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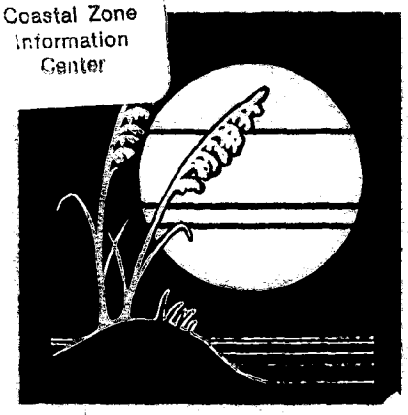

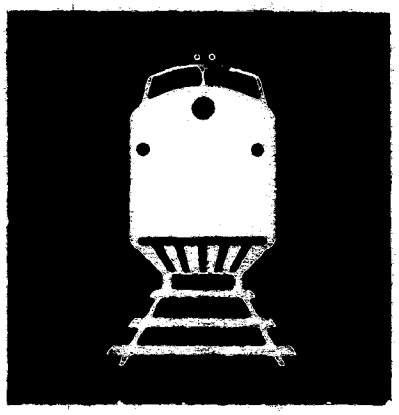

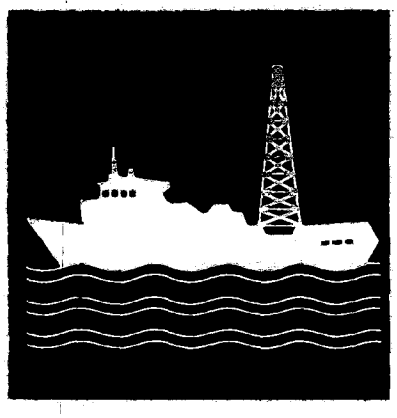

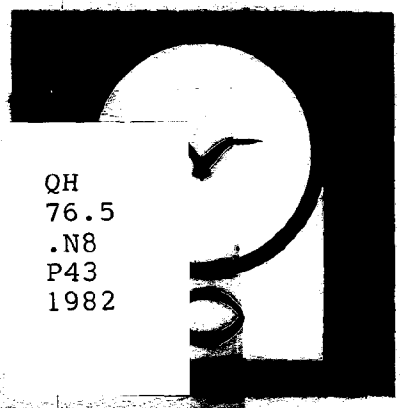

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Natural Areas Inventory of Pamlico County, North Carolina

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S. Lance Peacock
J. Merrill Lynch

NOVEMBER 1982

North Carolina
Coastal Energy Impact Program
Office of Coastal Management
North Carolina Department of Natural Resources
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NATURAL AREA INVENTORY OF PAMLICO COUNTY, NORTH CAROLINA

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S. Lance Peacock[1]

J. Merrill Lynch[2]

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PREFACE

The North Carolina Office of Coastal Management and the North Carolina Natural Heritage Program, both units of the Department of Natural Resources and Community Development, have commissioned a series of natural areas inventories for ten counties in the coastal zone of this state. The Pamlico County inventory was conducted in 1982 and was financed by a Coastal Energy Impact Program (CEIP) grant. CEIP funded the Pamlico County survey because of the potential environmental impacts of peat mining and other energy-related development.

The recommendations made in this report by J. Merrill Lynch and S. Lance Peacock are advisory. Their inventory and recommendations are designed to help state and federal agencies, county officials, resource managers, landowners and developers work out effective land management and preservation mechanisms to protect the six outstanding or exemplary natural areas described in the report. Agencies such as the N.C. Division of Environmental Management, Division of Land Resources, Division of Marine Fisheries, Wildlife Resources Commission, the U.S. Fish and Wildlife Service, U.S. Army Corps of Engineers, National Marine Fisheries Service and Environmental Protection Agency should find this report useful, as may university researchers, private consultants, and private conservation groups. The Office of Coastal Management will use the report in assessing permit applications and for federal and state consistency reviews.

Merrill Lynch and Lance Peacock are experienced field biologists, who have previously been employed with the N.C. Natural Heritage Program and are most familiar with natural habitats throughout the North Carolina coastal plain region. The investigators were exceptionally well qualified to identify, describe, and evaluate the most outstanding natural areas of the project region.

Project investigators were instructed to identify natural areas that contain highly unique, endangered, or rare natural features, or high-quality representations of relatively undisturbed natural habitats, <u>and</u> which may be vulnerable to threats and damage from land use changes. Consequently, the investigators were advised not to report extensively on the large expanses of brackish marshes that fringe most of the shoreline along the Pamlico Sound, and which, for the most part, is an ecosystem protected through state and federal regulatory programs.

We wish to underscore the investigators' recommendations, in their introduction to this report, that several other areas in Pamlico County warrant further inventory. Some of these other sites may prove to possess special interest natural features. One other area not identified in this report has been earlier considered as a natural area. Previous to this survey project, the Natural Heritage Program conducted a site inventory for Jones "Island" south of Hobuken. That 3,000-acre peninsula on the Pamlico Sound is cut off from the mainland by the Intracoastal Waterway. It is characteristic of extensive but ditched needlerush-brackish marshes, with second-growth loblolly pine, live oak, and black gum on upland hummocks. Jones Island is considered to be representative of a widespread and generally protected wetland habitat type.

The Office of Coastal Management, and the Coastal Resources Commission which it serves, implement the Coastal Area Management Act of 1974 (CAMA). Under this statute, the North Carolina Coastal Management Plan has been prepared and approved. It includes the definition and designation of various Areas of Environmental Concern (AEC). In many cases, AECs may coincide with natural areas that are herein recommended for preservation or special management. In some cases, AECs may encompass other areas--such as marsh zone wetlands--which are not extensively treated in this inventory.

Peat mining has particular implications for these natural areas, some of which overlay exploitable peat deposits. Mining will remove natural vegetation, permanently alter the hydrology of the region, lower surface soil types from high organic histosoils to the clayey, sandy, and loamy soils typical of other parts of the outer coastal plain. Thus, natural communities, once mining is complete, almost certainly could never be re-established or reclaimed on mined-out land. Preservation of the best natural areas, and appropriate hydrological management, is necessary prior to and during active peat mining.

The Natural Heritage Program is most pleased to have had this opportunity to conduct this project for the Office of Coastal Management. The inventory has revealed a number of high-quality natural areas that possess natural elements of statewide priority and are important parts of North Carolina's natural diversity. Most of the identified sites were previously unknown and undocumented by the state's scientific community. The Natural Heritage Program hopes that these areas will be protected for the benefits of present and future generations of North Carolinians and for the preservation of the state's truly exceptional natural heritage.

Charles E. Roe, Coordinator
N.C. Natural Heritage Program
November 16, 1982

ABSTRACT. Six natural areas are described and delineated for Pamlico County, North Carolina, as a result of a field survey December 1981 - September 1982. The natural areas contain about 18,500 acres, of which essentially 100% are in private ownership. Almost the entire acreage is wetland, primarily various pocosin types and palustrine mixed hardwood stands, along with some wetland and terrestrial longleaf pine communities. Several categories of significant features are described and mapped for each site, including representative plant communities, rare species, and the presence of exceptional biotic/abiotic diversity.

ACKNOWLEDGEMENTS

The assistance of the following individuals is gratefully acknowledged:

Julie H. Moore, Lee Otte, Chuck Roe and John Taggart reviewed manuscripts and offered many helpful comments. Lee Otte also provided invaluable insights into the ecology and biota of Pamlico County pocosins, and shared information on conditions at several sites. Others who assisted us in locating study sites include Otto Florschutz, Jr., and Pat White. Staff of the U. S. Soil Conservation Service, particularly Carolyn Boykin, allowed us to draw upon the unpublished manuscript of the Soil Survey of Pamlico County. Earl Faison ably assisted as our pilot during aerial reconnaissance phases of the project.

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INTRODUCTION

Pamlico County is in the eastern section of North Carolina, situated in the Coastal Plain Province. It was formed in 1872 from parts of Craven and Beaufort Counties, and has an area of 576 square miles, of which 341 are land and 235 are water (Powell, 1968). The approximately 369,000 acres encompass a variety of habitats, ranging from open sound waters, brackish marsh and embayed rivers to pocosins, wooded swamps, hardwood flats, pine flatwoods, upland pine stands and upland mixed pine-hardwood forests.

Pamlico County occupies the outer part of a peninsula which lies between the embayed lower portions of the Pamlico and Neuse Rivers. Beaufort County bounds Pamlico on the north and occupies the remainder of the peninsula; Craven bounds Pamlico County on the west along Upper Broad Creek. The county is bordered on the south by the embayed Neuse River and on the east by Pamlico Sound. The Pamlico Sound shoreline of the county is highly dissected by the embayment of local streams by sea level rise. This dissected aspect is evident also along the Neuse and Pamlico River shorelines. A major local embayment is the Bay River, which extends west nearly halfway across the county from the sound. Other embayments include two Goose Creeks, Broad Creek, Upper Broad Creek, Mouse Harbor, Jones Bay and numerous others. The entire drainage of the county is directly into estuarine bodies of water (Pamlico Sound and the Neuse and Pamlico River estuaries). The southwestern quarter of the county is the only section drained by a well-developed dendritic system of non-embayed creeks, Upper Broad being the major one. The flow in these creeks is sluggish. Pocosin areas with very poor natural drainage occupy much of the county interior. There are no natural lakes; a few vegetated Carolina bays are located on sandy surfaces in the western section. Elevations in the county range from 0-50 feet above mean sea level; this relatively great range is due to the fact that the western third of the county lies on an older and higher surface known as the Chowan marine terrace (see next section).

RECENT GEOLOGY

The eastern two-thirds of Pamlico County is on the Pamlico marine terrace or Pamlico surface. The Pamlico is the lowest and youngest of the several generalized surfaces of the state's Coastal Plain recognized as having been formed during periods

of higher sea level. The history of sea level rise and fall which formed the Pamlico surface is complex. About 75,000 yrs. BP (Daniel, 1981), during the Pamlico transgression, the edge of the sea lay inland to a point now marked by the sandy ridge of the Suffolk Scarp, known as Minnesott Ridge in Pamlico County. The toe of the scarp is now about 20 ft. above modern sea level, and 10-15 miles west of the Pamlico Sound shoreline of the county. During the peak of the Wisconsin glaciation (15,000 yrs. BP), sea level stood as much as 400 ft. below its modern level (Daniel, 1981). Since that period the sea has risen to its present level, and continues to rise today.

The complex cycle of marine transgressions and regressions has produced differing effects upon the topography of the alternately exposed and submerged surfaces. Rising seas slowed stream erosion by raising stream base level, and planed off or obscured with silts and muds the previous surface features. Falling sea level in contrast exposed areas of the continental shelf and rejuvenated streams, increasing downcutting and topographic relief.

The western third of the county is generally on the Chowan marine terrace, the next-oldest of the Coastal Plain marine surfaces. The history of the formation of the Chowan terrace is very similar to that of the younger Pamlico surface. The surface is interpreted as having formed during a higher stand of the sea; probably also involving several transgressions and regressions of the sea. Deposits in the vicinity of Arapahoe, Pamlico County, are interpreted by Mixon and Pilkey (1976) as being of lower Sangamon or pre-Sangamon Interglacial age. They note that researchers have reported a date of "147,000 $\pm$ 13,000 years BP for a similar stand of sea" in South Carolina (ibid, p. 36). The Chowan terrace portions of Pamlico County were not submerged during the Pamlico transgression, but did share the increased downcutting by streams during periods of lower sea level.

The two marine surfaces of Pamlico County are separated by the prominent ridge and scarp known as the Minnesott Ridge and Grantsboro Scarp. This ridge/scarp trends approximately north-south, and along the crest reaches elevations of 47 feet in Pamlico County (60 feet to the north in Beaufort County). Mixon and Pilkey interpret the pair of features as a multi-age "compound feature" representing shorelines and accompanying dunes formed by at least two transgressions of the sea, and younger than the Chowan surface to the west.

Concurrently with the most recent period of rising sea level, conditions favorable to peat formation have prevailed in Pamlico County and throughout the North Carolina Coastal Plain, in a variety of vegetational and topographic situations. During the past 10,000 years, peat has been forming in blocked drainages, Carolina bays and river floodplains; under swamp forests, pocosins and marshes (Otte,

1981). Of these, however, only floodplain and coastal marsh peats appear to be caused by or directly related to sea level rise and position. Interior Pamlico County peats are not a direct result of sea level rise (Otte, 1981).

Peat has filled many of the topographic lows which were developed on the pre-peat Pamlico and Chowan surfaces during the full-glacial lower stand of the sea, and peat deposits have spread beyond the original lows to mantle adjacent higher ground. In the Dismal Swamp Oaks and Whitehead (1981) have intensively examined the topography at the base of the peat deposits, and find that a dendritic pattern of stream drainage was present before peat formation began. Such detailed exploration of the sub-peat "topography" has not been conducted in Pamlico County, but extensive sampling of peat depths, in conjunction with surveys of energy-grade peat deposits, indicates that a somewhat similar but less complex stream-dissected surface is present beneath the Light Grounds Pocosin peat deposit (Ingram and Otte, 1980). Ingram and Otte found a north-trending channel to be the site of original peat formation, with peat eventually spreading into a broad, shallow depression in which the stream channel lay. Sub-peat features of other Pamlico County peat deposits have been less thoroughly studied, but probably resemble the pattern of the Light Grounds Pocosin.

On the basis of soils data, pocosin peat deposits occupy about 12 percent of Pamlico County. The rest of the county - mineral surfaces and marsh peats - also originated principally as a result of the influences of Pleistocene, recent, and ongoing sea level fluctuations.

SOILS

The Soils Associations of Pamlico County have been mapped on a General Soil Map by the US Soil Conservation Service (SCS, 1972); and more recently the entire county has been surveyed and mapped by SCS personnel. The latter survey is available in preliminary form (SCS, 1981) and the State SCS Office made available to us a manuscript version of the final Pamlico County Soil Survey (SCS, in manuscript). Because considerable refinement of soils information has been accomplished since 1972, we use the most recent (manuscript) source in the following soils discussion. In the main body of this report the equivalent Soil Association from the more readily available 1972 General Soil Map is given for each natural area.

a) Belhaven-Dare Association - nearly level, very poorly drained organic soils subject to frequent ponding, on low marine terraces.

Area of county: 8 percent; in Bay City and Light Ground Pocosins.

Natural areas identified: none.

b) Croatan-Dare Association - nearly level, very poorly drained organic soils on uplands subject to frequent ponding.

Area of county: 4 percent; in Northwest Pocosin

Natural areas identified: Northwest Pocosin.

c) Lafitte-Axis Association - nearly level, very poorly drained organic soils and loamy soils in marshes that are flooded frequently with salt water.

Area of county: 9 percent; mostly in the eastern section; naturally vegetated (marsh).

Natural areas identified: none.

d) Leon-Tomahawk-Rutlege Association - nearly level to gently sloping, poorly drained sandy soils with a hardpan subsoil, moderately well drained soils with a loamy subsoil, and very poorly drained sandy soils; on uplands.

Area of county: 5 percent.

Natural areas identified: North Minnesott Sand Ridge; South Minnesott Sand Ridge.

e) Stockade-Arapahoe-Wasda Association - nearly level, very poorly drained soils that have a loamy, moderately permeable subsoil; subject to occasional flooding or frequent ponding; on low marine terraces and stream terraces.

Area of county: 21 percent; about two-thirds woodland; the rest row crops and pasture.

Natural areas identified: Merritt Hardwood Stand.

f) Argent-Brookman-Wahee Association - nearly level, poorly drained, very poorly drained, and somewhat poorly drained soils that have a clayey, slowly permeable subsoil; subject to rare to occasional flooding; on low marine terraces.

Area of county: 11 percent; about three-fourths woodland.

Natural areas identified: Federal Paper Hardwood Stand; Stonewall Hardwood Stand.

g) Yonges-Altavista-Fork Association - nearly level, poorly drained, moderately well drained and somewhat poorly drained soils that have a loamy, moderately permeable subsoil; on low marine terraces and stream terraces.

Area of county: 26 percent; about one-third in row crops.

Natural areas identified: none.

Three other minor Associations are present in the county: Goldsboro-Lynchburg-Norfolk (4 percent of county area); Paxville-Rains (6 percent); and Leaf-Lenoir-Craven (6 percent). All are mineral soils; none has any identified natural areas.

THE VEGETATION

Much of Pamlico County is comprised of a diversity of wetland habitat types, under the criteria established by Cowardin, et al. (1979). Uncleared areas of the county generally support hydrophytic vegetation, and the soils of the county, whether drained or undrained, are predominantly hydric (51 percent very poorly drained; 29 percent poorly drained; SCS, in manuscript). Either of these attributes - hydrophytes or hydric soils - is sufficient to indicate the presence of wetlands. As in most counties of North Carolina's lower Coastal Plain, large areas of wetland soils and vegetation have been cleared and put into agricultural production. This land use was concentrated on wet mineral soils throughout much of the historical period of development, but recently large acreages of peat lands have been intensively developed.

About 12 percent of the county has soils considered moderately well drained to well drained, involving several Soils Associations concentrated in the western part of the county. These areas are mostly in second-growth successional communities or are cleared and

in agricultural use. The nature of the original vegetation is unknown, but was probably a diverse assemblage of mesic to xeric hardwoods and longleaf pine (Pinus palustris; cf. Frost, 1982). The drier uplands were cleared and farmed at an early date. Additional moderately well drained soils occur along Minnesott ridge, where they are dominated by the original longleaf pine, or a replacement growth of loblolly pine (Pinus taeda).

The forests of Pamlico County have been exploited since the colonial period. Timber cutting and similar activities do not necessarily entail a permanent alteration of plant communities, however. Plant communities along Minnesott Ridge and in the northwestern and southeastern quadrants of the county have retained considerable integrity of composition in the face of repeated logging cycles - although with changes in the age class structure and increased presence of some species which are promoted by disturbance or by selective removal of their competitors. Recovery in wetland communities after logging is most complete where extensive ditches have not been constructed. The longleaf pine communities of the Ridge, the Northwest Pocosin, and the hardwood flats around the southern edge of Light Grounds Pocosin in particular still exhibit a remarkable correlation with soil types. This observation supports the conclusion that edaphic and related hydrologic and nutrient conditions (and an uninterrupted fire regime on sand ridge and in pocosin) still exert a controlling influence on the basic wetland communities in those sections of the county.

Contemporary disturbances affecting the Pamlico County vegetation include continued timber cutting, fire suppression in certain communities, clearing of wetland vegetation and draining of wetland soils for agriculture and pine plantations, and, potentially, peat mining. The now common practice of extensive ditching in conjunction with timbering will shift wetland sites toward drier conditions and prevent the self-maintenance and recovery of the vegetation. Drained sites from which the original hydric tree species have been removed often become dominated by more mesic and "weedy" species such as red maple (Acer rubrum), sweetgum (Liquidambar styraciflua) and loblolly pine. This process is evident in the Bay City Pocosin in northern Pamlico County, where pocosin vegetation has been extensively replaced by loblolly pine and red maple thickets after drainage. The same process, with only minor variations occurs when longleaf pine flatwoods and hardwood flats are drained during logging.

Modern fire control and suppression also contribute to vegetational change. Fire is a natural and common force in the pocosin and longleaf pine communities which are extensive in Pamlico County. Fire/vegetation relationships cannot be adequately expressed solely in terms of fire presence or fire absence, however. Where fire occurs, as in Pamlico County pocosins and longleaf stands, its in-

fluence on vegetation will be in large measure a function of its frequency. The function of fire frequency in controlling the structure and composition of longleaf pine communities is fairly well known to ecologists and foresters, but the similar effect of fire frequency in pocosins has gone unnoted by most observers. Although wildfires continue to occur, particularly in pocosins, fire frequency is being reduced over much of the county, purposely through fire control efforts and incidentally through creation of cleared areas and ditches which act as firebreaks.

Long term land-use commitments such as agricultural development obviously require an effectively permanent alteration of the ecosystem, including both biotic and abiotic components. Recent, ongoing and proposed land conversion in Pamlico County totals many thousands of acres. Peat mining is the ultimate consumptive use proposed thus far for the county, in which the soil itself is removed from the site and used to produce energy. Light Grounds Pocosin contains the most suitable peats for energy production.

OUTLINE OF PRINCIPAL VEGETATION TYPES IN PAMLICO COUNTY

I. Aquatic Communities - submerged and floating aquatic plants are found in numerous areas of Pamlico County, principally in the brackish water habitats which abound along the estuarine shorelines and localized embayments of the county. Freshwater habitats are much scarcer in the county, but freshwater aquatics are undoubtedly present in the few small, non-embayed creeks.

II. Wetland Communities

A. Brackish Marsh - extremely abundant in the eastern part of the county along Pamlico Sound, the Pamlico River and their embayed tributaries. Also present along the Neuse River shoreline in scattered locales.

B. Freshwater Marsh - very uncommon in the county. Small amounts of fresh or near-fresh marsh were noted at the head of Brown Creek in the eastern part of Pamlico County, and additional small fresh marshes may be present in the upper reaches of other local embayments.

C. Cypress-gum-lowland conifers Swamp Forest (*Taxodium distichum*-*Nyssa sylvatica* var. *biflora*-lowland conifers) - A once fairly extensive community in Pamlico County, now much reduced by logging and land clearing. An excellent small example was noted at the head of Upper Broad Creek, in which loblolly pine is the coniferous element. Lesser examples are present further down the same creek and at the heads of local embayments throughout the county. Examples of palustrine, as opposed to riverine, swamp forest may be present in the Gum Swamp vicinity along the Pamlico-Beaufort County line, where additional field work is needed. Interestingly, almost no Atlantic white cedar was seen in Pamlico County, although W. W. Ashe (1894) reported 3000 acres "partly lumbered," near Vandemere in Gum Swamp.

D. Mixed Hardwood Flats - this community consists primarily of oaks, including swamp chestnut oak (*Quercus michauxii*), laurel oak (*Q. laurifolia*) and cherrybark oak (*Q. pagodaefolia*). Loblolly pine (*Pinus taeda*) is usually a common component. Other hardwoods present in varying proportions, depending on site conditions, are tulip

poplar (Liriodendron tulipifera), red maple (Acer rubrum), blackgum, (Nyssa sylvatica) swamp gum (N. s. var. biflora) and sweetgum (Liquidambar styraciflua). Beech (Fagus grandifolia) occurs at scattered, slightly better drained locales. Generally occupies flat "upland" areas of poorly drained, silty, clayey, or fine loamy soils (usually wet Alfisols in the sites examined).

Once an extensive community in Pamlico County, Mixed Hardwood Flats are now severely reduced by agricultural clearing, logging and pine plantation development; and generally are one of the most threatened communities of the North Carolina Coastal Plain.

E. Pocosin - one of the most common general habitats in Pamlico County, which has three major pocosins exhibiting varying degrees of disturbance: Light Grounds, Bay City and Northwest. A fire-influenced group of communities, always occurring on peats or peaty sands, but with considerable variation in the vegetation in response to varying peat depth, hydrology and availability of nutrients to the system. Four types recognized by Otte (1981) are Pond Pine Forest, Pond Pine Woodland, High Pocosin and Low Pocosin; his criteria for these types are summarized in Table 1.

F. Pine Flatwoods - a group of communities primarily associated with wet sandy soils of the Minnesott Ridge. Longleaf pine dominates the slightly higher "flats," pond pine (Pinus serotina) the interfingered swales, with various shrub and herb combinations in the lower strata . These communities are fire-maintained, and exhibit a great degree of variation in the proportion of shrub to herbaceous cover, depending on recent fire history. Long term fire exclusion will result in extensive changes in herb, shrub and canopy layers.

G. Wetland Seral Pine and Hardwoods - distributed throughout Pamlico County are areas of second-growth sweetgum, loblolly pine and red maple, which have grown up in differing mixes on disturbed wetland sites such as old fields, drained pocosins, logged swales, etc. These successional communities vary widely in age and size, often being disturbed repeatedly, and occur on a variety of soils. The original wetland communities likewise varied from site to site.

III. Terrestrial Communities

A. Upland Longleaf Pine - occurs on moderately well drained sites along the crest of Minnesott Ridge, and is the only ter-

restrial community in Pamlico County of which significant examples remain. This community is closely associated with the pine flatwoods described above, being physically intermingled and an ecologically very similar fire-maintained vegetation type.

B. Upland Seral Pine and Hardwoods - extensive areas of this second-growth type are found on better-drained sites in the western section of Pamlico County, where the original vegetation was probably a combination of hardwoods and/or longleaf pine. As with the wetlands successional assemblage discussed above, size and age of the canopy vegetation is variable, and disturbance often repeated.

Other land use types in Pamlico County include pine plantations, agricultural fields, abandoned fields and habitations, a state game land, urban areas, and extensive brackish marsh impoundments.

TABLE 1

SELECTED CHARACTERISTICS OF OTTE'S POCOSIN TYPES

(from Otte, 1981)

	low pocosin	high pocosin	pond pine woodland	pond pine forest
Soils	greater than four feet of peat	two to four feet of peat	one to two feet of peat	peaty sand to one or two feet of sandy peat
Hydroperiod	abundant surface water in wet season; saturated year-round except in severe drought	flooded in wet season; water table below surface but remains within organic layer in dry season	flooded or saturated in wet season but dropping to mineral layer in dry season	saturated in wet season; water table drops into mineral sediments in dry season
Shrubs	height is two to four feet on moss mats; four to six feet on hummocks; density of lower shrubs open; of taller shrubs closed	height is four to eight feet; tallest on hummocks; density is closed	height six to fifteen feet; shrub layer usually closed	height ten to twenty feet; generally closed
Pond Pines	height to ten feet; trees widely scattered, gnarled	height to 25 feet; widely scattered	up to 60 feet tall and 2 feet dbh; scattered, less than 50% cover	mostly less than 50 feet tall, dbh to 12 inches; canopy generally closed

STUDY OBJECTIVES, METHODS AND RESULTS

Contract requirements called for identification and field inventory of natural areas throughout Pamlico County. The field inventory was community-oriented; we concentrated on locating natural communities of exceptional quality, based on such factors as size and age of canopy species, biologic, edaphic and hydrologic diversity, extensiveness of habitat(s) and contiguity with other natural areas, absence of intensive disturbance and recovery from past disturbance, and the presence of a full range of communities and ecological conditions functioning as a system.

To inventory the diverse communities of Pamlico County first necessitated a general county-wide reconnaissance. After review of several sets of aerial photographs, particularly 1970 photography used by the US Soil Conservation Service in its preliminary soils mapping, an initial inspection of the county by vehicle and on foot was completed in February, 1982. Shortly later, an aerial reconnaissance of the entire county was conducted. Species and site reports on file with the North Carolina Natural Heritage Program were examined concurrently with these activities, and knowledgeable individuals were interviewed (see acknowledgements). A basic tentative list of potential study areas began to emerge early in the reconnaissance, and was finalized by early May.

During the reconnaissance period most of the private and public roads in the county were driven. Roads in most of the potential study areas identified during photography reviews were walked during April and May. Throughout all periods of fieldwork, notes were taken on vegetation, both in study areas and, for comparative purposes, in areas not exhibiting superior natural qualities. Orthophotoquad diazo (blackline) prints were used in the field as guides in assessing the extent of large communities, the amount of recent disturbance and to some degree the cover composition of inaccessible stands.

Sites selected as representative of community types to be described in this report were examined on foot. Plant species lists, tree diameters at breast height, tree height and age estimates and a judgement of dominant species were all recorded. Examples we considered representative or superlative and on which we base our descriptions of the vegetation are mapped on the site report maps incorporated in the text. We conducted an informal but complete survey of the breeding birds at most of the wooded and shrub-bog habitats upon which we report. Other "high profile" vertebrates were noted where observed.

The six natural areas we have identified are as follows (see also county map):

(1a) Federal Paper Hardwood Flats - 2400 acres

(1b) Stonewall Hardwood Flats - 425 acres

(1c) Merritt Hardwood Flats - 1500 acres

(2a) North Minnesott Sand Ridge - 1250 acres

(2b) South Minnesott Sand Ridge - 380 acres

(3) Northwest Pocosin - 12,500 acres

These areas are summarized in detail in the following report.

The candidates represent several edaphic and biotic combinations. Most of the areas selected have a long history of disturbance of the cover vegetation by human activity; but all are considered to be recovered from past disturbance and ecologically intact; i.e. not drained, having continued frequent fire in fire-adapted vegetation, etc. Some of the areas are large, in keeping with the expansive and relatively unbroken character of the vegetation in parts of Pamlico County, but no natural area was selected on the basis of so-called "wilderness values." All support some rare plant and/or animal species, but none was chosen based solely on the presence of these organisms. Typical questions we considered when examining a potential site were:

(1) Does the site have regional, state or county-wide significance as a natural area?

(2) Are there unusual habitat conditions present?

(3) Has the site recovered from (or escaped) prior disturbance?

(4) Is the site representative of a type of habitat which is rapidly being converted to other land uses?

(5) Would loss of the habitat constitute an irretrievable loss of resources to Pamlico County?

The inventory results reflect a bias toward large areas of relatively undisturbed land. A chief limit inherent in the study is that it was too broad; more attention should have been focused on analysis of communities at specific locations. While such an approach would have satisfied the desire for technically complete community descriptions, it would have diverted us from our objective to present useful natural areas data in the context of the county and its land use patterns as a whole. We recognize that certain biologically significant areas - and significant features at identified sites - have gone unnoted and unreported by us. We wish to point out the following areas in need of further inventory:

(1) Gum Swamp along the Pamlico-Beaufort County line north of Vandemere

(2) Goose Creek Game Land

(3) Brackish marshes throughout the northeastern section of the county

(4) additional botanical inventory along Minnesott Ridge

(5) further inventory of all hardwood flats

(6) Honey Road swamp forest on the Pamlico-Craven County line

(7) Carolina bays near Goose Creek in the southwestern area of the county.

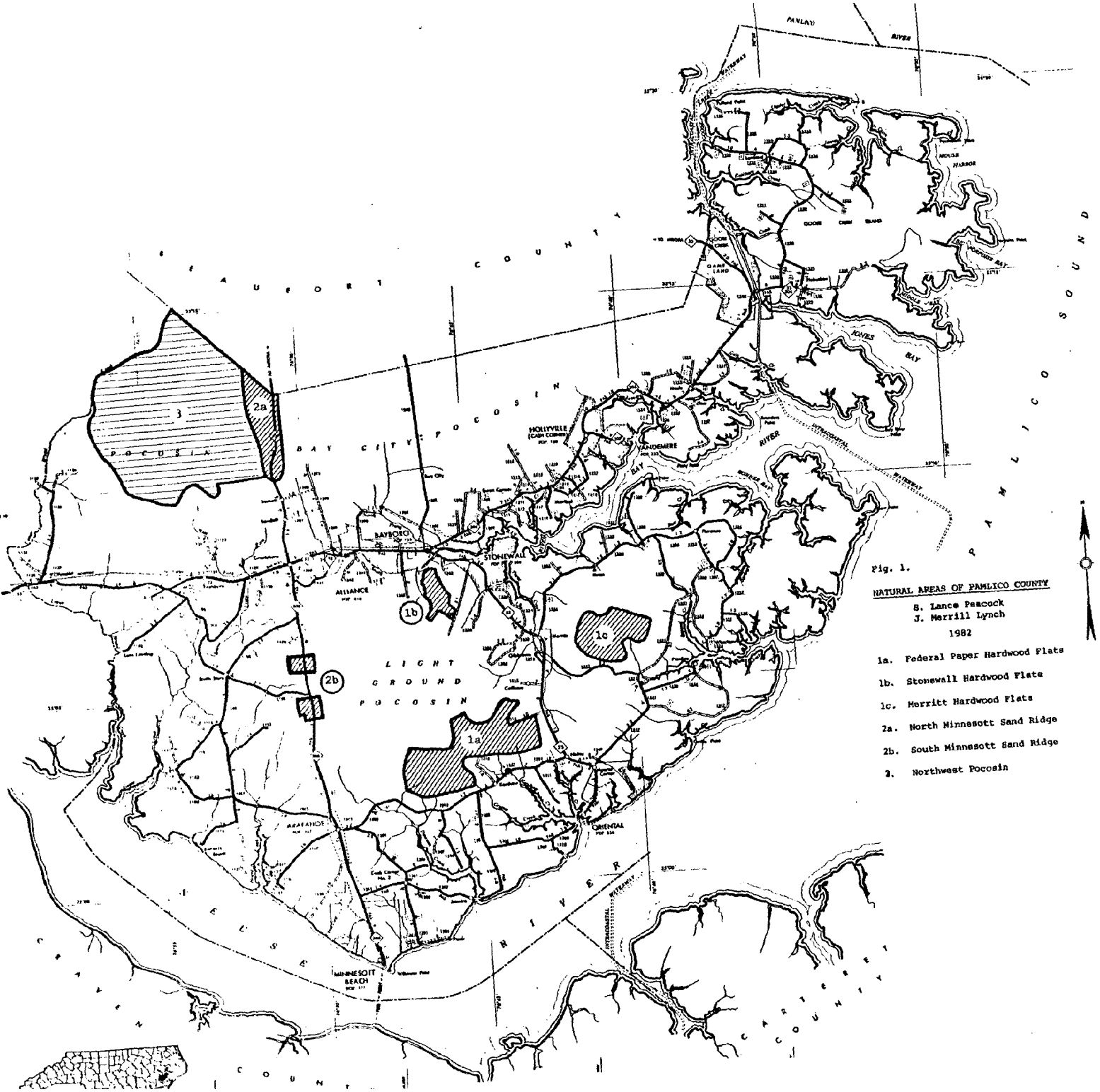

Fig. 1.

NATURAL AREAS OF PAMLICO COUNTY

S. Lance Peacock
J. Merrill Lynch
1982

1a. Federal Paper Hardwood Flats

1b. Stonewall Hardwood Flats

1c. Merritt Hardwood Flats

2a. North Minnesott Sand Ridge

2b. South Minnesott Sand Ridge

3. Northwest Pocosin

NATURAL AREA INVENTORY FORM
(To be prepared for each site)

Basic Information Summary Sheet

1. Natural Area Name: (a) Federal Paper Hardwood Flats, (b) Stonewall Hardwood Flats and (c) Merritt Hardwood Flats
(Descriptions of these three separate sites are combined due to their vegetational relationship)

2. County: Pamlico

3. Location: (a) Federal Paper - north of SR 1300, paralleling that road approximately between Granny Gut and the NC 55 junction. Light Ground Pocosin borders this tract on its western and northern edges.
(b) Stonewall - due south of Bayboro across the South Prong of the Bay River. Bounded on the east by SR 1337 and associated fields; on the west by Neal Creek.
(c) Merritt - centered about 2.3 miles ENE of the community of Merritt, in a large loop formed by SR 1324, 1329, 1321 and 1322.

4. Topographic quadrangle(s): Federal Paper: Arapahoe (1951) and Oriental (1975)
Stonewall: Bayboro (1974) and Oriental
Merritt: Oriental

All 7.5 min.

5. Size: Federal Paper - 2400 acres; Stonewall - 425 acres; Merritt - 1500 acres; all measured with a grid calculator

6. Elevation: Federal Paper and Stonewall: 10 to 15 feet or slightly higher above mean sea level.
Merritt: 7 to 8 feet above mean sea level

7. Access: The Federal Paper Hardwood Flat may be reached from points along SR 1300 and SR 1313, and from an unnamed woods road north from old SR 1300 (a minor relocation of SR 1300 may be confusing). The Stonewall tract is entered where it abuts SR 1337. The Merritt Flat is reached via Jack Taylor Road, a private woods road going southeast from SR 1324.

8. Names of investigators:

S. Lance Peacock	J. Merrill Lynch
P. O. Box 6006	Route 2, Box 222-B
Raleigh, NC 27628	Enfield, NC 27823

9. Date(s) of investigation: February 25, April 14, June 28 and July 13, 1982.

10. Priority rating: Medium, to high for the Federal Paper tract

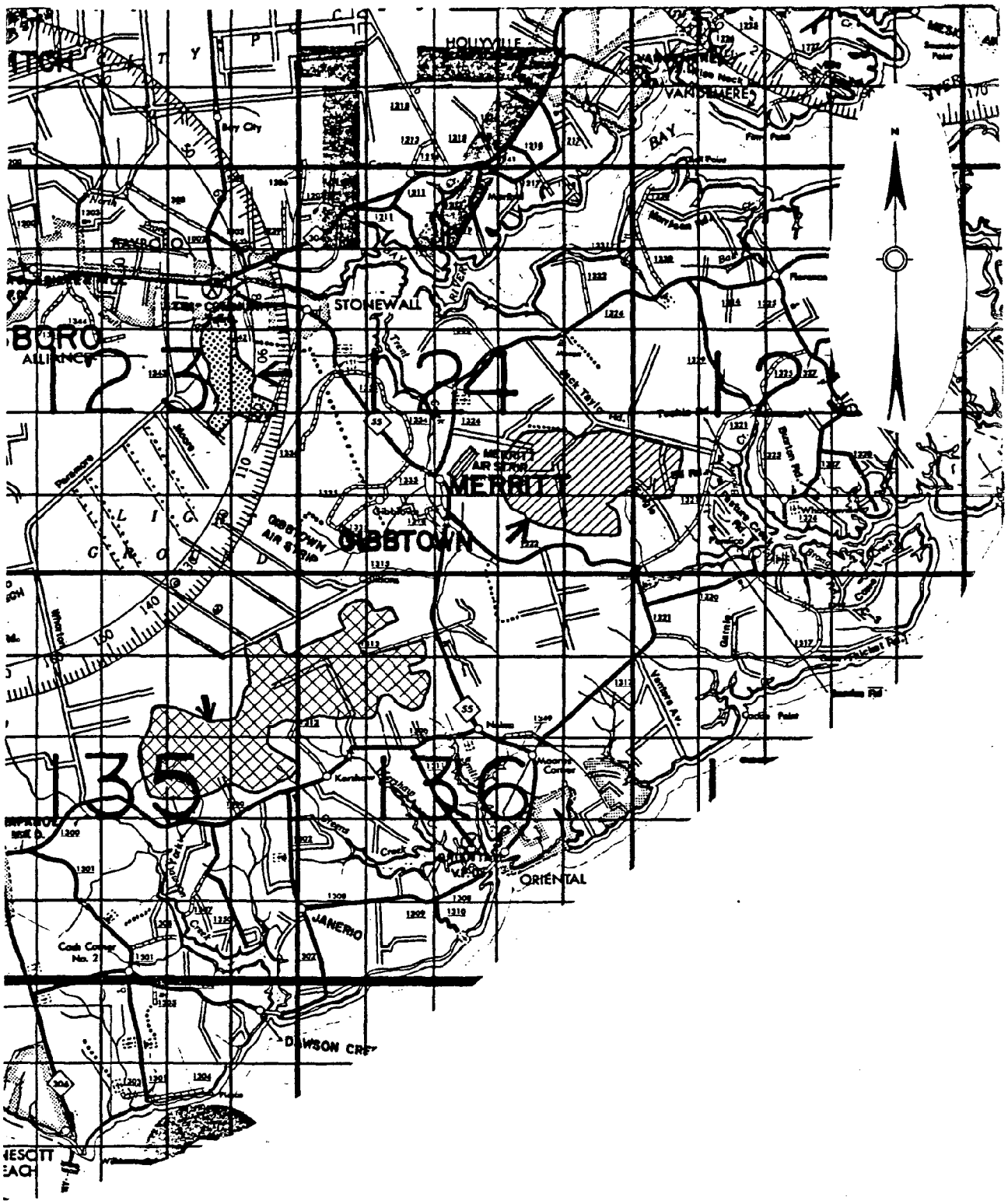

Fig. 2. Access information:

FEDERAL PAPER HARDWOOD FLATS — study area

STONEWALL HARDWOOD FLATS — study area

MERRITT HARDWOOD FLATS — study area

11a. Prose Description of Site:

SOILS AND TOPOGRAPHY

East of the Light Ground Pocosin lie extensive level tracts of hardwood forest, of which two examples of outstanding quality are described here plus a third of local significance. These examples represent the magnificent hardwood-dominated plant communities which once occupied a major percentage of the county, often fringing the peats and peaty mineral soils of the pocosins. Because of the preponderance of oak species (Quercus) in the canopy, these communities were termed "oak flats" by W. W. Ashe (1894); the more general term "hardwood flats" recognizes the common presence of a number of other hardwoods in addition to oaks.

Hardwood flats occur in Pamlico County primarily on the mineral soils of the Leaf-Bayboro and Portsmouth-Torhunta Associations. A suggestion of the original extent of the hardwood flats may be gained from the fact that 47 percent of the county area consists of these two soils associations (SCS 1974, Appendix H). Thus the hardwood stands associated with these soils probably were once one of the most common forest types in Pamlico County, and indeed are still common today in a reduced and disturbed condition.

Within the hardwood flats general habitat feature, herb, shrub and tree species composition varies considerably from one stand to the next (see detailed site description following). Soils characteristics control the composition at a given location with cutting and other disturbances introducing secondary variations. Internal soil drainage seems to be the most important natural determinant of plant communities on these extremely flat sites, which exhibit only poorly developed surface drainage systems (streams).

Typically in the areas surveyed, deep and shallow peat soils at slightly higher elevations bound the hardwood flats soilscape on the wet end of the soil moisture gradient. Mineral soils with a histic epipedon may be present also. (These peat and mineral soils generally are on pocosin sites.) Moving along the moisture gradient from hydric (saturated) peat sites to wet-mesic and mesic (very poorly to moderately well drained) sites, one finds a consistently arranged set of mineral soils, ranging from wettest to driest. Usually two or three mineral soil series are mapped across the moisture gradient, although the best-drained series is often mostly cleared for cropland. Elevation continues to fall very gently toward the better drained soils; the elevational

drop from peat soils to best-drained mineral soils is never more than three feet per mile. At the lowest edges of the broad flats, approaching the shoreline at the mouth of the Neuse River and local tributaries to Pamlico Sound, a better developed dendritic drainage pattern marks the topographic limit of hardwood flats. Cleared agricultural land invariably interposes a limit to the existing hardwood communities before the topographic boundary is reached. (Other sequences of soil moisture, organic content and elevation probably occurred in interior parts of the county, but no high quality examples of plant communities on such sites have been located.)

Following are descriptions of two excellent examples of hardwood flats over soils of the Leaf-Bayboro Association; both examples are adjacent to Light Ground Pocosin and follow the general moisture/organic content/elevation sequence put forth above. Sites described are chosen primarily for high natural quality, with a secondary consideration being to provide examples of the observed variation in species composition.

FEDERAL PAPER NATURAL AREA

The Federal Paper natural area, on the Arapahoe and Oriental Quadrangles (see map), is the most diverse hardwood community surveyed. It is named for the major landowner, Federal Paper Board Corporation. At the southern edge of this stand near Holt's Chapel, about 15 feet above mean sea level, are relatively well drained areas of Argent loam (Typic Ochraqualfs) upon which beech (*Fagus grandifolia*) in places dominates the canopy, growing with loblolly pine (*Pinus taeda*) and swamp chestnut oak (*Quercus michauxii*) (CT 1). The average canopy dbh (diameter at breast height) here is 12-18 inches, with some beech up to 24 inches. On the very best drained sites white oak (*Quercus alba*) replaces swamp chestnut oak. Tulip poplar (*Liriodendron tulipifera*) and sweetgum (*Liquidambar styraciflua*) are common in the canopy. Common understory species are the two oaks, beech and red maple (*Acer rubrum*). Sourwood (*Oxydendrum arboreum*) is also present in the subcanopy. No shrub or herb layer dominants are present. Shrub species include witch-hazel (*Hamamelis virginiana*), strawberry bush (*Euonymus americanus*), flowering dogwood (*Cornus florida*), and horse sugar (*Symplocos tinctoria*). Herbaceous species include New York fern (*Thelypteris novaboracensis*), heart leaf ginger (*Hexastylis arifolia*) and green adder's mouth orchid (*Malaxis unifolia*).

Beech-dominated stands were probably once much more common in Pamlico County; but because they occurred on soils highly suited to agriculture, they have been much reduced in extent.

Off SR 1313 on the eastern edge of the Federal Paper hardwood stand other areas of uncultivated Argent loam provide additional examples of the vegetation of the Argent soils in the natural area (CT 2). Unfortunately the ground cover here is heavily dominated by Japanese honeysuckle (Lonicera japonica), which invaded the site aggressively after selective logging opened the canopy. Native vines such as grape (Vitis spp.) and Virginia creeper (Parthenocissus quinquefolia) have also increased as ground cover in response to the opening of the canopy. This site is wetter than the Holt's Chapel site, as indicated by the denser growth of such herbs as false nettle (Boehmeria cylindrica), netted chain fern (Woodwardia areolata), southern lady fern (Athyrium asplenioides), and lizard's tail (Saururus cernuus). Scattered unvegetated depressions are present which probably hold water for long periods. Beech is less common and does not dominate any part of the site. Swamp chestnut oak and laurel oak (Quercus laurifolia) are canopy dominants, with some loblolly pine present (individuals of all three species to 3 feet dbh). Tulip poplar, sweetgum and American elm (Ulmus americana) are other canopy species; shorter individuals of the same trees, with ironwood (Carpinus caroliniana), form the subcanopy. Taller shrubs are red bay (Persea borbonia) and red maple transgressives. Leucothoe (Leucothoe axillaris) forms localized dense patches. Loblolly pine and cherrybark oak (Quercus falcata var. pagodaefolia) may have been selectively cut from this site.

The SR 1313 site, although disturbed, represents a transition to the wetter mineral soils closer to Light Ground Pocosin. These are mapped as Brookman mucky silt loam (Typic Umbraqualfs), the most extensive mapping unit in the Federal Paper natural area. Almost none of the Brookman soils here are in cultivation. Elevations range from 12 to 16 feet above mean sea level, but always relatively higher and wetter than the Argent loams described previously.

The best example seen in Pamlico County of natural vegetation over a Brookman soil is on the Federal Paper natural area (and owned by Federal Paper; CT 3). The canopy (av. dbh 24 in.) on these wetter soils is dominated by wet-mesophytic oaks, swamp chestnut oak and laurel oak being the most common. Cherrybark oak is fairly common also. Large American hollys (Ilex opaca) form a distinct subcanopy. In places the Federal tract is dominated by sweetgum and tulip poplar. Red maple and swamp

black gum (Nyssa sylvatica var. biflora) are present also in the canopy and subcanopy. The stand is very open beneath and shrubs are scattered, including red bay, sweet pepperbush (Clethra alnifolia) and in dense patches leucothoe, as well as transgressives of red maple and American holly. Netted chain fern is the predominant herb.

A slightly better-drained area mapped as Brookman is located in the Holt's Chapel section of the natural area (CT 4). The Argent loam beech flat described above (CT 1) grades into this stand, which is dominated by swamp chestnut oak and the same hydric hardwoods found on the Federal Paper property, but lacking the American holly, leucothoe and netted chain fern.

The Brookman soil series marks the edge of the Federal Paper natural area. Wasda muck is the next mapping unit encountered to the west; it consists of poorly drained soils, having thin black organic surface layers over loamy textured soils with a sandy substrate (SCS, 1981). Though not true histosols, Wasda mucks support a growth of pond pine (Pinus serotina) and bay shrubs.

STONEWALL NATURAL AREA

A second exceptional natural area within the Leaf-Bayboro Soil Association is near the community of Stonewall (see map). This area is smaller than the Federal Paper natural area, but offers the best known example of a hardwood stand over Argent loam (CT 5). The total acreage in the natural area designated here is mapped as Argent. Swamp chestnut oak and cherrybark oak dominate most of the stand, with loblolly pine and tulip poplar locally dominant, probably as second growth after logging. Laurel oak and red maple are uncommon in the canopy. The average canopy dbh is 18 inches. Ironwood and various transgressives dominate the very open shrub layer; "bay" shrubs are virtually absent. The herb layer is diverse but not developed into dense stands. Japanese honeysuckle has invaded only in local patches; overall this community has maintained its natural integrity. To the southwest the Stonewall hardwood flat gently gains elevation and grades into disturbed areas of Brookman mucky silt loam and Wasda muck. To the northwest, it grades into soils associated with a small tributary to the Bay River.

MERRITT NATURAL AREA

Within the Portsmouth-Torhunta Soil Association, one hardwood flat of local significance is found east of the community of Merritt. Again the flat is delimited topographically by well-developed local tributaries, in this case to the Bay River and Pamlico Sound. The Merritt hardwood flat centers on the highest local elevation, and no pocosin vegetation or peat soils abut this hardwood stand, although pond pine - dominated vegetation occurs to the north, probably as a secondary growth after removal of hardwoods.

Soils in the Merritt natural area include Arapahoe fine sandy loam and Stockade loamy fine sand, as well as small areas of several other soil series. (Arapahoe soils are Typic Humaquepts; Stockade soils are Typic Umbraqualfs.) Only the vegetation over the Arapahoe series has been examined in the field (CT 6). Sweetgum, laurel oak, tulip poplar and red maple form a mixed canopy over ironwood, red bay, wax myrtle (*Myrica cerifera*) and leucothoe; the shrub layer is fairly dense. Ground cover is 100 percent, except where open shallow pools occupy the forest floor. Herbs include netted chain fern, Virginia chain fern (*Woodwardia virginica*), cinnamon fern (*Osmunda cinnamomea*) and lizard's tail. Some canopy-sized pines were noted during aerial reconnaissance.

Based on field reconnaissance elsewhere of sites mapped as Stockade fine loamy sand, the vegetation over the Stockade series in the Merritt hardwood flat resembles that over the Arapahoe soils, possibly being slightly better-drained, with water oak (*Quercus nigra*) present and ironwood less common on Stockade.

The Merritt stand is less well-developed than the two hardwood flats natural areas detailed previously, having been more recently logged. It is, however, still a diverse community which has not succumbed to domination by "weedier" tree species.

11b. Prose Description of Site Significance:

The Federal Paper and Stonewall natural areas, which are parts of the same system, together make up one of the two highest quality non-alluvial hydric hardwood stands in the entire Coastal Plain of North Carolina, with quality being defined in terms of absence of recent disturbance, recovery from past disturbance, diversity of biologic, edaphic and hydrologic factors, extensiveness, average size of canopy trees, well-developed stratification, and the representation of a full range of communities and ecological conditions functioning as a system. To the knowledge of the authors, only one site, in Hyde County, surpasses the Federal Paper and Stonewall tracts in these natural qualities.

In addition to virtually intact gradients in soil moisture, soil organic matter content, and other factors, various microhabitats including hummocks, pools and elevated tree bases add to the habitat diversity of the natural areas. These stands offer exceptional opportunities for field study of an extensive and complete ecosystem which has scarcely been recognized by the state's plant ecologists and foresters since the time of W. W. Ashe. The Federal Paper and Stonewall hardwood stands are important examples of a little-known ecosystem which contributes to the plant community diversity of the North Carolina Coastal Plain.

The Merritt natural area is extensive but does not equal the preceding two natural areas in significance. It is, however, the best example observed of a non-alluvial hardwood community on the very wet mineral soils common in the extreme eastern part of the county. We present it in this report to further indicate the variation found in the ecology of hardwood communities in Pamlico County.

12. Significance Summary Table (categories represented and descriptions) - by site: Federal Paper Natural Area

a. Feature	Map Legend	b. Description of significant feature	c. Comparative assessment
High quality terrestrial plant community	CT 1	Fagus grandifolia-mixed oaks/mixed hardwoods	Small but good quality example of a beech flat (av. canopy
		approximate areal extent of CT 1	dbh 12-18 in) on well-drained Argent loam; adds to overall
			diversity of natural area.
High quality wetland plant community	CT 2	Quercus michauxii-Q. laurifolia/ Carpinus caroliniana-mixed hard-	Small but good quality example of a hardwood stand on a wet
		woods/mixed shrubs/Woodwardia areolata- mixed herbs//mixed clambering vines	phase of Argent loam. Natural quality of site lowered by
		representative stand surveyed by authors	invasion of Lonicera japonica.
High quality wetland plant community	CT 3	Mixed hydric oaks - mixed hardwoods/ Ilex opaca/Woodwardia areolata	Best example seen of hardwood community over Brookman series
		approximate areal extent of CT 3	(av. canopy dbh 24 in.). With CT 1, CT 2 and CT 4 forms the
			most extensive hardwood flat in the county. One of two
			best in outer Coastal Plain of North Carolina.

12. Significance Summary Table (categories represented and descriptions) - by site: Federal Paper Natural Area
-continued-

a. Feature	Map Legend	b. Description of significant feature	c. Comparative assessment
High quality wetland plant community	CT 4	Quercus michauxii-mixed hydric hardwoods/mixed hardwoods	Excellent hardwood community over Brookman soil series.
		representative example of CT 4	Together with CT 1 forms the most species-rich part of the natural area.

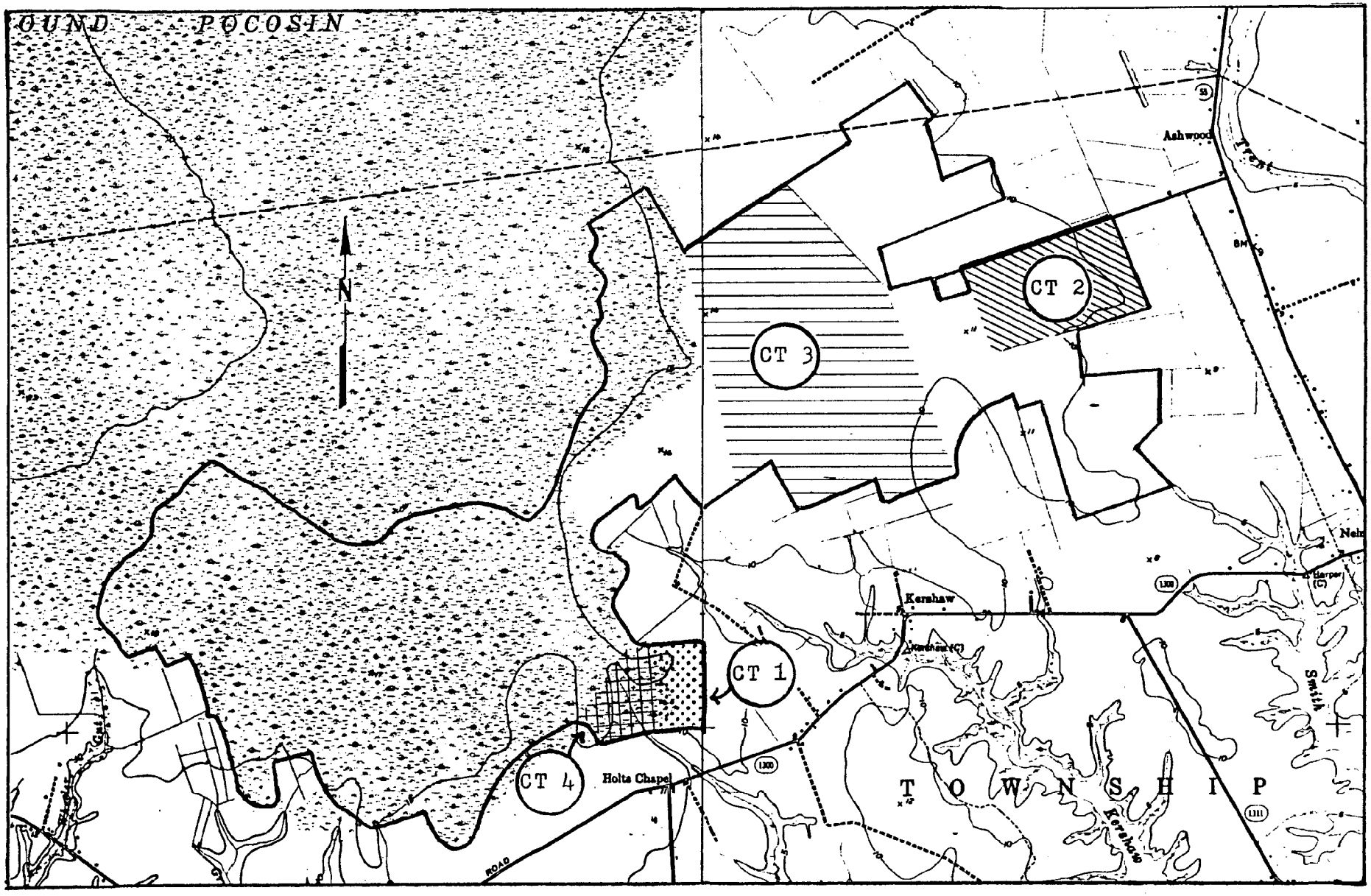

Fig. 3. Significant features:

FEDERAL PAPER HARDWOOD FLATS

——— natural area boundary (community type locations are mapped generally)

12. Significance Summary Table (categories represented and descriptions) - by site: Stonewall and Merritt Natural Areas

a. Feature	Map Legend	b. Description of significant feature	c. Comparative assessment
High quality wetland plant community	CT 5	Quercus michauxii-Q. falcata var. pagodaefolia/Carpinus caroliniana/	Best hardwood stand over Argent loam (av. canopy dbh
		mixed herbs	18 in.) in county.
		representative stand surveyed by authors	
High quality wetland plant community	CT 6	Mixed hydric hardwoods/mixed tall shrubs/Leucothoe axillaris/mixed ferns	Example of hardwood community over Arapahoe and Stockade
			soil series. Less completely recovered from cutting than
		extent of older-growth portions of CT 6	preceding stands.

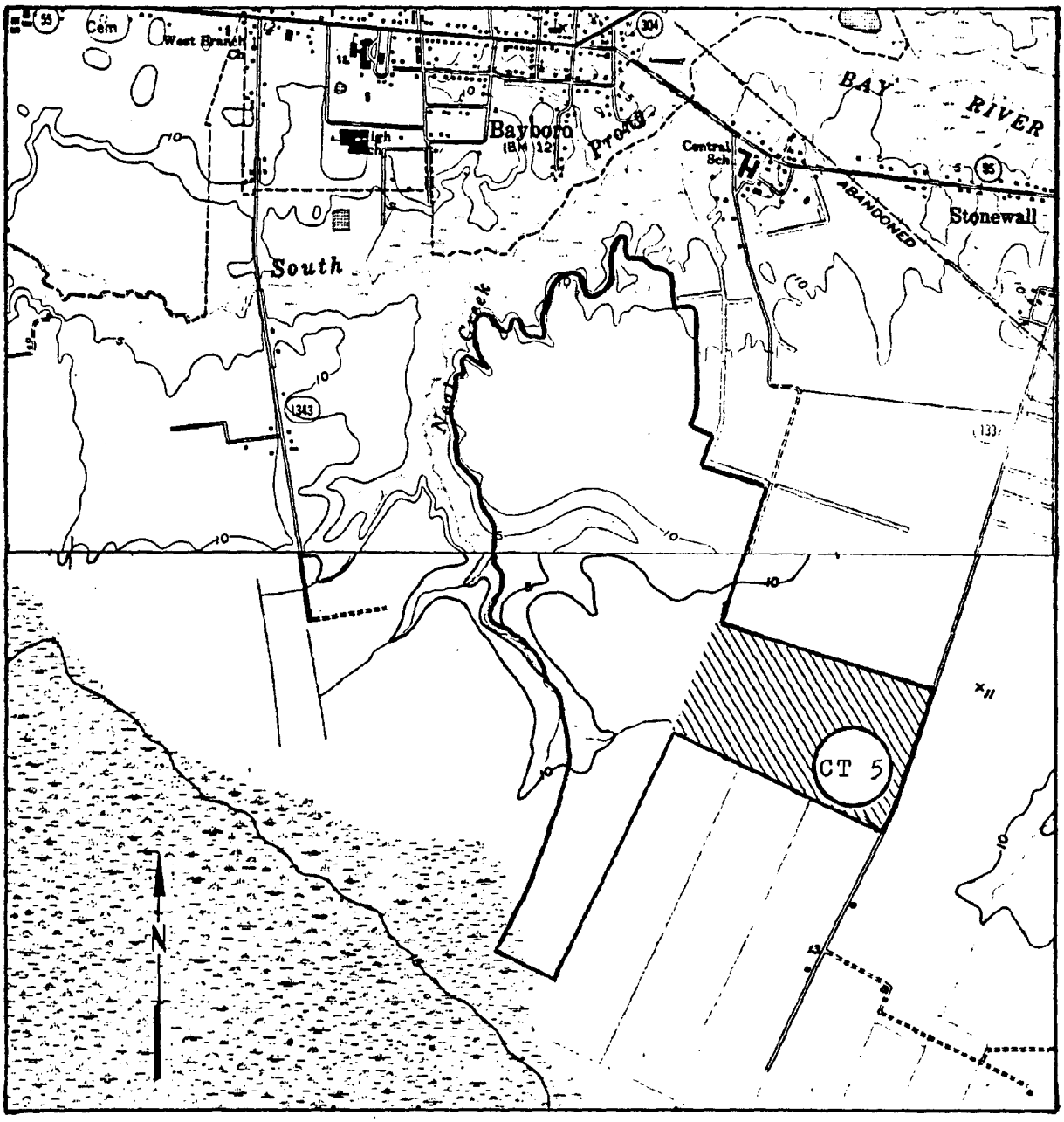

Fig. 4. Significant features:

STONEWALL HARDWOOD FLATS

——— natural area boundary (community type location is mapped generally)

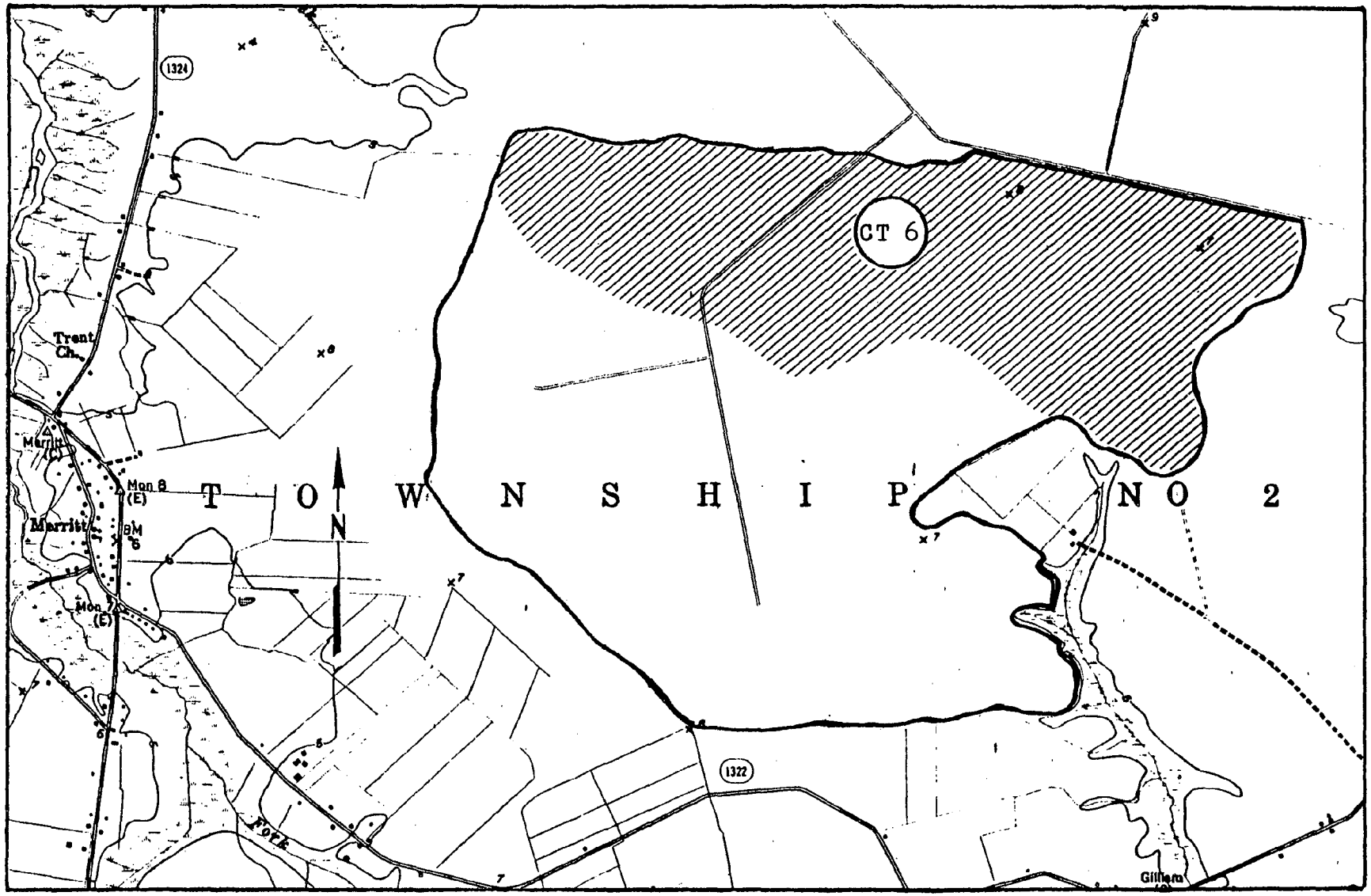

Fig. 5. Significant features:

MERRITT HARDWOOD FLATS

natural area boundary (community type location is mapped generally)

12. Significance Summary Table (categories represented and descriptions) - by site: Features shared by all three natural areas

a. Feature	Map Legend	b. Description of significant feature	c. Comparative assessment
Endangered or threatened species	through-out	Red-shouldered Hawk	Good population in excellent habitat.
Special concern species	scattered through-out	Swainson's Warbler Prothonotary Warbler	Fairly common breeding birds; excellent habitat.
High abiotic diversity	through-out	Complex of soil, moisture and elevational gradients	Uninterrupted ecological gradients including soil moisture, soil organic content, and elevation, over broad expanses of high-quality mesic hardwood growth, are conditions equalled in only 1-2 other sites known in the outer Coastal Plain.

Legal Status, Use, and Management

13. Ownership type by percent area:

Type		
Private	100 %	(for all three natural areas)
Public	%	
Unknown	%	

14. Number of Owners:

Federal Paper:	10 owners in 15 tracts, with two other tracts in unknown ownership.
Stonewall:	7
Merritt:	1

15. Name(s) of owner(s) and/or custodian(s) (with addresses, phone numbers, other pertinent information). Numbered tracts in order of importance, others listed alphabetically.

FEDERAL PAPER HARDWOOD FLAT:

(1) Federal Paper Board Company (9-8-011 and two other tracts), Regielwood Operations, P. O. Box 338, Bolton, NC 28423

(2) Georgia-Pacific Corporation (8-8-001 and one other tract), P. O. Box 1808, Augusta, GA 30903

(3) Weyerhaeuser Company, Plymouth, NC 27962

First Citizen's Bank & Trust, R. H. Morrison, trustee; P. O. Box 849, Kinston, NC 28501

A. Hugh Harris, Jr. (two tracts), P. O. Box 160, Oriental, NC 28571

International Paper Co. (two tracts), P. O. Box 2905, New Bern, NC 28560

James A. Miller, Box 314, Merritt, NC 28556

James W. Potter, Route 2, Box 217, Arapahoe, NC 28510

Alston W. Spruill, Route 1, Box 78, Oriental, NC 28571

Wachovia Bank & Trust Company, Agent for Swan Farm, P. O. Box 27886, Raleigh, NC 27611

STONEWALL HARDWOOD FLAT:

(1) Nellie H. Ratcliffe, P. O. Box 175, Bayboro, NC 28515

(2) Swan Motor Co., c/o W. F. Rawls, P. O. Box 848, New Bern, NC 28560

STONEWALL HARDWOOD FLAT: (continued)

H. H. Bate, P. O. Box 2945, New Bern, NC 28560

Cassie Mae Coppage, P. O. Box 846, New Bern, NC 28560

Louise W. Rawls, P. O. Box 848, New Bern, NC 28560

W. F. Rawls, P. O. Box 848, New Bern, NC 28560

Wachovia Bank & Trust Co., Agent for Swan Farm, P. O. Box 27886, Raleigh, NC 27611

MERRITT HARDWOOD FLAT:

(1) John Taylor, P. O. Box 1062, New Bern, NC 28560

16. Name(s) of knowledgeable person(s) (with addresses, phone numbers, other pertinent information).

None known.

17. Attitude of owner or custodian toward preservation (contacted?):

None contacted. Mr. H. H. Bate, owner of part of the Stonewall natural area, is personally interested in the natural values of his properties elsewhere in the state.

18. Uses of natural area:

All three Hardwood Flats natural areas covered in this report are used for hunting; possibly some tracts are leased to hunt clubs although no signs were posted indicating this use. All these lands have been logged selectively at least once and probably several times. The best drained soils may have been cultivated. Historically range animals have been pastured on these woodlands, but grazing is not a current use. Some firewood cutting is likely.

19. Uses of surrounding land:

a. Wildland 30 %

b. Agricultural land 70 %

c. high-intensity forestry _____ %

d. developed _____ %

20. Preservation Status:

Cat	* %	*Description of preservation status
6	100	private land, not protected by owner

21. Regulatory protections in force:

None.

22. Threats:

Logging is a constant likelihood in high-quality hardwood stands such as these, and is underway at the southern edge of the Federal Paper hardwood flat, in one of the best quality stands. Stands adjacent to the Federal Paper and Stonewall natural areas have been heavily logged within the last three years. An associated threat is the initiation of drainage, which always accompanies modern logging in the form of ditches bordering woods roads. Severe and permanent site alteration may also stem from treatment of a given hardwood stand in the aftermath of logging. Systematic drainage may be installed and the acreage converted to an agricultural use, or a pine plantation may be established.

Sheet flow from Light Ground Pocosin drains into the two most important hardwood stands described here (Lee Otte, pers. comm., 1982), and the hydrology of the natural areas is thus closely linked to conditions in Light Ground. That pocosin is being drained and developed, with possible drying effects on the hardwood stands.

23. Management and Preservation Recommendation:

No palustrine hardwood flats are highly protected in the Coastal Plain of North Carolina, and the authors know of no similar communities in protective ownership elsewhere in the Southeast. One publicly-owned example, of somewhat younger second growth than the Federal Paper and Stonewall sites, is located on the Gull Rock Game Land in Hyde County. A second excellent example in that county is protected by a private individual. The protection status of these two areas could well change suddenly.

The hardwood flats ecosystem is little-studied and barely mentioned in the ecological literature of North Carolina, despite its intriguing hydrologic and edaphic diversity. Additionally, this once fairly common vegetation type is now scarce, having been reduced by logging and clearing for agriculture and silviculture. The palustrine mixed hardwood community will very likely cease to exist in any significant acreage, and pass from the scene unstudied, unless some examples are protected quickly.

The Nature Conservancy should seek to acquire key tracts of this vegetation type in the North Carolina Coastal Plain, where excellent candidates are present in the Federal Paper and Stonewall Hardwood Stands. Only acquisition can maintain this very threatened group of communities in the long run. The Natural Heritage Program should establish or pursue landowner contacts and seek to register some tracts. Additional field work is of critical importance to fully define the significance of the hardwood flats biota.

Management needs are not well-known, but appear to be few after initial acquisition. Included are hydrologic monitoring, monitoring of rare species populations, control of vegetation such as Japanese honeysuckle, and prevention of timber trespass, firewood poaching and illegal hunting. No need for active site manipulation is currently recognized.

Natural Characteristics Summary

24a. Vegetation - Biotic Community Summary CT 1

Community type: Fagus grandifolia-mixed oaks/mixed hardwoods

Community cover type: Fagus grandifolia-mixed oaks

General habitat feature: Hardwood Flat

Average canopy height: 50-60 feet

Estimated age of canopy trees: unknown

Canopy cover: Closed

Estimated size of community: 50 acres

Successional stage: Climax

Common canopy species in community cover or community type (but not dominant):

Quercus alba, Liriodendron tulipifera, Liquidambar styraciflua, Acer rubrum, Pinus taeda

Common sub-canopy or shrub stratum species in community cover or community type (but not dominant):

Oxydendrum arboreum, Cornus florida, Euonymus americanus, Hamamelis virginiana, Symplocos tinctoria, Myrica cerifera, transgressives of canopy spp.

Common herb stratum species in community cover or community type (but not dominant):

Hexastylis arifolia, Thelypteris novaboracensis, Mitchella repens

Natural Characteristics Summary

24a. Vegetation - Biotic Community Summary CT 2

Community type: Quercus michauxii-Q. laurifolia/Carpinus caroliniana-mixed hardwoods/mixed shrubs/Woodwardia areolata-mixed herbs// mixed clambering vines

Community cover type: Quercus michauxii-Q. laurifolia

General habitat feature: Hardwood Flat

Average canopy height: 70-80 feet

Estimated age of canopy trees: Unknown

Canopy cover: Closed

Estimated size of community: 120 acres

Successional stage: Near-climax

Common canopy species in community cover or community type (but not dominant):

Pinus taeda, Fagus grandifolia, Liriodendron tulipifera, Liquidambar styraciflua, Ulmus americana, Nyssa sylvatica var. biflora

Common sub-canopy or shrub stratum species in community cover or community type (but not dominant):

Ilex opaca, Leucothoe axillaris, Persea borbonia

Common herb stratum species in community cover or community type (but not dominant):

Polystichum acrosticoides, Arisaema triphyllum, Boehmeria cylindrica, Athyrium asplenioides, Mitchella repens, Saururus cernuus, Woodwardia virginica

Natural Characteristics Summary

24a. Vegetation - Biotic Community Summary CT 3

Community type: Mixed hydric oaks-mixed hardwoods/Ilex opaca/ Woodwardia areolata

Community cover type: Mixed hydric oaks-mixed hardwoods

General habitat feature: Hardwood Flat

Average canopy height: 70-80 feet

Estimated age of canopy trees: 65+ years (one laurel oak stump had 65 annual rings at ground level; 24 in. dia.)

Canopy cover: Closed

Estimated size of community: 460 acres

Successional stage: Climax

Common canopy species in community cover or community type (but not dominant):

Acer rubrum, Quercus laurifolia, Quercus michauxii, Liriodendron tulipifera, Liquidambar styraciflua, Quercus falcata var. pagodaefolia, Fagus grandifolia

Common sub-canopy or shrub stratum species in community cover or community type (but not dominant):

Magnolia virginiana, Persea borbonia, Clethra alnifolia, Leucothoe axillaris, Callicarpa americana

Common herb stratum species in community cover or community type (but not dominant):

Boehmeria cylindrica, Asplenium platyneuron, Mitchella repens

Natural Characteristics Summary

24a. Vegetation - Biotic Community Summary CT 4

Community type: Quercus michauxii-mixed hydric hardwoods/mixed hardwoods

Community cover type: Quercus michauxii-mixed hydric hardwoods

General habitat feature: Hardwood Flat

Average canopy height: 60-70 feet

Estimated age of canopy trees: 60+ years (one loblolly pine stump had 60 annual rings at ground level; 22 in. dia.)

Canopy cover: Closed

Estimated size of community: not determined

Successional stage: Near climax

Common canopy species in community cover or community type (but not dominant):

Fagus grandifolia, Liriodendron tulipifera, Liquidambar styraciflua, Pinus taeda, Acer rubrum, Quercus laurifolia, Quercus falcata var. pagodaefolia, Nyssa sylvatica var. biflora.

Common sub-canopy or shrub stratum species in community cover or community type (but not dominant):

Myrica cerifera, Euonymus americanus, Ilex opaca, Lyonia lucida, Clethra alnifolia, Persea borbonia, transgressives of canopy spp.

Common herb stratum species in community cover or community type (but not dominant):

Arundinaria gigantea, Arisaema triphyllum, Osmunda regalis, Osmunda cinnamomea, Boehmeria cylindrica

Natural Characteristics Summary

24a. Vegetation - Biotic Community Summary CT 5

Community type: Quercus michauxii-Q. falcata var. pagadaefolia/ Carpinus carolinianus/mixed herbs

Community cover type: Quercus michauxii-Q. falcata var. pagodaefolia

General habitat feature: Hardwood Flat

Average canopy height: 70-80 feet

Estimated age of canopy trees: Unknown

Canopy cover: Closed

Estimated size of community: 150 acres

Successional stage: Near-climax

Common canopy species in community cover or community type (but not dominant):

Pinus taeda, Fagus grandifolia, Liriodendron tulipifera

Common sub-canopy or shrub stratum species in community cover or community type (but not dominant):

Euonymus americanus, Callicarpa americana, transgressives of canopy spp.

Common herb stratum species in community cover or community type (but not dominant):

Polystichum acrosticoides, Osmunda cinnamomea, Arundinaria gigantea, Woodwardia areolata, Thelypteris novaboracensis, Athyrium asplenioides, Pteridium aquilinum, Sabal minor

Natural Characteristics Summary

24a. Vegetation - Biotic Community Summary CT 6

Community type: Mixed hydric hardwoods/mixed tall shrubs/ Leucothoe axillaris/mixed ferns

Community cover type: Mixed hydric hardwoods

General habitat feature: Hardwood Flat

Average canopy height: 50 feet

Estimated age of canopy trees: Unknown

Canopy cover: Closed

Estimated size of community: +500 acres

Successional stage: transitional to young climax

Common canopy species in community cover or community type (but not dominant):

Platanus occidentalis, Acer rubrum, Liriodendron tulipifera, Quercus laurifolia, Liquidambar styraciflua

Common sub-canopy or shrub stratum species in community cover or community type (but not dominant):

Persea borbonia, Myrica cerifera, Carpinus caroliniana

Common herb stratum species in community cover or community type (but not dominant):

Saururus cernuus, Woodwardia areolata, Woodwardia virginica, Osmunda cinnamomea, Sabal minor

24b. (1) Soil Summary (by community type) - CT 1, CT 2, CT 5

Soil series: Argent loam

Soil classification: fine, mixed, thermic Typic Ochraqualfs

Soil association: Leaf-Bayboro

pH class: strongly acid to medium acid

(2) Soil Summary (by community type) - CT 3, CT 4

Soil series: Brookman mucky silt loam

Soil classification: fine, mixed, thermic Typic Umbraqualfs

Soil association: Leaf-Bayboro

pH class:

(3) Soil Summary (by community type) - CT 6

Soil series: Arapahoe fine sandy loam; Stockade loamy fine sand

Soil classification: Arapahoe: coarse-loamy, mixed, nonacid, thermic Typic Humaquepts

Stockade: fine-loamy, mixed, thermic Typic Umbraqualfs

Soil association: Portsmouth-Torhunta

pH class: Arapahoe: strongly to very strongly acid

Stockade: slightly acid

Source of information: All CT's

General Soil Map, Pamlico County, USDA, SCS (1972); Preliminary Soil Survey, Pamlico County, USDA, SCS (1981).

24c. Hydrology Summary (by community type) All CT's

Hydrologic system: Palustrine (generally) to terrestrial

Hydrologic subsystem: Interaqueous to mesic

Water chemistry: Fresh

Water regime: Saturated to temporarily flooded (palustrine portions)

24c. continued --

Drainage class: Very poorly to poorly drained

Drainage basin: Neuse River (CT 1, CT 2, CT 3, CT 4); and local tributaries to Pamlico Sound (CT 5, CT 6)

Hydrology characterization: Very poorly to poorly drained mucky silt loams and fine sandy loams in a saturated, temporarily flooded palustrine system; with, locally, moderately well drained loams in a mesic terrestrial system. Both systems drain either into the Neuse River or into Pamlico Sound via local tributaries.

24d. Topography Summary - All CT's

Landform: Interstream flat or lowland plain

Shelter: partly sheltered

Aspect: Not applicable

Slope Angle: Nearly level

Profile: Flat

Surface patterns: Hummocky to smooth, often with shallow pans present locally

Position: Not applicable

25. Physiographic characterization of natural area:

A climax to near-climax mixed mesophytic to hydrophytic forest of a pelosere or pelopsammosere, on a lowland plain underlain by Pleistocene marine and estuarine sediments, in the Outer Coastal Plain Region of the Embayed Section of the Coastal Plain Province.

Geological Formation: CT 1, CT 2, CT 3, CT 4, CT 5

Core Creek sand of the Pleistocene ("lower Wisconsin and (or) upper Sangamon (?)") possibly over the Yorktown Formation of the lower Pliocene to upper Miocene.

CT 6: unknown, but either similar to the preceding, or underlain by more recent Holocene deposits. All communities on the Pamlico marine terrace.

25. continued --

Geological Formation age: Core Creek Sand - 75,000 years
Yorktown formation - 7,000,000 years

References Cited:

Reconnaissance Geology of the Submerged and Emerged Coastal Plain Province, Cape Lookout Area, North Carolina. Robert B. Mixon and Orrin H. Pilkey. USGS Professional Paper 859 (1976).

27. Master species lists:

VASCULAR PLANTS
(listed alphabetically by family)

ACERACEAE
  Acer rubrum
ANACARDIACEAE
  Rhus radicans
AQUIFOLIACEAE
  Ilex glabra
  I. opaca
ARACEAE
  Arisaema triphyllum
ARECACEAE
  Sabal minor
ARISTOLOCHIACEAE
  Hexastylis arifolia
ASPIDIACEAE
  Athyrium asplenioides
  Dryopteris celsa
  Polystichum acrosticoides
  Thelypteris noveboracensis
ASPLENIACEAE
  Asplenium platyneuron
BETULACEAE
  Carpinus caroliniana
BIGNONIACEAE
  Anisostichus capreolata
BLECHNACEAE
  Woodwardia areolata
  W. virginica
CAPRIFOLIACEAE
  Lonicera japonica
  Sambucus canadensis
  Viburnum nudum
CELASTRACEAE
  Euonymus americanus
CLETHRACEAE
  Clethra alnifolia
CORNACEAE
  Cornus florida
CUPRESSACEAE
  Juniperus virginiana
CYPERACEAE
  Carex sp.
CYRILLACEAE
  Cyrilla racemiflora

ERICACEAE
  Leucothoe axillaris
  Lyonia lucida
  Oxydendrum arboreum
  Vaccinium corymbosum
FAGACEAE
  Fagus grandifolia
  Quercus alba
  Q. falcata var. falcata
  Q. f. var. pagodaefolia
  Q. laurifolia
  Q. michauxii
  Q. nigra
HAMAMELIDACEAE
  Hamamelis virginiana
  Liquidambar styraciflua
JUNCACEAE
  Juncus coriaceus
LAURACEAE
  Persea borbonia
LILIACEAE
  Smilax rotundifolia
LOGANIACEAE
  Gelsemium sempervirens
LORANTHACEAE
  Phoradendron serotinum
MAGNOLIACEAE
  Liriodendron tulipifera
  Magnolia virginiana
MORACEAE
  Morus rubra
MYRICACEAE
  Myrica cerifera
NYSSACEAE
  Nyssa sylvatica var. biflora
  N. s. var. sylvatica
OLEACEAE
  Fraxinus americana
ORCHIDACEAE
  Malaxis unifolia
  Tipularia discolor
OSMUNDACEAE
  Osmunda cinnamomea
  O. regalis
PINACEAE
  Pinus taeda
PLATANACEAE
  Platanus occidentalis
POACEAE
  Arundinaria gigantea

POLYPODIACEAE
  Polypodium polypodioides
PTERIDACEAE
  Pteridium aquilinum
RHAMNACEAE
  Berchemia scandens
ROSACEAE
  Crataegus sp.
  Geum canadense
  Prunus serotina
RUBIACEAE
  Mitchella repens
SAURURACEAE
  Saururus cernuus
SAXIFRAGACEAE
  Decumaria barbara
SYMPLOCACEAE
  Symplocos tinctoria
ULMACEAE
  Ulmus americana
URTICACEAE
  Boehmeria cylindrica
VERBENACEAE
  Callicarpa americana
VITACEAE
  Parthenocissus quinquefolia
  Vitis rotundifolia

AMPHIBIANS

Oak Toad
Gray Treefrog
Squirrel Treefrog
Little Grass Frog
Southern Leopard Frog

REPTILES

Spotted Turtle
Eastern Box Turtle
Ground Skink

BIRDS

(Emphasis of bird lists is on breeding or summering species; lack of adequate field work during the other seasons prevented compilation of a complete list.)

KEY

PR = Permanent resident
SR = Summer resident
WR = Winter resident
T = Transient
PV, SV, WV = Visitor; year-round, summer or winter
* = Breeding or suspected breeding at site

Red-tailed Hawk	PR*
Red-shouldered Hawk	PR*
Bobwhite	PR*
Mourning Dove	PR*
Yellow-billed Cuckoo	SR*
Common Flicker	PR*
Pileated Woodpecker	PR*
Red-bellied Woodpecker	PR*
Yellow-bellied Sapsucker	WR
Hairy Woodpecker	PR*
Downy Woodpecker	PR*
Great Crested Flycatcher	SR*
Acadian Flycatcher	SR*
Eastern Wood Pewee	SR*
Blue Jay	PR*
Carolina Chickadee	PR*
Tufted Titmouse	PR*
White-breasted Nuthatch	PR*
Carolina Wren	PR*
American Robin	WR
Wood Thrush	SR*
Blue-gray Gnatcatcher	SR*
Golden-crowned Kinglet	WR
Ruby-crowned Kinglet	WR
White-eyed Vireo	SR*
Red-eyed Vireo	SR*
Prothonotary Warbler	SR*
Swainson's Warbler	SR*
Northern Parula	SR*
Yellow-rumped Warbler	WR

Ovenbird	SR*
Kentucky Warbler	SR*
Hooded Warbler	SR*
Scarlet Tanager	SR*
Summer Tanager	SR*
Cardinal	PR*
Rufous-sided Towhee	PR*
White-throated Sparrow	WR

Note: no mammal list was recorded.

NATURAL AREA INVENTORY FORM
(To be prepared for each site)

Basic Information Summary Sheet

1. Natural Area Name: North Minnesott Sand Ridge; South Minnesott Sand Ridge

2. County: Pamlico

3. Location: North Minnesott Sand Ridge - lying along both sides of NC 306 between a private woods road named Beltline Road on the south, and the Pamlico-Beaufort County line on the north. Extending east of NC 306 an average of 0.25 mile, west an average of 0.75 mile.

   South Minnesott Sand Ridge - along both sides of NC 306 beginning at the north edge of the Pamlico Technical College campus and extending north about 2.0 miles, excluding some cleared areas. Distances east and west of NC 306 are as given for North Minnesott Sand Ridge.

4. Topographic quadrangle(s): North Minnesott Sand Ridge - Bayboro (1974)
   South Minnesott Sand Ridge - Arapahoe (1951)

5. Size: North Minnesott Sand Ridge - 1250 acres
   South Minnesott Sand Ridge - 380 acres
   both measured with a grid calculator

6. Elevation: Both natural areas range from slightly less than 20 feet to more than 45 feet above mean sea level.

7. Access: Both natural areas may be reached at various points along NC 306. Several private woods roads also traverse each area.

8. Names of investigators:

S. Lance Peacock	J. Merrill Lynch
P. O. Box 6006	Route 2, Box 222-B
Raleigh, NC 27628	Enfield, NC 27823

9. Date(s) of investigation: February 24 and 25, April 14, May 13 and 14, June 28, and July 11 and 12, 1982.

10. Priority rating: Medium to High

Fig. 6. Access information:

NORTH MINNESOTT SAND RIDGE study area

SOUTH MINNESOTT SAND RIDGE study area

11a. Prose Description of Site

LOCATION, GEOLOGY, TOPOGRAPHY

Crossing the inner and outer Coastal Plain of North Carolina are several linear scarps, usually trending north-south, which may often be traced for miles across the landscape. These marine scarps mark high stands of the sea during the Pleistocene epoch. Frequently associated with the scarps are elongate linear ridges of sand, interpreted to be beach, dune and overwash fan deposits formed in a marine environment and later abandoned as sea level fell. Scarps and associated ridges, though closely related in their origin, are separate geomorphological features, with ridges generally bounded by scarps on the seaward (east) side. These same scarps also mark the edges of the marine terraces described by early geologists such as Stephenson (1912): broad, flat, successively lower and younger surfaces which form much of the Coastal Plain, and which represent major sea level fluctuations in response to worldwide uptake and release of water into and out of glacial ice.

Extending the length of Pamlico County, the Minnesott Ridge and Grantsboro Scarp form one such ridge/scarp system, and together comprise one of the county's most prominent topographic features, still supporting several areas of natural and semi-natural vegetation.

Two natural areas have been identified in association with the Minnesott Ridge/Grantsboro Scarp. North Minnesott Sand Ridge natural area is located along both sides of NC 306, beginning at the Pamlico/Beaufort County line and extending south about 3.0 miles to "Beltline" road. South Minnesott Sand Ridge also lies on both sides of NC 306, extending about 2.0 miles north from the Pamlico Technical College campus.

For the two natural areas described here, and in general for Pamlico County, the Minnesott Ridge averages slightly more than 0.75 mile wide. Maximal elevations above mean sea level range from 35 to 47 feet, and the entire ridge crest north of Arapahoe is above 40 feet elevation (higher in Beaufort County). The ridge and scarp trend north-south. To the east the face of the Grantsboro Scarp is steep, falling off rather quickly to elevations of approximately 20 feet. At this toe of the scarp, where the surface of the Pamlico Terrace is encountered, were once two major pocosins systems, Bay City and Light Ground, but these are no longer in a natural condition. A narrow strip of swamp forest also borders the toe of the scarp in places, where mineral sediments wash from the ridge into the adjacent peats

(Lee Otte, 1981 and pers. comm., 1982). To the west the Minnesott Ridge grades more gradually to the Chowan Terrace, about 5 feet below the ridge crest and ranging from 35 to 40 feet above mean sea level. This "rear" edge of the Ridge is topographically less precisely defined than the front or eastern (scarp) edge, being more dissected into a complex system of low swales and islands of upland vegetation. On this western side the partially natural Northwest Pocosin borders the north half of the Minnesott Ridge (see pp.).

Mixon and Pilkey (1976) argue that the Grantsboro Scarp is not strictly equivalent to the well-known Suffolk Scarp alone, but that it is a feature of multiple ages, "as suggested by the southward convergency of relict shorelines in the Pamlico Sound area" (p. 37). According to the same authors, the Minnesott sands (which form the Minnesott Ridge) are in part correlative with the Pamlico Terrace to the east (op. cit., Geologic Map Plate I). Further summary of the fairly extensive published geologic and geomorphologic interpretive literature is beyond the scope of this report. However, conditions on the Minnesott Ridge natural areas have been strongly affected by the geomorphological origins of the ridge and scarp, particularly the depositional environment in which the Minnesott sands were laid down. The well-sorted, fine to coarse sands of the ancient barrier system have produced the sandy soils on which various pine flatwoods and upland pine natural communities have developed.

SOILS

The Minnesott Ridge natural areas are in the Leon-Lynn Haven Soil Association, which characteristically includes poorly drained soils with sand surface layers and sandy hardpan subsoils (SCS 1974, Appendix H). The soilscape across the Minnesott Ridge and immediately adjacent locations is very diverse, both in arrangement and in soil orders represented. Preliminary mapping of the two natural areas denotes three soil series in three different orders: Leon sand, a Spodosol; Tomahawk loamy sand, an Ultisol; and Rutlege mucky loamy fine sand, an Inceptisol. All three of these soil series are present within both natural areas; the mapping units are complexly interfingered on the surface of Minnesott Ridge.

Additional soil orders are found on either side of the North Minnesott Ridge natural area: Histosols (Dare and Croatan series) to the west in the Northwest Pocosin natural area, and Alfisols (Yonges and Stockade series) to the east, mostly recently logged over. Thus a mile-long transect spanning North Minnesott Ridge

will cross five soil orders, four of them having natural or partly natural vegetation. The soils within and contiguous to the South Minnesott Ridge natural area are somewhat less diverse, since no Alfisol is present in the transect.

VEGETATION

The pine-dominated natural communities along Minnesott Ridge contain the most diverse species assemblages found in Pamlico County. This diversity is consistent with the fact that herb and shrub dominated pine flatwoods, which cover most of both natural areas, are among the most diverse of southeastern Coastal Plain natural communities. The communities on the Ridge respond strongly to soil conditions, and beginning with the more hydric, are described here in two broad groups reflecting wetness of the soil upon which the communities occur.

The wettest soils are the Rutlege and Leon series. Rutlege occupies the lowest swales on the surface of Minnesott Ridge, including narrow linear units which possibly comprise poorly formed local drainageways. Rutlege soils are also present in the two small Carolina bays within North Minnesott Ridge natural area. Leon soils typically border areas of Rutlege, but are slightly higher, and derive their wet character from spodic horizons which impede internal soil drainage. Together, these two series form approximately 75 percent of the two natural areas. The vegetation is similar over each of these two series: wet, pine-dominated stands with a dense shrub layer, which are examples of the shrub-dominated pine flatwoods natural community (CT 1; CT 2).

Although not often thought of as wetlands, these diverse communities are strongly correlated with and dependent upon soils which are wet, due either to landscape position or to moisture-trapping spodic horizons. At other times of the year the soils, Spodosols particularly, can be very droughty. Hence the pine flatwoods communities must be adapted to severe seasonal extremes of both wetness and aridity. Fire is also a dominant ecological force shaping the pine flatwoods, as it has been historically and prehistorically in various southern pine forest types.

The wet shrub phase pine flatwoods over Leon soils are dominated by an open to scattered canopy of longleaf pine, (*Pinus palustris*). Other species are essentially absent from the canopy, excepting pond pine (*Pinus serotina*), which occurs as scattered individuals at the edges of long-

leaf stands and dominates the deepest, wettest (Rutlege) swales. (Some of the disturbed areas of Rutlege soils are occupied by low red maple (Acer rubrum) thickets probably resulting from logging.) Canopy height ranges from 20 to 40 feet. Generally no subcanopy is present, but widely scattered subcanopy height individual pines, tall bay species and a few red maples are present.

Beneath the canopy is a complex pattern of shrub-dominated areas, arranged in response to moisture and frequency of fire. Where fire has not occurred recently, an abrupt edge of dense shrubs 5 to 10 feet tall usually marks the boundary of the wetter soils. A partial species presence list includes sweet pepperbush (Clethra alnifolia), titi (Cyrilla racemiflora), male-berry (Lyonia ligustrina), sweet gallberry (Ilex coriacea), bitter gallberry (Ilex glabra), red bay (Persea borbonia), sweet bay (Magnolia virginiana), and fetterbush (Leucothoe racemosa). Catbriar (Smilax laurifolia) is usually abundant. The few herb species present include Virginia chain fern (Woodwardia virginica) and giant cane (Arundinaria gigantea). The community type is characterized as Pinus palustris or Pinus serotina/mixed tall pineland shrubs//Smilax laurifolia. Where fire has occurred more frequently, the community boundary is wider, and a broad low-shrub-dominated ecotone is found. In this ecotone are most of the shrubs mentioned above, as well as several species of a shorter growth habit, such as sheepkill (Kalmia angustifolia) and dwarf fothergilla (Fothergilla gardenii), all 2-4 feet tall.

Under natural conditions of frequent fire, the shrub phase pine flatwoods of Minnesott Ridge, especially over the Leon soil series, were probably much less shrubby and supported more herbaceous plant species. Unfortunately, a certain proportion of the original diverse Minnesott Ridge flora, particularly herbaceous species, has been lost or suppressed due to man's successful efforts to exclude fire, allowing shrubs to overtop and out-compete the herbs. One species of particular interest, Dionaea muscipula (venus' flytrap), here at its northern range limit, is persisting almost exclusively on ditch banks and mowed roadsides, where human activity incidentally provides the needed open conditions over wet mineral soil.

In drier portions of the Minnesott Ridge natural areas, the herbaceous component of the vegetation is more strongly evident, but shrubs still dominate (CT 3; CT 4). Soils are of the Tomahawk series. Tomahawk soils are drier than most pine flatwoods soils, being moderately well drained and with a seasonal water table at about 3 feet below the surface (SCS, 1981). The community over these soils is thus transitional between true pine flatwoods and more xeric upland pine communities (cf. Taggart in Radford et al., 1980).

The canopy is longleaf pine; open to scattered stands range from 40 to 60 feet tall, 6 to 12 inches dbh. A few relictual "flattop" canopy longleaf remain from past logging; these are much older than the average canopy tree. Tall shrubs and transgressive small trees such as sweetbay and red maple are scattered, as are patches of longleaf pine saplings. Scrub oak spp. (Quercus) are notably scarce. Zonation in the shrub layer is pronounced in places, probably due to the rhizomatous habit of the species involved, but the zones are not extensive in area. Typical shrub dominants locally are dwarf huckleberry (Gaylussacia dumosa), dangleberry (Gaylussacia frondosa) and bitter gallberry, with other common shrubs including sheepkill, sweet gallberry, wax myrtle (Myrica cerifera), dwarf azalea (Rhododendron atlanticum), blueberry (Vaccinium tenellum), squaw huckleberry (Vaccinium stamineum), and stagger-bush (Lyonia mariana) all ranging from 1 to 3 feet tall. Giant cane is scattered, not forming dense stands. Wiregrass (Aristida stricta) dominates the herb layer over much of this community, often sharing seasonal dominance with bracken (Pteridium aquilinum). Creeping blueberry (Vaccinium crassifolium), a prostrate shrub, is present throughout as a dense ground cover, absent only beneath the densest growth of other shrubs. Wintergreen (Gaultheria procumbens) is locally common. The community type is Pinus palustris/mixed low pineland shrubs/Aristida stricta-Vaccinium crassifolium.

WILDLIFE VALUES

Breeding bird diversity along the Minnesott Ridge is fairly high. We recorded approximately 30 species, including a full complement of characteristic open pine woodland species such as bluebird, brown-headed nuthatch and pine warbler. Worm-eating warblers (two individuals) were noted in association with the dense shrubby ecotones between open pine stands and deep shrub thickets.

Red-cockaded woodpeckers are permanent residents along the Ridge. Most activity by this endangered species was noted at the North Minnesott natural area. Inactive cavity trees were seen at South Minnesott. Suitable habitat is present at both sites. Additional details of our observations are given on p. .

The wildlife values of North Minnesott natural area in particular are enhanced by the contiguity of Northwest Pocosin to the west. Northwest Pocosin provides additional habitat for red-cockaded woodpeckers. It also supports a population of black bear which uses the sand ridge habitats to some extent.

Finally, one fox squirrel was noted on North Minnesott, and habitat appeared good for this species.

12. Significance Summary Table (categories represented and descriptions) - by site: North Minnesott Ridge

a. Feature	Map Legend	b. Description of significant feature	c. Comparative assessment
High quality wetland plant community	CT 1	Pinus palustris (or Pinus serotina)/ mixed tall pineland shrubs//Smilax laurifolia	Excellent example of shrub-dominated pine flatwoods over wet mineral soils (Leon and Rutlege series); forms the wetter portions of the best pine flatwoods system in the county, and one of the state's best examples of a naturally vegetated relict beach ridge/ scarp. Further significant due to presence of a contiguous natural pocosin to the west.
High quality terrestrial plant community	CT 3	Pinus palustris/mixed low pineland shrubs/Aristida stricta-Vaccinium crassifolium	Extensive and excellent example of a dry pine community which is transitional between flatwoods and more distinctly xeric upland pine communities. The more xeric part of the county's best pine flatwoods system (see CT 1 above).

12. Significance Summary Table (categories represented and descriptions) - by site: North Minnesott Ridge (continued)

a. Feature	Map Legend	b. Description of significant feature	c. Comparative assessment
Endangered species	1	Red-cockaded Woodpecker	Small population on North Minnesott Ridge natural area; probably should be considered a unit of the sparse woodpecker population occupying both the Ridge and Northwest Pocosin. Good quality habitat but with few pines of suitable age for use as cavity trees. See p. for details of observations.
Threatened endemic species	2	Dionaea muscipula (venus' flytrap)	Several hundred plants observed, growing in localities where human activity maintains suitably open habitat (ditch banks and roadsides). Northernmost extant population. With management more potential and more natural habitat could be provided.

12. Significance Summary Table (categories represented and descriptions) - by site: North Minnesott Ridge (continued)

a. Feature	Map Legend	b. Description of significant feature	c. Comparative assessment
Outstanding geomorphologic feature	through-out	Pleistocene relict beach ridge and marine scarp	Throughout Pamlico County Minnesott Ridge is a well-developed feature; at North Minnesott Ridge natural area this geomorphologic significance is complemented by the presence of the other biotic and abiotic features tabulated here, especially the natural communities (see CT 1, CT 3), and by the presence of two small carolina bays.
High abiotic diversity	through-out	five soil orders present, four of which support national or partially natural vegetation	The edaphic diversity is unusual for a rather small area; it reinforces the other features of North Minnesott natural area.

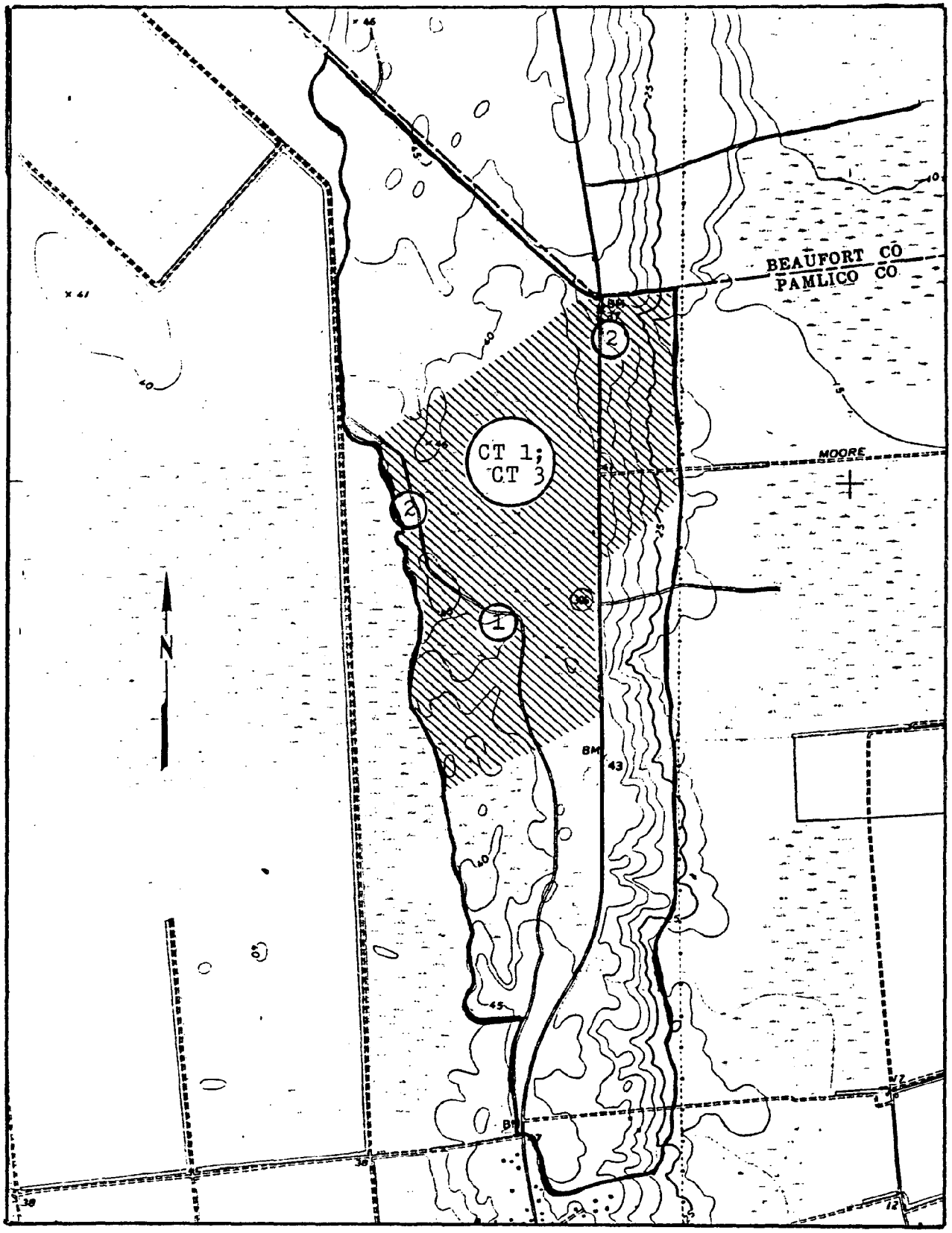

Fig. 7. Significant features:

NORTH MINNESOTT SAND RIDGE

natural area boundary (the complex pattern of community types is not mapped)

12. Significance Summary Table (categories represented and descriptions) - by site: South Minnesott Ridge

a. Feature	Map Legend	b. Description of significant feature	c. Comparative assessment
High quality wetland plant community	CT 2	Pinus palustris (or Pinus serotina)/ mixed tall pineland shrubs//Smilax laurifolia	Good example of wet, shrub-dominated pine flatwoods; less extensive than preceding example and lacking the high degree of integrity as part of a flatwoods system.
High quality terrestrial plant community	CT 4	Pinus palustris/mixed low pineland shrubs/Aristida stricta-Vaccinium crassifolium	Secondary to feature CT 3 in quality, extensiveness and integrity

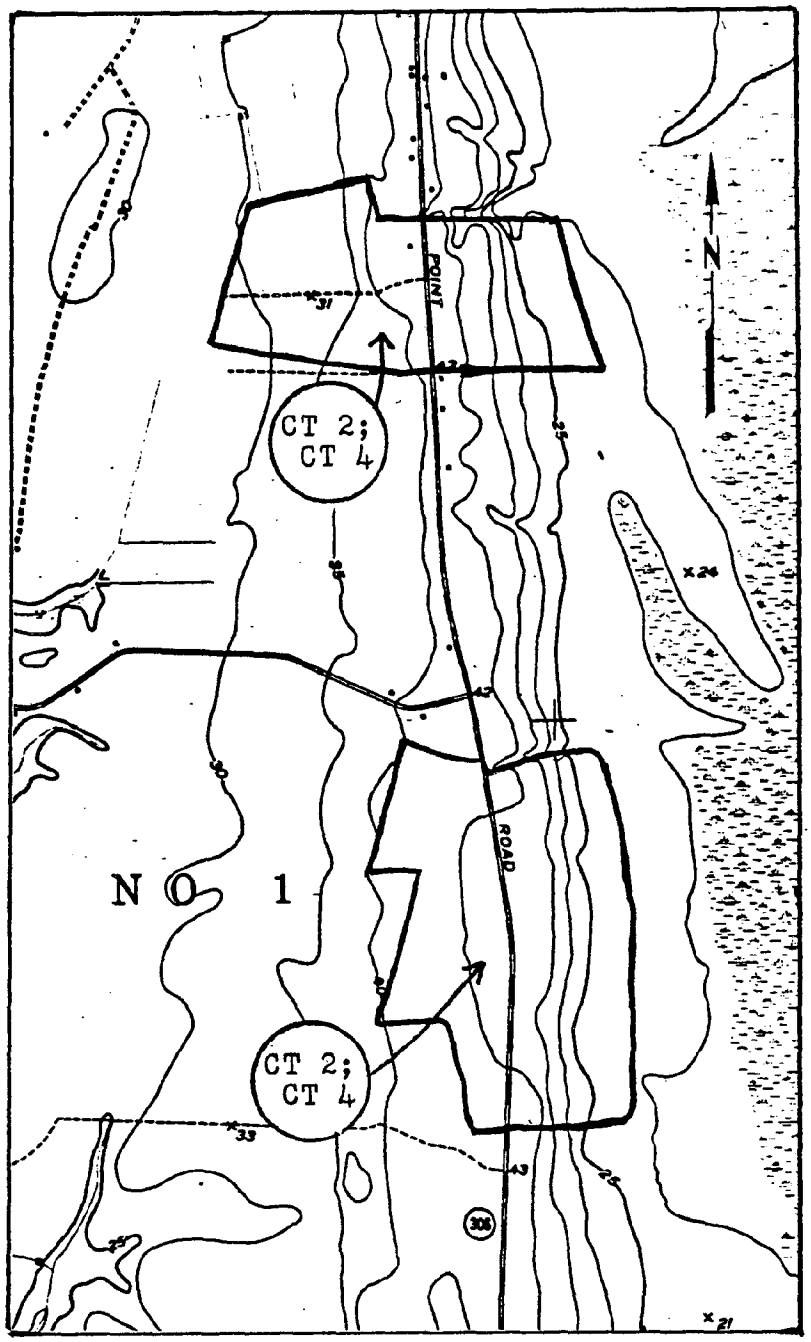

Fig. 8. Significant features: ——— natural area boundary (the complex pattern of community types is not mapped)

SOUTH MINNESOTT SAND RIDGE

Legal Status, Use, and Management

13. Ownership type by percent area: Type

Private 100 % (South Minnesott)

Public 5 % (North Minnesott; remainder private)

Unknown _____ %

14. Number of Owners: North Minnesott: six owners in seven tracts

South Minnesott: six owners

15. Name(s) of owner(s) and/or custodian(s) (with addresses, phone numbers, other pertinent information). Numbered tracts in order of importance, others listed alphabetically.

North Minnesott Sand Ridge

(1) Texasgulf, Inc., P. O. Box 425, Aurora, NC 27806

(2) Agrico Chemical & Kennecott, N. C. Phosphate Corporation, P. O. Box 1157, Washington, NC 27889

(3) N. L. Industries, Inc., Financial Service Dept., P. O. Box 360, Hightstown, NJ 85200

Pamlico County Government, Bayboro, NC

Channing Smith estate (two tracts), Route 1, Box 274, New Bern, NC 28560

James Tingle estate and Paul Waters, P. O. Box 1088, Washington, NC 27889

South Minnesott Sand Ridge

(1) M. D. Brinson, Sr. estate, P. O. Box 92, Grantsboro, NC 28529

(2) Milton D. Brinson, Jr., P. O. Box 58, Grantsboro, NC 28529

(3) Milton and R. T. Brinson, 4028 Converse Drive, Raleigh, NC 27609

15. continued --

Mrs. W. L. Dixon, Route 1, Box 136, Grantsboro, NC 28529

Austin R. Johnson, 1804 Marshburn Circle, Kinston, NC 28501

George S. Willis, Route 1, Box 18A, Grantsboro, NC 28529

16. Name(s) of knowledgeable person(s) (with addresses, phone numbers, other pertinent information).

None known.

17. Attitude of owner or custodian toward preservation (contacted?):

Unknown.

18. Uses of natural area:

The primary use historically has been the production of timber. Probably some turpentining was also conducted, although little visible evidence remains in the form of "boxed" pines. Both natural areas have been logged through several times, some parts as recently as 1981. Little cultivation has occurred, but both sites have most likely been grazed. Hunting is a long-term and continuing use. The ridge is a major highway corridor, and NC 306 bisects both natural areas. A 48-acre tract is used in part as a county landfill. Trash dumping and removal of sand for fill have been minor uses.

19. Uses of surrounding land:

a. Wildland 50 %
b. Agricultural land 20 %
c. high-intensity forestry 20 %
d. developed 10 %

20. Preservation Status:

Cat	* %	*Description of preservation status
6	100	Private land, not protected by owner or lesee

21. Regulatory protections in force:

None for the overall system; some of the features may be protected from taking (red-cockaded woodpecker) or potentially, from sale without a permit (venus' flytrap).

22. Threats:

Logging is a chronic threat, but its disruptive effects are moderated if severe soil disturbance is avoided. However carefully done, logging will unavoidably decrease the already limited foraging and nesting habitat for the red-cockaded woodpecker. Site preparation and pine planting, which have followed logging elsewhere on Minnesott Ridge, will critically disturb the natural areas' pine flatwoods ecosystem, through drainage, soil disturbance and fire suppression. Overall disruption of the natural fire cycle throughout the natural areas has already taken place, resulting in increased dominance of shrubby species, reduction of herbaceous diversity and loss of red-cockaded woodpecker habitat.

Other threats include subdivision of the natural areas into building lots, expansion of the landfill or development of other dumping sites, and possibly involvement of the natural areas in phosphate production.

23. Management and Preservation Recommendation:

Protection of the Minnesott Sand Ridge natural areas should be aimed at maintaining the relatively undisrupted hydrologic and edaphic conditions at the two sites, and at restoring the vigor and diversity of the herbaceous assemblage present. The natural areas typify many important sand ridge and savanna sites in the Southeast, in that the pine cover has been thoroughly disturbed in the past. This does not diminish the value of the natural areas, since the conditions required by the diverse herb assemblages still generally prevail.

The most pressing management need, after prevention of sheer physical disruption, is the resumption of a regime of frequent fire, through prescribed burns. The potentially herb-rich ecotones between upland and swale are especially in need of shrub control by fire.

Fire will also aid the red-cockaded woodpecker by maintaining the open pine forest preferred by the species. Potential and actual cavity trees are very scarce on the Ridge, and should be identified and protected from logging. Sufficient foraging habitat should also be withdrawn from logging, or at least, logged on a long rotation designed to provide adequate foraging stands (and cavity tree replacements).

Site protection is perhaps most expeditiously pursued through establishment of voluntary conservation agreements (registry) with landowners. The Natural Heritage Program should seek such agreements, and also explore the intentions of the corporate owners of large holdings. Where timbering is being considered, every effort should be made to persuade owners not to drain logging sites, plant pines, or disturb the soil intensively.

Natural Characteristics Summary

24a. Vegetation - Biotic Community Summary CT 1, CT 2

Community type: Pinus palustris (or Pinus serotina)/mixed tall pineland shrubs//Smilax laurifolia

Community cover type: Pinus palustris or Pinus serotina

General habitat feature: Pine flatwoods

Average canopy height: 20 to 40 feet

Estimated age of canopy trees: less than 50 years, with scattered older individuals

Canopy cover: open to sparse

Estimated size of community: not determined

Successional stage: pyroclimax

Sere type: Psammosere

Common canopy species in community cover or community type (but not dominant):

none

Common sub-canopy or shrub stratum species in community cover or community type (but not dominant):

Lyonia ligustrina, Kalmia angustifolia, Clethra alnifolia, Ilex coriacea , Ilex glabra, Persea borbonia, Magnolia virginiana

Common herb stratum species in community cover or community type (but not dominant):

Arundinaria gigantea, Woodwardia virginica

24b. Soil Summary (by community type) CT 1, CT 2

Soil series: Leon and Rutlege

Soil classification: Leon - sandy, siliceous thermic Aeric Haplaquods; Rutlege - sandy, siliceous, thermic Typic Humaquepts

Soil association: Leon - Lynn Haven on Pamlico County General Soil Map (1972); Leon-Tomahawk-Rutlege in soil survey of Pamlico County (1982, in manuscript).

pH class: Leon - very strongly acid
Rutlege - very strongly acid

Source of information: General Soil Map, Pamlico County, USDA, SCS (1972); Soil Survey of Pamlico County, USDA, SCS (1982, in manuscript).

Other notes:

24c. Hydrology Summary (by community type) CT 1, CT 2

Hydrologic system: Palustrine

Hydrologic subsystem: Interaqueous

Water chemistry: Fresh

Water regime: seasonally flooded to saturated

Drainage class: poorly drained to very poorly drained

Drainage basin: primary drainage is to the Neuse River, with some drainage from the northernmost areas of this community into the Pamlico and Bay Rivers.

Hydrology characterization: A very poorly drained, seasonally flooded to saturated interaqueous palustrine system in swales and depressions; bordered by a poorly drained, otherwise similarly characterized palustrine system on slightly higher soils.

24d. Topography Summary: CT 1, CT 2

Landform: relict beach ridge and marine scarp

Shelter: open to partly sheltered

Aspect: flat, to east facing along scarp

Slope Angle: nearly level to sloping

Profile: flat to slightly concave, becoming broken along the face of the scarp

Surface patterns: gently undulating; locally dissected by drainage off the scarp.

Position: CT 1 and CT 2 occupy both flats and the sloping face of the Grantsboro Scarp.

Natural Characteristics Summary

24a. Vegetation - Biotic Community Summary CT 3, CT 4

Community type: Pinus palustris/mixed low pineland shrubs/Aristida stricta-Vaccinium crassifolium

Community cover type: Pinus palustris

General habitat feature: Pine Flatwoods

Average canopy height: 40 to 60 feet

Estimated age of canopy trees: less than 50 years, with older individuals scattered or clumped.

Canopy cover: Open

Estimated size of community: not determined

Successional stage: Pyroclimax

Common canopy species in community cover or community type (but not dominant):

None

Common sub-canopy or shrub stratum species in community cover or community type (but not dominant):

Kalmia angustifolia, Gaylussacia dumosa, Gaylussacia frondosa, Ilex glabra, Lyonia mariana

Common herb stratum species in community cover or community type (but not dominant):

Arundinaria gigantea, Pteridium aquilinum

24b. Soil Summary (by community type) CT 3, CT 4

Soil series: Tomahawk

Soil classification: loamy, siliceous, thermic Arenic Hapludults

Soil association: Leon - Lynn Haven on Pamlico County General Soil Map (1972); Leon - Tomahawk-Rutlege in Soil Survey of Pamlico County (1982, in manuscript).
pH class: very strongly acid

Source of information: See Soil Summary for CT 1, CT 2

Other notes:

24c. Hydrology Summary (by community type) CT 3, CT 4

Hydrologic system: Terrestrial

Hydrologic subsystem: Mesic

Water chemistry: Fresh

Water regime: not applicable

Drainage class: moderately well to somewhat poorly drained

Drainage basin: Neuse River primarily; some areas of this community on the north end of Minnesott Ridge drain to the Pamlico and Bay Rivers.

Hydrology characterization: A moderately well to somewhat poorly drained mesic terrestrial system.

24d. Topography Summary: CT 3, CT 4

Landform: relict beach ridge

Shelter: open to partly sheltered

Aspect: flat

Slope Angle: nearly level

Profile: gently convex

Surface patterns: smooth, with local hummocks and depressions caused by windthrow of trees and possibly by removal of stumps for sale.
Position: on the nearly flat crest of Minnesott Ridge.

25. Physiographic characterization of natural area:

Fire-maintained climax wetland and transitional upland pine communities of a psammosere on a beach ridge and marine scarp system, underlain by Pleistocene marine sands, draining into the Neuse, Bay and Pamlico Rivers, and in the Outer Coastal Plain Region of the Embayed Section, Coastal Plain Province.

Geological Formation:

Underlain by Minnesott Sand (relict beach and dune deposits), over units of the Flanner Beach Formation, over pre-Quaternary rocks of the Yorktown Formation. The Grantsboro Scarp marks the boundary of the Pamlico Terrace to the east and the Chowan Terrace to the west.

Geological Formation age:

Minnesott Sand - Pleistocene epoch; "lower Wisconsin and/or upper Sangamon (?)" interglacial, 50,000 to 75,000 years. B.P.
Flanner Beach Formation - Pleistocene; "lower Sangamon or pre-Sangamon (?)" 100,000 years B.P.
Yorktown - Pliocene or Miocene; 7,000,000 years B.P.

References Cited:

Reconaissance Geology of the Submerged and Emerged Coastal Plain Province, Cape Lookout Area, North Carolina. Robert B. Mixon and Orrin H. Pilkey. USGS Professional Paper 859 (1976).

26. Summary - Endangered and threatened species

Name of species: Dionaea muscipula (Dionaeaceae) venus' flytrap

Species legal status and authority: Considered a threatened endemic by Hardin in Cooper et al. (1977). Not listed by the North Carolina Plant Protection Board.
Number of populations on site: two

Number of individuals per population: 30 and several hundred

Size or Maturity of individuals: various; immature to mature

Phenology of population:

Eg: vegetative % 25
flowering % 0
fruiting % 75

General vigor of population: very vigorous

Disturbance or threats to population: loss of habitat through succession to more closed conditions; widening of NC 306

Habitat characteristics

Plant community: pond pine-longleaf pine/mixed shrubs; along open roadsides maintained by mowing
Topography: Flat

Soil Series: Leon

Microclimate: not determined

Drainage basin: Neuse and Bay Rivers

Other plants and animal species present: Polygala lutea, Polygala ramosa, Spiranthes sp., Drosera intermedia, Drosera leucantha, Lacnanthes caroliniana, Zigadenus glaberrimus

AERIAL OR DETAILED MAPS WITH POPULATIONS CLEARLY MARKED.

26. Summary - Endangered and threatened species

Name of species: red-cockaded woodpecker

Species legal status and authority: endangered species on both Federal and state lists (Cooper et al. 1977 and Federal Register 10/30/70)
Number of populations on site: one

Number of individuals per population: not determined; at North Minnesott Ridge natural area, two birds observed February 26, 1982, one on May 14, 1982, and one active cavity tree located; at South Minnesott Ridge natural area several inactive cavity trees are present but no birds were observed.

Size or Maturity of individuals: adults

Phenology of population: not applicable

Eg: vegetative % not applicable
flowering % not applicable
fruiting % not applicable

General vigor of population: fair; probably reproducing, but scarcity of potential cavity trees may be limiting. Some good quality foraging habitat is present on both natural areas.

Disturbance or threats to population: Cutting of old-growth pines or extensive cutting of younger stands would reduce suitability of habitat. The continued occurrence of fire is needed to control shrub growth and maintain structure of vegetation preferred by this species.
Habitat characteristics

Plant community: Longleaf pine savanna and pond pine/shrub communities

Topography: not applicable

Soil Series: not applicable

Microclimate: not applicable

Drainage basin: not applicable

Other plants and animal species present: See Master Species Lists.

AERIAL OR DETAILED MAPS WITH POPULATIONS CLEARLY MARKED.

27. Master species lists:

VASCULAR PLANTS
(listed alphabetically by family)

ACERACEAE
  Acer rubrum
ANACARDIACEAE
  Rhus copallina
APIACEAE
  Ptilimnium capillaceum
AQUIFOLIACEAE
  Ilex coriacea
  I. glabra
  I opaca
ASTERACEAE
  Chaptalia tomentosa
  Erigeron sp.
  Pterocaulon pycnostachyum
BLECHNACEAE
  Woodwardia virginica
CLETHRACEAE
  Clethra alnifolia
CYPERACEAE
  Rhynchospora pallida
CYRILLACEAE
  Cyrilla racemiflora
DIAPENSIACEAE
  Pyxidanthera barbulata var. barbulata
DIONAEACEAE
  Dionaea muscipula
DROSERACEAE
  Drosera capillaris
  D. intermedia
  D. leucantha
EBENACEAE
  Diospyros virginiana
ERICACEAE
  Gaultheria procumbens
  Gaylussacia dumosa
  G. frondosa
  Kalmia angustifolia
  Leucothoe racemosa
  Lyonia ligustrina
  L. lucida
  L. mariana
  Rhododendron atlanticum
  Vaccinium corymbosum
  V. crassifolium
  V. stamineum
  V. tenellum

EUPHORBIACEAE
  Cnidoscolus stimulosus
FABACEAE
  Clitoria mariana
  Stylosanthes biflora
  Baptisia tinctoria
FAGACEAE
  Quercus falcata
  Q. incana
  Q. laevis
  Q. marilandica
  Q. nigra
  Q. phellos
GENTIANACEAE
  Sabatia diformis
HAEMODORACEAE
  Lacnanthes caroliniana
HAMAMELIDACEAE
  Fothergilla gardenii
IRIDACEAE
  Sisyrinchium sp.
LAURACEAE
  Persea borbonia
  Sassafras albidum
LENTIBULARIACEAE
  Utricularia sp.
LILIACEAE
  Aletris farinosa
  Smilax laurifolia
  Zigadenus glaberrimus
LOGANIACEAE
  Gelsemium sempervirens

LYCOPODIACEAE
  Lycopodium alopecuroides
MAGNOLIACEAE
  Magnolia virginiana
MELASTOMATACEAE
  Rhexia alifanus
MYRICACEAE
  Myrica cerifera
  M. heterophylla
NYSSACEAE
  Nyssa sylvatica var. biflora
ONAGRACEAE
  Ludwigia sp.
ORCHIDACEAE
  Calopogon pulchellus
  Spiranthes sp.
OSMUNDACEAE
  Osmunda cinnamomea
  O. regalis

PINACEAE
  Pinus palustris
  P. serotina
POACEAE
  Andropogon sp.
  Aristida stricta
  Arundinaria gigantea
POLYGALACEAE
  Polygala cruciata
  P. lutea
  P. ramosa
PTERIDACEAE
  Pteridium aquilinum
ROSACEAE
  Rubus sp.
SALICACEAE
  Salix sp.
SARRACENIACEAE
  Sarracenia flava
SCROPHULARIACEAE
  Gratiola pilosa
THEACEAE
  Gordonia lasianthus
VITACEAE
  Vitis rotundifolia
XYRIDACEAE
  Xyris sp.

AMPHIBIANS

Oak Toad
Southern Cricket Frog
Pine Woods Treefrog
Little Grass Frog
Carpenter Frog

BIRDS

(Emphasis of bird lists is on breeding or summering species; lack of adequate field work during the other seasons prevented compilation of a complete list.)

KEY

PR = Permanent resident
SR = Summer resident
WR = Winter resident
T = Transient; spring or fall
PV, SV, WV - Visitor; permanent, summer, or winter
* = Breeding or suspected breeding at site

Turkey Vulture	PV
Black Vulture	PV
Red-shouldered Hawk	PV
Bobwhite	PR*
Mourning Dove	PR*
Yellow-billed Cuckoo	SR*
Barred Owl	PV
Whip-poor-will	SR*
Common Nighthawk	SR*
Common Flicker	PR*
Pileated Woodpecker	PV
Yellow-bellied Sapsucker	WR or WV
Downy Woodpecker	PR*
Red-cockaded Woodpecker	PR*
Great Crested Flycatcher	SR*
Eastern Wood Pewee	SR*
Purple Martin	SV
Blue Jay	PR*
Common Crow	PR*
Fish Crow	SR or SV
Carolina Chickadee	PR*
Tufted Titmouse	PR*
Brown-headed Nuthatch	PR*
Carolina Wren	PR*
Gray Catbird	SR or PR*
American Robin	WR
Eastern Bluebird	PR*
Golden-crowned Kinglet	WR
Ruby-crowned Kinglet	WR
White-eyed Vireo	SR or PR*
Worm-eating Warbler	SR*
Yellow-rumped Warbler	WR
Yellow-throated Warbler	SR*

Pine Warbler	PR*
Prairie Warbler	SR*
Common Yellowthroat	PR*
Yellow-breasted Chat	SR*
Hooded Warbler	SR*
Bobolink	T
Brown-headed Cowbird	PR*
Summer Tanager	SR*
Cardinal	PR*
Indigo Bunting	SR*
Rufous-sided Towhee	PR*
Song Sparrow	WR

MAMMALS

White-tailed Deer
Eastern Mole
Fox Squirrel
Black Bear

Note: no reptile list was recorded.

NATURAL AREA INVENTORY FORM
(To be prepared for each site)

Basic Information Summary Sheet

1. Natural Area Name: Northwest Pocosin

2. County: Pamlico

3. Location: Tract is centered about 2.5 miles due west of where NC 306 crosses the Pamlico/Beaufort County line, in the northwest corner of the county. It is bordered by the Craven County line on the northwest, the Beaufort County line on the northeast, and parts of Whiskey, Beltline and other roads along the southwest and south.

4. Topographic quadrangle(s): Reelsboro (1974)
Bayboro (1974)
both 7.5 min.

5. Size: 12,500 acres, measured with a grid calculator

6. Elevation: approximately 35' to 40' above mean sea level

7. Access: Best access to the roadless portion is on foot along the bombardier track starting at the north end of Chamness II Road (private road so named on NC Forest Service county road map). Within 0.25 mile this track enters the low pocosin and continues for several miles before dead-ending. Other access points are off the boundary and interior roads, to taller pocosin vegetation.

8. Names of investigators:

Lance Peacock	J. Merrill Lynch
P. O. Box 6006	Route 2, Box 222-B
Raleigh, NC 27628	Enfield, NC 27823

9. Date(s) of investigation: February 24 and 25, April 14, May 14, June 28 and July 12, 1982

10. Priority rating: High

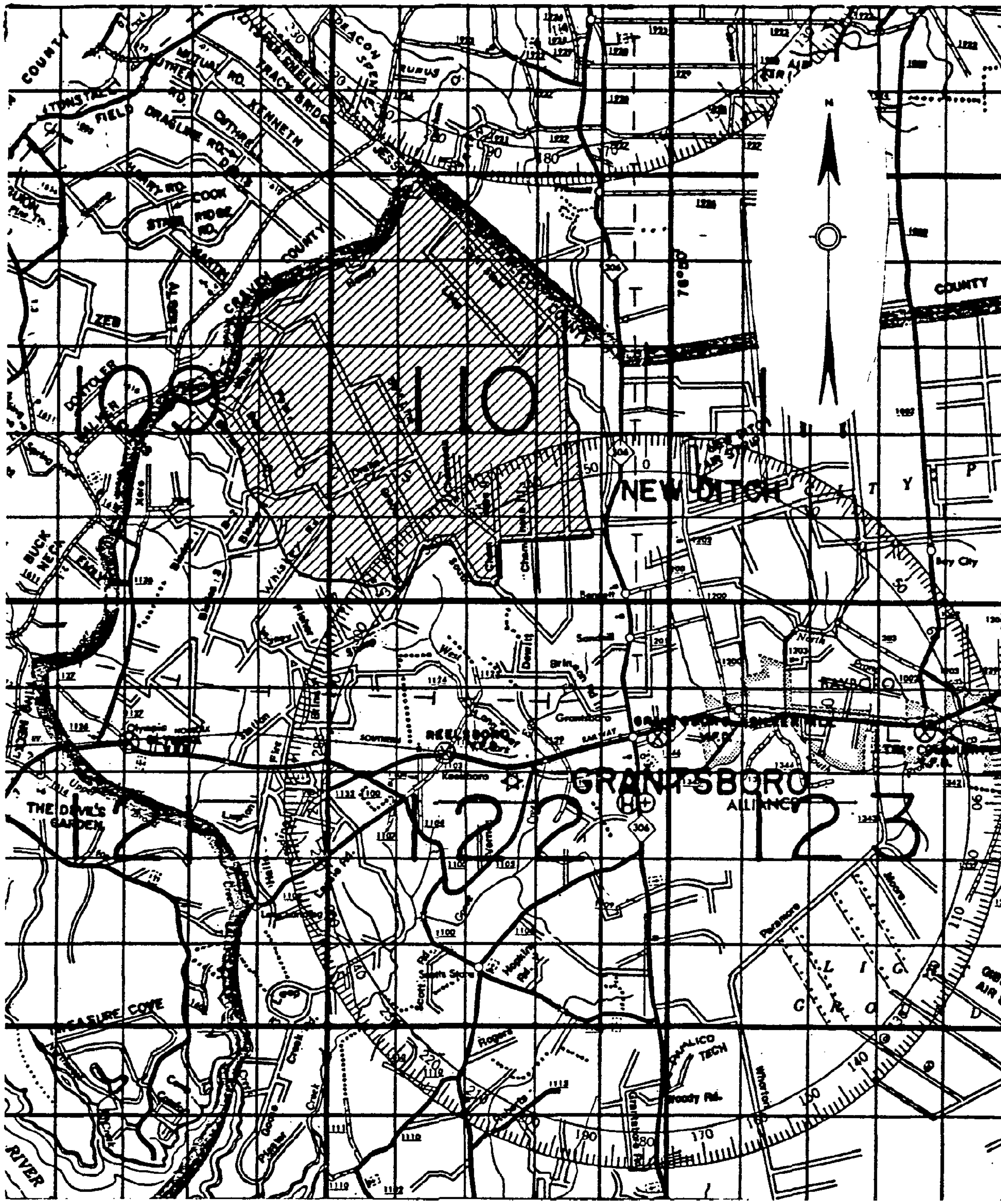

Fig. 9. Access information:

NORTHWEST POCOSIN

//// study area

11a. Prose Description of Site:

INTRODUCTION

Although pocosins are a widely recognized feature of eastern North Carolina, there exists no simple, unified statement of what is meant by or included in the term. B. W. Wells (1928) called pocosin "the most indefinite of the major communities" found in the state's Coastal Plain. A brief working characterization of the pocosin ecosystem includes the following points: pocosins are nutrient-poor wetlands vegetated by combinations of pond pine (*Pinus serotina*), semi-evergreen shrubs, and greenbriers (*Smilax* spp.), with height and composition of vegetation varying in response to recurrent fire, length of hydroperiod and mineral/organic matter proportions in the soils. The vegetation also responds to human activity, which has affected nearly all pocosins. Most major pocosins originated in blocked drainageways, and have spread far beyond the original blocked channels as peat accumulated, mantling interstream uplands. Pocosin vegetation is also found in some carolina bays, in swales between relict beach ridges and dunes, and around seepage areas and streams in the Sandhills.

Pamlico County has three large pocosins: Bay City, Light Ground and Northwest. Of these, the first two have been severely altered by construction of roads and canals, and clearing for agriculture and tree farming. Parts of Northwest Pocosin remain much closer to the original conditions of hydrology, soils and fire.

The least-disturbed portion of the Northwest Pocosin natural area is centered in an extensive roadless tract in the northwestern corner of the county, just south of the point at which Pamlico, Craven and Beaufort Counties meet. This roadless tract comprises about two thirds of the natural area, with the rest, contiguous to the north, west and south having been roaded and ditched. The most severely affected southerly portion of the original pocosin is excluded from this report. The natural area adjoins North Minnesott Ridge natural area to the east (see pp.); and is bounded on the south by sections of Beltline Road (from NC 306), Chamness II Road, South Road, and overland to Whiskey Road. Whiskey Road approximates the boundary on the west side, and the Craven and Beaufort County lines close out the boundary on the northwest and northeast, respectively.

The roadless section of the pocosin is about six square miles, or 3800 acres, in area. Except for one small deposit to the south, this six-mile expanse contains the only true peat deposit known in Northwest Pocosin, estimated by Otte and Ingram (1980) to be about three feet thick at the maximum. The rest of the pocosin is underlain by mineral soils, some of which have a layer of organic material (ibid.).

The soils of the Northwest Pocosin may be viewed as a group of three vast concentric mapping units, with deepest peats in the center ringed by progressively shallower peat, and finally mineral, soils. The pocosin is domed in the center with elevations slightly exceeding 40 feet above sea level, dropping to about 35 feet at the edges of the natural area, except along the east side, where the concentric and domed arrangement is truncated sharply by the Minnesott Ridge, which rises to about 45 feet adjacent to the pocosin natural area.

THE VEGETATION

Otte (1981) proposes a basic pocosin classification which relates vegetation to combined factors of peat depth, seasonal wetness, and nutrient availability from underlying mineral strata or some other source outside the pocosin system. Otte's classification is summarized in Table 1, and is used in the following discussion of the plant communities present in the Northwest Pocosin.

Several natural communities are found in the pocosin, with shorter, semi-evergreen shrub communities (Otte's high pocosin type) predominant over the deepest peats, and taller pond pine communities (Otte's pond pine woodland and pond pine forest) occurring on the fringes of the central shrub-dominated area. These communities will be described in order from deeper to shallower peat sites.

At the heart of Northwest Pocosin is an area of deepest peat soils, mapped as Dare muck (dysic, thermic Typic Medisaprists; SCS, 1981). Associated with these Dare soils is the relatively low, predominantly evergreen shrub community which falls within the lower height range of Otte's high pocosin criteria, which include: two to four feet of peat, water table at the surface much of the year and rarely falling to the level of the underlying mineral sediments, shrub height four to eight feet, pond pines about 25 feet tall and widely scattered. (Otte's classification is based on a set of grada-

tional characters; his types are in effect representative points selected from a vegetation continuum.)

This high pocosin community (1850 acres) is generally dominated by a dense shrub layer of titi (Cyrilla racemiflora), loblolly bay (Gordonia lasianthus) and fetterbush (Lyonia lucida). A sparse to scattered canopy of very stunted, gnarled pond pines about 15 feet tall emerges from the shrubs, and dense greenbriers (Smilax laurifolia) intertwine with the rest of the vegetation. The community is characterized as Pinus serotina/Cyrilla racemiflora-Lyonia lucida//Smilax laurifolia (pond pine/titi-fetterbush//greenbrier; CT 1). Although pond pine, as a characteristic species, is included in the community name, the true dominants of this type are shrubs and herbs.

Along bombardier trails which penetrate the high pocosin, species of shorter stature are common. Leatherleaf (Cassandra calyculata) is a prevalent low shrub in these tracks, and yellow pitcherplant (Sarracenia flava), purple pitcherplant (Sarracenia purpurea), and a sedge (Carex walteriana) are also associated. These species respond to the open conditions created by the passing vehicles, and possibly to locally wetter spots in the ruts. The open bombardier ruts mimic conditions which would prevail under a regime of more frequent fire, which would favor pitcherplants and other herbaceous and low shrub species throughout the pocosin by maintaining the open, full sun sites these plants need. Fires in pocosins also often burn out small depressions which provide locally wetter conditions and increase microhabitat diversity. The herb layer is depauperate in all the pocosin communities described here, except in association with disturbance resulting from human activity.

Surrounding the Dare muck soils is a wide band of Croatan muck (loamy, siliceous, dysic, thermic Terric Medisaprists; SCS, 1981), which form the second concentric band in the natural area soilscape. Croatan soils are shallow Histosols; they comprise the most extensive single soil series in the natural area, and support a rather heterogeneous vegetation which relates to peat depth variation, timbering history, and recent disturbance by ditching.

The best example seen in Northwest Pocosin of Otte's pond pine woodland type occurs over Croatan soils, along Loop Road to the northeast of CT 1 (see map). The large, old-growth trees of this 235-acre stand are about 12 inches dbh (diameter at breast height) and 70-80 feet tall. The canopy is open to scattered; the thick shrub layer is six to ten feet tall, consisting of sweet pepperbush (Clethra alnifolia), titi,

bitter gallberry (Ilex glabra), low red bay (Persea borbonia), low sweet bay (Magnolia virginiana) and loblolly bay. All these physical parameters fall within Otte's proposed pond pine woodland criteria. The community is characterized as Pinus serotina/mixed pocosin shrubs//Smilax laurifolia (pond pine/mixed pocosin shrubs//greenbrier; CT 2).

Although tall, the pond pines here have a very characteristic gnarled and twisted growth form, with many dead trunks present, killed by fire and possibly other agents. Recent fire in the vicinity of this old-growth pond pine stand has created a mosaic of different communities, most having large, isolated individual pond pines which seem to be the remnants of denser stands killed by fire.

Immediately adjacent to the old-growth pond pine woodland, across Loop Road, is a large area which burned about ten years ago, based on annual ring counts of sapling pond pines. Loop Road apparently acted as a firebreak, and is now at the boundary between the two abruptly different communities. The ten-year-old burn is dominated by zenobia (Zenobia pulverulenta) in slightly lower areas and a mixture of bitter gallberry, titi and other shrubs on relatively higher parts of the site; with a dense regeneration of young pond pine saplings about eight feet tall throughout the shrub layer. Also present are extremely scattered mature pond pines which survived the last severe fire. No community type is designated for this location, which demonstrates the early stages of secondary succession to pond pine woodland after very severe fire. Here the pond pine canopy was removed, completely altering the physiognomy of the community, but a young pond pine stand is already well-established on the site. Presumably the burned area can support a pond pine woodland community similar to that immediately across Loop Road, and will be occupied by the same community barring another killing fire.

Between the physiognomic extremes of old growth and recent burn is another and very common vegetation type associated with the Croatan muck soils in the Northwest Pocosin. This commonly encountered vegetation type is termed pond pine forest in Otte's classification. His criteria for this type are: one to two feet of sandy peat, water table in underlying mineral sediments much of the year, shrub height 10 to 20 feet, and pond pine height under 50 feet with canopy closed.

Much of the pond pine forest in Northwest Pocosin is co-dominated by loblolly bay (in addition to pond pine), with

red and sweet bays and red maple (Acer rubrum) also present in the canopy. In the shrub layer of this community are many of the species already mentioned under CT 2, as well as highbush blueberry (Vaccinium corymbosum), sweet gallberry (Ilex coriacea) and cane (Arundinaria gigantea). The community type is Pinus serotina-Gordonia lasianthus/mixed bay shrubs//Smilax laurifolia (pond pine-loblolly bay/mixed bay shrubs//greenbrier; CT 3). Relatively undisturbed areas of this community (3100 acres) form a narrow fringe around the high pocosin (CT 1) along most of its perimeter.

The extreme of this pond pine forest community is located along Whiskey Road in the southwest corner of the natural area. Here a small area (250 acres) of loblolly bay dominates the canopy locally, in nearly pure stands 30-50 feet tall (see map). We did not determine whether the dominance by loblolly bay is natural, or whether the stand resulted from selective logging of pond pine. The stand is considered a sub-type of CT 3 rather than a separate community type.

To complete the review of the Northwest Pocosin, several generally disturbed areas are briefly summarized. First, extensive additional areas of Croatan muck soils in the southern half of the natural area, once vegetated by pond pine forest and woodland types, are now much more disturbed than the pond pine communities described above (CT 2 and CT 3). In addition to extensive roads and ditches, other disturbances include considerable logging in the most accessible stands. This logging removed primarily large pond pines. Much of the area is now vegetated by a patchwork of pond pine stands varying greatly in size and age. Although much old-growth pond pine remains, it is in fragmented stands and scattered trees left after cutting. The pond pine communities in this section are deemed of insufficient quality to merit consideration as a significant feature in this report, but this southern section of the natural area is significant as habitat for black bear and to a lesser extent for the red-cockaded woodpecker.

Finally, an extensive band of Paxville mucky fine sandy loam encircles the natural area. This is the third concentric soils mapping unit, surrounding the Croatan and Dare muck units. No vegetation of noteworthy natural quality was located in association with the Paxville soils, but some areas of this soil series are included in the natural area, primarily as buffer.

ECOLOGY

The chief ecological factors operating in the Northwest Pocosin are soil nutrients, hydrology and fire, with logging and drainage being overriding and fairly recent additions to the forces affecting the ecosystem. Evidence of fire is common throughout the natural area and its environs, in the form of charred trees and abrupt changes in the character of the vegetation across manmade firebreaks such as roads. The entire plant species assemblage is fire adapted: able to survive fires and even promote fire-prone conditions, as well as colonize burned areas, through such mechanisms as trunk and root sprouts, serotinous cones and thick sclerophyllous leaves rich in aromatic compounds (Christensen *et al.*, 1981). Christensen *et al.* in their review note also that species diversity in pocosins is greatest immediately after fire. The authors tentatively relate the observed diversity to local variation in the amounts of nutrients released by any given fire, and to effects of fire on microclimate and water availability. The authors conclude that the role of fire "in maintaining species diversity [in pocosins] can not be overemphasized." (*ibid.*, p. 57).

Soil nutrient availability and hydrology are closely related factors. As noted above, the deepest peats are located in the center of the natural area, becoming gradually more shallow as one moves toward the pocosin edge. This arrangement is reflected in the concentric pattern of soil series mapped in Northwest Pocosin: Dare muck-Croatan muck-Paxville mucky fine sandy loam, from center to edge and from deep to shallow organic to mineral soils. The vegetation clearly responds to this factor of peat depth, with the lower communities (high pocosin) in the center of the peat body grading into pond pine woodland and forest in the surrounding shallow peat margins. This pattern follows the general intra-pocosin variation described by Otte (1981).

The essence of the pocosin system is that it is nutrient-poor or ombrotrophic (Otte, 1981; Daniel, 1981). The domed peat deposits of the Northwest Pocosin are isolated from any throughflowing water which could carry sediments and nutrients into the system. There is no adjacent high ground (excepting minor areas along Minnesott Ridge to the east), and no source of overbank flow from streams. Precipitation is the main source of water entering the pocosin, and waterflow is essentially out of the pocosin. Additionally, the deeper, wetter peats more effectively isolate plant roots from under-

lying mineral sediments. All these effects are gradational and most pronounced in the pocosin center, where nutrients are most limited and vegetation lowest.

Human-caused disturbance is not absent from the natural area, although its history and effects are difficult to discover and interpret. Certainly logging has gone on throughout Northwest Pocosin for 150 years or more, but it is unknown if shifts in community composition have resulted from selective removal of certain tree species. Interestingly, virtually no Atlantic white cedar (Chamaecyparis thyoides) has been noted in the Northwest Pocosin; nor is bald cypress (Taxodium distichum) an important modern-day component.

WILDLIFE AND AVIAN DIVERSITY

The avifauna of Northwest Pocosin is highly responsive to the structure of the vegetation, with extremes of breeding bird diversity ranging from three species in the evergreen shrub pocosin (CT 1) to nineteen in the old-growth pond pine stand (CT 2). The latter site, with its tall open canopy and numerous standing dead snags, is rich in feeding and nesting niches lacking in the short pocosin. The pond pine stand supported two unusual breeding species in the spring and summer of 1982. A singing male house wren present on May 14 was probably a breeding bird. The species is very rare in the North Carolina Coastal Plain during the nesting season. Unusual for the habitat were several orchard orioles, present at the old growth stand on May 14 and noted again on June 28.

Other notable birds present include Swainson's warbler, present in a medium-height stand of pond pine, red maple and loblolly bay, a somewhat unusual habitat for the species. Black-throated green warblers are probably present as breeders in the taller and denser pond pine forest stands where the canopy is comprised of an even mix of pine, bay species and red maple. The species occurs in the limited swamp forest stands on the western edge of the natural area (not described in this report). Worm-eating warblers are probable breeders in dense, moderately tall shrubs and low trees around the edges of the natural area; singing males were observed in similar and immediately adjacent habitats on the North Minnesott Ridge site to the east. All three warblers are considered local to uncommon breeding birds of North Carolina's Coastal Plain.

Red-cockaded woodpeckers occur in the Northwest Pocosin in a population of undetermined size, but which is undoubtedly small. One apparently active cavity tree in a pond pine was located on July 12, 1982; no birds were observed at this cavity tree (see map). Fairly extensive open stands of old-growth pond pine are present in the natural area. Our observations conducted in several major pocosins of the outer Coastal Plain during 1982 indicate the species is a rare and easily overlooked inhabitant of extensive pond pine pocosins.

Black bear sign was evident almost everywhere along the roads traversing the natural area; this observation is consistent with the conclusions of wildlife biologists as to the importance of large pocosins for black bear denning, feeding and cover areas (see Hamilton and Marchinton, 1980).

11b. Prose Description of Site Significance:

The primary significance of Northwest Pocosin is in its relatively undisturbed condition. Although it is small in acreage in comparison both to its original size and to other pocosin systems in the state, Northwest Pocosin is in several aspects superior to pocosin lands elsewhere in Pamlico County. First, most of the natural area is unditched, and appears to be hydrologically undisturbed. Large tracts of undisturbed pocosin wetland in private ownership are virtually absent in Pamlico County, and are becoming extremely scarce in North Carolina overall. In 1962 nearly 20 percent of Pamlico County was rated as "natural pocosin" (Wilson, 1962); today this figure has dropped to between 5 to 10 percent, representing a major loss of wetland habitat.

Of the several pocosin vegetation types present in Northwest Pocosin, high pocosin (sensu Otte, 1981) forms the least disturbed single community. More extensive examples of high pocosin are known in other parts of the Coastal Plain, but few are as completely undisturbed. The high pocosin portion of the natural area is notable in its extent and for its apparently uninterrupted fire history. (The latter observation is based on appearance of the vegetation in the field and on review of aerial photography.) The old-growth pond pine woodland and younger pond pine forest communities are also very well developed. The former is limited in extent; the latter is the largest pocosin community in the natural area.

The Northwest Pocosin natural area is contiguous with the natural area located along the north (Pamlico County) section of Minnesott Ridge on the east, and with areas of cypress-gum swamp along Upper Broad Creek to the west (not described in this document). Thus an intact system exists from pine flatwoods through a broad expanse of several pocosin types, to swamp forest. Each natural area complements and buffers the other; and both share populations of significant faunal elements such as the black bear and red-cockaded woodpecker.

Excellent black bear habitat is present throughout the pocosin natural area; the chief limitation is probably the small size of the area relative to the needs of a self-maintaining bear population.

Fairly extensive red-cockaded woodpecker habitat is present, including open, old-growth pine stands with a low understory, which provide potential cavity trees; and pine

stands of various ages and densities for foraging. The habitat seems to be currently under-utilized. Probably the main factor preventing an increase in the population of this species in the natural area is a high rate of loss of potential cavity trees to logging. Secondarily, logging fragments old growth stands, causing abnormal dispersion of cavity trees, and hence exposing the red-cockaded woodpecker clan to more intense competition with other cavity-inhabiting vertebrates in a habitat poor in natural cavities (Jackson, 1977).

12. Significance Summary Table (categories represented and descriptions) - by site

a. Feature	Map Legend	b. Description of significant feature	c. Comparative assessment
High-quality wetland plant community	CT 1	Pinus serotina/Cyrilla racemiflora-Lyonia lucida//Smilax laurifolia	Pamlico County's most extensive and least disturbed area of
		approximate areal extent of CT 1	high pocosin vegetation; comparable in quality to much of
			the pocosin in undeveloped parts of the Green Swamp
			(Brunswick County). Almost completely without roads and
			ditches; probably has burned fairly regularly. Associated
			with an area of Dare muck soils.
High-quality wetland plant community	CT 2	Pinus serotina/mixed pocosin shrubs// Smilax laurifolia	Best example in the county of this community cover type, in
		approximate extent of CT 2	terms of extensiveness and tree size (70-80 ft. tall; ave.
			dbh 12 in.). In Northwest Pocosin this cover type is
			associated with well decomposed shallow Histosols (organic
			depth between 16 & 51 in.) of the Croatan muck series. In
			the vicinity of the natural area it has been reduced in
			extent by fire and logging.

12. Significance Summary Table (categories represented and descriptions) - by site

a. Feature	Map Legend	b. Description of significant feature	c. Comparative assessment
High-quality wetland plant community	CT 3	Pinus serotina-Gordonia lasianthus (or Gordonia lasianthus)/mixed bay shrubs//Smilax laurifolia least-disturbed examples of CT 3	Good quality examples of this community are found along the southern border of the high pocosin and in the southwestern third of the natural area along Whiskey Road, occurring over Croatan muck. The presence of this community is probably due to several factors including to some extent local fire exclusion and logging of pine, allowing loblolly bay to dominate or co-dominate. The community occupies large areas but is patchily distributed.
Endangered species	1	Red-cockaded Woodpecker	One apparently active cavity tree located; no woodpeckers observed. Fairly extensive open stands of old-growth pond pine are present in the natural area. Population is small, probably part of the sparse population occupying both Northwest Pocosin and the north end of the Minnesott Sand Ridge.

12. Significance Summary Table (categories represented and descriptions) - by site

a. Feature	Map Legend	b. Description of significant feature	c. Comparative assessment
Species of Special Concern	through-out	Black Bear	Listed as of special concern in Cooper, et al. (1977). The best remaining black bear habitat in Pamlico County in terms of extent, diversity, and contiguity with other usable habitats (swamp to the west, sand ridge to the east). In the pocosin itself, foraging, denning and escape habitats are all present.
High faunistic diversity	CT 2	breeding bird diversity	19 breeding species were recorded in the tall pond pine stand (CT 2) on May 14, 1982. Included were house wren and orchard oriole, very uncommon breeding birds in pocosins.

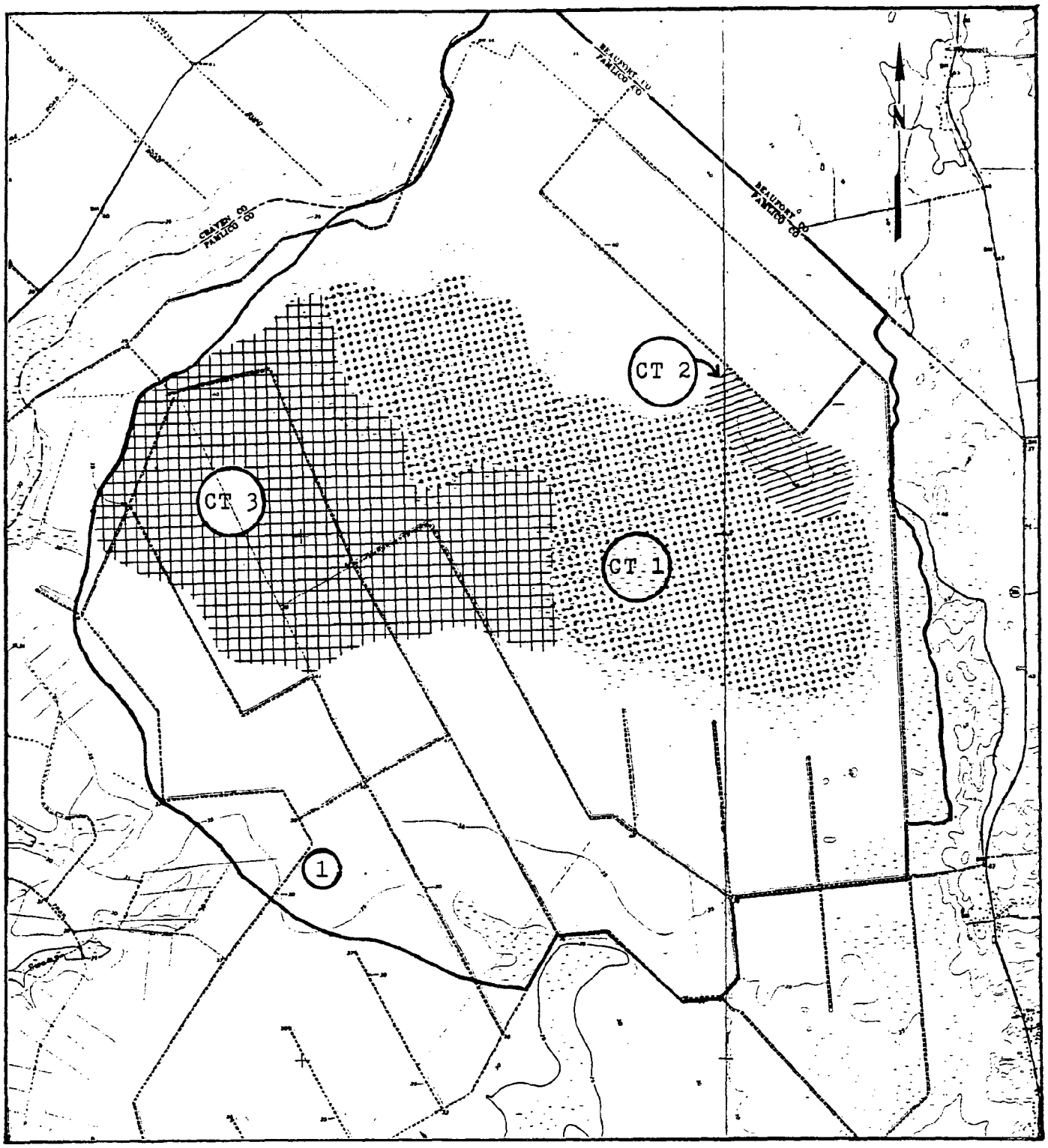

Fig. 10. Significant features:

NORTHWEST POCOSIN

——— natural area boundary (community type locations are mapped generally)

Legal Status, Use, and Management

13. Ownership type by percent area:

Type	
Private	100 %
Public	%
Unknown	%

14. Number of Owners: one

15. Name(s) of owner(s) and/or custodian(s) (with addresses, phone numbers, other pertinent information).

1) Texasgulf, Inc.
P. O. Box 425
Aurora, NC 27806

16. Name(s) of knowledgeable person(s) (with addresses, phone numbers, other pertinent information).

Lee J. Otte
Department of Geology
East Carolina University
Greenville, NC 27834

17. Attitude of owner or custodian toward preservation (contacted?):

Unknown.

18. Uses of natural area:

Timber production has been the major use of Northwest Pocosin for at least 150 years, and continues to be the main contemporary use. Logging has been cyclical, with each new cutting cycle concentrating on the commercially valuable tree species and individuals of that day. Recently, pond pine stands have been the main source of timber.

Hunting is a historic and continuing use of the natural area, kept to a low level of intensity by the inaccessibility of the pocosin. Certain potential uses of the area are discussed below under Item #22.

19. Uses of surrounding land:

a. Wildland 60 %

b. Agricultural land _____ %

c. high-intensity forestry 40 %

d. developed _____ %

20. Preservation Status:

Cat	* %	*Description of preservation status
6	100	Private land, not protected by owner.

21. Regulatory protections in force:

Drainage may be regulated by the Army Corps of Engineers, if certain technical criteria of flow rates are met.

22. Threats:

Logging is a continuing threat to old-growth pond pine stands in the natural area, and will eventually eliminate the red-cockaded woodpecker through destruction of its feeding, roosting and nesting habitat. Disturbance of the natural area by logging will be severely compounded if pine plantations are developed in the pocosin, as has happened on its fringes and extensively in other pocosins of Pamlico County. Very recently, apparent reconnaissance of mineral deposits has been conducted in the center of the high pocosin, with accompanying bombardier trails and exploratory pits. These disturbances, while minor, may presage a broad-scale operation in the area, possibly to produce phosphates. Agriculture is presumably a potential source of disturbance. Intensive uses such as mining, agriculture and tree farming will destroy the pocosin as a natural system. The peat resource of the Northwest Pocosin is not highly rated by Otte and Ingram (1980).

23. Management and Preservation Recommendation:

The central portion of Northwest Pocosin is one of the state's most natural expanses of shrub pocosin vegetation in private ownership. It is less disturbed than many parts of the Croatan National Forest pocosins and Holly Shelter Game Lands, although smaller than these publicly-owned pocosins. Northwest Pocosin natural area is similar in extent and condition to the Green Swamp Nature Preserve in Brunswick County (especially when adjacent Minnesott Sand Ridge habitats are considered).

The protection of Northwest Pocosin will also benefit Pamlico County in multiple ways. In addition to maintenance of habitat diversity, the pocosin can act as a black bear refuge, hunting area for other game species, and is valuable as wetlands. It is the last partially undisturbed pocosin in Pamlico, a county which has seen two of its three large pocosins drained and undergoing development.

Protection of the area is perhaps best pursued in terms of wetlands and game values. An appropriate ultimate holder is the North Carolina Coastal Federation or a like group empowered to hold title to wetlands. The state's Wildlife Resources Commission is an alternative managing agency.

The North Carolina Natural Heritage Program should initiate contacts with the owner, Texasgulf, to explore corporate intentions for the site, and to present and discuss the natural values of this large, undisturbed natural area.

Pocosin management problems include continuance of a natural fire regime, maintenance and monitoring of endangered species populations, hydrologic monitoring, and hunting control. All these problems will be encountered on any Northwest Pocosin preserve which may be established.

Natural Characteristics Summary

24a. Vegetation - Biotic Community Summary CT 1

Community type: Pinus serotina/Cyrilla racemiflora-Lyonia lucida// Smilax laurifolia

Community cover type: Pinus serotina

General habitat feature: high pocosin

Average canopy height: approximately 15 feet

Estimated age of canopy trees: unknown

Canopy cover: sparse to scattered

Estimated size of community: 1850 acres

Successional stage: pyroclimax

Sere type: pelopsammosere

Common canopy species in community cover or community type (but not dominant):

none

Common sub-canopy or shrub stratum species in community cover or community type (but not dominant):

Persea borbonia, Gordonia lasianthus, Magnolia virginiana, Ilex glabra, Kalmia angustifolia, Cassandra calyculata, Myrica cerifera

Common herb stratum species in community cover or community type (but not dominant):

Carex walteriana, Sarracenia flava, Woodwardia virginica

Natural Characteristics Summary

24a. Vegetation - Biotic Community Summary CT 2

Community type: Pinus serotina/mixed pocosin shrubs//Smilax laurifolia

Community cover type: Pinus serotina

General habitat feature: pond pine woodland (sensu Otte 1981)

Average canopy height: 70-80 ft.

Estimated age of canopy trees: 70+ yrs. (?)

Canopy cover: open to scattered

Estimated size of community: 235 acres

Successional stage: pyroclimax

Sere type: pelopsammosere

Common canopy species in community cover or community type (but not dominant):

none

Common sub-canopy or shrub stratum species in community cover or community type (but not dominant):

Cyrilla racemiflora, Clethra alnifolia, Persea borbonia, Magnolia virginiana, Gordonia lasianthus, Ilex glabra

Common herb stratum species in community cover or community type (but not dominant):

None

Natural Characteristics Summary

24a. Vegetation - Biotic Community Summary CT 3

Community type: Pinus serotina-Gordonia lasianthus (or Gordonia lasianthus)/mixed bay shrubs//Smilax laurifolia

Community cover type: Pinus serotina-Gordonia lasianthus

General habitat feature: pond pine forest (sensu Otte, 1981)

Average canopy height: 25-35 ft.

Estimated age of canopy trees: unknown

Canopy cover: closed to open

Estimated size of community: 3100 acres

Successional stage: seral to near-climax

Sere type: pelopsammosere

Common canopy species in community cover or community type (but not dominant):

Acer rubrum

Common sub-canopy or shrub stratum species in community cover or community type (but not dominant):

Persea borbonia, Ilex glabra, Ilex coriacea, Lyonia lucida

Common herb stratum species in community cover or community type (but not dominant):

Arundinaria gigantea

24b. (1) Soil Summary (by community type) - CT 1

Soil series: Dare muck

Soil classification: dysic, thermic, Typic Medisaprists

Soil association: Ponzer-Pamlico (SCS, 1972); or Croatan-Dare (SCS; in manuscript).

pH class: extremely acid

(2) Soil Summary (by community type) - CT 2, CT 3

Soil series: Croatan muck

Soil classification: loamy, siliceous, dysic, thermic Terric Medisaprists

Soil association: Ponzer-Pamlico (SCS, 1972); or Croatan-Dare (SCS; in manuscript).

pH class: extremely acid

Source of information: General Soil Map, Pamlico County, USDA, SCS (1972); Preliminary Soil Survey, Pamlico County, USDA, SCS (1981); Soil Survey, Pamlico County, USDA, SCS (in manuscript).

24c. Hydrology Summary (by community type) CT 1, CT 2, CT 3

Hydrologic system: Palustrine

Hydrologic subsystem: Interaqueous

Water chemistry: Fresh

Water regime: saturated

Drainage class: very poorly drained to poorly drained

Drainage basin: Neuse River, and to a small extent into the Pamlico River.

Hydrology characterization: A very poorly drained to poorly drained, saturated, interaqueous fresh palustrine system.

24d. Topography Summary: CT 1, CT 2, CT 3

Landform: Pocosin; a slightly domed deposit of peats, with peaty mineral soils.
Shelter: Open to partly sheltered

Aspect: not applicable

Slope Angle: nearly level

Profile: Flat

Surface patterns: irregular

Position: not applicable

25. Physiographic characterization of natural area:

Fire-influenced wetland communities (mostly climax) of a pelopsammosere, on recent peats accumulated in a shallow depression in the Chowan marine terrace, in the Inner Coastal Plain Region of the Embayed Section of the Coastal Plain Province.

Geological Formation:

Possibly underlain by units of the Quaternary Flanner Beach Formation, over pre-Quaternary rocks of the Pliocene to Miocene Yorktown Formation. The natural area lies on the Chowan terrace.

Geological Formation age:

Flanner Beach Formation - Pleistocene; "lower Sangamon or pre-Sangamon (?)"; 100,000 years BP

Yorktown - Pliocene or Miocene; 7,000,000 years BP

References Cited:

Reconnaissance Geology of the Submerged and Emerged Coastal Plain Province, Cape Lookout Area, North Carolina. Robert B. Mixon and Orrin H. Pilkey. USGS Professional Paper 859 (1976).

26. Summary - Endangered and threatened species

Name of species: red-cockaded woodpecker

Species legal status and authority: endangered species on both Federal and state lists (Cooper et al., 1977; and Federal Register 10/30/70).
Number of populations on site: one

Number of individuals per population: not determined, but few. No birds were observed; one apparently active cavity tree (pond pine) was located (see map).
Size or Maturity of individuals: ?

Phenology of population: not applicable

Eg: vegetative %

flowering %

fruiting %

General vigor of population: unknown; limited by small population size, coupled with habitat destruction and loss of cavity trees to cutting. A fair amount of old-growth pine remains and appears suitable for foraging and nesting.
Disturbance or threats to population: Cutting of old-growth pines or extensive cutting of younger stands will reduce habitat suitability. Land clearing for development of mineral resources may occur.
Habitat characteristics

Plant community: pond pine woodland and pond pine forest (see Table 1).
Topography: not applicable

Soil Series: not applicable

Microclimate: not applicable

Drainage basin: not applicable

Other plants and animal species present: See Master Species Lists.

AERIAL OR DETAILED MAPS WITH POPULATIONS CLEARLY MARKED.

26. Summary - Endangered and threatened species

Name of species: Black bear

Species legal status and authority: Special concern (Cooper *et al.*, 1977)

Number of populations on site: one

Number of individuals per population: unknown

Size or Maturity of individuals: unknown

Phenology of population: not applicable

Eg: vegetative %

flowering %

fruiting %

General vigor of population: unknown

Disturbance or threats to population: hunting; habitat destruction

Habitat characteristics

Plant community: various tall pond pine, tall bay and low shrub-dominated communities.

Topography: not applicable

Soil Series: not applicable

Microclimate: not applicable

Drainage basin: not applicable

Other plants and animal species present: See Master Species Lists.

AERIAL OR DETAILED MAPS WITH POPULATIONS CLEARLY MARKED.

27. Master species lists:

VASCULAR PLANTS
(listed alphabetically by family)

ANACARDIACEAE
  Rhus copallina
AQUIFOLIACEAE
  Ilex coriacea
  I. glabra
BLECHNACEAE
  Woodwardia virginica
CLETHRACEAE
  Clethra alnifolia
CYPERACEAE
  Carex walteriana
CYRILLACEAE
  Cyrilla racemiflora
ERICACEAE
  Cassandra calyculata
  Gaylussacia frondosa
  Kalmia angustifolia
  Lyonia lucida
  Rhododendron viscosum
  Vaccinium corymbosum
  Zenobia pulverulenta
GENTIANACEAE
  Bartonia virginica
LAURACEAE
  Persea borbonia
LILIACEAE
  Smilax laurifolia
MAGNOLIACEAE
  Magnolia virginiana
MYRICACEAE
  Myrica cerifera
PINACEAE
  Pinus serotina
POACEAE
  Andropogon sp.
  Arundinaria gigantea
ROSACEAE
  Rubus sp.
  Sorbus arbutifolia
SARRACENIACEAE
  Sarracenia flava
  S. purpurea
THEACEAE
  Gordonia lasianthus

BIRDS

(Emphasis of bird lists is on breeding or summering species; lack of adequate field work during the other seasons prevented compilation of a complete list.)

KEY

PR = Permanent resident
SR = Summer resident
WR = Winter resident
T = Transient, spring or fall
PV, SV, WV = Visitor; year-round, summer, or winter
* = Breeding or suspected breeding at site

Red-shouldered Hawk	PR*
Bobwhite	PR*
Mourning Dove	PR*
Common Flicker	PR*
Pileated Woodpecker	PV (?)
Hairy Woodpecker	PR*
Downy Woodpecker	PR*
Red-cockaded Woodpecker	PR*
Eastern Kingbird	SR*
Great Crested Flycatcher	SR*
Acadian Flycatcher	SR*
Eastern Wood Pewee	SR*
Carolina Chickadee	PR*
Brown-headed Nuthatch	PR*
House Wren	SR*
Carolina Wren	PR*
American Robin	WR
Eastern Bluebird	PR*
White-eyed Vireo	PR*
Swainson's Warbler	SR*
Yellow-rumped Warbler	WR
Yellow-throated Warbler	SR*
Prairie warbler	SR*
Common Yellowthroat	PR*
Yellow-breasted Chat	SR*
Hooded Warbler	SR*
Orchard Oriole	SR*
Rufous-sided Towhee	PR*

MAMMALS

Rabbit sp.
White-tailed Deer
Black Bear
Mole sp.
Bobcat (?)

Note: no other vertebrate species lists were compiled.

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GLOSSARY

(from Bellis *et al.*, 1975)

Area of Environmental Concern-(AEC) Especially fragile or ecologically unique areas of the North Carolina Coast where development should occur only if it is in harmony with natural processes. Areas of the coast where the public welfare might be endangered by unwise manipulation of the environment.

BP - Before present.

canopy - A layer of leaves and branches formed by the interlocking mosaic of tree tops in a forest.

Coastal Area Management Act of 1974 - An act passed by the North Carolina legislature in 1974 intended to promote wide development of North Carolina's coastal resources. Among other provisions this act calls for the designation of certain especially sensitive areas as 'Areas of Environmental Concern.'

cypress fringe - A straight or curved line of cypress running parallel to the shoreline. Older cypress fringe has its trees standing in water while young cypress fringe occupies sandy beaches in front of eroding sand or clay banks.

dbh - Diameter at breast height (diameter of tree in inches measured at a point 4.5 feet above the ground).

ecological succession - Process by which one community of living organisms is gradually replaced by another. Usually each successive community is more stable than the last, thus leading toward a final community especially well suited to the particular environmental conditions existing at that location.

flood plain - Lowlands adjacent to a river or stream which become inundated during periods of high flow. Flood plains are a natural component of the river system and function as overflow storage areas.

msl - Mean sea level.

Pamlico Terrace - A low, flat, featureless, topographic surface extending over the Coastal Plain of the Southeastern U.S. at elevations less than 20 feet above sea level. It is considered the relict sea floor of the Sangamon Interglacial.

Pamlimarle Peninsula - The peninsula bounded on the north by Alvemarle Sound and on the south by the Pamlico River. Includes all of Washington, Beaufort, and mainland portions of Dare and Hyde Counties.

peat - Accumulations of slowly decomposing plant remains. Peat is formed in swamps and marshes. Erosion of peat soils releases suspended organic matter into coastal waters as well as certain 'humic acids' which give water a tea colored stain.

Pleistocene Epoch - That period of earth history which saw the advance and retreat of the four great Ice Ages. It is generally considered to have begun between 1 and 2 million years ago and to have continued up until about 18,000 years ago.

relict beach ridge - Throughout the Southeastern U.S. ancient shorelines are detected at various elevations inland from the coast. These shorelines are often manifested as continuous ridges and are considered a product of higher stands of the sea during the Pleistocene Ice Ages.

Sangamon Interglacial - A period of deglaciation (no continental ice sheets) during the Pleistocene Epoch between the Illinoian and Wisconsin Ice Ages. This period is generally considered to have taken place about 80-100,000 years ago.

sp and spp - Species (singular and plural).

Suffolk Scarp - A topographic ridge rising from 20 to 40 feet above sea level which runs parallel to the coast throughout North Carolina. It is considered an ancient shoreline formed during the Pleistocene Epoch.

swamp forest - Type of forest characterized by seasonal flooding and water saturated organic soils. Water tupelo, swamp black gum and bald cypress are dominant tree species.

Talbot (Chowan) Terrace - A rather flat but stream-dissected surface lying at an average elevation of 40-45 feet throughout Southeastern United States. It is considered to have been a sea floor during the Pleistocene Epoch. In North Carolina it lies west of the topographic ridge known as the Suffolk Scarp.

Yorktown Formation - An ancient deposit of clay and clayey sand which typically contains abundant marine fossils including clams, snails, whale vertebrae, and shark teeth. It occurs extensively over eastern North Carolina and is generally considered a depositional product of the Miocene Epoch which took place 15-20 million years ago.

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