DRAFT - Freshwater Tidal Wetlands

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Ecosystem Description

Freshwater tidal wetlands occur in sites where flooding occurs in response to lunar or wind tides, but where the water has less than the 0.5 parts per thousand (ppt) salt content used to define fresh water. Tidal fresh waters occur in rivers, where freshwater flow keeps out salt water, and along the large sounds where distance from seawater inlets keeps the water fresh. Components of this habitat include: Tidal Cypress-Gum Swamps and Tidal Freshwater Marshes. The most extensive examples can be found in the Albemarle and Currituck Sounds and at the mouths of the Cape Fear, Neuse, Tar, and Roanoke Rivers.

Tidal Cypress-Gum Swamps occupy vast areas at the mouths of large rivers and also occur at the mouths of smaller creeks and occasionally along the sound shoreline. They are dominated by swamp black gum, water tupelo, and bald cypress. Understory trees, shrub, and herb layers are generally sparse and low in diversity. Tidal Cypress-Gum Swamps are extensive along shorelines and along drowned river valleys (*e.g.* Cape Fear, Neuse, and Chowan River).

Tidal Freshwater Marshes occur in the lowermost parts of some tidal rivers and creeks and, more commonly, in large flats along the shorelines of freshwater sounds. The vegetation is generally strongly zoned and often very diverse in at least some zones. Two distinct variants are recognized, one with very slightly salty (oligohaline) water, the other completely fresh. The most extensive examples are around Currituck Sound; others occur around the Outer Banks farther south.

The 2005 Wildlife Action Plan describes Tidal Swamp Forest and Wetland communities as a priority habitat (see Chapter 5A) (NCWRC 2005). These habitats occur along rivers or sounds in areas where flooding is influenced by lunar or wind tides. Fresh water input may heavily influence the salt content (NCWRC 2005).

Table 1 at the end of this report provides of 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 greatest conservation need (priority species) that use habitats in this ecosystem.

No terrestrial animals are endemic to this Ecosystem Group within North Carolina. Manatees, spoonbills, and possibly other species may be able to persist in North Carolina in the future climate with warmer weather. Coastal freshwater wetlands provide important habitats for bitterns, rails, and a variety of other wading and shore birds. Conversion of other habitats to tidal freshwater marsh will occur over time which means availability of this habitat for nesting,

cover, and forage will be absent following inundation or conversion, at least until new marsh lands become established (DeWan *et al.* 2010).

Tidal freshwater wetlands provide nursery habitat for aquatic species that live in salt waters but rely on fresh and brackish waters for larval recruitment and development. Many of these species are economically or commercially important, such as crabs, shrimp, and flounder species. (DeWan *et al.* 2010). Coastal freshwater wetlands are also important to furbearers, waterfowl and other game species.

The rare skipper (*Problema bulenta*) occurs solely within tidal freshwater marshes throughout its range, from New Jersey to southern Georgia. Duke's skipper (*Euphyes dukesi*) is also restricted to these habitats along the Atlantic coastal portion of its range, although it also occurs inland in Florida, and in the Mid-West region. Although the reasons for these restrictions are not clear, the larvae of both species feed on plants that occur well inland from the coast, even in North Carolina, both of these species are potentially susceptible to extirpation from the state if they or their specialized habitats cannot keep pace with the effects of sea-level rise and saltwater intrusion.

Nutria are considered a serious pest species in the U.S. because they eat a variety of wetland and agricultural plants and their burrowing damages stream banks, impoundments, and drainage systems. Nutria may also be a vector for diseases (tuberculosis and septicemia) or parasites (*Giardia, Fasciola*, liver flukes, and nematodes), with fecal contamination in water the likely pathway. As warming trends increase, the range of nutria is likely to expand and populations currently limited by intolerance to cold winters will quickly expand (Carr 2010).

Climate Change Compared to Other Threats

Changes caused by rising sea level are the greatest threat, but increased intensity of storms, both in rainfall and wind, are also important. Because these systems are so subject to sea level, tidal movement, water salinity, and storms, these effects of climate change are the greatest threats.

Table 6 compares climate change with other existing threats.

Table 6. Comparison Of Climate Change With Other Threats

Threat	Rank Order	Comments
Climate Change	1	This Ecosystem Group is likely to experience drastic changes in extent and to see significant movement of communities.
Invasive Species	2	*Phragmites, Triadica*, alligatorweed, and nutria are primary concerns. The disruptions created by shifting communities and catastrophic events may increase the spread of *Phragmites*. Giant *Salvinia* could become a problem. Early control of species that have proven more

Table 6. Comparison Of Climate Change With Other Threats		
Threat	**Rank Order**	**Comments**
		invasive farther south will be less costly and less ecologically disruptive than allowing populations to become large.
Shoreline Hardening	2	Erosion control measures may help protect these communities, but measures that alter the shoreline, whether sea walls, "soft" structures, or plantings of off-site species, are potentially destructive to these communities. Shoreline armoring and hardening to protect infrastructure will prevent ecosystems such as tidal marshes from migrating inland (DeWan *et al.,* 2010).
Logging/Exploitation	3	Logging is a threat to some tidal cypress-gum swamps, while others are in protected status or are too wet for logging equipment. Drying may create opportunities for logging these wet areas.
Fire	3	Small plants of low interior marshes appear to need fire to maintain their habitat. Lack of fire allows unnatural vegetation succession in some freshwater marshes.
Flooding Regime Alteration	4	Alteration of flood regimes in rivers may affect these systems. Some areas are fresh largely, or at least partly, because of dilution of sea water by river input. Increased water withdrawal or inter-basin transfer may increase this problem in the future. The effects are local, affecting primarily the mouth of the altered rivers, but could be important cumulatively. Existing drainage ditches and canals bringing salt water into wetlands is a serious threat. Tide gates or blocking ditches are needed.
Freshwater Withdrawal	5	As development continues inland, water demands in the Piedmont will affect freshwater flows from the major rivers that feed this system through water removals.

Summary and Recommendations

Priority to increase resilience in these systems should be placed on protecting areas that will be likely to persist or migrate, blocking ditches that are now allowing saltwater into freshwater wetlands, and controlling *Phragmites* in these areas. While many existing marshes are likely to be lost, there is a need to protect the examples that will be the seed source for newly developing marshes. There is also a need to protect the areas that will become tidal freshwater marshes as sea level rises. Most of these are likely tidal cypress-gum swamp at present. Tidal cypress-gum swamps with mature cypress trees in them may lead to marshes with a tree component that will improve their resistance to erosion.

There is a corresponding need to protect sites that will become tidal cypress-gum swamp in the future. Because most of the dominant trees are the same and can persist in the transition to tidal conditions, protecting mature nonriverine swamp forest and brownwater or blackwater cypress-gum swamp areas will allow more rapid development of tidal cypress-gum swamps.

Recommended Actions

Surveys	• Surveys are needed to document the distribution, relative abundance and status of many wildlife species associated with these habitats. Priorities for conducting surveys need to focus on species believed to be declining, at risk or mainly dependent on these communities (like rails). • 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	• Long-term monitoring, following survey data, is needed for all marshbirds, mammals and reptiles in this habitat type (NCWRC 2005).
Research	• Investigate how reduction in freshwater marsh and increases in higher salinity areas affect alligators. • Conduct research on fire management in marsh habitats to determine optimal frequency, timing, and firing techniques (*e.g.,* flanking fire, back fire) to benefit priority birds (NCWRC 2005). • Research is needed to investigate population densities, population growth rates, dispersal range, and extent of property damage from nutria burrowing and herbivory. • Determine what circumstances cause organic soils to rapidly decay in coastal wetlands.
Management Practices	• Explore techniques for restoration of tidal swamp forest and wetlands (NCWRC 2005). • Consider planting bald cypress to create the next shoreline as sea level rises and blocking ditches to slow salt water flow into the interior of freshwater tidal marsh as a measure to reduce erosion and buy time for habitat migration inland.
Land Protection	• Work with Land Trusts and The Nature Conservancy to identify priority sites needing protection. Purchase easements or fee title priority parcels.

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References

Boorman, L.A. And R.M. Fuller. 1981. The changing status of reed swamp in the Norfolk broads. Journal of Applied Ecology 18:241-269.

Carr, C. S. 2010. The Status of Nutria (Myocastor coypus) in North Carolina. Unpublished thesis, Master of Fisheries and Wildlife Science, College of Natural Resources, North Carolina State University. Richard Lancia, Ph.D., major professor.

Day, R.H., R.K. Holz, and J.W. Day Jr. 1990. An inventory of wetland impoundments in the coastal zone of Louisiana, USA: historical trends. Environmental Management 14: 229-240.

DeWan, A., N. Dubois, K. Theoharides, and J. Boshoven. 2010. Understanding the impacts of climate change on fish and wildlife in North Carolina. Defenders of Wildlife, Washington, DC.

Doyle, T.W.; O'Neil, C.P.; Melder, P.V.; From, A.S.; and Palta, M.M. 2007. Tidal freshwater swamps of the Southeastern United States: effects of land use, sea-level rise and climate change. In: W.H. Conner, T.W. Doyle, and K.W. Krauss (eds) Forested Wetlands of the Southeastern United States. Springer; Dordrecht.

Feldman, R. L., J. G. Titus, and B. Poulter. 2009. North Carolina. Pages 688-713 in Appendix 1: State and local information on vulnerable species and coastal policies in the Mid-Atlantic. In: Coastal Sensitivity to Sea-Level Rise: A Focus on the Mid-Atlantic Region. A Report by the U.S. Climate Change Science Program and the Subcommittee on Global Change Research. [Titus, J.G. (Coordinating Lead Author), K.E. Anderson, D.R. Cahoon, D.B. Gesch, S.K. Gill, B.T. Gutierrez, E.R. Thieler, and S.J. Williams (Lead Authors)]. U.S. Environmental Protection Agency, Washington, D.C.

Gaff, H., DeAngelis, D.L., Gross, L.J., Salinas, R., and M. Shorrash. 2000. Ecological Modeling 127:3352.

Gosling, L. M. and S. J. Baker. 1991. Rodents: order Rodentia, family Myocastoridae coypu Myocastor coypus. Blackwell Scientific Publications Ltd., Osney Mead, Oxford.

Guichon, M.L., C.P. Doncaster, and M.H. Cassini. 2003. Population structure of coypus (Myocastor coypus) in their region of origin and comparison with introduced populations. Journal of Zoology 261: 265-272. The Zoological Society of London. Printed in the United Kingdom.

Krauss, K.W.; Duberstein, J.A.; Doyle, T.W.; Conner, W.H.; Day, R.H.; Inabinette, L.W.; and Whitbeck, J.L. 2009. Site condition, structure, and growth of baldcypress along tidal/non-tidal salinity gradients. Wetlands 29:505–519.

Maryland Department of Natural Resources. 2004. Invasive and exotic species. Habitat Conservation, Wildlife and Heritage Service. Available http://www.dnr.state.md.us/wildlife/invnutriafaq.asp. (Accessed 4/16/10).

Maryland Department of Natural Resources. 2004. Invasive and exotic species.

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.

Micol, T., C. P. Doncaster, and P. Jouventin. 1996. Biologie du ragondin (Ch. 1); Demographie du ragondin (Ch. 2). In Le ragondin: 11-41. P. Jouventin, T. Micol, C. Verheyden, and G. Guedon, eds. Paris: Acta.

N.C. Natural Heritage Program (NCNHP). 2001. Descriptions of the biological themes of North Carolina, 2nd edition. N.C. Department of Environment and Natural Resources, Natural Heritage Program, Raleigh, NC.

NC Wildlife Resources Commission. 2005. North Carolina Wildlife Action Plan. Raleigh, NC

Panzacchi, M., S. Bertolino, R. Cocchi, and P. Genovesi. 2007. Population control of coypu Myocastor coypus in Italy compared to eradication in UK: a cost-benefit analysis. Wildlife Biology 13(2):159-171.

Pearsall, S. and B. Poulter. 2005. Adapting coastal lowlands to rising seas. Pages 366-369 in Principles of Conservation Biology, 3rd edition. Sinauer Ass ociates, Inc., Sunderland, MA.

Reggiani, G., L. Boitani, S. D'Antoni, and R. De Stefano. 1993. Biology and control of the coypu in the Mediterranean area. Supplemento alle Ricerche di Biologia della Selvaggina 21, 67-100.

Schafale, M. P., and A. S. Weakley. 1990. Classification of the natural communities of North Carolina, third approximation. N.C. Department of Environment and Natural Resources, Natural Heritage Program, Raleigh, NC.

Table 1. Predicted Impacts of Climate Change	
Climate Change Factor	**Comments**
Coastal Erosion	Already occurring along the sounds, and likely to increase with increased storm intensity. The rich organic soils associated with tidal freshwater marsh habitats will be subject to erosion or inundation; loss of vegetated cover due to increased salinity will speed the rate of erosion.
Increased Temperature	Warmer temperatures and winters could affect competition among species and allow more southern species to migrate into these systems.
Drought	Drought conditions further inland may have more effect than drought in the vicinity of these habitats. Freshwater withdrawals from upstream reaches of rivers that contribute to tidal wetlands will cause variation in salinity.
Flooding	Existing tidal freshwater marshes are likely to be flooded for prolonged periods or converted to open water as tidal range changes. Freshwater flooding will cause salinity variation.
Wind Damage	Increased intensity of wind, other than its effect on wave erosion along the shoreline, could alter forest structure or contribute to the shift from swamp forests to marshes.
Storm Surge	Brings temporary pulses of salt that act as a disturbance. Storm surge is likely part of what determines the current boundary between tidal freshwater marshes and swamps and between tidal and non-tidal swamps. If hurricanes become more intense or storm surge is greater than expected, there may be more disturbance of freshwater tidal wetlands by salt intrusion. If storm surges are more frequent, chronic disturbance may shift the ecological character of the marshes to some extent. If increased storm frequency produces more wave impact on shorelines, some marshes or swamps may be eroded at increased rates. This habitat type is already subject to fairly frequent disturbances, and the vegetation naturally recovers quickly from these disturbances.
Sea Level Rise -- Salt Intrusion	Likely to convert large area to salt marsh. May accelerate erosion of organic soils. Formation of new inlets into Albemarle Sound, Currituck Sound, and the upper Pamlico River will turn extensive freshwater areas into brackish or salt water. New inlets will allow the influence of lunar tidal fluctuations into wind tidal areas.
Sea Level Rise – Inundation	Permanent inundation and shoreline erosion are already occurring gradually and can be expected to accelerate. The freshwater tidal wetlands in the southern part of the state are mostly associated with rivers and large creeks. Lunar tides dominate, and tidal amplitude can be several feet in the lower portions. Rising sea level can be expected

Table 1. Predicted Impacts of Climate Change	
Climate Change Factor	**Comments**
	to shift the zone of tidal influence upstream. Permanent inundation and conversion to brackish water can be expected in the downstream portions. The northern tidal wetlands are mostly along the sounds and are driven by wind tides. This region has been subsiding due to geologic forces, so that relative sea level rise has been more significant here than farther south. Where drainage patterns have been altered through ditching or draining, vertical accretion has been altered such that, with saltwater intrusion, subsidence and conversion to open water is likely (Pearsall and Poulter 2005).
Exotic species invasion	Phragmites is already invading, but disturbances associated with climate change may increase it. Other exotics such as . Chinese tallow tree (*Triadica sebifera*) may expand with warmer weather.
Compositional Change	If the Outer Banks are breached, abrupt changes in salinity would cause drastic shifts in community types and composition over large areas in the region. Salt intolerant species would be killed and freshwater marshes would become brackish or salt marshes. Tidal swamps may be killed and become brackish marshes. Farther inland, swamps may be killed by saltier storm surges but develop as freshwater marshes. Dominant brackish marsh plants can establish quickly, but it is unclear if time will be needed for the full complement of species to establish. The appearance of species native to comparable ecosystems farther south may not be negative.
Structural Change	Much conversion of tidal swamp to marsh. Some additional structural change in surviving swamps with increased storm damage.
Inland Migration	Where salinities don't change catastrophically, communities should be able to migrate inland. There is natural connectivity along river floodplains and along the flatter shorelines. Tidal swamps and freshwater marshes in river valleys will move upstream into river swamps. Tidal swamps and freshwater marshes along shorelines will move inland into nonriverine swamps if the land slope is gentle. The net change in acreage of communities will vary with the slope of the land. If there is a steepening or abrupt change in land slope inland, communities along shorelines may be squeezed and become smaller or disappear. Slopes to uplands are relatively steep, and inland shifts other than along river courses are likely to be relatively small. Tidal influence can be expected to penetrate farther inland into nonriverine wetlands in some of these areas, allowing the potential for inland migration. In other portions, abrupt slopes to uplands, development, or lack of any higher land adjacent will make migration impossible. Some areas of inland migration will result in less acreage but some could increase.

Table 1. Predicted Impacts of Climate Change	
Climate Change Factor	**Comments**
Acreage Change	Tidal Cypress-Gum Swamps turn into Tidal Freshwater Marshes with rising sea level. The net effect will certainly be a loss of extent, but the magnitude of change is uncertain and depends on the rate and degree of sea level rise and on the fate of the barrier islands. Drastic losses are likely if the Outer Banks collapse. The extensive tidal wetlands in northeastern North Carolina will be affected most because of very gentle land slopes and because of the potential for drastic changes in the sheltering barrier islands. Because of steeper slopes, narrower estuaries, higher tidal ranges, and systems that are in equilibrium with numerous existing barrier island inlets, the changes will be less drastic in southeastern North Carolina. Organic soil (peats) which are stable in freshwater conditions can be rapidly oxidized by sulfur bacteria if oligohaline or brackish waters reach them. However, many oligohaline tidal freshwater marshes, tidal swamps, and even brackish marshes occur on organic soils, yet appear to be stable. If they become unstable, rapid loss of much of their extent could occur.

Table 2. Bird Species Utilizing Freshwater Tidal Wetlands							
Species	**Common Name**	**Element Rank**	**Endemic**	**Major Disjunct**	**Extinction/ Extirpation Prone**	**US/ NC/ WAP***	**Comments**
BIRDS							
Ammodramus caudacutus	Saltmarsh Sharp-tailed Sparrow					/ /P	
Ammodramus nelsoni	Nelson's Sharp-tailed Sparrow					/ /P	
Anas Rubripes	Black Duck						NC represents the southern extent of species breeding range. Although poorly documented, decline in breeding numbers in NC expected. Breeding declines nationwide and wintering declines in North Carolina as well. Black Ducks ranked in the "highest" conservation tier (Atlantic Coast Joint Venture - Waterfowl Implementation Plan, 2005)
Anhinga anhinga	Anhinga					/SR/P	
Asio flammeus	Short-eared Owl					/ /P	
Botaurus lentiginosus	American bittern	G4/S1B, S3N				/SR/P	
Circus cyaneus	Northern Harrier					/SR/P	
Cistothorus platensis	Sedge Wren					/ /P	
Coturnicops noveboracensis	Yellow Rail					/SR/P	

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Species	**Common Name**	**Element Rank**	**Endemic**	**Major Disjunct**	**Extinction/ Extirpation Prone**	**US/ NC/ WAP***	**Comments**
BIRDS							
Egretta caerulea	Little Blue Heron					/SC/P	
Egretta thula	Snowy Egret					/SC/P	
Elanoides forficatus	Swallow-tailed Kite					/ /P	
Gallinula chloropus	Common Moorhen					/ /P	
Haliaeetus leucocephalus	Bald Eagle					T/T/P	
Himantopus mexicanus	Black-necked Stilt					/SR/P	
Ixobrychus exilis	Least bittern	G5/S3B				/SR/P	
Laterallus jamaicensis	Black Rail					/SR/P	
Mycteria americana	Wood Stork					E/E/P	
Nyctanassa violacea	Yellow-crowned Night-heron					/ /P	
Plegadis falcinellus	Glossy Ibis					/SC/P	
Porzana carolina	Sora					/ /P	
Rallus elegans	King rail	G4/S3B, S3N				/W1,W3/P	
Rallus limicola	Virginia Rail					/ /P	

Table 3. Mammal Species Utilizing Freshwater Tidal Wetlands							
Species	**Common Name**	**Element Rank:**	**Endemic**	**Major Disjunct**	**Extinction/ Extirpation Prone**	**US/ NC/ WAP***	**Comments**
MAMMALS							
Condylura cristata	Star-nosed Mole					/SC/P	
Cryptotis parva	Least Shrew					/ /P	
Sylvilagus palustris	Marsh Rabbit					/ /P	

Table 4. Reptile Species Utilizing Freshwater Tidal Wetlands							
Species	**Common Name**	**Element Rank**	**Endemic**	**Major Disjunct**	**Extinction/ Extirpation Prone**	**US/ NC/ WAP***	**Comments**
REPTILES							
Alligator mississippiensis	American Alligator					T/T/P	
Farancia abacura abacura	Eastern Mudsnake					/ /P	
Farancia erytrogramma erytrogramma	Common Rainbow Snake					/ /P	
Kinosternon baurii	Striped Mud Turtle					/ /P	
Thamnophis sauritus sauritus	Common Ribbonsnake					/ /P	

Table 5. Invertebrate Species Utilizing Freshwater Tidal Wetlands							
Species	**Common Name**	**Element Rank**	**Endemic**	**Major Disjunct**	**Extinction/ Extirpation Prone**	**US/ NC/ WAP***	**Comments**
INVERTEBRATES							
Acronicta perblanda	Cypress daggermoth	G3G4/ S1S2		YES		/SR/	Known in NC only from the vicinity of Core Creek. Next nearest documented population is in SC. Probably not strictly tied to tidewater habitats, but general habitat requirements are not well understood.
Anacamptodes cypressaria	An inchworm moth	G2G4/SU				/SR/	Largest known population in the state is in the Albemarle-Pamlico Peninsula. Associated primarily with non-riverine swamps.
Euphyes dukesi	Duke's skipper	G3/S1			YES	/SR/	NC populations all occur along ecotones between tidal freshwater marshes and tidal swamp forests. Larvae feed on Carex, including hyalinolepis, which occur farther inland, possibly allowing some migration upstream as coastal habitats become more brackish.

Table 5. Invertebrate Species Utilizing Freshwater Tidal Wetlands							
Species	**Common Name**	**Element Rank**	**Endemic**	**Major Disjunct**	**Extinction/ Extirpation Prone**	**US/ NC/ WAP***	**Comments**
INVERTEBRATES							
Problema bulenta	Rare skipper	G2G3/S1		YES	YES	FSC/SR/	Completely tied to tidal freshwater marshes. Only a single population is known from NC, in the tidal portion of the Cape Fear River. The next nearest population may be in Charleston, SC.

*** 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

NC Natural Heritage Program Status:
http://www.ncnhp.org/Images/2010%20Rare%20Animal%20List.pdf

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