

### **Ecosystem Description**

Peatlands occur on nearly flat, poorly drained areas of the outer Coastal Plain and in large shallow depressions such as Carolina bays. Peat deposits develop where the soil is saturated for long enough periods that organic matter cannot completely decompose. Once peat has developed, it holds water, raising water levels in the soil and making the site wetter. Without decomposition, plant nutrients are tied up in organic matter and the soil is extremely infertile and acidic. Without the overland flooding of river systems, nutrients can be limited to only the small amount that comes in rain water.

Fire history, hydrology, and drainage influence the composition of the community type, with some occupying many thousands of acres. The five natural community types are determined by variation in wetness, depth of peat, and fire dynamics and include: low pocosin, high pocosin, pond pine woodland, peatland Atlantic white cedar forest, and bay forest.

Low pocosins occur on the deepest peats, in the interior of large domed peatlands, and in the largest peat-filled Carolina bays. These, the wettest, most nutrient-poor sites, support only low shrubs and scattered stunted pond pine trees. Often beds of pitcher plants and sphagnum moss cover large areas, and bog species such as cranberries occasionally occur.

High pocosins occur in somewhat less deep peats. The shrubs, up to six or eight feet tall and impenetrably dense, are generally laced together with greenbriars and punctuated with sparse stunted pond pines.

Pond pine woodlands occur on shallow organic deposits on the edge of peatlands and in shallow swales and bays, where tree roots can grow through the thin organic layer to reach mineral soil below. Pond pines are tall and often fairly dense and the shrub layer is tall and usually very thick. In some pond pine woodlands the dense shrub layer is replaced by canebrake.

Peatland Atlantic white cedar forests occur in sites similar to pond pine woodland or high pocosin but are dominated by Atlantic white cedar instead of pond pine.

Bay forests may occur in similar sites, but they are usually more associated with the heads of creeks draining out of the peatlands. They have a canopy dominated by evergreen hardwood trees .

The 2005 Wildlife Action Plan describes Mid-Atlantic Coastal Plain Pocosin communities as a priority habitat (see Chapter 5A) (NCWRC 2005). Public lands hold the highest concentrations of pocosin and peatland communities in the Coastal Plain. Extensive examples of low and especially high pocosins still exist in the Green Swamp, Croatan National Forest, Holly Shelter

Game Land, Camp Lejeune, much of the Albermarle-Pamlico peninsula and many other places as well. Extensive examples of Pond Pine Woodlands exist in the Green Swamp, at Alligator River National Wildlife Refuge, Pocosin Lakes National Wildlife Refuges and in Dare County at the Dare Bombing Range. Atlantic white cedar-dominated communities still exist at Alligator River and Pocosin Lakes National Wildlife Refuges, and in the Great Dismal Swamp (NCWRC 2005).

Table 1 at the end of this report provides a summary of expected climate change impacts to these natural communities.

### **Predicted Effects to Wildlife Species**

Tables 2 through 5 at the end of this report identify the species of conservation concern and priority species that use habitats in this ecosystem.

In general, little detailed information exists for many species of wildlife that use pocosin habitats because of the impenetrable nature of these communities. Few surveys have been done on a long-term basis, which makes land management decisions difficult. We also lack detailed information about populations of small mammals, bats, reptiles and amphibians in pocosin habitats (Mitchell 1994). Black bears are dependent on the large undisturbed areas that pocosins offer in the east. Reduction in this habitat type could impact bear populations.

Pocosins are particularly important for wintering birds because of the high amount of soft mast available. Greenbrier (*Smilax* spp.), red bay, sweet bay, and many ericaceous shrubs produce large quantities of berries that are persistent through much of the winter. Pocosin habitats are important for a variety of shrub-scrub birds though we are lacking status and distribution data, as well as detailed information, about the bird communities that utilize them (Karriker 1993). Red-cockaded woodpeckers exist in some of these pond pine-dominated sites (NCWRC 2005).

Guilds associated with these habitats (including wet, acidic shrublands and forested floodplains and non-riverine wet flats) are not confined to the peatdome pocosins in the Outer Coastal Plain or the Carolina bays in the Inner Coastal Plain, although many of them have their largest known populations in those areas. While the largest expanses of peatlands may be severely affected by sea-level rise, the guilds are likely to survive farther inland, including in the Sandhills, as well as more elevated, though still poorly drained habitats in the Outer Coastal Plain.

### **Climate Change Compared to Other Threats**

Overall, climate change is not the most significant threat to Peatland Pocosins. Logging, particularly of Atlantic white cedar and pond pine stands, altered flood regime through ditching, fire suppression, and conversion to agriculture or silviculture are more problematic compared to the effects of climate change.

Table 6 compares climate change with other existing threats.

<b>Threat</b>	<b>Rank Order</b>	<b>Comments</b>
Logging/Exploitation	1	Unprotected white cedar and pond pine stands continue to be logged and often do not regenerate.
Flood Regime Alteration	2	Ditching for drainage and for road construction alters communities, increases wild fire damage, and likely exacerbates effects of droughts. Ditches will bring tidal water into peatlands and will hasten their destruction. Impounding effects of roads also alter hydrology in some peatlands, and may have increasing impact if rainfall events become more extreme.
Fire	3	Loss of natural fire has altered communities and ecosystem processes. Deep peat fires in artificially drained areas cause lasting damage to communities. Increased wildfire or increased temperature may actually be ecologically beneficial in some areas, but could be detrimental in others that have been ditched and could cause excessive peat consumption. Extreme wildfires in deep peat can result in depressions several feet deep. These areas could fill with water in wet years and create freshwater marsh type conditions.
Conversion to agriculture/ silviculture	3	Pocosins on private land have largely been ditched and converted to loblolly pine plantations by the forest products industry. While deeper peats resist conversion, pine plantations continue to replace pond pine woodland and peatland Atlantic white cedar forest.
Climate Change	4	Areas that occur in the lowest elevations may be lost to sea level rise due to saltwater intrusion and inundation. Loss of significant, but minority, acreage is a likely threat. Other threats are very uncertain.

### **Summary and Recommendations**

Though extensive amounts of pocosin lands are already protected, some specialized types require more protection, such as Carolina bays (Bladen Lakes area) and white cedar stands. Land managers and planners need to address management issues related to pocosin habitats in conservation and land-use planning efforts and also work to understand what the public wants and is willing to accept regarding the management of pocosin habitats and the wildlife associated with these habitats (Thompson and DeGraaf 2001 in NCWRC 2005). Protecting additional inland examples will help mitigate the loss of those that lie near sea level.

## Recommended Actions

- Surveys
- Surveys are needed to document the distribution, relative abundance and status of many wildlife species associated with pocosin habitats. Priorities for conducting surveys need to focus on species believed to be declining, at risk or mainly dependent on pocosin communities. (NCWRC 2005).
  - Secondary priority for surveys should be for species for which current distribution information is already available or for species that are considered common. (NCWRC 2005).
- Monitoring
- Monitoring systems need to be expanded and/or targeted to be able to assess current population status and trend information for all wildlife species associated with pocosin habitats. (NCWRC 2005).
  - Long-term monitoring for breeding and wintering birds, amphibians and reptiles, and mammal populations (including bats) needs to be developed or enhanced (Ellis *et al.* 2002, Taylor II and Jones 2002). (NCWRC 2005).
- Research
- Examine the relationship between habitat patch size and nesting success of shrubland birds (Burhans and Thompson 1999) and habitat use by small mammals (Litvaitis 2001). (NCWRC 2005).
  - Determine the best ways to burn these sites, or alternative management that will mimic the effects of fire at sites where birds, mammals, reptiles and amphibians are being monitored. (NCWRC 2005).
  - Determine how the use of chipping (using a hydro-ax or other heavy chipping machinery) midstory and understory vegetation affects the plant and animal communities. This practice is becoming more common, particularly in areas where red-cockaded woodpeckers are present. (NCWRC 2005).
- Management Practices
- Restoring hydrology by reversing the effects of artificial drainage is probably the most important action to protect pocosins.
- Land Protection
- Land acquisition should focus on consolidating these areas into larger holdings so that they may be managed through fire.

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## **References**

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**Table 1. Predicted Impacts of Climate Change**

<b>Climate Change Factor</b>	<b>Comments</b>
Wind Damage	Severe threat for Atlantic White Cedar, moderate for Pond Pine Woodland, no threat for other communities.
Sea Level Rise -- Salt Intrusion	Salt intrusion, exacerbated by ditches, will affect a limited fraction, primarily in the Alligator River.
Sea Level Rise -- Inundation	A relatively small fraction of these systems is low enough to be inundated. More may be affected by hydrological shifts without being inundated.
Mild Winters	Some species reach their southern range limit in pocosins, but temperature is unlikely to be the primary determinant of their range limit. Warmer temperatures could disrupt phenological relationships.
Fire	Severe fires are natural, and increased fire may offset the loss of natural fire in recent years. But damaging peat fires may increase.
Drought	Increased drought will lead to increased risk of peat fires, and may also affect nutrient cycling and peat accumulation.
Compositional Change	Uncertain effects caused by changes in drought, fire, and peat decomposition, more than temperature.
Structural Change	Potentially severe for Atlantic White Cedar, moderate for Pond Pine Woodland, limited for other pocosins.
Acreage Change	Some extensive protected examples will be lost, but the majority of the acreage will not be lost. Human altered drainage patterns appear to be limiting their vertical accretion, which, in combination with saltwater intrusion, could cause subsidence and conversion to open water (Pearsall and Poulter 2005 in DeWan <i>et al</i> 2010).

**Table 2. Bird Species Utilizing**

Species	Common Name	Element Rank	Endemic	Major Disjunct	Extinction/Extirpation Prone	US/NC/WAP*	Comments
<b>BIRDS</b>							
<i>Anhinga anhinga</i>	Anhinga	G5/S3B				/W2/P	
<i>Colaptes auratus</i>	Northern Flicker					//P	
<i>Dendroica discolor</i>	Prairie Warbler					//P	
<i>Dendroica virens waynei</i>	Wayne's Black-throated Green Warbler					//P	
<i>Helmitheros vermivorous</i>	Worm-eating Warbler					//P	
<i>Limnothlypis swainsonii</i>	Swainson's Warbler					//P	
<i>Melanerpes erythrocephalus</i>	Red-headed Woodpecker					//P	
<i>Picoides borealis</i>	Red-cockaded Woodpecker					E/E/P	
<i>Wilsonia citrina</i>	Hooded Warbler					//P	

**Table 3. Mammal Species Utilizing**

Species	Common Name	Element Rank:	Endemic	Major Disjunct	Extinction/Extirpation Prone	US/NC/WAP*	Comments
<b>MAMMALS</b>							
<i>Canis rufus</i>	Red wolf						Introduced populations on USFWS wildlife refuges in NE Coastal Plain region
<i>Condylura cristata</i>	Star-nosed Mole					/SC/P	
<i>Corynorhinus rafinesquii macrotis</i>	Rafinesque's big-eared bat	G3G4TNR / S3				FSC/SC /	Coastal Plain subspecies
<i>Mustela frenata</i>	Long-tailed Weasel					/ /P	
<i>Myotis austroriparius</i>	Southeastern myotis	G3G4/S3				FSC/SC /P	
<i>Peromyscus gossypinus</i>	Cotton Mouse					/ /P	
<i>Peromyscus leucopus easti</i>	White-footed Mouse					/SC/P	
<i>Sylvilagus palustris</i>	Marsh Rabbit					/ /P	
<i>Synaptomys cooperi helaletes</i>	Southern Bog Lemming					/SR/P	

**Table 4. Reptile Species Utilizing Peatland Pocosins**

Species	Common Name	Element Rank	Endemic	Major Disjunct	Extinction/Extirpation Prone	US/NC/WAP*	Comments
<b>REPTILES</b>							
<i>Clemmys guttata</i>	Spotted Turtle	G5/S3				/ /P	
<i>Crotalus horridus</i>	Timber Rattlesnake					/SC/P	
<i>Elaphe guttata</i>	Corn Snake					/ /P	
<i>Farancia abacura abacura</i>	Eastern Mudsnake					/ /P	
<i>Farancia erythrogramma erythrogramma</i>	Common Rainbow Snake					/ /P	
<i>Heterodon platirhinos</i>	Eastern Hog-nosed Snake					/ /P	
<i>Lampropeltis getula getula</i>	Eastern Kingsnake					/ /P	
<i>Regina rigida</i>	Glossy Crayfish Snake					/SR/P	
<i>Rhadinaea flavilata</i>	Pine Woods Littersnake					/ /P	
<i>Seminatrix pygaea</i>	Black Swamp Snake					/SR/P	
<i>Sistrurus miliarius</i>	Pigmy Rattlesnake					/SC/P	
<i>Terrapene Carolina</i>	Eastern Box Turtle					/ /P	
<i>Thamnophis sauritus sauritus</i>	Common Ribbonsnake					/ /P	

**Table 5. Amphibian Species Utilizing Peatland Pocosins**

Species	Common Name	Element Rank:	Endemic	Major Disjunct	Extinction/Extirpation Prone	US/NC/WAP*	Comments
<b>AMPHIBIANS</b>							
Ambystoma mabeei	Mabee's Salamander	G4/S3				/SR/P	
Ambystoma maculatum	Spotted Salamander					//P	
Ambystoma opacum	Marbled Salamander					//P	
Bufo quercicus	Oak Toad					/SR/P	
Desmognathus auriculatus	Southern Dusky Salamander					//P	
Eurycea guttolineata	Three-lined Salamander					//P	
Eurycea quadridigitata	Dwarf Salamander	G5T2Q/S2				/SC/P	
Hyla andersonii	Pine Barrens Treefrog					//P	
Hyla gratiosa	Barking Treefrog					//P	
Hyla versicolor	Northern Gray Treefrog					/SR/P	
Pseudacris brimleyi	Brimley's chorus frog	G5/S3S4				/W1/P	
Pseudacris ornata	Ornate Chorus Frog					/SR/P	
Scaphiopus holbrookii	Eastern Spadefoot					//P	
Siren intermedia intermedia	Eastern Lesser Siren	G5/S3S4				//P	
Siren lacertina	Greater Siren	G5/S3?				/W3/P	
Stereochilus marginatus	Many-lined Salamander					//P	

**Table 6. Invertebrate Species Utilizing**

Species	Common Name	Element Rank	Endemic	Major Disjunct	Extinction/Extirpation Prone	US/NC/WAP*	Comments
<b>INVERTEBRATES</b>							
<i>Callophrys hesseli</i>	Hessel's hairstreak	G3G4/S3		YES		/SR/	Restricted to stands of white cedar but occurs in both the Outer Coastal Plain and Sandhills.
<i>Callosamia securifera</i>	Sweetbay silkmoth	G4/S2S3				/SR/	
<i>Cleora projecta</i>	Projecta gray (moth)	G4/S3?				/W3/	
<i>Dysgonia similis</i>	An owlet moth	G3G4/S2S3				/SR/	
<i>Hypagyrtis brendae</i>	Brenda's hypagyrtis (moth)	G4/S2S3		YES		/SR/	Restricted to stands of white cedar but occurs in both the Outer Coastal Plain and Sandhills.
<i>Lithophane lemmeri</i>	Lemmer's pinion (moth)	G3G4/S1S3				/SR/	
<i>Orgyia detrita</i>	A tussock moth	G3G4/S2S3				/SR/	
<i>Spilosoma dubia</i>	Dubious tiger moth	G4/S3S4				/W3/	
<i>Xestia youngii</i>	Young's xestia (moth)	G5/S3S4				/W3/	

**\* US/ NC/ WAP Abbreviations (species are subject to reclassification by USFWS, NHP, or WRC).**

E	Endangered	SC	Special Concern	P	WAP Priority Species
T	Threatened	SR	Significantly Rare		
FSC	Federal Species of Concern	W	Watch Category		
T(S/A)	Threatened due to Similarity of Appearance				

NatureServe Element Rank: <http://www.natureserve.org/explorer/ranking.htm>

USFWS Endangered Species Listing Status: [http://www.fws.gov/raleigh/es\\_tes.html](http://www.fws.gov/raleigh/es_tes.html)

NC Natural Heritage Program Status:

<http://www.ncnhp.org/Images/2010%20Rare%20Animal%20List.pdf>

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