. The swamp is drained by Buckskin Creek into Tull Creek at the northern end, and by East Canal and North River on the south. The swamp is approximately 2 miles wide at its northern end, but at its southern end near North River, it widens to 4 to 5 miles wide and is continuous with forests that line both eastern and western shores of the North River. Tidal, slightly brackish marshes are present along Buckskin Creek at the northern end of the natural area. Numerous floodplain islands are embedded within the swamp; their origin is unclear. There are oak forests on terrace flats, outside of the floodplain, in the northern portion of the natural area, and likely as well along parts of the eastern and western fringes of the natural area (that were not surveyed).

Along Buckskin Creek is a diverse fresh to slightly brackish marsh (Oligohaline Marsh natural community). The dominant species is sawgrass (Cladium jamaicense), with narrow-leaf cattail (Typha angustifolia) also numerous, in the herbaceous zone. However, this marsh is undergoing succession to swamp forest, as bald cypress (Taxodium distichum), red maple (Acer rubrum), waxmyrtle (Myrica cerifera) and other woody species are invading the marsh in the long absence of fire. The northern portion of the natural area contains many sloughs that are the remnants of former river or creek channels. These sloughs contain cypress-gum swamps (of a mosaic of community types, but probably mostly Nonriverine Swamp Forest community). Swamp tupelo (Nyssa biflora) dominates these sloughs, but cypress, sweetgum (Liquidambar styraciflua), pumpkin ash (Fraxinus tomentosa), and even swamp cottonwood (Populus heterophylla) are also canopy species. An excellent

assortment of shrub species is present, with Virginia willow (Itea virginica) being a dominant. The extensive swamp forest on the interstream basin in the southern half of the natural area was not surveyed.

Mature and extensive Nonriverine Wet Hardwood Forests are present on floodplain islands and low flats. The integrity of these forests is high, with the average trunk diameters being in the 22-24 inch range, with one swamp chestnut oak (Quercus michauxii) measured at 45 inches in diameter (Frost 1989dd). A slightly drier subtype, on Roanoke soils, features cherrybark oak (Quercus pagoda) as a dominant, though other oaks such as swamp chestnut, water (Q. nigra), and white (Q. alba) also occur. The slightly wetter subtype, mainly on Cape Fear soils, is dominated by swamp chestnut oak. Cherrybark oak and American beech (Fagus grandifolia) are also important, and laurel oak (Q. laurifolia) occurs in this subtype but was not located on the Roanoke soils in the natural area. Giant cane (Arundinaria gigantea) is common on the Cape Fear soils.

As with most sites examined in the fall, little animal data were collected. However, the black bear (Ursus americanus) is found in Great Swamp. This Special Concern mammal requires extensive swamps and pocosins, or other forested habitats, for survival.

OWNERSHIP: Private; multiple ownership

PROTECTION STATUS: None

RECOMMENDATIONS FOR MANAGEMENT OR PROTECTION: The remaining oak stands need to be protected from logging. Portions of the natural area need fire to maintain certain plant communities. For example, the marshes along Buckskin Creek need fire to maintain diversity and prevent them from succeeding to swamp forest. This large natural area should be combined with others, especially to the south along the North River, into one large protection project, as has been done recently with the U.S. Fish and Wildlife Service's involvement in protection and management of the Alligator River and Roanoke River refuges. Perhaps this agency might be a lead for protection of the swamp forests, and especially the oak forests, in this portion of Currituck County. The N.C. Wildlife Resources Commission owns a tract -- the North River Game Land -- only several miles south of US 158, which forms the southern boundary of the natural area. This agency might wish to enlarge that Game Land in the future by acquisition of lands farther to the north in Great Swamp.

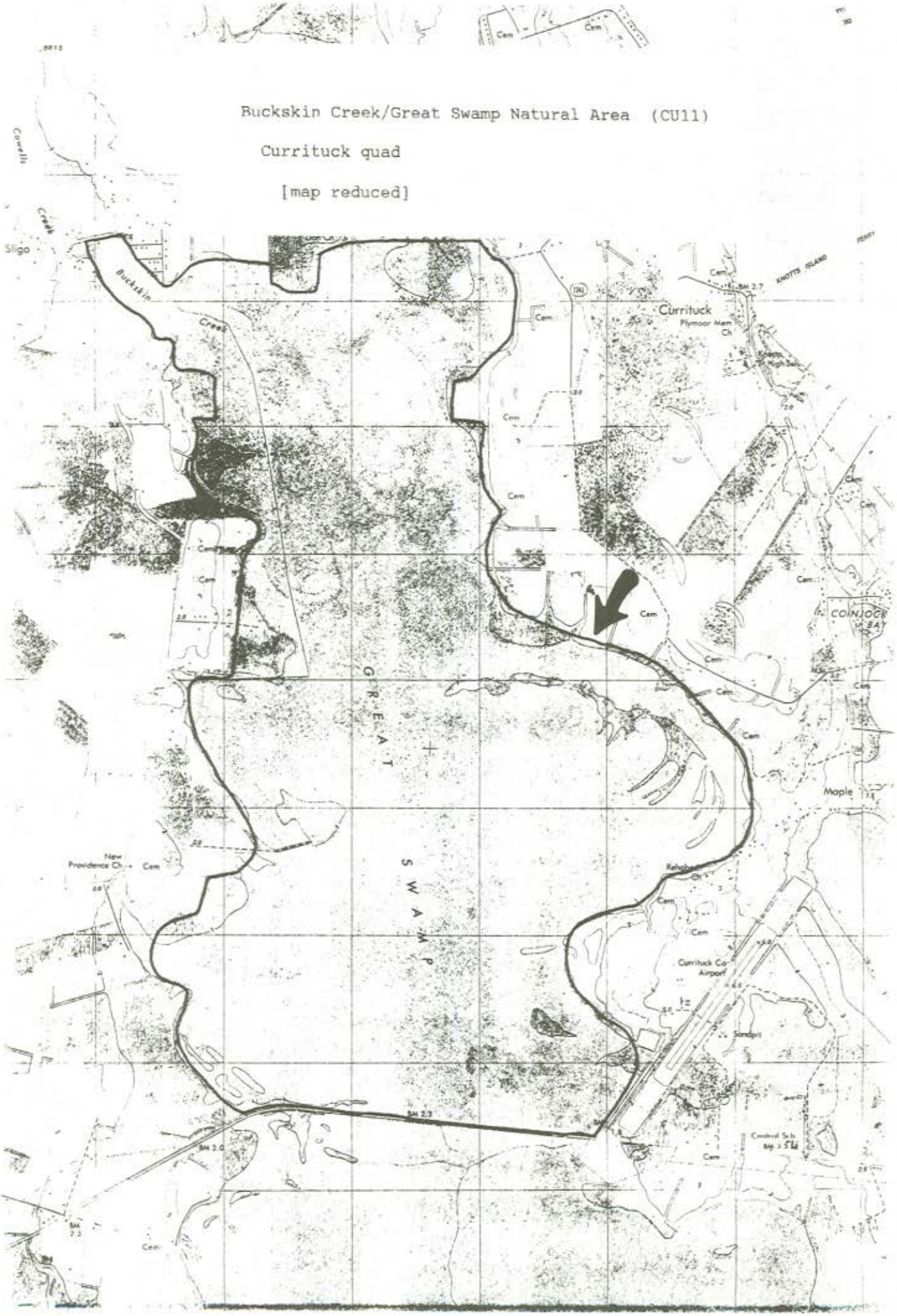
COMMENTS: Field work needs to be conducted on floodplain islands and terrace flats in the southern portion of the natural area. There are a number of old natural levees or floodplain ridges portrayed on the Currituck topographic map just west of the community of Maple that need to be surveyed. Likewise, many of the terrace flats that flank both the eastern and western margins of the swamp floor appear to be wooded, and perhaps mature oak forests occur on them.

REFERENCES: Frost (1989dd)

Buckskin Creek/Great Swamp Natural Area (CU11)

Currituck quad

[map reduced]



SITE NAME: Indiantown Creek Cypress Forest

SITE NUMBER: CU12 SIZE: about 1950 acres

SITE SIGNIFICANCE: B (State)

LOCATION: Along the western edge of Currituck County; located south of US 158 and east of SR 1147, with Indiantown Creek forming the southern boundary.

QUAD MAPS: Shiloh, Currituck

SIGNIFICANT FEATURES:

1. There is an apparently virgin stand of bald cypress (Taxodium distichum) at the natural area; such stands are very rare north of Albemarle Sound.
2. There are several hardwood flats, with a high diversity of oak species, an uncommon feature in a coastal county.

GENERAL DESCRIPTION:

This natural area is an extensive stand (of nearly 2000 acres) of relatively mature swamp forest, with some areas of bottomland forest along the northwestern margin of the site. Near the southwestern end of the natural area, approximately due south from a right angle bend in SR 1148, is an apparently virgin stand of bald cypress (Taxodium distichum). Cypress is a common tree in Coastal Plain swamps, but stands of virgin timber are rare. Most of the natural area is a Cypress-Gum Swamp, Blackwater subtype natural community. Cypress is the dominant canopy species, with swamp tupelo (Nyssa biflora), water tupelo (N. aquatica), and pumpkin ash (Fraxinus tomentosa) also represented in the canopy. Red maple (Acer rubrum) is the principal understory species. Shrub and herb species are rather abundant, especially along the shoreline of Indiantown Creek.

Where the swamp is slightly drier, and where disturbance through logging has been prevalent many decades ago, red maple and a different set of canopy trees are present. Atlantic white cedar (Chamaecyparis thyoides) was apparently a dominant tree at one time, but logging of the cedar has removed much of that species. Loblolly pine (Pinus taeda) and swamp tupelo are also common in the canopy. This forest can be considered a mosaic of Cypress-Gum and Atlantic White Cedar Forest natural communities.

One other natural community present along the upland fringes of the site, though it is a wetland (palustrine) community, is a Nonriverine Wet Hardwood Forest containing about 35 acres. A variety of oaks, both wetland and upland species, are present, such as cherrybark (Quercus pagoda), southern red (Q. falcata), swamp chestnut (Q. michauxii), and water (Q. nigra). Also present are trees typical of mesic sites, such as American beech (Fagus grandifolia), pignut hickory (Carya glabra), and mockernut hickory (C. tomentosa).

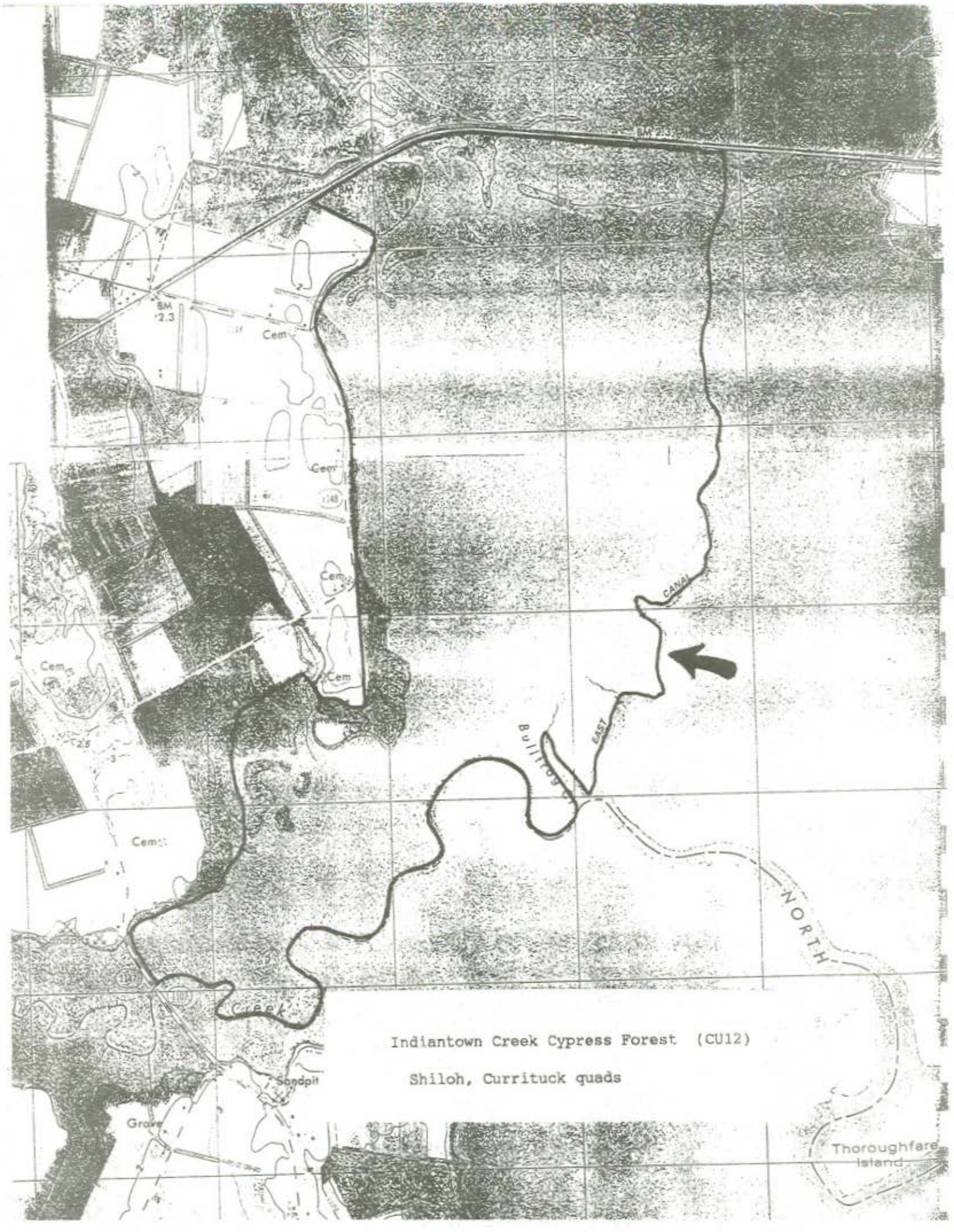
OWNERSHIP: Multiple private owners

PROTECTION STATUS: None

RECOMMENDATIONS FOR MANAGEMENT OR PROTECTION: The most feasible protection might be acquisition by the N.C. Wildlife Resources Commission. Their North River Game Land lies immediately adjacent to the natural area on the east. Little or no management of the area is necessary; logging would damage the area.

COMMENTS: No logging appears to have been done in several decades. The oak forest adjacent to uplands could be cleared for agriculture, as numerous cultivated fields are present along the western boundary.

REFERENCES: Frost and Schneider (1989)



Indiantown Creek Cypress Forest (CU12)

Shiloh, Currituck quads

SITE NAME: Church Island Marsh

SITE NUMBER: CU13 SIZE: about 1825 acres

SITE SIGNIFICANCE: B (State)

LOCATION: The eastern portion of mainland Currituck County, located on Church Island and ranging north to Goose Point and Goosecastle Point and south to SR 1142, with Cedar Bay, Cedar Island Bay, and Coinjock Bay forming the western border and uplands of Church Island forming the eastern boundary.

QUAD MAPS: Barco, Coinjock

SIGNIFICANT FEATURES:

1. The marsh on Church Island is one of the most extensive fresh to slightly brackish (oligohaline) marshes in North Carolina.
2. The marsh, especially the low marsh, has a high diversity of emergent wetland herbs. Two rare species in the state -- winged seedbox (Ludwigia alata) and Carolina lilaeopsis (Lilaeopsis carolinensis) -- occur in the natural area.
3. The marshes and bays support a major waterfowl feeding area in the winter.
4. The site contains good examples of Estuarine Fringe Loblolly Pine Forests, especially at Piney Island.

GENERAL DESCRIPTION:

Church Island is a peninsula that juts northward for approximately 4 miles into Currituck Sound on the eastern side of mainland Currituck County. Most of the western portion of the peninsula or "island" consists of fresh to brackish marshes and pine forests. The southwestern portion of the peninsula is called Piney Island. The major feature of the peninsula is the extent (nearly 3 square miles) of natural vegetation, particularly marshes.

The marshes are an excellent example of an Oligohaline Marsh natural community. The site contains both a low marsh and a high marsh. The low marsh contains a more diverse aquatic flora, with no major dominants. Dominants over small areas include coastal arrow-head (Sagittaria falcata), creeping spikerush (Eleocharis fallax), pale spikerush (E. flavescens), swamp rosemallow (Hibiscus moscheutos), salt meadow cordgrass (Spartina patens), and other species. Such localized dominance apparently is related to minor variations in water depth. These patches of low marsh are interspersed with high marsh. The high marsh is dominated primarily by three species -- big cordgrass (Spartina cynosuroides), broad-leaf cattail (Typha latifolia), and common reed (Phragmites communis) -- each occurring in extensive stands to the exclusion of most other species. The first species is the most numerous. Black needlerush (Juncus roemerianus) is common, but not nearly as dominant as in other brackish marshes elsewhere in the state.

The forested margins of the marsh were not thoroughly studied. The dominant natural community is Estuarine Fringe Loblolly Pine Forest. Loblolly pine (Pinus taeda) is the dominant in the canopy, with sweetgum (Liquidambar styraciflua) also common. Waxmyrtle (Myrica cerifera) is very common along the edge of the woods, and various greenbriers (Smilax spp.) are numerous also

along the wooded edges. There are scattered pine stands amid the marsh, and these stands have the appearance of what is called "hammock" vegetation in Florida and along the Gulf Coast.

Cedar Bay, Cedar Island Bay, and Currituck Sound are very shallow and have submerged aquatic vegetation rooted to the bottom. Extensive beds of three species -- wild-celery (Vallisneria americana), sago pondweed (Potamogeton pectinatus), and widgeon-grass (Ruppia maritima) -- cover the sounds and provide food for waterfowl during the cooler months.

Two species of rare plants are present in the natural area. The Carolina lilaeopsis (Lilaeopsis carolinensis) is considered Threatened in North Carolina by the N.C. Plant Conservation Program and is a C2 candidate for Federal listing. It is found at a few scattered coastal sites. At this natural area, it grows in shallow water on the south side of Goosecastle Point. The winged seedbox (Ludwigia alata), considered "significantly rare" in the state, also is present on Goosecastle Island.

OWNERSHIP: Unknown, but presumed private

PROTECTION STATUS: None

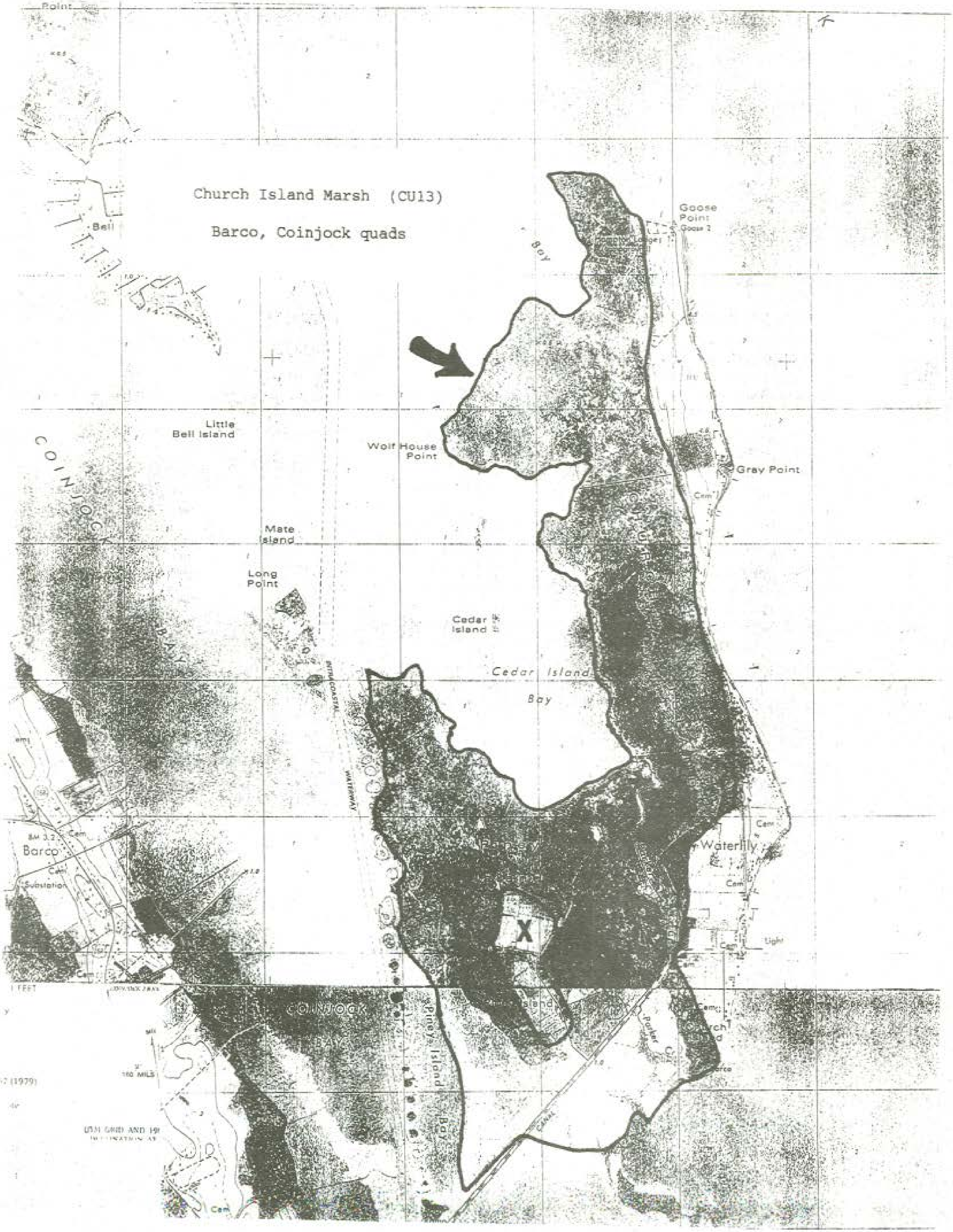
RECOMMENDATIONS FOR MANAGEMENT OR PROTECTION: The marshes should be protected from ditching or dredging for boat access channels or mosquito control. At present, only a few canals cross the marsh from the uplands to the bays and do not appear to be causing much damage (by drying out the marsh). The forests at the eastern and southern portions of the natural area should be protected from clearing in order to provide a buffer for the marsh. The marshes are likely burned by owners and local residents to provide foraging habitat for waterfowl. Such burning should continue every 5 to 10 years. Burning of marshes apparently provides floral diversity and seems to prevent monocultures where a single tall species dominates the marsh. These marshes would be a suitable acquisition project for the U.S. Fish and Wildlife Service as an addition to Currituck National Wildlife Refuge, or for the N.C. Wildlife Resources Commission as a Game Land.

COMMENTS: Further inventory of the site is needed. Biological description of the wooded habitats along the fringe of the marshes is very incomplete.

REFERENCES: Frost (1989e)

Church Island Marsh (CU13)

Barco, Coinjock quads



SITE NAME: Maple Swamp Gordonia Forest

SITE NUMBER: CU14 SIZE: about 4600 acres

SITE SIGNIFICANCE: B (State)

LOCATION: Central portion of Currituck County, located east of US 158 and south of the canal from Church Island to Coinjock, extending south to NC 3.

QUAD MAP: Coinjock

SIGNIFICANT FEATURES:

1. The extensive and mature stand of loblolly bay (Gordonia lasianthus) may be the largest in extent and in size of individual trees in the state.
2. The natural area also includes a variety of natural communities, such as swamp forests (both tidal and nonriverine) and marshes.
3. Rare species at the natural area include the black bear (Ursus americanus) and Carolina lilaeopsis (Lilaeopsis carolinensis).

GENERAL DESCRIPTION:

Maple Swamp lies in a long basin between two parallel sand ridges on the mainland of Currituck County. The basin is over 6 miles long and 1 to 1.5 miles wide. The northern end of the basin extends northward to Piney Island Bay and to Currituck Sound, but a canal and highway now partially block the natural movement of water northward into the bay, so that water in the swamp received by rainfall likely moves northeast to discharge into the sound.

The northern edge of the natural area is marsh and is fairly extensive near Parker Creek at the northern edge of the natural area, as well as along the shoreline of Currituck Sound. A slightly brackish marsh at this portion of the site has not been burned for several decades, and it now consists of a tall marsh of black needlerush (Juncus roemerianus), sawgrass (Cladium jamaicense), and common reed (Phragmites communis). Somewhat farther toward the interior is a less saline (more fresh) marsh that appears to be succeeding to swamp forest. Scattered bald cypress (Taxodium distichum), red maple (Acer rubrum), and waxmyrtle (Myrica cerifera) occur in this fresh marsh, which contains at least one rare species, Carolina lilaeopsis (Lilaeopsis carolinensis), a plant that is a Federal candidate for listing.

The majority of the natural area is wooded, consisting of Tidal Cypress-Gum Swamp, Nonriverine Swamp Forest, and Bay Forest natural communities. Nearest to the marshes is a Tidal Cypress-Gum Swamp, where much of the moisture for the forest comes from wind and lunar tides pushing water from Currituck Sound to the forest. Cypress is the major dominant tree, with red maple common along with loblolly pine (Pinus taeda). The majority of the inner portions of Maple Swamp is a Nonriverine Swamp Forest, where the moisture for the forest comes mainly from inflow from the surrounding sand ridges. Red maple and swamp tupelo (Nyssa biflora) form the canopy, along with an occasional large loblolly bay (Gordonia lasianthus), sweetgum (Liquidambar styraciflua), and a few other species. As is typical with nonriverine forests, pocosin/bay species are numerous, with redbay (Persea borbonia), sweetbay (Magnolia virginiana), and sweet pepperbush (Clethra alnifolia) a major part of the understory or shrub layers.

The most significant feature of the natural area is an extensive stand of at least 200 acres of mature loblolly bay forming a canopy. Radford et al. (1968) do not indicate the occurrence of this species north of Albemarle Sound; thus, the location of the stand is a significant northern disjunction, all the more remarkable for its extent and large size of the trees. This Bay Forest community features loblolly bay and red maple in the canopy, with bay trees averaging 18 inches in trunk diameter, with a likely state champion tree of 32 inches in diameter. Maple dominates the understory, but loblolly bay, redbay, and American holly (Ilex opaca) are also important. The shrub layer is dominated by sweet pepperbush.

Some of the more fertile soils near the edge of the swamp are dominated by sweetgum in the canopy. Other stands along the wetland-upland boundary are dominated by loblolly pines and mixed hardwoods and other conifers. The latter forest type would likely have been naturally burned during pre-settlement times and possibly would have been a Pine Flatwoods natural community.

The animals of the natural area are not well known. However, the black bear (Ursus americanus), a Special Concern species in the state, occurs in the swamp.

OWNERSHIP: Private; multiple ownership

PROTECTION STATUS: None. The major owner of the bay forest is conservation-minded, and he wishes to sell the tract, preferably to an agency that would protect the forest.

RECOMMENDATIONS FOR MANAGEMENT OR PROTECTION: The site should be protected from timber cutting, and fire should be excluded from the loblolly bay stand. The marshes, however, could use some fire to provide species diversity and to keep portions from succeeding to a swamp forest. The site should also be protected from ditching. The entire natural area needs protection, not just the highly significant bay forest, which lies south of SR 1140 in the southern portion of the natural area. Options include acquisition by either the N.C. Wildlife Resources Commission for a Game Land or by the N.C. Division of Coastal Management for the Coastal Reserve system. Registry with the Natural Heritage Program is probably not adequate in the long-term without some additional assurrance of protection, but conservation easements might be suitable as a long-term protective measure.

COMMENTS: Further research into the problem of succession of marshes to swamp forest needs to be undertaken. The more saline type of brackish marsh does not succeed to woody vegetation, but eventually succeeds (in the absence of fire) to monocultures of tall species such as black needlerush or big cordgrass (Spartina cynosuroides). However, the marshes leaning toward freshwater conditions, unless they are strongly tidal in nature, are often invaded by maple, waxmyrtle, and other woody species. This is obviously the case at inland sites around the periphery of newly-constructed reservoirs, but the conversion of coastal freshwater marshes to swamp forest, in the absence of fire, is a poorly known phenomenon in need of further research.

REFERENCES: Frost (1989k)

STATE OF NORTH CAROLINA
DEPARTMENT OF NATURAL RESOURCES
AND COMMUNITY DEVELOPMENT
RALEIGH, NORTH CAROLINA

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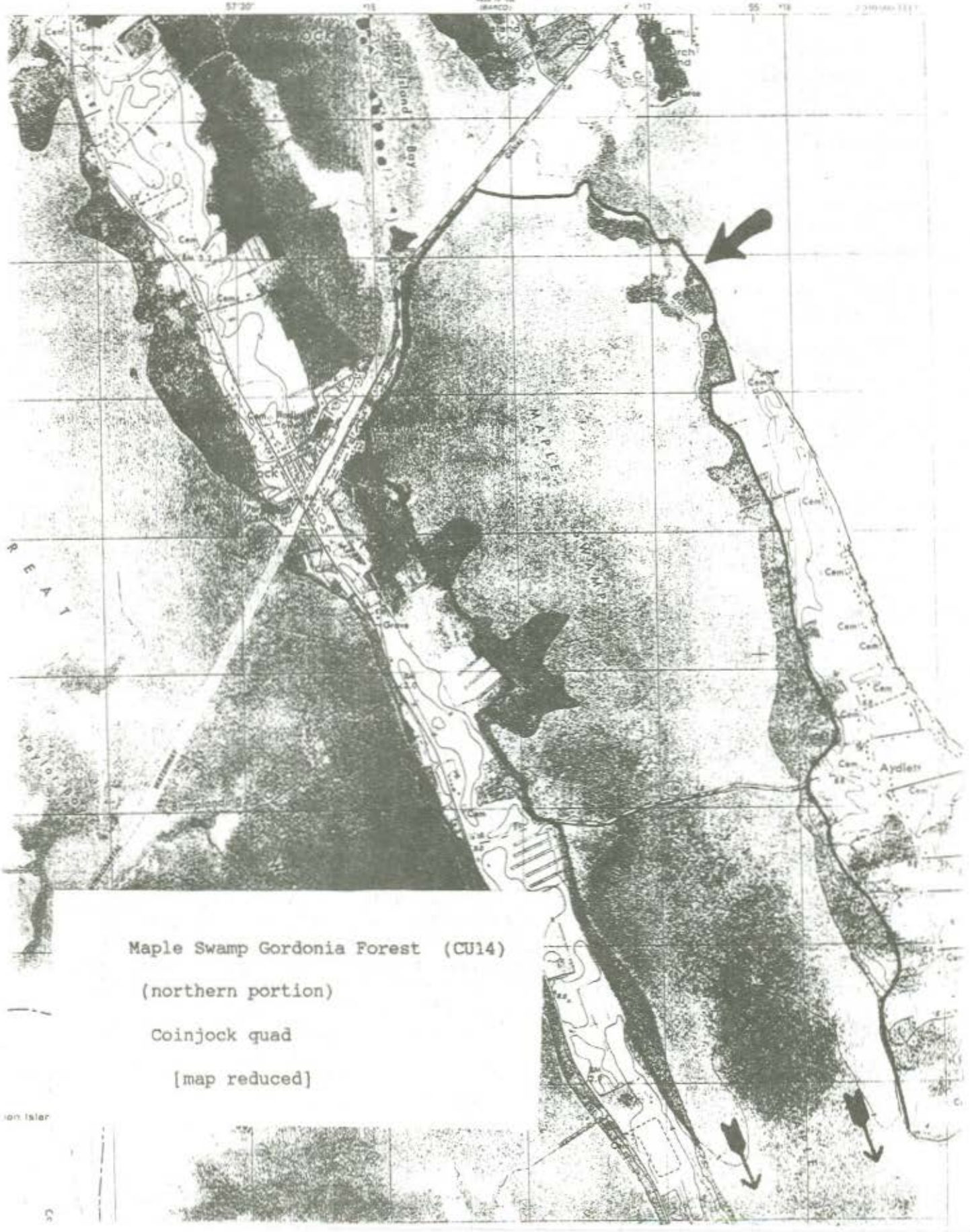
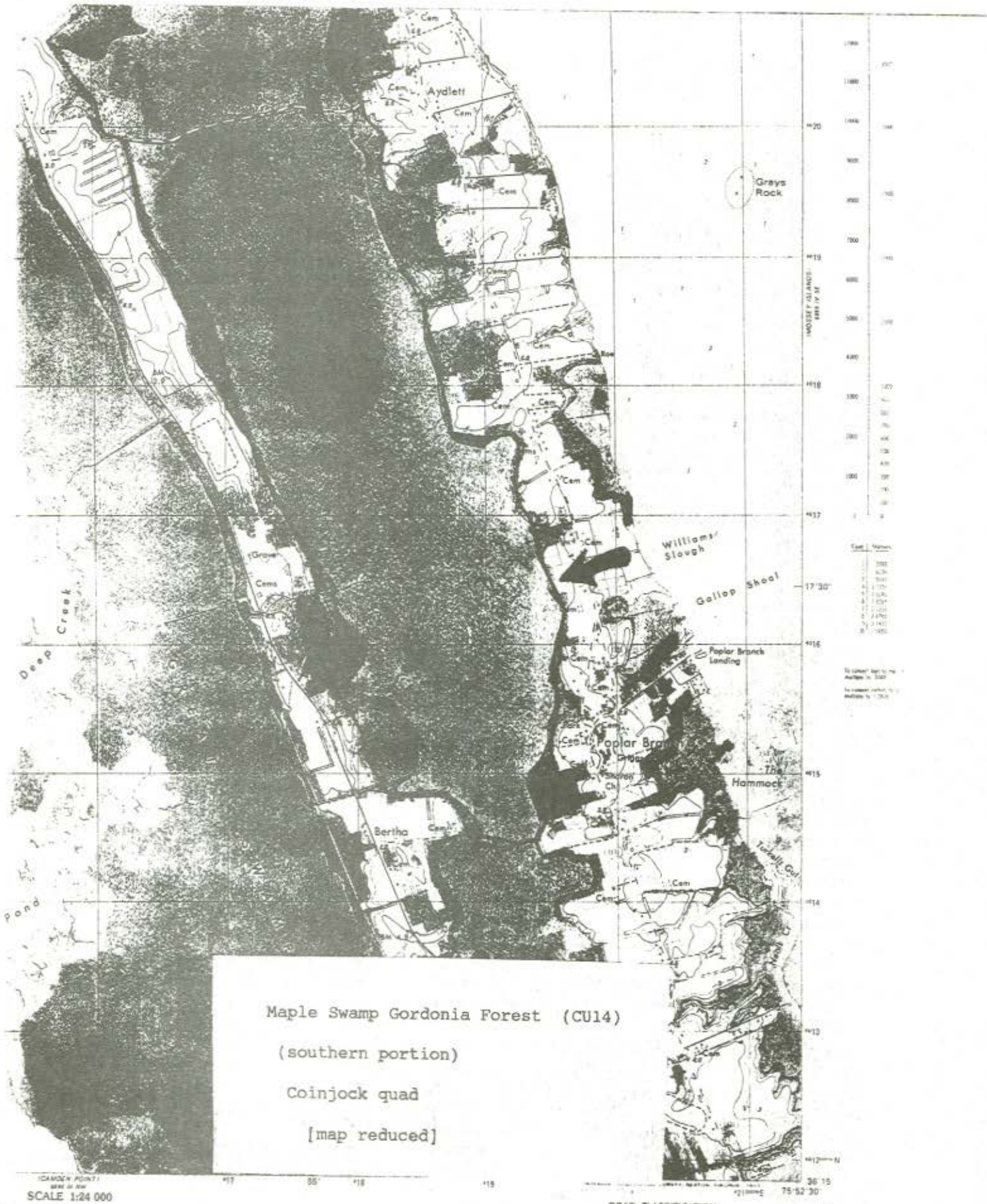


Maple Swamp Gordonia Forest (CU14)

(northern portion)

Coinjock quad

[map reduced]



Maple Swamp Gordonia Forest (CU14)

(southern portion)

Coinjock quad

[map reduced]

SITE NAME: North River/Deep Creek Marshes and Forest

SITE NUMBER: CU15 SIZE: about 1900 acres

SITE SIGNIFICANCE: B (State)

LOCATION: Central part of Currituck County, lying between US 158 and North River and immediately west of the Bertha community, ranging from Deep Creek on the north to Goose Pond on the south, including marshes along these creeks.

QUAD MAP: Coinjock

SIGNIFICANT FEATURES:

1. The natural area contains an excellent example of Tidal Cypress-Gum Swamp natural community (portion of Great Swamp).
2. The tidal freshwater marshes (Oligohaline Marsh natural community) are among the most diverse in terms of plant species in the state.

GENERAL DESCRIPTION:

Most of the vegetation along the entire extent of North River is in a relatively natural state, though many of the forests are only middle-aged, having been selectively logged or burned by wildfires a few decades ago. The forests in the Deep Creek and Goose Pond portion of the river are more mature than elsewhere, especially approximately 1 mile northwest of the community of Bertha. This forest is quite mature, with numerous old bald cypresses (Taxodium distichum), many of which are over 30 inches in trunk diameter. Some portions of the swamp, directly adjacent to the marshes, may be virgin, with density and stature of trees limited by past fire and salt influence, before closure of the Currituck inlets in the early 19th Century. The canopy is somewhat open, especially near the western fringes. Although the transition from forest to marsh is rather abrupt, there is a zone of "savanna-like" vegetation, with widely scattered cypresses and loblolly pines (Pinus taeda) amid marsh vegetation. Other major components of the swamp forest (a Tidal Cypress-Gum Swamp natural community) include loblolly pine and swamp tupelo (Nyssa biflora). Red maple (Acer rubrum) is the most common understory tree. The shrub and herb layers are quite diverse for a swamp forest, partly because of the somewhat open nature of the canopy. Waxmyrtle (Myrica cerifera), fetterbush (Lyonia lucida), highbush blueberries (Vaccinium spp.), and swamp rose (Rosa palustris) are common shrubs. Vines and ferns are significant components of the forest, as well.

The freshwater marshes that line North River, Deep Creek, and Goose Pond (a creek) are among the most diverse in the state, certainly in part because they are frequently burned by the owners/managers to provide habitat for waterfowl. The most widespread marsh species is sawgrass (Cladium jamaicense). Big cordgrass (Spartina cynosuroides) is common along channels; large beds of narrow-leaf cattail (Typha angustifolia) and common three-square (Scirpus americanus) occur in the marsh interior. Black needlerush (Juncus roemerianus) is quite scarce, but common reed (Phragmites communis) -- a noxious weed -- is scattered in a few places in the marsh. Other "non-graminoids" in the marsh include marsh fern (Thelypteris palustris), coastal arrow-head (Sagittaria falcata), arrow arum (Peltandra virginica), Virginia

blueflag (Iris virginica), and swamp rosemallow (Hibiscus moscheutos).

OWNERSHIP: Private

PROTECTION STATUS: Approximately 800 acres of swamp forest have been designated a Registered Natural Heritage Area (in August 1989). The marshes have no protection status.

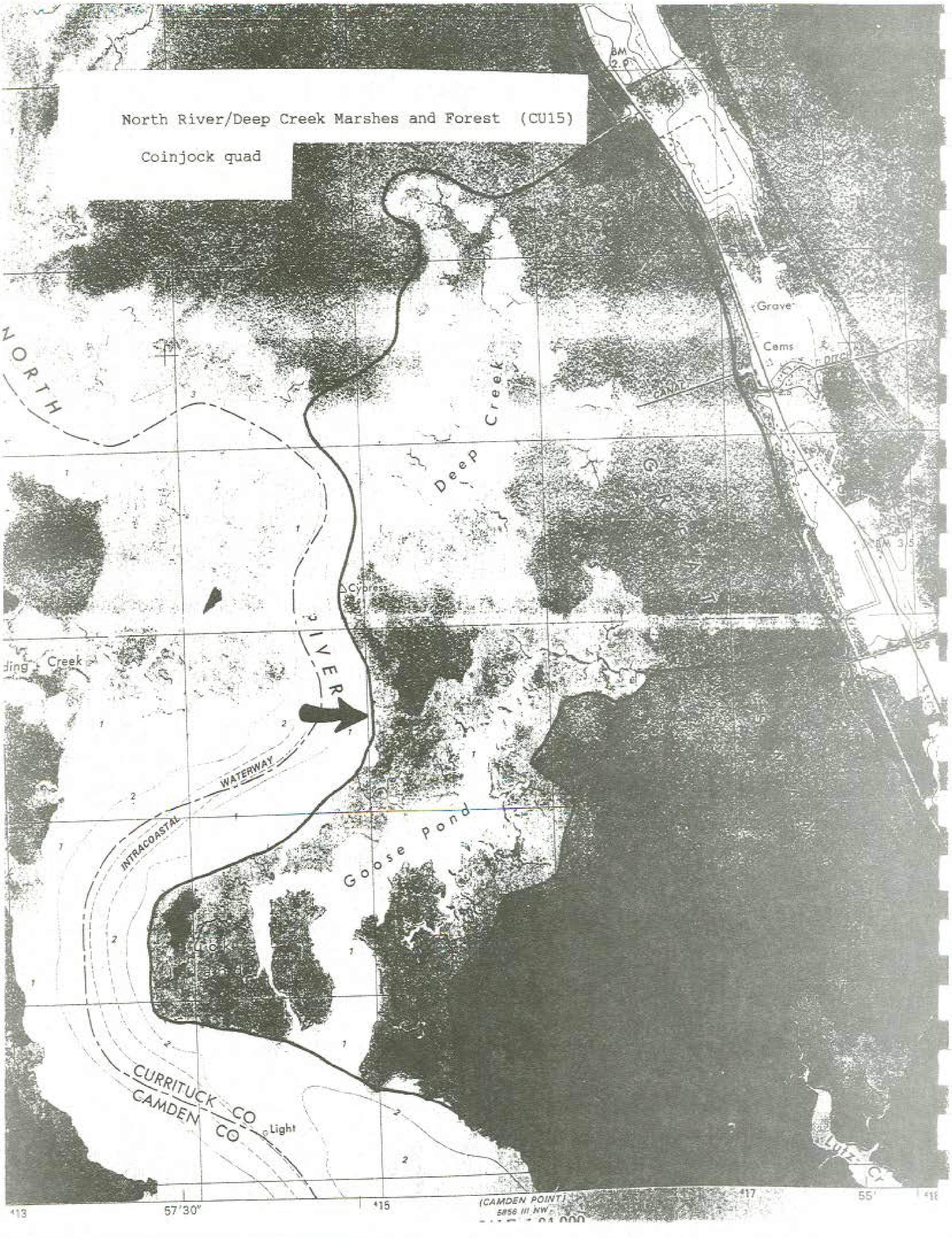
RECOMMENDATIONS FOR MANAGEMENT OR PROTECTION: The N.C. Natural Heritage Program and private conservation groups are interested in seeing the forests and marshes protected in some manner. As mentioned above, 800 acres of forested land have been protected through a registry agreement, though this does not provide long-term protection. These agencies, particularly the Heritage Program, hope to arrange protection for some of the marshes, as well. As with nearly all wooded sites, logging would damage the natural area. However, burning of the marsh on a regular basis, every several years, should continue; otherwise, the marsh could become a "monoculture", with one species completely dominating. The population of common reed should be monitored, as this tall grass has invaded other marshes elsewhere to the complete exclusion of all other species. Once this species dominates a marsh, productivity decreases and the marsh is seldom suitable habitat for waterfowl.

COMMENTS: The marshes and swamp forests north and south of the natural area are certainly of at least Regional significance, but because of time constraints, they were not studied intensively but were viewed from the North River. The marsh just to the north has an interesting inclusion of pond pine (Pinus serotina) forest or pocosin that deserves further exploration.

REFERENCES: Schafale et al. (1989)

North River/Deep Creek Marshes and Forest (CU15)

Coinjock quad



SITE NAME: Mamie Upland Forest and Carolina Bay

SITE NUMBER: CU16 SIZE: about 35 acres

SITE SIGNIFICANCE: C (Regional)

LOCATION: Southern portion of Currituck County; located on the north side of SR 1114, about 0.4 mile east of US 158 (about 1 mile north of Mamie).

QUAD MAP: Jarvisburg

SIGNIFICANT FEATURES:

1. A medium-aged upland forest is present in the natural area; such upland forests are rather rare north of Albemarle Sound. The forest features an unusual mix of upland plant species with several species typically found in bays and maritime forests.
2. A well-defined Carolina bay is present, with a drop in topography of 5 or 6 feet. Bays are scattered along the mainland of Currituck County, but most have had the vegetation removed or severely altered.

GENERAL DESCRIPTION:

The southern half of the Currituck County mainland is a narrow peninsula that contains a slight ridge down the center, as opposed to the northern part of the county, which is primarily flat with more extensive wetlands. There is a surprising number of Carolina bays located in the southern portion of the county, but nearly all of them have been cleared for agriculture or have been severely cut-over. Likewise, most of the sandier portions of the peninsula have been cleared or cut-over, and few relatively intact upland forests remain.

This natural area features a small Carolina bay located just west of an upland forest. The forest canopy in the bay, which has a drop in elevation of about 6 feet, is relatively immature, with medium-sized loblolly pines (Pinus taeda) being dominant. The understory and shrub layers feature "bay" or pocosin species, but the site had no standing water in a site visit in early December. Sweetbay (Magnolia virginiana) and redbay (Persea borbonia) are common, as well as sweet pepperbush (Clethra alnifolia).

The upland forest is also only of moderate age, having been selectively cut in 1969. The forest is a Dry Oak-Hickory Forest natural community, but it has atypical elements for this community, perhaps owing to its proximity to the coast. The dominant canopy trees are loblolly pine and southern red oak (Quercus falcata), but also numerous are mockernut hickory (Carya tomentosa), water oak (Q. nigra), chestnut oak (Q. montana), and a variety of other oaks and hickories. The chestnut oak apparently has not been previously reported in the state east of Pitt County (N.C. Natural Heritage Program database), but it does occur in adjacent counties in southeastern Virginia. A few shortleaf pines (P. echinata) are also present; this is an uncommon tree near the coast. The understory features a mix of both dry-mesic and bay species, with flowering dogwood (Cornus florida) and American holly (Ilex opaca) representing the former and redbay representing the latter. The shrub layer is very diverse. Common are several blueberries (Vaccinium spp.) and dangleberry (Gaylussacia frondosa), along with American beautyberry

(Callicarpa americana), yaupon (Ilex vomitoria), inkberry (I. glabra), waxmyrtle (Myrica cerifera), and sweetleaf (Symplocos tinctoria).

OWNERSHIP: Private

PROTECTION STATUS: None

RECOMMENDATIONS FOR MANAGEMENT OR PROTECTION: The sites should be allowed to mature, with no further timber cutting. There are apparently no ditches into the Carolina bay, and no new ditches should should be cut. Because the site is very small (under 50 acres), it seems that the best protective measures would be registry of the property with the Natural Heritage Program or an easement or gift arrangement with a conservation group.

COMMENTS: Additional survey work is needed, both in the bay and in the upland forest. The hydrology of the bay needs to be examined; nearly all Carolina bays in the state are wet to flooded at times of the year, but this bay appeared completely dry during the site visit with little or no evidence that water ever ponds there.

REFERENCES: LeGrand (1989e)

Mamie Upland Forest and Carolina Bay (CU16)

Jarvisburg quad

SITE NAME: Mamie Marshes and Ponds

SITE NUMBER: CU17 SIZE: about 1475 acres

SITE SIGNIFICANCE: B (State)

LOCATION: Southern portion of Currituck County, located between US 158 and Albemarle Sound, lying north of SR 1112 and south of Powells Point (and thus due west of Mamie).

QUAD MAPS: Jarvisburg, Point Harbor

SIGNIFICANT FEATURES:

1. The natural area is a unique mosaic of marsh, ponds, wet meadows, and swamp forest. A high diversity of marsh plants is present.
2. Most unusual is a "wet meadow" dominated by beaked spikerush (Eleocharis rostellata) and featuring several rare to uncommon marsh species, plus a few showy flowering plants. There are only 3 examples known of this rare community types, all in Currituck and Camden counties.
3. A "significantly rare" species -- twig-rush (Cladium mariscoides) is present.

GENERAL DESCRIPTION:

This natural area, nearly 1500 acres in size, lies on the Albemarle Sound side (west side) of the Currituck peninsula near the town of Mamie. At least half the area is freshwater to slightly brackish marsh, and can be considered an Oligohaline Marsh natural community. The marsh can be broken down into several distinct sub-communities. In addition to a submerged aquatic community in the adjacent sound, there is a sand berm along parts of the shoreline that contains salt meadow cordgrass (Spartina patens) and a handful of somewhat weedy herbaceous plants. There are several small, natural ponds embedded in the marsh; some reach perhaps 5 acres in size. The majority of the marsh consists of several tall (greater than 3 feet) species as dominants -- sawgrass (Cladium jamaicense), big cordgrass (Spartina cynosuroides), and black needlerush (Juncus roemerianus). Other tall herbs in the marsh include broad-leaf cattail (Typha latifolia), narrow-leaf cattail (T. angustifolia), common three-square (Scirpus americanus), and common reed (Phragmites communis). There is a moderately high diversity of other herbs in this marsh, but these 7 species, each of which has the ability to dominate large expanses of marshes in the state, are the principal species around the periphery. In the interior, however, these stands open into a broad mosaic of low marsh and wet meadow.

One of the most unusual features of the marsh is a possibly unique "wet meadow" habitat, covering perhaps 25 acres. The principal herbs are beaked spikerush (Eleocharis rostellata), which is considered rare in North Carolina by Radford et al. (1968), and Asian coinleaf (Centella asiatica), typically a species of savannas, ditches, and other non-marsh situations. Scattered in the meadow is twig-rush (Cladium mariscoides), a "significantly rare" species in the state. Presenting a visually pleasing appearance to the meadow, when in flower in July and August, are large rose-gentian (Sabatia dodecandra) and ten-angle pipewort (Eriocaulon decangulare). The pipewort is a common species

of ditches, pools, savannas, and other wetland habitats south of Albemarle Sound, but its occurrence in a fresh to brackish marsh, north of the sound, is most surprising.

Surrounding the marsh on the south and east is a mature swamp forest that was not studied intensively. However, it is included in the natural area because of its reasonably pristine condition.

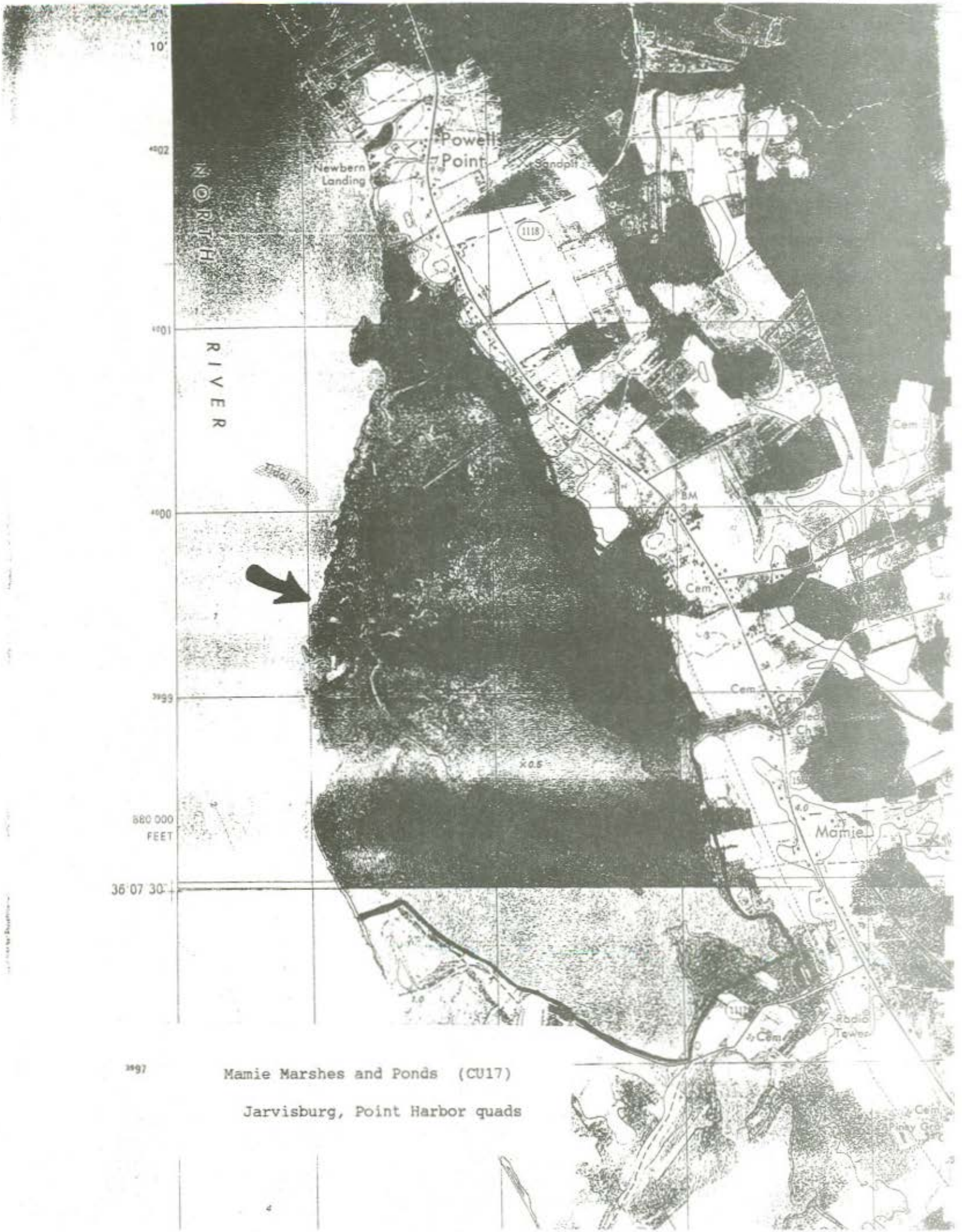
OWNERSHIP: Private

PROTECTION STATUS: None

RECOMMENDATIONS FOR MANAGEMENT OR PROTECTION: There is evidence to indicate that burning of marshes enhances the diversity of the herbs, so that mono-cultures, such as of black needlerush, are retarded. Many of the marshes in Currituck County are burned every few years by their owners to enhance the marsh for waterfowl foraging. This marsh appears to have burned frequently, presumably for that purpose, and fires at several year intervals are encouraged to increase plant diversity. These marshes would have burned fairly often in presettlement times, ignited by fire spreading from the adjacent uplands which had remnant longleaf pine (Pinus palustris), a fire-dependent species as late as the late 19th Century. Ditching of marshes should be discouraged. Portions of the forest, especially along the eastern edge near US 158, will likely be cut for timber or for residential or commercial development along the highway. The marsh should definitely be protected, such as being acquired as a Game Land for the N.C. Wildlife Resources Commission. One of the 3 Eleocharis meadows known in the state should perhaps be acquired as a nature preserve, either by a private conservation group or a Federal agency.

COMMENTS: The wet meadows in the marsh need further exploration and inventory work. It is not known if this is a unique sub-community in North Carolina.

REFERENCES: Frost (1989a)



Mamie Marshes and Ponds (CU17)

Jarvisburg, Point Harbor quads

SITE NAME: Harbinger Marshes

SITE NUMBER: CU18 SIZE: about 750 acres

SITE SIGNIFICANCE: C (Regional)

LOCATION: Extreme southern portion of Currituck County, on the western side of the peninsula; located west of US 158 and south of SR 1112.

QUAD MAP: Point Harbor

SIGNIFICANT FEATURES:

1. The natural area contains three marshes with a good diversity of aquatic and wetland plant species.
2. There is a wide extent of forest land separating the marshes from agricultural land, providing buffer from runoff.

GENERAL DESCRIPTION:

The natural area contains a series of 3 marshes along the eastern part of Albemarle Sound, separated by fingers of upland and swampy forests. Unlike most other marshes lining both sides of the North River, these marshes are separated from Albemarle Sound by a low sand berm and in one area by remnants of a higher sand ridge.

The low sand berm along the marsh edge contains species typical of coastal sands, including herbs such as creeping cucumber (Melothria pendula) and ground-cherry (Physalis viscosa var. maritima), as well as several weedy herb species. This 1-foot high berm was formed by deposition of sand during storms. The higher sand ridge, along the shore in the northern portion of the natural area, contains a remnant of a maritime forest (Coastal Fringe Evergreen Forest natural community), which is very rare today on the mainland of Currituck County. A few live oak (Quercus virginiana), sand live oak (Q. geminata), post oak (Q. stellata), and water oak (Q. nigra) trees are in the open canopy. Redbay (Persea borbonia) and red maple (Acer rubrum) form a sparse subcanopy. Actually, vines are the most significant layer in the forest, with 9 species represented. The sand ridge that supports the forest, however, is actively eroding and will not be expected to survive for more than perhaps 25-50 more years.

The marshes are an Oligohaline Marsh natural community, but several distinct sub-types are present. Along the shoreline, except on the sandy berms, a tall marsh zone featuring big cordgrass (Spartina cynosuroides) is dominant. Most of the marsh features sawgrass (Cladium jamaicense) in extensive stands, but a number of very dense clones of common reed (Phragmites communis) are found. The zone between the marsh and uplands is generally that of the Estuarine Fringe Loblolly Pine Forest community. Loblolly pine (Pinus taeda) forms a nearly complete canopy, whereas the subcanopy is dominated by redbay and red maple. Giant cane (Arundinaria gigantea) is common in the shrub layer in the drier parts of the pine forest. The upland forests are dominated by loblolly pine and sweetgum (Liquidambar styraciflua), with a dense understory of redbay, flowering dogwood (Cornus florida), sassafras (Sassafras albidum), sweetgum, and red maple. Shrubs are also common, with yaupon (Ilex vomitoria) an indicator of maritime influence. The herb layer is

rather sparse, though Virginia creeper (Parthenocissus quinquefolia) is common. The classification of such a forest, which is actually fairly common near the coast, is not well treated in Schafale and Weakley (1985); it probably represents a seral stage or disturbance phase of a maritime forest community.

OWNERSHIP: Private

PROTECTION STATUS: None

RECOMMENDATIONS FOR MANAGEMENT OR PROTECTION: The natural area has a number of potential threats. It needs protection from ditching for drainage of the adjacent woodlands. It needs protection from dredge and fill operations for the construction of shoreline access and boat channels from the uplands. The uplands need protection from further clearing for agriculture or for vacation home development. Also, the marshes need to be burned every few years to maintain plant species diversity. It is hoped that these marshes and adjacent uplands can be acquired by a State or Federal agency, as a part of a larger complex of North River/Albemarle Sound preserves, especially for the protection of the slightly brackish marshes.

COMMENTS: The "taxonomy" of some of the mainland forests adjacent to estuarine habitats needs considerable attention. There are many rather mature forests that are dominated by loblolly pine, with hardwoods such as sweetgum, in coastal sites such as mainland Currituck County or on Roanoke Island in Dare County that do not appear to fit well into the Classification of the Natural Communities of North Carolina (Schafale and Weakley 1985). The third approximation of this classification (in prep.; Mike Schafale, pers. comm.) also does not seem to classify such mixed pine/hardwood forests. At maturity, the pines would presumably be replaced by sweetgum, red maple, and perhaps several oak species; however, such forests generally have some "maritime" plants present, such as wild olive (Osmanthus americana), yaupon, or live oak. The third approximation does include a Coastal Fringe Evergreen Forest natural community, and portions of the forests at Harbinger can apparently be considered as this community, though the presence of sweetgum as a dominant implies either disturbance or a somewhat wetter site than is typical for most sites of this natural community. At any rate, the orignial maritime forests, Coastal Fringe Loblolly Pine Forests, and Pine Flatwoods in mainland Currituck County have only partially recovered from 250 years of grazing, logging, and agriculture.

There is a good potential for the marshes to contain rare plant species. Winged seedbox (Ludwigia alata) and twig-rush (Cladium mariscoides) are present in similar marshes and might well be present in these, as well.

REFERENCES: Frost (1989n)

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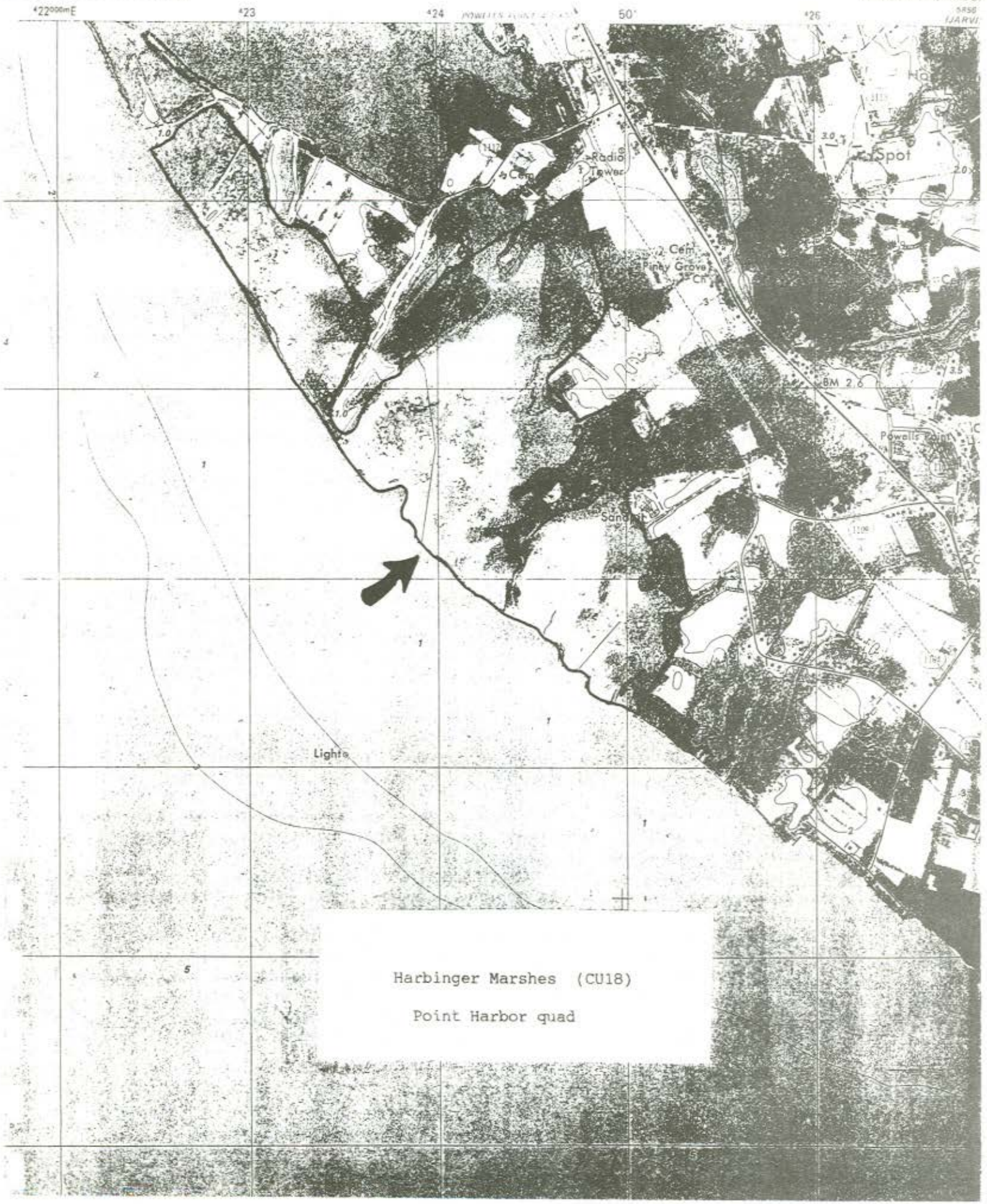


Harbinger Marshes (CU18)

Point Harbor quad

SITE NAME: The Green Sea

SITE NUMBER: CA3 SIZE: about 10,900 acres

SITE SIGNIFICANCE: B (State)

LOCATION: Straddles the boundary between Camden and Currituck counties. The northern border is the Virginia state line, extending east nearly to SR 1218 in Currituck County and west nearly to US 17; the southern border is approximately due west of the Snowden community in Currituck County.

QUAD MAPS: Lake Drummond SE, Moyock, Lambs Corner, South Mills

SIGNIFICANT FEATURES:

1. This natural area is the largest unditched remnant of the Great Dismal Swamp outside of the National Wildlife Refuge (of the same name).
2. There are remnants of Atlantic White Cedar Forest in the natural area, as well as remnants of canebrakes, both of which were extensive types in pre-settlement times. A large extent of Pond Pine Woodland is present in the southern portion of the area, and swamp forests are common.
3. The large size of the area provides habitat for large mammals such as black bear (Ursus americanus).

GENERAL DESCRIPTION:

The Green Sea is the eastern extension of the Great Dismal Swamp. Much of the eastern half of this swamp (east of US 17) has been cleared for agriculture or pine plantations, but over 10,000 acres still remain in relatively natural condition. This site was visited as early as 1728 by William Byrd, who was surveying the line between North Carolina and Virginia. The name comes the former vast areas of giant cane (Arundinaria gigantea), which apparently had no overstory or canopy; these canebrakes were kept nearly free of other woody vegetation by frequent natural fires. Also abundant on portions of the area were extensive stands of Atlantic white cedar (Chamaecyparis thyoides). With the advent of civilization and fire suppression, the cedars were eventually timbered or replaced by other swamp trees more suited to fire-suppressed conditions. Today, red maple (Acer rubrum) is the dominant tree over much of the Green Sea. As a result of fire suppression, the most extensive community is a Nonriverine Swamp Forest featuring maple in the canopy and shrub-sized redbay (Persea borbonia) as an understory tree. These sites were mainly white cedar stands in the 1700's (Frost 1989ff). Sites that were formerly canebrakes are now mostly dominated by red maple, with some sweetgum (Liquidambar styraciflua), swamp tupelo (Nyssa biflora), and loblolly pine (Pinus taeda). Redbay dominates the understory, and sweet pepperbush (Clethra alnifolia) is abundant in the shrub layer.

Small remnants of Atlantic White Cedar Forest communities still persist. Along the eastern boundary of the natural area there appear to be hardwood flats, judging from aerial photos and soil maps, but such sites were not investigated in this inventory. These might be Nonriverine Wet Hardwood Forests. The southern portion of the Green Sea, south of SR 1218, is a pond pine (Pinus serotina) pocosin. Apparently, most of this section was

originally canebrake, but fire suppression on the shallow organic soils has led to a forest of pond pine. A wide variety of pocosin shrubs is present. This is apparently the largest extent of Pond Pine Woodland community in the Albemarle Sound region outside of Great Dismal Swamp National Wildlife Refuge.

The natural area is very important for refuge for larger animals. Black bears (Ursus americanus) are present, as are bobcats (Felis rufus) and red-shouldered hawks (Buteo lineatus). The area likely has a high breeding bird diversity.

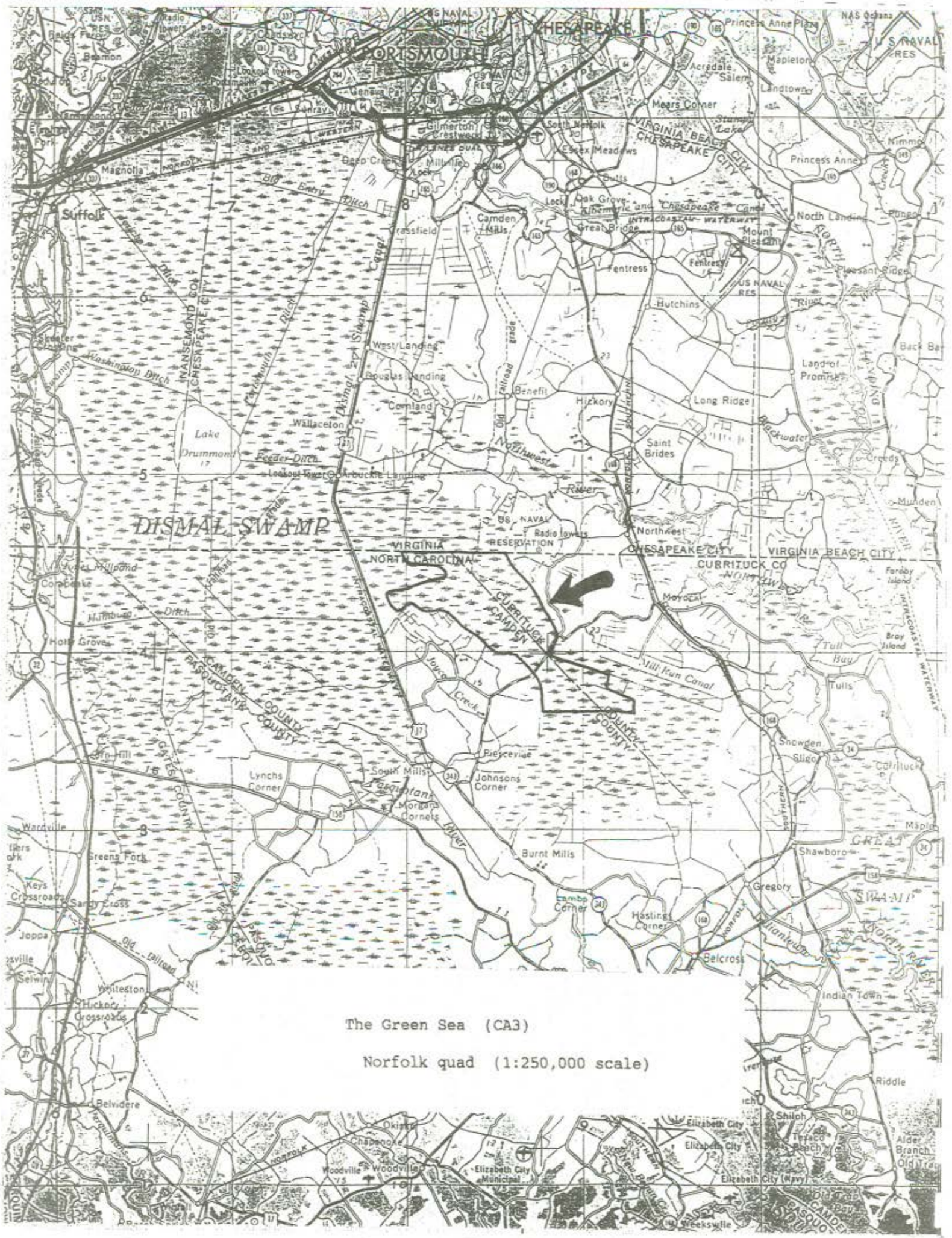
OWNERSHIP: The great majority of the area is in just 3 ownerships. Two are private (a farm operation and a timber company), where portions of the northeastern extremity are owned by the U.S. Navy, which operates a Naval Communication Station on the property.

PROTECTION STATUS: None

RECOMMENDATIONS FOR MANAGEMENT OR PROTECTION: The area should be protected from further logging. This threat is assumed to be very high, since there are many recent clearcuts along the margins of the area. Portions of the natural area should be burned to restore the original canebrake and white cedar communities, which are now replaced by maple swamps that are common in the Great Dismal Swamp region. The U.S. Fish and Wildlife Service, which administers the National Wildlife Refuge to the west of US 17, might wish to acquire this natural area, which extends into Virginia, for addition to the refuge. The N.C. Division of Parks and Recreation owns and administers the undeveloped Dismal Swamp State Park immediately to the west of US 17. Acquisition of the Green Sea by this agency, to add to its state park holdings, is another protection option. The natural area extends into Virginia; both the Virginia Natural Heritage Program and private conservation groups are interested in protection of this portion of the Green Sea. Protection coordination with these agencies is recommended.

COMMENTS: Considerable portions of this vast area still remain unexplored, at least by this inventory team. Sites on Roanoke soils along the eastern margin of the area might well contain oak flats, which are extremely rare in the Dismal Swamp proper. Animal surveys are also needed.

REFERENCES: Frost (1989ff)



The Green Sea (CA3)

Norfolk quad (1:250,000 scale)

Figure 12. Significant natural areas in Gates County. The areas are numbered generally in a north to south, or west to east, manner; see Table 7 and the Inventory of Sites section for further information.


V I R G I N I A
GA1
GA1
GA1
GA1
GA2
GA3
GA3
GA4
GA5
GA6
GA7
GA8
GA9
CA1
CH1
PERQUIMANS
COUNTY

SITE NAME: Chowan Sand Banks

SITE NUMBER: GA1

SIZE: about 1040 acres -- total
340 acres -- northern section
350 acres -- central section
350 acres -- southern section

SITE SIGNIFICANCE: B (State) [collectively]
C (Regional) -- northern section
C -- central section
B -- southern section

LOCATION: Western portion of Gates County; located in the vicinity of Storys community, both east and west of SR 1200 from just south of US 13-158 northward for approximately 6 miles along SR 1200.

QUAD MAPS: Winton, Riverdale

SIGNIFICANT FEATURES:

1. The Sand Banks is the only site in the northern portion of the North Carolina Coastal Plain where Sandhills-type vegetation is present to any extent. It is one of the few sites in this part of the state where a sizable stand of longleaf pine (Pinus palustris) occurs, and turkey oak (Quercus laevis) and other typical Sandhills species are also present.
2. The site contains the most extensive stand of mature old-growth loblolly pine (P. taeda) in the state. The state champion longleaf pine occurs at the site.
3. A remarkable number and abundance of ericaceous species (Family Ericaceae) occurs in the natural area.
4. Significant animal species include the red-cockaded woodpecker (Picoides borealis) and the black bear (Ursus americanus).

GENERAL DESCRIPTION:

The Chowan Sand Banks is an unusual and striking geomorphic feature that parallels the eastern side of the Chowan River for tens of miles from southern Gates County northward into Virginia. This complex of sandy ridges also extends southward through Chowan County, paralleling the course of the Chowan River. The formation of the Sand Banks apparently is a complex and apparently cannot be explained by a single geological event (Frost 1982). The occurrence of such sand ridges along the eastern side of major north-south flowing Coastal Plain streams is striking and can be seen also in North Carolina at the US 421 Sand Ridge in Pender and New Hanover counties (near the eastern side of the Cape Fear River) and also along the Lumber River in Columbus County. It is postulated that these are eolian (wind-blown) deposits caused by prevailing winds, from a westerly direction, blowing sand from the floodplains onto the eastern banks of the rivers (Daniels et al. 1969). The ridges are apparently not simply old beach ridges and dune lines. The Chowan Sand Banks appears to be the only such inland ridge of sand in the Albemarle Sound region of the state.

Because of the sandy nature of the soil, it is not surprising that longleaf pine (Pinus palustris) and turkey oak (Quercus laevis) are present. The

longleaf pine was certainly more frequent in the past and was exploited at this site for making tar and pitch as early as 1622 (Cecil Frost, pers. comm.), but logging has removed most of the mature individuals. Loblolly pine (P. taeda) is now the dominant canopy tree. Though the site is not apparently climax, because pines still dominate the canopy, the forest appears to be in an arrested stage of succession because of the sandy soil. As evidence of this, many pines are very old (over 250 years). Southern red oak (Q. falcata) is also common in the understory, and turkey oak is quite common in the natural area as well.

The shrub layers are dominated by ericaceous species, with at least 13 species known for the area. Surprisingly, there are no rare species of plants known from the 800-acre natural area, though coast jointweed (Polygonella articulata) has been found on the Sank Banks just south of the Virginia border for its only known station in North Carolina. There are a number of old records of savanna species, but the herb layer has been largely eliminated by shade resulting from many years of fire exclusion.

The natural area had three nesting colonies of red-cockaded woodpeckers (Picoides borealis) in the 1970's, but as of 1988, there was just one remaining colony. The species may well disappear from the site by 1990. Lynch (1980) has recorded 62 species of breeding birds, including 7 species of woodpeckers.

The natural area has been subdivided into three sections in this report, owing to logging along portions of SR 1200. The northern section has an unusual, hilly topography, with remnant dune-like features that are 30 or more feet high and sinkhole-like swales between the "dunes". The central and southern sections are rather gentle in slope, so that the majority of the Sand Banks is a long, north-south ridge that is 15 to 30 feet higher than the surrounding lands. The northern and central sections feature rather young vegetation, with dense bluejack (Quercus incana), turkey, and southern red oaks under a canopy of loblolly pines, for the most part. The southern portion, near the Storys community, contains the oldest growth trees, by far, along the sand ridge.

Most of the natural area is best considered a Pine/Scrub Oak Sandhill natural community, particularly where turkey oaks, bluejack oaks, and scrub post oaks (Quercus margaretta) are present. A few places, now heavily cut-over, are dominated solely by turkey oak and can be considered (marginally) as a Xeric Sandhill Scrub community. It is difficult to place natural community names on portions of the site, especially because the forest has long had a history of fire suppression. Several sites in the Sandhills of Moore County that formerly were dominated by longleaf pine, but which have been fire suppressed for nearly a century, are now dominated by xeric to mesic species of oaks and hickories and were considered "Oak-Hickory Sandhill" communities in Carter and LeGrand (1989). Such a community, not considered completely natural because of the suppression of the former fire regime, appears to be fairly common at Chowan Sand Banks, especially where southern red oak and various hickories are dominant. One might be tempted to call some of the forests Dry Oak-Hickory Forest natural community, but the very sandy substrate, with elements typical of the Sandhills region of the state, seem to indicate that most of the Sand Banks should be considered as Pine/Scrub Oak Sandhill, with portions as Xeric Sandhill Scrub and others as "Oak-Hickory Sandhill".

In addition to the various upland forests, there are numerous wet sloughs between the sand ridges. Many of these have small stands of Atlantic white cedar (Chamaecyparis thyoides); other wetland forest types are also present.

OWNERSHIP: Multiple private owners

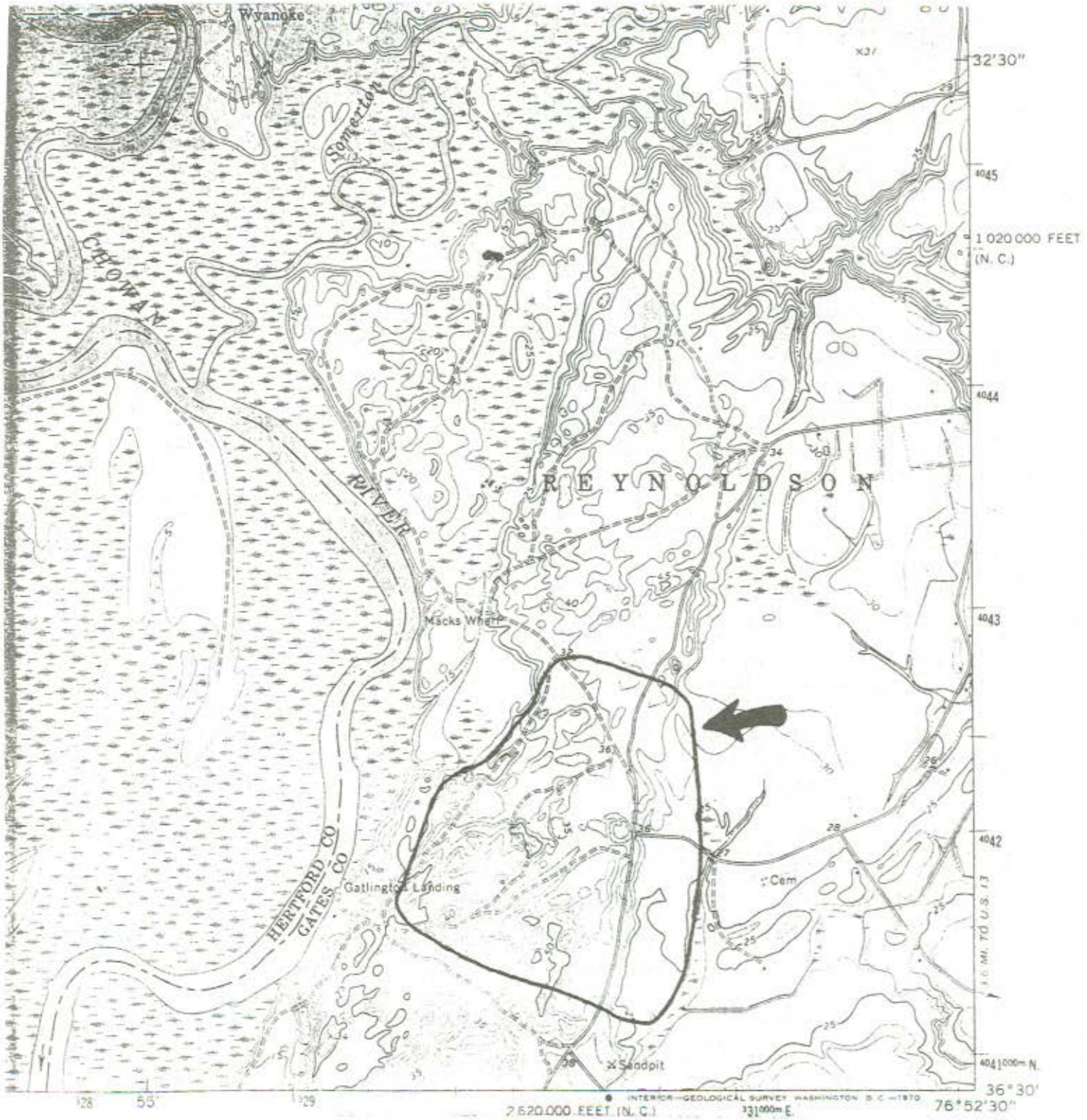
PROTECTION STATUS: None

RECOMMENDATIONS FOR MANAGEMENT OR PROTECTION: This site is in the utmost need of protection. Portions of the forest along the Sand Banks are being clearcut or selectively cut, almost annually. Some selective cutting has occurred within the natural area in recent years, and there is always the fear of clearcutting of the southern section of the site. Several of the landowners have been approached about protecting their portions of the natural area, but no protective measures have been achieved. Registry with owners would be a short-term protective measure. Ultimately, acquisition of portions or all of the natural area by a conservation group or agency would be the best long-term protective measure.

Another concern is the lack of fire in recent decades. It is presumed that the sand ridge was burned by natural fires every few years on average, before the advent of settlement in the area; and historical records indicate that longleaf pine was the original dominant on the ridges. The lack of fire is allowing hardwoods to reach the canopy, one of the reasons the red-cockaded woodpecker is declining at the site as well as in the state as a whole. A suitable fire management plan, to control or retard the growth of hardwoods and restore the banks to a open pinewoods, is needed also, but such a plan would be highly unlikely as long as the natural area remains in multiple private ownership.

COMMENTS: A large timber company owns about 7000 acres on the west side of the natural area, much of which lie in the Chowan Sand Banks. The majority of the uplands of this 7000 acres have been converted to plantations for pine pulpwood. Apparently, this company has approached land owners in the natural area about sale of the land or sale of timber rights. Portions of the Sand Banks need additional survey work, especially those portions west of SR 1200. The sand ridge extends northward into Virginia, and places on the ridge north of the natural area need field work.

REFERENCES: Daniels et al. (1969), Otte (1978), Lynch (1980), Risk (1981), Frost (1982)



Chowan Sand Banks [northern section] (GA1)

Riverdale quad

VIRGINIA

QUADRANGLE LOCATION

RIVERDALE, VA.—N. C.

SW/4 HOLLAND 15' QUADRANGLE

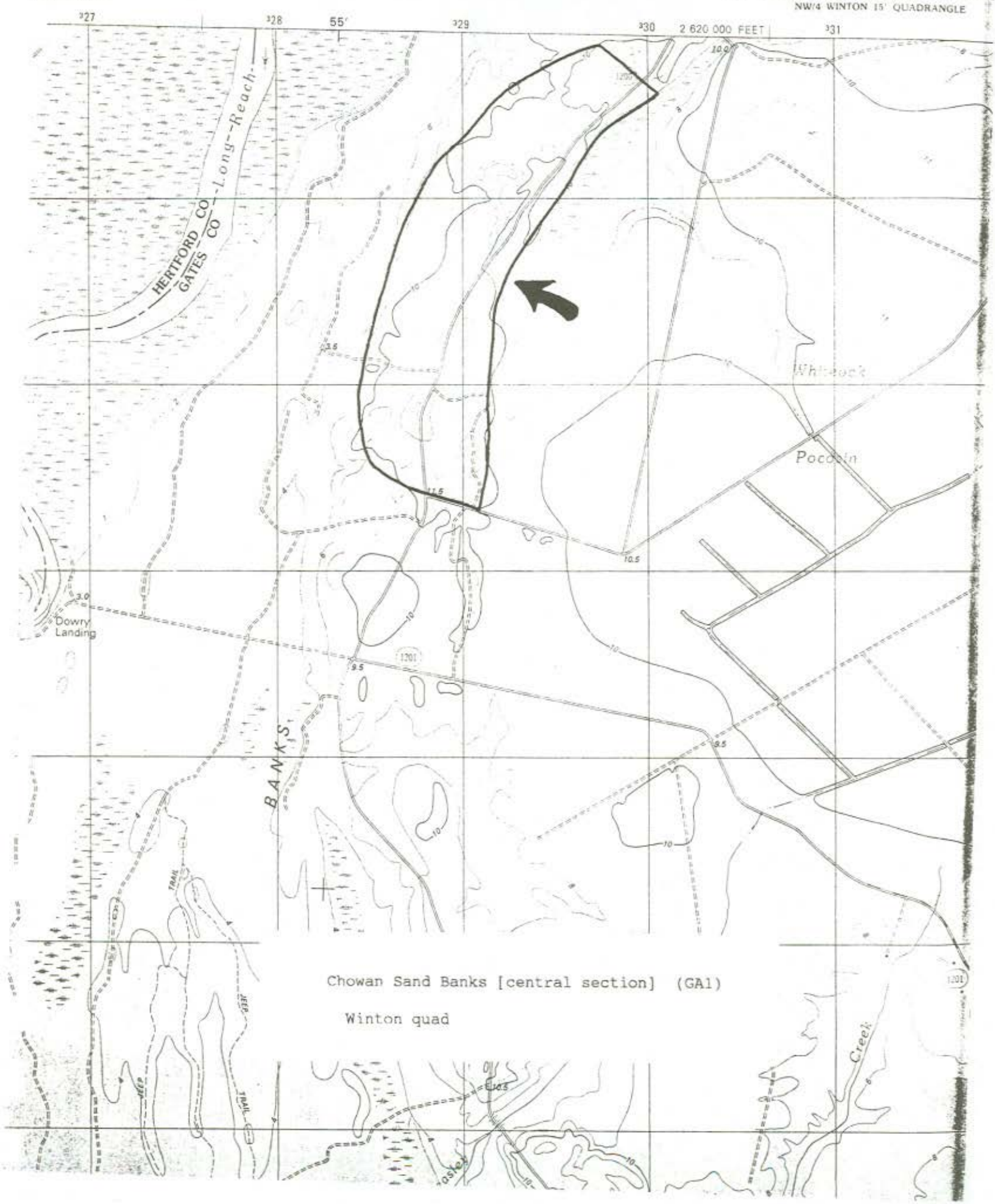
N3630—W7652.5/7.5

1967

AMS 5657 III SW—SERIES V634

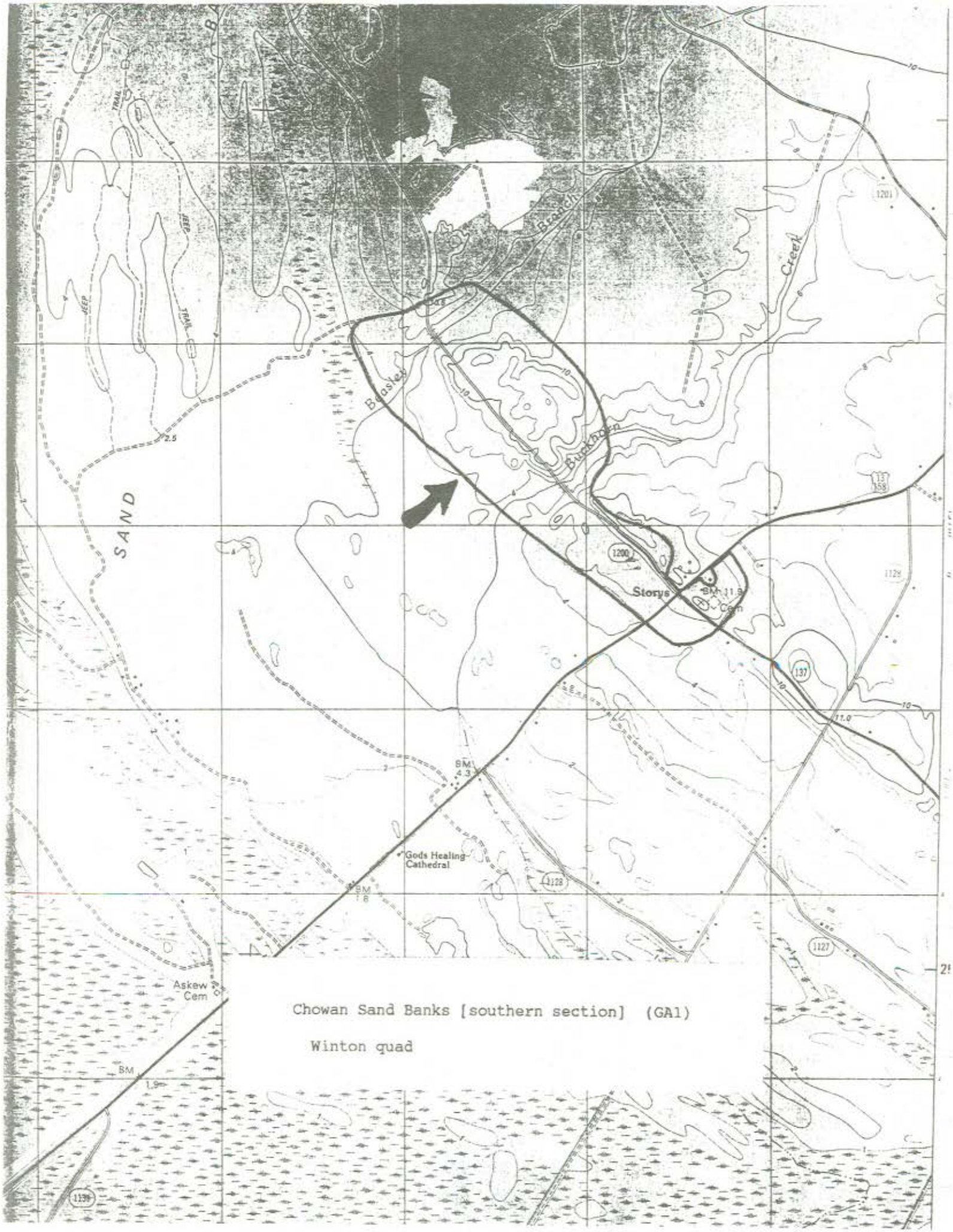
. RESOURCES
ELOPMENT
AROLINA

NORTH CAROLINA
7.5 MINUTE SERIES (TOPOGRAI
NW/4 WINTON 15' QUADRANGLE



Chowan Sand Banks [central section] (GA1)

Winton quad



Chowan Sand Banks [southern section] (GA1)

Winton quad

SITE NAME: Horsepen Pocosin

SITE NUMBER: GA2 SIZE: about 45 acres

SITE SIGNIFICANCE: C (Regional)

LOCATION: Southwestern portion of Gates County; on the north side of SR 1118, directly northeast of the intersection with SR 1220, about 1 mile southeast of Eure.

QUAD MAP: Gatesville

SIGNIFICANT FEATURES:

1. The site contains a northern disjunct population of the rare shrub pondspice (Litsea aestivalis).
2. The natural area is a slight, "Carolina bay-like" elliptic depression in an otherwise upland area, containing swamp forest vegetation.

GENERAL DESCRIPTION:

Horsepen Pocosin is a slight depression in an otherwise upland area in southwestern Gates County. Immediately to the west of the depression is the southern portion of Chowan Sand Banks. In some respects, the "pocosin" resembles a Carolina bay, but the orientation of the depression is east-northeast to west-southwest, and thus not properly oriented (northwest to southeast) for such a geomorphic feature.

The vegetation of the "pocosin" is actually a Nonriverine Swamp Forest natural community, except that portions of the fringes, on slightly higher ground, are pocosin-like with a number of shrubs and small trees typical of pocosins and bay forests. The depression is bisected by a powerline. The interior of the depression contains standing water, with relatively little understory, shrub, or herb layers. The canopy is only medium-aged and contains predominantly 3 species -- water tupelo (Nyssa aquatica), swamp tupelo (N. biflora), and red maple (Acer rubrum). Along the perimeter of the swamp is a moderate layer of shrubs and small trees, which are typical of pocosins, such as sweet pepperbush (Clethra alnifolia), sweetbay (Magnolia virginiana), and highbush blueberry (Vaccinium spp.). In this zone, at the edge of standing water, grows a scattered population of the "significantly rare" shrub pondspice (Litsea aestivalis). This species was formerly recorded from southeastern Virginia, but presently known sites (except for Horsepen Pocosin) range northward only to Carteret County in North Carolina. Thus, this natural area contains a population approximately 120 miles north of the previously known site in the state.

OWNERSHIP: Not known, but presumably private

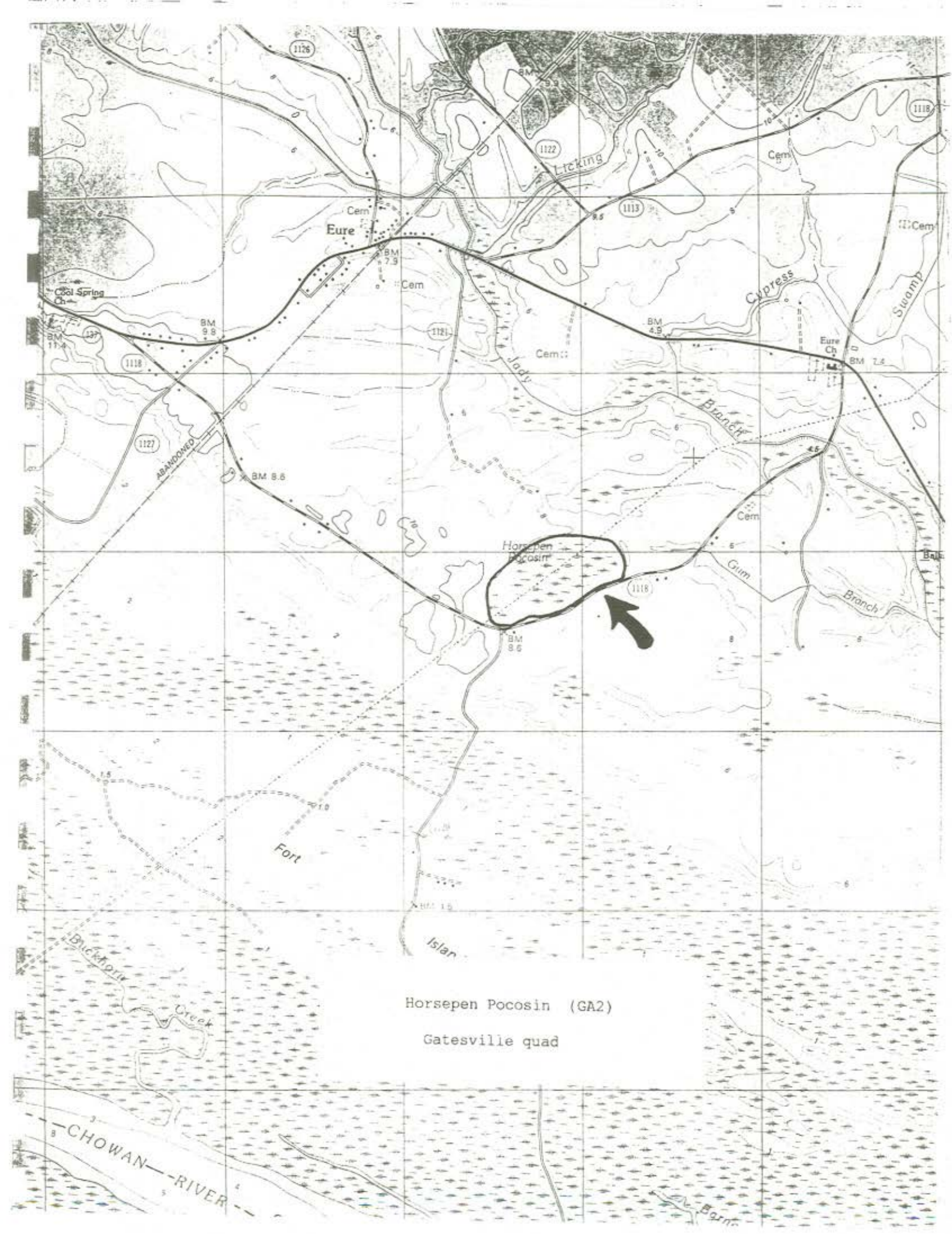
PROTECTION STATUS: None

RECOMMENDATIONS FOR MANAGEMENT OR PROTECTION: The site needs no management, but it is essential that no further utility corridors or ditches be constructed in the natural area. Timber cutting would also be detrimental to the site. The site is so small and isolated that it would not be an

acquisition project for a State or Federal agency. Thus, a registry agreement or conservation easement might be the best protection strategy.

COMMENTS: The surprising presence of pondspice at this site was discovered in September 1989 by Steve Leonard. There are several other, smaller depressions in the local vicinity that have not been surveyed for this species or for significant natural communities.

REFERENCES: LeGrand (1989c)



Horsepen Pocosin (GA2)

Gatesville quad

SITE NAME: Chowan Swamp

SITE NUMBER: GA3 SIZE: about 16,000 acres

SITE SIGNIFICANCE: B (State)

LOCATION: Southern and southwestern portions of Gates County; in the floodplain of the Chowan River, extending west to opposite the mouth of the Meherrin River and extending downriver (east) to near Trotman and Catherine creeks; natural area lies south of NC 137 and SR 1100.

QUAD MAPS: Winton, Gatesville, Harrellsville, Merchants Millpond, Mintonsville

SIGNIFICANT FEATURES:

1. The site contains some of the most extenive swamp forests in the state, especially maple/gum swamp.
2. Lying near the mouths of Bennetts Creek and Sarem Creek are excellent examples of Tidal Freshwater Marshes.
3. Low ridges or "islands" within the swamp contain mature examples of Mesic Mixed Hardwood Forest, Swamp Island subtype natural community.
4. The natural area provides outstanding wildlife habitat for bears, hawks and owls, and other species requiring extensive acreage.
5. Rare species present include southern twayblade (Listera australis), an orchid that grows on the mesic floodplain islands; a grass of the marshes, prairie cordgrass (Spartina pectinata); and black bear (Ursus americanus).

GENERAL DESCRIPTION:

Chowan Swamp is a wetland receiving some tidal action, from wind and lunar tides. The swamp covers over 20,000 acres, but portions of the northern fringes, especially on uplands, have been recently timbered. The natural area contains four broad ecosystems: swamp forest, mesic islands or ridges within the swamp, mesic slopes along the margins of the swamp, and freshwater marshes.

The dominant natural community is the Tidal Cypress-Gum Swamp. Along the Chowan River, a narrow strip of bald cypress (Taxodium distichum) and water tupelo (Nyssa aquatica) are present. However, the great majority of the swamp, particularly the inner and more poorly drained portions, are composed of swamp tupelo (N. biflora) and red maple (Acer rubrum) in the canopy. In earlier times, Atlantic white cedar (Chamaecyparis thyoides) was a major component of the swamp, but all of the cedar was logged in the late 19th Century and again in the mid-20th Century. Most was replaced by swamp forest but a significant stand occurs on the N.C. Wildlife Resources Commission property west of US 158.

Embedded within the swamp are a number of low ridges or floodplain islands, generally running east-west. This somewhat higher ground contains mesic and even xeric species of plants; the latter group are surprising for floodplain islands. Captain Jim Felton's Island, portions of Landing Ridge, and the eastern portion of Fort Island contain floodplain ridges featuring American beech and a variety of mesic oak species such as southern red (Quercus falcata), black (Q. velutina), water (Q. nigra), and post (Q. stellata).

Portions of the ridges are quite sandy and resemble a few areas of the Chowan Sand Banks, and turkey oaks (Q. laevis) are even present at Landing Ridge. The communities thus represented on the ridges include Mesic Mixed Hardwood Forest, Dry-Mesic Oak Hickory Forest, and (surprisingly) Pine/Scrub Oak Sandhill. One rare species of the islands is southern twayblade (Listera australis), which has been found on Felton's Island.

Likely the most significant natural communities, in terms of rarity in the state, are the Tidal Freshwater Marshes located near the mouths of Bennetts Creek and Sarem Creek. Near the mouth of Bennetts Creek is a marsh dominated by prairie cordgrass (Spartina pectinata), a "significantly rare" grass in North Carolina. Southern wildrice (Zizaniopsis miliacea) is also common in these marshes, especially along the margins of the creeks. Sarem Creek marshes contain an abundance of sedges (Carex stricta and C. alata), with arrow arum (Peltandra virginica) growing between sedge hummocks. The marshes are very diverse in herb species.

Near the northern edge of the floodplain, just below the slopes of the floodplain rim, are stands of Atlantic white cedar (Chamaecyparis thyoides) mixed with other tree species. Some of the slopes contain tuliptree (Liriodendron tulipifera), which is locally uncommon.

The swamp is extensive enough that it provides habitat for a wide range of wildlife and is an important reserve for large species, such as black bear (Ursus americanus), bobcat (Felis rufus), red-shouldered hawk (Buteo lineatus), and barred owl (Strix varia). Other wetland and aquatic mammals are also present, such as beavers (Castor canadensis), river otters (Lutra canadensis), muskrats (Ondatra zibethicus), and mink (Mustela vison).

OWNERSHIP: Both public and private. Public lands total approximately 11,000 acres -- approximately 3,800 acres owned by the North Carolina Forestry Foundation (associated with N.C. State University School of Forestry), approximately 6,000 acres owned by the N.C. Division of Parks and Recreation, and approximately 900 acres owned by the N.C. Wildlife Resources Commission. The easternmost lands are owned by the Forestry Foundation, the lands west of US13-158 are owned by the Wildlife Commission, and Parks owns most of the central portion. Private land is located primarily west of Barnes Creek, extending to US 13-158.

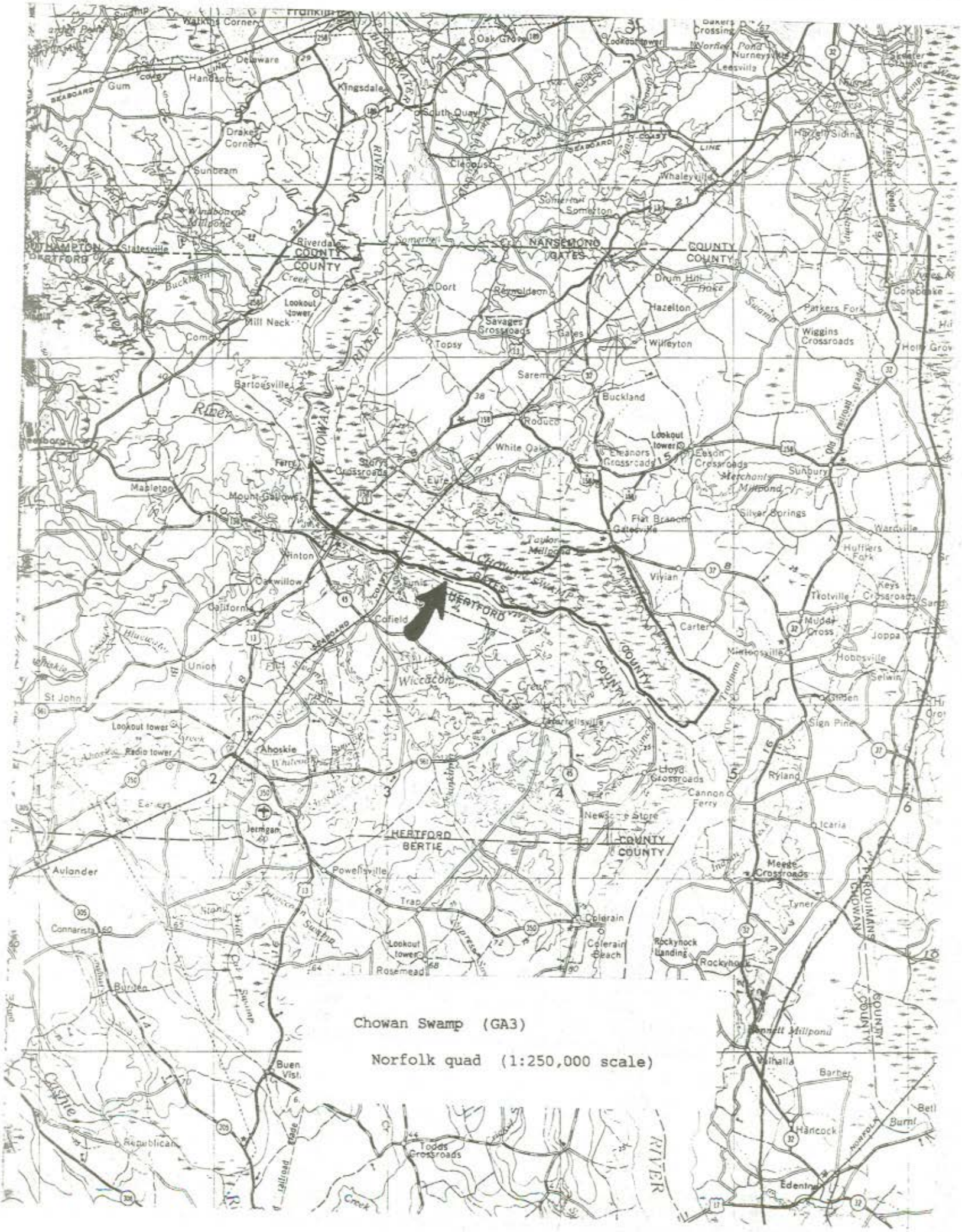
PROTECTION STATUS: The public lands can be considered "protected" in the broad sense, with protection according to rules and regulations of each agency. None of the lands have been registered with the N.C. Natural Heritage Program or have been declared Dedicated Nature Preserves. The State Park land is the Chowan Swamp State Natural Area; both it and the Wildlife land are the Chowan Swamp Game Land, with hunting allowed.

RECOMMENDATIONS FOR MANAGEMENT OR PROTECTION: Little management of the natural area is necessary. Any timber harvest would be detrimental. The public tracts are still not settled in terms of overall management plans and uses, and hunting is allowed at present on the State Park tract, which is a banned activity on all other State Park units. It appears that mineral rights to the public tracts are still open, and thus peat mining on the tracts is a possibility in the future. Mineral rights need to be acquired for these tracts to prevent such destruction. Further acquisition of the private

sectors of the swamp seems necessary, especially since the Wildlife Resources tract and the westernmost State Parks tract are isolated from the remainder of the public land to the east. Acquisition by the Wildlife Resources Commission as a Game Land would be the most feasible means of protection for private holdings. All of these lands should be registered with the Natural Heritage Program.

COMMENTS: Because of the difficulty of access, much of the swamp is yet to be explored. Floodplain islands at the eastern end of Fort Island have been poorly inventoried.

REFERENCES: Deyle and Smith (1976), Smith and Deyle (1976), North Carolina Natural Heritage Program (1979b), Frost (1982)


Chowan Swamp (GA3)
Norfolk quad (1:250,000 scale)

SITE NAME: Catherine Creek Marsh and Swamp

SITE NUMBER: GA4 SIZE: about 2000 acres (but continuous with natural area GA6)

SITE SIGNIFICANCE: B (State)

LOCATION: Along the boundary of Gates and Chowan counties. The natural area straddles Catherine Creek and lies west of SR 1232 (Chowan), extending northwestward to near the mouth of Bennetts Creek, with the Chowan River forming the western border of the site.

QUAD MAP: Mintonsville

SIGNIFICANT FEATURES:

1. The tidal freshwater marsh along Catherine Creek contains no evidence of brackish conditions and is quite different from the slightly brackish marshes in Currituck and Camden counties. The marsh is very rich in herbaceous species diversity.
2. Noteworthy species include the rather rare prairie cordgrass (Spartina pectinata), an unusual variety of turk's-cap lily (Lilium superbum), and black bear (Ursus americanus), a Special Concern species.
3. The natural area contains an extensive Tidal Cypress-Gum Swamp.

GENERAL DESCRIPTION:

The Chowan River is a drowned river valley that contains extensive swamp forests along its floodplain. Alongside several tributary streams are found freshwater marshes that contain no evidence of brackish conditions. Such marshes are rare in North Carolina. There is a measurable diurnal tide of approximately 6 inches, but these tides are almost always obscured by wind tides. The lower mile of Catherine Creek is vegetated by a freshwater marsh on both banks. No species is dominant, but the very tall (often over 6 feet) southern wildrice (Zizaniopsis miliacea) is the most conspicuous herb. The rare prairie cordgrass (Spartina pectinata) occurs in small patches. Rhizome hummocks of upright sedge (Carex stricta) and royal fern (Osmunda regalis) provide attachment habitat for many other plants. Conspicuous in the marsh are broad-leaved herbs such as arrow arum (Peltandra virginica), coastal arrow-head (Sagittaria falcata), broad-leaf arrow-head (S. latifolia), and pickerelweed (Pontederia cordata).

Along the inland margins of the marsh, red maple (Acer rubrum) is dominant. It appears that the maple is invading the marsh and might eventually overtake the herbaceous plants, barring fire or other events such as storms that would kill back the maples.

Much of the natural area consists of relatively inaccessible cypress-gum swamps that have a tidal influence. Of more interest, in terms of rarity, is a former extensive stand of Atlantic white cedar (Chamaecyparis thyoides) in the swamp, especially south of Catherine Creek. However, nearly all of the cedar has been removed by logging, so that the remaining area contains a loblolly pine (Pinus taeda) canopy, with some cedar and pond pine (P. serotina).

OWNERSHIP: Portions of the natural area, primarily land southeast of Catherine Creek, are privately owned. The State of North Carolina (N.C. Forestry Foundation, N.C. State University School of Forestry) owns the land northwest of the creek within the natural area.

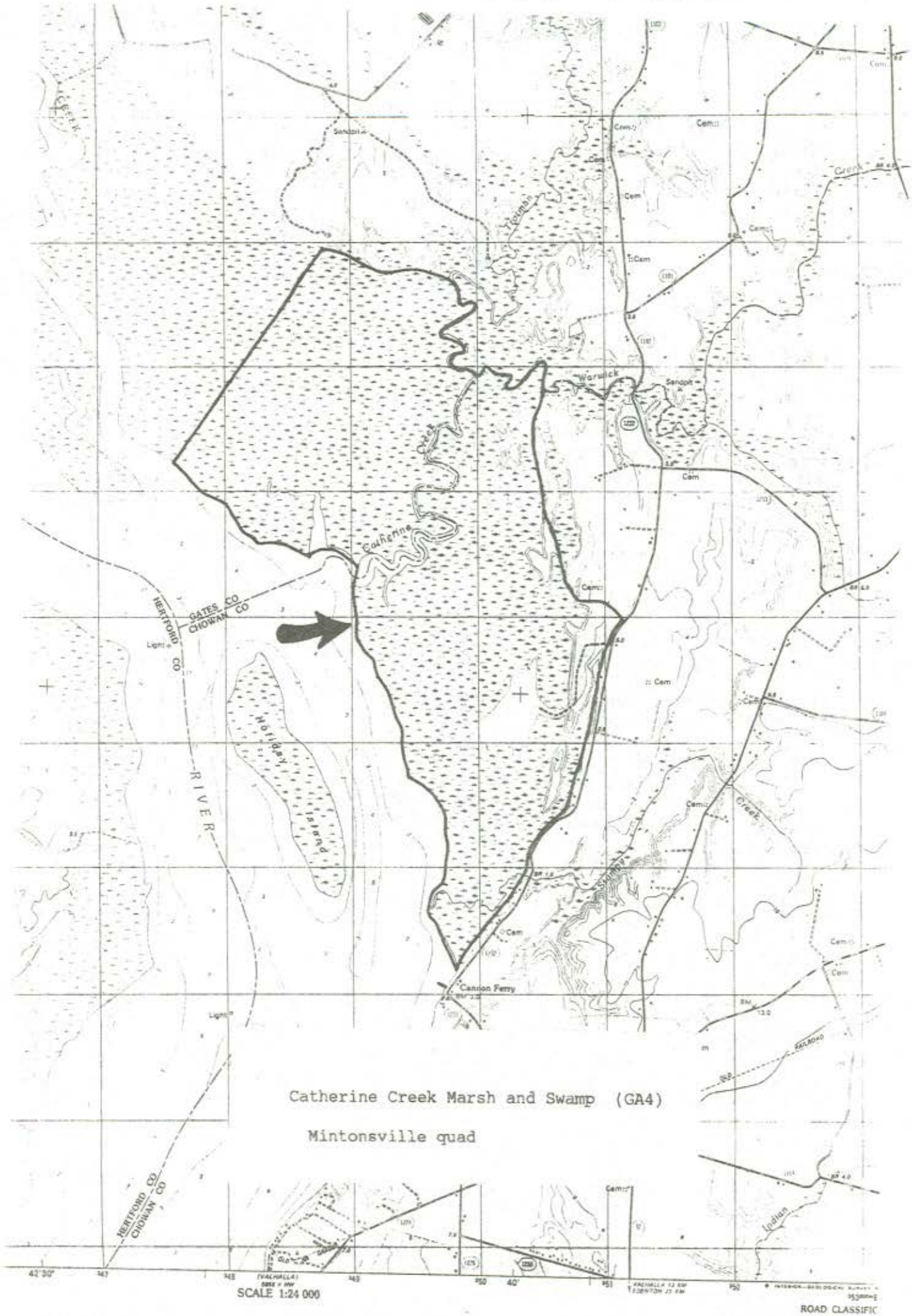
PROTECTION STATUS: No official protection status for either the private portion or the State-owned portion. The portion owned by the Forestry Foundation is undergoing no manipulation and is being maintained, at least for the present time, for eventual use for scientific and educational purposes.

RECOMMENDATIONS FOR MANAGEMENT OR PROTECTION: Succession of the marsh by red maples is taking place in some portions of the marsh, and burning of the marsh every 20-25 years may be necessary to control the maples. Logging of the trees in the swamp has been detrimental, especially to the cedars. In order to regenerate cedars in the swamp, it might be necessary to burn the forest in the hopes of having seedlings gain a foothold in the swamp. This would likely not be a suitable management tool, and it seems best to allow the forest to mature, even at the eventual complete loss of the cedar. The private portion of the site needs protection, and the best method would be by acquisition by the State, such as by the Wildlife Resources Commission for a Game Land or by the N.C. Forestry Foundation at N.C. State University to add to its holding on the opposite side of Catherine Creek.

A privately-owned, 116-acre tract has been placed on the market for sale in late 1989. This tract is adjacent to the Forestry Foundation land. It is suggested that the Foundation inquire about the acquisition of the property for inclusion with their landholdings at Chowan Swamp.

COMMENTS: Frost and Lane (1989) discuss the differences between the Chowan River marshes and the marshes in Currituck and Camden counties. The marshes in the latter counties are slightly brackish and feature a considerable number of graminoids (grasses, sedges, and rushes). The marshes along the Chowan, including this natural area, feature an abundance of broad-leaved herbaceous species with relatively few grasses, sedges, and rushes. The forested portions of the natural area need further inventory, but access is a considerable problem because of water depth.

REFERENCES: North Carolina Natural Heritage Program (1979b), Frost (1982), Frost and Lane (1989)



Catherine Creek Marsh and Swamp (GA4)

Mintonsville quad

SITE NAME: Bear Garden

SITE NUMBER: GA5 SIZE: about 790 acres

SITE SIGNIFICANCE: B (State)

LOCATION: Northwestern portion of Gates County; located just west of the community of Sarem, bounded by US 13 on the west, SR 1218 on the northeast, and by a dirt track on the south. A small portion of the site lies east of Sarem along Hackley Branch.

QUAD MAP: Gatesville

SIGNIFICANT FEATURES:

1. The natural area is large in size -- over a square-mile -- and contains an excellent mosaic of at least 6 major natural communities of uplands of the A/P Study area.
2. The area contains examples of semi-evergreen oak forests on meanders along a small creek. Also present is a cypress-gum swamp with a population of American featherfoil (Hottonia inflata), a rather rare aquatic plant in the state.
3. The site is the the only significant remnant of forest types of the loamy and clayey, mesic to dry-mesic soils that once dominated uplands of the counties north of the Albemarle Sound. The only other truly upland communities surviving in the region are on the deep, xeric sands of western Gates and Chowan counties, all other uplands having been long ago put into cultivation.

GENERAL DESCRIPTION:

The Hazelton Scarp lies in an east-west direction along the northern end of the Bear Garden natural area. The gentle slopes of the scarp at this site range from about 38 feet above sea level at the base to approximately 75 feet at the terrace above the scarp. Below the scarp, which is where Bear Garden lies, is a broad and poorly drained flat. The West Fork of Hackley Branch does drain the site, but most of the southern portion of the natural area is very flat without any obvious streams.

The entire site is heavily wooded, and a number of natural communities are present, several of which appear to be fire-suppressed and thus not completely natural. Just east of the community of Sarem, at the eastern extremity of the natural area, is a Coastal Plain Small Stream Swamp. However, the significant feature of the swamp is a population of American featherfoil (Hottonia inflata), a rather rare and bizarre-looking aquatic species in the same family (Primulaceae) as loosestrifes and shooting stars!

Within the "slough" (West Fork of Hackley Branch) that flows eastward through the middle of the natural area is a bottomland forest that is a composite of Coastal Plain Small Stream Swamp natural community and Nonriverine Wet Hardwood Forest natural community. This "community" is probably best treated as a Semi-evergreen Oak subtype of the Nonriverine Wet Hardwood Forest community, though it is not treated as such in this report, pending further research on this variant of forest subtype. The canopy is composed primarily of oaks -- laurel oak (Quercus laurifolia), overcup oak (Q.

lyrata), and willow oak (Q. phellos). Overcup oak is rare in the A/P Study area, except along the Roanoke River. There is little subcanopy, but a dense 6-foot tall layer of giant cane (Arundinaria gigantea) is conspicuous. Herbs are almost totally lacking except for cypress-swamp sedge (Carex joorii).

Most of the remainder of the natural area bordering the sloughs is a complex mosaic of Nonriverine Wet Hardwood Forest and mesic "flatwoods" of mixed loblolly pine (Pinus taeda) and hardwood canopy species (Mesic Mixed Hardwood Forest natural community). The wetter flats feature loblolly pine and wet-mesophytic hardwoods such as white oak (Q. alba), swamp chestnut oak (Q. michauxii), and cherrybark oak (Q. pagoda). Sweetgum (Liquidambar styraciflua) is common in the understory. Cane and a few other shrub species are present. A slightly drier subtype features a canopy dominated by oaks such as white, post (Q. stellata), southern red (Q. falcata), swamp chestnut, and cherrybark, with some loblolly and shortleaf (P. echinata) pines. On the drier portions of the slopes and on the top of the scarp is a Dry-Mesic Oak-Hickory Forest, with portions perhaps even Dry Oak-Hickory Forest. These drier woods likely burned frequently in pre-settlement days, as did the flats, and longleaf pine (P. palustris) may have been a component of the drier portions of the forest. Presently, however, a closed canopy of loblolly pine and southern red oak dominates, along with a few other oak species.

Shade resulting from long fire exclusion has eliminated the savanna herb layer from beneath the tree canopy, but most of the species may persist along the forest edge on roadsides. Broad areas bordering the woods along US 13 support a remnant savanna assemblage of muhly species (Muhlenbergia spp.), three-awns (Aristida spp.), and broom-sedges (Andropogon spp.), an atypical roadside flora that was only briefly examined and may contain many more remnant species. Upon canopy thinning and reintroduction of fire these species could return to the rest of the natural area. No fire-maintained remnant has survived, and the original composition of the herb layer in savannas north of the Albemarle Sound is unknown.

OWNERSHIP: Private; multiple ownership

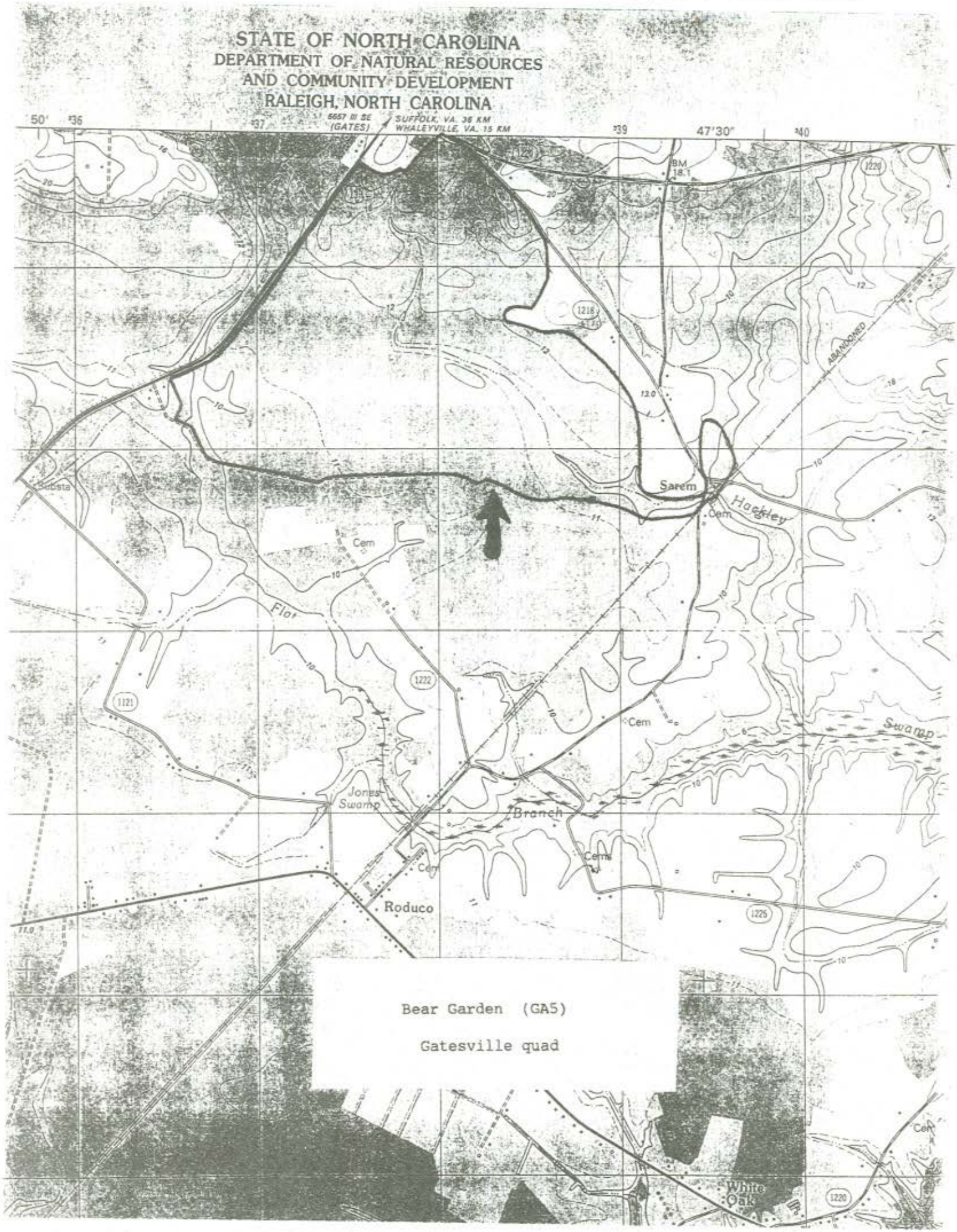
PROTECTION STATUS: None

RECOMMENDATIONS FOR MANAGEMENT OR PROTECTION: The site should be protected from logging. The threats of logging are assumed to be high in such a mesic site, based on observations made elsewhere by the authors. Portions, or perhaps all of the site, should be burned in late spring or early summer to restore the original community structure and permit the recovery of the herb layer. The upland woods are suitable for reintroduction of longleaf and shortleaf pine. This natural area features most of the natural communities found on uplands in the region, as well as a few wetland communities. Pyrophytic communities on fertile soils are the most thoroughly extirpated major community types in the South, and such sites as Bear Garden urgently need protection and restoration. Acquisition by private conservation groups might be the best protection strategy.

COMMENTS: This natural area features many communities that are quite different today, a result of fire suppression, from those during pre-settlement times, when frequent natural fires shaped the landscape. In the

1700's, much of the uplands apparently were open pinewoods, according to writings of William Byrd. Frequent fire on the uplands likely maintained the site in longleaf, loblolly, and shortleaf pines, over an understory of inkberry (Ilex glabra) and a variety of herbaceous "savanna" species. Fire in the wetter soils with pockets of organic matter would have created an open forest of mature hardwoods and loblolly pines over cane. According to Frost (1989z), frequent fire on relatively fertile organic soils produces canebrakes -- dense stands of cane -- often without a canopy. Such canebrakes were not unusual before the turn of the century. On wet mineral soils, cane tends to increase over time and with fire suppression because of surface accumulation of organic matter, whereas on organic soils the dense stands of cane often seen after fire tend to become reduced over time as typical pocosin/bay species of trees and shrubs appear. There is still much to be learned about fire dynamics in the A/P Study area, and especially the composition and types of natural communities actually present before the turn of the century, when natural fires were much more frequent.

REFERENCES: Frost (1989z)



Bear Garden (GA5)

Gatesville quad

SITE NAME: Black Mingle Pocosin

SITE NUMBER: GA6 SIZE: about 600 acres

SITE SIGNIFICANCE: C (Regional)

LOCATION: Northern portion of Gates County; located just east of the community of Hazelton, extending from SR 1312 on the southwest to Duke Swamp on the northeast, mainly along the eastern side of SR 1304.

QUAD MAP: Whaleyville

SIGNIFICANT FEATURES:

1. The natural area features several fire-related natural communities that are rarely found in the A/P Study area today. There are remnants of canebrakes and pine-mixed hardwood pyrophytic woodlands; however, the long absence of fire has caused such sites to vegetate to mixed pine-hardwood forests on poorly drained flats.
2. The site contains nonriverine wet hardwood forests, with a laurel oak (Quercus laurifolia) swamp being most significant.

GENERAL DESCRIPTION:

Black Mingle Pocosin is one of several "pocosins" found in interstream regions of the western portions of the A/P Study area. Most of these sites listed as pocosins on the maps are actually various swamp or bottomland forests, at least today. Black Mingle has shown no evidence of being a pocosin in the modern ecological sense, as pond pines (Pinus serotina) and dense shrub and understory layers of evergreen "bay" species are rare to absent. Soils are not deep organic ones that are typical of pocosins in the lower coastal plain.

The name "pocosin", however, in the South was first used in Virginia and northeastern North Carolina for such mineral soil wetlands. "Pocosin" is an Algonquian Indian word meaning "opening" and had no special connotation of peat soil. On the upper Coastal Plain terraces, "pocosin" apparently referred to open wet meadows dominated by grasses and bog species, and by canebrakes, kept free of woody species by a combination of seasonal moisture stress and fire (see Frost 1989y).

This natural area lies on a poorly drained flat at the toe of the Hazelton Scarp, which lies along the western edge of the site. Most of the "pocosin" has been converted to loblolly pine (P. taeda) plantations. Some of the western portions of the area still retain natural vegetation. Nonriverine Wet Hardwood Forest natural community is present in some places, featuring American beech (Fagus grandifolia) and other hardwood trees in the canopy. In slight depressions or sloughs at the site, laurel oak (Quercus laurifolia) forms locally dominant stands. With the laurel oak are sweetgum (Liquidambar styraciflua), red maple (Acer rubrum), and a lesser number of other oak species such as willow oak (Q. phellos) and swamp chestnut oak (Q. michauxii).

Much of the natural area lies on shallow organic soil featuring loblolly pine and various wetland hardwood tree species in the canopy. Portions feature patches of giant cane (Arundinaria gigantea) beneath the pines, whereas other areas are slightly drier and feature red maple subcanopy over a

variety of ericaceous and other shrub species. Both of these pine habitats likely burned frequently in pre-settlement days, and Frost (1989y) indicates that the original natural communities might have been canebrake and loblolly pine/mixed oak pyrophytic woodland communities, respectively.

A powerline crosses much of the natural area. The clearing is regularly mowed and adds herbaceous species diversity. Some of the species in the clearing likely give some clues as to the herbaceous species present in the original fire-maintained vegetation.

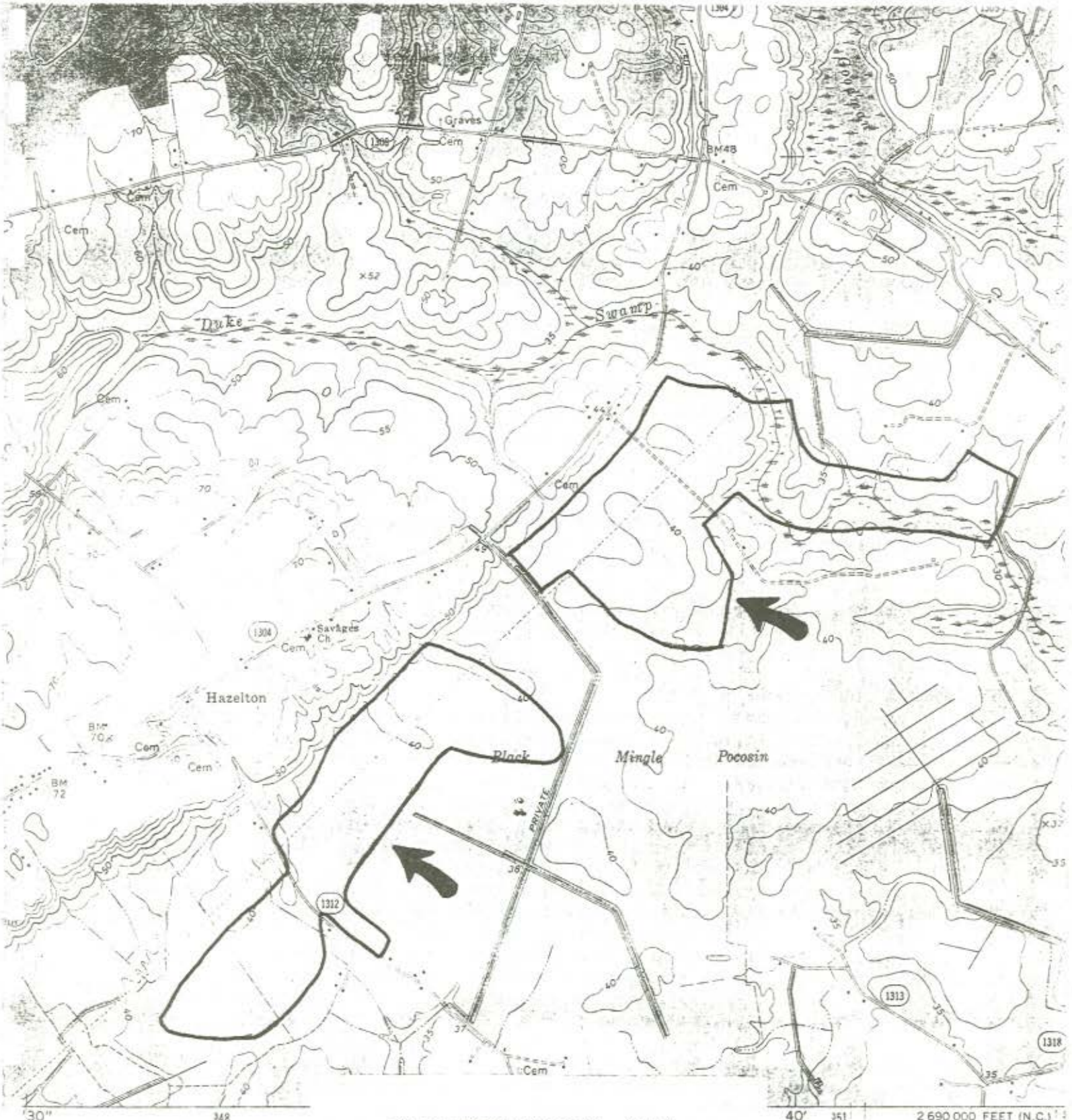
OWNERSHIP: Private; the majority is owned by a timber company

PROTECTION STATUS: None

RECOMMENDATIONS FOR MANAGEMENT OR PROTECTION: The remaining portions of the natural area not already converted to pine plantation should be protected from logging. Most of the "pocosin" has already been cleared in the past 10 years for pine plantations. Portions of the natural area should be burned on a regular frequency to provide a sample of the original vegetation mosaic. The best protection of the site is likely a conservation easement, donation, or registry agreement with the timber company that owns the majority of the property. Thus, private conservation groups or the N.C. Natural Heritage Program would probably be the lead agencies responsible for protection.

COMMENTS: Most of the Duke Swamp portion of the site, lying at the northeastern end of the natural area, was not surveyed. Also, there should be further inventory along the Hazelton Scarp to see if any natural vegetation remains, particularly at the northern edge of the natural area.

REFERENCES: Frost (1989y)



Black Mingle Pocosin (GA6)

Whaleyville quad

1000 0 1000

CONTOUR INTERVAL 5 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

VIRGINIA
QUADRANGLE LOCATION

THIS MAP COMPLIES WITH NATIONAL MAP ACCURACY STANDARDS
FOR SALE BY U. S. GEOLOGICAL SURVEY, RESTON, VIRGINIA 22092

SITE NAME: Merchants Millpond State Park

SITE NUMBER: GA7 SIZE: about 3300 acres

SITE SIGNIFICANCE: B (State)

LOCATION: Central portion of Gates County; located between Gatesville and Sunbury along Bennetts Creek and Lassiter Swamp, being south of US 158, east of SR 1400, north of SR 1404, and west of NC 32.

QUAD MAPS: Merchants Millpond, Sunbury

SIGNIFICANT FEATURES:

1. The upper end of Merchants Millpond and Lassiter Swamp contains about 50 scattered virgin bald cypress (Taxodium distichum) trees and a small patch of virgin cypress - water tupelo (Nyssa aquatica) one or two acres in extent. The stand of cypress and water tupelo in these areas is old-growth, and one of the tupelos is the state champion in size.
2. The pond and swamp has one of the most diverse assemblages of aquatic and wetland plant species on the mid-Atlantic Coastal Plain, including a number of rare species.
3. There are several mature stands of mesic/upland hardwood forests in the park, such as an American beech (Fagus grandifolia) community on moderately steep slopes. Additional rare plant species are found on the moist slopes.
4. The pond and the forests surrounding the pond provide excellent habitat for hundreds of vertebrate species.

GENERAL DESCRIPTION:

Merchants Millpond is a man-made body of water located along Bennetts Creek in Gates County. Its elevation above sea level is only 6.5 feet, with nearly all drainage into the pond being from Lassiter Swamp on the east end. The pond was constructed in 1811 to provide a source of power; however, all commercial activity around the dam and mill have long since vanished. At present, the pond contains an exceptional aquatic and wetland flora, with over 165 such plant species present, only three of which are not native to the area (Frost 1982).

Lassiter Swamp averages about 1/2-mile wide and is bounded on both sides by fairly steep valley walls, which rise to an average elevation of 30 feet above sea level. The uplands are remnants of the Talbot Terrace.

Frost (1982) lists 6 major forest community types within Merchants Millpond State Park; these can be incorporated into 3 or 4 natural communities, based on the N.C. Natural Heritage Program classification (Schafale and Weakley 1985). Those listed by Frost are:

1) cypress-tupelo swamp forest -- The community occurs in Lassiter Swamp, and portions might be virgin, especially the bald cypress (Taxodium distichum). In addition to the cypress, water tupelo (Nyssa aquatica) occurs in the canopy, and the state champion tupelo is found here. Red maple (Acer rubrum) and water ash (Fraxinus caroliniana) are dominant in the understory; lizard's-tail (Saururus cernuus) is a characteristic herb.

2) tupelo forest -- This community consists almost solely of water tupelo, at the upper end of the pond; the community likely would not have existed prior to construction of the pond. Nonetheless, a number of aquatic herb species are present at the upper end of the pond under the tupelos. Rare species include yellow water-crowfoot (Ranunculus flabellaris), American featherfoil (Hottonia inflata), prickly hornwort (Ceratophyllum echinatum), and pale mannagrass (Glyceria pallida). The water-crowfoot is considered "significantly rare" in the state and is found at just one other site in North Carolina. Both it and the featherfoil likely have their best state populations at the park. Based on a range-wide study of Hottonia inflata and a study of beaver pond flora in Virginia and the Carolinas, Frost concluded that all of these are species that found their primary original natural habitats in beaver ponds (Cecil Frost, unpubl. data). Sites like this, in the headwaters of old mill ponds, duplicate the unusual, stable shallow-water habitat provided by beaver ponds. Anhingas (Anhinga anhinga) have been sighted in this part of the pond on occasions; these waterbirds could possibly breed in the future here.

3) old mill pond with diverse aquatic and wetland plants -- The 600-acre pond contains a remarkable flora, many of which are rare. In addition to watermilfoil, other notable herbs are Conferva pondweed (Potamogeton confervoides), leafy pondweed (P. foliosus), hop-like sedge (Carex lupuliformis), and pappilose water meal (Wolffia papulifera). The Conferva pondweed is considered "significantly rare" in North Carolina.

4) black gum swamp -- This community occurs mainly along a small tributary on the south side of the pond, and it somewhat resembles the dominant community in Great Dismal Swamp. Black gum or swamp tupelo (Nyssa biflora) is the dominant canopy species, with red maple, tuliptree (Liriodendron tulipifera), and sweetgum (Liquidambar styraciflua) also important. Several rare herbs are present, such as log fern (Dryopteris celsa) and southern twayblade (Listera australis), which is present at several sites in Gates County but is nonetheless a "significantly rare" species in the state.

5) beech slope -- This community is dominated by American beech (Fagus grandifolia) and occurs in a rather narrow band along several miles of the park, on the slopes above the pond but below the flat uplands. Notable plants in this mesic forest community include silky camellia (Stewartia malacodendron) and the least trillium (Trillium pusillum). A fairly large population of the trillium is present and is one of the few protected sites for it in North Carolina. The trillium is a Federal candidate for listing. One portion of beech forest has trailing arbutus (Epigaea repens) and galax (Galax aphylla); these herbs are more typical of rocky slopes in the Piedmont and mountains.

6) mixed mesophytic oaks -- Only a few moderately mature patches of this type occur in the park, but this is one of the most heavily cut-over and destroyed communities in North Carolina. In the park, white oak (Quercus alba), black oak (Q. velutina), southern red oak (Q. falcata), and water oak (Q. nigra) are the primary canopy trees.

The wildlife at the park is fairly well known, with the largest portion of such species being birds, of which over 160 species have been recorded (Frost 1982). Though no truly rare species of animals are known, the park provides habitat for uncommon species such as red-shouldered hawk (Buteo lineatus), wild turkey (Meleagris gallopavo), and bobcat (Lynx rufus). The pond is moderately used by wintering waterfowl, and Canada geese (Branta canadensis) occasionally stop-over on the pond, though they likely forage elsewhere. Ospreys (Pandion haliaetus) use the pond for fishing during spring and fall migrations.

OWNERSHIP: As of late 1989, the State of North Carolina's Division of Parks and Recreation owned 2762 acres at Merchants Millpond State Park, which was established in 1973 with a donation of the millpond and some adjacent land by A.B. Coleman to the Division for the establishment of a State Park. Additional lands are actively being acquired by the Division for inclusion within the park. Over 500 acres of land within the park master plan acquisition boundary are in multiple private ownership.

PROTECTION STATUS: The portion owned by the N.C. Division of Parks and Recreation is protected according to State Park regulations. In 1979, approximately 1900 acres of the park were added to the N.C. Registry of Natural Heritage Areas. Lands added to the park since that date have not been registered.

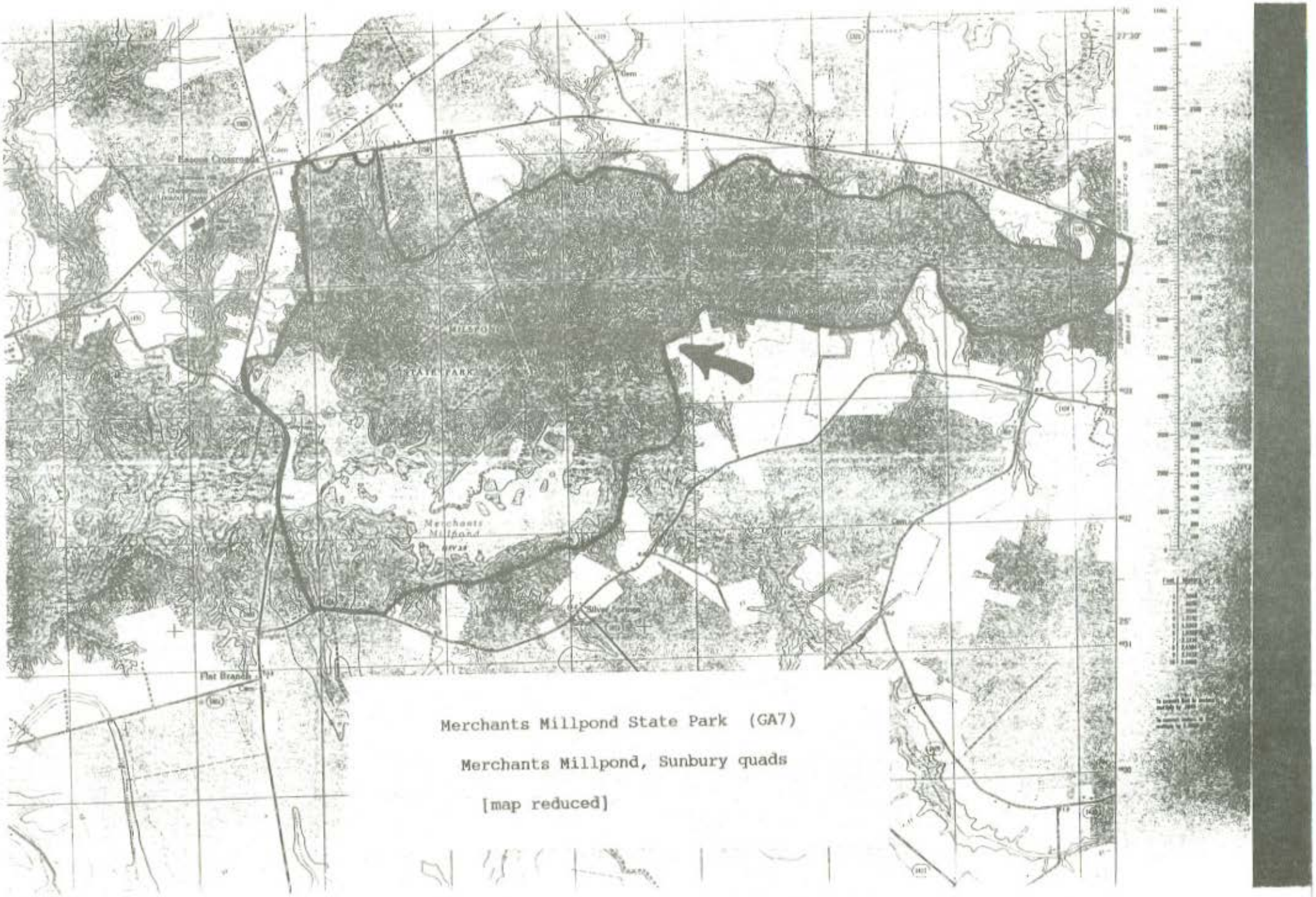
RECOMMENDATIONS FOR MANAGEMENT OR PROTECTION: The park master plan (Division of Parks and Recreation 1978) should be amended or revised to refrain from having park development in the center of the park and farther upstream. Development should be limited to the upland areas between the pond and US 158, as well as near SR 1400. Construction of a proposed park road from the entrance across a ravine or drain to planned facilities on the east of the drain, as shown in the master plan, would be detrimental to the pond and the vegetation along the stream. This road should either loop to the north of the drain, or the road should be constructed directly off US 158 (where the land is now in private ownership).

The Division of Parks and Recreation has added a number of tracts of land to the park in recent years, and negotiations continue with other private landowners for additional acquisition. Such acquisitions are highly important, to add additional swamp forest to the park (for the enjoyment of canoeists and for additional water quality protection), and to add uplands for buffer and for location of future park facilities.

The biggest problem facing the millpond is eutrophication. Runoff from agricultural fields, especially where fertilizers are used, add nutrients and sediment to the pond. Eventually, the pond will fill in with sediment or will be heavily choked by algae or other aquatic plants. Little can be done to stop this flow of material into the pond, but it is suggested (Frost 1982) that the water level of the pond may need to be raised, slowly, by increasing the height of the spillway by several inches at a time. The present level is 12 to 18 inches lower than that when it was used to power the old mill.

COMMENTS: Frost has worked for several years on preparation of detailed maps of pre-settlement and modern vegetation of the park. These maps should be available in 1991 or 1992.

REFERENCES: Division of Parks and Recreation (1978), Frost (1982), Lawrence (1984)



Merchants Millpond State Park (GA7)

Merchants Millpond, Sunbury quads

[map reduced]

SITE NAME: Corapeake Marsh

SITE NUMBER: GA8 SIZE: about 300 acres

SITE SIGNIFICANCE: C (Regional)

LOCATION: Extreme northeastern Gates County, being a part of Great Dismal Swamp National Wildlife Refuge; located about 1 mile east of SR 1332, both north and south of Cross Canal.

QUAD MAP: Corapeake

SIGNIFICANT FEATURES:

1. The site is a unique freshwater marsh in North Carolina, but its origin is of question, as there is a question whether any freshwater marshes in North Carolina away from tidal rivers are natural and self-perpetuating.

GENERAL DESCRIPTION:

The Corapeake Marsh consists today of about 30 acres of open marsh and totals about 300 acres of former marsh that is rapidly being invaded by red maple (Acer rubrum) saplings. It is believed by Frost (1982) that the marsh will eventually become a maple swamp forest, barring any disturbances or manipulation of the habitat. Freshwater marshes, away from tidal rivers and the upper ends of estuaries, are generally transitory in North Carolina and rapidly succeed to woody thickets and eventually to swamps or bottomland forests. Thus, the occurrence of a once extensive freshwater marsh in the western portion of Great Dismal Swamp is puzzling. Frost (1982) provided much historical information about the site, and he provided several hypotheses about the origin of the marsh. The marsh may have been created by settlers in the 1700's by burning or clearing of a portion of the swamp, or it may have been a natural feature maintained by fire. The marsh is in an unusual deltaic area where Corapeake Swamp drains into the Dismal Swamp, and it may have been wetter and richer in nutrients than the rest of the swamp. There is the likelihood that it could have been burned by frequent fires spreading down from the fire-adapted communities on the adjacent scarp, documented as having abundant longleaf pine (Pinus palustris) by William Byrd in 1728 (Cecil Frost, pers. comm.). At any rate, in the 1700's and 1800's the marsh was certainly larger and perhaps wetter than it is today, but it is being rapidly invaded by maples, and at least 270 acres of former marsh is now a hardwood thicket with small marshy openings.

The marsh is vegetated by a mixture of hydrophytic grasses and other species of wetland herbs. Species diversity is very low, though herbs such as golden club (Orontium aquaticum), lizard's-tail (Saururus cernuus), and Virginia blueflag (Iris virginica) indicate a very high water table which is at or above the land surface for parts of the year. However, the marsh is being invaded by woody vegetation, especially by red maples. Coastal Plain willow (Salix caroliniana) and swamp tupelo (Nyssa biflora) are other woody species invading the marsh.

Little information on animals is available for the marsh. The uncommon southern bog lemming (Synaptomys cooperi) has been reported from the site (Frost 1982).

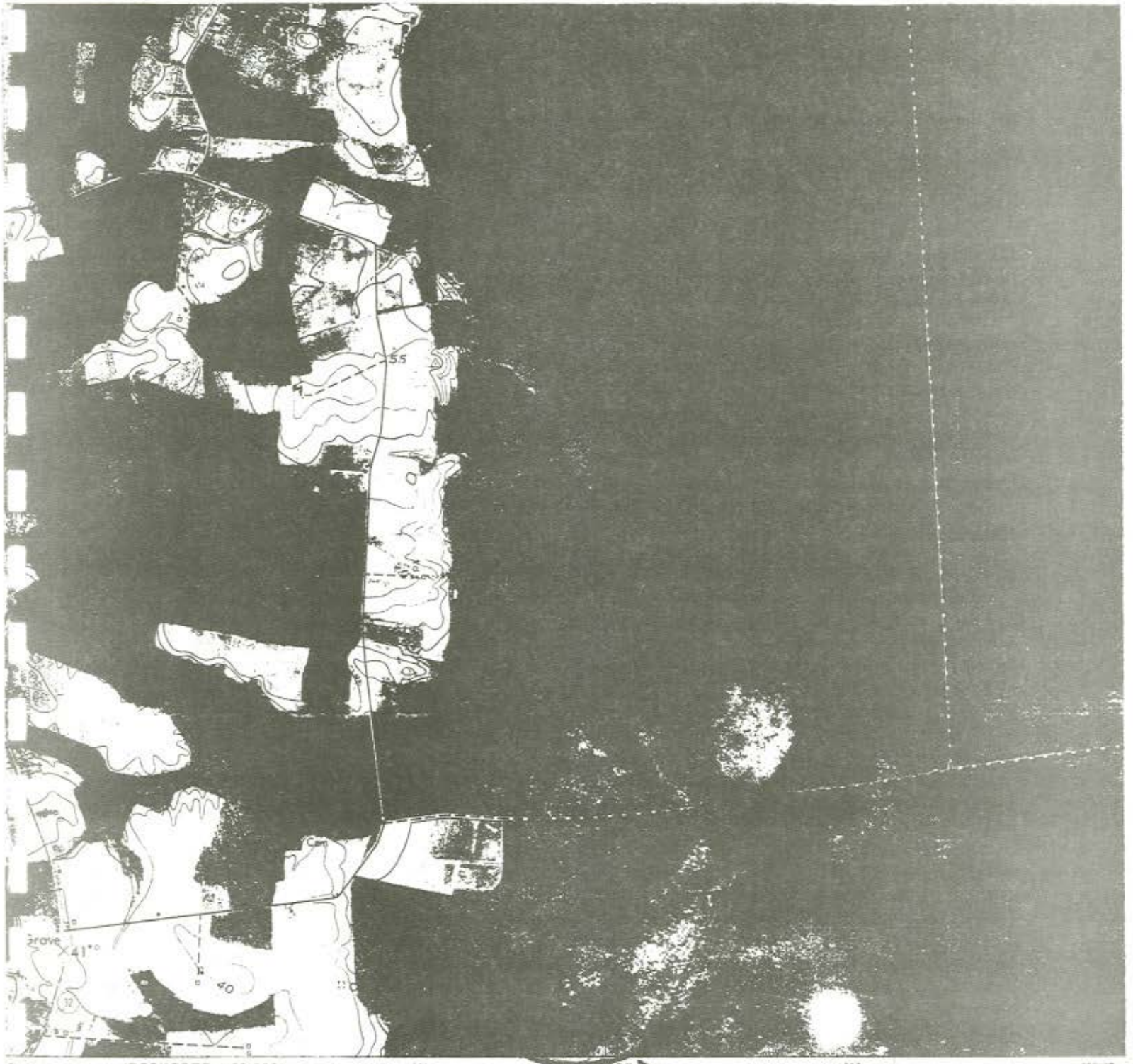
OWNERSHIP: U.S. Fish and Wildlife Service (Great Dismal Swamp National Wildlife Refuge). Small portions of the marsh might be in private ownership, as the refuge boundary is "ragged" along the western border near the Suffolk Scarp.

PROTECTION STATUS: Protected as a National Wildlife Refuge. The portion of the refuge in North Carolina is a Registered Natural Heritage Area.

RECOMMENDATIONS FOR MANAGEMENT OR PROTECTION: First, the Fish and Wildlife Service should continue acquiring all tracts in private ownership along the western portion of the refuge, as the seepage and stream flow off the Suffolk Scarp onto the terrace in which the refuge lies is essential to the viability of the swamp and Corapeake Marsh. Without management, however, the marsh will undoubtedly succeed to a maple or maple-tupelo swamp. Perhaps only fire will keep the woody vegetation retarded to maintain the marsh. Cross Canal bisects the marsh and removes water from the marsh. Another strategy needed to maintain the marsh is to raise the water table, and this would best be accomplished by closing Cross Canal at a point just east of the marsh, so that water from Corapeake Swamp (which lies west of Suffolk Scarp but flows across the scarp and empties into Great Dismal Swamp) would be diverted into the marsh, where it flowed naturally before canal construction (Frost 1982). Frost believes that only a combination of frequent fires and a raising of the water table will effectively remove the woody vegetation and perpetuate the marsh.

COMMENTS: The marsh needs additional plant and animal survey work. Most importantly, studies about the nature of the marsh and its relation to hydroperiod and fire frequency need to be conducted.

REFERENCES: United State Department of the Interior (1979), Frost (1982)



Corapeake Marsh (GA8)

Corapeake quad

MAP COMPLIES WITH NATIONAL MAP ACCURACY
E BY U. S. GEOLOGICAL SURVEY, RESTON, VIRGINIA 22092
ISION OF MINERAL RESOURCES, CHARLOTTESVILLE, VIRGINIA 22903
RIBING TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST

SITE NAME: Dismal Swamp Shield Fern Natural Area

SITE NUMBER: GA9 SIZE: about 40 acres

SITE SIGNIFICANCE: B (State)

LOCATION: Eastern portion of Gates County; located along the western edge of Great Dismal Swamp, just south of US 158, about 0.6 mile east of Acorn Hill community.

QUAD MAP: Sunbury

SIGNIFICANT FEATURES:

1. The site contains one of the richest assemblages of shield ferns (Dryopteris spp.) on the entire East Coast and the most diverse assemblage of shield ferns in North Carolina. Each of the four species, and several hybrids, is either rare in the state or rare in the Coastal Plain.
2. A population of the "significantly rare" southern twayblade (Listera australis) occurs at the site.

GENERAL DESCRIPTION:

The natural area occurs at the toe of the Suffolk Scarp, which is a sharply defined ridge forming the western edge of Great Dismal Swamp. The scarp was a former shoreline, and the land drops sharply, approximately 25 feet to the swamp, which was a sea floor at a time when the scarp was the shoreline. The soil at the western edge of the swamp is less peaty than that elsewhere, presumably because of some overwash of alluvial soil from the terrace just west of the scarp. The forest at the natural area is a swamp/bottomland with red maple (Acer rubrum) being dominant in the canopy and American holly (Ilex opaca) being common in the understory. The richer and less wet and peaty soil is the location of a remarkable variety of shield ferns (Dryopteris spp.), which are more common in the mountains and in the northern United States.

Spinulose shield fern (Dryopteris spinulosa) is known from approximately 10 sites in North Carolina (N.C. Natural Heritage Program database); this is just one of three known sites in the state's Coastal Plain. Crested shield fern (D. cristata) is rather rare in the state, being found at scattered locations, primarily in the mountains. It is known for just one other Coastal Plain site in the state (Frost 1982). Log fern (D. celsa) is quite abundant at the site, but it is rather scarce in its entire range. It is believed to be more numerous in the Great Dismal Swamp than anywhere else in its range. The least likely of the rare ferns at the site is fancy fern (D. intermedia), which is common in the mountains but is apparently absent in the state farther east, except at this natural area. In addition to the four full species of shield ferns, four hybrids have been found by Dr. Lytton Musselman, who discovered the site in 1974.

The only rare "non-fern" known for the site is southern twayblade (Listera australis). This is a small and easily overlooked orchid that is likely not as rare as the records for North Carolina would indicate. It is considered "significantly rare" in the state by the Plant Conservation Program and the Natural Heritage Program.

OWNERSHIP: Two private owners

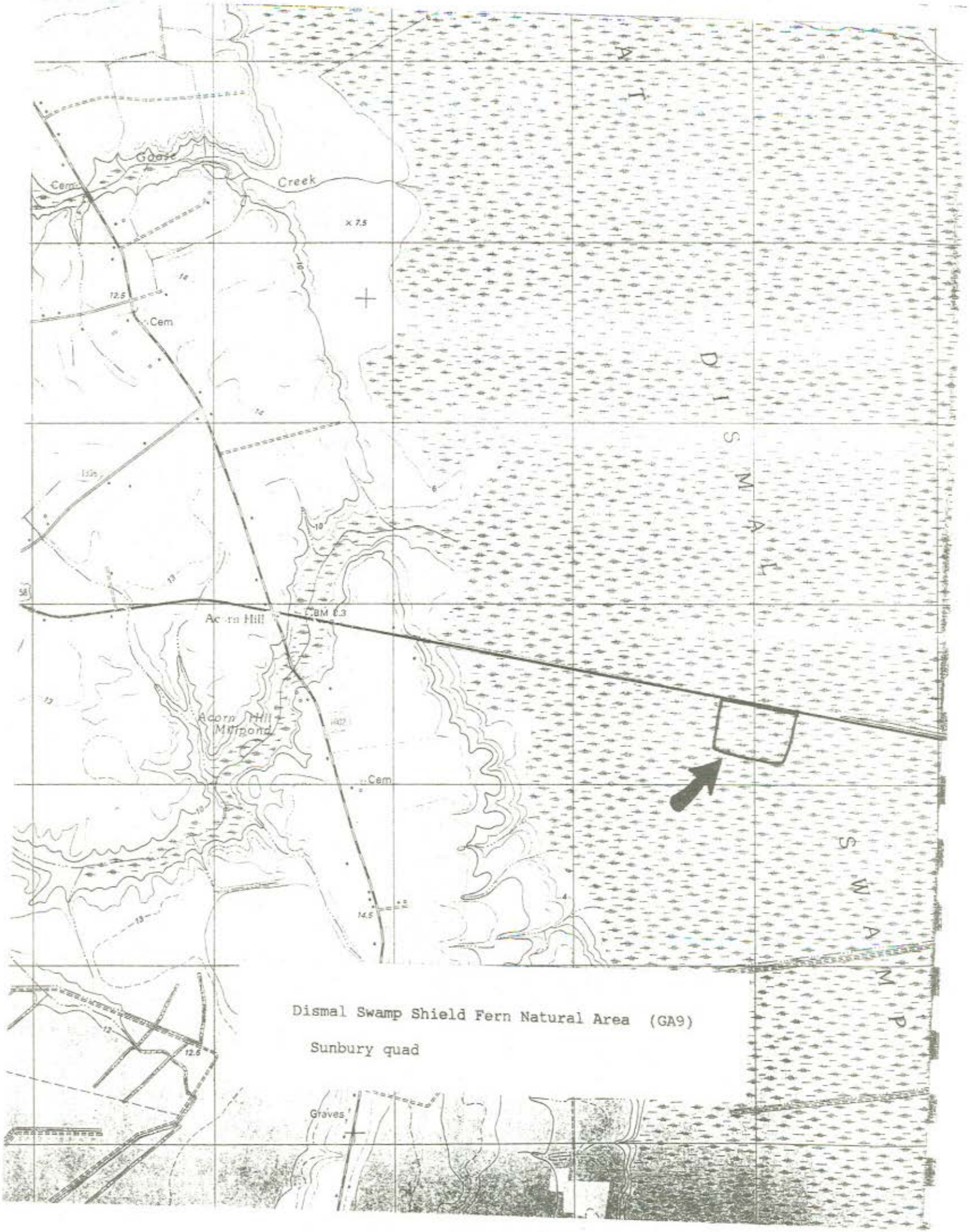
PROTECTION STATUS: The eastern half of the natural area (approximately 25 acres) has been placed on the Registry of Natural Heritage Areas by Moses White, the owner of the site. The western portion remains unprotected.

RECOMMENDATIONS FOR MANAGEMENT OR PROTECTION: It might intuitively be believed that the best management for a swamp site would be to allow the site to remain as is, with no timbering. Certainly, no timbering should be allowed at the site, as opening of the canopy would cause exotic and early-succession species to the ferns. Japanese honeysuckle (Lonicera japonica) is quite common in much of the area and is a threat to smother the ferns; some manual removal of the honeysuckle may be needed. Another concern is hydrology. US 158 blocks some flow of water from north to south, causing land on the south side of the road to be somewhat drier than that on the north. If US 158 were to be widened to 4 lanes in the future, it is imperative that no ditching on the south side of the highway be done, in order to maintain a moist soil for the ferns.

Eventually, the best protective measure for the natural area is acquisition by the U.S. Fish and Wildlife Service for inclusion with the Great Dismal Swamp National Wildlife Refuge, which lies just north of US 158, though that land immediately opposite the site (north of US 158) is privately owned.

COMMENTS: Further survey work is needed in this part of the Great Dismal Swamp. Especially needed is more work along the base of the Suffolk Scarp, both north and south of this natural area, to determine if the remarkable fern populations continue outside the site.

REFERENCES: Musselman et al. (1977), Nickrent et al. (1978), Wagner and Musselman (1979), Frost (1982)



Dismal Swamp Shield Fern Natural Area (GA9)

Sunbury quad

SITE NAME: Great Dismal Swamp National Wildlife Refuge

SITE NUMBER: CA1 SIZE: about 24,600 acres

SITE SIGNIFICANCE: A (National)

LOCATION: Northeastern Gates County, extreme northern Pasquotank County, and northwestern Camden County; specifically, bounded on the east by US 17, bounded partly on the south by US 158, and bounded on the west by the Suffolk Scarp. The refuge also extends into adjacent Virginia.

QUAD MAPS: Corapeake, Sunbury, Lynchs Corner, Lake Drummond

SIGNIFICANT FEATURES:

1. The refuge contains some of the most extensive swamp forests on the Atlantic Coastal Plain, though the majority of the forests are not mature.
2. Several extensive stands of Atlantic white cedar (Chamaecyparis thyoides) occur on the refuge; stands of this tree have been and are being logged at a rapid rate in North Carolina, and few protected sites still remain. The stands on the refuge constitute the largest remaining body of white cedar anywhere.
3. Within the swamp forest are a few pocosin/shrub bogs. Also adding diversity to the refuge, on the North Carolina side, are several mesic "islands" of high ground in the southwestern portion of the refuge, vegetated in a Mesic Mixed Hardwood Forest natural community; and an unusual freshwater marsh, of unknown origin, is present just east of the Suffolk Scarp (see Site GA8 [Corapeake Marsh] for further information).
4. The extensive forest provides excellent habitat for a wide variety of animal species, especially the black bear (Ursus americanus). Significant populations of several uncommon warblers are also present.

GENERAL DESCRIPTION:

The Great Dismal Swamp occupies an extensive flat area of very recent origin, apparently being formed less than 9,000 years ago. The Suffolk Scarp, lying along the western boundary of the refuge, was the former shoreline, and the swamp was the nearshore floor of the ocean. As the ocean levels receded, the former ocean floor became "dry land" -- the Great Dismal Swamp.

The swamp originally was dominated by Atlantic white cedar (Chamaecyparis thyoides). Akerman (1923) considered 125,000 acres to be a conservative estimate of the original cover of the species. Bald cypress (Taxodium distichum), water tupelo (Nyssa aquatica), and swamp tupelo (N. biflora) were largely limited to the dendritic system of natural streams draining the swamp, which is now long vanished after canal construction, and to the wet zone along the toe of the Suffolk Scarp. However, extensive logging over the past 200 years, as well as drainage of the land by canals, has converted the majority of the forest to a middle-aged maple forest. Red maple (Acer rubrum) is the dominant tree over thousands of acres, with swamp tupelo also a dominant tree. Most of the cypress occurs near the western portion of the refuge.

The North Carolina portion of the refuge contains several thousand acres of Atlantic white cedar forest, mostly one to two miles south of the state line in the extreme corner of Camden County. Extensive stands of this tree have

become rare, because the wood provides high-quality timber for many uses, especially as poles, fences, and outdoor home construction.

The most diverse habitat in the swamp is the mesic "islands", which are low and narrow east-west trending ridges. These ridges are mainly located in the southeastern corner of the refuge, in Gates County. American beech (Fagus grandifolia) is a characteristic tree on such ridges, along with tuliptree (Liriodendron tulipifera) and various oak species (Quercus spp.). Several noteworthy plant species grow on these ridges, especially the southern twayblade (Listera australis), a "significantly rare" species of orchid. The uncommon and showy silky camellia (Stewartia malacodendron) is also a notable species. Though found in many of the counties in the lower Coastal Plain of the state, it is not common and is most often found growing with American beech on these mesic wooded ridges located within swamps. Log fern (Dryopteris celsa) grows in portions of the refuge, especially in the more mesic sites; this is an uncommon fern with its greatest abundance in the Dismal Swamp vicinity.

An excellent variety of birds nests in the refuge; Meanley (1973) lists 84 species. Probably the most significant are the Swainson's warbler (Limnothlypis swainsonii) and the black-throated green warbler (Dendroica virens). The Swainson's is uncommon throughout its range, and a moderately large population occurs in the swamp, especially on the Virginia side. The black-throated green warbler is a common species of northern coniferous forests, ranging through the Appalachians, but the mid-Atlantic population is quite disjunct. This coastal population extends from Dismal Swamp to the Charleston, South Carolina, area, and is perhaps nowhere more abundant than at Dismal Swamp. The most notable mammals in the refuge are the black bear (Ursus americanus) and the bobcat (Felis rufus). Interestingly the Federally Threatened Dismal Swamp southeastern shrew (Sorex longirostris fisheri) has not been taken from the refuge on the North Carolina side, but it is to be looked for in brushy places, clearcuts, and woodland borders along the refuge boundary.

OWNERSHIP: U.S. Fish and Wildlife Service (Great Dismal Swamp National Wildlife Refuge). There are several private holdings along the western and southern boundary of Federal land that lie within the proposed refuge boundary. Also, the State of North Carolina (Division of Parks and Recreation) owns 13,500 acres at the southeastern corner of Great Dismal Swamp; this is the undeveloped Dismal Swamp State Park (see Site CA2 [Dismal Swamp State Park] for more information).

PROTECTION STATUS: The Federally-owned portion of the refuge is protected as a National Wildlife Refuge. The North Carolina portion is a Registered Natural Heritage Area.

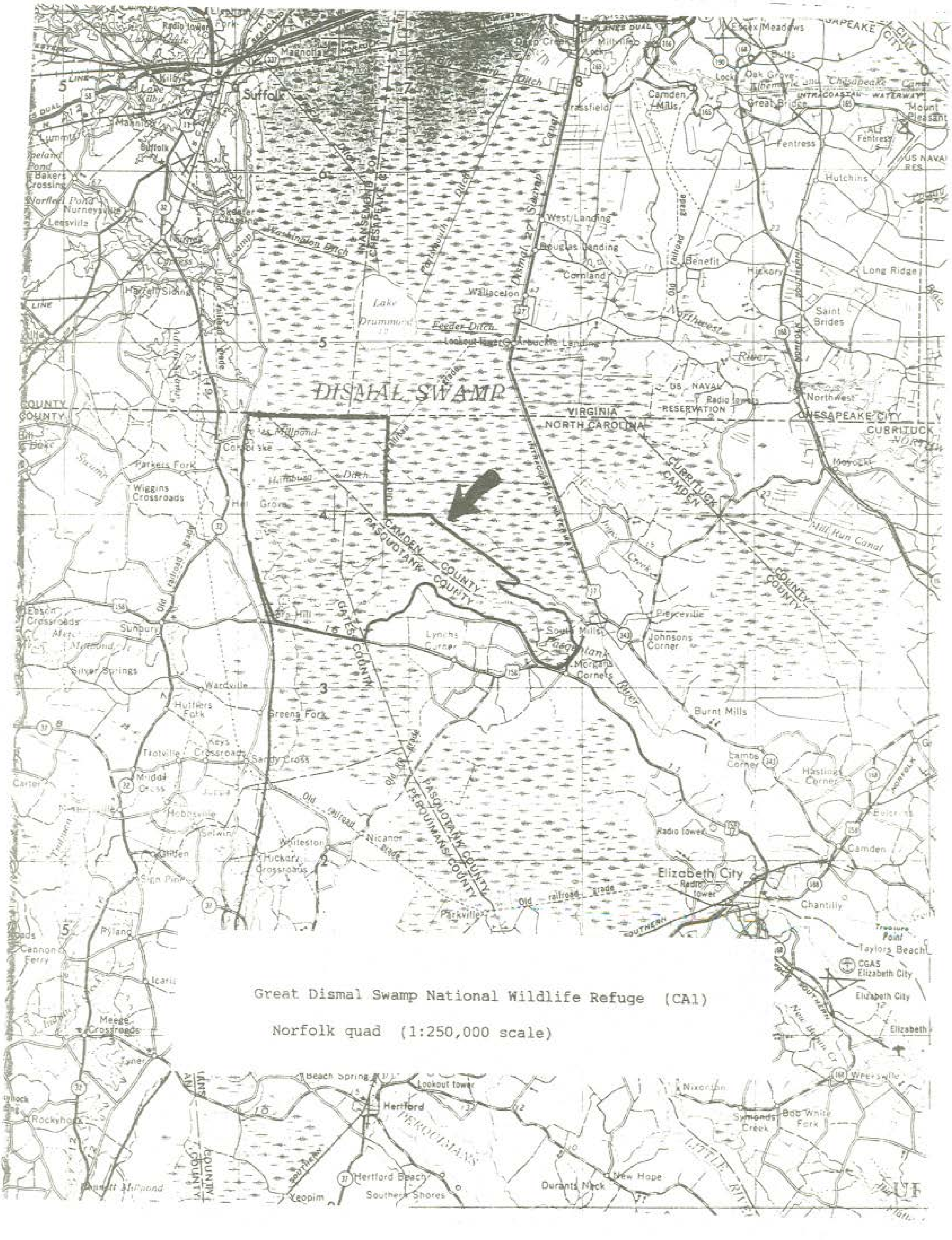
RECOMMENDATIONS FOR MANAGEMENT OR PROTECTION: Little management of the vegetation of the refuge is planned by the staff. The cypress-tupelo forests along the Suffolk Scarp should be allowed to mature. Management should be designed toward the maintenance of the cypress and white cedar communities, at the expense of the maple-gum community, plus restoration of some areas originally occupied by white cedar. Some of the canals and ditches likely will need to be blocked to return the area to a wetter hydrology. Any further

drying of the swamp will be detrimental. Some selective cutting, especially in maple areas, may be beneficial for wildlife populations and the possible re-establishment of white cedar, if the water table is raised by blocking ditches and canals. Efforts of the refuge forester to use controlled burns over the past 2 years for restoration of samples of pond pine (Pinus serotina) pocosin and other natural fire-dependent communities are to be commended.

Acquisition of privately owned tracts should also continue. This is especially important for those tracts that lie at the base of the Suffolk Scarp along the western edge of the refuge, as seepage from the adjacent terrace west of the scarp onto the lower terrace is important is keeping the swamp wet.

COMMENTS: Inventory work on plants and animals has been rather sporadic on the North Carolina side of the refuge. More intensive survey work seems necessary, such as surveys for Dismal Swamp southeastern shrew, dwarf trillium (Trillium pusillum), and shield ferns (Dryopteris spp.), all of which probably occur on the North Carolina side of the refuge.

REFERENCES: Meanley (1973), Musselman et al. (1977), Kirk (1979), United States Department of the Interior (1979), Frost (1982), U.S. Fish and Wildlife Service (1986)


DISMAL SWAMP
Suffolk
Lake Drummond
Feeder Ditch
Washington Ditch
Dismal Swamp Canal
VIRGINIA
NORTH CAROLINA
CAMDEN COUNTY
PASQUOTANK COUNTY
GATES COUNTY
PERQUIMANS COUNTY
CURRITUCK
South Mills
Pasquotank River
Elizabeth City
Camden
Hertford
Deep Creek
Great Bridge
Northwest River
Wallaceton
West Landing
Douglas Landing
Cornland
Benefit
Hickory
Saint Brides
Fentress
Lynchs Corner
Morgans Corners
Johnsons Corner
Burnt Mills
Sunbury
Wardville
Greens Fork
Sandy Cross
Parkville
Nicanor
Whiteston
Hickory Crossroads
Mill Run Canal
Radio tower
Lookout tower
Old railroad grade

Great Dismal Swamp National Wildlife Refuge (CA1)

Norfolk quad (1:250,000 scale)

SITE NAME: Warwick Creek Oak Flats and Slopes

SITE NUMBER: CH1 SIZE: about 475 acres

SITE SIGNIFICANCE: C (Regional)

LOCATION: Along the border of Chowan and Gates counties, lying alongside Warwick Creek, extending from NC 32 on the east nearly to SR 1232 on the west.

QUAD MAP: Mintonsville

SIGNIFICANT FEATURES:

1. The natural area contains swamps and mature upland hardwood stands that have a high diversity of oaks. Such upland hardwood forests are uncommon in the Coastal Plain.
2. Black bears (Ursus americanus) have been seen in this natural area; bears are considered of Special Concern in the state.

GENERAL DESCRIPTION:

Warwick Creek is a small blackwater stream with gently rolling slopes along the margins of its narrow floodplain. A hardwood forest on the flats above the floodplain in the natural area is best considered a Mesic Mixed Hardwood Forest, Upland Flats subtype. American beech (Fagus grandifolia) is dominant in many places: water oak (Quercus nigra) is important on the moister sands; and southern red oak (Q. falcata), shortleaf pine (Pinus echinata), and loblolly pine (P. taeda) are common in the canopy on slightly drier areas. A variety of subcanopy trees are present. Several species of blueberries (Vaccinium spp.) and giant cane (Arundinaria gigantea) are important in the shrub layer. A slight depression in the flats contains somewhat mesic/hydric oaks -- willow oak (Q. phellos) and laurel oak (Q. laurifolia).

The very gentle slopes also contain a mesic forest, perhaps a combination of the former community and the Mesic Mixed Hardwood Forest, Bluff/Slope subtype. American beech is the dominant tree. On the north-facing slopes, elements such as northern red oak (Q. rubra) and black oak (Q. velutina) are present. Flowering dogwood (Cornus florida) and red maple (Acer rubrum) are common in the understory on the slopes.

The wetlands in the floodplain are a Coastal Plain Small Stream Swamp natural community. Water tupelo (Nyssa aquatica) is the dominant canopy tree of the swamp along Warwick Creek, with red maple being the most common understory tree.

The black bear (Ursus americanus) occurs in the natural area. This Special Concern animal requires a large extent of habitat. Likely, the fact that the forest in the natural area is continuous with the very extensive Chowan Swamp area to the west is the reason for the presence of bears along Warwick Creek.

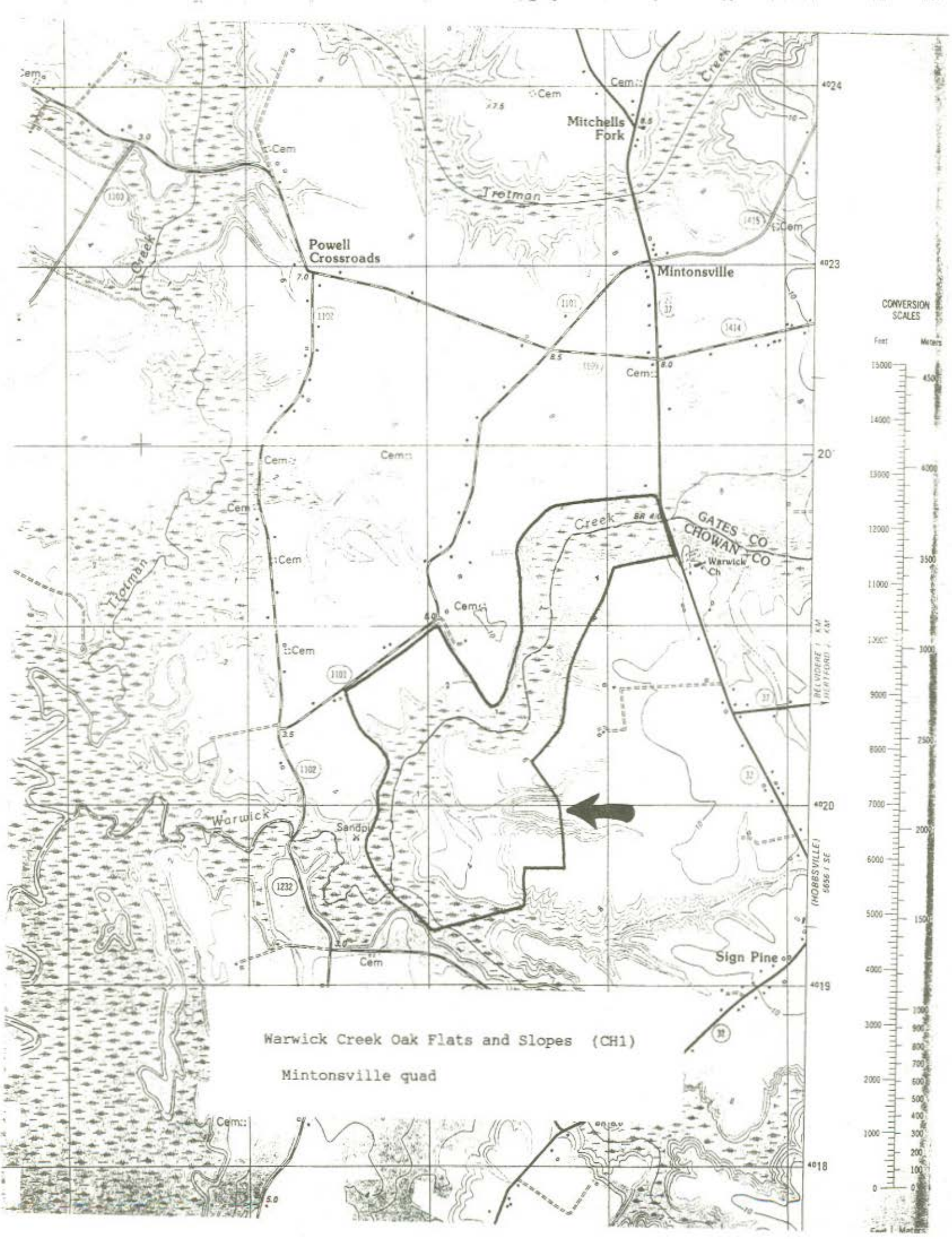
OWNERSHIP: Private

PROTECTION STATUS: None

RECOMMENDATIONS FOR MANAGEMENT OR PROTECTION: The upland forests need protection from logging, since they may provide shelter for the bear and since they are examples of a threatened natural community. The natural area should be designated as a Wildlife Resources Commission Bear Sanctuary. The Wildlife Commission might take in interest in acquisition of the natural area.

COMMENTS: Beaver impoundments within the swamp contain possible habitat for several species of rare plants. Natural community taxonomy of mesic flats and very gentle slopes in the lower Coastal Plain need further survey work. The steep to moderate slopes in the western Coastal Plain often feature many "Piedmontane" species that are rather scarce in the Coastal Plain. The gentle slopes in the lower Coastal Plain do not show such an affinity. The slopes are often so gentle that xeric, mesic, and hydric species may occur practically side-by-side, which is certainly the case on the upland flats.

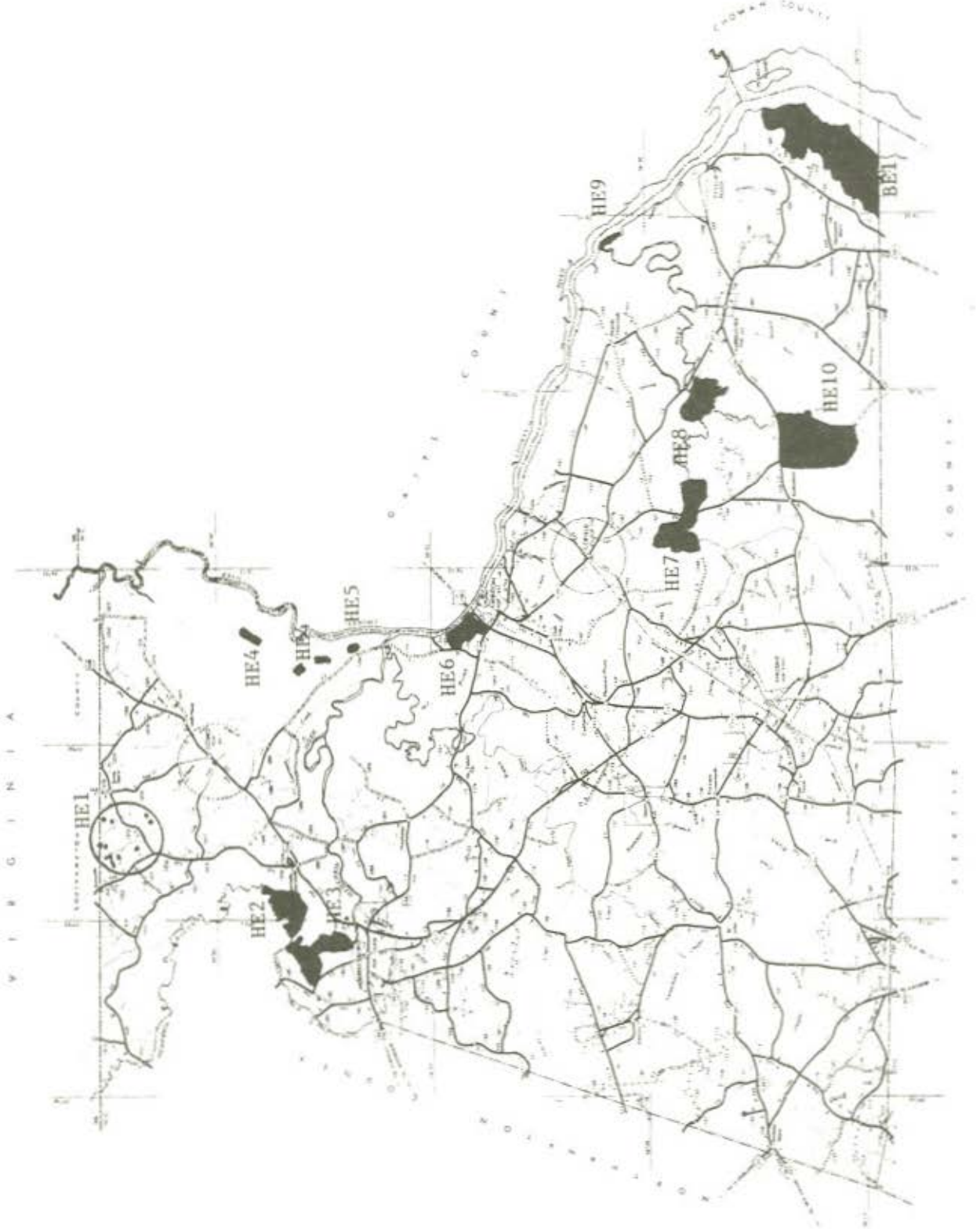
REFERENCES: Frost (1989p)



Warwick Creek Oak Flats and Slopes (CH1)

Mintonsville quad

Figure 13. Significant natural areas in Hertford County. The areas are numbered generally in a north to south, or west to east, manner; see Table 7 and the Inventory of Sites section for further information.


HE1
HE2
HE3
HE4
HE5
HE6
HE7
HE8
HE9
HE10
BE1

SITE NAME: The Pot Holes

SITE NUMBER: HE1

SIZE: about 25 acres (not including land around the depressions)

SITE SIGNIFICANCE: C (Regional)

LOCATION: Extreme northern part of Hertford County, lying both north and south of SR 1315 from the Virginia border south to approximately one mile southeast of Britts Store community.

QUAD MAP: Sunbeam

SIGNIFICANT FEATURES:

1. Sinkholes are rather rare in North Carolina and are generally associated with the presence of limestone or marl, being located primarily from Carteret County southwest to Brunswick County. Limestone or marl is apparently not known to occur in Hertford County, so the unusual presence of small, shallow sinkholes is unexplained.

GENERAL DESCRIPTION:

In extreme northern Hertford County, there are located more than a half-dozen very shallow depressions or sinkholes, each about 1/2-acre in size. These depressions lie in the uplands to the west and southwest of Britts Store community. The majority of the uplands in that area have been cut-over, and some of the land is now in young pine plantation. At least one hole, however, contains natural vegetation. The entire surface of the sink, which apparently contains water for part of the year, is covered by a carpet of sphagnum (Sphagnum cuspidatum). The canopy in the sink is fairly open and is dominated by swamp tupelo (Nyssa biflora). The subcanopy is sparse, as is the shrub layer. Two species of highbush blueberry (Vaccinium corymbosum and V. atrococcum) dominate the shrub zone. The surrounding vegetation is a fairly young upland forest dominated by red maple (Acer rubrum), loblolly pine (Pinus taeda), white oak (Quercus alba), and southern red oak (Q. falcata).

The origin of the depressions is a mystery. This part of North Carolina (north of Albemarle Sound) is not noted for containing marl deposits, nor do the depressions appear to be Carolina bays, since they are circular and not oriented in a northwest-southeast direction.

OWNERSHIP: Private

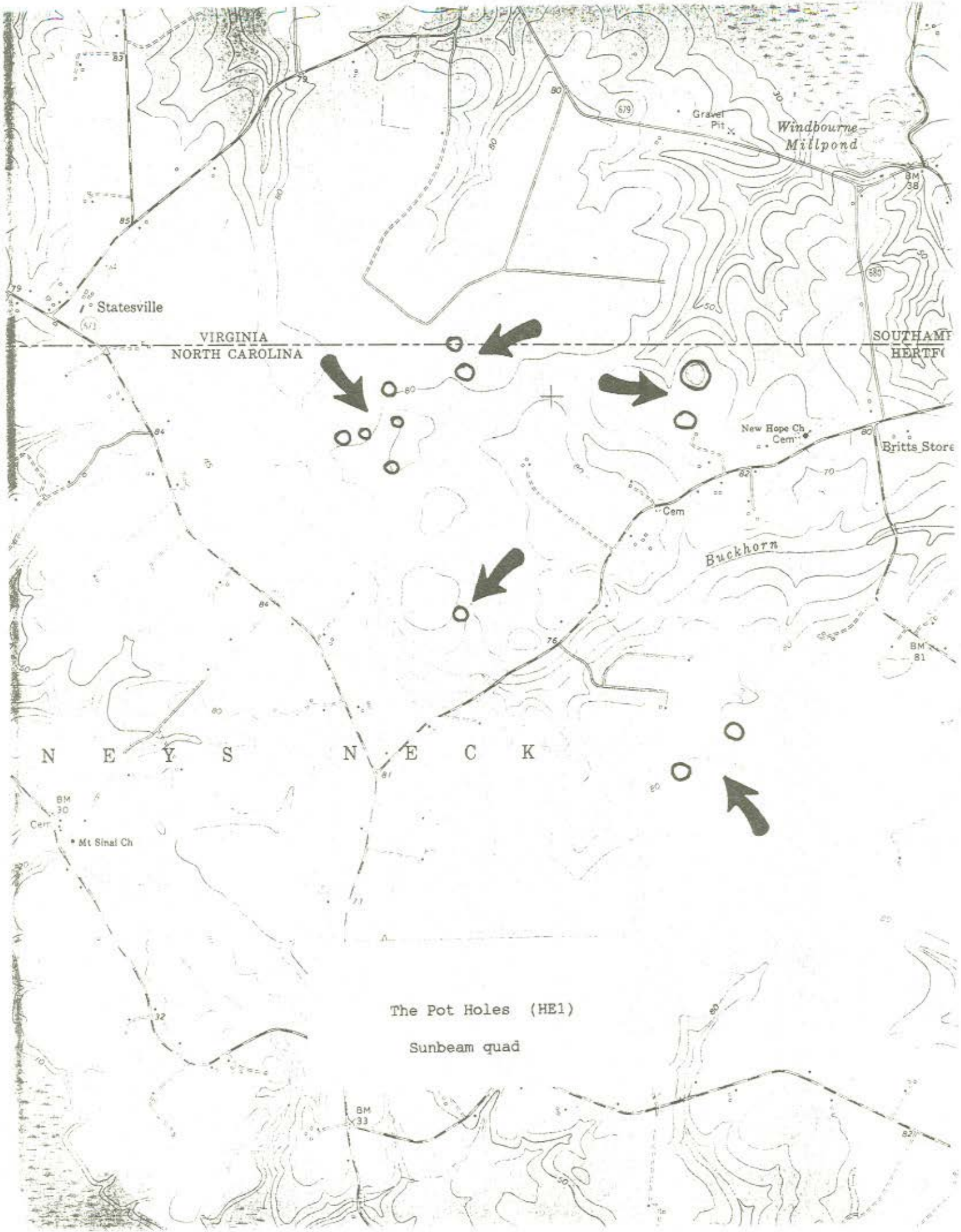
PROTECTION STATUS: None

RECOMMENDATIONS FOR MANAGEMENT OR PROTECTION: Much of the surrounding forests in the vicinity of the sinkholes have been converted to pine plantations, causing a loss of the sinkholes by altering the hydrology in the vicinity of them. Any further timber harvest near the sinks would be detrimental. Draining of the sinks is also a great threat, especially if water stands in the sinks for much of the year. The sites seem too small for

any active acquisition campaign; thus, a registry or easement agreement with owners is probably the best protection objective.

COMMENTS: Several of the sinkholes or depressions were not visited because of time constraints. They may or may not still be present in a natural condition. A fairly large depression of a few acres in size is shown on the topographic map (Sunbeam quad) about 1/2-mile northwest of New Hope Church. Other depressions not visited lie due east of the intersection of SR 1310 and SR 1315.

REFERENCES: Schneider (1989e)



The Pot Holes (HE1)

Sunbeam quad

SITE NAME: Meherrin River Swamp

SITE NUMBER: HE2 SIZE: about 505 acres

SITE SIGNIFICANCE: C (Regional)

LOCATION: Northern portion of Hertford County; located in the Meherrin River floodplain (east of the river) about 2 miles north of Murfreesboro.

QUAD MAP: Murfreesboro

SIGNIFICANT FEATURES:

1. The natural area contains excellent examples of forests on levees and floodplain islands adjacent to the channel of the Meherrin River.
2. The site contains an extensive backswamp feature that is nearly one mile wide; a mature swamp forest is present at the backswamp.

GENERAL DESCRIPTION:

The Meherrin River is somewhat intermediate in character between a brownwater stream and a blackwater stream. Technically, it is the former, as it extends onto the lower Piedmont of Virginia. However, its mineral sediment load is much less than that of the Roanoke River, and the waters of the Meherrin River are likely more similar to blackwater streams than to the Roanoke, a classic brownwater stream. The Meherrin shows some development of riverine features such as natural levees and backswamps, and these features are present in this natural area.

The levees and adjacent floodplain islands are vegetated in mature hardwood forests of the Coastal Plain Levee Forest, Brownwater subtype. This natural community is apparently rare in the A/P Study area except along the Roanoke River, where it is widespread. A number of large trees are present on the levees, including a swamp chestnut oak (Quercus michauxii) measured at 51 inches trunk diameter, an overcup oak (Q. lyrata) at 48 inches, and a water hickory (Carya aquatica) at 35.5 inches (Schneider and Frost 1989b). Water hickory and green ash (Fraxinus pennsylvanica), along with oaks such as swamp chestnut and overcup, are the dominants. American hornbeam (Carpinus caroliniana) is the most numerous understory tree. Common winterberry (Ilex verticillata) and deciduous holly (I. decidua) are numerous in the shrub layer.

The extensive backswamp, over 480 acres in size, features a mature stand of Cypress-Gum Swamp, Brownwater subtype. Water tupelo (Nyssa aquatica) and bald cypress (Taxodium distichum) are the dominant species. Water ash (Fraxinus caroliniana) is the main species of the understory layer. Whereas the shrub layer is sparse, the herb layer in the swamp is moderately diverse, with lizard's-tail (Saururus cernuus) the most common species.

OWNERSHIP: Private; several owners

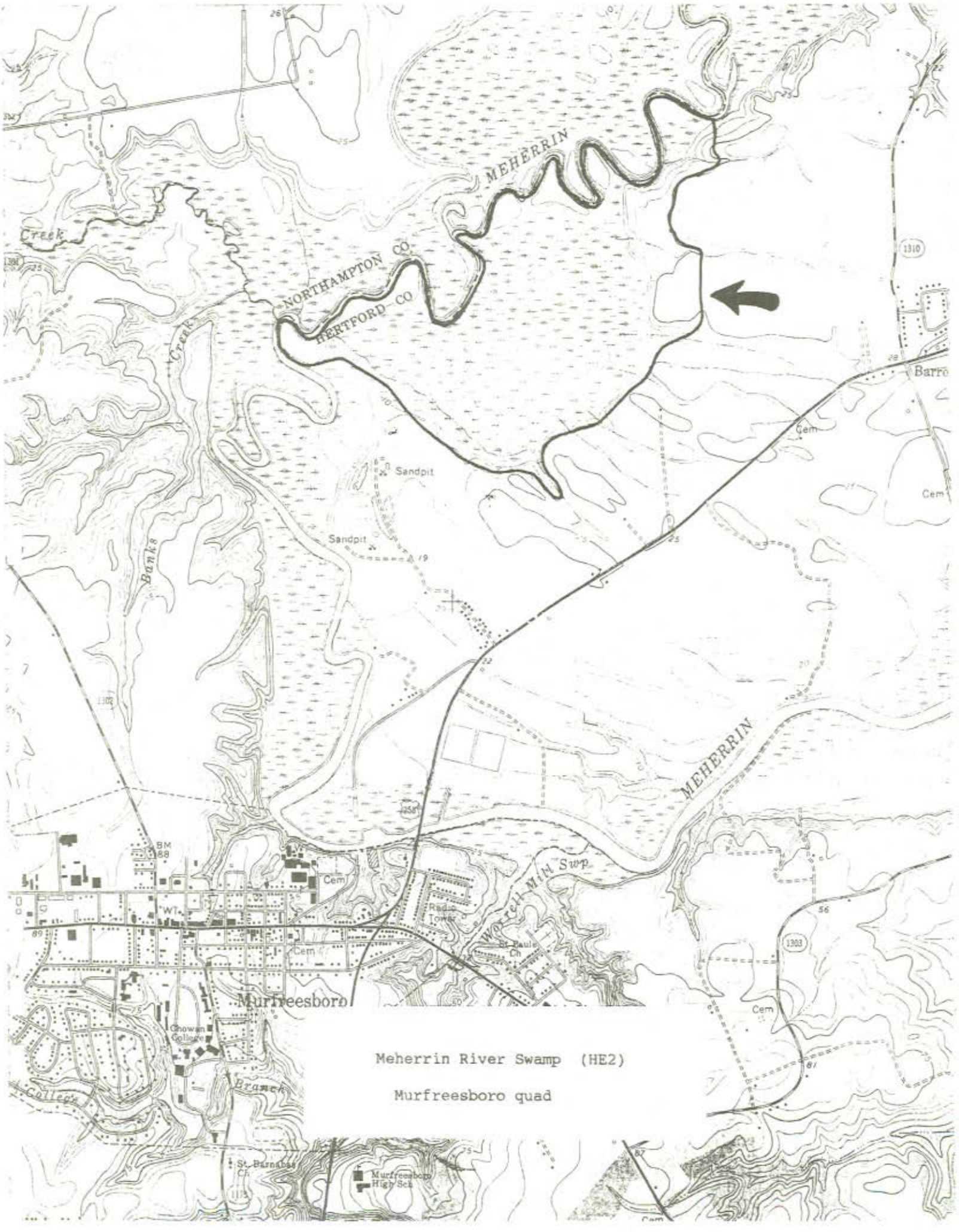
PROTECTION STATUS: None

RECOMMENDATIONS FOR MANAGEMENT OR PROTECTION: As with nearly all mature forests, there is the need to protect a natural area from any further

timbering. Runoff from adjacent agricultural lands on the terrace above the floodplain is another concern. Runoff can be slowed by leaving a buffer strip of uncultivated land between the fields and the forests on the slopes, as well as by not cutting timber off the slopes adjacent to the floodplain. This site might be best protected as a part of a larger preserve that includes the adjacent swamp forest and slopes to the west and north. The area immediately to the southwest is the Meherrin River/Banks Creek Natural Area (Site HE3). Perhaps protection at the local level, such as by Hertford County or by Chowan College for use as a nature preserve or research study area, would be feasible, since these sites are considered to be of Regional rather than of State or National significance.

COMMENTS: Additional survey work farther upstream on the Meherrin River is needed. The wildlife values of the site are very poorly known.

REFERENCES: Schneider and Frost (1989b)



Meherrin River Swamp (HE2)

Murfreesboro quad

SITE NAME: Meherrin River/Banks Creek Natural Area

SITE NUMBER: HE3 SIZE: about 570 acres

SITE SIGNIFICANCE: C (Regional)

LOCATION: Northwestern portion of Hertford County; located on the west side of the Meherrin River, from the northern edge of Murfreesboro north to near the junction of Kirby Creek and the Meherrin River, extending westward to include portions of Banks Creek.

QUAD MAP: Murfreesboro

SIGNIFICANT FEATURES:

1. The site has a number of steep slopes with mature hardwood forests. The floodplain of the Meherrin River contains a mature cypress swamp.
2. A rather rare fern -- glade fern (Athyrium pycnocarpon) -- grows along Banks Creek. This is the first state Coastal Plain record and one of just 2 or 3 sites for the species away from the mountains.
3. There are at least 2 outcroppings of Yorktown fossil deposits where the river has eroded against the banks of somewhat resistant material.

GENERAL DESCRIPTION:

The steep east-facing slopes along the Meherrin River are vegetated in a mature hardwood forest. American beech (Fagus grandifolia) is a common and characteristic tree of the slopes. Some of the slopes at the southern end of the natural area have considerable southern magnolia (Magnolia grandifolia) growing in the subcanopy, presenting a most unusual site perhaps reminiscent of the beech-magnolia natural community of the ravines of northern Florida and southern Georgia. It is likely that the magnolia here is an escaped population; though native as far north as North Carolina, the species is essentially limited as a native to the southeastern corner of the state's Coastal Plain in maritime forests or floodplain forests.

The steepest slopes and bluffs have a dense shrub layer of mountain laurel (Kalmia latifolia). Near the bases of these bluffs, especially at Murfreesboro, are places where the river has abraded the parent material and fossils of the Yorktown formation of late Miocene or Pliocene are visible (Carter et al. 1988).

A few noteworthy herb species occur on the bluffs and slopes. Columbine (Aquilegia canadensis) occurs on the bluff near the northern end of the natural area; this species favors circumneutral soils, and it occurs at the site because of the presence of the limestone in the shell material on the outcrops. Also growing on the shell deposits is scouring rush (Equisetum hyemale). Pennywort (Obolaria virginica) occurs on the mesic slopes; this is a considerable extension of the range, based on the distribution in Radford et al. (1968).

The steep slopes along Banks Creek are very scenic, featuring mature beech trees. In seeps along the steeper slopes, and along Banks Creek itself, are areas where ferns are especially common. These seeps are a rather uncommon natural community in the Coastal Plain -- the Low Elevation Seep. Several of the seepages contain the rare glade fern (Athyrium pycnocarpon), its only

known site in the state in the Coastal Plain and apparently present at just one to several other sites (in the Piedmont) outside of the mountains.

The floodplain of the Meherrin River is essentially a mature stand of bald cypress (Taxodium distichum). Plant diversity in the stand is apparently very low.

The natural area is used by a number of animal species, especially warblers. Louisiana waterthrushes (Seiurus motacilla) occur along the river and streams and undoubtedly nest in the natural area.

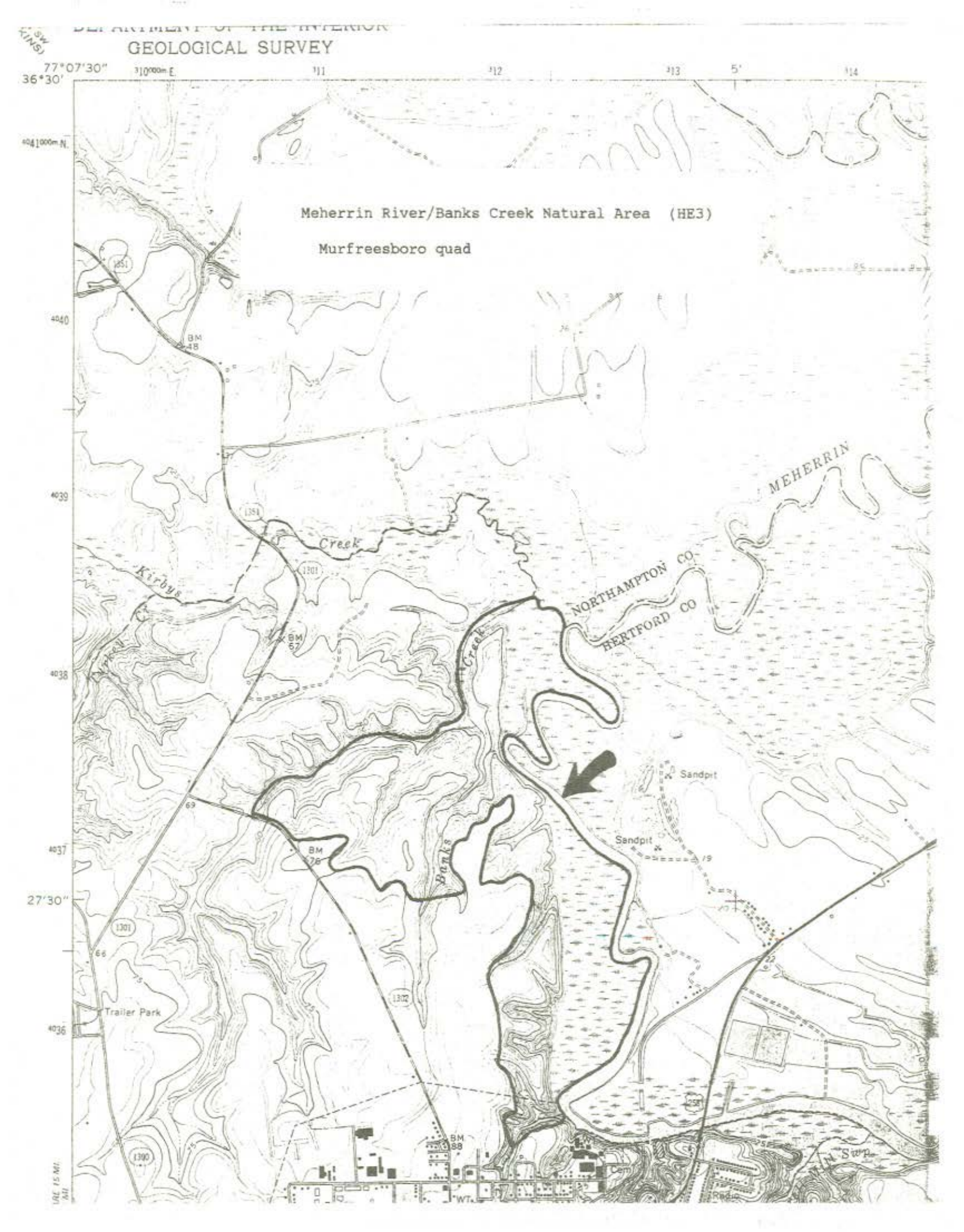
OWNERSHIP: Private, multiple ownership

PROTECTION STATUS: None

RECOMMENDATIONS FOR MANAGEMENT OR PROTECTION: The natural area should remain in its present state. Even though the magnolias are probably not native, there is probably little need to remove them from the site, as they do not appear to be displacing native tree species. Fossil collecting at the Yorktown outcrops on the bluffs has been a popular activity, and the site has been included in Fossil Collecting in North Carolina (Carter et al. 1988). The site would best be protected as a registry agreement with the owner(s) to voluntarily preserve the land.

COMMENTS: The slopes were under threat of being bisected by the proposed Murfreesboro (US 258) bypass. The original Environmental Assessment for the proposed bypass showed a northerly route around Murfreesboro that would have bisected the slopes. A number of State and Federal agencies criticized the route selection because of considerable environmental damage that would be done to the slopes and to wetlands along the river. A revised Assessment has now proposed that the bypass be constructed south of town to connect US 158-258 west of town with US 158 east of town. If approved, such a bypass would avoid damage to the slopes and bluffs. Nonetheless, such an action does not "protect" the natural area from logging or development. More survey work on the plants and animals of the slopes is needed, especially slopes farther northward along Banks Creek and Kirby Creek, and farther eastward along the Meherrin (east of the mouth of Worrell Mill Swamp).

REFERENCES: LeGrand et al. (1985), Carter et al. (1988), Schneider (1989a)


GEOLOGICAL SURVEY
77°07'30"
36°30'
Meherrin River/Banks Creek Natural Area (HE3)
Murfreesboro quad
MEHERRIN
NORTHAMPTON CO.
HERTFORD CO
Kirbys Creek
Banks Creek
Sandpit
Sandpit
Trailer Park
BM 48
BM 67
BM 78
BM 88
27'30"

SITE NAME: Union Camp -- Chowan River Natural Areas

SITE NUMBER: HE4 SIZE: 193 acres

SITE SIGNIFICANCE: B (State)

LOCATION: Northeastern portion of Hertford County; three separate sites within 2.5 miles of each other; 1) Chowan River Natural Area (74 acres) -- along the western edge of the Chowan River floodplain, about 1.5 mile north of where SR 1306 meets the Meherrin River at Parkers Ferry; 2) Big Pine Woods Natural Area (19 acres) -- about 2 miles east-southeast of the intersection of SR 1306 and SR 1308; 3) Chowan Swamp Heronry (100 acres) -- along the western edge of the Chowan River floodplain, 0.75 mile northwest of Dowry Island.

QUAD MAP: Winton

SIGNIFICANT FEATURES:

1. The Chowan River Natural Area contains an outstanding example of old-growth swamp forest, as recognized by the Society of American Foresters.
2. The Big Pine Woods Natural Area contains an exceptionally old-growth pine forest featuring the former national champion loblolly pine (Pinus taeda). Red-cockaded woodpeckers (Picoides borealis), a Federally Endangered species, also nest here.
3. The Chowan Swamp Heronry is the only known heronry (of great blue herons [Ardea herodias] and great egrets [Casmerodius albus]) along the Chowan River and is the second largest inland heronry in the state (Soots and Parnell 1979).

GENERAL DESCRIPTION:

Union Camp Corporation owns extensive acreages of land in and near the Chowan River floodplain in northeastern Hertford County. Several portions of this land holding contain mature, old-growth forests.

1) Chowan River Natural Area -- This is an old-growth swamp forest with bald cypress (Taxodium distichum) and water tupelo (Nyssa aquatica) in the canopy. The average diameter of the canopy trees is 2.5 to 3 feet. Within the natural area are 3 distinct plant community types: bald cypress, cypress-tupelo, and tupelo. Various species of blueberries (Vaccinium spp.) are common in the shrub layer. This tract has been designated as a Society of American Foresters Natural Area.

2) Big Pine Woods Natural Area -- This is an upland site, though a small stream flows through the area. It is located just west of the Chowan River floodplain. The site contains one of the best examples of old-growth loblolly pine (Pinus taeda) - hardwood forests remaining in the state. The dominant vegetation is loblolly pine, many trees being 125 to 150 feet tall and 21 to 26 inches in diameter (North Carolina Natural Heritage Program 1979a). Scattered in the canopy are large mockernut hickories (Carya tomentosa) and tuliptrees (Liriodendron tulipifera). The site contains the former champion loblolly pine, as of 1979; the tree has a 54.5-inch diameter, is 162 feet high has a 73-foot crown, and is estimated to be 230 years old (in 1979). However,

a recent listing of national trees (July 1986 issue of American Forests) gives champion tree status to trees in Virginia and Arkansas.

The natural area contained an active colony of the Federally Endangered red-cockaded woodpecker (Picoides borealis) in the late 1970's. Because the woodpecker is rapidly abandoning sites in the northern Coastal Plain of the state, it is uncertain if the species is still present on the site.

3) Chowan Swamp Heronry -- A fairly large heronry occurs at this site, which is a mature stand of bald cypress and water tupelo. In the late 1970's, the last apparent census of the site, there were approximately 75 nests each of great blue heron (Ardea herodias) and great egret (Casmerodius albus). At the time of the survey, this was the second largest inland heronry in the state and the only heronry along the Chowan River. There have apparently been no surveys of inland heronries in the 1980's (as a plane is required for such a survey); thus, the current status and size of the colony is not known.

This site, as well as the Chowan Swamp Natural Area, still supports a remnant population of black bears (Ursus americanus). Bears are rapidly losing habitat over much of their range in the Coastal Plain.

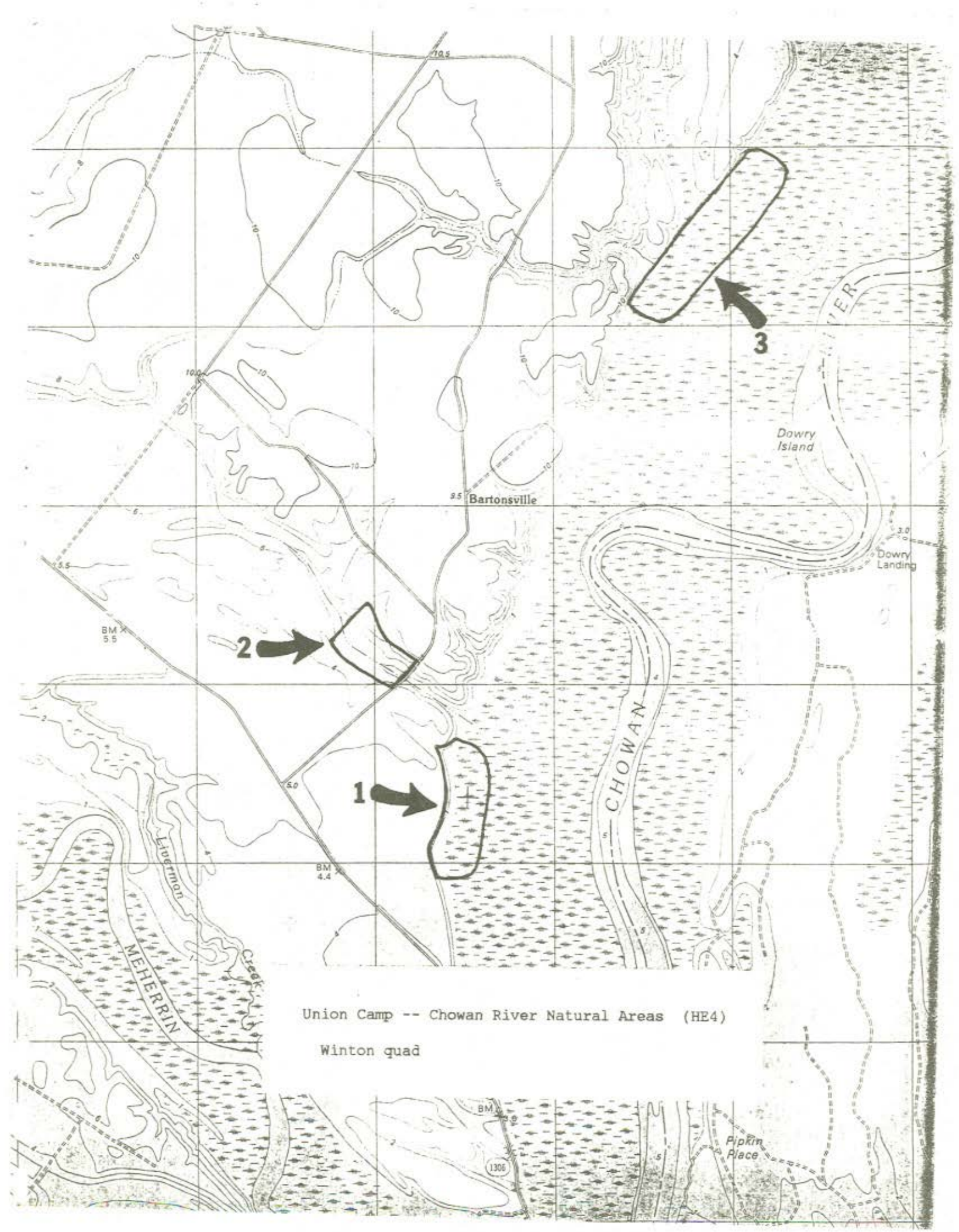
OWNERSHIP: Union Camp Corporation

PROTECTION STATUS: The three natural areas are protected under the management policies of Union Camp. All 3 sites are Registered Natural Heritage Areas.

RECOMMENDATIONS FOR MANAGEMENT OR PROTECTION: Further protection, in terms of long-term, binding means, is probably unlikely. It is hoped that changing timber market conditions do not reach a stage whereby cutting of trees within the natural areas is deemed necessary by Union Camp. No management of the natural areas is needed, as they are in mature stages, though the Big Pine Woods Natural Area will eventually succeed to a hardwood forest as the pines die. However, the red-cockaded woodpeckers, if they are still present, will soon leave the site unless hardwoods are removed from the vicinity of cavity trees.

COMMENTS: Recent data on the natural areas are sketchy, and even details about plant species are inadequate. Most importantly, follow-up information on the status of the heronry and the red-cockaded woodpecker is needed.

REFERENCES: North Carolina Natural Heritage Program (1979a), Soots and Parnell (1979)



Union Camp -- Chowan River Natural Areas (HE4)

Winton quad

SITE NAME: Chowan River White Cedar Swamp

SITE NUMBER: HE5 SIZE: about 65 acres

SITE SIGNIFICANCE: C (Regional)

LOCATION: Northeastern portion of Hertford County; located in the Chowan River floodplain just east of SR 1306, about 3/4 mile north of the mouth of the Meherrin River.

QUAD MAP: Winton

SIGNIFICANT FEATURES:

1. This is a moderately large stand of Atlantic white cedar (Chamaecyparis thyoides). Though not a rare tree, stands of the species of more than several acres are rare in most of the A/P Study area.

GENERAL DESCRIPTION:

The Chowan River floodplain contains primarily a cypress-gum (tupelo) swamp in the vicinity of the confluence with the Meherrin River in northern Hertford County. However, there is a medium-aged stand, estimated at 65 acres, of Atlantic white cedar (Chamaecyparis thyoides) just north of the confluence. This Atlantic White Cedar Forest natural community is rather rare north of Albemarle Sound. White cedar is not an uncommon tree in the A/P Study area, but it generally occurs today as scattered individuals in various types of swamp forest communities. The species is not a tree of the climax forest, and without fire for long periods of time the white cedar forest eventually becomes a bay forest or a swamp forest featuring various hardwoods. However, such a scenario is not completely natural, since the normal fire regime (prior to the 20th Century) would have maintained many swamps and bays in stands of white cedar.

This natural area has considerable signs of selective cutting, and the forest is only of medium age. The canopy is fairly open and dominated by white cedar. The average trunk diameter is 10 to 12 inches, with the maximum diameter being 17 inches (Schneider 1989o). Also present in the canopy are loblolly pine (Pinus taeda), bald cypress (Taxodium distichum), swamp tupelo (Nyssa biflora), and red maple (Acer rubrum). Red maple also dominates the understory layer, which is rather dense. The shrub layer is dominated by sweet pepperbush (Clethra alnifolia) and Virginia willow (Itea virginica). Ferns such as cinnamon fern (Osmunda cinnamomea), royal fern (O. regalis), and netted chainfern (Woodwardia areolata) are numerous in the ground layer.

OWNERSHIP: Private; single ownership (timber company)

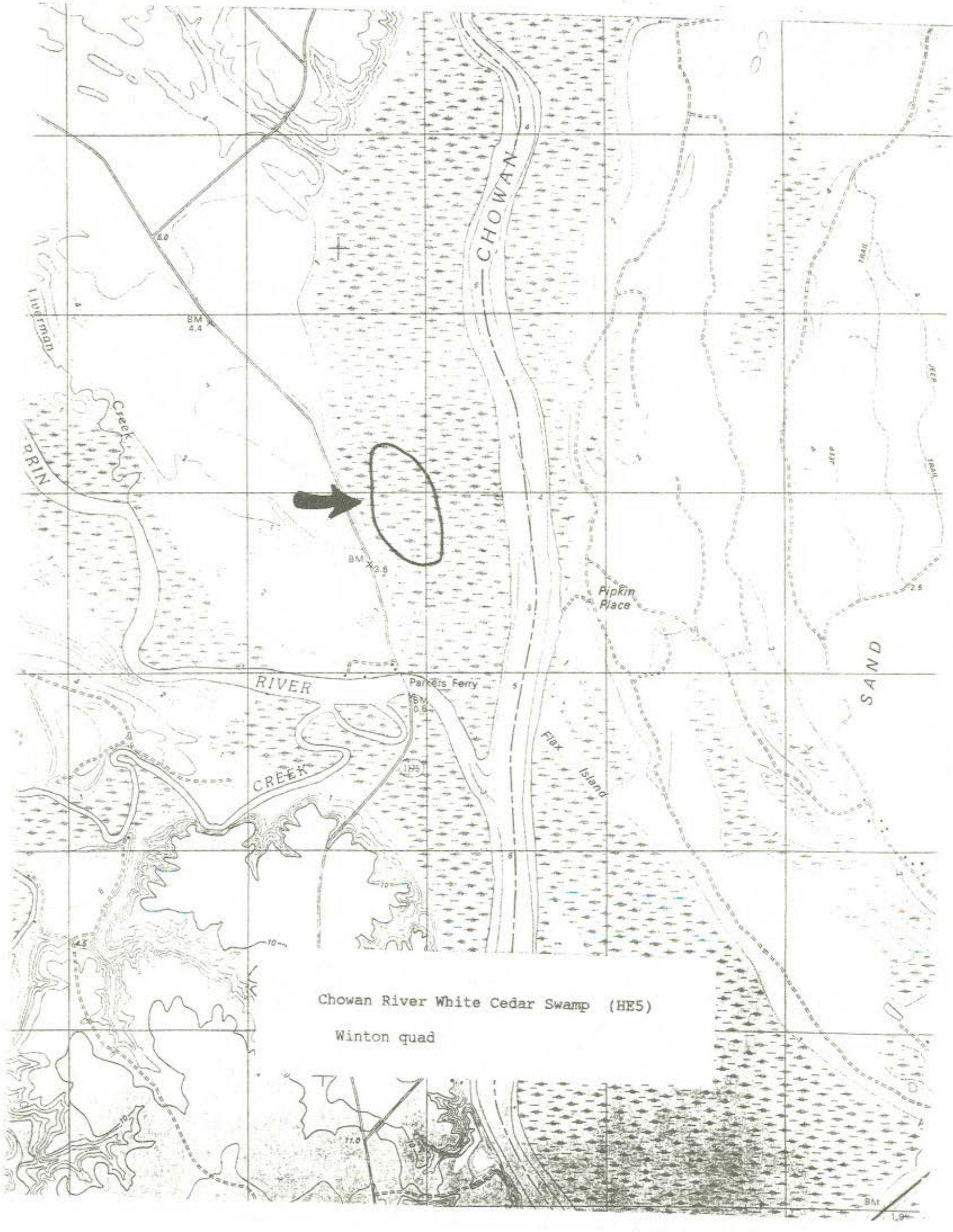
PROTECTION STATUS: None

RECOMMENDATIONS FOR MANAGEMENT OR PROTECTION: Logging should be prevented in order to maintain the integrity of the stand. This site is only several miles south of other tracts (Site HE4) that have been registered by Union Camp Corporation with the N.C. Natural Heritage Program; Union Camp also owns the

white cedar stand. This stand, by itself, should not be a target for acquisition by a conservation agency. but the stand could be combined with a larger tract in the Chowan River floodplain to include Site HE4 as an acquisition project or as a conservation easement granted to a private conservation group. However, most of the swamp surrounding this natural area is badly cut-over.

COMMENTS: There is a need to locate additional stands of Atlantic white cedar in the A/P Study area. This is best done by aerial means, as such stands are often embedded in extensive swamps and surface access is difficult. No survey by aircraft was made during this 1989 phase of the A/P Study. This natural area is rather heavily disturbed, and its quality is only fair. However, white cedar stands of this size are rather rare at present.

REFERENCES: Schneider (1989o)



Chowan River White Cedar Swamp (HE5)

Winton quad

SITE NAME: Chowan River Bluffs west of Winton

SITE NUMBER: HE6 SIZE: about 350 acres

SITE SIGNIFICANCE: C (Regional)

LOCATION: Eastern edge of Hertford County, located just northwest of Winton and US 13-158, on the southwest bank of the Chowan River.

QUAD MAP: Winton

SIGNIFICANT FEATURES:

1. The natural area contains 3 rather distinct geomorphic features: upland flats, ravine slopes and bluffs, and small stream swamps. The entire site is forested in hardwoods, representing several natural communities.

GENERAL DESCRIPTION:

The Chowan River contains a number of bluffs and steep slopes along its banks in North Carolina, especially on its western and southern banks. Just northwest of Winton is a series of ravines and bluffs both along the river and along small tributary streams flowing northeast to the river. Above the ravines the terrain is a very flat terrace.

The upland terrace contains a medium-aged Mesic Mixed Hardwood Forest, Upland Flats subtype natural community, with some elements of Dry-Mesic Oak-Hickory Forest also present. White oak (Quercus alba) is the dominant canopy tree, with red maple (Acer rubrum) and sweetgum (Liquidambar styraciflua) also important in the subcanopy. The shrub layer is rather diverse, featuring many ericaceous species, especially various blueberries (Vaccinium spp.).

The ravines and bluffs, being more protected from logging by the steeper terrain, have been little disturbed and are in good condition. This habitat contains mainly a Mesic Mixed Hardwood Forest, Bluff/Slope subtype natural community, but elements of Piedmont/Coastal Plain Heath Bluff are notable. The canopy is again dominated by white oak, and the fairly well developed understory is dominated by sourwood (Oxydendrum arboreum). The steeper slopes feature a Heath Bluff community, with mountain laurel (Kalmia latifolia) and galax (Galax aphylla) being present and typical indicator species of this community. Galax is rather uncommon in the Coastal Plain.

The small tributaries that flow through the natural area contain Coastal Plain Small Stream Swamp communities. As with most swamps in the A/P Study area, bald cypress (Taxodium distichum) and swamp tupelo (Nyssa biflora) are the dominant trees. Water ash (Fraxinus caroliniana) and red maple are the most numerous species in the understory layer.

OWNERSHIP: Private, several owners

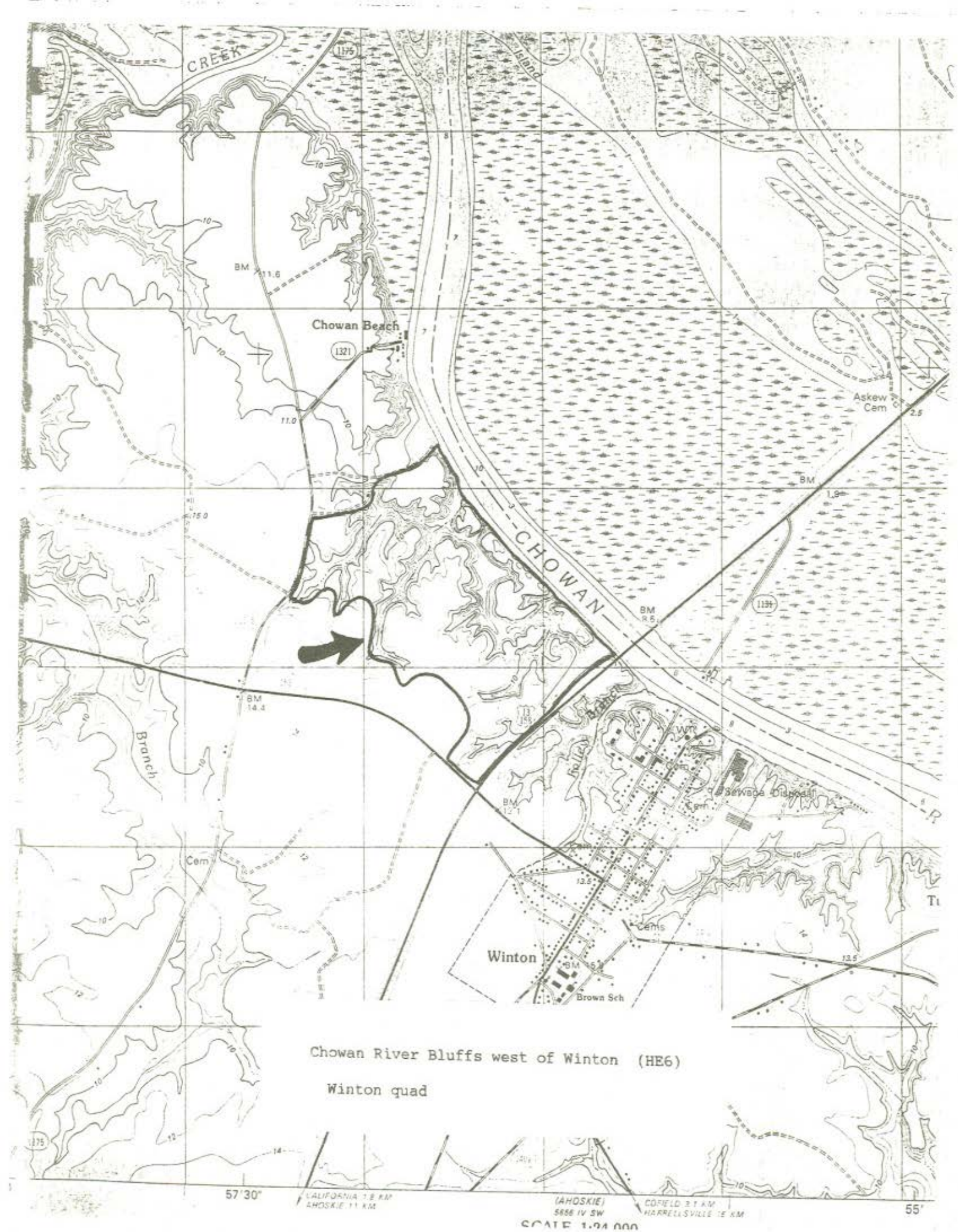
PROTECTION STATUS: None

RECOMMENDATIONS FOR MANAGEMENT OR PROTECTION: Runoff from farmlands on the terrace above the slopes may need to be monitored. The sandy soil of the terraces in the Coastal Plain are easily eroded, a feature shown well on topographic maps. Cutting of timber on the terrace also undoubtedly allows

for greater erosion problems than would be the case if timbering were not done. A conservation easement or registry agreement with the owners might be the best means of assuring protection for the natural area.

COMMENTS: Although the individual features of the natural area are not extremely significant, the mosaic of at least 3 distinct geomorphic features in close conjunction is noteworthy. Good or excellent examples of mature forests on upland flat terraces are rather rare, because they are easily reached by logging equipment or are cleared for agriculture. Though the upland forest at the site is not mature, it does appear to be a representative example of such forests in the lower Coastal Plain.

REFERENCES: Schneider (1989c)



Chowan River Bluffs west of Winton (HE6)

Winton quad

SITE NAME: Upper Wiccacon River Swamp

SITE NUMBER: HE7 SIZE: about 600 acres

SITE SIGNIFICANCE: C (Regional)

LOCATION: Southeastern portion of Hertford County; located in the floodplain of the Wiccacon River for about a mile both upstream and downstream of the SR 1427 crossing of the river (Thomas Bridge), to include Hoggard Swamp.

QUAD MAP: Ahoskie

SIGNIFICANT FEATURES:

1. This natural area contains both a river swamp and several small islands of uplands embedded within the swamp. Both the swamp and the uplands are vegetated in mature forests, with little or no evidence of logging in the past 75 years.

GENERAL DESCRIPTION:

The Wiccacon River is a very short river, with it and its tributaries being nearly confined to Hertford County. The lower several miles of the river show extensive meanders, remnant oxbows, and bluffs (see Site HE8). A few miles farther upstream, near Cofield, the meanders are smaller and bluffs or steep slopes are not common. There is a fairly wide floodplain, 1/2-mile or more in width, in the vicinity of SR 1427.

The floodplain is vegetated in a mature swamp forest (Small Coastal Plain Stream Swamp, Blackwater subtype natural community). Bald cypress (Taxodium distichum) and water tupelo (Nyssa aquatica) are the dominant canopy trees. Water ash (Fraxinus caroliniana) is the most numerous subcanopy tree, especially along the river banks. The best shrub development also occurs along the river banks; dominants are common winterberry (Ilex verticillata) and several viburnums (Viburnum spp.).

Of perhaps more interest than the swamp forest are several scattered islands of higher ground embedded in the swamp. These uplands, which are visible on the Ahoskie topographic map to the southeast of Thomas Bridge, have a collection of mesic species of trees and shrubs; the natural community is a Mesic Mixed Hardwood Forest, Swamp Island subtype. Dominants in the canopy are loblolly pine (Pinus taeda), southern red oak (Quercus falcata), and American beech (Fagus grandifolia). Sourwood (Oxydendrum arboreum) and red maple (Acer rubrum) are the most numerous of the subcanopy species. The shrub and herb layers are rather sparse.

The natural area probably has a high wildlife value. Great blue heron (Ardea herodias) and yellow-crowned night-heron (Nyctanassa violacea) have been seen in the summer months; the former is known to nest in a few scattered inland colonies, such as farther north along the Chowan River, but the latter is an uncommon breeder, with a relatively poorly known distribution in the state. The swamp is expected to contain a wide variety of reptiles and amphibians.

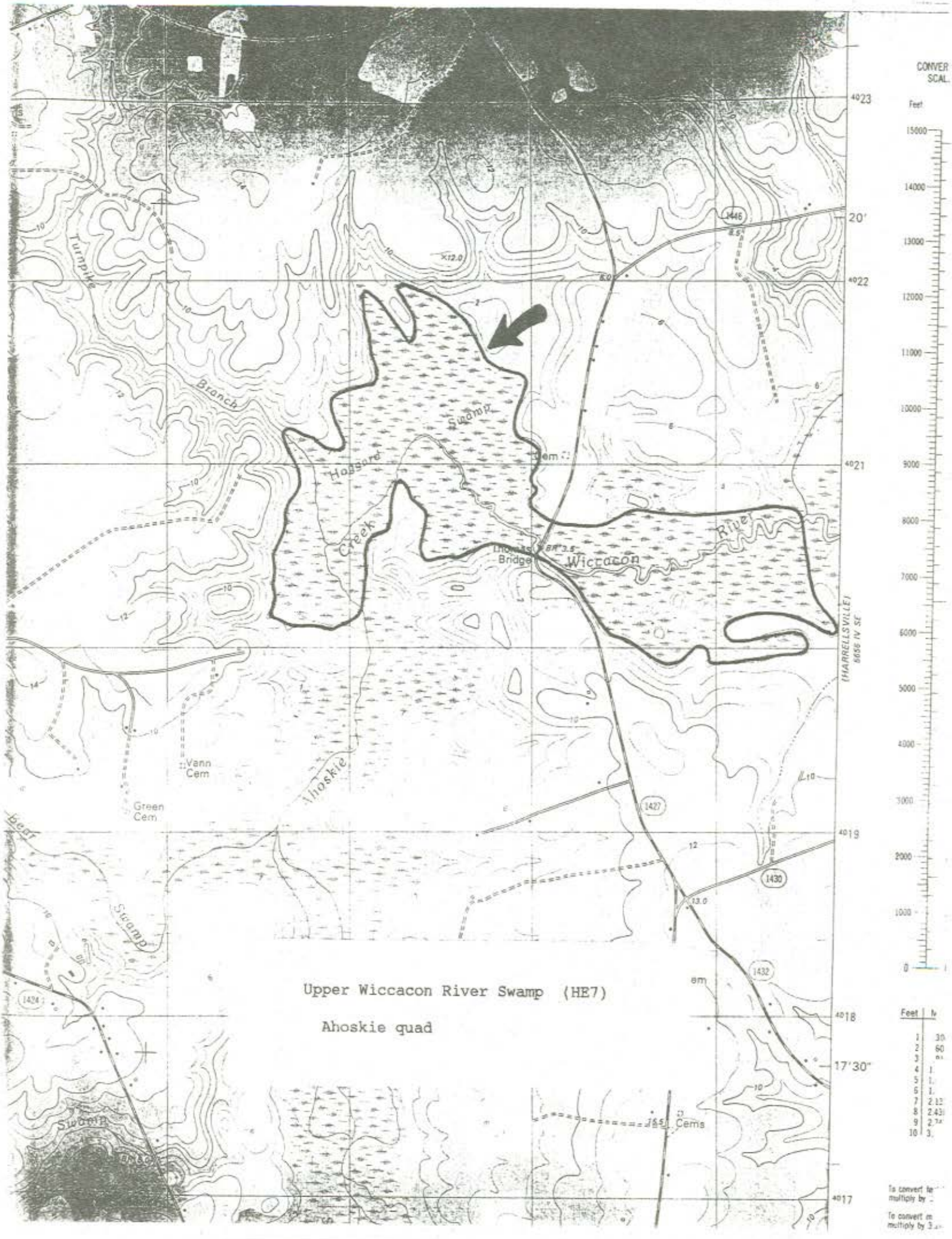
OWNERSHIP: Multiple private ownership; portion owned by Chowan College

PROTECTION STATUS: None known

RECOMMENDATIONS FOR MANAGEMENT OR PROTECTION: Timber removal would be detrimental. Because of the wetness of the area, logging would be difficult, but as several timber companies own a portion of the site, this threat must be taken as a major factor. Because the site is wet and timber harvest would be difficult, acquisition is a possible goal, possibly by the N.C. Wildlife Resources Commission for its Game Land designation.

COMMENTS: Detailed inventory is difficult because access to the site is mainly by boat. Surveys for breeding birds and other animals are needed. The extent of the forest downstream, as well as farther upstream along Ahoskie Creek, also needs further study. However, most of this creek is channelized, and thus the forests might also show disturbance.

REFERENCES: Schneider (1989d)


Upper Wiccacon River Swamp (HE7)
Ahoskie quad
Turnpike
Branch
Swamp
Hogsard
Creek
Wiccacon
River
Ahoskie
Vann Cem
Green Cem
Cems
1446
1427
1430
1432
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(HARRELLSVILLE)
5656 IV SE
4023
20'
4022
4021
4019
4018
17'30"
4017

SITE NAME: Wiccacon River Ridges and Swales

SITE NUMBER: HE8 SIZE: about 410 acres

SITE SIGNIFICANCE: C (Regional)

LOCATION: Southeastern portion of Hertford County, lying immediately south of the NC 45 crossing of Wiccacon River, inside a bend of the river on the northern bank.

QUAD MAP: Harrellsville

SIGNIFICANT FEATURES:

1. The natural area contains a mixed pine-hardwood forest on low ridges and a swamp forest in the swales. The site shows good geomorphic examples of old oxbows that have been cut-off by the Wiccacon River, leaving the swales that are now vegetated in swamp forest.

GENERAL DESCRIPTION:

The lower portion of the Wiccacon River contains many large meanders. Within the floodplain of the river are many remnant meanders or oxbows that have long since been cut off as the river straightened its course. These old oxbows no longer contain oxbow lakes, but have become vegetated in swamp forests. This natural area contains a medium-aged forest composed of bald cypress (Taxodium distichum) and swamp tupelo (Nyssa biflora) in the canopy; these trees have an average trunk diameter of 19 inches (Schneider 1989b). American hornbeam (Carpinus caroliniana) dominates the understory. The shrub and herb layers are very sparse, as is typical with most cypress-gum forests.

The low ridges lie between the remnant oxbows. Logging within the past several decades has created a young to middle-aged forest composed of loblolly pines (Pinus taeda) in some areas and hardwoods in others. Various oaks, especially southern red oak (Quercus falcata), and American beech (Fagus grandifolia) are common canopy trees. In portions with an open canopy, the subcanopy layer is quite dense, with red maple (Acer rubrum), American holly (Ilex opaca), and sourwood (Oxydendrum arboreum) being the most prevalent trees. The shrub layer is moderately diverse, with a number of evergreen "pocosin" species, as well as the uncommon silky camellia (Stewartia malacodendron).

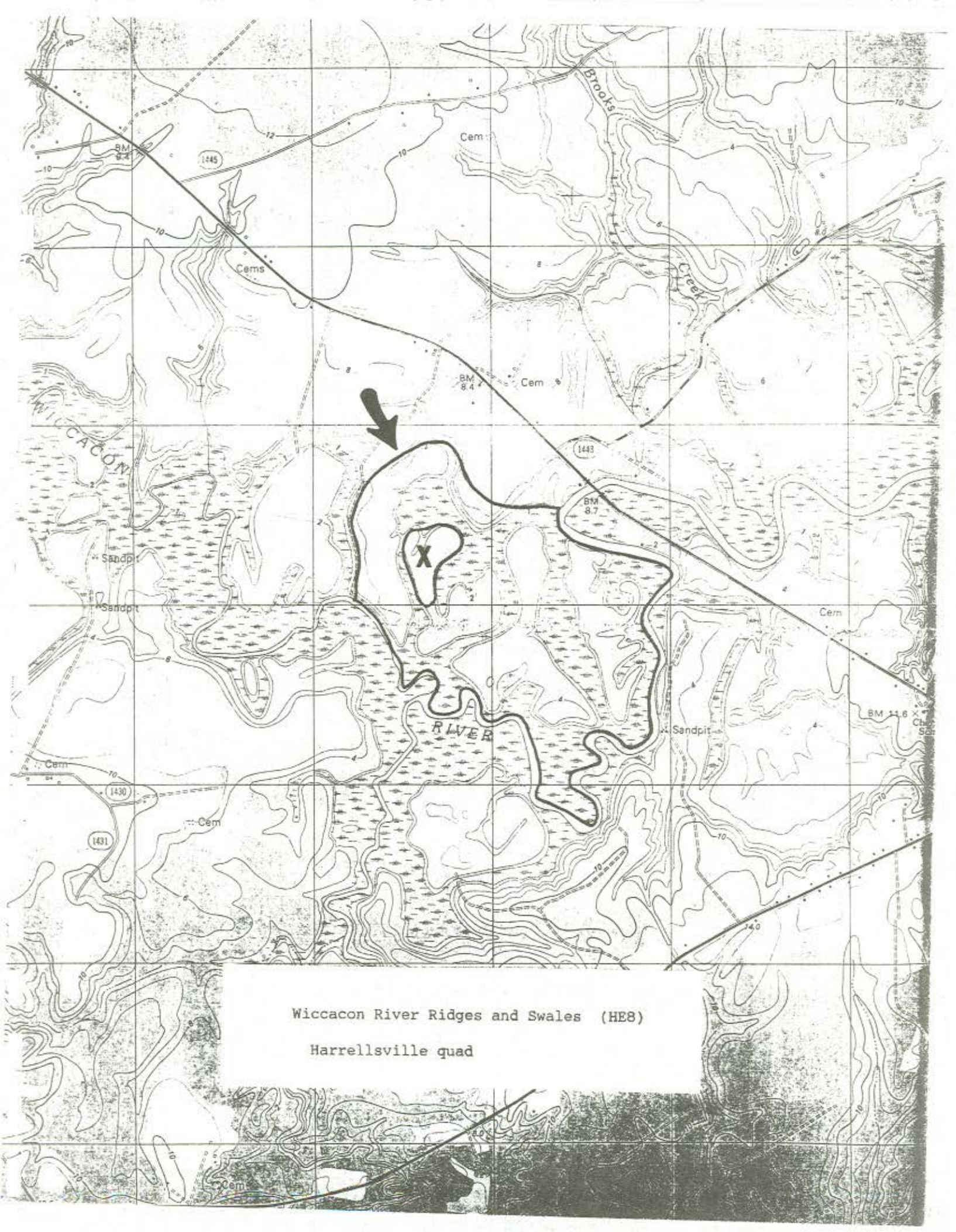
OWNERSHIP: Private

PROTECTION STATUS: None

RECOMMENDATIONS FOR MANAGEMENT OR PROTECTION: The site should be allowed to mature. Acquisition of the natural area is not recommended, at least through a purchase. The most feasible protection would be a registry agreement or a conservation easement with the owner(s).

COMMENTS: Further field work along the Wiccacon River is needed. The river's floodplain shows an extensive series of meanders and remnant oxbows in its last few miles, as well as fairly steep bluffs along the outside of the meander bends.

REFERENCES: Schneider (1989b)



Wiccacon River Ridges and Swales (HE8)

Harrellsville quad

SITE NAME: Wiccacon River Freshwater Marsh

SITE NUMBER: HE9 SIZE: about 38 acres

SITE SIGNIFICANCE: C (Regional)

LOCATION: Southeastern portion of Hertford County; located on a narrow peninsula just north of the confluence of the Wiccacon River with the Chowan River.

QUAD MAP: Harrellsville

SIGNIFICANT FEATURES:

1. The natural area is a good example of a Tidal Freshwater Marsh natural community, which is a rare community in the A/P Study area. It is perhaps the most extensive of the freshwater marshes in the study area.

GENERAL DESCRIPTION:

Along the lower portions of several creeks and rivers that flow into the Chowan River are found freshwater marshes that have a slight tidal influence. These marshes are relatively rare north of Albemarle Sound, as most of the naturally occurring marshes are the slightly brackish (oligohaline) ones in the Currituck County vicinity. The freshwater marshes near the Chowan contain a different set of plant species than do the oligohaline marshes, and they tend to be slowly succeeding to shrub and sapling thickets along portions of the upper fringes.

This marsh lies on a narrow peninsula between the lower portion of the Wiccacon River and the Chowan River. There are no trees on the spit, but a part of the marsh is being invaded by red maple (Acer rubrum), which forms a 6 to 7 foot-tall thicket. The shrubs at the site are sparse to moderate in density, with swamp rose (Rosa palustris) and tag alder (Alnus serrulata) being present among others. The herb layer is dense and diverse, with no true dominants. Dense patches of wildrice (Zizania aquatica) occur along the edges of the rivers. Also occurring is Turk's-cap lily (Lilium superbum or a new variety or species). Arrow arum (Peltandra virginica), broad-leaf arrow-head (Sagittaria latifolia), broad-leaf cattail (Typha latifolia), and several species of asters (Aster novi-belgii, A. elliottii) are among dozens of herb species present.

OWNERSHIP: Private; owned by a timber company

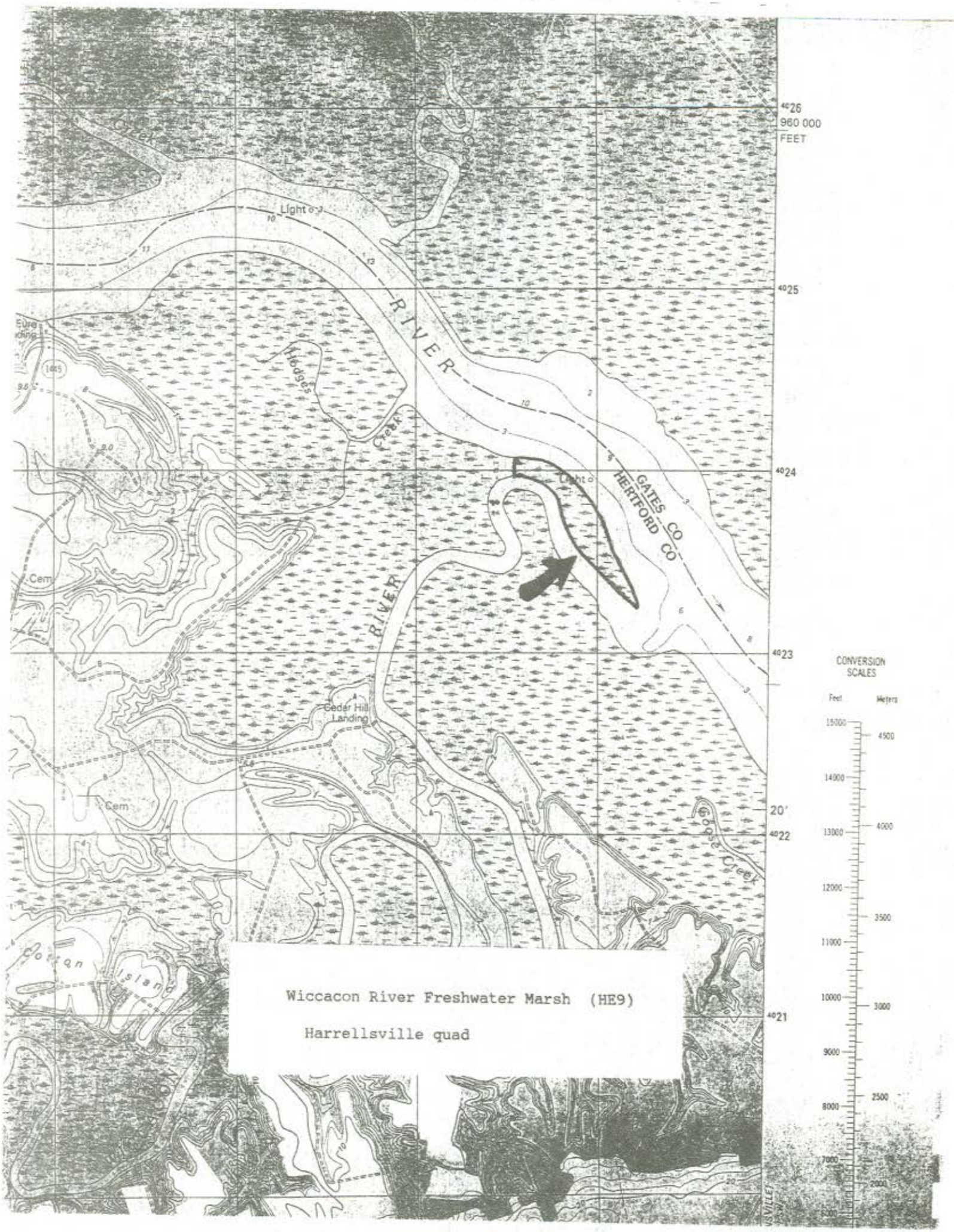
PROTECTION STATUS: None

RECOMMENDATIONS FOR MANAGEMENT OR PROTECTION: The marsh should be burned to control the invasion of shrubs and saplings, in addition to providing additional diversity among the herb species. Otherwise, the site might become a shrub/sapling thicket in several decades. This marsh, as well as nearly all marshes in the A/P Study area, are endangered by sea level rise. Because this is a very small (under 100 acres) site, protection of the natural area, by itself, is not really feasible. Instead, the marsh and the surrounding swamp forests should be protected as a unit, as has been accomplished across the

Chowan River in the Chowan Swamp natural area (Site GA3). Acquisition by the N.C. Wildlife Resources Commission is the best strategy. The N.C. Division of Parks and Recreation maintains the Chowan Swamp State Natural Area on the opposite side of the Chowan River, and thus this agency might also be willing to look into protective measures for this natural area.

COMMENTS: The dynamics of the tidal freshwater marshes near the Chowan River are not well understood. Generally speaking, tidal freshwater marshes along the Atlantic Coast, such as along the shores of Chesapeake Bay, maintain themselves over time and are not succeeded by woody vegetation, apparently because the tidal fluctuation is great enough to prohibit the continued presence of trees and shrubs in the marshes. However, the tidal amplitude in North Carolina is less than in adjacent states, plus the only nearby inlet that can contribute tidal fluctuations is Oregon Inlet, which is over 100 river miles from these marshes! Needless to say, there is hardly any tidal amplitude in the Chowan River, and any tidal action is generated by wind pushing water into the marshes.

REFERENCES: Schneider and Frost (1989c)



Wiccacon River Freshwater Marsh (HE9)

Harrellsville quad

SITE NAME: Chinkapin Creek Hardwood Forest

SITE NUMBER: HE10 SIZE: about 1425 acres

SITE SIGNIFICANCE: B (State)

LOCATION: Southeastern portion of Hertford County, about 4 miles southwest of Harrellsville; located just west of Chinkapin Creek, with NC 561 forming the northern boundary and SR 1432 crossing the natural area. Most of the natural area lies east of SR 1432.

QUAD MAP: Harrellsville

SIGNIFICANT FEATURES:

1. This site is one of the most extensive tracts of upland hardwood forest remaining in the Coastal Plain of North Carolina, and the natural area contains one of the best examples of Dry-Mesic Oak-Hickory Forest natural communities known for this province.
2. The natural area contains other well-developed natural communities, most significant being several xeric ridges with remnants of sandhills vegetation, including the locally rare longleaf pine (Pinus palustris).

GENERAL DESCRIPTION:

Nearly all of the uplands of the North Carolina Coastal Plain are presently in agriculture, pine plantation, commercial development, or seral stages of forest land. Besides wetlands, few acres of mature to climax forest vegetation exist. Such a forest is present just west of Chinkapin Creek south of NC 561. Over 2 square miles of land are forested in hardwoods, with some pines. The majority of the uplands are a Dry-Mesic Oak-Hickory Forest natural community. In general, the canopy is rather "Piedmont-like", but the shrub layer features many Coastal Plain species. White oak (Quercus alba), southern red oak (Q. falcata), black oak (Q. velutina), and loblolly pine (Pinus taeda) are common in the canopy in the uplands, with the pine dominating in the younger portions of the forest. The average trunk diameter of the canopy trees is 10 to 12 inches. American holly (Ilex opaca), sourwood (Oxydendrum arboreum), red maple (Acer rubrum), and black gum (Nyssa sylvatica) are numerous in the understory. Various species of ericaceous shrubs are common, especially blueberries (Vaccinium spp.). The herb layer in the uplands is sparse. Gentle ravine slopes are present along tributary streams that drain into Chinkapin Creek, and American beech (Fagus grandifolia) is a common tree in such habitats (Mesic Mixed Hardwood Forest, Bluff/Slope subtype). Hop hornbeam (Ostrya virginiana) is numerous in the subcanopy.

Several of the narrow ridges between ravines, generally near the southeastern portion of the natural area, feature a most surprising xeric "sandhills" vegetation. One ridge has a mature longleaf pine (Pinus palustris), a very rare tree in Hertford County; timbering and the virtual absence of fire in upland woods have eliminated essentially all of the longleaf pines from this and other counties north of Albemarle Sound. Shortleaf pine (P. echinata) is also found on this ridge, along with the less notable loblolly pine. This and another ridge feature such xeric plants as

wild lupine (Lupinus perennis), tread-softly (Cnidoscolus stimulosus), Carolina ipecac (Euphorbia ipecacuanhae), baby morning star (Bonamia humistrata), and reindeer lichen (Cladonia sp.).

The rather narrow floodplain of Chinkapin Creek, as well as "fingers" along the tributaries, are vegetated in mature swamp forests (Coastal Plain Small Stream Swamp, Blackwater subtype). The well-developed canopy along Chinkapin Creek features bald cypress (Taxodium distichum) and swamp tupelo (Nyssa biflora) as dominants. Several species of oaks, such as laurel oak (Quercus laurifolia) and swamp chestnut oak (Q. michauxii), occur along the "finger" swamps.

The forest is fairly rich in breeding birds, including a variety of woodpeckers and the white-breasted nuthatch (Sitta carolinensis). Species of warblers are also common. Various game species such as white-tailed deer (Odocoileus virginianus) are likely to be present in this extensive forest. Wild turkeys (Meleagris gallopavo) have been re-introduced at this site and are now well established.

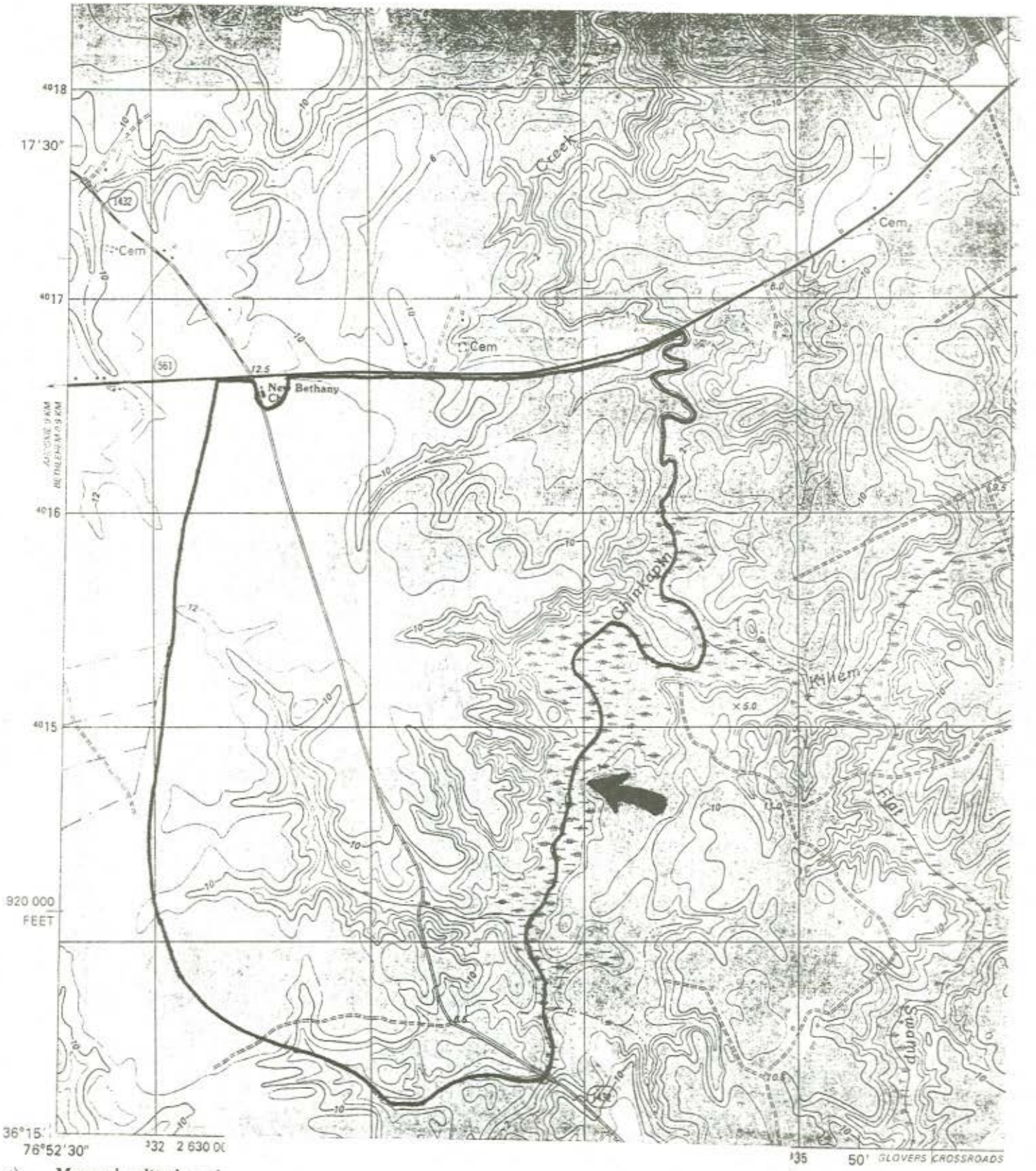
OWNERSHIP: Private (one ownership)

PROTECTION STATUS: No official protection. However, the owners have hired a manager for the tract to insure that the forest remains intact and remains free of vandalism (such as timber removal).

RECOMMENDATIONS FOR MANAGEMENT OR PROTECTION: The tract should be left alone; no timber cutting should be allowed. Hunting is compatible with management and protection. Both the owners (private individuals) and the manager wish to see the tract protected and remain in a wooded state. Obviously, the timber value of the tract is high, and it can be presumed that timber companies would wish to have the opportunity to own or to lease the site for timber harvest. The best protection measures are either a conservation or management easement with a private conservation organization or a registry agreement with the N.C. Natural Heritage Program, as the owners apparently do not wish to sell the property. The owners might also consider leasing the land to the N.C. Wildlife Resources Commission as a Game Land.

COMMENTS: Despite several inventory forays to the site in 1989, much of the forest still remains to be surveyed, particularly the southern and western portions. Parts of the natural area, especially west of SR 1432, might well be under different ownership from the main portion of the natural area (east of the road).

REFERENCES: N.C. Natural Heritage Program database, Schneider and Frost (1989a)



Mapped, edited, and

Control by USGS, NOS/N

(POWELLSVILLE) 3656 III NW

Topography by photogran
taken 1975. Field check

Selected hydrographic da
This information is not intended for navigational purposes

Projection and 10,000-foot grid ticks: North Carolina coordinate system (Lambert conformal conic)
1000-meter Universal Transverse Mercator grid, zone 18
1927 North American Datum
To place on the predicted North American Datum 1983 move the projection lines 12 meters south and 29 meters west as shown by dashed corner ticks

Chinkapin Creek Hardwood Forest (HE10)

Harrellsville quad

1
1000
1
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19 MILS

UTM GRID AND 1982 MAGNETIC NORTH
DECLINATION AT CENTER OF SHEET

I

SITE NAME: Colerain/Cow Island Swamp and Slopes

SITE NUMBER: BE1 SIZE: about 3500 acres

SITE SIGNIFICANCE: C (Regional)

LOCATION: Extreme northeastern corner of Bertie County and southeastern corner of Hertford County; the floodplain of the Chowan River and adjacent slopes extending south nearly to Colerain and north to a group of floodplain islands northeast of Lloyd Crossroads.

QUAD MAPS: Colerain, Valhalla, Mintonsville

SIGNIFICANCE:

1. The natural area contains a very large extent of upland forests on slopes. These slopes are located in ravines and extend for over two miles along the western edge of the Chowan River floodplain.

GENERAL DESCRIPTION:

Most of the land in extreme eastern Bertie County and southeastern Hertford County lies on a terrace that is at least 50 feet higher than the Chowan River. Bluffs are located along portions of the river, whereas other portions are more gently eroded in the form of ravines along tributary streams. The latter is the case north of Colerain; not only are there numerous ravines but there is a floodplain between the base of the ravines and the river itself. Thes slopes along the streams extend for at least 8 miles and cover more than a dozen tributaries. Several of the ravines extend nearly a mile to the west of the floodplain.

Many of the forests on the slopes are mature and are rather park-like, as the understory and shrub layers are not dense. The forests contain both Dry-Mesic Oak-Hickory Forest and Mesic Mixed Hardwood Forest natural communities, with the former being more prevalent in the southern portion of the natural area. On some of the slopes near Colerain, white oak (Quercus alba) dominate the canopy; other canopy species include tuliptree (Liriodendron tulipifera), mockernut hickory (Carya tomentosa), black oak (Q. velutina), and southern red oak (Q. falcata). The understory layer features mesic tree species such as sourwood (Oxydendrum arboreum), flowering dogwood (Cornus florida), and American holly (Ilex opaca). The shrub layer, though rather sparse, features a wide array of species, especially ericaceous ones, with blueberries (Vaccinium spp.) being most common. The uncommon silky camellia (Stewartia malacodendron) is present on these slopes. Farther north in the natural area, slopes sampled to the west of Cow Island contain American beech (Fagus grandifolia) as a canopy dominant, along with various oaks and loblolly pine (Pinus taeda). Because of the extensive length of the natural area, featuring many miles of slopes, there is a wide variation on plant species diversity.

The swamp forest in the floodplain east of the slopes is a Tidal Cypress-Gum Swamp natural community. In the southern portion of the natural area, swamp tupelo (Nyssa biflora) is the dominant species, with red maple (Acer rubrum) also numerous, especially in the understory layer. The shrub layer in the swamp is well developed, featuring Virginia willow (Itea virginica), fetter-bush (Leucothoe racemosa), and highbush blueberry

(Vaccinium corymbosum). Swamp forests farther north, near Cow Island, are dominated by bald cypress (Taxodium distichum), along with both swamp tupelo and water tupelo (N. aquatica). Portions of the understory are dominated by sweetbay (Magnolia virginiana); red maple and water ash (Fraxinus caroliniana) are also common. Sweet pepperbush (Clethra alnifolia), maleberry (Lyonia ligustrina), Virginia willow, and fetter-bush are numerous shrub species.

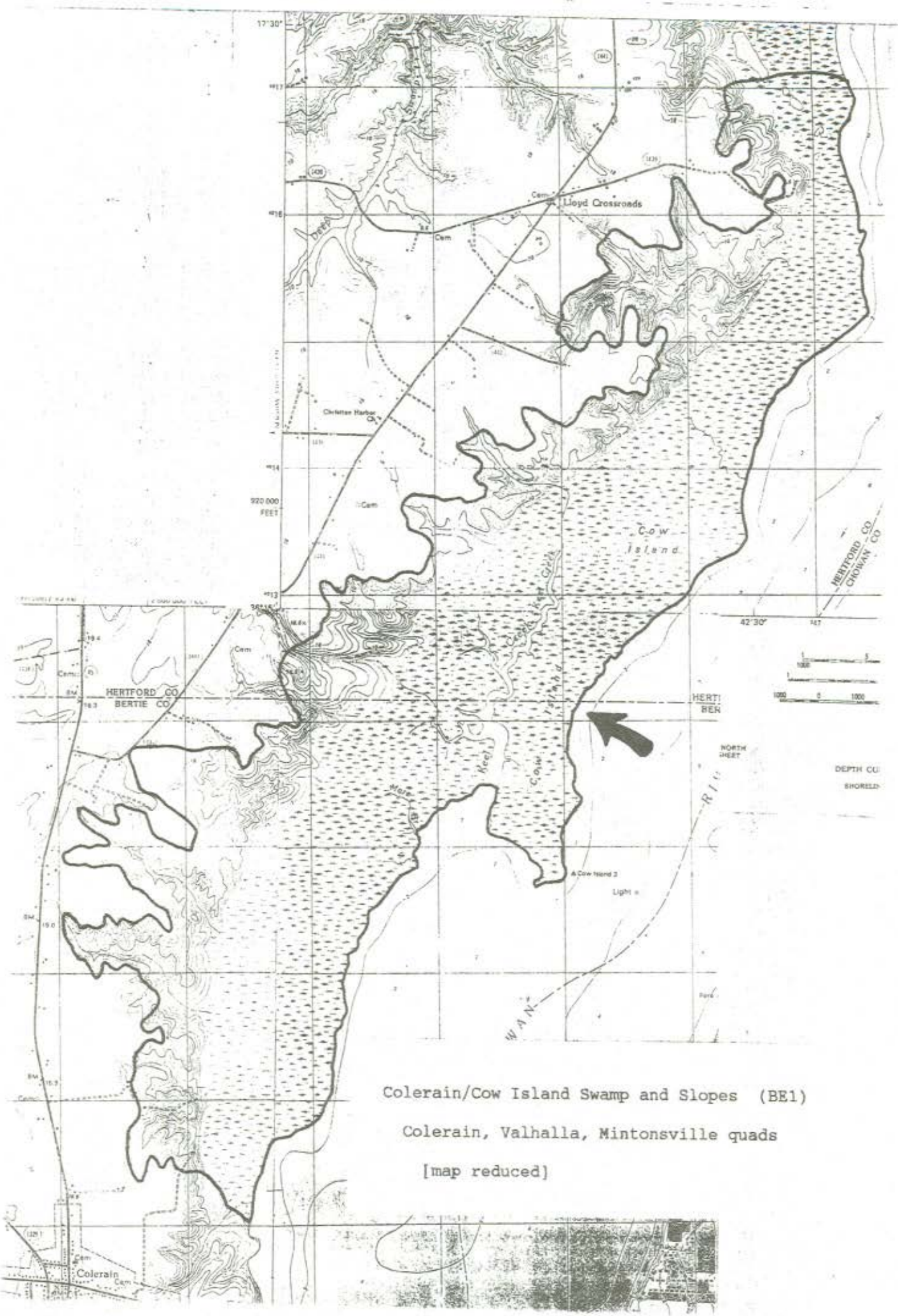
OWNERSHIP: Multiple private owners

PROTECTION STATUS: None

RECOMMENDATIONS FOR MANAGEMENT OR PROTECTION: The site needs to be protected in its present state. Upland tracts are easily timbered, and most such uplands in the A/P Study area have been timbered within the past 30 to 50 years. Because the site is not believed to be of National or State significance, the best protection measures are not acquisition (unless gifts of land are involved) but rather registry or conservation easements with the private landowners.

COMMENTS: This natural area needs further inventory, as only the southern portion, and parts of the central section near Cow Island, were inventoried. The wildlife value of the natural area is poorly known, and further field work in spring and summer is needed to survey for animal populations such as breeding birds, in addition to surveying for spring-blooming wildflowers on the slopes.

REFERENCES: Schneider (1989f), Schneider and Frost (1989d)



Colerain/Cow Island Swamp and Slopes (BE1)

Colerain, Valhalla, Mintonsville quads

[map reduced]

Figure 14. Significant natural areas in Martin County. The areas are numbered generally in a north to south, or west to east, manner; see Table 7 and the Inventory of Sites section for further information.


MA1
MA2
MA3
MA4
MA5
MA6
MA7
MA8
MA9

SITE NAME: Roanoke River Slopes southeast of Palmyra

SITE NUMBER: MA1 SIZE: about 310 acres

SITE SIGNIFICANCE: C (Regional)

LOCATION: Northwestern portion of Martin County; located along the southern banks of the Roanoke River, ranging from about 1 mile northeast of Williams Chapel upstream to about 1 mile north-northeast of Jones Chapel, a straight-line distance of approximately 2.5 miles.

QUAD MAP: Palmyra

SIGNIFICANT FEATURES:

1. The natural area features mature hardwood forests on moderate to steep slopes. These are among the best examples of upland hardwood forests in Martin County.

GENERAL DESCRIPTION:

This natural area consists of over two dozen ravines of tributary streams, each of which flows less than a mile to the Roanoke River. The ravines are actually erosion gullies, in that the terrace above the ravines (the Wicomico Terrace) is easily eroded. The river is actively moving southward in this region and is eroding into the terrace sides. With a terrace elevation of 80 feet, and a river and floodplain elevation of 25 feet, the elevation differential (55 feet) causes a high stream gradient that explains the relatively severe development of the ravines. Some of the ravine slopes are as steep as 45 degrees.

Most of the hardwood forests on the slopes are Mesic Mixed Hardwood Forest, Bluff/Slope natural community type. However, portions appear to be Dry-Mesic Oak-Hickory Forest and perhaps Piedmont/Coastal Plain Heath Bluff as well. The slopes are dominated by American beech (Fagus grandifolia). Many oak species are present, particularly Shumard oak (Quercus shumardii). Several species of hickories (Carya spp.) are also widespread on the slopes. The presence of white oak (Q. alba), southern red oak (Q. falcata), and black oak (Q. velutina), along with mockernut hickory (Carya tomentosa), indicate that oak-hickory forests are present on the slopes, in addition to mesic forests. The most common subcanopy trees on the slopes are red maple (Acer rubrum) and American holly (Ilex opaca). Numerous shrub species include sweet pepperbush (Clethra alnifolia), bigleaf snowbell (Styrax grandifolia), and mountain laurel (Kalmia latifolia). The herb layer is not well known on the slopes because the survey was conducted in October. There are expected to be dozens of species of wildflowers on the slopes in the spring and summer months.

The narrow bottomlands in the ravines, as well as a few flats along the Roanoke River, are not impressive in size, though many of the forests are quite mature. Pond cypress (Taxodium ascendens) is a dominant in the narrow bottomlands. American hornbeam (Carpinus caroliniana) is a very common subcanopy tree, whereas spicebush (Lindera benzoin) is the most numerous shrub species. Giant cane (Arundinaria gigantea) and netted chainfern (Woodwardia areolata) dominate the patchy ground cover in the ravine bottoms.

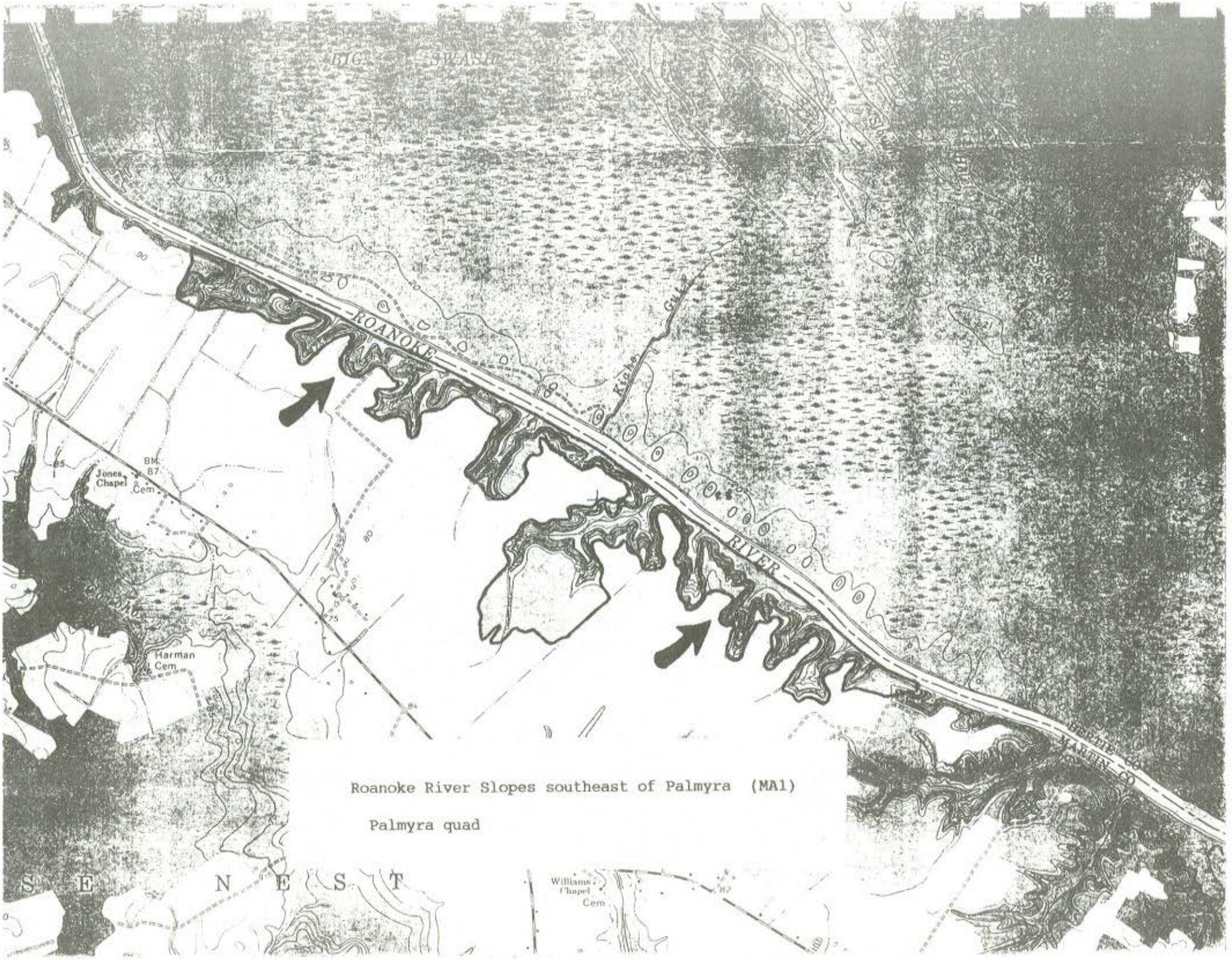
OWNERSHIP: Private; multiple ownership

PROTECTION STATUS: None

RECOMMENDATIONS FOR MANAGEMENT OR PROTECTION: No management of the site is needed. Trees should not be cut. Because the site consists of uplands, there would be no interest by the U.S. Fish and Wildlife Service in acquiring the slopes for the Roanoke River refuge, nor would the N.C. Wildlife Resources Commission likely be interested in such uplands. Although the area as identified in this report is too small for a State Park (minimum of 400 acres, as a rule, for the establishment of a new park), it is possible that adjacent lands east and west of the natural area are of moderate to high quality and could provide enough acreage for a park. There is a need for a State Park in this part of the state, particularly on the uplands of the Roanoke River. There are numerous slopes and ravines on the southern and western banks of the river extending from Williamston on the south to Weldon on the north that would be suitable sites for the establishment of such a park. Many such sites feature mature hardwood canopies, Piedmont-like vegetation, access to the river for boating or fishing, uplands suitable for picnic sites and campgrounds, and other features that are found in State Parks. However, it must be remembered that a State Park on such steep slopes might well accelerate erosion along trails, and construction of facilities such as ranger residences would also mar the attractiveness of such a natural area.

COMMENTS: There is a need to survey additional slopes both upstream and downstream of this natural area. Also, there is a need for survey work during the spring months to identify ephemeral wildflower species, many of which completely disappear by mid-May.

REFERENCES: Richards (1950), Lynch (1981), Schneider (1989p)



Roanoke River Slopes southeast of Palmyra (MA1)

Palmyra quad

SITE NAME: Roanoke River/NC 11 Alluvial Flats

SITE NUMBER: MA2 SIZE: about 1850 acres

SITE SIGNIFICANCE: B (State)

LOCATION: Roanoke River floodplain in Martin and Bertie counties; located on both sides of NC 11-42 in northwestern Martin County and adjacent southwestern Bertie County, extending northward to SR 1126 (Bertie) and southward to terrace walls at the edge of the Roanoke River floodplain.

QUAD MAPS: Woodville, Hamilton

SIGNIFICANT FEATURES:

1. Portions of the natural area feature perhaps the best examples of Alluvial Flats fluvial landforms/community types in North Carolina. Examples of backswamps, natural levees, sloughs, and ridges are also present in the floodplain.
2. The mature hardwood forest features an excellent diversity of canopy trees, perhaps owing to the many subtle changes in elevation and landforms in the floodplain. Most of the area is a Coastal Plain Bottomland Forest, Brownwater subtype natural community.
3. The area has a high wildlife value, and the "significantly rare" cerulean warbler (Dendroica cerulea) is present in summer.

GENERAL DESCRIPTION:

The floodplain of the Roanoke River is nearly 5 miles wide in southwestern Bertie and northwestern Martin counties. Where NC 11-42 crosses the floodplain, an extensive forest is present that is in excellent condition, especially that on the Martin County side of the river. Although a scan of the topographic maps (Woodville and Hamilton) seem to indicate that the floodplain along the road is almost entirely a backswamp, such is not the case. There are several sloughs oriented in a northwest-southeast direction that cross the road. However, most of the area in Martin County is slightly higher in elevation and functions as an Alluvial Flat, even though technically it may be a backswamp that floods only at infrequent intervals, so that water does not stand on the floor for more than a few days or weeks at a time. A natural levee is present on both banks of the river. In Bertie County, there is a well-developed relict ridge, but it is traversed by SR 1126 and thus shows some disturbance.

The natural levee features typical canopy trees such as sugarberry (Celtis laevigata) and green ash (Fraxinus pennsylvanica), along with silver maple (Acer saccharinum), which is uncommon in North Carolina but is fairly frequent on Roanoke River levees. The slightly drier portions of the floodplain (alluvial flats) contain a large number of canopy species with no dominants. Water hickory (Carya aquatica) is common. Both eastern cottonwood (Populus deltoides) and swamp cottonwood (P. heterophylla) are present and grow side-by-side, a rather unusual situation in the state. American elm (Ulmus americana), overcup oak (Quercus lyrata), swamp chestnut oak (Q. michauxii), cherrybark oak (Q. pagoda), and box elder (Acer negundo) are other trees present. Common pawpaw (Asimina triloba) is numerous in the shrub layer.

Along the sloughs grow bald cypress (Taxodium distichum), water tupelo (Nyssa aquatica), sweetgum (Liquidambar styraciflua), and red maple (Acer rubrum), among other species. The somewhat higher ridge in Bertie County, east of NC 11-42, contains more mesic species such as willow oak (Quercus phellos), cherrybark oak, American beech (Fagus grandifolia), and white oak (Q. alba). Alluvial flats west of NC 11-42 in Bertie County feature an abundance of willow oak.

Wildlife values of the forest are undoubtedly high. Wild turkeys (Meleagris gallopavo) are present. The most noteworthy animal known from the site is the "significantly rare" cerulean warbler (Dendroica cerulea), which inhabits tall trees along the river, generally in natural levees forests.

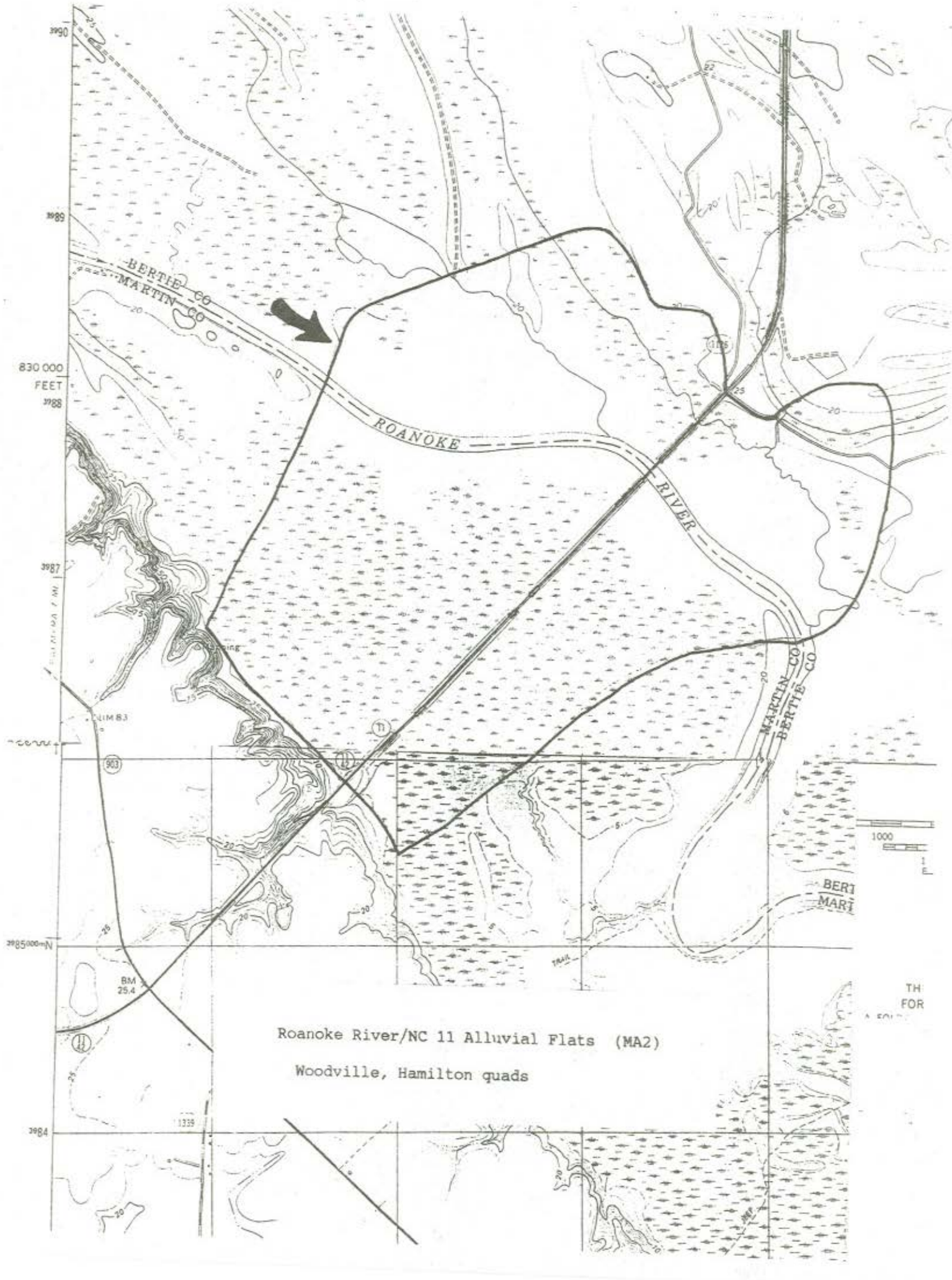
OWNERSHIP: Private; most of the natural area in Martin County is in a single ownership.

PROTECTION STATUS: None

RECOMMENDATIONS FOR MANAGEMENT OR PROTECTION: No management of the natural area is necessary, and timber cutting should not be allowed. The proposed acquisition boundary for the Roanoke River National Wildlife Refuge included most of the natural area, as illustrated in the Final Environmental Assessment (U.S. Fish and Wildlife Service 1988). However, the refuge plan approved by Governor James Martin removes all of the Martin County land from Federal acquisition. A map in local newspapers dated August 11, 1989 show that possibly portions of the Bertie County forests at this site would be acquired by the Fish and Wildlife Service for the refuge, and that possibly portions of the Martin side would be acquired by the Wildlife Service to give to the State of North Carolina as a Game Land. The newspaper maps, however, show little detail. At any rate, it is essential that all of the Martin County portion of the natural area be protected, whether as a Game Land (the most feasible alternative), a nature preserve managed or owned by a private conservation group, or a registered Natural Heritage Area.

COMMENTS: The extent of the natural area away from the highway is poorly known. Fairly mature forests extend to the north of the boundaries shown on the map, but these forests are interspersed with agricultural fields and do not form extensive tracts of 500 or more acres. It is puzzling why this natural area was not included in Lynch's (1981) inventory of the natural areas along the Roanoke River.

REFERENCES: LeGrand (1989a)



Roanoke River/NC 11 Alluvial Flats (MA2)

Woodville, Hamilton quads

SITE NAME: Fort Branch Bluffs and Rainbow Banks

SITE NUMBER: MA3 SIZE: about 430 acres

SITE SIGNIFICANCE: C (Regional)

LOCATION: Northern portion of Martin County; located on slopes near the south bank of the Roanoke River, north of SR 1416, and about 3 miles east-southeast of Hamilton, extending from Fort Branch on the west to approximately one mile northwest of the intersection of SR 1416 and SR 1417.

QUAD MAP: Hamilton

SIGNIFICANT FEATURES:

1. The steep slopes and bluffs at the natural area contain good examples of Mesic Mixed Hardwood Forest, Bluff/Slope subtype natural communities. Also present are rather restricted examples of Piedmont/Coatal Plain Heath Bluff, Dry Oak-Hickory Forest, and Dry-Mesic Oak-Hickory Forest natural communities.
2. The floodplain contains Coastal Plain Levee Forest, Brownwater subtype and Cypress-Gum Swamp, Brownwater subtype natural communities.
3. A number of plant species typical of Piedmont forests are present; some of these are near the eastern limits of their range in the state on these slopes.

GENERAL DESCRIPTION:

Fort Branch was a civil war fort built on a steep bluff overlooking the Roanoke River. The slopes and bluffs in the vicinity have been called "Rainbow Banks" by local citizens. The western portion of the natural area is located on the outside of a southerly meander of the river, downstream from Hamilton. It consists of steep 70-foot high bluffs and ravines. The river is actively cutting into the bluffs at this site, and the river has exposed some fossiliferous marl deposits of the Yorktown Formation. The steepest bluffs facing the river contain primarily a Piedmont/Coastal Plain Heath Bluff community, with American beech (Fagus grandifolia) forming a canopy over a dense shrub layer of mountain laurel (Kalmia latifolia) and sweetleaf (Symplocos tinctoria). Where north-flowing streams cut down into the terrace, deep ravines have formed. These sites (a Mesic Mixed Hardwood Forest, Bluff/Slope subtype natural community) are richer and contain more herbaceous vegetation than do the steep bluffs. Again, beech is the dominant tree, with common pawpaw (Asimina triloba), umbrella tree (Magnolia tripetala), and painted buckeye (Aesculus sylvatica) forming the understory/shrub layer. Among the many species of herbs on the slopes are green dragon (Arisaema dracontium), trout lily (Erythronium americanum), toothwort (Cardamine concatenata), bloodroot (Sanguinaria canadensis), and maidenhair fern (Adiantum pedatum). This last species is quite abundant at the site; this fern is rare in the Coastal Plain.

The slopes and bluffs continue eastward from the fort for several miles. Some of these are rather xeric, and small-scale examples of both Dry Oak-Hickory Forest and Dry-Mesic Oak-Hickory Forest are present on the upper slopes. Species typical of dry slopes in the Piedmont, such as scarlet oak (Quercus coccinea), galax (Galax aphylla) and dittany (Cunila origanoides),

are present in the former community, which is rather rare or is poorly known in the A/P Study area. Additional species typical of xeric to mesic conditions include sourwood (Oxydendrum arboreum), dwarf pawpaw (Asimina parviflora), lowbush blueberry (Vaccinium tenellum), and sparkleberry (V. arboreum).

There is a narrow floodplain natural levee near the base of the slopes at the western end of the natural area, and this levee broadens farther to the east along the river. Dominating the canopy are sugarberry (Celtis laevigata), American sycamore (Platanus occidentalis), eastern cottonwood (Populus deltoides), and water hickory (Carya aquatica). Farther eastward the floodplain broadens to nearly 1/2 mile, and a fairly typical cypress-gum swamp is present between the slopes and the natural levee.

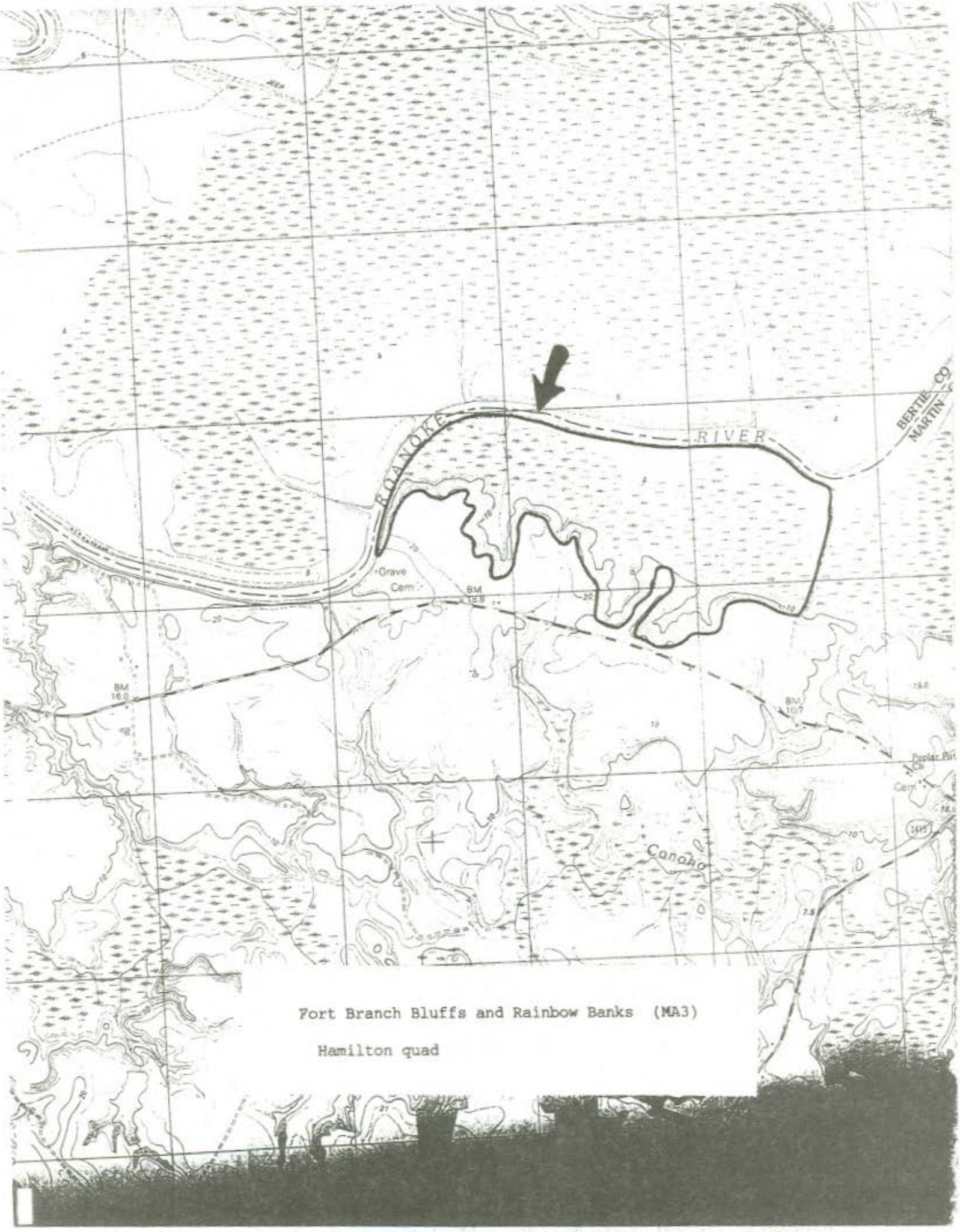
OWNERSHIP: Private; multiple owners

PROTECTION STATUS: No official designation. However, portions of the westernmost slopes near Fort Branch may be owned by the Fort Branch Battlefield Commission; if so, there is some protection of the slopes.

RECOMMENDATIONS FOR MANAGEMENT OR PROTECTION: The area should be maintained in its present state, with no timber cutting. Erosion of the bluffs is a major concern. Public access at Fort Branch has caused further erosion of some of the steeper slopes. The landowners at the westernmost bluffs (apparently Fort Branch Battlefield Commission) have attempted to control erosion, but seemingly with little success. One protection measure would be a registry agreement with the N.C. Natural Heritage Program, at least for the steeper bluffs at the western end of the natural area. The Final Environmental Assessment for the Roanoke River National Wildlife Refuge (U.S. Fish and Wildlife Service 1988) indicated on a map that the floodplain at this site was within the acquisition boundaries for the refuge. However, a modified plan was agreed to by Governor James Martin for a joint Federal/State refuge, with most lands in Martin County removed from Federal acquisition. The modified plan map apparently does not call for eventual acquisition and protection of the floodplain in this natural area. Nonetheless, the N.C. Wildlife Resources Commission is expected to acquire floodplain forests only several miles to the east of this natural area, and this agency should keep options open for acquisition of portions of this site.

COMMENTS: This is a rather diverse site, featuring natural levee, backswamp, and both moist and dry forests on steep slopes. Portions of the natural area are somewhat similar in vegetation to Cliffs of the Neuse State Park. Further field work is needed on the slopes to the east of Fort Branch, especially during the spring months.

REFERENCES: Pridgen and Corda (1978), Lynch (1978), Lynch (1981), Schneider (1989r)



Fort Branch Bluffs and Rainbow Banks (MA3)

Hamilton quad

SITE NAME: Poplar Point Slopes

SITE NUMBER: MA4 SIZE: about 75 acres

SITE SIGNIFICANCE: C (Regional)

LOCATION: Northern edge of Martin County, lying adjacent to the Roanoke River between SR 1417 and the river and extending along slopes westward from Poplar Point Landing.

QUAD MAPS: Hamilton, Quitsna

SIGNIFICANT FEATURES:

1. The natural area features a mature hardwood canopy on mesic slopes with numerous plant species of Piedmont affinities.

GENERAL DESCRIPTION:

A line of north-facing slopes extends in an east-west direction for at least 3 miles between Hamilton and Williamston. These slopes lie on the southern rim of the Roanoke River floodplain but, except near Poplar Point Landing, are separated from the river by swamp forest up to a mile wide. The river formerly ran along this edge of the floodplain and abraded against it to form the steep slopes. In addition to the north-facing slopes, there are several steep side ravines caused by north-flowing streams cutting deeply into the soft sediments of the upland terrace.

The steep slopes have a relatively cool microclimate and are inhabited by many plants with Piedmont affinities. The canopy is dominated by American beech (Fagus grandifolia); other species in the canopy include tuliptree (Liriodendron tulipifera), white oak (Quercus alba), bitternut hickory (Carya cordiformis), and mockernut hickory (C. tomentosa). Shrubs or understory trees that are common are flowering dogwood (Cornus florida), painted buckeye (Aesculus sylvatica), common pawpaw (Asimina triloba), American holly (Ilex opaca), and American hornbeam (Carpinus caroliniana). Herbs that are widespread are green dragon (Arisaema dracontium), mayapple (Podophyllum peltatum), black cohosh (Cimicifuga racemosa), bloodroot (Sanguinaria canadensis), broad beech fern (Thelypteris hexagonoptera), and giant chickweed (Stellaria pubera). These herbaceous species are primarily found in the Piedmont or mountains in North Carolina. One other plant of the site that is notable is log fern (Dryopteris celsa). This is an uncommon fern of the Coastal Plain, with a few sites elsewhere in the state.

The slopes contain a variety of mammal and bird species. Most significant is the presence of wild turkeys (Meleagris gallopavo); this is an uncommon species in the state but is fairly widespread in forests along the Roanoke River.

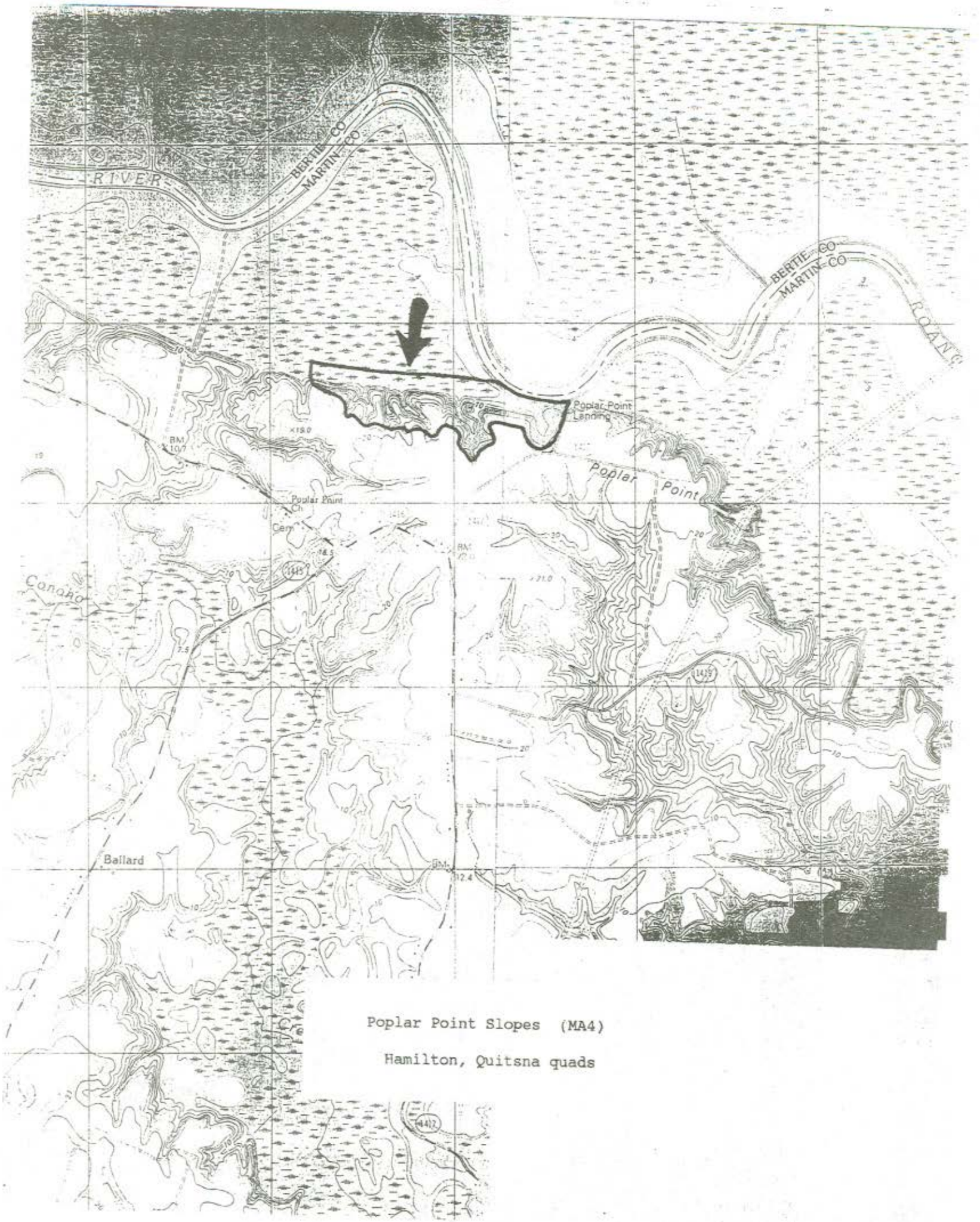
OWNERSHIP: Private

PROTECTION STATUS: None

RECOMMENDATIONS FOR MANAGEMENT OR PROTECTION: No management of the site is needed. However, fields are located immediately to the south of the slopes, and monitoring of the tops of the slopes for invasion of weedy plant species might be necessary. The natural area is outside the acquisition boundary for the Roanoke River refuge. A registry agreement between the owner(s) and the N.C. Natural Heritage Program is the best protection option, at least at the state level. Other protection options include a conservation easement with a private conservation group or acquisition by a local college or local government as a nature preserve or research area.

COMMENTS: Further survey work along the slopes, both east and west of the described natural area, is needed. The swamp forest to the north of the area is not of high quality (mature canopy).

REFERENCES: Lynch (1981)



Poplar Point Slopes (MA4)

Hamilton, Quitsna quads

SITE NAME: Conoho Creek Schisandra Slopes

SITE NUMBER: MA5 SIZE: about 130 acres

SITE SIGNIFICANCE: B (State)

LOCATION: North-central portion of Martin County; located on north-facing slopes of the Conoho Creek floodplain just south of SR 1417 and east of the Conoho Creek bridge crossing, on west- and north-facing slopes north of SR 1417, and on several floodplain ridges north of this road.

QUAD MAP: Quitsna

SIGNIFICANT FEATURES:

1. The rich forests contain 3 populations of magnolia vine (Schisandra glabra), the only known sites in North Carolina. It is considered a State Threatened species.
2. Other rare species present are ginseng (Panax quinquefolius) and log fern (Dryopteris celsa). The former is very rare east of the Fall Line in the state and is at a disjunct site on the slopes; it is a Special Concern species in North Carolina.
3. An abundance of silky camellia (Stewartia malacodendron) and umbrella tree (Magnolia tripetala) are noteworthy; neither is common in the Coastal Plain.

GENERAL DESCRIPTION:

This natural area is one of the richest mesic hardwood forests in the Coastal Plain of North Carolina. The mature canopy south of SR 1417 is composed primarily of white oak (Quercus alba), northern red oak (Q. rubra), bitternut hickory (Carya cordiformis), and tuliptree (Liriodendron tulipifera). North of this road, American beech (Fagus grandifolia) is a dominant canopy tree. The understory layer is well developed, with at least 12 hardwood species present, including several characteristic of rich slopes in the Piedmont -- redbud (Cercis canadensis), umbrella tree (Magnolia tripetala), hop hornbeam (Ostrya virginiana), and bigleaf snowbell (Styrax grandifolia). An uncommon shrub in the state -- silky camellia (Stewartia malacodendron) -- is present north of the road. The most significant plant in the forest is a woody vine: magnolia vine (Schisandra glabra), a rather rare species of the Coastal Plain of the Southeast. The only site north of South Carolina is at this natural area. The vine is actually a rather aggressive species that climbs over low vegetation. A large population is present south of the road, whereas much smaller populations occur at 2 sites north of the road.

The herb layer is quite rich for a Coastal Plain forest and features some Piedmont elements. The most significant herb is ginseng (Panax quinquefolius), which grows in rich woods in the mountains and at scattered sites in the Piedmont, but is very rare in the Coastal Plain. The small population on the slopes is well disjunct to the east of any other known site in the state. Other species typical of the Piedmont include black cohosh (Cimicifuga racemosa), autumn coral-root (Corallorhiza odontorhiza), and bloodroot (Sanguinaria canadensis). An uncommon fern in the state -- log fern

(Dryopteris celsa) -- occurs at several places in the natural area at the foot of the slopes in damp ground. It is found primarily in rich soil of bottomlands in the lower Coastal Plain. A species of bedstraw (Galium uniflorum) that is relatively scarce in the state grows on a moist ridgetop north of the road.

North of the slopes on the north side of the road, within the floodplain of the creek, are a few low ridges vegetated in mature mesic forests. Beech, cherrybark oak (Quercus pagoda), swamp chestnut oak (Q. michauxii), white oak, southern sugar maple (Acer barbatum), and bitternut hickory are the dominants in the canopy. Hop hornbeam and American hornbeam (Carpinus caroliniana) are common in the understory. Silky camellia is quite common in the shrub layer.

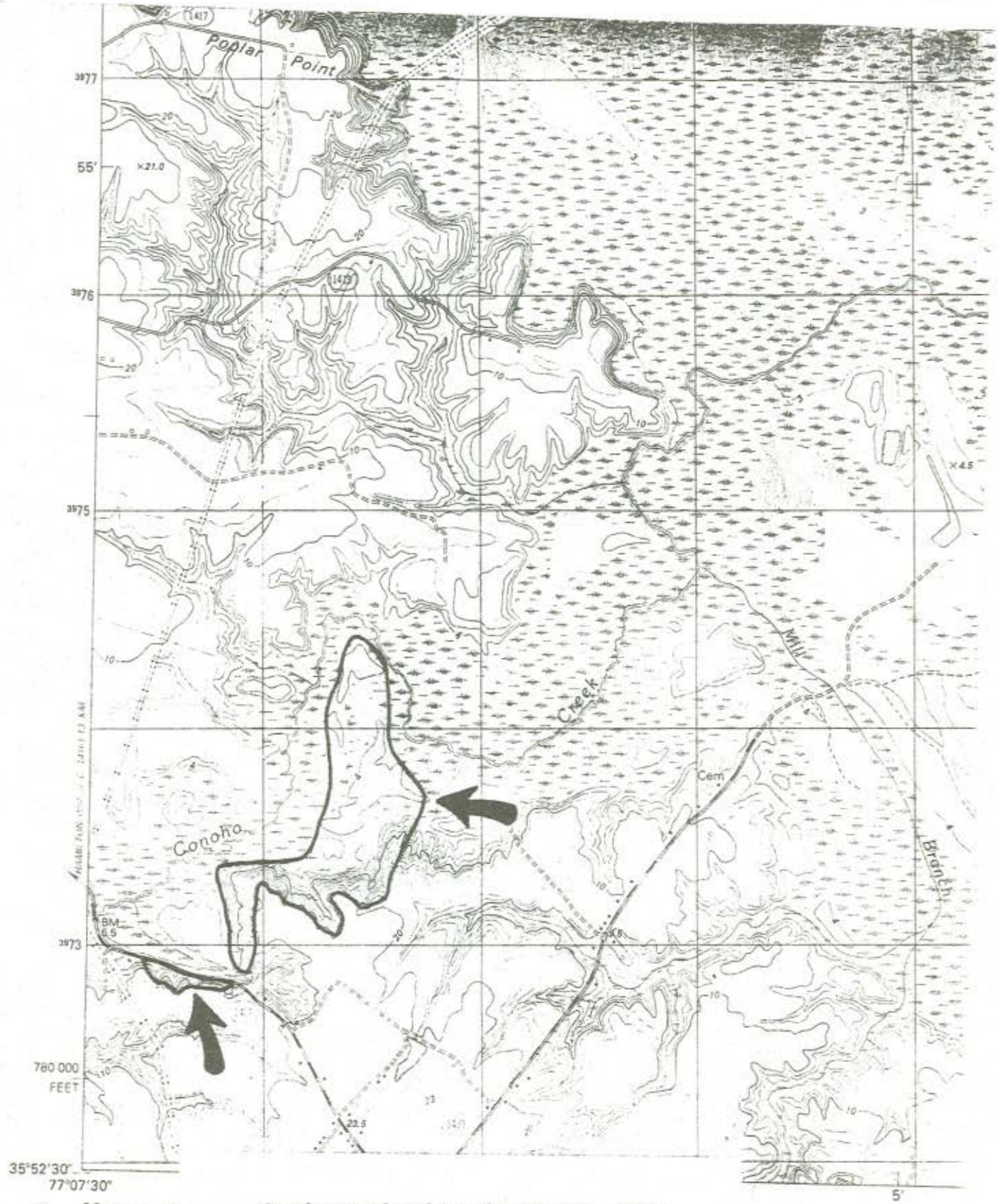
OWNERSHIP: Private

PROTECTION STATUS: None

RECOMMENDATIONS FOR MANAGEMENT OR PROTECTION: The N.C. Natural Heritage Program has known about the site south of SR 1417 since its inception in the mid-1970s, but protection efforts have been fruitless. The significance of the slopes north of the road were apparently not known until this year's survey. Portions of the rich slope south of the road have been destroyed in the past 10 years by the construction of a few homes, though the richest portion of the slope is still in reasonably sound condition. The site is certainly under great threat, both in terms of home construction and timber harvest. Protection options include a registry agreement or a conservation easement with the owner(s). This site is not within the acquisition boundaries for the Roanoke River National Wildlife Refuge.

COMMENTS: This natural area can be considered to be a critical protection priority, partly because it is the only known site in North Carolina for the magnolia vine, and partly because it is a location for many Piedmont species of plants. As mentioned above, threats to the site are believed to be high. There are other steep slopes along the southern edge of the Conoho Creek floodplain that perhaps need survey work.

REFERENCES: N.C. Natural Heritage Program database, Radford (1976, p. 139), LeGrand (1989b)



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Control by US

Topography b
taken 1977.

(ROBERSONVILLE EAST)
6555 I SW

Conoho Creek Schisandra Slopes (MA5)

Quitsna quad

Projection and 10,000-foot grid ticks: North Carolina coordinate system (Lambert conformal conic)
1000-meter Universal Transverse Mercator grid, zone 18
1927 North American Datum
To place on the predicted North American Datum 1983 move the projection lines 12 meters south and 28 meters west as shown by dashed corner ticks

Short dashed blue lines indicate elliptical bay outlines

MN
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UTM GRID AND 1981 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

SITE NAME: Conoho Creek Swamp

SITE NUMBER: MA6 SIZE: about 1150 acres

SITE SIGNIFICANCE: B (State)

LOCATION: The north-central part of Martin County; located in the wedge between lower Conoho Creek and the Roanoke River, ranging south to the confluence of these waters and north to a small canal approximately 2 miles north of the confluence.

QUAD MAP: Quitsna

SIGNIFICANT FEATURES:

1. The natural area features a backwater area lying between the Roanoke River and Conoho Creek, caused by water backing up along the lower reaches of Conoho Creek by a well-developed natural levee along the Roanoke River.
2. The mature swamp forest in the backwater has the appearance of an old millpond in that the trees are somewhat widely scattered and there is almost always standing water present.
3. A heronry was present in the swamp in the 1970s; the present status of the colony is not known.

GENERAL DESCRIPTION:

Conoho Creek flows for 40 miles and empties into the Roanoke River a few miles north of Williamston. The lower 2 to 3 miles of Conoho Creek somewhat parallel the river, and apparently the natural levee of the river has deflected the creek's course, a typical feature of large rivers with relatively high levees. During flood stages of the river, water backs up into Conoho Creek and other such tributaries and spreads out into the floodplain of the creek. Because of the levee on the east, the water is somewhat dammed up and a "ponding" effect is present. The open water at the site is frequently 6 to 10 feet deep. An open stand of bald cypress (Taxodium distichum) is present, and the trees are festooned with Spanish moss (Tillandsia usneoides). There is no understory, but various floating or submerged herb species are present, especially alligator weed (Alternanthera philoxeroides). This natural area thus resembles an old millpond, but the site is apparently completely natural.

Soots and Parnell (1979) reported the presence of a heronry at the site in 1976. An aerial count indicated 80 pairs of great blue herons (Ardea herodias) and 4 pairs of great egrets (Casmerodius albus). The current status of this and most other inland heronries is not known, since no organized aerial counts have been conducted. Inland heronries in North Carolina are limited to the Coastal Plain are are rather rare, though several are located in the Roanoke River floodplain.

OWNERSHIP: Private

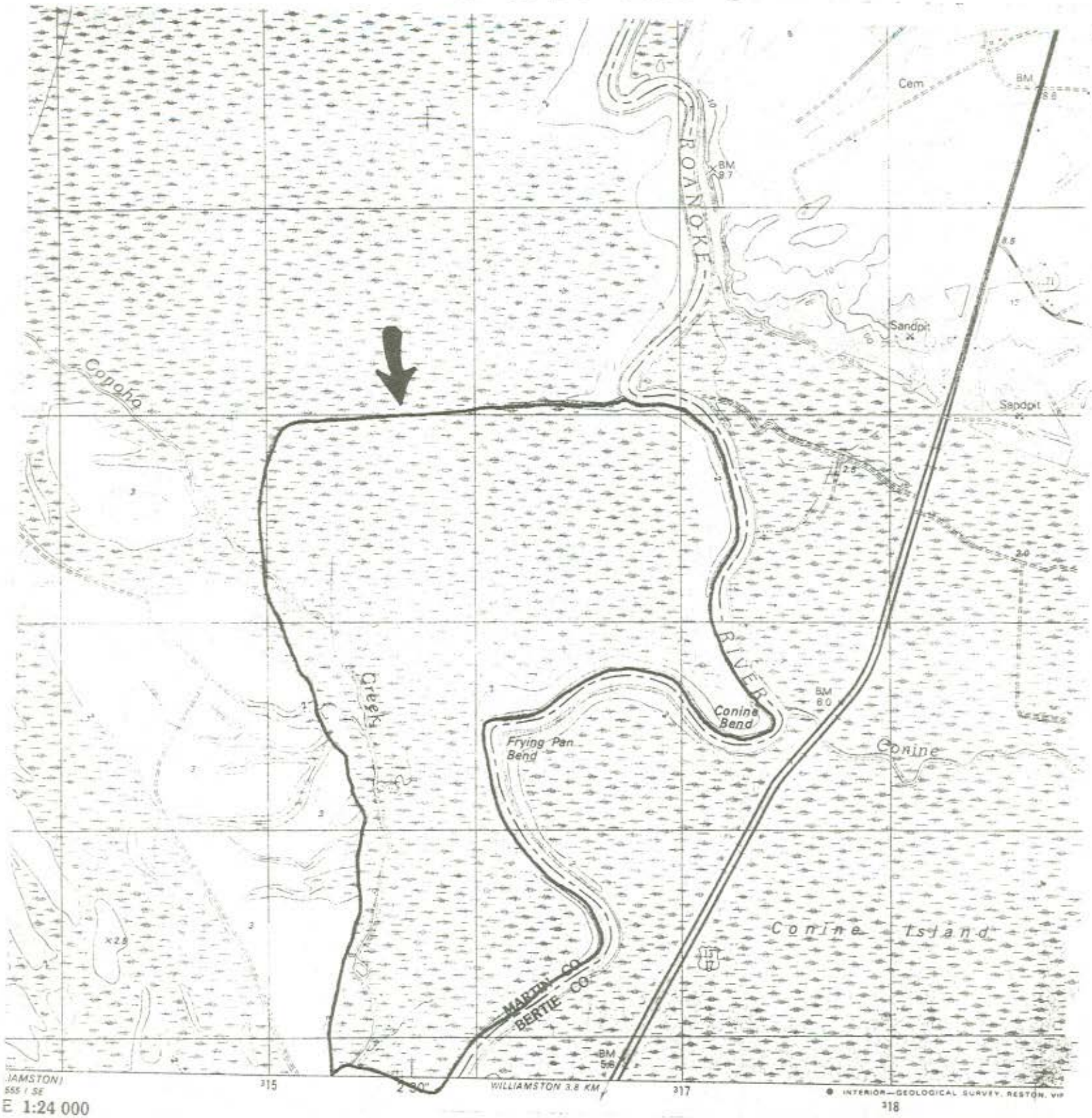
PROTECTION STATUS: None

RECOMMENDATIONS FOR MANAGEMENT OR PROTECTION: This site was proposed for Federal acquisition for the Roanoke River National Wildlife Refuge (U.S. Fish and Wildlife Service 1988). However, the compromise plan endorsed by Governor James Martin indicates that this natural area would likely become a State Game Land. In all likelihood, the Fish and Wildlife Service would acquire the property, then trade it to the N.C. Wildlife Resources Commission to be used as a Game Land (in exchange for State properties in Bertie County that would be traded to the Fish and Wildlife Service for the creation of the refuge).

Little management of the site appears necessary. Timber cutting would be detrimental to the natural area.

COMMENTS: The western border of the site needs further inventory, as a series of low relict point bar ridges is present. The natural area, other than these point bars, is reachable only by boat.

REFERENCES: Lynch (1981), U.S. Fish and Wildlife Service (1988)



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APS AND SYMBOLS IS AVAILABLE ON REQUEST

Conoho Creek Swamp (MA6)

Quitsna quad

N.C.
QUADRANGLE LOCATION

CONTOURS AND ELEVATIONS
IN METERS

ROAD CLASSIFICATION

nary highway, Light-duty ro
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d surface ..... Unimproved ro
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QUIT
NE/4 WILLIAM
N3552.5

DMA 5555

SITE NAME: Sweetwater Creek Swamp Forest

SITE NUMBER: MA7 SIZE: about 650 acres

SITE SIGNIFICANCE: C (Regional)

LOCATION: Central part of Martin County, about 2 miles east of Williamston; consisting of the floodplain of Sweetwater Creek, from US 64 upstream to the Roanoke River downstream.

QUAD MAP: Williamston

SIGNIFICANT FEATURES:

1. The swamp forest is an excellent example of a backwater stream community and is probably the best developed community of its type in the Roanoke River floodplain.
2. An uncommon plant -- American featherfoil (Hottonia inflata) -- grows in mats in the creek. Spanish moss (Tillandsia usneoides) is also quite common along the creek.

GENERAL DESCRIPTION:

Sweetwater Creek is a blackwater stream in the Roanoke River floodplain. It is approximately 18 miles in length and empties into the river just east of Williamston. The lower 2 miles of the creek's floodplain is typical of a well-developed backwater stream. Most of the floodplain is under water during the year, and at times as much as 7 feet of water is present. The standing water is responsible for large buttresses to develop on most of the canopy and subcanopy trees. The creek channel is quite meandering and is often obscured by beds of aquatic herbs. The canopy is rather open, with water tupelo (Nyssa aquatica) the dominant tree. Water ash (Fraxinus caroliniana) is the primary understory species. The creek tends to be covered with mat-forming herbs, especially alligator weed (Alternanthera philoxeroides). Duckweeds (Lemna and other genera) and American featherfoil (Hottonia inflata) are also common, as are several species of bladderworts (Utricularia spp.). The largest population of Spanish moss (Tillandsia usneoides) in the Roanoke River floodplain is present along Sweetwater Creek. This epiphyte is near the northern edge of its range on the Atlantic Coastal Plain.

The swamp provides excellent wildlife habitat, and turtles and aquatic snakes are quite common. The river otter (Lutra canadensis), mink (Mustela vison), and muskrat (Ondatra zibethicus) are known to be present, as are raptors such as barred owl (Strix varia) and red-shouldered hawk (Buteo lineatus). Woodpeckers, warblers, and other landbirds are also numerous. Waterfowl feed in the area in fall and early winter, and wood ducks (Aix sponsa) are common all year.

OWNERSHIP: Private

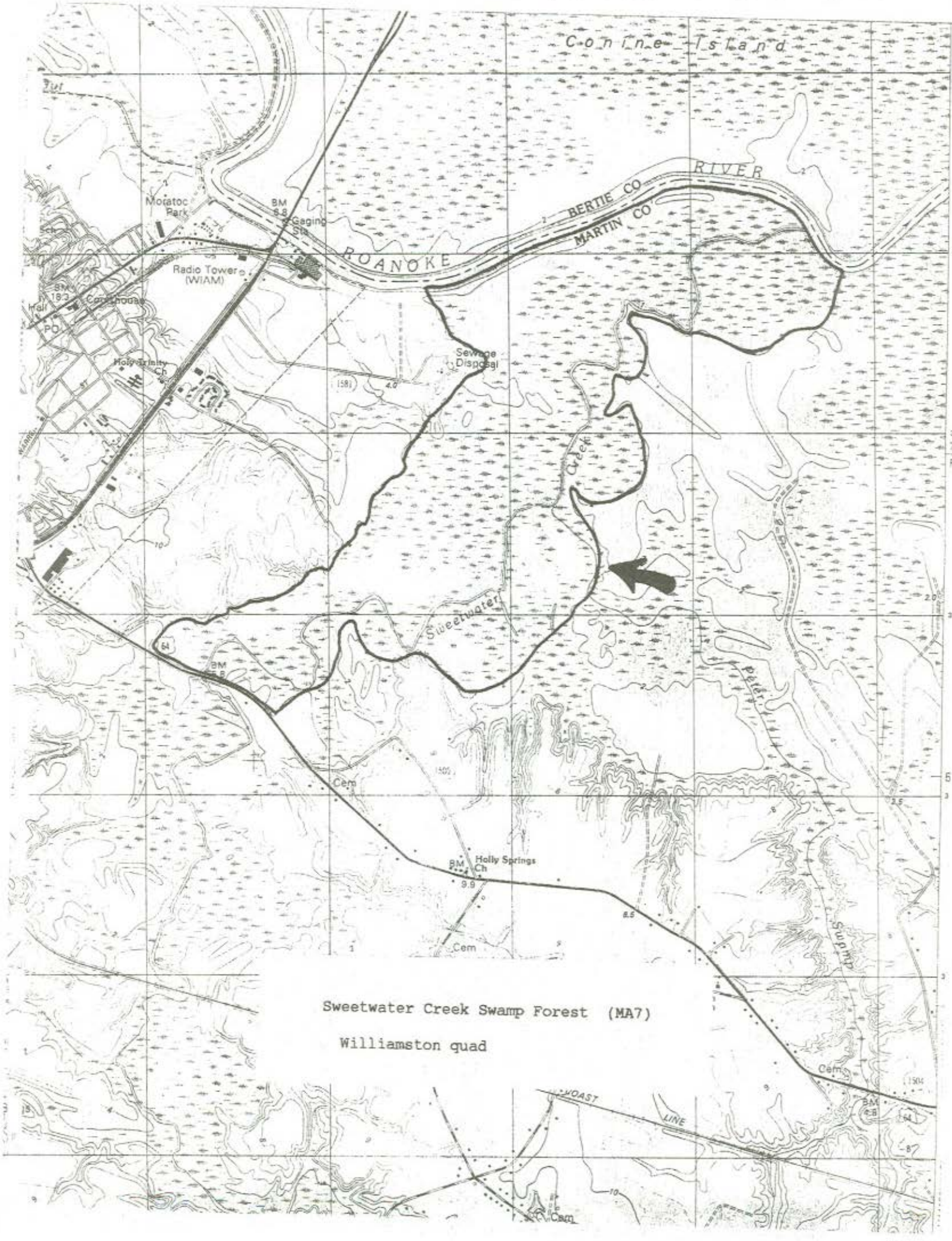
PROTECTION STATUS: None

RECOMMENDATIONS FOR MANAGEMENT OR PROTECTION: Based on the Final Environmental Assessment for the Roanoke River National Wildlife Refuge (U.S.

Fish and Wildlife Service 1988), the Sweetwater Creek floodplain would be scheduled for refuge acquisition. However, the revised agreement signed by Governor James Martin in August 1989 makes it uncertain if Sweetwater Creek is to be acquired by the Federal government for the refuge, by the Federal government to be owned and managed by the N.C. Wildlife Resources Commission as a Game Land, or is no longer part of any acquisition plans. The Federal government's Fish and Wildlife Service is planning to purchase, and retain, portions of Devil's Gut in Martin County for the refuge; thus, Sweetwater Creek, which lies just west of Devil's Gut, might be a part of the national wildlife refuge. At any rate, the floodplain is deserving of acquisition by either the Fish and Wildlife Service or the Wildlife Resources Commission.

COMMENTS: One threat to the creek is the unusually dense abundance of alligator weed, a non-native species. A State effort has been made to spray the weed to control its growth, but the authors do not know how effective such controls have been.

REFERENCES: Lynch (1981), U.S. Fish and Wildlife Service (1988)



Sweetwater Creek Swamp Forest (MA7)

Williamston quad

SITE NAME: Devil's Gut Natural Area

SITE NUMBER: MA8 SIZE: about 2025 acres

SITE SIGNIFICANCE: A (National)

LOCATION: Eastern part of Martin County; located just south of Devil's Gut and north of SR 1505, extending east to Gardner Creek and west to approximately the SR 1505 terminus.

QUAD MAP: Jamesville

SIGNIFICANT FEATURES:

1. The Devil's Gut area contains some of the best examples of old-growth, climax alluvial forest communities in the southeastern United States. Both bottomland forest communities and swamp forest communities are present.
2. The natural area contains a high diversity of alluvial landforms, such as ridge and swale topography, natural levees, and meanders.

GENERAL DESCRIPTION:

The Roanoke River floodplain east of Williamston is nearly 5 miles wide, and a large bend in the river has been cut off by a distributary stream called Devil's Gut. North of the gut is an extensive swamp forest, whereas south of the gut is a mosaic of swamp forest, much of which lies in former river channels (sloughs), and bottomland forest on slightly higher ridges. The ridges presumably represented former natural levees and the swales are sloughs that were former sites of the river channel. (For more information about geomorphology of river swamps in the Southeast, see Wharton et al. 1982).

The swamp forests are typical of those in the lower Roanoke River floodplain and consist generally of bald cypress (Taxodium distichum) and water tupelo (Nyssa aquatica). In the deeper swales, the tupelos average 30 to 36 inches in trunk diameter. Scattered cypresses reach 130 feet in height and 5 to 6 feet in trunk diameter. Water ash (Fraxinus caroliniana) is occasionally present in the subcanopy.

The most significant feature of the natural area is the extent and maturity of the bottomland forests on the slight ridges and natural levees within the floodplain. These ridges were former natural levees which, over time, became farther removed from the river as the channel migrated northward. The ridges are vegetated in a Coastal Plain Bottomland Forest, Brownwater subtype natural community, whereas the present-day natural levee along Devil's Gut is slightly lower in elevation and contains a Coastal Plain Levee Forest community. The natural levee along the gut contains green ash (Fraxnus pennsylvanica), American sycamore (Platanus occidentalis), silver maple (Acer saccharinum), American elm (Ulmus americana), sweetgum (Liquidambar styraciflua), and water hickory (Carya aquatica). The higher and drier former levees (now well south of the current river channel) contain a hardwood forest dominated by oaks. These "oak flats" include swamp chestnut oak (Quercus michauxii), laurel oak (Q. laurifolia), water oak (Q. nigra), cherrybark oak (Q. pagoda), willow oak (Q. phellos), white oak (Q. alba), and overcup oak (Q. lyrata). These ridges are park-like in appearance and have a moderate ground layer but little understory or shrub layers. The higher ridges, especially

those at the southern edge of the floodplain, are dominated by American beech (Fagus grandifolia), with tuliptree (Liriodendron tulipifera) and various oaks mentioned above also present.

OWNERSHIP: The Nature Conservancy owns approximately the eastern 60% of the natural area; the remainder is owned by a single individual

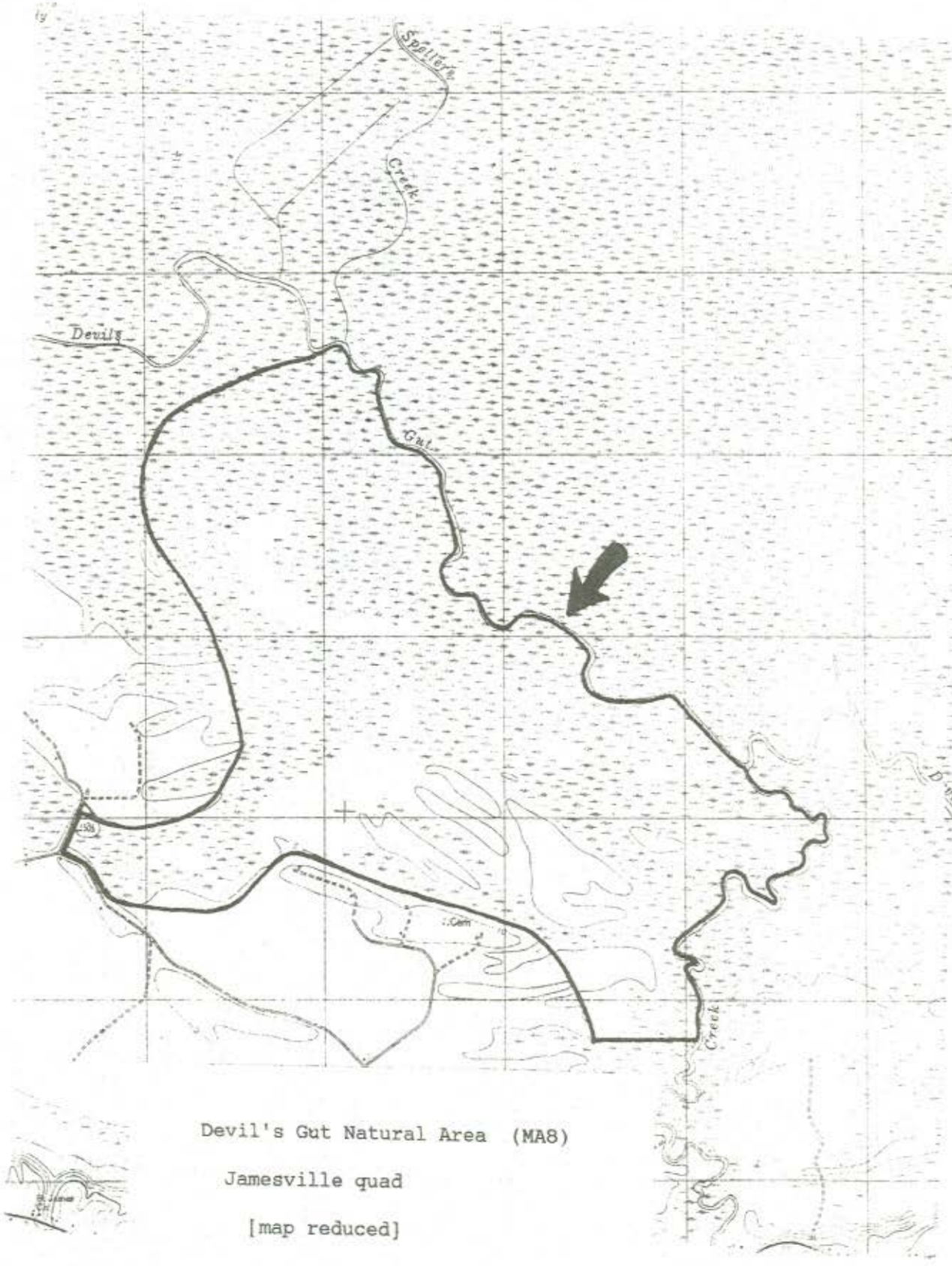
PROTECTION STATUS: The portion owned by The Nature Conservancy can now be considered "protected", and it seems likely that the forested portions of the property will remain free of any logging or other disturbances. This tract was acquired by the Conservancy in the summer of 1989. The portion of the natural area owned by the private individual has no protection status.

RECOMMENDATIONS FOR MANAGEMENT OR PROTECTION: The Nature Conservancy has been in consultation with the owner of the other portion of the natural area to ensure the site's protection; it would like to acquire that property. The Conservancy will likely enter into a registry or dedication agreement with the State of North Carolina for the property it has recently acquired.

This natural area apparently does not fall within the proposed boundary of the Roanoke River National Wildlife Refuge. Though the land on the opposite side (north side) of Devil's Gut will likely be acquired for the refuge, Federal or State involvement with the Devil's Gut Natural Area does not seem likely.

COMMENTS: Portions of both the Conservancy tract and the remaining private tract have been selectively logged, but the forests (primarily on the ridges) are still of high quality and remain in a reasonably natural state.

REFERENCES: N.C. Natural Heritage Program database, Lynch (1981), Wharton et al. (1982)



Devil's Gut Natural Area (MA8)

Jamesville quad

[map reduced]

SITE NAME: Lilley's Swamp

SITE NUMBER: MA9 SIZE: about 275 acres

SITE SIGNIFICANCE: C (Regional)

LOCATION: Southeastern portion of Martin County; located inside a sharp bend of SR 1516, just east of the intersection with SR 1521.

QUAD MAP: Williamston

SIGNIFICANT FEATURES:

1. The natural area contains mature forests on both upland slopes and in the floodplain of a tributary of Sweetwater Creek.

GENERAL DESCRIPTION:

This natural area features an unusually wide "floodplain" (over 1/3-mile wide) along a very small stream. This and other nearby streams in this section of Martin County southeast of Williamston are highly meandering, with surprisingly large floodplains along portions of the stream channels. There are gentle slopes along the margins of the floodplain that contain well-developed and mature hardwood forests (Mesic Mixed Hardwood Forest, Bluff/Slope subtype natural community). American beech (Fagus grandifolia) dominates the canopy, but various oak species, such as white (Quercus alba), Shumard (Q. shumardii), water (Q. nigra), and southern red (Q. falcata) are also present, along with other species. The moderate density understory features American holly (Ilex opaca), sourwood (Oxydendrum arboreum), flowering dogwood (Cornus florida), and sassafras (Sassafras albidum). The shrub and herb layers on the uplands are rather sparse; four species of blueberries (Vaccinium elliottii, V. atrococcum, V. corymbosum, and V. tenellum) are present in the shrub layer.

The floodplain features a Coastal Plain Small Stream Swamp natural community. The forest is mature and in excellent condition; it is inundated much of the year but is generally dry in summer. As with most swamps in the A/P Study area, the canopy is dominated by water tupelo (Nyssa aquatica) and bald cypress (Taxodium distichum). The subcanopy is open, with water ash (Fraxinus caroliniana) the most common tree. The shrub and herb layers are sparse, as would be expected for sites that are flooded much of the year.

OWNERSHIP: Private; several owners in the same family

PROTECTION STATUS: None

RECOMMENDATIONS FOR MANAGEMENT OR PROTECTION: The ownership of a portion of the tract is apparently unsettled or is being contested. Change in ownership might well lead to a portion of the forest being cut for timber. It appears that, as the natural area is of Regional significance and is isolated from the extensive forests along the Roanoke River, the best protection strategy is a registry agreement with the N.C. Natural Heritage Program or a conservation easement with a private conservation group. It is hoped that local

governments or colleges take a part in protection of sites such as this natural area, as well.

COMMENTS: This site, along with many others studied during the inventory, could use additional visits, especially during the spring and early summer months, to search for herbaceous species on the uplands and for animal species in general.

REFERENCES: Schneider (1989q)

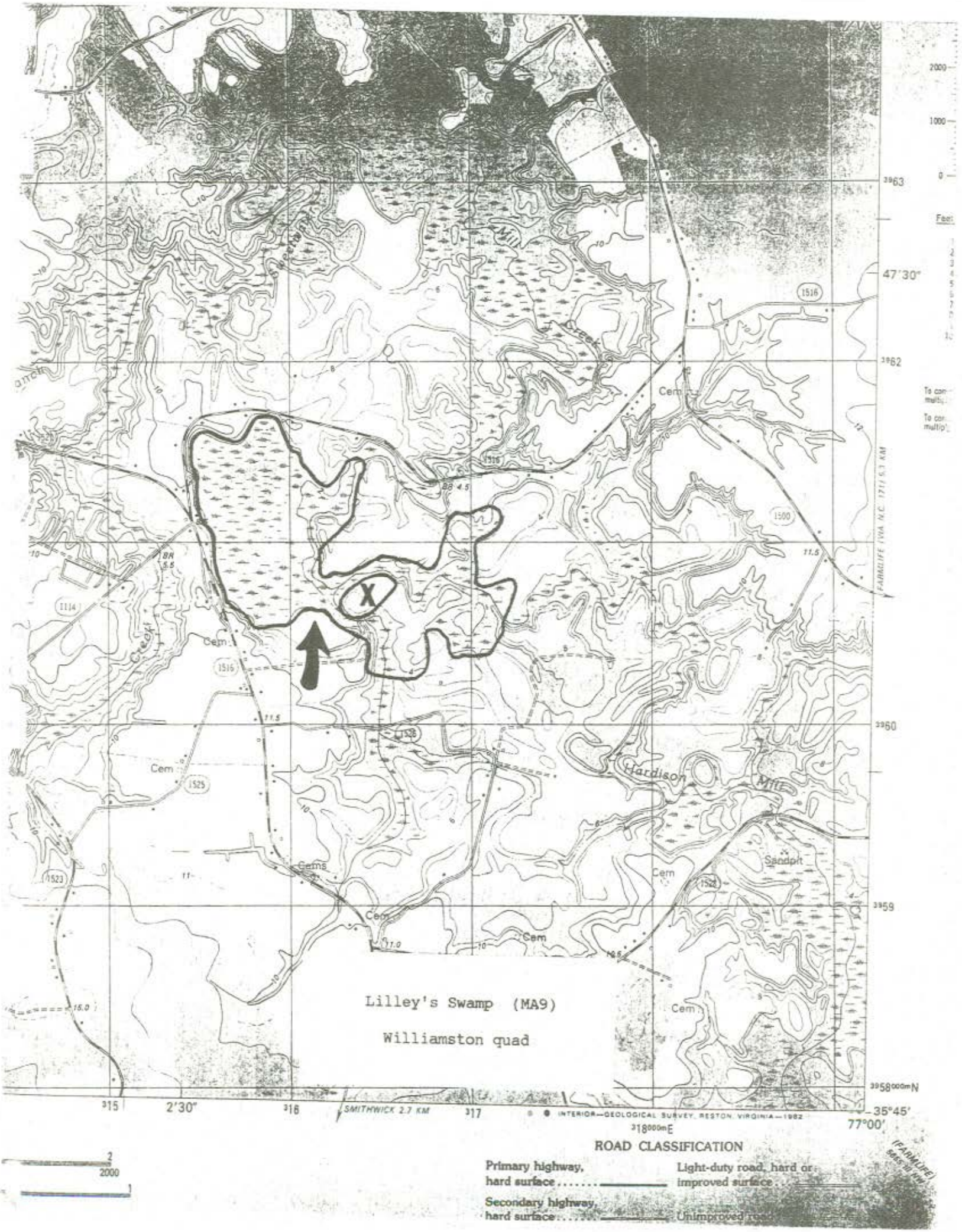

Lilley's Swamp (MA9)
Williamston quad
Hardison Mill
Sandpit
Cem
Creek
SMITHWICK 2.7 KM
FARMLIFE (VA N.C. 17) 5.3 KM
47'30"
2'30"
77°00'
35°45'
3963
3962
3960
3959
3958000mN
315
316
317
318000mE
INTERIOR—GEOLOGICAL SURVEY, RESTON, VIRGINIA—1982
ROAD CLASSIFICATION
Primary highway, hard surface
Secondary highway, hard surface
Light-duty road, hard or improved surface
Unimproved road
2000
1000
0
Feet

Figure 15. Significant natural areas in Pasquotank County. The areas are numbered generally in a north to south, or west to east, manner; see Table 7 and the Inventory of Sites section for further information.


CA1
PA1
PA2
PA2
ALBEMARLE

SITE NAME: Little Flatty Creek Forests and Marsh

SITE NUMBER: PA1 SIZE: about 2500 acres

SITE SIGNIFICANCE: B (State)

LOCATION: Extreme southeastern portion of Pasquotank County; located both north and south of Little Flatty Creek, extending north to near the mouth of New Begun Creek, and lying east of SR 1102 and north of SR 1104.

QUAD MAP: Wade Point

SIGNIFICANT FEATURES:

1. The natural area contains as much as 2500 acres of essentially pristine communities, with little or no signs of disturbance along Little Flatty Creek.
2. The site contains extensive Nonriverine Wet Hardwood Forests, one of the most endangered natural communities in the state. Examples of slightly brackish marshes and tidal swamp forests are also present, as is a pine swamp community (Estuarine Fringe Loblolly Pine Forest).
3. Rare species include winged seedbox (Ludwigia alata) and prairie cordgrass (Spartina pectinata).

GENERAL DESCRIPTION:

Little Flatty Creek is a tidal creek that drains into a very shallow bay tributary to the Pasquotank River. Tidal fresh to slightly brackish marshes (considered Oligohaline Marsh natural community in this report) line the creek. Swamps of various composition lie adjacent to the marsh. The upland flats adjacent to the swamps feature mature oak-dominated forests.

The marshes along the creek feature a fairly high herb diversity, with no clear dominant species. Prairie cordgrass (Spartina pectinata), a "significantly rare" species in the state, is common along with salt meadow cordgrass (S. patens) and black needlerush (Juncus roemerianus). Another portion of the marsh is dominated by big cordgrass (S. cynosuroides). The marshes along Little Flatty Creek appear not to have been burned for at least 15 years, and many of them are beginning to show invasion by bald cypress (Taxodium distichum), red maple (Acer rubrum), sweetgum (Liquidambar styraciflua), and swamp tupelo (Nyssa biflora).

Swamp tupelo dominates some of the swamps between the marshes and the uplands. Of more interest is the poorly understood Estuarine Fringe Loblolly Pine Forest, which occurs as a band around low islands in the marsh or adjacent to uplands where there is a low, wet mineral soil in a fire-exposed situation. This forest type takes on the appearance of a pine hammock, but the interior of the forest may have small stands of hardwoods. In this forest, the canopy is essentially loblolly pine (Pinus taeda). Most of the understory is a bulrush believed to be Scirpus cyperinus, with patches of joint grass (Manisuris rugosa).

The most significant feature is the extent of hardwood forest on upland flats. The flats are wet enough to be Nonriverine Wet Hardwood Forests rather than Mesic Mixed Hardwood Forest, Upland Flats subtype, though it is likely that the slightly drier portions of the forest are actually the latter community, as the distinction between the two is often a matter of a few

inches in relation to the water table. The forest that was explored by Frost (1989s) is quite mature, with the average trunk diameter of canopy trees being about 24 inches. The forest is dominated by swamp chestnut oak (Quercus michauxii) and cherrybark oak (Q. pagoda), with the former occurring on the slightly wetter sites. The subcanopy is thin, and there are few shrubs except for patches of giant cane (Arundinaria gigantea) around the periphery. Additional hardwood flats are visible on aerial photos, but were not surveyed because of time constraints.

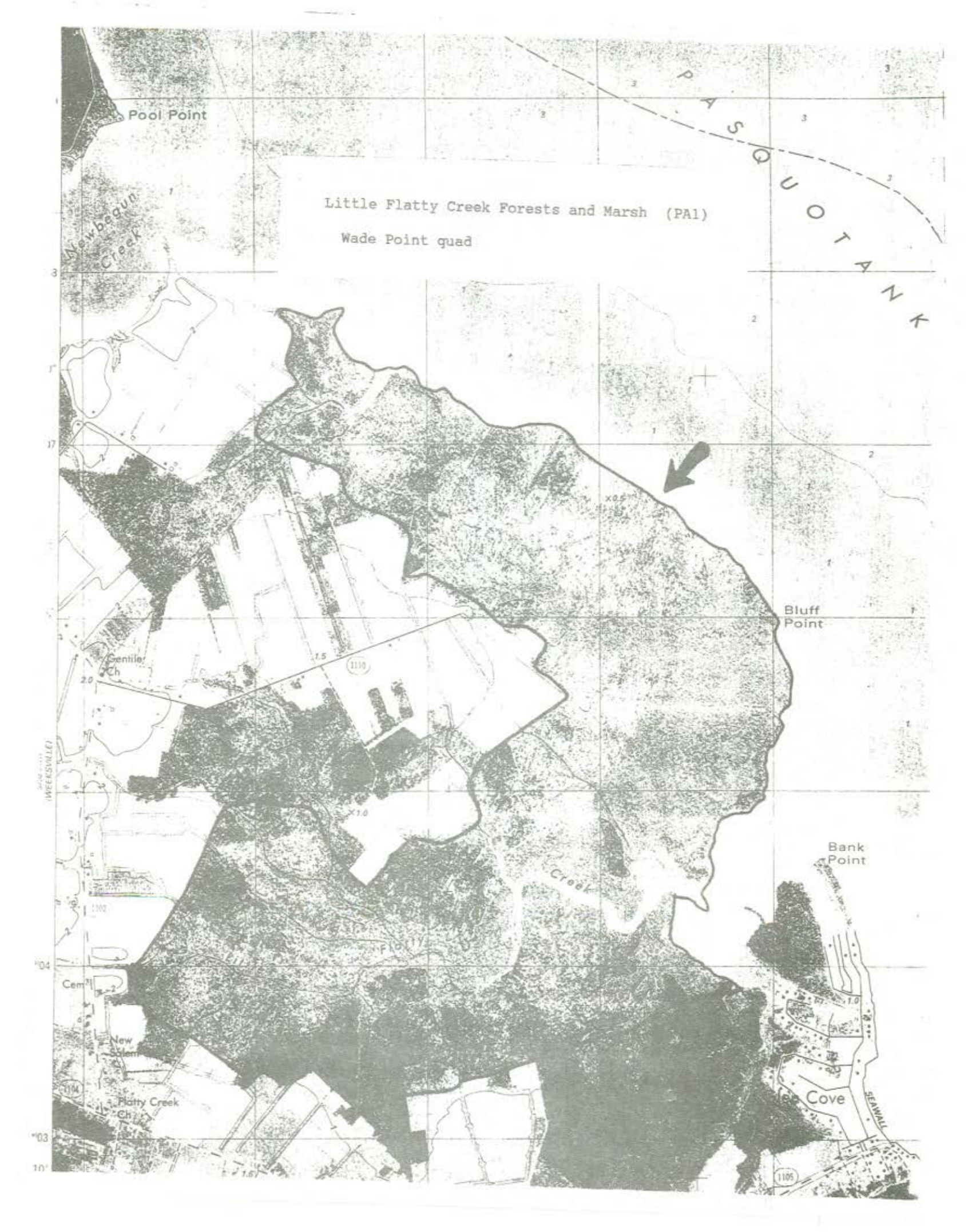
OWNERSHIP: Private; over a dozen owners

PROTECTION STATUS: None

RECOMMENDATIONS FOR MANAGEMENT OR PROTECTION: A few spots within the natural area have been logged in recent years, and logging is certainly a high threat to the hardwood flats. The marshes need to be burned on a more frequent basis than is occurring at present to control invasion by woody plants. Because of the State significance given to the site, it is hoped that eventually much of the site, especially the hardwood flats, can be permanently protected by acquisition by a public agency or private organization. It is hoped that the N.C. Division of Coastal Management will eventually expand their Coastal Reserve system to include sites away from the immediate coast, such as this site and others near the shores of Albemarle Sound. Certainly, this agency might be a lead for protection, as might the N.C. Wildlife Resources Commission. Private conservation groups should also seek protection for hardwood flats, both wetland and upland, either at this site or others in the State's Coastal Plain.

COMMENTS: Much more field survey work is needed at this site, especially to examine the condition of the hardwood forests that extend to the shoreline of the Pasquotank River, north of the creek. It is expected that some of these forests have been cut-over (based on previous experience elsewhere), but aerial photos show extensive upland forests reaching to the river. The animal life of the site is not well known, but species diversity is expected to be quite high, particularly since wet oak forests provide an abundance of mast for mammal and bird consumption.

REFERENCES: Frost (1989s)


Little Flatty Creek Forests and Marsh (PA1)
Wade Point quad
Pool Point
Newbegun Creek
PASQUOTANK
Bluff Point
Gentile Ch
Bank Point
Creek
Cem
New Salem
Platty Creek Ch
Cove
SEAWALL

SITE NAME: Big Flatty Creek Forests and Marshes

SITE NUMBER: PA2 SIZE: about 3700 acres

SITE SIGNIFICANCE: B (State)

LOCATION: Southeastern portion of Pasquotank County; located from Wade Point westward along the shore of Albemarle Sound, extending northwestward to Big Flatty Creek. The area is bounded by SR 1103 on the west and SR 1104 on the north.

QUAD MAPS: Wade Point, Weeksville

SIGNIFICANT FEATURES:

1. This natural area contains the largest extent of remnant oak flats, particularly Nonriverine Wet Hardwood Forest natural community, north of Albemarle Sound and one of the most extensive in the state.
2. Big Flatty Creek is extremely shallow, and a rare and unusual freshwater tidal flat community is present. The rare species Carolina lilaeopsis (Lilaeopsis carolinensis) is found in this community.

GENERAL DESCRIPTION:

Much of Pasquotank County originally supported extensive stands of hardwood flats, both Nonriverine Wet Hardwood Forest and Mesic Mixed Hardwood Forest communities, based on the topography, soils, and remnant vegetation still remaining. Forests in the extreme southeastern corner of the county have not been completely cleared for agriculture or timber production, as have those elsewhere in the county. Extensive areas of over 100 acres each still remain with mature hardwood forests. These areas extend from the Big Flatty Creek vicinity eastward to Wade Point. Moreover, Big Flatty Creek is the shallowest body of water of its size in northeastern North Carolina (Frost 1989aa). Most of the creek and the bay at its mouth are barely navigable by a small boat. There is a broad clay flat underlying the bay and creek, and a remarkable aquatic plant community is present where these shallow flats border tributaries like Indian Creek.

The hardwood flats that cover much of the natural area are dominated by oak species and are considered to be Nonriverine Wet Hardwood Forests. Cherrybark oak (Quercus pagoda) is the most common species, but swamp chestnut oak (Q. michauxii) may be locally dominant. Willow oak (Q. phellos), sweetgum (Liquidambar styraciflua), and loblolly pine (Pinus taeda) are other components of the canopy. The locally uncommon shagbark hickory (Carya ovata) is found in the subcanopy, as are American hornbeam (Carpinus caroliniana) and a few other species. Shrubs and herbs are sparse in the more mature areas. According to Frost (1989aa), this natural area contains more acreage of hardwood flats still remaining in reasonably intact condition than any other site in the A/P Study area, and is certainly one of the most extensive stands in the state. It should be pointed out that these flats are not in one continuous stand; they are located on flats separated from others by a handful of tidal creeks (tributaries of Big Flatty Creek and Albemarle Sound).

Between the hardwood flats are creeks lined with cypress-gum vegetation. These Tidal Cypress-Gum Swamp communities feature either bald cypress

(Taxodium distichum) or swamp tupelo (Nyssa biflora) in the canopy; they often occur in single-species stands. The understory layer varies greatly in density, but the shrub layer is usually sparse.

Along the lower portion of Indian Creek, which lies just west of the Frog Island community, are fresh to brackish marshes (Oligohaline Marsh natural community). The shoreline is dominated by tall graminoids often 6 or more feet tall. The relatively uncommon wildrice (Zizania aquatica) grows in this zone with big cordgrass (Spartina cynosuroides) and sawgrass (Cladium jamaicense), all of which are locally abundant. Portions of the marshes between the shoreline zone and the forests contain stands of narrow-leaf cattail (Typha angustifolia), particularly in deeper water and adjacent to shallow pools. The uncommon Carolina mosquito fern (Azolla caroliniana) is present in these pools. These marshes have apparently not been burned in over 15 years, and some woody succession is taking place. Some portions of the marshes have bald cypress invasion; others are succeeding to loblolly pine, swamp tupelo, sweetgum, or red maple (Acer rubrum).

An unusual aquatic community is present along the margin of Big Flatty Creek near the mouth of Indian Creek. Frost (1989aa) considers the community as freshwater tidal flats, a rare landform in North Carolina. In the shallow water, common hornwort (Ceratophyllum demersum), southern naiad (Najas quadalupensis), small pondweed (Potamogeton pusillus), and wild-celery (Vallisneria americana) are abundant. On the flats, which are irregularly flooded by wind and lunar tides, grow species uncommon in the A/P Study area, such as horned pondweed (Zannichellia palustris), Nuttall's water-weed (Elodea nuttallii), and the State Threatened Carolina lilaeopsis (Lilaeopsis carolinensis).

OWNERSHIP: Private; multiple ownership

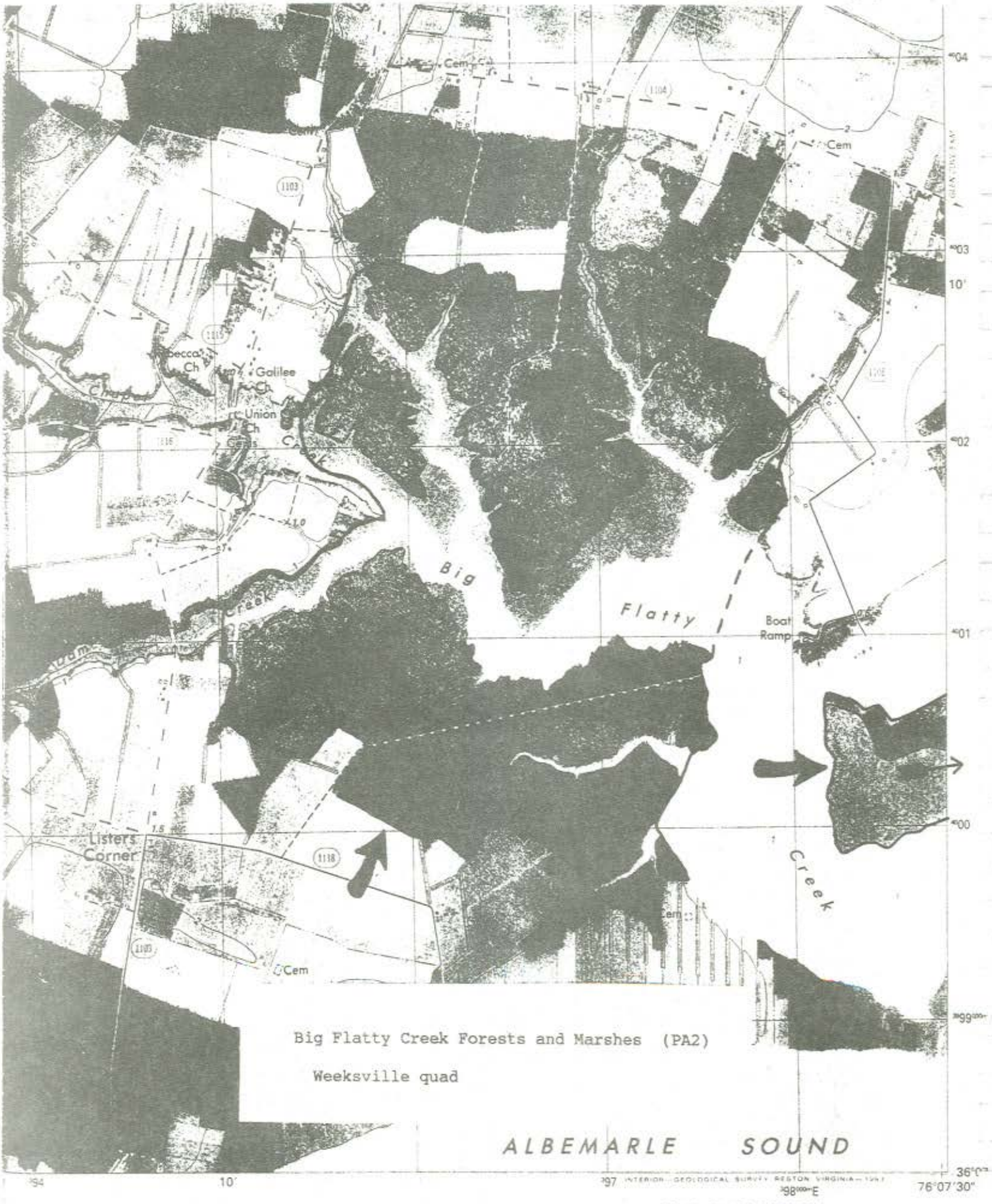
PROTECTION STATUS: None

RECOMMENDATIONS FOR MANAGEMENT OR PROTECTION: The mature hardwood forests should be protected from logging. Because bald eagles (Haliaeetus leucocephalus) are occasionally seen along this portion of Albemarle Sound, mature loblolly pines near the shore need to remain uncut, since this species usually chooses a very tall pine near a shoreline for the nest site. The marshes badly need burning to maintain herbaceous species diversity. This is another large natural area that might make an excellent Coastal Reserve unit for the N.C. Division of Coastal Management, if this agency begins to acquire natural areas removed from the immediate coastline. The site's location along Albemarle Sound makes it a candidate for Coastal Management interest. Private conservation groups are also urged to look into the protection of high quality examples of nonriverine hardwood forests, both wetlands and upland flats. These communities are extremely poorly protected in North Carolina.

COMMENTS: Considerable portions of the natural area were not surveyed for lack of time, and most field work was done by boat. A noteworthy research project would be to determine the manner of woody succession and species composition in these fresh to slightly brackish marshes, and to determine why

some marshes succeed to woody vegetation with fire exclusion and others seemingly remain in herbaceous vegetation indefinitely.

REFERENCES: Frost (1989aa)



Big Flatty Creek Forests and Marshes (PA2)

Weeksville quad

ROAD CLASSIFICATION

Primary highway, hard surface

Light-duty road, hard or improved surface

Secondary highway,

Cem
Wade Point
Big Flatty Creek
880 000 FEET
2 860 000 FEET
36°07'30"
76°07'30"
'00
'01
'02
'03
'04
5'
Big Flatty Creek Forests and Marshes (PA2)
Wade Point quad
A R L E
Produced by the United States Geological Survey
Control by USGS and NOS NOAA
Orthophotomap prepared from aerial photograph taken
SCALE 1:24 000
KILOMETERS
METERS
1000
STEVENSON POINT)

SITE NAME: Great Dismal Swamp National Wildlife Refuge

SITE NUMBER: CA1 SIZE: about 24,600 acres

SITE SIGNIFICANCE: A (National)

LOCATION: Northeastern Gates County, extreme northern Pasquotank County, and northwestern Camden County; specifically, bounded on the east by US 17, bounded partly on the south by US 158, and bounded on the west by the Suffolk Scarp. The refuge also extends into adjacent Virginia.

QUAD MAPS: Corapeake, Sunbury, Lynchs Corner, Lake Drummond

SIGNIFICANT FEATURES:

1. The refuge contains some of the most extensive swamp forests on the Atlantic Coastal Plain, though the majority of the forests are not mature.
2. Several extensive stands of Atlantic white cedar (Chamaecyparis thyoides) occur on the refuge; stands of this tree have been and are being logged at a rapid rate in North Carolina, and few protected sites still remain. The stands on the refuge constitute the largest remaining body of white cedar anywhere.
3. Within the swamp forest are a few pocosin/shrub bogs. Also adding diversity to the refuge, on the North Carolina side, are several mesic "islands" of high ground in the southwestern portion of the refuge, vegetated in a Mesic Mixed Hardwood Forest natural community; and an unusual freshwater marsh, of unknown origin, is present just east of the Suffolk Scarp (see Site GA8 [Corapeake Marsh] for further information).
4. The extensive forest provides excellent habitat for a wide variety of animal species, especially the black bear (Ursus americanus). Significant populations of several uncommon warblers are also present.

GENERAL DESCRIPTION:

The Great Dismal Swamp occupies an extensive flat area of very recent origin, apparently being formed less than 9,000 years ago. The Suffolk Scarp, lying along the western boundary of the refuge, was the former shoreline, and the swamp was the nearshore floor of the ocean. As the ocean levels receded, the former ocean floor became "dry land" -- the Great Dismal Swamp.

The swamp originally was dominated by Atlantic white cedar (Chamaecyparis thyoides). Akerman (1923) considered 125,000 acres to be a conservative estimate of the original cover of the species. Bald cypress (Taxodium distichum), water tupelo (Nyssa aquatica), and swamp tupelo (N. biflora) were largely limited to the dendritic system of natural streams draining the swamp, which is now long vanished after canal construction, and to the wet zone along the toe of the Suffolk Scarp. However, extensive logging over the past 200 years, as well as drainage of the land by canals, has converted the majority of the forest to a middle-aged maple forest. Red maple (Acer rubrum) is the dominant tree over thousands of acres, with swamp tupelo also a dominant tree. Most of the cypress occurs near the western portion of the refuge.

The North Carolina portion of the refuge contains several thousand acres of Atlantic white cedar forest, mostly one to two miles south of the state line in the extreme corner of Camden County. Extensive stands of this tree have

become rare, because the wood provides high-quality timber for many uses, especially as poles, fences, and outdoor home construction.

The most diverse habitat in the swamp is the mesic "islands", which are low and narrow east-west trending ridges. These ridges are mainly located in the southeastern corner of the refuge, in Gates County. American beech (Fagus grandifolia) is a characteristic tree on such ridges, along with tuliptree (Liriodendron tulipifera) and various oak species (Quercus spp.). Several noteworthy plant species grow on these ridges, especially the southern twayblade (Listera australis), a "significantly rare" species of orchid. The uncommon and showy silky camellia (Stewartia malacodendron) is also a notable species. Though found in many of the counties in the lower Coastal Plain of the state, it is not common and is most often found growing with American beech on these mesic wooded ridges located within swamps. Log fern (Dryopteris celsa) grows in portions of the refuge, especially in the more mesic sites; this is an uncommon fern with its greatest abundance in the Dismal Swamp vicinity.

An excellent variety of birds nests in the refuge; Meanley (1973) lists 84 species. Probably the most significant are the Swainson's warbler (Limnothlypis swainsonii) and the black-throated green warbler (Dendroica virens). The Swainson's is uncommon throughout its range, and a moderately large population occurs in the swamp, especially on the Virginia side. The black-throated green warbler is a common species of northern coniferous forests, ranging through the Appalachians, but the mid-Atlantic population is quite disjunct. This coastal population extends from Dismal Swamp to the Charleston, South Carolina, area, and is perhaps nowhere more abundant than at Dismal Swamp. The most notable mammals in the refuge are the black bear (Ursus americanus) and the bobcat (Felis rufus). Interestingly the Federally Threatened Dismal Swamp southeastern shrew (Sorex longirostris fisheri) has not been taken from the refuge on the North Carolina side, but it is to be looked for in brushy places, clearcuts, and woodland borders along the refuge boundary.

OWNERSHIP: U.S. Fish and Wildlife Service (Great Dismal Swamp National Wildlife Refuge). There are several private holdings along the western and southern boundary of Federal land that lie within the proposed refuge boundary. Also, the State of North Carolina (Division of Parks and Recreation) owns 13,500 acres at the southeastern corner of Great Dismal Swamp; this is the undeveloped Dismal Swamp State Park (see Site CA2 [Dismal Swamp State Park] for more information).

PROTECTION STATUS: The Federally-owned portion of the refuge is protected as a National Wildlife Refuge. The North Carolina portion is a Registered Natural Heritage Area.

RECOMMENDATIONS FOR MANAGEMENT OR PROTECTION: Little management of the vegetation of the refuge is planned by the staff. The cypress-tupelo forests along the Suffolk Scarp should be allowed to mature. Management should be designed toward the maintenance of the cypress and white cedar communities, at the expense of the maple-gum community, plus restoration of some areas originally occupied by white cedar. Some of the canals and ditches likely will need to be blocked to return the area to a wetter hydrology. Any further

drying of the swamp will be detrimental. Some selective cutting, especially in maple areas, may be beneficial for wildlife populations and the possible re-establishment of white cedar, if the water table is raised by blocking ditches and canals. Efforts of the refuge forester to use controlled burns over the past 2 years for restoration of samples of pond pine (Pinus serotina) pocosin and other natural fire-dependent communities are to be commended.

Acquisition of privately owned tracts should also continue. This is especially important for those tracts that lie at the base of the Suffolk Scarp along the western edge of the refuge, as seepage from the adjacent terrace west of the scarp onto the lower terrace is important is keeping the swamp wet.

COMMENTS: Inventory work on plants and animals has been rather sporadic on the North Carolina side of the refuge. More intensive survey work seems necessary, such as surveys for Dismal Swamp southeastern shrew, dwarf trillium (Trillium pusillum), and shield ferns (Dryopteris spp.), all of which probably occur on the North Carolina side of the refuge.

REFERENCES: Meanley (1973), Musselman et al. (1977), Kirk (1979), United States Department of the Interior (1979), Frost (1982), U.S. Fish and Wildlife Service (1986)

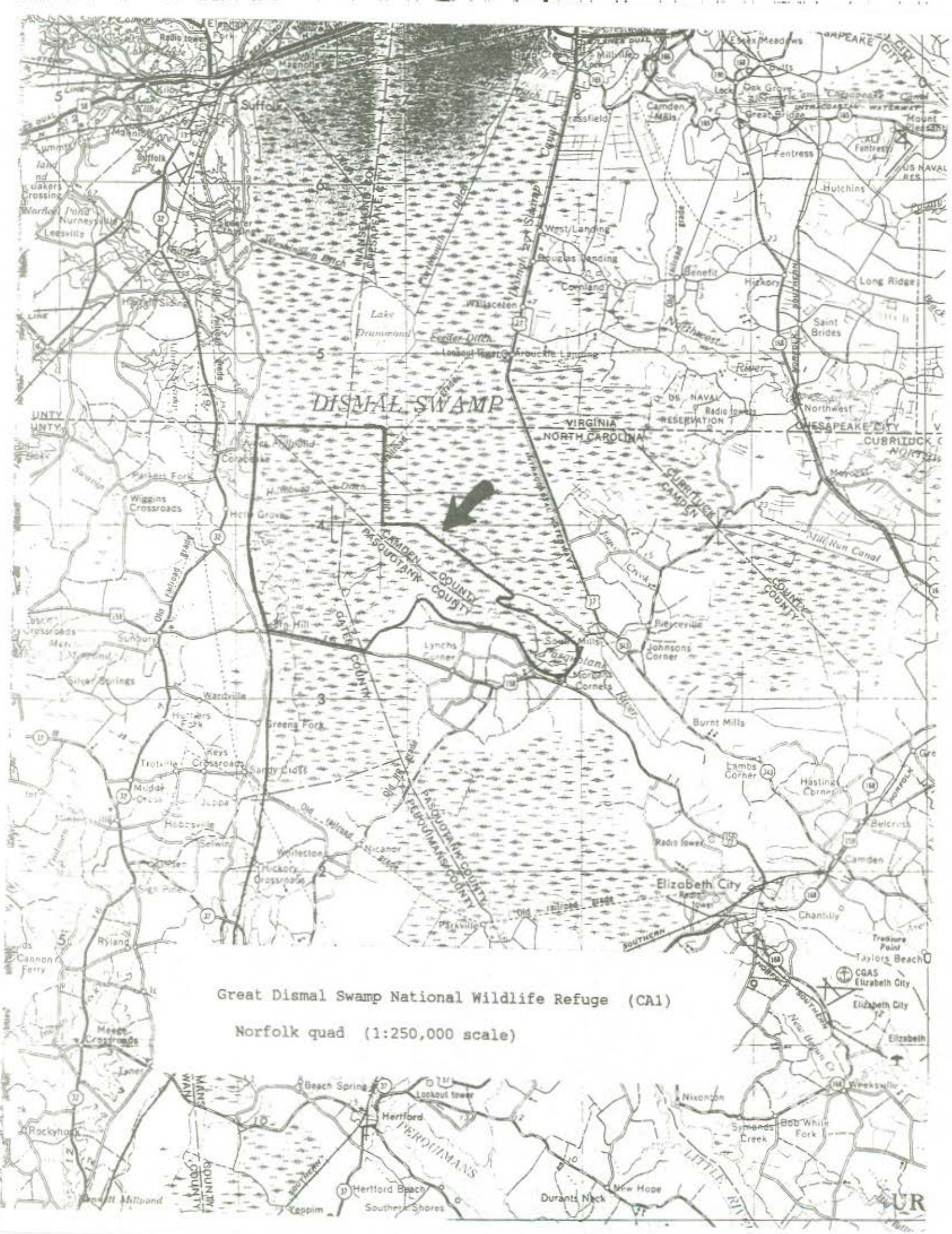

DISMAL SWAMP
VIRGINIA
NORTH CAROLINA
Suffolk
Elizabeth City
Camden
Hertford
Lake Drummond
Feeder Ditch
Lookout Tower
Great Bridge
Deep Creek
Chesapeake City
Northwest River
Dismal Swamp Canal
Pasquotank River
Perquimans River
Camden County
Pasquotank County
Perquimans County
Gates County
Currituck County
Mill Run Canal
Jericho Canal
Burnt Mills
Lambs Corner
Johnsons Corner
Lynchs Corner
Wardville
Sunbury
Hobbsville
Whiteston
Nicanor
Parkville
Pierceville
Chantilly
Taylors Beach
Treasure Point
Hastings Corner
Belcross
Wrecksville
Nixonton
Bob White Fork
Symonds Creek
Beach Spring
Hertford Beach
Southern Shores
Durants Neck
New Hope
Rocky Hock
Meads Crossroads
Ryland
Cannon Ferry
Wiggins Crossroads
Parkers Fork
Keys Crossroads
Sandy Cross
Greens Fork
Hunters Fork
Silver Springs
Trotville
Muddy Creek
Juppa
Selwin
Deep Creek
Oak Grove
Camden Mills
Grassfield
Fentress
Hutchins
West Landing
Douglas Landing
Cornland
Wallaceton
Benefit
Hickory
Long Ridge
Saint Brides
Northwest
Corapeake
Harris Hill
Mt. Hill
Old railroad grade
Great Dismal Swamp National Wildlife Refuge (CA1)
Norfolk quad (1:250,000 scale)

Figure 16. Significant natural areas in Perquimans County. The areas are numbered generally in a north to south, or west to east, manner; see Table 7 and the Inventory of Sites section for further information.


PE1
PE2
PE3
PE4
ALBEMARLE SOUND

SITE NAME: Belvidere Natural Area

SITE NUMBER: PE1 SIZE: about 145 acres

SITE SIGNIFICANCE: C (Regional)

LOCATION: Northwestern portion of Perquimans County; located on the western shore of the Perquimans River immediately north of NC 37, about 0.5 mile northwest of the town of Belvidere.

QUAD MAP: Hobbsville

SIGNIFICANT FEATURES:

1. Though the site is rather small (less than 150 acres) for a floodplain natural area, it contains examples of floodplain ridges and swamp forest. Notable plants include Carolina mosquito fern (Azolla caroliniana) and wintergreen (Gaultheria procumbens).

GENERAL DESCRIPTION:

The Perquimans River in the northwestern part of Perquimans County is considerably smaller in size than the wide, drowned portion of the river in the southern part of the county. The floodplain is approximately 1/2 mile in width. Immediately north of NC 37 are several low floodplain islands or ridges that are vegetated in a Mesic Mixed Hardwood Forest, Swamp Island subtype natural community. The tall canopy on the largest island is partially open, mainly because of selective logging in the past. Loblolly pine (Pinus taeda) and southern red oak (Quercus falcata) are the dominants. There is a high diversity of understory species, such as American beech (Fagus grandifolia), sourwood (Oxydendrum arboreum), and flowering dogwood (Cornus florida). The shrub and small tree zone is exceptionally rich, and a surprising number of species of rather dry, sandy sites are present, including dwarf pawpaw (Asimina parviflora), chinkapin (Castanea pumila), witch hazel (Hamamelis virginiana), and wintergreen (Gaultheria procumbens).

Portions of this island are somewhat wetter, and the canopy features sweetgum (Liquidambar styraciflua), water oak (Quercus nigra), laurel oak (Q. laurifolia), and several other species. The subcanopy is dominated by American holly (Ilex opaca), and sweet pepperbush (Clethra alnifolia) is abundant in the shrub zone.

The forest surrounding the islands -- a Tidal Cypress-Gum Swamp -- is typical of those elsewhere in the A/P Study area. Bald cypress (Taxodium distichum) dominates near the river and near land shorelines, whereas swamp tupelo (Nyssa biflora) dominates in nearly pure stands in interior sections. An uncommon, aquatic fern is found in this habitat -- Carolina mosquito fern (Azolla caroliniana).

The animal life at the site is poorly known, as the site visit was made in October, when few birds are singing and reptiles and amphibians are not conspicuous. Red-shouldered hawk (Buteo lineatus) is present in the swamp.

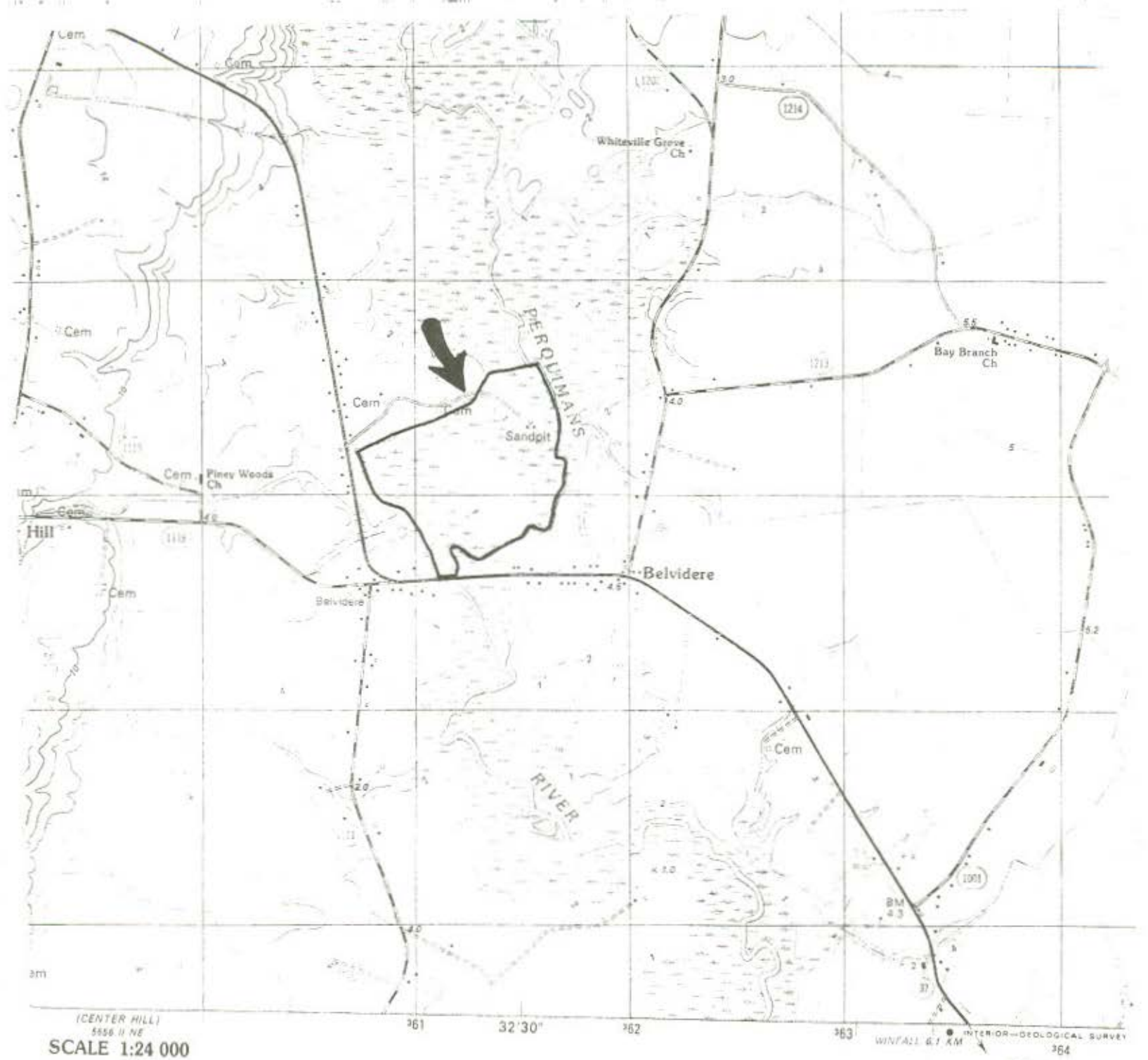
OWNERSHIP: A portion is owned by the N.C. Department of Transportation, whereas the second owner is a private timber company.

PROTECTION STATUS: None

RECOMMENDATIONS FOR MANAGEMENT OR PROTECTION: The forests should be protected from logging. The Department of Transportation maintains a sandpit pond that extends into the area near the northern boundary. Part of the sand road to the pond is lined with garbage; this area needs to be cleaned up, but it is unlikely that unwarranted visitations can be eliminated unless the road is gated. The best protection might be initiated by Perquimans County government, and the site would be suitable for a local park or preserve.

COMMENTS: Though most swamps tend to be somewhat alike in vegetation, the floodplain islands in the A/P Study area vary considerably in composition. The most common type of vegetation on an island is mesic forest featuring American beech as a dominant tree, but others are rather xeric, including portions of the largest island in the natural area. Some islands are rather hydric and feature bottomland tree species.

REFERENCES: Frost (1989v)



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OLOGICAL SURVEY, RESTON, VIRGINIA 22092
PHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST

Belvidere Natural Area (PE1)

Hobbsville quad

QUADRANGLE LOCATION

CONTOURS AND ELEVATIONS IN METERS

ROAD CLASSIFIC

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Secondary highway, hard surface — Un

Interstate Route U. S.

H SE

DA

SITE NAME: Yeopim Creek Oak Slopes

SITE NUMBER: PE2 SIZE: about 510 acres

SITE SIGNIFICANCE: C (Regional)

LOCATION: Extreme southern Perquimans County; located just west and north of the Snug Harbor community, bounded on the east by Yeopim Creek and on the south by SR 1340.

QUAD MAP: Yeopim River

SIGNIFICANT FEATURES:

1. The natural area contains a mature hardwood forest, primarily of oak species in the canopy, on rolling slopes. A small amount of upland flat habitat is also present. High quality upland forests are rather rare in the A/P Study area.
2. A mature swamp forest is present in the natural area; the forest has potential for nesting by osprey (Pandion haliaetus) and bald eagle (Haliaeetus leucocephalus), both of which have been seen in the area.

GENERAL DESCRIPTION:

The landscape near Snug Harbor in southern Perquimans County is essentially a flat terrace, with gently rolling slopes within several hundred yards of a stream. Yeopim Creek and an unnamed tributary have eroded into the terrace, creating gentle slopes, with a change of elevation of just 10-12 feet from terrace to creek bottom. Nearly all of the forests in this part of the county have been cleared or cut-over, but a stand of over 500 acres is nearly intact.

Most of the forest contains upland hardwoods, with the primary natural communities being Mesic Mixed Hardwood Forest, Bluff/Slope subtype and Mesic Mixed Hardwood Forest, Upland Flats subtype, along with minor elements of Dry-Mesic Oak-Hickory Forest. The communities occur on the slopes and gently rolling flats and are primarily composed of oak species in the canopy, which is somewhat unusual for slope communities in the lower Coastal Plain. Oaks such as white (Quercus alba), cherrybark (Q. pagoda), southern red (Q. falcata), swamp chestnut (Q. michauxii), and Shumard (Q. shumardii) are present in the canopy, with southern red oak being most numerous. American beech (Fagus grandifolia) and several other species are also found in the canopy. The subcanopy is very diverse, again with no dominant species. Frost (1989m) counted 18 species of shrubs in this community in a single site visit; this is an excellent diversity for a hardwood forest site. Shrubs near the southeastern or eastern edge of the range here include black huckleberry (Gaylussacia baccata), early lowbush blueberry (Vaccinium vacillans), and bigleaf snowbell (Styrax grandifolia). Several fern species are common in the herb layer.

The terrace flats are vegetated in a Mesic Mixed Hardwood Forest, Upland Flats subtype, and in slightly moister places, a Nonriverine Wet Hardwood Forest. The forests on the flats are only of medium age. White oak is the dominant species, with cherrybark oak also fairly important. Swamp chestnut oak is believed by Frost (1989m) to be prominant in this community at

maturity, but it was not seen in a site visit. One slightly wetter spot in this forest contains a mature stand of willow oak (Q. phellos).

Yeopim Creek is lined by a Tidal Cypress-Gum Swamp natural community, featuring swamp tupelo (Nyssa biflora) as the dominant tree, along with occasional bald cypresses (Taxodium distichum). Red maple (Acer rubrum) is the dominant understory tree; common in the shrub layer are swamp doghobble (Leucothoe racemosa), sweet pepperbush (Clethra alnifolia), and Virginia willow (Itea virginica).

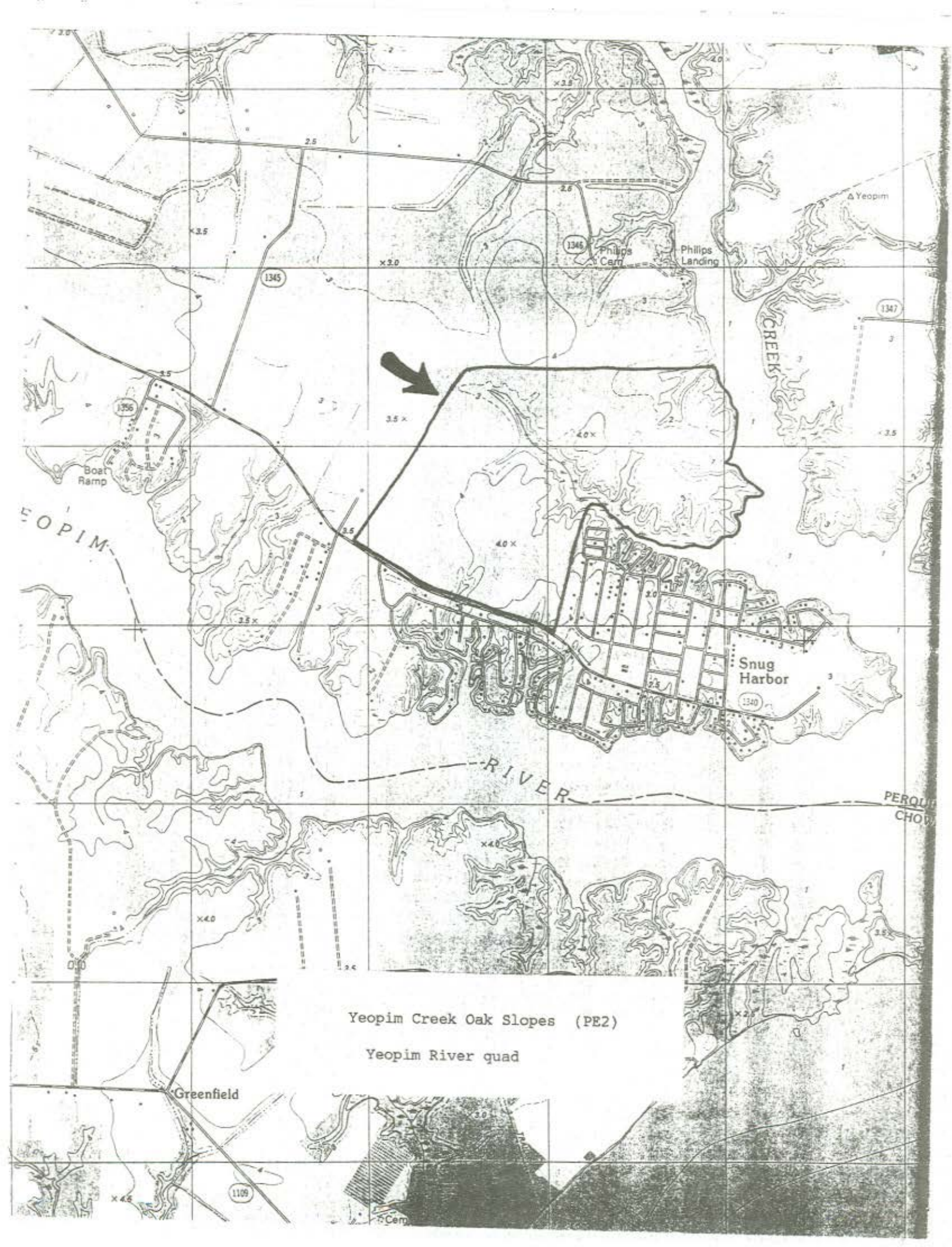
OWNERSHIP: Private

PROTECTION STATUS: None

RECOMMENDATIONS FOR MANAGEMENT OR PROTECTION: It should be assumed that the forest is in imminent danger of being timbered or developed. The forest lies immediately west of the Snug Harbor development, and timbered land is common in the uplands surrounding the forest. Timber harvest has occurred in the natural area on a number of separate occasions, with portions within the natural area having been logged perhaps 50 or more years ago. Most of the wooded uplands to the west and north have been logged in the past decade. No management of the site is necessary, other than preventing timbering or development of the natural area. Because Perquimans County has no protected natural areas, public or private, it seems that the site would make an excellent county park or preserve, with nature trails and a few other facilities.

COMMENTS: The wildlife value of the site is not well known. The upland forests are likely important to nesting songbirds. Osprey (Pandion haliaetus) likely nests in the vicinity of the site, and the species was seen during a site visit. A bald eagle (Haliaeetus leucocephalus), a Federally Endangered species, was also seen approximately 1 mile from the site; it likely does not nest nearby, though habitat appears somewhat suitable.

REFERENCES: Frost (1989m)



Yeopim Creek Oak Slopes (PE2)

Yeopim River quad

SITE NAME: Menzie's Pond

SITE NUMBER: PE3 SIZE: about 915 acres

SITE SIGNIFICANCE: B (State)

LOCATION: Extreme southern portion of Perquimans County; located on Harveys Neck, immediately north and east of the Holiday Island development.

QUAD MAPS: Harvey Neck, Yeopim River

SIGNIFICANT FEATURES:

1. The natural area contains a rare example of a natural pond created by a barricading of an embayed creek by sedimentation, perhaps from storms.
2. A most unusual "quaking bog" occurs along the perimeter of the pond. This bog contains a remarkable diversity of plant species, especially herbs; the rare Carolina lilaeopsis (Lilaeopsis carolinensis) is present in the bog.
3. There is an excellent example of old-growth Nonriverine Wet Hardwood Forest, as well as a Mesic Mixed Hardwood Forest on gentle slopes. Mature remnants of both types are becoming increasingly rare in the state because of timber cutting. Oaks on the hardwood flat were the largest found during the A/P Study.

GENERAL DESCRIPTION:

This natural area features several highly unusual and rare landforms and communities for North Carolina. Menzie's Pond is a natural pond along the lower portion of Menzies Creek. At some time in the past, sediment barricaded the embayed portion of the creek, leaving a natural pond, apparently with the flow to the adjacent Albemarle Sound leaving the pond by percolation through the mineral soil berm across its mouth. Such ponds, over time, generally begin to fill in as a result of sedimentation and peat formation, and Menzie's Pond shows a "quaking bog" or floating mat of soil and vegetation along its perimeter, extending for more than a mile in distance! This mat "shakes" when walked on, and one can easily break through the mat unless care is taken.

The pond itself contains pillow-like masses of submerged plants, mainly southern naiad (Najas guadalupensis), but also common hornwort (Ceratophyllum demersum). The "quaking bogs", which defy the present natural community classification for North Carolina (Schafale and Weakley 1985), can best be included in the Coastal Plain Semipermanent Impoundment natural community for this report, though certainly this community classification is extremely heterogeneous. The bog is apparently similar in structure and dynamics to typical quaking bogs of boreal wetlands, but obviously there is a near complete difference in plant species between this site and the northern bogs. Scattered small bald cypresses (Taxodium distichum), red maples (Acer rubrum), and shrubs are present, but the bulk of the vegetation on the mat is a remarkable variety of herb species. Frost (1989u) counted 56 species of plants in a brief survey in November 1989, certainly not the best time of year for such a survey. Notable species of the mat include Carolina mosquito fern (Azolla caroliniana), common watergrass (Hydrochloa caroliniensis), and the State Threatened Carolina lilaeopsis (Lilaeopsis carolinensis).

Portions of the natural area feature swamps typical of the tidal cypress-gum swamp natural community found elsewhere in better condition in the A/P Study area. The shoreline vegetation along Albemarle Sound contains a few species of herbs not found elsewhere in the natural area, such as stout wood-reedgrass (Cinna arundinacea) and salt meadow cordgrass (Spartina patens). Dense green carpets of herbaceous plants are also found along the shore; dominant are Carolina lilaeopsis, water pimpernel (Samolus parviflorus), and coast rose-gentian (Sabatia calycina). Bald cypress forms a fringe along the shore, but there is an impressive white clay scarp along the shore at the eastern end of the area.

Highly significant in the natural area, primarily on the flats in the eastern portion, is an outstanding example of mature Nonriverine Wet Hardwood Forest community, perhaps the best example remaining north of Albemarle Sound in the state. The average trunk diameter of the canopy trees is approximately 20 inches, with some reaching over 50 inches. Dominant are cherrybark oak (Quercus pagoda) and swamp chestnut oak (Q. michauxii), with a lesser amount of shagbark hickory (Carya ovata). The open understory features mesic species such as American hornbeam (Carpinus caroliniana), hop hornbeam (Ostrya virginiana), and American beech (Fagus grandifolia). Leading from the oak flat to the fingers of swamp forest are gentle slopes vegetated with Mesic Mixed Hardwood Forest. American beech is the dominant, as expected, but surprising on such gentle slopes this far east in the state is galax (Galax aphylla).

The wildlife value of the site is probably significant. Ospreys (Pandion haliaetus) occur along the shoreline, and a bald eagle (Haliaeetus leucocephalus) was seen by Frost (1989u) in October 1989.

OWNERSHIP: Private; multiple owners

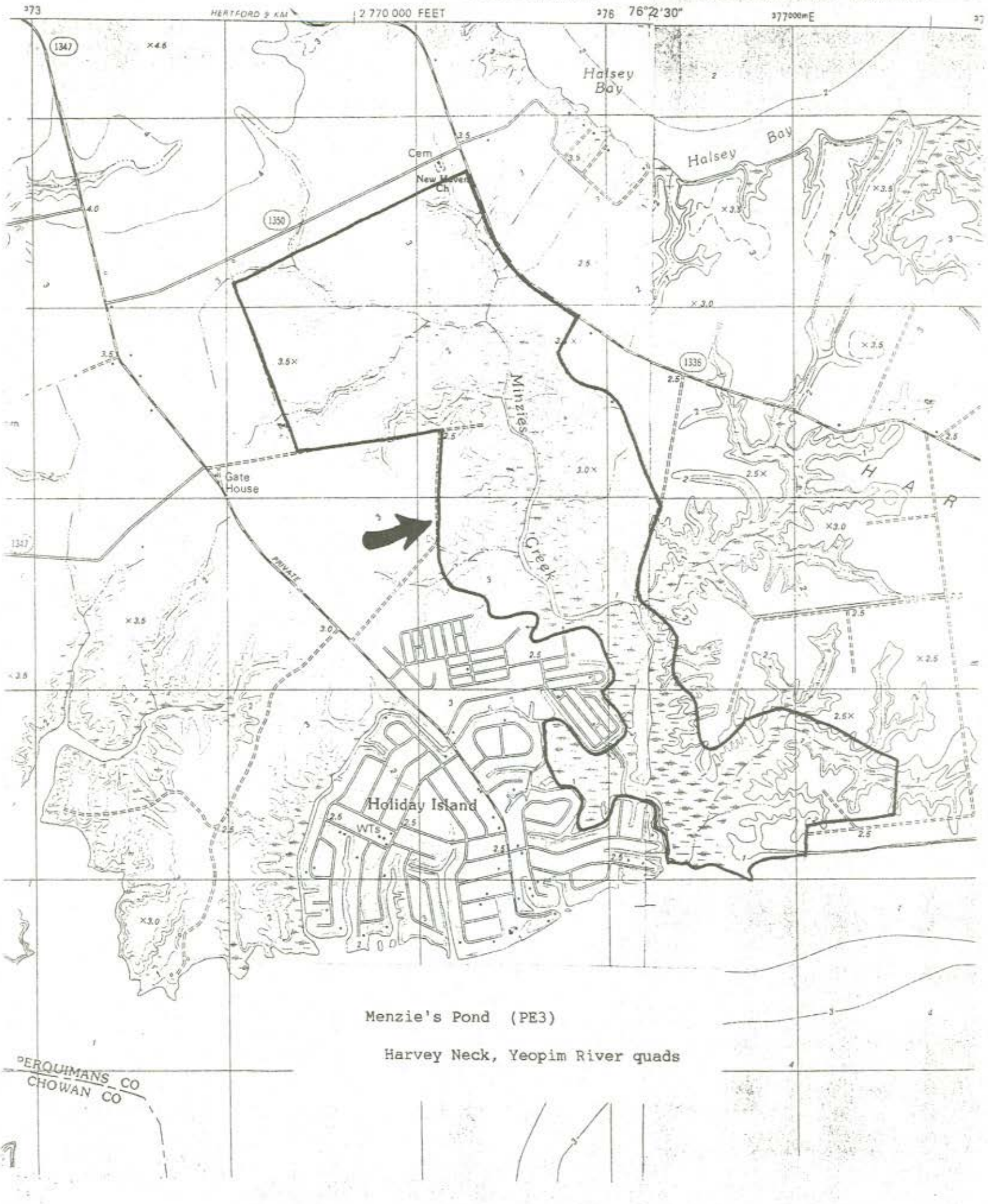
PROTECTION STATUS: None

RECOMMENDATIONS FOR MANAGEMENT OR PROTECTION: The oak flats are very vulnerable to logging because of the large size of the trees, and it is important to protect this portion of the site from timber harvest. Cutting would also negatively impact the swamp forest, but the most critical forest for protection is the oak flat. Menzie's Pond also needs protection from channelization or treatment with herbicides. The Holiday Island development has a channel cut into the side of the pond that apparently is not presently doing any damage to the pond's vegetation, as yet. The N.C. Natural Heritage Program or private conservation groups might be the best agencies to arrange protection in the form of registry or easement agreements. Acquisition of the pond or the oak flat is a possible option, as these features (natural pond, quaking bog, and mature oak flats) are possibly, collectively, of National significance.

COMMENTS: Considerably more field work is needed. A review of the spring and summer flora of the quaking bog is warranted. Exploration of the forests and flats in the northern half of the area is a high priority. The bog around the margin of the pond is somewhat unique in the state, though a few other

floating bogs are known from elsewhere in the Coastal Plain, particularly where beaver ponds are beginning to fill in with sediment.

REFERENCES: Frost (1989u)



Menzie's Pond (PE3)

Harvey Neck, Yeopim River quads

SITE NAME: Perquimans River Cherrybark Oak Flats

SITE NUMBER: PE4 SIZE: about 140 acres

SITE SIGNIFICANCE: B (State)

LOCATION: Southeastern portion of Perquimans County; located on the north shore of the Perquimans River, between SR 1319 and SR 1320.

QUAD MAP: Nixonton

SIGNIFICANT FEATURES:

1. The natural area probably contains the best example of a mesic hardwood flat forest in the state. Such a forest type is considered a Mesic Mixed Hardwood Forest, Upland Flats subtype natural community in this report.
2. There is an exceptionally diverse aquatic plant flora in the river and in pools in the natural area.
3. The area contains probably the largest population in the state for Carolina lilaeopsis (Lilaeopsis carolinensis), a Threatened plant species in North Carolina.

GENERAL DESCRIPTION:

This site contains a mature and pristine hardwood forest, dominated by oaks, on an upland flat and on gentle slopes along the northeastern shore of the embayed Perquimans River. There are isolated pools in the natural area; a distinctive flora is present in the pools that is not found elsewhwere in the vicinity. Swamp forests are found along the ravines.

The shallow waters of the Perquimans River estuary contain extensive beds of submersed aquatic plants. Dominant in large patches are Eurasian water-milfoil (Myriophyllum spicatum), an introduced species, and the native wild-celery (Vallisneria americana). Also common are southern naiad (Najas guadalupensis), sago pondweed (Potamogeton pectinatus), and clasping-leaf pondweed (P. perfoliatus). Waters of this small estuary are the clearest in the Albemarle Sound region and appear to represent an isolated pocket of exceptionally high water quality.

Areas along the narrow stream corridors in the natural area contain swamp forests. Farthest from the river, near the heads of these streams, bald cypress (Taxodium distichum) is the dominant tree. Understory trees include pumpkin ash (Fraxinus tomentosa), swamp tupelo (Nyssa biflora), and sweetgum (Liquidambar styraciflua). Other swamps occur essentially at sea level near the river. These Tidal Cypress-Gum Swamps feature water tupelo (N. aquatica) in the deeper water, but swamp tupelo is dominant in the shallower water. Large pools are present within the swamp forest, and some of them contain extensive patches of the state Threatened Carolina lilaeopsis (Lilaeopsis carolinensis). Another aquatic species that is uncommon in the state -- American frogbit (Limnobium spongia) -- is abundant in shady pools near the swamp mouth.

By far the most significant communities occur on the upland flats and gentle slopes. On the flats is a mature forest that is considered in this report to represent Mesic Mixed Hardwood Forest, Upland Flats subtype natural community. Cherrybark oak (Quercus pagoda) and American beech (Fagus

grandifolia) dominate the flats. White oak (Q. alba) and loblolly pine (Pinus taeda) are also common in the canopy. The understory is less well developed, but features trees such as hop hornbeam (Ostrya virginiana), American hornbeam (Carpinus caroliniana), and sourwood (Oxydendrum arboreum). The shrub layer is sparse, but giant cane (Arundinaria gigantea) dominates some areas. The slopes, a Mesic Mixed Hardwood Forest, Bluff/Slope subtype, is dominated by cherrybark oak and swamp chestnut oak (Q. michauxii). Hop hornbeam dominates the understory. These gentle slopes are noticeably different in flora than on the steeper slopes farther west in the Coastal Plain, which feature beech and white oak as dominants. The slopes in this natural area are gentle enough that typically floodplain species such as cherrybark and swamp chestnut oaks are dominant.

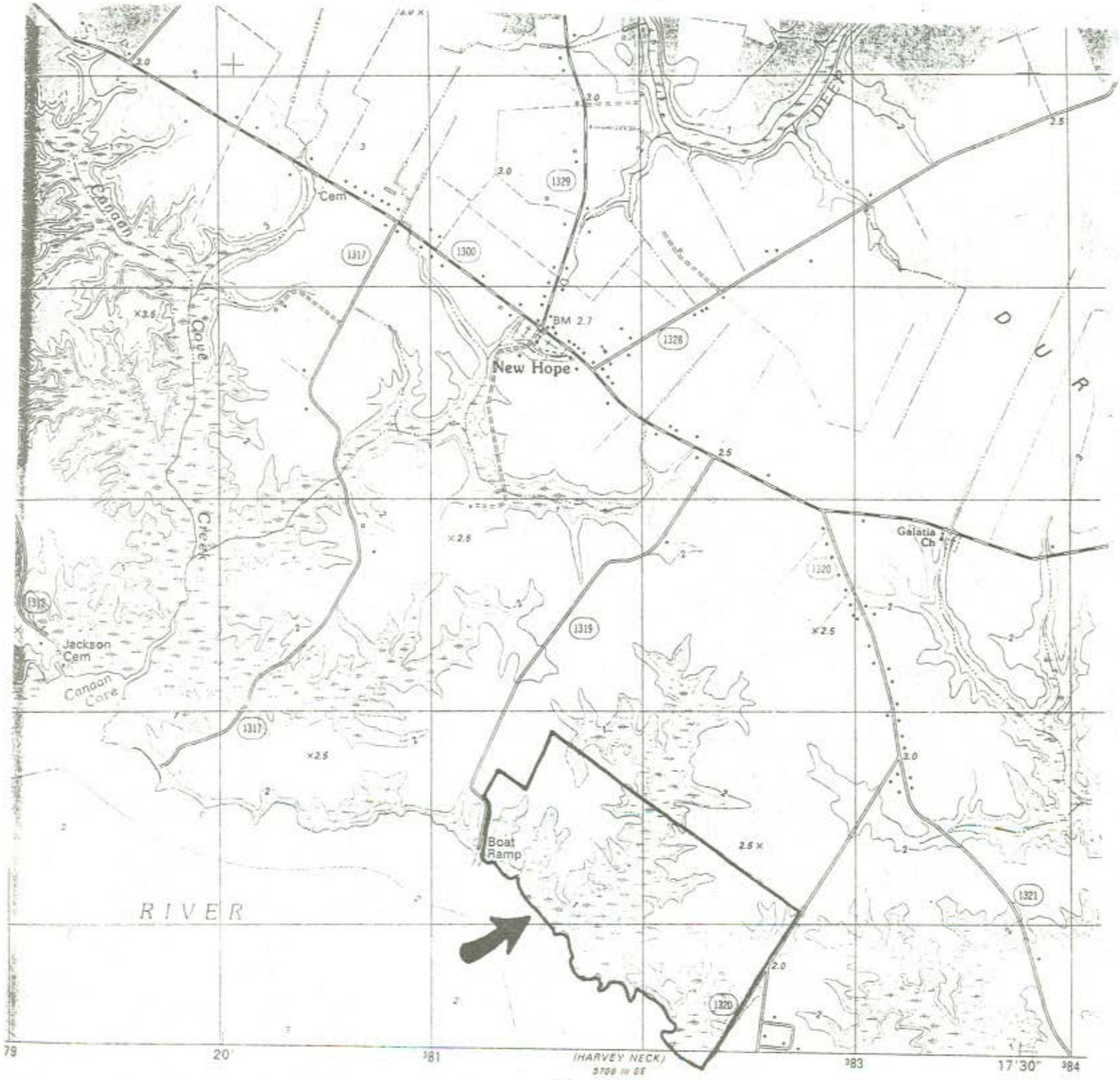
OWNERSHIP: Private; several owners, but most of the natural area under one ownership

PROTECTION STATUS: None

RECOMMENDATIONS FOR MANAGEMENT OR PROTECTION: This is one of the highest priority upland forests in the Coastal Plain for protection, as such stands have nearly all been cleared for agriculture or have been timbered. Any timber harvest would be detrimental. The site has mature trees and is very aesthetically pleasing, featuring a number of natural communities. The best protection option would be acquisition or obtaining an easement by a private conservation group. Registry with the N.C. Natural Heritage Program is another protection measure.

COMMENTS: The pools in the natural area, numbering perhaps 50 or more, need additional survey for uncommon to rare plants. They contain potential habitat for Conferva pondweed (Potamogeton confervoides), yellow water-crowfoot (Ranunculus flabellaris), and American featherfoil (Hottonia inflata). Further work on classification of natural communities of mesic sites in the lower Coastal Plain is needed, as it seems improper to be lumping communities on upland flats in the lower Coastal Plain with those on fairly steep slopes in the western Coastal Plain as "Mesic Mixed Hardwood Forests". Although the Upland Flats is distinguished as a distinct subtype of community in this report, it may warrant full natural community status.

REFERENCES: Frost (1989o)



SCALE 1:24 000

Perquimans River Cherrybark Oak Flats (PE4)

Nixonton quad

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CLINATION AT CENTER OF SHEET

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OTHER ELEVATIONS SHOWN TO THE NEAREST 0.5 METER
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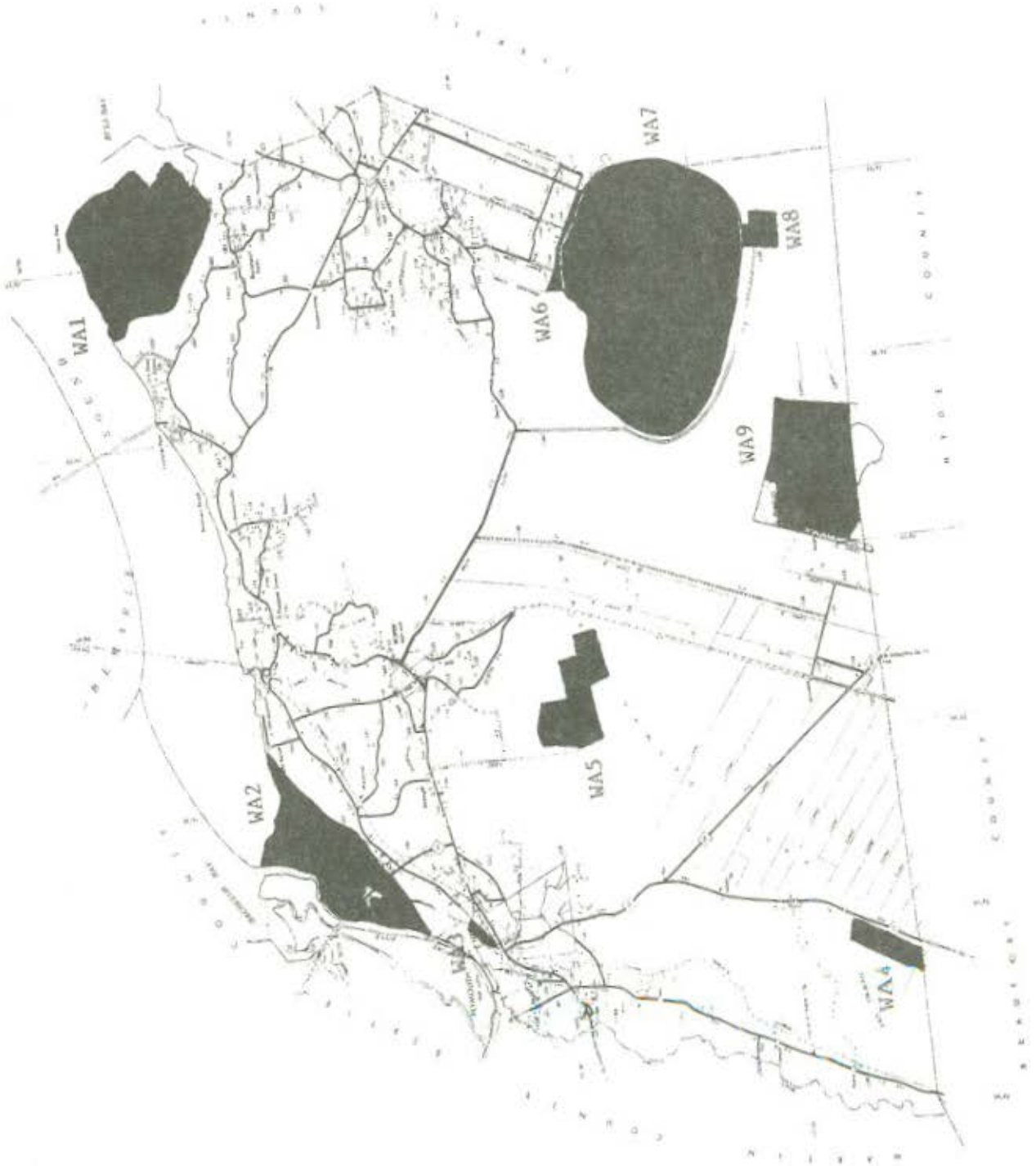
SHORELINE SHOWN REPRESENTS THE APPROXIMATE LINE OF MEAN HIGH WATER
THE PERIODIC TIDES IN THIS AREA ARE NEGLIGIBLE

CC

THIS MAP COMPLIES WITH NATIONAL MAP ACCURACY STANDARDS
FOR SALE BY U. S. GEOLOGICAL SURVEY, RESTON, VIRGINIA 22092
A FOLDER DESCRIBING TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST

Figure 17. Significant natural areas in Washington County. The areas are numbered generally in a north to south, or west to east, manner; see Table 7 and the Inventory of Sites section for further information.


WA1
WA2
WA4
WA5
WA6
WA7
WA8
WA9

SITE NAME: Bull Neck Swamp

SITE NUMBER: WA1 SIZE: about 6450 acres

SITE SIGNIFICANCE: C (Regional)

LOCATION: The extreme northeastern corner of Washington County; located along the southern shore of Albemarle Sound, with Bull Bay on the eastern boundary. The site is north and east of SR 1302.

QUAD MAP: Leonards Point

SIGNIFICANT FEATURES:

1. The natural area contains some of the largest extent of swamp forest in the A/P Study area. Although portions have been logged recently, especially for Atlantic white cedar (Chamaecyparis thyoides), the forest is still reasonably intact.
2. The site contains an intact fringe of bald cypress (Taxodium distichum) along the shores, plus tidal fresh to brackish marshes along Deep Creek.
3. A State Threatened plant -- Carolina lilaeopsis (Lilaeopsis carolinensis) -- occurs in the natural area.

GENERAL DESCRIPTION:

Extensive hardwood forests in Washington County have become scarce in the past several decades because of clearcutting of them and the subsequent planting of pines for pulp production, as well as clearing for agriculture and peat mining. Over 6000 acres of forested land still occurs in the northeastern portion of the county in the Bull Creek area. However, within the past few years, timber companies have logged considerable acreages within the forest and have removed much of the Atlantic white cedar (Chamaecyparis thyoides).

The great majority of the forest is swampy (Tidal Cypress-Gum Swamp natural community), and swamp tupelo (Nyssa biflora) forms the dominant canopy for several thousand acres. There are stands of white cedar, but much has been removed in the past few years. Also scattered in the canopy are bald cypress (Taxodium distichum) and loblolly pine (Pinus taeda). The cypress occurs primarily along the shoreline of the natural area. Portions of the swamp that have been logged within recent decades are dominated by loblolly pine and red maple (Acer rubrum). A rather unusual community is a pocosin-type association with a canopy of pond pine (P. serotina). The understory is primarily white cedar and red maple. A low shrub community featuring evergreen bayberry (Myrica heterophylla) and groundsel tree (Baccharis halimifolia) is present, along with a mixture of marsh herbs. This community occurs in the northern portion of the natural area.

Fringing the shore of Albemarle Sound is a community dominated by mature bald cypresses. The canopy is open enough that a diversity of shrubs and herbs are present. Along the shoreline fringe, a lens of mineral soil has formed over the peat substrate. A bright green carpet of herbaceous plants grows on this soil, with the dominants being the State Threatened Carolina lilaeopsis (Lilaeopsis carolinensis), water pimpernel (Samolus parviflorus),

and coast rose-gentian (Sabatia calycina). Lining the lower third of Deep Creek is a marsh dominated by sawgrass (Cladium jamaicense).

The forest is extensive enough that black bears (Ursus americanus) are present. Bears are uncommon in the Coastal Plain and are considered Special Concern in the state. At least 10 species of warblers are known to breed in the swamp, including the uncommon Swainson's warbler (Limnothlypis swainsonii) and worm-eating warbler (Helmitheros vermivorus) (Lynch and Peacock 1982).

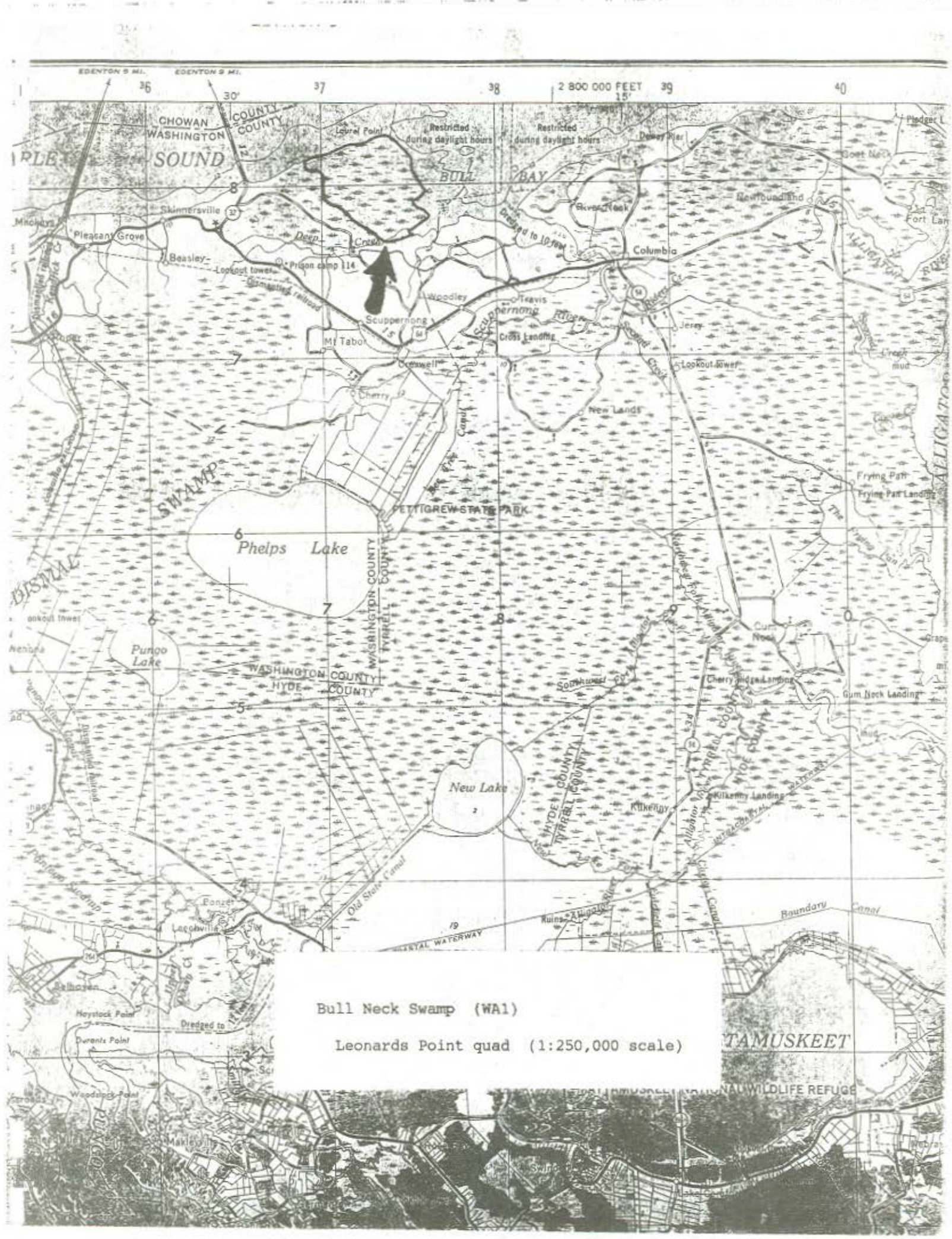
OWNERSHIP: Private; several owners, but primarily in one ownership

PROTECTION STATUS: None

RECOMMENDATIONS FOR MANAGEMENT OR PROTECTION: The selective cutting of white cedar and probably other tree species has damaged but not devastated this natural area. Unfortunately, no timber companies appear to be replanting white cedar as replacement for those cut and removed. Management of the site would strongly urge the replanting of white cedar in the cut-over areas. Protection of the natural area might well be difficult because of its Regional significance; few agencies would likely have the site high on their priority lists for acquisition. The best protection strategy would be a gift or bargain sale by the major owner to a private conservation group or to the N.C. Wildlife Resources Commission.

COMMENTS: Merrill Lynch (pers. comm.) flew over the natural area in October 1989 and reported on the recent logging of white cedar. Frost (1989r) visited the site by boat and also noted recet logging on the higher parts of the property. The wetness of the site and its difficulty of access both from water and from land make the area difficult to study.

REFERENCES: Lynch and Peacock (1982), Frost (1989r)



Bull Neck Swamp (WA1)

Leonards Point quad (1:250,000 scale)

SITE NAME: Conaby Creek/Roanoke River Swamp

SITE NUMBER: WA2 SIZE: about 2000 acres

SITE SIGNIFICANCE: B (State)

LOCATION: Northwestern portion of Washington County; bounded by Albemarle Sound on the north and NC 45 and SR 1300 on the south, extending along Conaby Creek to the Roanoke River and northeastward to Albemarle Sound.

QUAD MAP: Westover

SIGNIFICANT FEATURES:

1. The forest is a distinctive assemblage of alluvial swamp forest and non-alluvial pocosin/bay vegetation. Such a community, especially featuring pocosin vegetation, is rarely found in the Roanoke River floodplain.
2. The presence of Atlantic white cedar (Chamaecyparis thyoides) and pond pine (Pinus serotina) at the site is apparently unique for the Roanoke River floodplain.
3. A pair of the Federally Endangered bald eagles (Haliaeetus leucocephalus) has nested in the swamp since the mid-1980's.

GENERAL DESCRIPTION:

This natural area lies at the southeastern edge of the Roanoke River floodplain at its mouth where it enters Albemarle Sound. Conaby Creek lies within the floodplain of the Roanoke, and it flows northward to join the Roanoke about two miles from Albemarle Sound. The natural area ranges in elevation to just 1 foot above sea level; thus, it is extremely flat and is wet all year. Much of the water in the swamp is presumably from wind action blowing water from Albemarle Sound into the forest.

The vegetation is unusual for the Roanoke River floodplain, as many pocosin/bay elements are present. The canopy consists primarily of bald cypress (Taxodium distichum), swamp tupelo (Nyssa biflora), and red maple (Acer rubrum), with water tupelo (N. aquatica) only scattered in the canopy. Away from the waterways, patches of pond pine (Pinus serotina) and Atlantic white cedar (Chamaecyparis thyoides) occur. Portions of the swamp, away from the river, also contain considerable loblolly pine (P. taeda); this pine is mixed with swamp tupelo as a characteristic canopy tree. The understory contains evergreen or semi-evergreen species such as sweetbay (Magnolia virginiana) and redbay (Persea borbonia). The shrub layer is dominated by pocosin species such as sweet pepperbush (Clethra alnifolia), titi (Cyrilla racemiflora), coastal doghobble (Leucothoe axillaris), inkberry (Ilex glabra), and various blueberries (Vaccinium spp.). The density of shrubs plus bamboo-vine (Smilax laurifolia) makes much of the natural area virtually impassible. Along the creeks and river, bald cypress is the dominant canopy tree, a condition true of most of the lower Roanoke River floodplain farther upstream. Tingley (1985) provides a vegetation map for most of the natural area.

Portions of the area, away from the influence of the river, are underlain by deep peat deposits, reaching as deep as 20 feet. These areas, more acidic than sites near the river, are dominated by pocosin/bay vegetation that is so

characteristic elsewhere in non-alluvial areas in the lower Coastal Plain of the state.

In 1985, an active bald eagle (Haliaeetus leucocephalus) nest was discovered by the N.C. Nongame and Endangered Wildlife Program. The eagle is a Federally-listed Endangered species. This was just the second active nest found in the state since the early 1970's. The site has been active each year since 1985. The nest is located in a large loblolly pine located deep in the swamp.

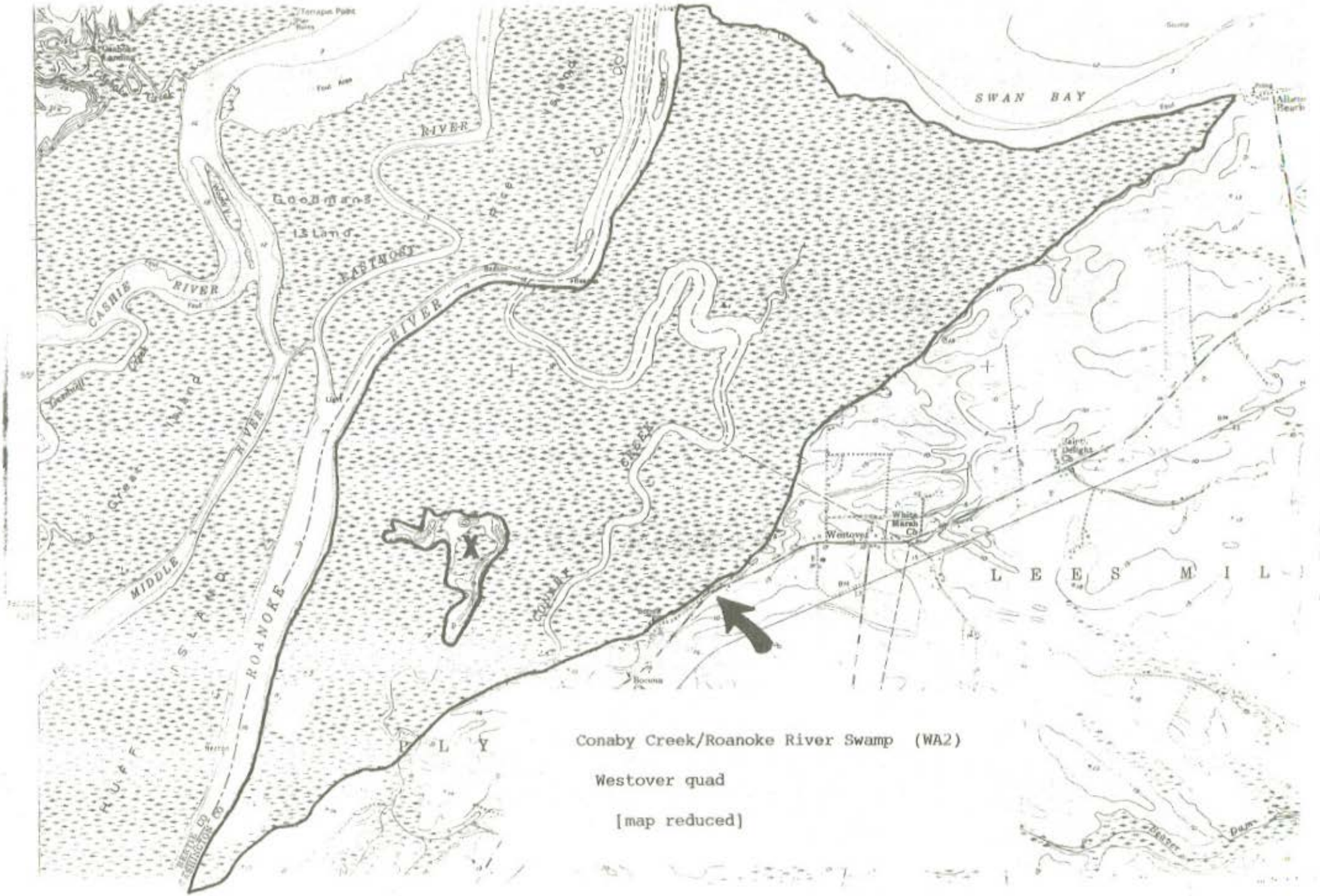
OWNERSHIP: Private, presumably large timber companies

PROTECTION STATUS: None. The owners of the land where the bald eagle nest is located have been notified of the presence of the nest. Because willfully cutting the nest tree of an endangered species is a criminal act, it is likely that the nest tree and the immediate vicinity are thus somewhat "protected". However, the natural area is not within the acquisition boundary of the proposed Roanoke River National Wildlife Refuge.

RECOMMENDATIONS FOR MANAGEMENT OR PROTECTION: The best management recommendation is to spare the natural area from timbering or other disturbances. The eagle nest needs to be checked each spring to see if it is active, in addition to surveying the area (by air) for any additional nests. The best protection for the area would be a donation or sale of the land to a conservation agency, such as the N.C. Wildlife Resources Commission. The Commission recently acquired Great and Goodman islands (Site BE20), located in the western portion of the Roanoke River floodplain, as Game Lands. However, that property is expected to be given to the U.S. Fish and Wildlife Service for addition to the Roanoke River National Wildlife Refuge, in exchange for property elsewhere along the river.

COMMENTS: The areal extent of the natural area is poorly known because of the difficulty of access. The construction of NC 45 across the mouth of the Roanoke River bisected the swamp. Delineation of boundaries for such a natural area needs to be done from the air.

REFERENCES: Lynch (1981), Tingley (1985)



Conaby Creek/Roanoke River Swamp (WA2)

Westover quad

[map reduced]

SITE NAME: Conaby Swamp Natural Area

SITE NUMBER: WA3 SIZE: 82 acres

SITE SIGNIFICANCE: C (Regional)

LOCATION: Western portion of Washington County; located essentially within the city limits of Plymouth, along Conaby Creek north of the Norfolk Southern railroad track and south of SR 1325 (East Main Street).

QUAD MAP: Plymouth East

SIGNIFICANT FEATURES:

1. The natural area contains a medium-aged to mature example of Coastal Plain Small Stream Swamp natural community, with a notable mixture of blackwater and brownwater floral elements.

GENERAL DESCRIPTION:

Conaby Creek is a tributary of the Roanoke River, flowing northward through western Washington County to empty into the Roanoke River only 2 miles before the river reaches Albemarle Sound. Technically, the creek is a blackwater stream, because its head lies in the Coastal Plain, but because the Roanoke River (a brownwater system) lies only a mile to the west of Conaby, or because of heavy runoff of sediment from farms upstream in the Conaby Creek watershed, there is much silty soil along the creek.

The upper end of the tract (the southern portion) is dominated primarily by water tupelo (Nyssa aquatica); common in the understory are water ash (Fraxinus caroliniana) and red maple (Acer rubrum). Lizard's-tail (Saururus cernuus) is the dominant herb species. Farther downstream, the dominants change to bald cypress (Taxodium distichum) and swamp tupelo (N. biflora), with water ash and red maple in the subcanopy. Giant cane (Arundinaria gigantea) is common in the shrub layer. Other numerous species are Virginia willow (Itea virginica), sweet pepperbush (Clethra alnifolia), elderberry (Sambucus canadensis), poison ivy (Rhus radicans), jewelweed (Impatiens capensis), false nettle (Boehmeria cylindrica), and netted chainfern (Woodwardia areolata) (Lynch 1985a).

The animal life of the swamp is apparently poorly known. Typical swamp bird species such as prothonotary warbler (Protonotaria citrea) and northern parula (Parula americana) are present in the breeding season.

OWNERSHIP: Martin Community College Foundation

PROTECTION STATUS: This is a Registered Natural Heritage Area. The site is jointly administered by the College Foundation and by the Boy Scouts of America, with the intent to develop educational programs. The land was donated by the former owner, Mrs. William H. Linkins, Jr., to the N.C. Nature Conservancy for protection. The Conservancy transferred the natural area to Martin Community College Foundation for ownership and management.

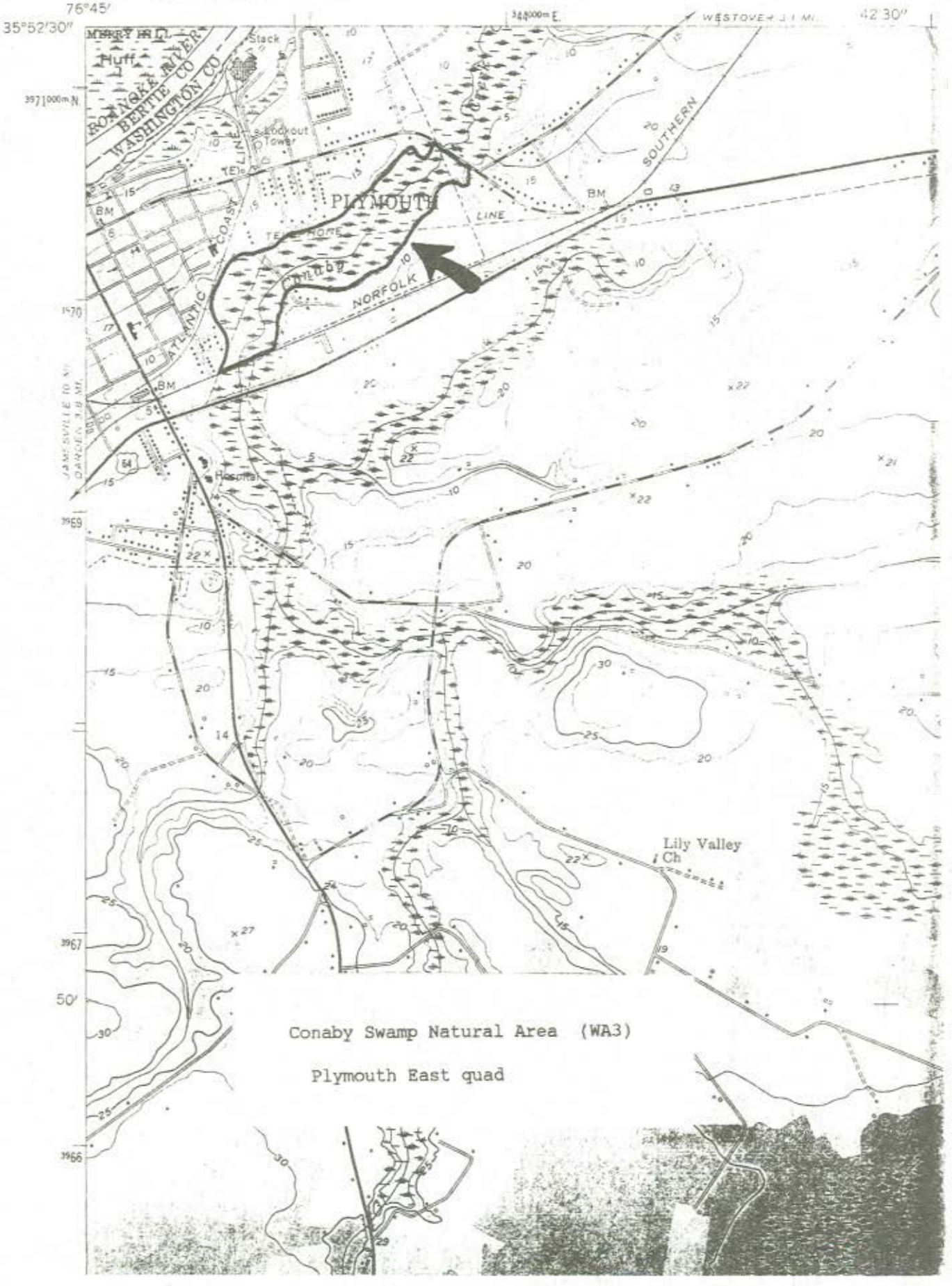
RECOMMENDATIONS FOR MANAGEMENT OR PROTECTION: The registry of the site gives the natural area short-term protection. Long-term protection would most

likely be achieved by having the natural area be declared a Dedicated Nature Preserve. Because the site is located within the city limits of Plymouth, and a road bisects the property, there are likely to be serious management problems in the future, such as increasing runoff from development just off the property or the increasing likelihood for additional utility lines or road widenings to infringe on the site. Any timber harvest would be detrimental to the site, as would increased sedimentation. Low impact educational uses should be encouraged at the site by the Community College and the Boy Scouts.

COMMENTS: The site has a high potential for research on brownwater and blackwater systems, since it appears to have features of both systems.

REFERENCES: Lynch (1985a), Weakley (1986)

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY



SITE NAME: Van Swamp

SITE NUMBER: WA4 SIZE: about 1200 acres

SITE SIGNIFICANCE: C (Regional)

LOCATION: Southwestern portion of Washington County (and extending into northern Beaufort County); located west of NC 32, east of SR 1100, southeast of the community of Hoke.

QUAD MAP: Hoke

SIGNIFICANT FEATURES:

1. Van Swamp contains one of the finest old-growth stands of swamp tupelo (Nyssa biflora) known in North Carolina. The forests also contain very large individual trees of several bay forest species, such as sweetbay (Magnolia virginiana) and loblolly bay (Gordonia lasianthus).
2. The swamp formerly contained a representative example of a pond pine (Pinus serotina) pocosin, but little or none is left now because of logging.
3. The swamp functions as habitat for larger species of mammals and birds.

GENERAL DESCRIPTION:

Van Swamp originally covered much of southwestern Washington County, extending from south of Plymouth into northern Beaufort County, occupying nearly 13,500 acres. Today, the swamp has been reduced by timber cutting and conversion to pine plantations so that only 1,000+ acres remains. The swamp lies in a poorly drained flat region and is non-alluvial in nature. Both the west and east margins of the swamp are bordered by parallel north-south trending scarps, which likely were old beach ridges. That portion of the swamp, mainly the outer portions, that consisted of wet, loamy or sandy mineral soils have generally been converted to pine plantations. The more central portions of the swamp contain organic soils with peat deposits, and this is the part of the swamp still reasonably intact.

Most of the swamp is a Nonriverine Swamp Forest natural community. Swamp tupelo (Nyssa biflora) is the dominant canopy tree. Scattered individuals of loblolly pine (Pinus taeda), bald cypress (Taxodium distichum), sweetbay (Magnolia virginiana), and Atlantic white cedar (Chamaecyparis thyoides) are also present in the canopy. Red maple (Acer rubrum) forms the primarily understory layer. The dense tall shrub layer is dominated by redbay (Persea borbonia).

Portions of the swamp, primarily near the southern boundary of the swamp, are vegetated in a Pond Pine Woodland natural community. This is a type of pocosin vegetated in large (60 to 90 feet high) pond pines (Pinus serotina), over a very dense tall shrub/small tree layer. This layer features typical pocosin species such as loblolly bay (Gordonia lasianthus), sweetbay, redbay, fetterbush (Lyonia lucida), sweet gallberry (Ilex coriacea), and red maple. Bamboo-vine (Smilax laurifolia) forms tangles through this zone. One clump of loblolly bay trees in this habitat is about 70 feet tall, and one tree measures 27 inches in trunk diameter (Lynch and Peacock 1982).

Van Swamp provides excellent habitat for wildlife. A few black bears (Ursus americanus) are still present, despite the reduction in mature forest

habitat over the past decades. White-tailed deer (Odocoileus virginianus) are common, and bobcats (Felis rufus) are known to occur. Among the notable breeding bird species include black-throated green warbler (Dendroica virens), worm-eating warbler (Helmitheros vermivorus), and Swainson's warbler (Limnothlypis swainsonii). Species requiring large acreages for breeding, such as red-shouldered hawk (Buteo lineatus) and pileated woodpecker (Dryocopus pileatus), are also found in Van Swamp.

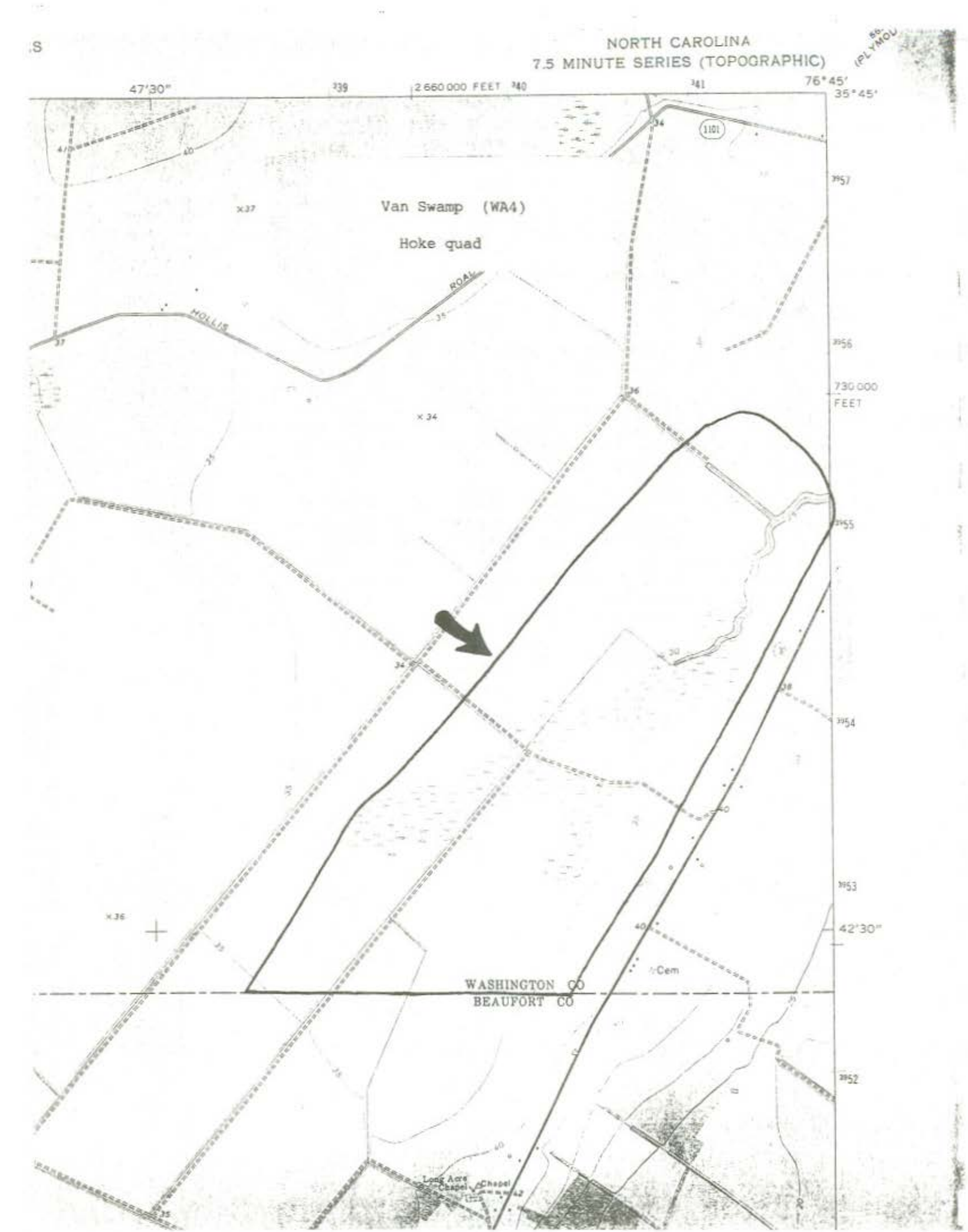
OWNERSHIP: Private; multiple ownership

PROTECTION STATUS: None

RECOMMENDATIONS FOR MANAGEMENT OR PROTECTION: Further timbering would be harmful, particularly the ditching of portions of the forest prior to removal of trees, which is a common practice in the timber industry when attempting to remove trees from wetlands. Protection possibilities include acquisition by the N.C. Wildlife Resources Commission as a Game Land or registry by the N.C. Natural Heritage Program. Conservation easements by the owners with private conservation groups are also an option.

COMMENTS: Portions of the natural area have been timbered and put into loblolly pine plantation since the major study of this site was made in 1982 (Lynch and Peacock 1982). No detailed study of the boundaries of the area was made during the A/P Study in 1989. During a one-day reconnaissance in 1989, it was noted that natural vegetation remaining is primarily on Pungo muck soils, the deepest organic soil along the east side of the natural area delimited by Lynch and Peacock (1982).

REFERENCES: Lynch and Peacock (1982)


NORTH CAROLINA
7.5 MINUTE SERIES (TOPOGRAPHIC)
47'30"
2 660 000 FEET
76°45'
35°45'
Van Swamp (WA4)
Hoke quad
HOLLIS ROAD
1101
730 000 FEET
42'30"
WASHINGTON CO
BEAUFORT CO
Cem
Long Acre Chapel
Chapel

SITE NAME: East Dismal Swamp

SITE NUMBER: WA5 SIZE: about 1000 acres

SITE SIGNIFICANCE: B (State)

LOCATION: Central portion of Washington County: located about 4 miles south-southwest of Roper, south of SR 1119 and west of SR 1127.

QUAD MAP: Plymouth East, Roper South

SIGNIFICANT FEATURES:

1. This natural area contains the last remnants of the once-extensive swamp forests of East Dismal Swamp. The area is a mature to old-growth non-alluvial swamp forest, with many plant species of bottomlands present with typical swamp forest vegetation.
2. The natural area is rich in breeding bird species, including at least 13 species of warblers, some of which are uncommon in the Coastal Plain of the state.

GENERAL DESCRIPTION:

East Dismal Swamp was once an extensive forested area of at least 70,000 acres, situated on a poorly drained upland flat along the western margin of the Pamlico Terrace. Peat deposits underlie the swamp. All but 1000+ acres of the swamp have been cleared in the past few decades for agriculture or for pine plantations, and additional land is being cleared at the present (in 1989).

The natural area contains elements of both Nonriverine Swamp Forest and Nonriverine Wet Hardwood Forest natural communities, though the swamp forest community is prevalent over most of the site. A dominant canopy species is swamp tupelo (Nyssa biflora), with red maple (Acer rubrum) and sweetbay (Magnolia virginiana) characteristic in the understory, along with redbay (Persea borbonia). In some places, tuliptree (Liriodendron tulipifera) is common in the canopy with the swamp tupelo; there are many large specimens of the tuliptree, ranging to 90 feet tall and 24-36 inches in diameter. Large bald cypresses (Taxodium distichum) and loblolly pines (Pinus taeda) also form part of the canopy. Scattered in places is Atlantic white cedar (Chamaecyparis thyoides), originally dominant over large portions of the swamp before logging by Roper Lumber Company in the late 19th and early 20th centuries. The dense shrub layer is dominated by redbay; also common are sweet pepperbush (Clethra alnifolia), highbush blueberry (Vaccinium corymbosum), and royal fern (Osmunda regalis). Vines are also quite abundant, with climbing hydrangea (Decumaria barbara), yellow jessamine (Gelsemium sempervirens), and Virginia creeper (Parthenocissus quinquefolia) being the most numerous.

The presence of several plant species on peat deposits is unusual in North Carolina. Tuliptree is only infrequently seen growing over peat deposits, and the presence of a fairly large population of common pawpaw (Asimina triloba) is quite surprising over peat. This shrub is normally found growing on alluvial soils or on rich slopes.

The forest has a high wildlife value, and the breeding bird population is probably one of the richest, per 100 acres, of any forest in the Coastal Plain. Merrill Lynch and LeGrand, in one hour at midday on May 30, 1987, recorded 48 bird species, all of which presumably nest in the forest. Of this total, 13 species were warblers. Significant for the Coastal Plain are moderate populations of Swainson's warbler (Limnothlypis swainsonii), worm-eating warbler (Helmitheros vermivorus), and black-throated green warbler (Dendroica virens). Also, a large population of American redstarts (Setophaga ruticilla) is present; this is near the eastern edge of the breeding range of the species in North Carolina.

OWNERSHIP: Private

PROTECTION STATUS: None

RECOMMENDATIONS FOR MANAGEMENT OR PROTECTION: This is one of the most critically endangered natural areas in the Albemarle Sound region. The owner, Weyerhaeuser Corportation, has been clearcutting portions of the remaining forest in East Dismal Swamp for pine plantations for the timber production. At the present rate of cutting, perhaps averaging 100 acres per year, the site might be completely destroyed in the next few years. Obviously, essentially all of the plants and animals of the mature swamp forest disappear upon clearcutting. The owner has been approached about protecting the remaining acres, but the corporation wishes to retain the site for future timber production. The only protection method likely for saving the site may be outright purchase, or purchase of a conservation easement, perhaps by a private conservation group.

COMMENTS: Frost noted that logging of the natural area was taking place in November 1989. The current acreage of uncut forest remaining is certainly less than 1000 acres, as of the end of 1989.

REFERENCES: Lynch and Peacock (1982), Lynch (1987)


East Dismal Swamp (WA5)
Plymouth East, Roper South quads
LEES MILLS
SWAMP

SITE NAME: Pettigrew State Park -- Cypress Natural Area

SITE NUMBER: WA6 SIZE: about 180 acres

SITE SIGNIFICANCE: B (State)

LOCATION: Southeastern portion of Washington County; located on the northeastern shore of Lake Phelps, bounded on the south by the lake, on the north by SR 1166, and on the east by Thirty Foot Canal.

QUAD MAP: Creswell

SIGNIFICANT FEATURES:

1. This natural area contains the oldest bald cypress lakeshore stand known in North Carolina. The old-growth forest contains many trees of near record size in the state.
2. The mixture of common pawpaw (Asimina triloba) in abundance in the shrub layer is unusual for a site dominated by cypress.

GENERAL DESCRIPTION:

This natural area is a very narrow east-west forest bounded on the north by a road and primarily agricultural areas and on the south by Lake Phelps. The width of the forest ranges only from 350 to 1300 feet. The forest varies somewhat in composition from the road to the lake, as the topography is imperceptibly higher and more mesic near the road. Bald cypress (Taxodium distichum) dominates the forest, especially near the lakeshore. Mixed with this species, primarily along the northern portion of the site, are tuliptree (Liriodendron tulipifera) and sweetgum (Liquidambar styraciflua). These canopy trees average 90-100 feet tall and 2-3 feet in diameter. Growing with the cypress in the wet ground along the lake is swamp tupelo (Nyssa biflora). Common pawpaw (Asimina triloba) is the dominant shrub/small tree in the natural area, at least where the ground is not wet. The ground cover is nearly 100% in places, though diversity is not high. Common herbs include Japanese honeysuckle (Lonicera japonica), jewelweed (Impatiens capensis), false nettle (Boehmeria cylindrica), and lady fern (Athyrium asplenioides). Various vines are abundant, especially since the canopy is somewhat open, perhaps a result of the death of old trees in the forest. As one moves toward the lake, pawpaw and herbs generally disappear. Instead, flood tolerant species such as Virginia willow (Itea virginica), elderberry (Sambucus canadensis), and buttonbush (Cephalanthus occidentalis) become prominent.

The most significant feature of the site is the size of individual trees. One bald cypress in the natural area is over 85 inches in diameter (Sid Shearin, pers. comm.). Many of these trees are over 100 feet tall, with the tallest being approximately 120 feet. The average diameters of canopy tuliptree, sweetgum, and American elm (Ulmus americana) average 39, 27, and 21 inches, respectively (Lynch and Peacock 1982).

The forest is fairly rich in wildlife. At least 39 species of breeding birds have been reported (Lynch and Peacock 1982). Louisiana waterthrushes (Seiurus motacilla) occur in summer and are presumed to nest; this may be the eastern edge of the range in North Carolina.

OWNERSHIP: The N.C. Division of Parks and Recreation (Pettigrew State Park) owns the majority of the natural area. Portions at the western end are in private ownership.

PROTECTION STATUS: The portion owned by Parks and Recreation is protected according to State Park regulations. The narrow section between SR 1166 and the lake (40 acres) is a Registered Natural Heritage Area.

RECOMMENDATIONS FOR MANAGEMENT OR PROTECTION: All of the forested area not currently in State Park ownership is proposed for acquisition, based on the Master Plan for Pettigrew State Park (1977). The Master Plan does not call for development of park facilities in any of the currently owned portion of the natural area. Portions of the forest to the west of the natural area, known as the Big Point area, are scheduled for construction of a boat launch and docks, picnic grounds, and other facilities, if the land is acquired. In the fall of 1989, the Conservation Fund purchased, for $8.8 million, over 100,000 acres of land formerly owned by First Colony Farms in Washington, Tyrrell, Hyde, and Dare counties. The privately owned land along the northern and western shore of Lake Phelps is part of this land purchase. The Conservation Fund is expected to donate that portion of its lands along the lakeshore to the Division of Parks and Recreation for addition to Pettigrew State Park. The present natural area contains a nature trail (the Carriage Trail) running the length of the site, along the northern edge of the woods and thus paralleling the county road (SR 1166). Management of the area is not needed, though any activities that open up the canopy should be avoided.

COMMENTS: Water level in the lake has a profound influence on the natural area. Should the water level drop for a considerable period of time, mesic vegetation and herbs will move southward and cover more of the forest. An increase in water level could cause death of mesic vegetation such as the tuliptrees, sweetgums, and pawpaws.

REFERENCES: Wilson (1975), North Carolina Division of Parks and Recreation (1977), Hazard (1978), Lynch and Peacock (1982)

Pettigrew State Park -- Cypress Natural Area (WA6)

Creswell quad

SITE NAME: Lake Phelps

SITE NUMBER: WA7 SIZE: about 16,600 acres

SITE SIGNIFICANCE: B (State)

LOCATION: Southeastern portion of Washington County and southwestern Tyrrell County, but primarily in the former county.

QUAD MAPS: Creswell, Roper South, Pungo Lake, New Lake NW

SIGNIFICANT FEATURES:

1. Lake Phelps is the second largest natural lake in North Carolina, with a sandy and muddy bottom rather than a peaty one. Its origin, whether actually a composite of two overlapping Carolina bays or whether formed by water filling a deep peat burn, is still a mystery.
2. The southern shoreline of the lake contains natural marshes with several rare plants -- leafless watermilfoil (Myriophyllum tenellum), northeastern bladderwort (Utricularia resupinata), and seven-angled pipewort (Eriocaulon septangulare).
3. The lake is one of just 2 known sites for the Waccamaw killifish (Fundulus waccamensis), a Federal candidate species.

GENERAL DESCRIPTION:

Lake Phelps is the second largest natural lake in North Carolina, with only Lake Mattamuskeet being larger. It is an elliptically-shaped lake approximately 16,600 acres in size, situated on the Albemarle-Pamlico peninsula, a portion of the state that is largely underlain by peat deposits. There is no drainage into the lake, as it is approximately the same elevation as the surrounding land. There is drainage out of the lake to the Scuppernong River to the northeast. Rainfall is the main source of water.

The origin of the lake is a mystery. There are no obvious Carolina bays in the general vicinity; thus, it would seem unlikely that the lake would be composed of two overlapping Carolina bays, as has been suggested (North Carolina Division of Parks and Recreation 1977). However, much of the bottom of the lake is sandy, and there is a narrow sandbar that extends southward down the center, in addition to sand deposits along portions of the southern and eastern shores. These features are suggestive of Carolina bay formation. Portions of the lake bottom are rather muddy, and peat deposits are common in areas surrounding the lake. Most other similar lakes in the eastern Coastal Plain of the state have peaty bottoms (such as Lake Mattamuskeet, Pungo Lake, New Lake, and those in Croatan National Forest) and are believed to have formed when fires burned deep into the soil during periods of unusually severe drought. Water later filled in these depressions and lakes were formed. Lake Phelps may have formed in a similar fashion.

Most of the shoreline of the lake features a zone of bald cypress (Taxodium distichum), especially along the northern shore (see Site WA6). Pocosins surround much of the southern shoreline (see Site WA8). Also along the southern shoreline is a narrow zone of freshwater marsh, which is a rare community away from tidal areas. A number of rare plant species occur in the marsh zone or in shallow water. The most notable is leafless watermilfoil

(Myriophyllum tenellum), considered a "primary proposed" species in North Carolina, being disjunct from the Northeast to Lake Phelps and White Lake in this state. Plants considered "significantly rare" in the state are northeastern bladderwort (Utricularia resupinata), found in 1957 on the north shore of the lake, and found in the last few years along the southern shore; and seven-angled pipewort (Eriocaulon septangulare), which grows in large numbers on the southern shoreline. Another notable shoreline plant, but which has no state status, is slender arrow-head (Sagittaria teres).

A large list of freshwater fish species has been recorded from Lake Phelps (North Carolina Division of Parks and Recreation 1977, 1980). The only rare animal species is the Waccamaw killifish (Fundulus waccamensis), which was taken from the lake in 1975 and is reportedly common there (Cooper et al. 1977). This fish is otherwise known only from Lake Waccamaw and is a candidate for Federal listing. The lake has a moderate wintering waterfowl population, especially of tundra swans (Cygnus columbianus) and Canada geese (Branta canadensis), both of which feed on grain in adjacent fields.

OWNERSHIP: North Carolina Division of Parks and Recreation. The lake is administered as a State Lake and is not part of Pettigrew State Park, though Pettigrew personnel monitor and manage the lake.

PROTECTION STATUS: The lake is protected according to State Park regulations. In addition, the lake is a Registered Natural Heritage Area.

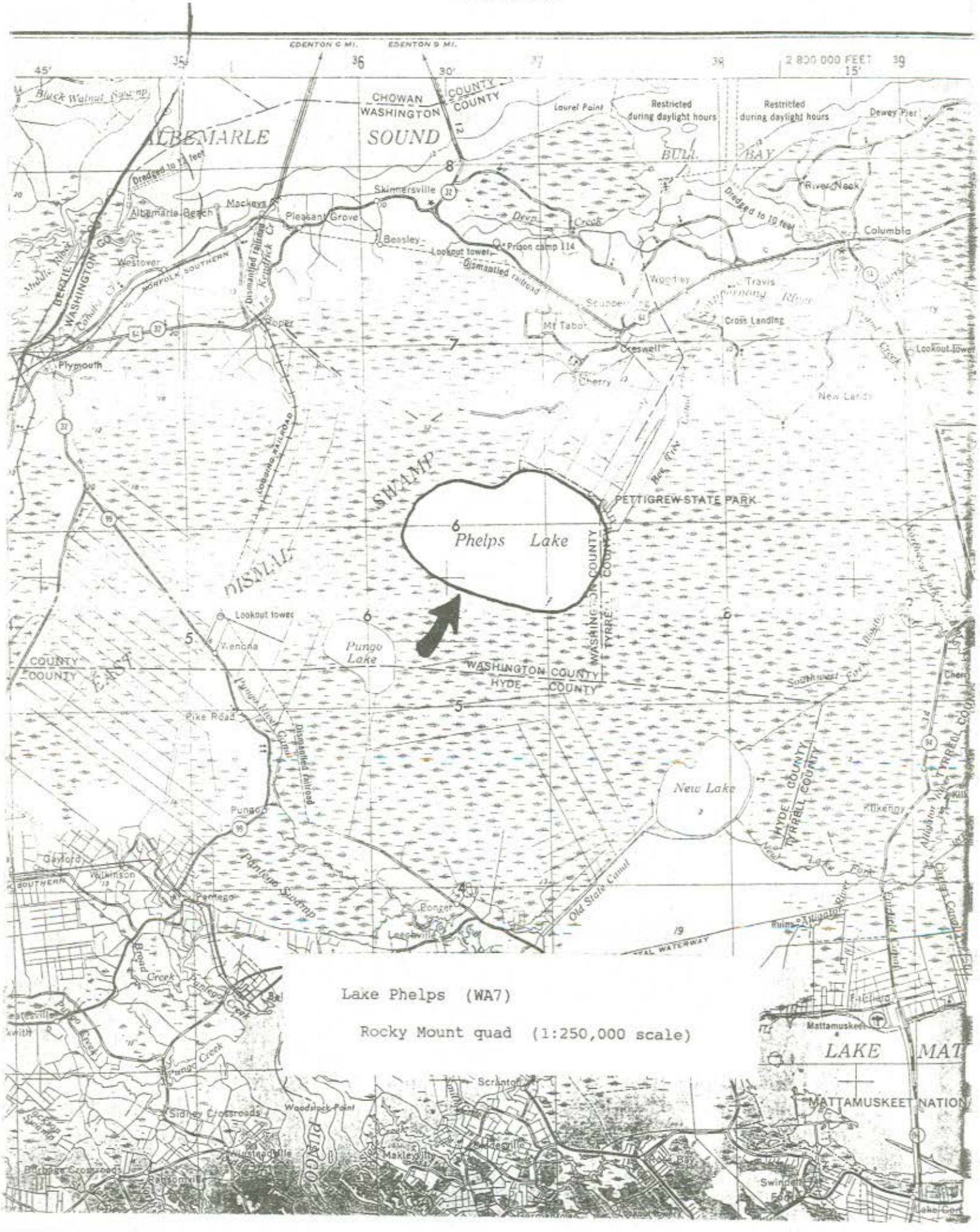
RECOMMENDATIONS FOR MANAGEMENT OR PROTECTION: The main proposed action stated in the Lake Phelps lake management study (North Carolina Division of Parks and Recreation 1980) is to control the water level in the lake by the operation of the water control gate. The average lake level is proposed to be 11.5 feet above sea level, with some opening and closing of the gate during various times of the year to assist in fish migration to and from the lake, to provide runoff into canals for irrigation, to provide proper levels for recreation and wildlife habitat in the lake, in addition to other factors. There are numerous impacts to the lake in terms of sedimentation. Because most of the land surrounding the lake is in agriculture or peat production, strong winds blow topsoil and dust from the fields into the lake. Homes on the western and southern shoreline have lawns that reach to the shore, and persons living in the homes have often removed all trees along the shore to provide a view of the lake; thus, winds blowing from the southwest are not blocked by trees, and sediment can be carried into the lake. Runoff of fertilizers from fields and lawns is also a problem, and algae blooms and fish kills could be expected to occur periodically.

COMMENTS: In 1989, the Conservation Fund purchased over 100,000 acres of land that formerly was owned by First Colony Farms. Portions of the north, west, and south shores of the lake are a part of this acquisition. It appears that lands along the north and west shores will be reallocated by this private organization to Pettigrew State Park. The land along the south shore will be reallocated to either the State Park or to the U.S. Fish and Wildlife Service. Acquisition of such shoreline property will likely help to control some of the sedimentation and runoff problems in the lake and will prevent future

conversion of forests and pocosins along the shoreline to agriculture or development.

REFERENCES: Cooper et al. (1977), North Carolina Division of Parks and Recreation (1977, 1980), Taggart (1981)

EDITION 3



Lake Phelps (WA7)

Rocky Mount quad (1:250,000 scale)

SITE NAME: Pettigrew State Park -- South Shore Pocosin

SITE NUMBER: WA8 SIZE: about 500 acres

SITE SIGNIFICANCE: C (Regional)

LOCATION: Southeastern portion of Washington County; located along the southern shore of Lake Phelps, just east of the end of SR 1183.

QUAD MAP: New Lake NW

SIGNIFICANT FEATURES:

1. The natural area contains remnants of the pocosin type once extensive in the Albemarle-Pamlico ("Pamlimarle") peninsula. A good example of pocosin vegetation is present.

GENERAL DESCRIPTION:

Several decades ago, Lake Phelps was surrounded on the west, south, and east by extensive pocosins. However, large-scale agricultural operations have destroyed the pocosins in favor of croplands and peat-mining. Only a few remnants still exist in the Lake Phelps area. A tract of 500 acres owned by the N.C. Division of Parks and Recreation at the southern edge of the lake is part of Pettigrew State Park. Allen and Repasky (1977) examined the tract, dividing it into four plant communities. In the very shallow water along the shore is a "bulrush bed", with common three-square (Scirpus americanus) the dominant species. Various rushes (Juncus spp.) occur in the zone, as do several forbs, such as ten-angle pipewort (Eriocaulon decangulare).

Adjacent to the bulrush zone is a waxmyrtle (Myrica cerifera) zone, which grades into a bay forest zone farther removed from the lakeshore. This bay forest contains pond pine (Pinus serotina), redbay (Persea borbonia), and red maple (Acer rubrum) in the canopy, which is approximately 20 feet high. Located within the bay forest is an "island" of non-tree vegetation, featuring clammy azalea (Rhododendron viscosum) and inkberry (Ilex glabra), with highbush blueberry (Vaccinium corymbosum) forming a ring around the "island". The predominant vegetation of the "island" in the natural area is a low pocosin community. Most of the vegetation consists of shrubs 2 to 6 feet high. Common species are redbay, honeycup (Zenobia pulverulenta), and bamboo-vine (Smilax laurifolia). Other typical pocosin species present are inkberry, sweet gallberry (Ilex coriacea), fetterbush (Lyonia lucida), sweet pepperbush (Clethra alnifolia), and sheep-kill (Kalmia angustifolia).

OWNERSHIP: N.C. Division of Parks and Recreation (Pettigrew State Park)

PROTECTION STATUS: The area is currently protected by State Parks regulations.

RECOMMENDATIONS FOR MANAGEMENT OR PROTECTION: The master plan for the state park (North Carolina Division of Parks and Recreation 1977, Hazard 1978) suggests that the 500-acre tract be sold. This might be a direct sale, or might involve a land swap for acreage more favorable to the park's development

plans (on the north shore of the lake). Conceivably, the tract could become a State Natural Area. The future status of this property is uncertain. There have been some problems of vandalism or cutting in the natural area. However, the 12 years since the publication of the park master plan has seen destruction of all remaining peatland vegetation, leaving this 500-acre site the only remaining example of this natural community type in the vicinity of the lake. Its importance as a natural area has thus been greatly increased and its discarding as an "undevelopable" site is no longer justified. In addition, that portion of the lake shoreline immediately to the west of this tract was recently purchased (in fall 1989) by the Conservation Fund from First Colony Farms. As of late 1989, the Conservation Fund had not decided whether to donate the south shore property to the Division of Parks and Recreation (for addition to Pettigrew State Park) or to the U.S. Fish and Wildlife Service (for addition to Pungo National Wildlife Refuge).

The best protective measure for this site would be to keep it in Pettigrew State Park and designate it a Registered Natural Heritage Area.

COMMENTS: If the Conservation Fund donates the shoreline property immediately to the west of this natural area to the Fish and Wildlife Service, then this 500-acre tract will remain isolated from the park property on the north shore of Lake Phelps. In that case, Parks and Recreation would have less reason to hold onto this property and may wish to sell or trade this property to the Fish and Wildlife Service. However, the State Parks system has relatively little pocosin land holdings (mainly at Carolina bays in the Bladen County area) and should do what it can to retain this natural area.

REFERENCES: Allen and Repasky (1977), North Carolina Division of Parks and Recreation (1977), Hazard (1978)


PETTIGREW
STATE PARK
APPROXIMATE BOUNDARY
Pettigrew State Park -- South Shore Pocosin (WA8)
New Lake NW quad

SITE NAME: Pungo National Wildlife Refuge Natural Areas

SITE NUMBER: WA9 SIZE: about 4800 acres

SITE SIGNIFICANCE: C (Regional)

LOCATION: Extreme southern Washington County and extreme northwestern Hyde County, located about 4 miles northeast of the intersection of NC 45 and NC 99.

QUAD MAP: Pungo Lake

SIGNIFICANT FEATURES:

1. Pungo Lake is one of the larger natural lakes in North Carolina, and it provides resting habitat for thousands of wintering swans, geese, and ducks.
2. The natural area contains remnant pocosin vegetation and swamp forest near the shore of the lake.

GENERAL DESCRIPTION:

Pungo Lake is a natural lake, of 2800 acres, on the Albemarle-Pamlico peninsula. Like most other large Coastal Plain lakes, it was formed when an intense fire (or fires) burned deep into the peat and left a depression of several feet. This depression was filled by water and thus became a lake. The site where the lake is was formerly vegetated primarily in cypresses (Taxodium distichum) and white cedars (Chamaecyparis thyoides). However, frequent fires are believed to have converted these forests into pocosins. Pocosins surrounded the lake as late as several decades ago, but most of the land has been cleared for agriculture and peat mining. A remnant of 1000 acres of pocosin exists on the eastern side of the lake, and this has been designated as a "research natural area" by the U.S. Fish and Wildlife Service. Titi (Cyrilla racemiflora), inkberry (Ilex glabra), waxmyrtle (Myrica cerifera), as well as bay species, are numerous. A few pond pines (Pinus serotina) and red maples (Acer rubrum) are scattered in the pocosin. Parts of the northern and western shoreline are fringed in swamp forest, with swamp tupelo (Nyssa biflora) being the dominant species.

Though Pungo Lake is nearly sterile, as far as wildlife food is concerned, the lake provides resting habitat for several thousand tundra swans (Cygnus columbianus), Canada geese (Branta canadensis), and ducks. The swans and geese feed in corn fields and other grain fields elsewhere on the refuge or in adjacent private fields. The ducks feed in marshes in the vicinity. One rare species of the refuge is the golden eagle (Aquila chrysaetos). Every few winters, an eagle is reported at the refuge, where they presumably feed on waterfowl at the lake. In addition to the birds, black bears (Ursus americanus) are present in the swamp forests on the northern and western shores of the lake.

OWNERSHIP: U.S. Fish and Wildlife Service (Pungo National Wildlife Refuge)

PROTECTION STATUS: The refuge is protected according to Fish and Wildlife Service regulations. The lake and the research natural area (total of 3800

acres) have also been designated as a North Carolina Registered Natural Heritage Area.

RECOMMENDATIONS FOR MANAGEMENT OR PROTECTION: The portions of the refuge still remaining in forest should be allowed to mature. The pocosin natural area was burned in the 95,000-acre natural "Pungo Fire" of April 1985, but it should return to typical pocosin vegetation in a few years. One observation tower has been constructed at the southern end of the lake for viewing of waterfowl on the lake.

COMMENTS: The entire refuge is not being listed in this report as a natural area. The majority of the 12,000+ acres of the refuge are in fields that are reverting back to pocosin or are in cultivation as wildlife food and cover.

REFERENCES: North Carolina Natural Heritage Program (no date), U.S. Fish and Wildlife Service (1968)

Pungo National Wildlife Refuge Natural Areas (WA9)

Pungo Lake quad

[map reduced]

Appendix A. Site Survey Report Form (Blank)

SITE SURVEY REPORT
-- N.C. Natural Heritage Program
P.O. Box 27687 / Raleigh NC 27611

Date: _____
Quad Name: _____
County: _____

Name of Site: _____
Surveyors: _____
Location & Directions: _____

Size: _____ Province: _____ Watershed: _____
Owners and address: _____

Owner contacted & attitude: _____

General Landscape Description:

Physical Description:

Aspect:	Slope:	Topog. Position:	Hydrology:	Moisture:
___ N	___flat	___crest	___terrestrial	___inundated
___ E	___0-5	___upper slope	___palustrine	___seasonally flooded
___ S	___5-10	___mid slope	___estuarine	___frequently flooded
___ W	___10-35	___lower slope	___riverine	___seasonally wet
___ flat	___35 +	___upland flat	___lacustrine	___wet mesic
___ all	___vertical	___alluvial flat	___subterranean	___mesic
		___nonalluvial flat	___marine	___dry mesic
				___xeric (dry)

Elevation: _____
Geology:

Soils (series if known, correlated with Natural Communities, p.2, if possible):

Comments on Physical Description:

Biological Description:

Natural Communities. List communities and for each describe:

A) name of community (see Schafale & Weakley) & size,
B) vegetation structure,
C) dominants & important spp. by strata,
D) position in landscape & relation to other communities,
E) quality & condition,
F) size

Special Status Species present (attach forms):

Potential for other Special Status Species:

Other noteworthy species or features present:

Site Integrity: ___high ___good ___fair ___poor

Average DBH of canopy trees:

Maximum DBH of canopy trees:

Fire regime (natural, suppression, date of most recent, etc.):

___logged (when, describe):

___even-aged canopy (successional stand from pasture or clearcut):
___non-native or weedy spp. present (list and describe):

___ditched/drained (describe):

___stream channelized:
___dredging/filling:
___understory cleared:
___grazing:
___ORV damage (describe):
___other (describe):

Adjacent land use (describe):

Significance of site: (high quality and/or rare communities, rare spp., etc.):

Discussion:

___national
___state
___regional
___county
___local
___low

Protection Considerations and Management Needs: (discuss recommended protection for natural area, and management needed to maintain or improve quality of site, such as fire, ORV exclusion, fencing, blocking drainage, etc.)

Documentation

Survey boundaries (describe why your survey stopped where it did):

Priority for further survey (why, for what, at what season):

Specimens collected (plants, animals, soil, rock - of what and state repository):

Photographs (of what):

Others knowledgeable about site:

___TOPO MAP ATTACHED
___Sketch of site or part of site attached (as needed or appropriate, to show access, rare spp., relative positions of communities, etc., particularly if cannot be well-portrayed on attached topo map).

PLANT SPECIES LIST

Code species by community in which they occur.
How thorough is this list? ___nearly complete ___medium ___casual

CANOPY:

SUBCANOPY:

SHRUBS:

VINES:

PLANT SPECIES LIST (page 2)

HERBS:

HERBS:

NONVASCULARS:

NOTES ON ANIMAL SPECIES PRESENT

List animals present, evidence (sighting or other), breeding?, etc. (attach separate list if needed):

Appendix B. Site Survey Report Form (Completed)

SITE SURVEY REPORT
-- N.C. Natural Heritage Program
P.O. Box 27687 / Raleigh NC 27611

Date: 10-25-89
Quad Name: WADE POINT & WEEKSVILLE
County: PASQUOTANK

Name of Site: BIG FLATTY CREEK (INDIAN CREEK PORTION)
Surveyors: CECIL FROST
Location & Directions: SOUTHERN PASQUOTANK COUNTY. ACCESS BY WATER FROM WRC BOAT RAMP AT END OF SR 1108.

Size: ~3700 acres (measured) Province: COASTAL PLAIN Watershed: BIG FLATTY CREEK → ALBEMARLE SOUND
Owners and address: SEE LIST ATTACHED TO OWNERSHIP MAP.

Owner contacted & attitude:

General Landscape Description: FRESHWATER MARSHES, TIDAL SWAMPS AND EXTENSIVE PATCHES OF NONRIVERINE WET HARDWOOD FOREST IN THE WATERSHED OF BIG FLATTY CREEK, A UNIQUE CLAY-BOTTOMED EMBAYMENT AND SHALLOW BAY ON A CLAY BENCH PLANED BY WAVE ACTION FROM THE ADJACENT OPEN WATERS OF THE ALBEMARLE SOUND.

Physical Description:

Aspect:	Slope:	Topog. Position:	Hydrology:	Moisture:
___ N	✓ flat	___ crest	✓ terrestrial	✓ inundated
___ E	___ 0-5	___ upper slope	✓ palustrine	___ freq. flooded
___ S	___ 5-10	___ mid slope	✓ estuarine	✓ saturated
___ W	___ 10-35	✓ lower slope	___ riverine	___ seasonally wet
✓ flat	___ 35 +	✓ upland flat	___ lacustrine	✓ moist (mesic)
___ all	___ vertical	✓ alluvial flat	___ subterranean	___ dry (xeric)
			___ marine	

Elevation: 0 TO 2 METERS, MSL
Geology: HOLOCENE AND RECENT PEAT AND CLAY OOZE (CT-1 THRU CT-5); LATE SANGAMON (40,000-50,000 YBP) SILT AND CLAY (PAMLICO MONTHOSTRATIGRAPHIC UNIT) DEPOSITED IN A SHALLOW ESTUARY BY THE RECEDING SANGAMON SEA, WITH POSSIBLE HOLOCENE ADDITIONS.
Soils (series if known, correlated with Natural Communities, p.2, if possible):
CT-1 RECENT PEATY MUCK AND CLAY OOZE OF LOCAL ORIGIN
CT-2, CT-3, CT-4 } CORNUCOPIA AND HOBONNY
CT-5 CHOWAN, CONABY, DOROVAN
CT-6 ROANOKE AND CAPE FEAR

THE PASQUOTANK CO. SOIL MAP IS OUT OF DATE: THESE ARE MY PERCEPTIONS OF THE SOILS PRESENT, SUBJECT TO REEVALUATION AND RIDICULE AT SOME FUTURE DATE.

Comments on Physical Description:

BIG FLATTY WELL DESERVES ITS NAME, BEING THE SHALLOWEST BODY OF WATER OF ITS SIZE IN NORTHEASTERN NORTH CAROLINA. THERE IS NO DISTINCT CHANNEL AND MOST OF THE CREEK INCLUDING THE BAY AT ITS MOUTH IS BARELY NAVIGABLE BY SMALL BOAT (MY BOAT DRAWS ABOUT 12 INCHES AT THE KEEL AND THE AVERAGE DEPTH IS ABOUT 18"). DEVELOPMENT OF THE EXTREMELY SHALLOW BAY ON A BROAD CLAY FLAT MAY BE EXPLAINED BY SHORELINE RECESSION UNDER THE STRONG WAVE ACTION FROM THE SOUTH AND THE DIURNAL COASTAL EASTERLIES ON THE ALBEMARLE SOUND, HERE AT ITS WIDEST POINT.

Biological Description:

Natural Communities. List communities and for each describe:
A) vegetation structure,
B) dominants & important spp. by strata,
C) position in landscape & relation to other communities,
D) quality & condition,
E) size

CT-1 SUBMERGED, FLOATING, AND INTERMITTENTLY EXPOSED ROOTED AQUATICS.

THIS COMMUNITY, ON SOFT PEAT AND CLAY OOZE, IS UNIQUE IN THE ALBEMARLE REGION. THE 12 AQUATIC SPECIES FOUND OCCUR ON BOTH SIDES OF THE LOWER PORTION OF INDIAN CREEK ON WHAT MAY BE BEST DESCRIBED AS FRESHWATER TIDAL FLATS, A RARE LANDFORM. CERATOPHYLLUM DEMERSUM, NAJAS GUADALUPENSIS AND POTAMOGETON PUSILLUS ARE ABUNDANT IN SHALLOW WATER WHILE MOST OF THE OTHER SPECIES AT TIME OF SURVEY WERE STRANDED ON THE FLATS. THE FLATS ARE VERY IRREGULARLY-FLOODED BY (1) LUNAR TIDES, (2) WIND TIDES ASSOCIATED WITH ALTERNATING WARM AND COLD FRONTS, AND (3) BY DIURNAL WIND TIDES ASSOCIATED WITH COASTAL EASTERLIES. THIS LAST COULD BE THE MOST REGULAR IN ITS EFFECTS. DEHYDRATION OF AQUATIC PLANTS EXPOSED FOR VARYING LENGTHS OF TIME MAY BE PREVENTED BY THE SOFT SUBSTRATE INTO WHICH PLANTS CAN PARTIALLY SINK WHEN WATER WITHDRAWS.

WATER IS FRESH TO VERY SLIGHTLY OLIGOHALINE BUT IS SUBJECTED IN SOME YEARS TO SALT PULSES WHEN WIND CONDITIONS OCCUR WHICH FORCE SALTY WATER NORTHWARD THROUGH ROANOKE AND CROATAN SOUNDS FROM PAMLICO SOUND AND OREGON INLET. WIND MAY CIRCULATE THIS BRACKISH WATER AT LEAST AS FAR UP THE SOUND AS PERQUIMANS COUNTY, CAUSING EXTENSIVE DIEBACK OF FRESHWATER SHORELINE AQUATIC AND WETLAND VEGETATION. I OBSERVED ONE SUCH PARTICULARLY STRIKING EVENT AROUND 1979. THIS WAS THE ONLY SITE FOUND FOR ZANNICHELLIA ON THE ALBEMARLE SOUND AND THE ONLY POPULATION OF ELODEA NUTTALLII ENCOUNTERED IN THE WHOLE ALBEMARLE-CURRITUCK STUDY AREA.

CT-2 SHORELINE MARSH

DIVERSE MIXED FRESHWATER TO SLIGHTLY OLIGOHALINE MARSH EMERGENTS.

THERE WERE NO CLEAR DOMINANTS IN THESE SPECIES-RICH SHORELINE-FRINGING MARSHES, BUT ZIZANIA AQUATICA, SPARTINA CYNOSUROIDES AND CLADIUM JAMAICENSE WERE LOCALLY ABUNDANT. ZIZANIA APPARENTLY REACHES ITS PEAK OF FRUITING AT THIS SITE AROUND OCTOBER 1, AS THE LAST GRAINS OF WILD RICE WERE FALLING AT TIME OF SURVEY.

CT-3 _ TYPHA ANGUSTIFOLIA MARSH

_ TYPHA ANGUSTIFOLIA – DWERSE MIXED MEDIUM AND TALL FRESH TO SLIGHTLY OLIGOHALINE MARSH EMERGENTS.

TYPHA MARSHES WERE OF LIMITED EXTENT, OCCURRING WHENEVER THERE WAS SOME DISTANCE BETWEEN CT-2 AND ADJACENT WOODED SWAMP. THIS TYPE WAS PROBABLY MORE ABUNDANT BEFORE MODERN FIRE-SUPPRESSION AND HAS PROBABLY BEEN REPLACED IN SOME AREAS BY CT-4. REMNANTS OCCUR IN AREAS WET ENOUGH TO INHIBIT SUCCESSION TO WOODY SPECIES, OFTEN WITH INTERIOR SHALLOW POOLS OF STANDING WATER, HENCE THE HABITAT FOR SPECIES LIKE AZOLLA CAROLINIANA.

CT-4 _ SUCCESSIONAL MARSH

_ MIXED EARLY SUCCESSIONAL COASTAL PLAIN WETLAND CANOPY TREES / MYRICA CERIFERA / OSMUNDA REGALIS – MIXED REMNANT FRESH TO SLIGHTLY OLIGOHALINE MARSH EMERGENTS.

UNLIKE THE MORE EXTENSIVE MARSHES OF THE NORTH RIVER TO THE EAST, WHICH HAVE NEARLY ALL BURNED IN THE LAST 2 TO 15 YEARS, THOSE OF THE PASQUOTANK RIVER AND OTHER ALBEMARLE SOUND TRIBUTARIES TO THE WEST, LIKE BIG FLATTY CREEK, HAVE LARGELY BEEN WITHOUT FIRE FOR MANY YEARS. CONSEQUENTLY, FIRE-SUPPRESSED SUCCESSIONAL MARSH IS THE MOST EXTENSIVE TYPE TO BE FOUND. THROUGHOUT THE REGION ALL STAGES OF SUCCESSION MAY BE SEEN, WITH CANOPY DOMINANCE BY BALDCYPRESS, LOBLOLLY PINE, SWAMP BLACK GUM, SWEETGUM OR RED MAPLE, EITHER AS SINGLE SPECIES DOMINANTS OR IN COMBINATIONS RESULTING APPARENTLY FROM COMPLEX INTERACTIONS OF GRADIENTS LIKE SUBSTRATE ORGANIC MATTER CONTENT, WATER

CHEMISTRY AND PAST FIRE EFFECTS WHICH ARE POORLY UNDERSTOOD (BY ME) AND WOULD BE A GOOD SUBJECT FOR A 10-YEAR DISSERTATION PROJECT.

THE UNDERSTORY IS MORE PREDICTABLY DOMINATED BY MYRICA CERIFERA IF FIRE HAS BEEN COMPLETELY EXCLUDED. DEPENDING UPON DEGREE OF SUCCESSION, THE HERB LAYER IS COMPOSED OF VARIOUS MARSH SPECIES REMNANTS, FADING OUT, WHILE OSMUNDA REGALIS IS TYPICALLY INCREASING TO BECOME DOMINANT OR AT LEAST ONE OF THE MOST IMPORTANT MEMBERS OF THE STRATUM. SUCH STANDS MAY ALSO BE COLONIZED BY SPECIES FROM ADJACENT SWAMPS LIKE WOODWARDIA AREOLATA AND SPHAGNUM PALUSTRE.

CT-5 _ CYPRESS-GUM SWAMP

- TAXODIUM DISTICHUM - NYSSA SYLVATICA VAR. BIFLORA / MIXED SWAMP SUBCANOPY TREES / MIXED FLOATING AND EMERGENT FRESHWATER SWAMP HERBS
- TIDAL CYPRESS-GUM SWAMP (SCHAFALE AND WEAKLEY).

THESE SWAMPS, IN WHICH EITHER CYPRESS OR NYSSA MAY OCCUR IN NEARLY PURE STANDS, ARE FOUND IN TWO LANDSCAPE POSITIONS: ONE ON THE BROAD FLATS ADJACENT TO THE SOUND NEAR WADE POINT AND ALONG THE LOWER MILE OF BIG FLATTY CREEK; AND THE OTHER IN NARROW SLOUGHS DRAINING THE UPLANDS BETWEEN PENINSULAS OF OAK FLATS (CT-6). BOTH TYPES ARE STRICTLY FRESH WATER, DRAINING INTERIOR UPLANDS, AND APPEAR TO BE AFFECTED ONLY BY THE HIGHEST WIND TIDES, DURING STORMS. THE SUBCANOPY VARIES GREATLY IN DENSITY BUT THE SHRUB LAYER IS USUALLY SPARSE. VINES ARE DIVERSE BUT NOT ABUNDANT EXCEPT ON WET MINERAL SOIL TRANSITIONAL FROM SWAMPS TO ADJACENT OAK FLATS.

CT-6 _ OAK FLATS

- QUERCUS PAGODA - MIXED WET-MESOPHYTIC COASTAL PLAIN HARDWOODS OF FINE-TEXTURED SOILS / MIXED COASTAL PLAIN SUBCANOPY TREES.
- NONRIVERINE WET HARDWOOD FOREST (SCHAFALE AND WEAKLEY).

THE OAK FLATS ARE DOMINATED BY *Quercus pagoda*, ALTHOUGH *Q. michauxii* MAY BE FOUND IN LOCALLY DOMINANT PATCHES. THE OPEN SUBCANOPY OF *Carpinus* AND A FEW OTHER SPECIES IS THE NEXT BEST-DEVELOPED STRATUM IN MATURE STANDS. BOTH SHRUBS AND HERBS ARE VERY SPARSE, AND VISIBILITY AND MOVEMENT ARE VERY LITTLE HINDERED.

THESE OAK FLATS MAY BE THE MOST EXTENSIVE REMNANTS OF THEIR KIND IN THE ALBEMARLE REGION BUT THEIR TREATMENT BY INDIVIDUAL LANDOWNERS HAS BEEN PATCHY IN RECENT YEARS AND THE MORE DISTANT PAST, WITH SOMETHING OF A DISTURBANCE GRADIENT FROM FORESTS NEAR FIELDS AND ROADS, WHICH ARE YOUNGER IN GENERAL, TO LARGE OLD-GROWTH STANDS NEAR THE TIPS OF PENINSULAS EXTENDING INTO SWAMP OR MARSH. THIS MAY REFLECT PAST LOGGING DIFFICULTIES, BIG FLATTY AND LITTLE FLATTY CREEKS BEING THE ONLY BODIES OF WATER IN NORTHEASTERN N C TOO SHALLOW TO HAVE FLOATED BARGES FOR LOGGING WITH STEAM OR INTERNAL-COMBUSTION POWERED WINCHES AND SKIDDERS. THE UNLOGGED PENINSULAS INVESTIGATED HAD STANDS OF VERY LARGE (UP TO 45 INCHES DBH) OAKS WHICH APPEAR TO BE ONLY ONE GENERATION AWAY FROM VIRGIN STANDS CUT IN THE GENERAL LOGGING OF THE REGION IN THE LATE 19TH AND EARLY 20TH CENTURY.

THE EXTENT OF REMNANT OLD-GROWTH FOREST ON THESE FLATS EXTENDING FROM UPPER BIG FLATTY CREEK EAST TO INDIAN CREEK AND WADE POINT, THEN NORTH TO LITTLE FLATTY CREEK AND BEYOND, IS UNDETERMINED. SINCE THIS LARGE AREA MAY CONTAIN THE LARGEST REMNANT NONRIVERINE WET HARDWOOD FOREST IN THE STATE, ITS QUALITY AND CONNECTIVITY IS AN IMPORTANT PRIORITY FOR FURTHER INVESTIGATION IN THE FIELD, BY RECENT AERIAL PHOTOGRAPHY, OR OVERFLIGHT.

Special Status Species present (attach forms):

LILAEOPSIS CAROLINENSIS

Potential for other Special Status Species:

POTENTIAL HABITAT IN MARSHES FOR CLADIUM MARISCOIDES, LUDWIGIA ALATA. POSSIBLE HABITAT IN CREEK NEAR MOUTH FOR LIMOSELLA SUBULATA.

Other noteworthy species or features present:

- USE OF THE ALBEMARLE SOUND BY BALD EAGLES IS RECOVERING AND THERE IS POTENTIAL NESTING HABITAT IF LARGE LOBLOLLY PINES ALONG THE SHORELINE CAN BE PROTECTED.
- PATCHES ON PENINSULAS OF OLD-GROWTH *Quercus pagoda* - *Quercus michauxii* FOREST.

Site Integrity: ✓ high ___ good ___ fair ___ poor

Average DBH of canopy trees: CT-6 20-22 INCHES.

Maximum DBH of canopy trees: *Quercus pagoda* - 45 INCHES, *Pinus taeda* - 36", *Quercus phellos* - 21".

Fire regime (natural, suppression, date of most recent, etc.):

NO FIRE FOR MANY YEARS. MARSHES ARE UNDERGOING SUCCESSION TO PINE, *Nyssa*, *sweetgum* AND RED MAPLE (SEE CT-4). ORIGINAL FIRE REGIME WOULD HAVE BEEN LIGHT GROUND FIRES IN WOODS WHICH SPREAD TO FLAMMABLE PINE SWAMPS AND MARSHES, WITH LITTLE EFFECT ON UPLANDS OTHER THAN PREVENTION OF BEECH COLONIZATION (BEECH IS NEARLY LACKING BUT BEGINNING TO ESTABLISH IN THE UNDERSTORY).

___ logged (when, describe): SOME PINE STANDS ON UPLANDS, SOME PORTIONS OF SWAMP, AND THE HARDWOOD PATCHES IN THE PINE SWAMP INTERIOR NEAR WADE POINT HAVE BEEN LOGGED IN THE PAST 10 YRS.

___ even-aged canopy (successional stand from pasture or clearcut):

___ non-native or weedy spp. present (list and describe):

NONE SEEN.

___ ditched/drained (describe):

___ stream channelized:

___ dredging/filling:

___ understory cleared:

___ grazing: NONE IN RECENT YEARS. A WOMAN ABOUT 80 TOLD ME THAT WHEN SHE WAS A GIRL OPEN-RANGE HOGS AND CATTLE KEPT MOST OF THE WOODS UNDERSTORY CLEARED.

___ ORV damage (describe):

___ other (describe):

Adjacent land use (describe):

- PINE PLANTATION (A FEW PATCHES)
- WOODS
- GLEN COVE - A LOW-KEY VACATION HOME DEVELOPMENT
- SMALL FARM ROW CROP AGRICULTURE.

Significance of site: (high quality and/or rare communities, rare spp., etc.):

Discussion: BIG FLATTY CREEK, WADE POINT AND LITTLE FLATTY CREEK NATURAL AREAS FORM A NEARLY CONTINUOUS BAND AROUND THE SOUTHERN TIP OF PASQUOTANK COUNTY, COMPRISING THE LARGEST REMNANT NATURAL AREA ON THE NORTH SIDE OF THE ALBEMARLE SOUND. IT CONTAINS A RARE LANDFORM, FRESHWATER TIDAL FLATS, WITH A UNIQUE AQUATIC PLANT COMMUNITY. INDIAN CREEK SUPPORTS AT LEAST ONE RARE SPECIES, LILAEOPSIS CAROLINENSIS, AND STANDS OF WILD RICE. THERE IS POTENTIAL NESTING HABITAT FOR THE BALD EAGLE, WHICH HAS RECENTLY RETURNED TO THE REGION, AND THERE ARE EXTENSIVE OAK FLATS, SUPPORTING STANDS OF OLD-GROWTH NONRIVERINE WET HARDWOOD FOREST, PERHAPS THE LARGEST REMNANT OF THIS ORIGINAL NATURAL FOREST TYPE IN THE STATE.

___national
_✓_state
___regional
___county
___local

Protection Considerations and Management Needs: (discuss recommended protection for natural area, and management needed to maintain or improve quality of site, such as fire, ORV exclusion, fencing, blocking drainage, etc.)

- PROTECT FROM LOGGING, ESPECIALLY CT-6, REMNANT OLD-GROWTH OAK FLATS
- PROTECT SHORELINE PINUS TAEDA FOR FUTURE BALD EAGLE NESTING SITES
- RESTORE MARSHES BY BURNING.

Documentation

Survey boundaries (describe why your survey stopped where it did):

NIGHTFALL

Priority for further survey (why, for what, at what season):

UPPER BIG FLATTY CREEK HAS EXTENSIVE OAK FLATS THAT WERE NOT EXPLORED - SHOULD HAVE HIGH PRIORITY FOR SURVEY. PINUS TAEDA FLATS NEAR WADE POINT WERE ALSO NOT SURVEYED.

Specimens collected (plants, animals, soil, rock - of what and state repository):

Photographs (of what):

CT-4, CT-6

Others knowledgeable about site:

_✓_ TOPO MAP ATTACHED

___Sketch of site or part of site attached (as needed or appropriate, to show access, rare spp., relative positions of communities, etc., particularly if cannot be well-portrayed on attached topo map).

PLANT SPECIES LIST

Code species by community in which they occur.
How thorough is this list? ___nearly complete ✓ medium ___casual

CANOPY:

CT-	1 - Aquatics	2 - Tall Marsh	3 - Tyan "	4 - Successional Marsh	5 - Swamp	6 - Uplands
Taxodium distichum		✓	✓	✓	D	
Nyssa sylvatica var. biflora				✓	D	
Pinus taeda				✓	✓	✓
Liquidambar styraciflua				✓		✓
Quercus pagoda						D
Quercus michauxii						✓
Quercus phellos						✓
Ulmus americana (1)						✓
Acer rubrum				✓		

SUBCANOPY:

CT-	1	2	3	4	5	6
Salix sp.					✓	
Ilex opaca						✓
Acer rubrum				✓	✓	✓
Liquidambar styraciflua					✓	✓
Ulmus americana					✓	
Nyssa sylvatica var. biflora					✓	
Carpinus caroliniana						✓
*Carya ovata						✓
Fagus grandifolia						✓
Carya tomentosa						✓
Amelanchier sp.						✓

PLANT SPECIES LIST (page 2)

SHRUBS:

CT-	1 - Aquatics	2 - Shoreline marsh	3 - Tidal marsh	4 - Successional marsh	5 - Swamp	6 - Uplands
Baccharis halimifolia			✓		✓	
Myrica cerifera			✓	D	✓	
Rosa palustris				✓		
Clethra alnifolia				✓		
Persea borbonia				✓		✓
Ilex opaca					✓	
Diospyros virginiana						✓
Lyonia ligustrina						✓
Vaccinium atrococcum						✓

VINES:

CT-	1	2	3	4	5	6
Mikania scandens		✓	✓	✓		
Apios americana			✓			
Rhus radicans				✓		✓
Smilax laurifolia				✓		
Smilax rotundifolia						✓
Smilax bona-nox						✓
Smilax glauca						✓
Smilax walteri				✓	✓	
Berchemia scandens						✓
Gelsemium sempervirens						✓
Anisostichus capreolata						✓
Campsis radicans						✓
Vitis rotundifolia						✓

EPIPHYTES:

Tillandsia usneoides		✓	✓		✓	✓

PLANT SPECIES LIST (page 3)

HERBS:

D = STRATAL DOMINANT
* = SPECIAL STATUS OR SPECIAL INTEREST

	CT-	1 AQUATICS	2 SHORELINE	3 TYAN MARSH	4 SUCCESSIONAL	5 SWAMP	6 UPLANDS
*	ZIZANIA AQUATICA		✓		✓		
	TYPHA ANGUSTIFOLIA		✓	D	✓		
	PANICUM VIRGATUM		✓		✓		
	SCIRPUS AMERICANUS		✓				
	SCIRPUS VALIDUS		✓				
	SPARTINA CYNOSUROIDES		✓	✓			
	CLADIUM JAMAICENSE		✓		✓		
	ECHINOCHLOA WALTERI		✓	✓			
	SACCIOLEPIS STRIATA		✓				
	ELEOCHARIS FALLAX		✓	✓	✓		
	ERIANTHUS GIGANTEUS		✓				
	JUNCUS EFFUSUS		✓				
	CYPERUS		✓		✓		
	PHRAGMITES COMMUNIS		✓				
	PANICUM COMMUTATUM						✓
	CAREX (VEGETATIVE, LVS 3MM WIDE)		✓			✓	
	CAREX (" LVS 10 ")						✓
	CAREX (" LVS 6MM WIDE)						✓
	HIBISCUS MOSCHEUTOS		✓		✓		
	KOSTELETZKYA VIRGINICA		✓	✓	✓		
	PELTANDRA VIRGINICA		✓	✓	✓		
	SAGITTARIA FALCATA		✓	✓	✓		
	GALIUM OBTUSUM		✓	✓			
	ASCLEPIAS INCARNATA		✓				
	ASCLEPIAS LANCEOLATA		✓				
	LIPPIA LANCEOLATA		✓	✓			
	CICUTA MACULATA				✓	✓	
	SIUM SUAVE		✓				
	IRIS VIRGINICA		✓		✓	✓	
	ACORUS CALAMUS				✓		
	ALTERNANTHERA PHILOXEROIDES		✓				
	POTEDERIA CORDATA		✓				

	CT-	1	2	3	4	5	6
*	LILAEOPSIS CAROLINENSIS	✓	✓				
	POTOMOGETON PUSILLUS	✓					
	POTOMOGETON PERFOLIATUS VAR BUPLEUROIDES	✓					
*	ZANNICHELLIA PALUSTRIS	✓					
	NAJAS GUADALUPENSIS	✓					
*	ELODEA NUTTALLII	✓					
	CERATOPHYLLUM DEMERSUM	✓					
	VALISNERIA AMERICANA	✓					
	UTRICULARIA VULGARIS	✓					
	MYRIOPHYLLUM (SPICATUM?)	✓					
	SPIRODELA POLYRHIZA	✓					
	POLYGONUM ARIFOLIUM		✓	✓	✓		
	POLYGONUM OPELOUSANUM		✓		✓		
	POLYGONUM HYDROPIPEROIDES		✓		✓		
	AMARANTHUS CANNABINUS		✓				
	ASTER NOVI-BELGII		✓	✓	✓		
	BIDENS MITIS			✓			
*	AZOLLA CAROLINIANA			✓			
	OSMUNDA REGALIS			✓	D	✓	
	THELYPTERIS PALUSTRIS			✓	✓		
	ASPLENIUM PLATYNEURON						✓
	HYPERICUM WALTERI			✓			
	BOEMERIA CYLINDRICA			✓	✓	✓	
	LOBELIA ELONGATA			✓			
	HYDROCOTYLE VERTICILLATA			✓	✓		

MORE →

NONVASCULAR:

	SPHAGNUM PALUSTRE						✓
	CHLOROPHYTA: ROOTED, FILAMENTOUS GREEN ALGA	✓					

PLANT SPECIES LIST (page 3)

CONTINUED

HERBS:

D = Stratal Dominant
* = Special Status Species

CT-	1 Aquatics	2 Shoreline	3 [illegible]	4 [illegible] Marsh	5 Swamp	6 Uplands
Solidago sempervirens			✓		✓	
Ludwigia leptocarpa			✓			
Lycopus rubellus				✓		
* Spiranthes cernua var odorata				✓		
* Limnobium spongia					✓	
Decodon verticillata					✓	
Mitchella repens						✓
Uniola laxa						✓
Tipularia discolor						✓
Hexastylis arifolia						✓
Euonymus americana						✓

CT-	1	2	3	4	5	6

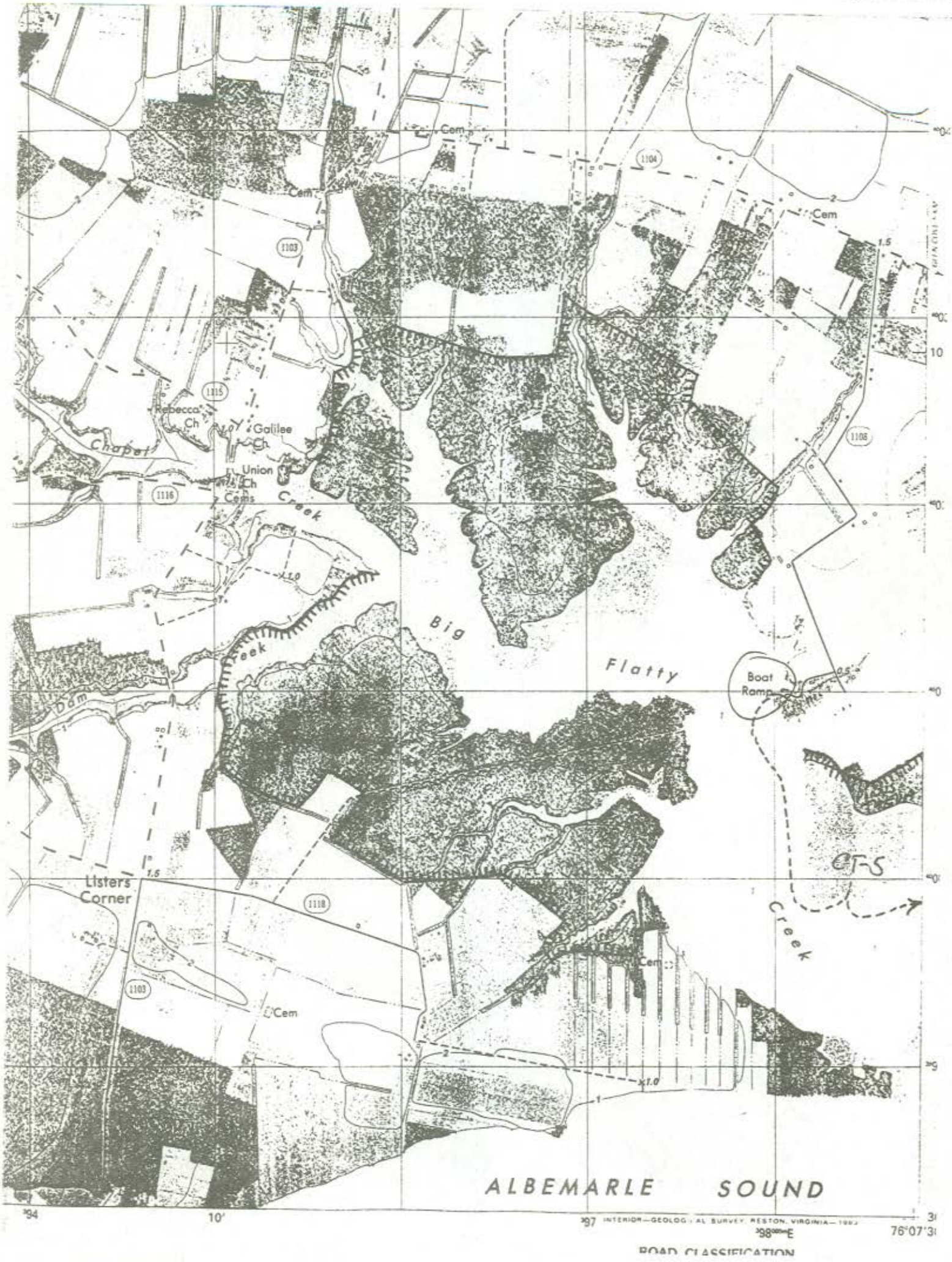
NONVASCULAR:

NOTES ON ANIMAL SPECIES PRESENT

List animals present, evidence (sighting or other), breeding?, etc.

WHITE-TAILED DEER
GRAY SQUIRREL
RACCOON
NUTRIA
WOOD DUCK
KESTREL
PILEATED WOODPECKER
FLICKER
KINGFISHER
DOUBLE-CRESTED CORMORANT
RING-BILLED GULL
BLUEJAY
RED-WINGED BLACKBIRD
GREAT-BLUE HERON
YELLOW-RUMPED WARBLER


METRIC
TO LITTLE FLATTY CREEK
Flatty Creek Ch
Cem
1105
Wade Point
Frog Island
Indian Creek
Big Flatty Creek
NATURAL AREA BOUNDARY
ROUTE OF SURVEY
ALBEMARLE
30 000 FEET


Cem
1104
Cem
1.5
1103
1115
Rebecca Ch
Galilee Ch
Chapel
Union Ch
Cems
1116
Creek
1108
x1.0
Big
Flatty
Creek
Boat Ramp
0.5
Dam
1.5
Listers Corner
1118
1103
Cem
Cem
Creek
x1.0
ALBEMARLE SOUND
94
10'
97
98000mE
76°07'3
ROAD CLASSIFICATION