NONRIVERINE WET HARDWOOD FORESTS IN NORTH CAROLINA
STATUS AND TRENDS

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INTRODUCTION

Nonriverine Wet Hardwood Forests are among the most threatened of North Carolina's natural communities, and in some ways among the least well known. Also called oak flats, they were once widespread in the outer Coastal Plain of northeastern North Carolina, but were long ago reduced to a small fraction of their presettlement abundance. Today few citizens of North Carolina have seen and appreciated this part of the state's natural heritage.

Definition and Description

Nonriverine Wet Hardwood Forests, as defined in Schafale and Weakley (1990), are wetland forests of poorly drained, mineral soils on broad interstream flats. They correspond to the *Quercus michauxii-Quercus pagoda*/*Clethra alnifolia-Leucothoe axillaris* Forest and *Quercus laurifolia-Nyssa biflora* Forest associations of the International Classification of Ecological Communities (NatureServe 2007). They would be classified as type 91, Swamp Chestnut Oak-Cherrybark Oak in the Society of American Foresters system, where they represent a small minority amid the more common bottomland hardwoods along rivers (Eyre 1980).

Nonriverine Wet Hardwood Forests are naturally dominated by some of the same trees as bottomland hardwood forests along large brownwater rivers: swamp chestnut oak (*Quercus michauxii*), laurel oak (*Quercus laurifolia*), and cherrybark oak (*Quercus pagoda*). Water oak (*Quercus nigra*), sweetgum (*Liquidambar styraciflua*), loblolly pine (*Pinus taeda*), red maple (*Acer rubrum*), and tulip poplar (*Liriodendron tulipifera*) have increased with past logging and are often abundant. Unlike the canopy, the understory, shrub, and herb layers consist primarily of plants shared with pocosins and nonriverine swamp forests, with some shared with blackwater river floodplains, but only the most widespread species also shared with brownwater rivers. The most typical understory trees are red bay (*Persea palustris*), red maple (*Acer rubrum*), and ironwood (*Carpinus caroliniana*). Common shrubs are sweet pepperbush (*Clethra alnifolia*), evergreen dog hobble (*Leucothoe axillaris*), and cane (*Arundinaria gigantea* ssp. *tecta*). The dominant herbs are netted chain fern (*Woodwardia areolata*), Virginia chain fern (*Woodwardia virginica*), and royal fern (*Osmunda regalis*). Peat moss (*Sphagnum* spp.) is usually present in small amounts. There is natural variation in composition clearly related to wetness, with swamp black gum (*Nyssa biflora*) and laurel oak increasing in wetter sites and swamp chestnut oak and cherrybark oak increasing in less wet sites. Variation in the amount of ironwood versus red bay, and in sweet pepperbush versus fetterbush, may be related to soil base status or fertility, as may be the presence of unusual species such as shagbark hickory (*Carya ovata*) and Shumard oak (*Quercus shumardii*) in a few examples. Variation in amount of red maple, sweetgum, and pine appears to relate primarily to logging history.

Animals include widespread species such as white-tailed deer, black bear, and gray squirrel. The large oak component makes Nonriverine Wet Hardwood Forests excellent habitat for wild

turkeys. The multi-layered structure characteristic of mature Nonriverine Wet Hardwood Forests supports high densities and diversities of neotropical migrant birds such as wood thrush, ovenbird, Swainson's warbler, worm-eating warbler, prothonotary warbler, hooded warbler, white-breasted nuthatch, and the Coastal Plain black-throated green warbler. In the outer Coastal Plain, where large river floodplains with bottomland hardwoods are absent, the once-extensive Nonriverine Wet Hardwood Forests may once have supported much larger populations of these species than now occur in this region. Invertebrates of these communities have not been studied, but it is likely that a suite of insects specialized to feed on oaks and a suite of soil organisms adapted to the unique hydrological conditions are present.

In contrast to bottomland hardwood forests along rivers, wetland conditions in Nonriverine Wet Hardwood Forests are caused by seasonal high water tables and limited runoff of rainfall, due to flatness and natural absence of streams. Rheinhardt and Rheinhardt (1998a) found that soil drainage class in this type did not correlate with soil texture as is common in many places, but was more subject to topography and landscape position. However, the continued wetness of small remnant sites despite the drainage in the surrounding landscape suggests that perching of water by impermeable soils may be partly responsible for the wetness in some sites. The soil is generally saturated or flooded with a few inches of water through most winters and well into the early summer, and the lower soil probably remains moist through most summers. The water never gets as deep as it may in river floodplains, but the soil undoubtedly stays saturated longer than in bottomland hardwoods. Furthermore, no additional nutrients are brought in by flowing water, and aquatic animals cannot move in from the river during flooded times. Thus, debris processing and nutrient cycling are likely very different from floodplain communities.

A number of other natural community types occur on wet nonriverine flats and share some characteristics with the Nonriverine Wet Hardwood Forest type. Most similar are Nonriverine Swamp Forests, which are wetter and lack oaks, but share some of the shrubs and herbs. Mesic Mixed Hardwood Forests contain some of the same tree species but are drier than Nonriverine Wet Hardwood Forests and have beech (*Fagus grandifolia*) as a major component. Often the centers of nonriverine flats are so wet that organic matter has accumulated, burying the mineral soils. These peatlands support either pocosin communities (Low Pocosin, High Pocosin, or Pond Pine Woodland, or Bay Forest), Nonriverine Swamp Forests, or Peatland Atlantic White Cedar Forests (all names from Schafale and Weakley 1990). Fires were an important part of the natural dynamics of the pocosin and white cedar communities. Fire is believed to have been much less frequent in Nonriverine Wet Hardwood Forests, due to the limited flammability of the leaf litter and lack of continuous live fuel layers, but they certainly would have burned with low intensity surface fires at times. Fire has not been believed to be important to Nonriverine Wet Hardwood Forests or Nonriverine Swamp Forests, but Rheinhardt and Rheinhardt (1998a) suggest it may play a significant role in maintaining dominance of oaks over other hardwoods.

A typical natural landscape pattern on the largest nonriverine flats is a complex of peatland communities in the center of the flat, with a fringe of Nonriverine Wet Hardwood Forest where the peat gives way to wet mineral soils, then a band of upland communities on the gentle slopes closer to the streams, then stream swamps and tidal swamps and marshes along the drainages. On some of the smaller flats farther inland, no peat may be present, and Nonriverine Swamp

Forest and Nonriverine Wet Hardwood Forest on mineral soils may be in the center of the flat. Because the easiest lands to drain and convert to other uses are the least wet and those close to slopes, the Nonriverine Wet Hardwood Forests were generally among the first wetlands to be put into agriculture and later intensive silviculture.

The primary range of Nonriverine Wet Hardwood Forests is northeastern North Carolina. They range from Craven County north into the southeastern counties of Virginia. None are definitely known south of North Carolina or north of Chesapeake Bay. Although one example was known inland nearly to Tarboro, the vast majority of acreage was, and is, on the outermost terrace of the Coastal Plain, east of New Bern, Washington, and Plymouth.

Composition and Quality of Nonriverine Wet Hardwood Forests

Most early and more recent qualitative descriptions of Nonriverine Wet Hardwood Forests describe them as being dominated by oaks. The only extensive quantitative study of Nonriverine Wet Hardwood Forest composition is that of Rheinhardt and Rheinhardt (1998b). They measured canopy and understory basal area and density in most of the known remaining examples in North Carolina. They noted that, in contrast to earlier qualitative descriptions, most stands were dominated by sweetgum, red maple, or tulip poplar. Oaks were abundant, but only in a few places were they codominant.

Sweetgum, red maple, and tulip poplar are, ecologically speaking, weedy species, producing abundant, small, widely dispersed seeds, and able to take advantage of disturbance much more readily than oaks. It is clear that, although these native species have always been present, they have increased in absolute and relative abundance as a result of logging. Thus, although the precise composition of the earlier natural forests is not well known, examples with more oak are believed to be closer to natural composition. This belief is supported by the abundance of oak saplings in examples that contain a strong minority of oak in the canopy, suggesting that over time without severe disturbance oaks will increase in the forest. The presence and abundance of oaks therefore serves both as an indicator that a community is a Nonriverine Wet Hardwood Forest rather than a Nonriverine Swamp Forest and as an indicator of its natural condition. In the best remnants known, Rheinhardt and Rheinhardt (1998a, 1998b) found oaks to be 1.2% to 50% of basal area and 1.5% to 42.9% of canopy stem density. Given current conditions, examples with oaks comprising more than 10% of the basal area or of the canopy cover should be considered good examples. They have the best potential to recover to natural oak abundance in time, and are most likely to retain species associated with oaks.

Observations of areas clearcut in recent years indicate that the tree regeneration is primarily weedy hardwoods or loblolly pine, with little or no oak component. Given the abundance of weedy tree species and the scarcity of oaks in the landscapes where they once were abundant, it is unlikely that oaks will ever again become abundant on these sites. Any animal species which are dependent on oaks are presumably eliminated. Although all remaining stands with oak have been logged in the more distant past, many probably by clearcutting, it appears that these communities no longer have the ability to recover readily from clearcutting. The reason is likely some combination of altered seed rain, the cumulative impact of repeated logging events, and

perhaps subtle changes in hydrology or fire regime. Therefore, Nonriverine Wet Hardwood Forests that are clearcut at present must be considered lost. Those that are selectively cut may be expected to recover if a substantial amount of oak is left in the stand. However, oaks are generally the most desirable species for removal.

Besides abundance of oaks in the canopy and understory, other indicators of good condition in Nonriverine Wet Hardwood Forests are canopy maturity, canopy age structure, extent, and connection to other natural communities. The most mature examples known have many trees 16-24 inches in diameter, with some exceeding 36 inches. However, given the scarcity of these communities, examples with trees averaging 12 inches in diameter are considered significant examples. Even those with trees averaging 8 to 10 inches in diameter are significant if the canopy composition is good and the example is extensive. As with most North Carolina hardwood forests, the natural canopy is believed to be uneven-aged, with trees reproducing primarily in small to medium canopy gaps that formed periodically from storms and possibly fires, and with old trees abundant. In no remaining examples is this structure well developed, but it can be expected to develop over time in the oldest examples. Examples with some canopy gaps containing oak saplings, or with large old trees that will form canopy gaps in the near future, will have more of the characteristics of natural forests than those with uniform younger canopies. Nonriverine Wet Hardwoods naturally occurred in large patches, and some aspects of ecosystem function probably depend on large extent. Therefore, large examples are more likely viable and are more significant than small examples.

CURRENT STATUS AND TRENDS IN NONRIVERINE WET HARDWOOD FORESTS

Methods

The North Carolina Natural Heritage Program first started recording occurrences of Nonriverine Wet Hardwood Forest in the 1980s. The most concentrated survey work occurred as part of the Albemarle/Pamlico Estuarine Study (Frost, LeGrand, and Schneider 1990; LeGrand, Frost, and Fussell 1992), which covered all of the range of Nonriverine Wet Hardwood Forest in North Carolina. Additional examples have been added continuously to the database as they were discovered**.** To assess the current status of the community type, all known examples were checked against current aerial photography (2006 NAIP DOQQs). While Nonriverine Wet Hardwood Forests cannot be definitively identified on aerial photography, the loss of known stands by clearcutting or conversion can usually be recognized with confidence. Acreages were estimated and ratings (EO ranks) were updated. The EO ranks are based on a combination of condition, size, and landscape context, using the criteria described above. Condition, primarily based on stand maturity and composition, was assumed to be the same as initially described, but size and landscape context were re-evaluated using the aerial photos.

To assess trends**,** the current status was compared to two previous times when a reasonably complete picture of the status of the community type was determined. A study by Rheinhardt and Rheinhardt (1998b) reviewed the status of all known sites. They attempted to sample vegetation at every known example, and examined aerial photos and consulted with foresters to determine the status of examples they were unable to visit. In the few cases where Rheinhardt and Rheinhardt's report did not give the condition of the site, I attempted to determine its status

by personal communication and by consulting aerial photos. Sites not confirmed to be destroyed were assumed extant, possibly resulting in an overestimate of the amount remaining. The results of this comprehensive picture were recorded at that time.

To obtain an earlier picture of the status of the community type, I reconstructed the status of Nonriverine Wet Hardwood Forest around 1990 by estimating acreage for all the examples we have evidence of having existed at that time. This reflected the Albemarle/Pamlico Estuarine Study surveys, for which most field work was conducted in 1989 and 1990. More of the known occurrences were found during these studies than at any other single time. The occurrences were recorded in the Natural Heritage Program database when the studies were completed, and some occurrences were visited and the records updated over the years. This time is labeled 1990, but it really represents a range of last observation dates from 1990 through 1998, with information on the state before the most recent data no longer readily accessible.

It is clear that not all of the Nonriverine Wet Hardwood Forests were found in the 1990s. Several additional sites have been discovered. In addition, the extent of the community in some previously known sites has become better known more recently. To make the analysis of trends as accurate as possible, newly discovered sites and more accurate estimates of acreage were used to adjust the earlier data. Thus, sites discovered since 1998 were added to the figures for 1990 and 1998, since they clearly existed at those times as well. Because these sites may have been reduced in size between 1990 and 2007, the figures for acreage lost in that time period are an underestimate. Some additional sites likely were destroyed in that time period without ever having become known to the Natural Heritage Program, making the trend figures more of an underestimate. Sites that were thought to be Nonriverine Wet Hardwood Forest at the time and were later determined to be other community types were not included for any of the times.

To get an indication how much Nonriverine Wet Hardwood Forest may have once been present, I analyzed digitized soil survey maps for two sample counties: Hyde and Currituck (USDA-NRCS 1996 and 1997). Acreage of all soil series believed to support Nonriverine Wet Hardwood Forest in the past was determined by GIS. The list of soils to include in the acreage included those series mapped under known remnant Nonriverine Wet Hardwood Forest occurrences, plus a few closely related series that are not known to support other natural community types. Series were rated as high (most supporting this community in natural remnants), medium (supporting this community but also substantial amounts of other natural community types), and low (supported this community only in small patches that probably represent inclusions). Series with high and medium potential are listed in Table 3. Acreage totals were calculated for high rated soils alone and for high and medium rated soils together. The former can be expected to be a serious underestimate of the amount of Nonriverine Wet Hardwood Forest once present, the latter an overestimate.

Results

Table 1 lists the known remaining sites, with their estimated acreage of Nonriverine Wet Hardwood Forest and current EO rank. Map 1 shows their distribution. A total of 25 separate extant sites are known to the Natural Heritage Program. These occurrences total approximately 5576 acres. Of these, three sites have EO ranks of A, seven have rankings of B or possibly B

(BC), 14 have rankings of C, and one is too little known to rank. Only eight sites are 100 acres or larger. Though patches of this community once covered thousands of acres, only two remnants are as large as 500 acres. Of the 25 sites, seven have some kind of land status that may protect them from future destruction. Only one of these, however, is of substantial size. About 600 acres total are protected.

In the study period, the total acreage of Nonriverine Wet Hardwood Forest went from 35 sites in 1990 to 25 sites in 2006. The area went from 13,885 acres in 1990 to 7907 acres in 1998 to 5576 acres in 2006. This represents an acreage decline of 43% in the first 8-year period and 42% in the next eight years. Of the 35 occurrences known to have existed in 1990, nine (26%) are completely destroyed and another 13 (38%) were reduced in acreage, most by more than half. Six sites (17%) are known not to have declined. The other seven sites (20%) were newly discovered since 1990, and may or may not have been larger in 1990. Some of the remaining sites had selective cutting or other damage that reduced their EO rank. The loss has been particularly heavy for large occurrences. Of six occurrences of 500 acres or more in 1990, only two remain over 500 acres. There were 19 occurrences of at least 100 acres in 1990, and now there are only six.

Based on soil mapping, it appears that Hyde County once had between 34961 and 50,586 acres of Nonriverine Wet Hardwood Forest. Currituck County had 15,317 to 43,941 acres. The most extensive of the medium-rated series, Roanoke, probably supported Nonriverine Wet Hardwood Forest on a majority of its acreage, but is also known to support significant amounts of Mesic Mixed Hardwood Forest. It is likely that the true estimate, at least for Currituck County, is closer to the higher figure. This is more difficult to evaluate for Hyde County, where several abundant soil series were not mapped in other counties.

Discussion

The results indicate a community type in serious decline. While there is high uncertainty in the estimates of original acreage based on soils, this analysis shows the drastic loss of Nonriverine Wet Hardwood Forest. Currituck County alone, one of the smallest counties in North Carolina, once had several times, perhaps ten times, as much Nonriverine Wet Hardwood Forest as now remains in the whole state. Much of the loss occurred long ago, as the most easily converted lands were put into agriculture or repeatedly logged. However, recent losses are still proportionally high. While comparable figures do not exist for other community types, this appears to exceed that of virtually all other community types in North Carolina. In overall portion lost from original extent, it is comparable to the losses of wet and mesic longleaf pine savannas, and probably exceeds that of any other wetland community type. In percentage of remaining examples unprotected and likely to be lost in the near future, it far exceeds longleaf pine communities and virtually all other community types in the state.

This rapid decline comes from a unique combination of vulnerabilities. The mineral soils on which they occur are more easily drained than the organic soils that cover much of the nonriverine wet flats, and the drained soils are productive for agriculture and growing of planted pines. Their occurrence around the edges of nonriverine wet flats, or in smaller flats, also makes them easier to drain than most wetlands. Finally, their vegetation is very vulnerable to loss with

logging. More extreme wetlands often have a limited range of tree species that can regenerate if a forest is logged, and are more likely to regenerate in the characteristic species of the natural community. Nonriverine Wet Hardwood Forests rarely regenerate to the characteristic oak species and tend to become stands of weedy tree species that show little tendency ever to return to an oak canopy. Although Nonriverine Wet Hardwood Forests are jurisdictional wetlands, occurrences can be destroyed by common activities that are fully legal. In this situation, only active land protection in the form of public acquisition or conservation easements is likely to save any example in the long run.

The fate of land formerly supporting Nonriverine Wet Hardwood Forest varied. A few sites appeared to have been developed or converted to cropland. A number were found to have been converted to pine plantations. Many sites that had been recently clearcut at the time the aerial photos were taken were likely converted to pine plantation later. Other sites presumably are regenerating with weedy canopies. It is likely that lands in the last category could be restored, and a few might recover spontaneously. Some pine plantations may also have good restoration potential, but common practices of bedding, fertilization, and herbicide treatment mean that less of the characteristic flora and local fauna can be expected to remain present.

Given the limitations of Natural Heritage inventories, some additional examples of Nonriverine Wet Hardwood Forest probably remain undiscovered. During the eight years after 1990, four new occurrences were found. Since 1998, six new examples have been discovered, and a couple other examples have been found to be larger than realized. There is therefore some hope that additional occurrences will be found, but these are unlikely to be anywhere as large individually or collectively as the sites now known. Without substantial effort at protecting remaining examples, the expected trend for this endangered community is continued rapid decline.

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Table 1. Remaining Nonriverine Wet Hardwood Forest sites in North Carolina. EO ranks are from the December 2007 Natural Heritage Program database. A is excellent, B very good, C fair, E uncertain, X destroyed. Size figures are in acres.

site name	county	EO rank	size	protection status
Bonnerton Road Wet Hardwood Forest and Seeps	Beaufort	B	198	
Drinkwater Creek Wet Hardwood Forest	Beaufort	C	130	
Hell Swamp	Beaufort	C	44	
Jackson Swamp Remnants	Beaufort	C	20	
Sparrow Road Wet Hardwood Forest	Beaufort	B	40	
Roquist Pocosin	Bertie	A	500	State Ecosystem Enhancement Program wetland mitigation land
Whitehall Shores Hardwood Forest	Camden	C	30	
Gum Swamp Bottomland Hardwoods	Craven	B	40	National Forest, Special Interest Area, Registred
Sea Gate Woods	Craven	C	85	Land trust preserve
Buckskin Creek/Great Swamp	Currituck	C	73	
Lower Tull Creek Woods and Marsh	Currituck	C	30	
Indiantown Creek/North River Cypress Forest	Currituck	B	30	State Game Land, Dedicated
Gibbs Woods/Tull Bay Marshes	Currituck	C	135	
Troublesome Point/Gibbs Point Forests and Marshes	Currituck	C	10	
Alligator River/Swan Lake Swamp Forest	Dare	C	15	National Wildlife Refuge
Great Dismal Swamp National Wildlife Refuge	Gates	CD	5	National Wildlife Refuge, Registered
Scranton Hardwood Forest	Hyde	A	3580	
Gull Rock Game Land	Hyde	BC	20	State Game Land
South Prong Natural Area	Pamlico	B	60	
Light Ground Pocosin Southeast Section	Pamlico	C	55	
Little Flatty Creek Forests	Pasquotank	C	40	
Big Flatty Creek Forests and Marshes	Pasquotank	E	50	
Belvoir Carolina Bays and Flats	Pitt	C	30	
Bethel/Grindle Hardwood Flats	Pitt	A	216	
East Dismal Swamp	Washington	C	125	State Agricultural Experiment Staton
Palmetto-Peartree Swamp Forest	Washington	C	15	
total 25 sites	12 counties		5576	

Table 2. Change in Nonriverine Wet Hardwood Forest from 1990 to 1998. EO ranks are based on 1998 condition.

site name	county	EO rank	1990 size	1998 size	2006 size	status change since discovery
Bonnerton Road Wet Hardwood Forest and Seeps	Beaufort	B	198+	198	198	newly discovered in 2000s
Drinkwater Creek Wet Hardwood Forest	Beaufort	C	130	130	130	newly discovered in 2000s
Hell Swamp	Beaufort	C	44	44	44	newly discovered in 2000s
Jackson Swamp Remnants	Beaufort	C	165	165	20	part destroyed in 2000s
Sparrow Road Wet Hardwood Forest	Beaufort	B	40	40	40	newly discovered in 2000s
Roquist Pocosin	Bertie	A	500+	500+	500	part destroyed in 1990s, part newly discovered in 2000s
Whitehall Shores Hardwood Forest	Camden	C	100	100	30	part destroyed in 2000s
Forest Wet Hardwood Forest	Craven	X	138	0	0	destroyed in 1990s
Gum Swamp Bottomland Hardwoods	Craven	B	40	40	40	
Sea Gate Woods	Craven	C	280	85	85	part destroyed in 1990s
Buckskin Creek/Great Swamp	Currituck	C	420	100	73	part destroyed in 1990s and 2000s
Lower Tull Creek Woods and Marsh	Currituck	C	120	30	30	part destroyed in 1990s
Indiantown Creek/North River Cypress Forest	Currituck	B	30	30	30	affected by rising sea level
Gibbs Woods/Tull Bay Marshes	Currituck	C	135	135	135	selectively cut in 1990s
Maple Swamp Gordonia Forest	Currituck	X	40	0	0	destroyed in 1990s
Northwest Backwoods	Currituck	X	900	0	0	destroyed in 1990s
Troublesome Point/Gibbs Point Forests and Marshes	Currituck	C	40	40	10	part destroyed in 2000s, part selectively cut in 1990s
Alligator River/South Lake Swamp Forest	Dare	C	15	15	15	newly discovered in 1990s
Mildred Wet Hardwood Flat	Edgecombe	X	40	0	0	destroyed in 1990s, restoration occurring
Black Mingle Pocosin	Gates	X	150	0	0	destroyed in 1990s
Great Dismal Swamp National Wildlife Refuge	Gates	CD	5	5	5	heavy blow down has degraded
Scranton Hardwood Forest	Hyde	A	5700	4100	3580	part destroyed in 1990s and 2000s
Gull Rock Game Land	Hyde	BC	20	20	20	
South Prong Natural Area	Pamlico	B	100	70	60	part destroyed in 1990s and 2000s
Light Ground Pocosin Southeast Section	Pamlico	C	60	60	55	part destroyed in 1980s and in 2000s
Merritt Hardwoods	Pamlico	X	1400	900	0	last remnant destroyed in 2000s
Little Flatty Creek Forests	Pasquotank	C	185	40	40	part destroyed in 1990s

Big Flatty Creek Forests and Marshes	Pasquotank	E	1500	300	50	part destroyed in 1990s and 2000s
Menzies Pond	Perquimans	X	20	20	0	destroyed in 2000s
Belvoir Carolina Bays and Flats	Pitt	B	85	30	30	part destroyed in 1990s
Bethel/Grindle Hardwood Flats	Pitt	AB	1080	530	216	part destroyed in 1990s and 2000s
Lewis Point Swamp Forest	Tyrrell	X	15+	15	0	destroyed in 2000s
Highway 99 Nonriverine Hardwood Flat	Washington	X	50	25	0	part destroyed in 1990s, rest in 2000s
East Dismal Swamp	Washington	C	125	125	125	part damaged by logging
Palmetto-Peartree Swamp Forest	Washington	C	15	15	15	newly discovered in 2000s, may be larger
total 35 sites	15 counties, 12 remaining		13885	7907	5576	

Table 3. Soil series of Nonriverine Wet Hardwood Forest occurrences and additional series likely to have supported Nonriverine Wet Hardwood Forest. Rating is an estimate of the fraction of the soil series acreage that would have supported Nonriverine Wet Hardwood Forest.

series	taxonomy	sites	rating
Acredale	Typic Endoaqualf	Scranton	high
Arapahoe	Typic Humaquept	Merritt Hardwoods	low
Argent	Typic Endoaqualf	Light Ground Pocosin Southeast, South Prong, Scranton Hardwoods	high
Brookman	Typic Umbraqualf	Scranton	med.
Cape Fear	Typic Umbraqualt	Highway 99 Hardwood Flats, Belvoir Carolina Bays	high

Deloss	Typic Umbraquult	Sea Gate Woods	low
Hydeland	Typic Umbraqualf	Scranton	med.
Leaf	Typic Albaquult	Roquist Pocosin, Gum Swamp	low
Pantego	Umbric Paleaquult	Gum Swamp	low
Pasquotank	Typic Endoaqualf		high
Portsmouth	Typic Umbraquult	Jackson Swamp Remnants	low
Roanoke	Typic Endoaquult	Whitehall Shores, Sea Gate Woods, Gibbs Woods/Tull Bay, Troublesome Point, Lower Tull Creek, Buckskin Creek/Great Swamp, Big Flatty Creek, Little Flatty Creek, Menzies Pond, Bethel/Grindle, East Dismal Swamp	med.
Tomotley	Typic Endoaquult	Indiantown Creek, Lewis Creek	high
Yonges	Typic Endoaqualf		high

Table 4. Amount of soils likely to have supported Nonriverine Wet Hardwood Forest in Hyde and Currituck counties. Rating is an estimate of the fraction of the soil series acreage that would have supported Nonriverine Wet Hardwood Forest.

series	Hyde	Currituck	rating
Argent	9467		high
Acredale	12425		high
Brookman	7777		medium
Cape Fear		6104	medium
Hydeland	17848		medium
Pasquotank	590	1509	high
Roanoke		28624	medium
Tomotley		6104	high
Yonges	2479		high

total	50586	43941	
total of high probability only	24961	15317	

Map 1. Locations of Nonriverine Wet Hardwood Forest community occurrences remaining in North Carolina in 2006.