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

Blackwater Coastal Plain Floodplains

Ecosystem Group Description:

Blackwater Coastal Plain Floodplains include the vegetated communities that occur on the floodplains of blackwater rivers. Blackwater rivers originate in the Coastal Plain. In contrast to brownwater rivers, they carry little mineral sediment, in particular little clay and silt. The water chemistry is dominated by dissolved organic matter leached from decomposing vegetation and is generally very acidic and low in nutrients. The water is tea colored but is not cloudy. The soils of blackwater floodplains are usually sandy or mucky and are acidic and infertile. Many floodplains, particularly the larger ones, have at least some development of depositional features such as natural levees, point bars, and ridge-and-swale systems, but these are not as large or prominent as on brownwater rivers. Many smaller blackwater floodplains are filled with muck and are flat and featureless.

Communities that occur in Blackwater Coastal Plain floodplains include Coastal Plain Levee Forest and Bottomland Hardwoods on the larger floodplains, Cypress-Gum Swamps in the wettest and forested parts of the floodplain, Coastal Plain Small Stream Swamps, Coastal Plain Semipermanent Impoundments (primarily beaver ponds), Oxbow Lakes along the large rivers in abandoned channel segments, and Sand and Mud Bars along the rivers.

Ecosystem Level Effects:

Predicted Impacts of Climate Change:

Climate Change Factor:	Likelihood:	Effect:	Magnitude:	Comments:
Wind Damage	Med	Neg	Med	Increased hurricane intensity will increase blow down, especially in those near the coast. Bottomland hardwoods are especially likely to be affected by windthrow than other floodplain communities.
Sea Level Rise Salt Intrusion	High	Neg	High	Strongly adverse effects on the lower reaches
Sea Level Rise Inundation	High	Neg	High	Strongly adverse effects on the lower reaches
Mild Winters	High	Neg	High	Increased temperatures/decreased winter kills will allow southern species to move farther north. E.g., Murdannia, Lygodium japonicum, Triadica (other species that are already established in Florida)
Increased Temperature	High	Neg	Med	Most species in this habitat type have a Southeastern distribution and are fairly well adapted to higher temperatures per se.
Flooding	High	Neg	Uncertai	Increased severity of flooding may destabilize channels, alter sediment load and deposition, increase erosion. Effects on composition are unknown. Increased frequency may have beneficial effects but increased duration may not.
Drought	High	Neg	Low	Invasion of upland species (e.g., red maples and beech).

Changes in flood regimes and rising sea level are the most important climate effects. The effects of rising sea level will be felt only in the lower reaches of the rivers. Large expanses in these areas will shift to tidal swamps. Because there is not substantial potential for coastal plain floodplain systems to expand inland, there will be a net loss in area. However, these systems will remain common.

Effects of changed flooding regime are very uncertain. If floods become more extreme, channels may begin to migrate more. In the Pleistocene, which was cooler but had more extreme floods, many of the large blackwater rivers had braided channels, with much newly deposited bar habitat and with enough bare sand that sand dunes were able to form. Even without this shift, more large floods might mean increased area but increased instability of bars. This would come at the expense of forests along the river banks, often the least altered forests in the floodplains. Increased magnitude of floods could affect higher terraces that now see little flooding. If flood frequency also increases, it might possibly cause the boundaries between Bottomland Hardwoods and Cypress-Gum Swamp to shift, but this would likely not be large. Effects on smaller streams would less than on larger rivers.

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Increased frequency of severe wind storms will affect all forest communities by increasing gap area and decreasing average canopy age. However, these changes are likely to be relatively modest shifts beyond the current range. Logging will remain a larger source of altered canopy age and structure.

Predicted Ecosystem Reponses:

Ecosystem Response:	Likelihood:	Effect:	Magnitude: Comments:	
Channel Hydrodynamics	Med	Neg	Med	Increased channel migration will have strong effects on bar communities.
Exotic species invasion	High	Neg	Med	
Structural Change	Med	Neg	Med	Increased canopy gaps may result from increased storm wind damage and from flood scouring.
Compositional Change	High	Mix	Low	Likely limited, except where systems become tidal.
Acreage Change	High	Neg	Med	Downstream reaches will transform into tidal marshes. No expansion is possible upstream and expansion into the Piedmont is not possible for this ecosystem. Consequently, the net effect will be an overall loss of acreage.

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Diversity of "native" species may potentially increase due to movement of more southerly species to move northward into this habitat type (e.g., wood storks, swallowtail kites, Planera aquatica, Gleditsia aquatica). More substantial changes may occur in floodplains north of North Carolina, beyond the current range of widespread southern floodplain species.

Habitat Level Effects:

Natural Communities:

Third Approximation Name:	Comments:				
Oxbow Lake					
Coastal Plain Semipermanent Impoundment					
Sand and Mud Bar	May increase due to increased flood scouring events.				
Coastal Plain Small Stream Swamp (Blackwater Subtype)	The concern about increased erosion with more severe floods is less likely to be significant on smaller streams, but may occur to some degree. Logging and changing beaver populations are likely to continue to have more effect on these communities than climate change.				
Coastal Plain Bottomland Hardwoods (Blackwater Subtype)					
CypressGum Swamp (Blackwater Subtype)					
Coastal Plain Levee Forest (Blackwater Subtype)					

Levee communities, where present, are the most likely forested floodplain community to be affected by changes in flooding regime and channel stability.

LHI Guilds:

Guilds with Significant Concentration in Ecos	system Group: Comments:
Wet-Mesic Hardwood Forests	
Forested Floodplains	
Forest Canebrakes	Increased canopy gaps and flooding could benefit canebrakes and their associated species, but both the magnitude and direction of the effects are uncertain.
Cypress-Gum Swamp Forests	

Only two guilds appear to have a significant concentration of their habitats within this group. The cypress-gum swamp forest guild is likely to be adversely affected by climate change, primarily due to sea level rise and accompanying saltwater intrusion. The forest canebrake guild may benefit from an increased formation of canopy gaps.

Species Level Effects:

Species:	Element Rank:	Endemic	Major Disjunct	Extinction/ Extirpation Prone	Status:	Comments:
Isoetes microvela	G1/S1	Yes		Yes	FSC/E	Occupies habitats strongly affected by storm-induced flooding.
Ludwigia ravenii	G1G2/S1				FSC/SR-T	
Hymenocallis pygmaea	G1G2Q/S1	Yes			FSC/SR-L	
Sagittaria macrocarpa	G2/S2	Yes			/SR-L	This species is endemic to NC and SC.
Fissidens hallii	G2/S1				/SR-T	NC is the northern limit of this species' range.
Scirpus flaccidifolius	G2/S1	Yes			FSC/E	This species is endemic to VA and northeast NC.

Rhynchospora crinipes	G2/S1		Yes	FSC/E	NC is the northern limit of this species'
Fimbristylis perpusilla	G2/S1		Yes	FSC/E	range; the nearest population is in GA. Restricted to river bars on the Waccamaw River. Effects of climate change could be either positive or negative, depending on the effects of scouring on the creation/destruction of river bars.
Macbridea caroliniana	G2G3/S2			FSC/T	
Sabatia kennedyana	G3/S2		Yes	/T-SC	Restricted to river bars on the Waccamaw River. Effects of climate change could be either positive or negative, depending on the effects of scouring on the creation/destruction of river bars.
Chasmanthium nitidum	G3/S1			/SR-T	
Carex sp. 4	G3G4/S2			/SR-L	
Schoenoplectus etuberculatus	G3G4/S3			/SR-P	
Sagittaria weatherbiana	G3G4/S2			FSC/SR-T	
Rhynchospora decurrens	G3G4/S1S2			FSC/SR-P	
Persicaria hirsuta	G3G4/S1			/SR-P	
Lejeunea bermudiana	G3G4/S1			/SR-P	
Sphagnum torreyanum	G3G4/S1			/SR-P	
Coreopsis helianthoides	G3G4Q/S1S2			/SR-P	
Trillium pusillum var. virginianum	G3T2/S1	Yes		FSC/E	
Ilex amelanchier	G4/S3			/SR-P	
Pycnanthemum setosum	G4/S2			/SR-T	
Epidendrum magnoliae	G4/S2			/SR-P	This is a more southerly species that may increase in a warmer climate.
Hottonia inflata	G4/S1			/SR-O	
Heteranthera multiflora	G4/S1			/SR-P	
Carex lupuliformis	G4/S1			/SR-P	Occurs from Ontario to Louisiana, but rare in much of its range; only 4 populations are extant in NC.
Potamogeton confervoides	G4/S2			/SR-D	
Carex reniformis	G4?/S1			/SR-P	
Lopholejeunea muelleriana	G4G5/SH			/SR-D	
Schoenoplectus subterminalis	G4G5/S3			/SR-P	
Sagittaria stagnorum	G4G5/SH			/SR-P	
Ponthieva racemosa	G4G5/S2			/SR-P	
Plagiochila dubia	G4G5/S1			/SR-P	
Gelsemium rankinii	G5/S1S2			/SR-P	
Gratiola aurea	G5/S1			/SR-O	Restricted to river bars on the Waccamaw River. Effects of climate change could be either positive or negative, depending on the effects of scouring on the creation/destruction of river bars.
Ditrysinia fruticosa	G5/S1?			/SR-T	
Clinopodium georgianum	G5/S2			/SR-P	

Fissidens hallianus	GNRQ/SH		/SR-O	
Echinodorus tenellus	G5?/S1	Yes	/SR-T	Restricted to river bars on the Waccamaw River. Effects of climate change could be either positive or negative, depending on the effects of scouring on the creation/destruction of river bars.
Lipocarpha micrantha	G5/SH		/ E	
Phanopyrum gymnocarpon	G5/S1		/SR-O	
Acmella repens	G5/S1		/SR-D	
Carex crus-corvi	G5/S1		/SR-P	
Ranunculus flabellaris	G5/S1		/SR-P	
Torreyochloa pallida	G5/S1		/SR-P	
Potamogeton amplifolius	G5/S1		/SR-D	
Eriocaulon aquaticum	G5/S2		/SR-P	
Cheilolejeunea rigidula	G5/S2		/SR-P	

Habitat does not seem to be a limiting factor for most of the rare plant species occurring in Blackwater Coastal Plain Floodplains (much suitable habitat seemingly exists now and is expected to exist into the future). Climate change is not expected to present major problems for these species, unless invasive exotic species move in and outcompete for space and resources. Most of the rare species in these systems are small herbs that may not be able to compete with larger invasive species.

<u>Terrestrial Animals</u> Species:	Element Rank: Endemid	Major Disjunct	Extinction/ Extirpation U Prone		Comments:
Anacamptodes cypressaria	G2G4/SU		TTOTIC	/SR/	
Hypomecis longipectinaria	G2G4/S3S4			/W3/	
Acronicta perblanda	G3G4/S1S2	Yes		/SR/	Currently known from only one site in North Carolina, located in Craven County. The next nearest populations
	0004/00		_		are in South Carolina.
Myotis austroriparius	G3G4/S3			SC/SC/P	
Argillophora furcilla	G3G4/S2S3			/W3/	
Franclemontia interrogans	G3G4/S3?			/SR/	
Corynorhinus rafinesquii macrotis	G3G4TNR/S3			FSC/T/	
Acrapex relicta	G4/S3			/W3/	
Dasychira atrivenosa	G4/S3?			/W3/	
Tolype minta	G4/S2S3			/W3/	
Limnothlypis swainsonii	G4/S3B		/V	W2,W5/P	
Papaipema sp. 3	G4/S3S4			/W3/	
Cisthene kentuckiensis	G4/SU			/W3/	
Hemidactylium scutatum	G5/S3			/SC/P	
Anhinga anhinga	G5/S3B			/W2/P	
Oporornis formosus	G5/S4B			//P	

Apameine, New Genus 4, Species 1	GNR/S2S3	Yes		/SR/	Recently described as Lascopia roblei. Only known from the North Carolina Coastal Plain and an adjoining area of the Great Dismal Swamp in Virginia.
Apameine, New Genus 2, Species 3	GNR/S2S3	Yes		/SR/	Only known from the North Carolina Coastal Plain and the Dismal Swamp in Virginia.
Apameine, New Genus 2, Species 1	GNR/S2S3		Yes	/W3/	Single specimen from the Coastal Plain from Greenbank Bluff

Two cane-feeding moths are endemic (or nearly so) to the North Carolina Coastal Plain. Habitat for these species, as well as another one in this group, is divided between blackwater and brownwater floodplains, as well as peatlands. All of these species, plus the larger guild of cane-feeding insects, is likely to benefit from increased canopy gaps and other disturbances associated with climate change.

One species of cypress-feeding moth, Acronicta perblanda, is currently known in North Carolina from only a single blackwater site. However, this species is likely to be found at more sites with more early spring season sampling. The one existing location, however, is located close to Core Sound and is likely to be affected by the effects of sea level rise and saltwater intrusion.

Combined Threats and Synergistic Impacts:

Importance of Climate Change Factors Compared to Other Ecosystem Threats:

Threat:	Rank Order:	Comments:
Flood Regime Alteration		
Logging/Exploitation	1	
Groundwater Depletion	2	
Invasive Species	2	
Climate Change	3	

An overall loss of acreage is expected as downstream reaches transform into tidal marshes (due to rising sea level). Increased flood severity and increased drought are generally expected. Otherwise, climate change effects upstream of the tidal zone are likely to be limited, and the other threats lists here are likely to be more significant.

Invasive exotic species are already a problem and are expected to increase with climate change. Ligustrum sinense, Microstegium vimineum, Lonicera japonica, and Murdannia keisak are causing severe damage to forests already. If not controlled, these species will greatly expand the acreage severely affected, regardless of climate.

Increased drought may lead to demand for more water withdrawal and more logging in all large river systems.

Recommendations for Action:

Interventive Measures:

Intervention:	Importance:	Feasibility:	Comments:
Reduce groundwater extraction	High	Low	
Restore/Maintain Hydrology	High	Low	
Protect/Expand Remaining Examples	High	Medium	
Control Invasive Species	High	Medium	Species that are not already widespread may be easier to target than some of the worst invaders.

Ecosystem Group Summary:

This ecosystem contains some extremely rare disjunct and near endemic plant species. Their rarity makes them vulnerable to changes in habitat. Random events in specific locations can have major impacts on the expected viability of whole species. While impacts to the Floodplains are likely to occur near the mouths of the rivers, converting swamp forests to marshes, the system as a whole will probably persist. Very few specific climate change-related impacts have been identified, and the rare species and their habitats are expected to persist.

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