

North Carolina Ecosystem Response to Climate Change: DENR Assessment of Effects and Adaptation Measures

DRAFT

Streamhead Pocosins

Ecosystem Group Description:

These communities have vegetation fairly similar to that in peatland pocosins, but the physical setting is very different. They occur in ravines in dissected, sandy Coastal Plain terrain. The soils, kept essentially permanently saturated primarily by acidic seepage from adjacent sandhills, are mucky, very acidic, and infertile. Streamhead Pocosins have an open tree canopy usually dominated by pond pine. Red bay and sweetbay often form an open understory. As in other pocosins, the shrub layer is very dense and is frequently tangled with laurel-leaf greenbriar. Herbs are nearly absent except in the edge (ecotone) with neighboring sandhill communities. These ecotones often support a high diversity of herb and shrub species including many rare ones.

Diverse herb patches also develop in places where very intense fire burns the shrubs down, creating boggy openings. Fire spreading from adjacent sandhills probably frequently burned through streamheads under natural conditions. All of the shrubs readily resprout after fire. In the few remaining places where fire is frequent, Streamhead Pocosins are patchy, with some parts being dense shrub thickets, some being savanna-like with sparse trees over ferns, and some being treeless canebrakes. Streamhead Atlantic White Cedar Forests are dominated by Atlantic White Cedar, though any of the species of the Streamhead Pocosin type may be present in small numbers. The canopy is often dense enough that the shrub layer is fairly open. Atlantic white cedars are sensitive to fire, but depend on fire to prepare a seedbed for regeneration. These communities probably can persist only where fire is infrequent.

Ecosystem Level Effects:

Predicted Impacts of Climate Change:

Climate Change Factor:	Likelihood:	Effect:	Magnitude:	Comments:
Wind Damage	High	Neg	Med	May be high for Streamhead Atlantic White Cedar.
Fire	Med	Mix	Med	
Drought	High	Neg	Low	

The Climate Wizard median temperature model (Maurer et al., 2007) predicts a rise in average annual temperature in northeastern North Carolina of around 3.7 degrees by 2050. The range of individual models is 2.4-5.6 degrees increase. The average annual rainfall model predicts almost no change. However, the rainfall values in the different models range from a decrease of 16 inches to an increase of nearly 20 inches. An increase in severe storms and droughts is also expected.

Wetland hydrology in these systems is driven by seepage of rainwater through the adjacent sands. The seepage provides a substantial buffer against drying in dry periods, but prolonged drought might make these systems drier than they typically become at present. Drying would make them more susceptible to fire and potentially to invasion by upland species or oxidation of soil organic matter. Most Streamhead Pocosins have small streams flowing through them, with a steady flow maintained by seepage. Increased intensity of rainfall events might lead to more channel flow and possible increase in channel size.

Streamhead Pocosins naturally burn, often at high intensity. Drying related to drought would increase their susceptibility to fire. However, fire frequency is partly driven by fire in the surrounding uplands. Because wild fires are easy to control in Sandhills uplands, an increase in wild fire in the streamheads is unlikely, even in drought.

Streamhead Pocosins have a substantial tree canopy, and an increase in severe winds will create more canopy gaps. This may alter the structure of the forest, increasing the area of gaps and reducing the average age of canopy trees. Atlantic white cedar is particularly susceptible to wind throw, and an increase in severe storms may have a particularly significant effect on it.

Predicted Ecosystem Responses:

Ecosystem Response:	Likelihood:	Effect:	Magnitude:	Comments:
Flow Regime	Low	Neg	Low	Intense rainfall might lead to more stream flooding.
Compositional Change	Low	Mix	Low	Increased fire or drought might change composition. Warmer temperatures might allow a few southern species to enter.
Structural Change	Med	Neg	Med	May be high for Streamhead Atlantic White Cedar Forest

The most significant effect of climate change on streamheads is likely to come from rainfall extremes, both drought and heavy rains. Heavy rains may create more overland runoff and cause stream flooding where it is now rare. Because of the permeability of the sandy soil and the buffering effect of the dense vegetation, such effects are likely to be mild in natural systems. They may be more significant in areas with impermeable surfaces or cleared land.

These systems are naturally buffered from drought by the storage capacity of the sands. However droughts, if prolonged more than at present, could be significant. They could allow upland species to invade, and could allow more intense fire behavior, both of which might change composition and structure. Virtually all fire in these systems originates in adjacent upland sandhills. Because fire in sandhills is easy to control, drought is not likely to result in many more wild fires in Streamhead Pocosin. Most examples are presently altered by lack of fire. If increased drought makes prescribed burning more difficult, the effects of fire suppression would be exacerbated.

These systems are unlikely to migrate in response to climate change. They are tied to distinctive topographic and hydrologic sites. Component species and comparable communities range well to the south. Changes caused by climate change are expected to be less than ongoing changes caused by fire suppression and landscape alterations.

Habitat Level Effects:

Natural Communities:

Third Approximation Name:

Comments:

Streamhead Atlantic White Cedar Forest

These communities are rare. They are particularly vulnerable to wind damage in severe storms. They naturally burn less frequently than Streamhead Pocosins, but almost no examples of either burn at anything close to natural frequency at present.

Streamhead Pocosin

Most examples of this theme are this community type.

LHI Guilds:

Guilds with Significant Concentration in Ecosystem Group: Comments:

Streamhead Atlantic White Cedar Forests

Sandhill Streamhead Swamp and Pocosin Shrub Thickets

Atlantic White Cedar Forests

The guilds comprised by this theme all include a broader range of habitat types than peatlands per se. The Wet, Acidic Shrublands Guild, which contains many of the species most typical of peatland habitats, also includes some types of riparian and flatwoods habitats, as well as non-riverine wetland communities associated with mineral soils. The same is also true for the Atlantic White Cedar Forests Guild.

Species Level Effects:

Plants

Species:	Element Rank:	Endemic	Major Disjunct	Extinction/Extirpation Prone	Status: US/NC	Comments:
Lilium pyrophilum	G2/S2	Yes			FSC/E-SC	The majority of this species occurs in NC, though a few populations occur in SC and VA.
Lindera subcoriacea	G2G3/S2S3				FSC/T	North Carolina is at the northern limit of this species' range.
Dichanthelium sp. 9	G2G3/S2				/SR-L	
Eupatorium resinsum	G3/S3				/T-SC	
Rhynchospora macra	G3/S2				/E	This species is rare throughout its range and reaches its northern limit in the Sandhills of NC.
Carex sp. 4	G3G4/S2				/SR-L	
Hypoxis rigida	G4/S2				/SR-P	North Carolina is at the northern limit of this species' range.
Eriocaulon texense	G4/S1				/E	North Carolina is at the northern limit of this species' range.

Many rare plant species associated with Streamhead Pocosins are at the northern limit of their range in NC, but they are unlikely to move north with warmer temperatures. The Streamhead Pocosin habitat is not likely

to expand to the north with the changing climate because the distinctive soils and hydrology of the Sandhills do not occur there. Some of these species are rare in NC, but are considered globally secure, as their habitat is widespread throughout the southeastern United States.

Species associated with this theme are dependent on the combination of wet conditions and frequent fire. Changes in climate that reduce frequency of fire or degree of moisture could cause extinction of the rarest species and extirpation within NC of others.

Additional species listed for Peatland Pocosins and Wet Pine Savannas may occur in Streamhead Pocosins.

Terrestrial Animals

Species:	Element Rank:	Endemic	Major Disjunct	Extinction/ Extirpation Prone	Status: US/NC/WAP	Comments:
Eurycea sp. 9	G3?Q/S3?	Yes		Yes	/W3/P	
Lithophane lemmeri	G3G4/S1S3				/SR/	
Callophrys hesseli	G3G4/S3		Yes		/SR/	
Hypagyrtis brendae	G4/S2S3		Yes		/SR/	
Hyla andersonii	G4/S3		Yes		/SR/P	
Cleora projecta	G4/S3?				/W3/	
Callosamia securifera	G4/S2S3				/SR/	

Eurycea n. sp. 9 is endemic to this theme and is the species most at risk to alterations of hydrology and fire frequency due to climate change. Other species associated with habitats in this theme -- including the pinebarrens treefrog (Hyla andersonii), another species with strong associations to Sandhill streamheads -- occur in other types of habitat and are not as confined to the Sandhills ecoregion.

Combined Threats and Synergistic Impacts:

Importance of Climate Change Factors Compared to Other Ecosystem Threats:

Threat:	Rank Order:	Comments:
Fire	1	Suppression of natural fire continues to have the most drastic ecological effects on these communities.
Logging/Exploitation	2	Some unprotected examples are logged, altering canopy composition and structure and sometimes damaging the soil.
Flood Regime Alteration	2	Affects examples near developed or cleared land, through sediment input and channel cutting.
Development	2	Development effects are usually indirect, through altered local runoff or sediment input.
Climate Change	3	
Impoundments	3	A few examples are impounded. Climate change may create more incentive for impoundment

These wet communities, of limited extent, are seldom developed, but are sometimes logged or affected indirectly by development or disturbance on adjacent uplands. They are naturally buffered from most of the effects of climate change. Alteration to natural fire regimes has, and continues to, degrade most examples.

Recommendations for Action:

Interventive Measures:

Intervention:	Importance:	Feasibility:	Comments:
Stormwater Controls	Mediu	High	Important where surrounding uplands are developed or disturbed, including by eroding roads.
Conduct Prescribed Burns	High	High	High feasibility for examples in conservation lands. More limited in developed areas.

The most important management needed for these systems is restoration of fire, which will over time reverse the alteration in natural composition and structure. While of general ecological benefit, burning will also reduce the risk of uncontrollable or damaging wild fires during droughts caused by climate change, and the more robust natural vegetation will be better able to withstand all kinds of climate-related stress.

Many of the other negative alterations in these systems are the indirect result of activity in the surrounding uplands. Protection of adjacent uplands from development, clearing, and heavy logging, will help protect these systems from climate-related threats as well as from current threats.

Ecosystem Group Summary:

Streamhead Pocosins are not likely to be severely impacted by climate change. Due to the buffering effect of dense vegetation and the high storage and drainage capacity of the adjacent sands, they are likely to be more resilient to flooding and droughts. If climate change effects are extreme, however, they will likely not be able to migrate due to their association with unique topographic and hydrologic areas. Fire suppression is the most significant threat to most community types in this Ecosystem Group and conducting prescribed burns would promote resiliency in the face of climate change.

References:

Maurer, E.P, L.Brekke, T.Pruitt, and P.B. Duffy. 2007. Fine-resolution climate projections enhance regional climate change impact studies. *Eos Trans. AGU*, 88(47), 504.