Focal Areas Appendix

to the

Cape Fear Arch Conservation Plan

Principal Habitats & Focal Area Summaries

April 2015

Part I
Riverine & Riparian

The riparian zone are areas where there is a land and river interface. These areas function in a variety of ways including, nutrient cycling, energy flow, habitat for plants and animals, and other ecological characteristics. The water flow of riparian zones also affect what the soil composition is like and also what kinds of vegetation grow. Hydrophillic plants are associated with riparian areas.

Riparian zones provide many benefits to an ecosystem. They help control nonpoint source pollution. They supply habitat and food for a wide variety of animals-- including migratory species. Undisturbed riparian areas have trees and vegetation that helps to stabilize the banks, which reduces the velocity of flood waters.

Reference: Riparian Zones

Black River *Photo courtesy of Josh Batrom*

Section One
Cape Fear Arch Riverine Priority Habitats

Riverine Aquatic Communities

Definition
Coastal plain is a low, flat or gently sloping land that extends along the Atlantic Ocean

Threats
There are many threats to the coastal plain river communities. One threat is saltwater intrusion due to sea level rise and other anthropogenic impacts. Potential threats to water quality and/or ecological integrity of the both rivers and their floodplains due to: excess nutrients and fecal coliform bacteria from leaking or breached animal waste lagoons; sedimentation due to timbering/clearing of stream banks on tributaries; and/or overzealous snagging of riverbanks after hurricane or storm events. Dams are also damaging to the river ecosystem by blocking necessary migration routes for migratory fishes such as the endangered Atlantic sturgeon.

Opportunities
The Army Corps of Engineers has completed a rock arch passage to facilitate movement of fish over the Lock and Dam #1 to their historic spawning locations. With three primary lock and dam structures on the main stem, only Lock and Dam #1 has been improved for this purpose.

Floodplain Forests

Definition

Floodplain forests are impacted by flooding regimes that have been changed by dams, development, habitat fragmentation, water chemistry, agricultural runoff, invasive species and high grading of stands and logging that reduces wide buffers. Floodplain forests are associated with blackwater rivers or brownwater rivers. These habitats include levee forest, cypress-gum swamps, bottomland hardwoods, and alluvial floodplains with small poorly defined fluvial features, as well as semi-permanent impoundments, sand and mud bars, and oxbow lakes.

Threats

This forest is fragments of the original millions of acres that were around prior to loss due to development, drainage, agriculture, and logging. There has been introduction of many non-native plant life. Many of the species in the floodplain systems have been greatly reduced in numbers. Untreated storm water and agricultural runoff is a major problem that impacts both aquatic and terrestrial wildlife.

Opportunities

Land acquisition and easements may be pursued to increase the width of riparian buffers and create larger patches of connected habitat. Brownwater bottomlands are the most species rich but are also the most susceptible to clearcutting and thus should be a priority in conservation.

Conservation of lands that are used as waterbird nesting and resting areas should also be acquired. These birds should be included in future management plans.

Section Two
Cape Fear Arch Riverine Focal Areas

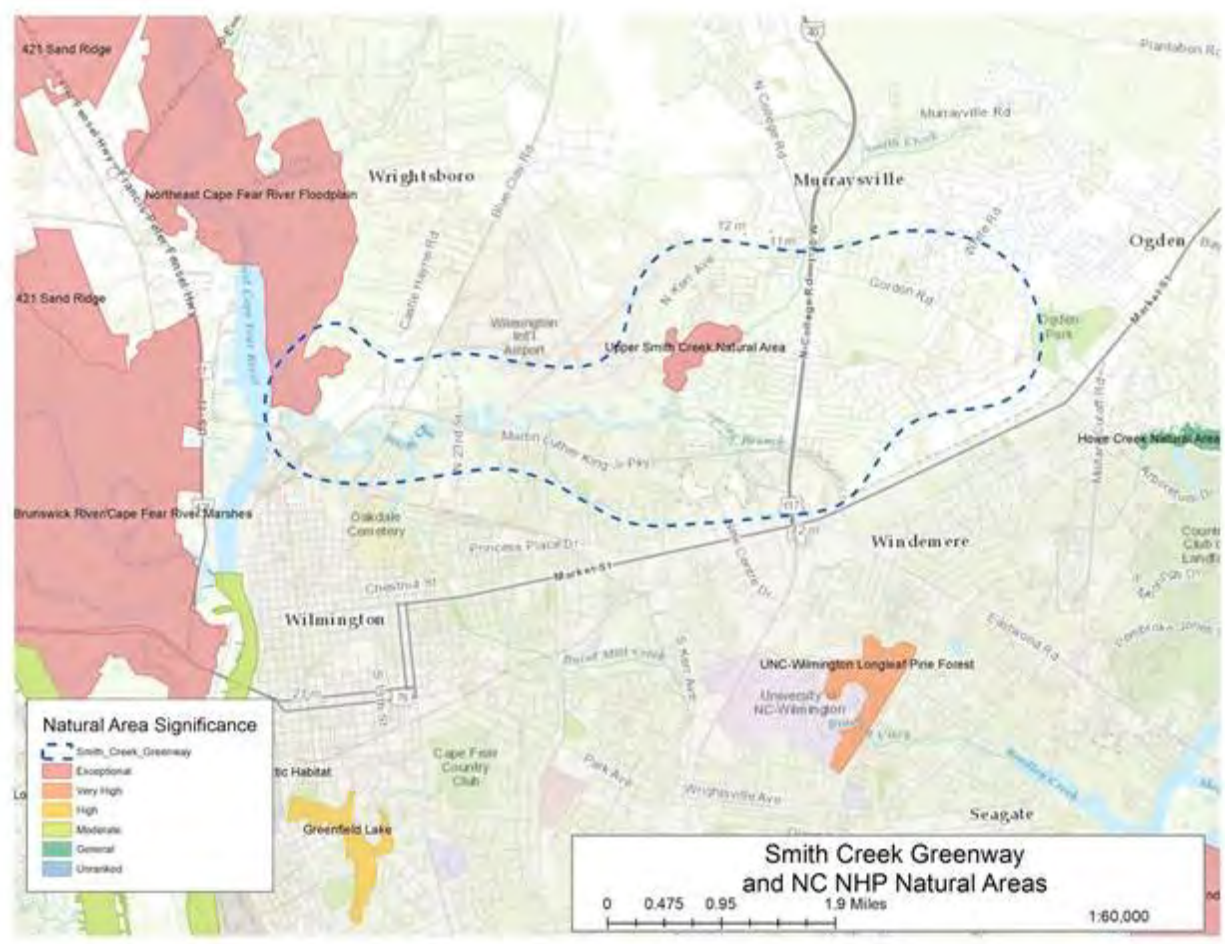
1. Smith Creek Greenway

Geographic Extent

This focal area includes the aquatic habitat and riparian buffers of Smith Creek located in north-central New Hanover County. Smith Creek drains into the lower Northeast Cape Fear River, just north of the Northeast Cape Fear River's confluence with the Cape Fear River. The watershed drains land within the Wilmington City limits and the unincorporated county.

Conservation Importance

Smith Creek is a designated primary nursery area for American eel and provides important spawning habitat for several species of anadromous fish. The tidal freshwater marsh contains one of two known locations for Carolina Bishop-weed (*Ptilimnium ahlesii*) in North Carolina.



Important Species

Fauna

Atlantic sturgeon (*Acipenser oxyrinchus*), shortnose sturgeon (*Acipenser brevirostrum*), blueback herring (*Alosa aestivalis*), American eel (*Anguilla rostrata*), striped bass (*Morone saxatilis*), American shad (*Alosa sapidissima*)

Flora

Carolina Bishop-weed (*Ptilimnium ahlesii*), Globe-fruit Seedbox (*Ludwigia sphaerocarpa*).

Guilds

Cypress-Gum Swamp Forests

Land Owners/Use

The Smith Creek watershed consists primarily of residential with some commercial, industrial, light industrial and airport use. A substantial amount of the riparian buffer along the creek itself is in conservation ownership, especially upstream of North Kerr Avenue.

Existing Conservation Lands

New Hanover County has acquired 160-acres of land and the Department of Transportation owns a 47-acre mitigation tract along Smith Creek, forming keystones of a growing greenway along Smith Creek.

Threats

Smith Creek is listed on the 303(d) list of impaired waters for fecal coliform bacteria and NPDES point sources.

Key Contacts

City of Wilmington, New Hanover County, Cape Fear River Partnership.

Objectives/ Action

Implement the Smith Creek Watershed Plan and the Cape Fear River Partnership Action Plan.

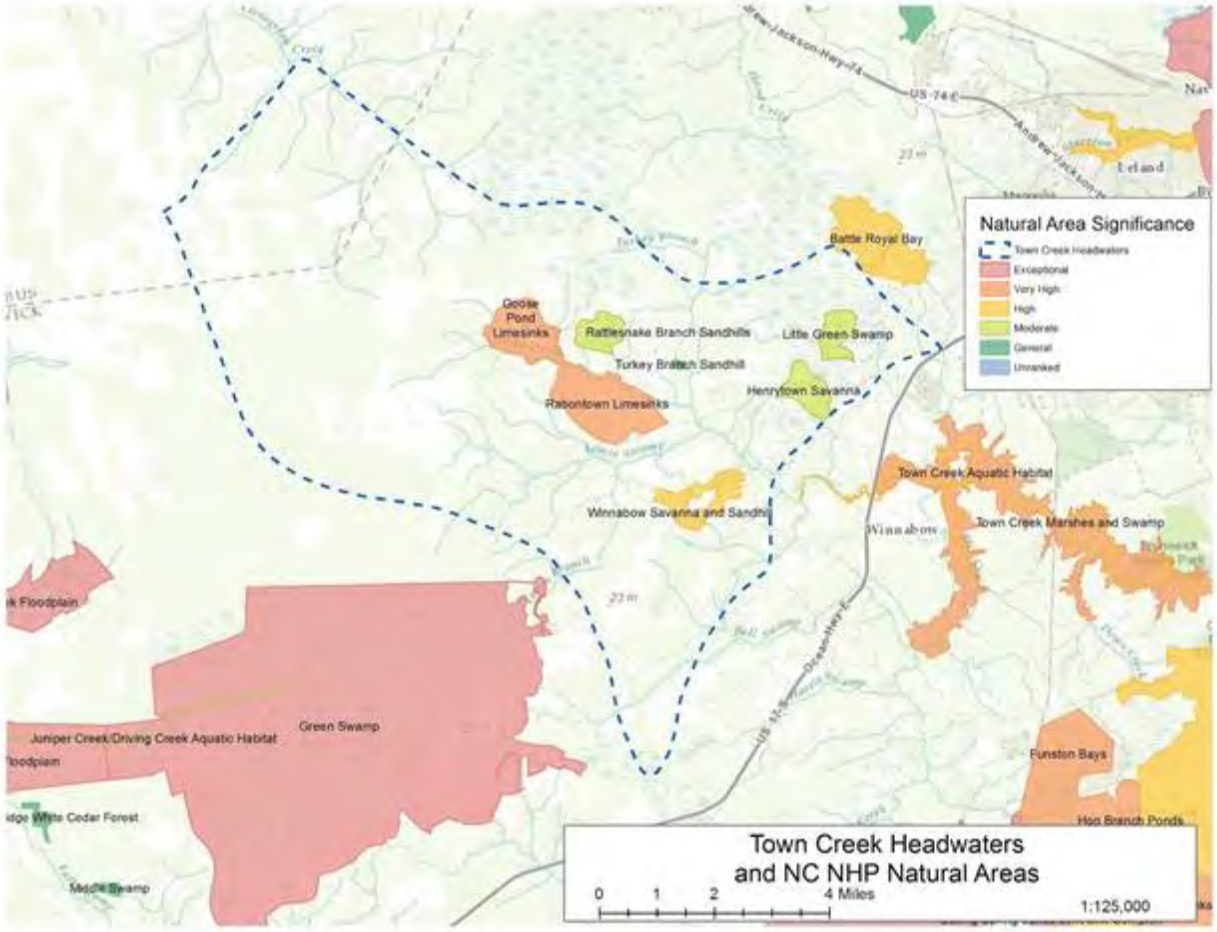
2. Town Creek Headwaters

Geographic Extent

The Town Creek Headwaters focal area consists of lands on both sides of the creek, its tributaries, and its aquatic habitat beginning just north of Highway 17 in Brunswick County and extending upstream.

Conservation Importance

The aquatic habitat in this focal area is a designated primary nursery area for many estuarine fish species and provides important spawning habitat for several species of anadromous fish. The headwaters also contains seven discrete Natural Heritage Areas, including some particularly rare and high quality examples of natural communities, and populations of rare species. The largely rural landscape is also an important link between the Town Creek/Lower Cape Fear River Corridor Focal Area and the Juniper Creek/Green Swamp Corridor Focal Area.



Important Species

Fauna

Greensfield ramshorn snail (*Helisoma eucosmium*), American alligator (*Alligator mississippiensis*), blueback herring (*Alosa aestivalis*), American eels (*Anguilla rostrata*)

Flora

Warty sedge (*Carex verrucosa*), pondspice (*Litsea aestivalis*), Florida sunflower (*Helianthus floridanus*), Venus flytrap (*Dionaea muscipula*).

Guilds

Forested Floodplains and Non-Riverine Wet Flats; Dry-Hydric Hardwood and Mixed Forests
Sparsely Settled Mixed Habitats.

Land Owners/Use

The headwaters area is primarily in industrial forestland use, currently managed by two Timber Investment Management Organizations (TIMOs). Land ownership changes further downstream with a mix of smaller forestry tracts, undeveloped lands and a small percentage of residential development.

Existing Conservation Lands

There are no current conservation lands in this focal area.

Threats

Town Creek is listed on the 303(d) list of impaired waters for fecal coliform bacteria and NPDES point sources.

Key Contacts

North Carolina Coastal Land Trust, Cape Fear River Partnership Coordinator.

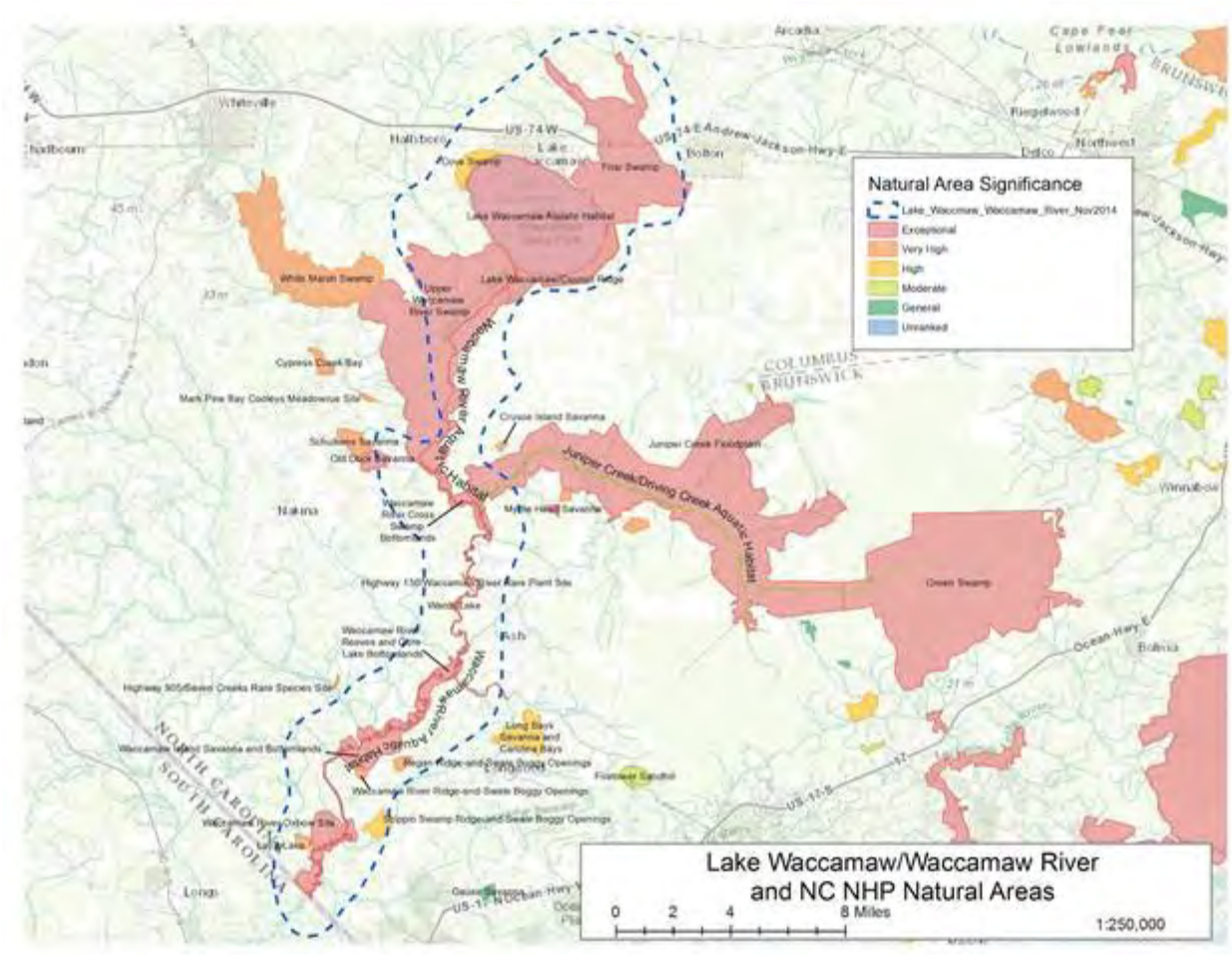
Objectives/ Action

- Target the larger high priority parcels for conservation with willing sellers. Work with partners to identify lead agency/organization for specific parcels.
- Work with TIMOs to protect riparian buffers and manage longleaf pine where and when appropriate.
- Implement prescribed fire in areas of longleaf pine forest
- Monitor saltwater intrusion
- Address lack of information about groundwater levels

3. Lake Waccamaw/ Waccamaw River Corridor

Geographic Extent

The Lake Waccamaw/Waccamaw River Corridor includes Lake Waccamaw, the Waccamaw River and its associated wetlands and floodplains. This priority area includes the headwater wetlands that drain into Lake Waccamaw, a permanently inundated Carolina Bay that is owned and managed as Lake Waccamaw State Park. The Waccamaw River Corridor includes 48 river miles and associated floodplains along the river to the border with South Carolina.



Conservation Importance

Lake Waccamaw is an 8,900-acre Carolina bay classified as Outstanding Resource Waters (ORW) due to a high water quality, high recreational value and because it provides habitat for many rare and endemic species. The Waccamaw River watershed includes Lake Waccamaw, the most biologically diverse lake in the state and one of the most species-rich lakes in the Western hemisphere. It has 52 fish species, 11 species of snails and 15 species of mussels and clams, many of them rare and endemic to the lake. The watershed also includes a large portion of the Green Swamp where scientists have recorded the highest density of small-scale plant diversity in North America, more than 40 species in a single square meter.

Just below Lake Waccamaw, River Swamp is the largest remaining blackwater cypress-gum swamp in the state. In fact, the Waccamaw River is one of North Carolina's largest blackwater rivers.

All waters that drain to Lake Waccamaw are subject to the Lake Waccamaw Special Management Strategy. These waters have the same requirement as ORW waters because they are vital to protecting water quality in the lake.

The shoreline along the Lake Waccamaw State Park on the southeastern shore of the lake is classified as a Unique Wetland. Lake Waccamaw, the Waccamaw River and associated floodplains contain habitat supporting the greatest concentration of endemic animals in North Carolina. Some of the most extensive cypress-gum swamp in the state is found in the Upper Waccamaw River Swamp. The floodplain forests along the Waccamaw River include some of the best examples of globally rare natural communities, including Evergreen Subtype of Blackwater Bottomland Hardwoods as well as Oxbow Lake and Blackwater Levee/Bar Forest. Juniper Creek with its extensive, mostly uninterrupted floodplain connects the Green Swamp to the Waccamaw River. There are also areas of longleaf pine forest, including Old Dock Savanna, a Very Wet Clay Savanna.

Important Species

Fauna

Coastal plain crayfish (*Procambarus ancylus*), Waccamaw crayfish (*Procambarus braswelli*), Waccamaw darter (*Etheostoma perlongum*), lined topminnow (*Fundulus lineolatus*), Waccamaw killifish (*Fundulus waccamensis*), Waccamaw silverside (*Menidia extensa*), pod lance (*Elliptio folliculata*), Waccamaw spike (*Elliptio waccamawensis*), yellow lampmussel (*Lampsillis cariosa*), Waccamaw fatmucket (*Lampsilis fullerkati*), eastern lampmussel (*Lampsilis radiata*), tidewater mucket (*Leptodea ochracea*), savannah lilliput (*Toxolasma pullus*), eastern creekshell (*Villosa delumbis*), ridged lioplax (*Lioplax subcarinata*), banded pygmy sunfish (*Elassoma zonatum*), spotted sunfish (*Lepomis punctatus*), ironcolor shiner (*Notropis chalybaeus*), taillight shiner (*Notropis maculatus*), rayed pink fatmucket (*Lampsilis splendida*),Waccamaw snail (*Amnicola sp*. 1), Waccamaw ambersnail (*Catinella waccamawensis*), Waccamaw siltsnail (*Cincinnatia sp. 1*), Waccamaw white miller (*Nectopsyche waccamawensis)*

Flora

Waccamaw river spiderlily (*Hymenocallis pygmaea)*, Long Beach seedbox (*Ludwigia brevipes)*, Plymouth rose gentian (*Sabatia kennedyana)*, Harper's fimbry (*Fimbristylis perpusilla)*, swampforest beaksedge (*Rhynchospora decurrens)* , Weatherby's arrowhead (*Sagittaria weatherbiana)*, common maidenhair fern (*Adiantum capillus-veneris)*, Wood Stork (*Mycteria americana*), Globe-fruit Seedbox (*Ludwigia sphaerocarpa*), Northeastern Bladderwort (*Utricularia resupinata*) White-doll's Daisy (*Boltonia asteroides var. glastifolia*), Southern Water Grass (*Luziola fluitans*), Venus Hair Fern (*Adiantum capillus-veneris*),

Guilds

Forested Floodplains and Non-Riverine Wet Flats, Dry-Wet Hardwood and Mixed Forests, Dry-Hydric Hardwood and Mixed Forests, Sparsely Settled Mixed Habitats.

Landowners/Use

The watershed is primarily rural, with the exception of extensive development along the lake and some homes along the river. Most of the floodplains are still intact.

Existing Conservation Lands

Lake Waccamaw State Park is owned and managed by the NC State Division of Parks and Recreation. The State Wildlife Resources Commission owns and manages a series of sites along the Waccamaw River and on the northeast side of Lake Waccamaw. Both The Nature Conservancy and the NC Coastal Land Trust have protected lands along the Waccamaw River, as has Ducks Unlimited. Boggy Swamp-Waccamaw River subwatershed (03040206020040).is part of the Ecosystem Enhancement Program's Targeted Local Watershed and is considered by the North Carolina Natural Heritage Program to be of exceptional significance.

Threats

Lake Waccamaw and the Waccamaw River are listed as impaired waterways due to the presence of mercury. Lake Waccamaw and the adjacent canal have experienced algal blooms and associated water quality impairments. Stormwater upgrades within the Town of Lake Waccamaw were implemented to address these issues and monitoring continues, though vegetation issues in the canal continue, algal issues occur in the lake particularly along its shoreline, threats from invasive species like Hydrilla and Lyngbya, extensive ditching and draining throughout the watershed contribute to sedimentation. Additional development within the Town of Lake Waccamaw has the potential to impact lake water quality and its endemic and rare species. These species are now under threat due to non-native species. In addition, the ongoing issues associated with timbering along the Waccamaw River poses threats to water quality and habitat availability.

Key Contacts

Division of Parks and Recreation, Wildlife Resources Commission, Winyah Rivers Foundation, The Nature Conservancy, NC Coastal Land Trust.

Objectives/ Action

- Continue to implement hydrilla control and monitor results in Lake Waccamaw through the established task force. Continue to monitor Waccamaw River for hydrilla. Establish Early Detection and Rapid Response Program for new invasive species like recently identified Lyngbya sp.
- Sustain a water quality monitoring project in Lake Waccamaw and along the Waccamaw River. Determine if there is a nutrient enrichment problem and address sources.
- Develop and promote a paddle trail from Lake Waccamaw and along the Waccamaw River to Winyah Bay. North Carolina and South Carolina portions of the Waccamaw River Water Trail were recognized in 2012 by the National Park Service and US Department of the Interior as a keystone conservation and outdoor recreation project under President Obama's America's Great Outdoors Program and in 2013 the South Carolina portion was designated a National Water Trail
- Identify additional land acquisition along the Waccamaw River for conservation and public access. Focus land acquisition on the entire floodplain, and not fixed width riparian buffer. Of

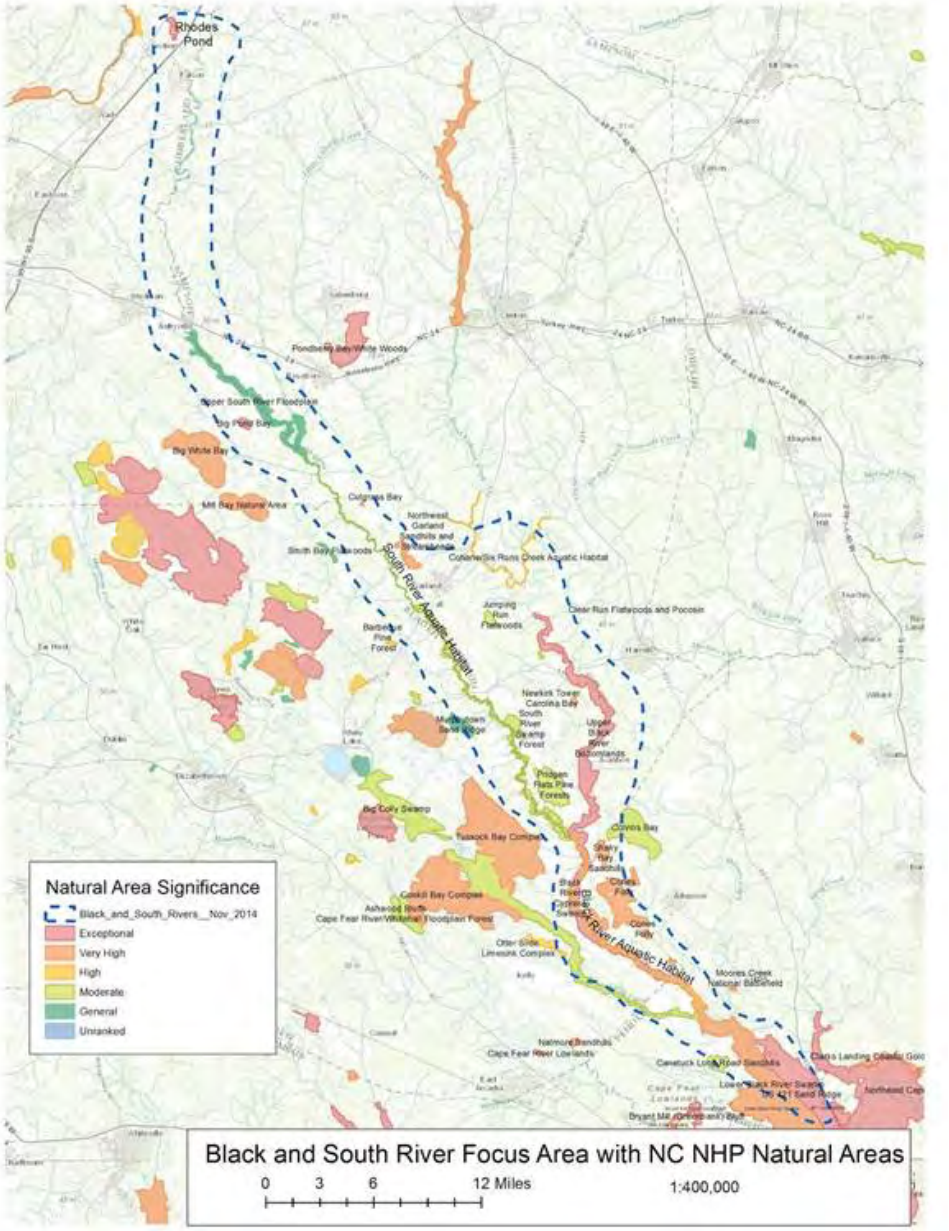
particular importance would be areas with intact natural communities. and areas supporting habitat for rare, threatened and endangered plant and animal species.

- Maintain designation of Outstanding Resource Waters for Lake Waccamaw and its headwaters (potentially seek designation for Waccamaw River).
- Restoration of longleaf pine habitats where off-site species have been planted would also be encouraged. Areas with longleaf pine forest ecosystems will continue to need fire.

4. Black River and South River

Geographic Extent

This focal area also includes both sides of the Black River and its aquatic habitat from its confluence with the Cape Fear River to its origination near the town of Ingold and Highway 701. The focal area also includes both sides of the South River and its aquatic habitat from its confluence with the Black River in Bladen and Sampson Counties to Rhodes Pond Game Lands, north of I-95 in Cumberland County.



Conservation Importance

The Black and South Rivers are tributaries of the Cape Fear River and are designated by the N.C. Natural Heritage Program as significant aquatic communities. The Black River Preserve, managed by The Nature Conservancy, is the most spectacular old-growth example of what was once a common sight along North Carolina's blackwater rivers. It is home to the oldest stand of trees in eastern North America, with bald cypress exceeding 1,600 years old. The Upper Black River Bottomlands natural area contains the best examples of Blackwater Bottomland Hardwoods in North Carolina, and a population of Thin-wall Quillwort that is considered the best in North Carolina. The focus area also contains the best population of Pondberry (*Lindera melissifolia*), which is endangered.

Important Species

Fauna

Broadtail madtom (*Noturus sp*.), thinlip chub (*Cyprinella sp*.), banded pygmy sunfish (*Elassoma zonatum*), spotted sunfish (*Lepomis punctatus*), pod lance (*Elliptio folliculata*), Cape Fear spike (*Elliptio marsupiobesa*), Atlantic pigtoe (*Fusconaia masoni*), yellow lampmussel (*Lampsillis cariosa*), Eastern lampmussel (*Lampsilis radiata*), Eastern creekshell (*Villosa delumbis),* wood stork (Mycteria americana),

Flora

Thin-wall quillwort (*Isoetes microvela*), golden hedge-hyssop (*Gratiola aurea*, pondberry (*Lindera melissifolia*)

Guilds

Dry-Wet Hardwood and Mixed Forests, Forested Floodplains and Non-Riverine Wet Flats, Cypress-Gum Swamp Forests, Wet Hardwood Forests, Wet-Mesic Hardwood Forests, Dry-Hydric Hardwood and Mixed Forests, Sparesly Settled Mixed Habitats, Wet Acidic Shrublands, Wet-Xeric Longleaf-Wiregrass Woodlands, Xeric-Mesic Longleaf Pine and Mixed Oak Woodlands, Wet-Xeric Longleaf-Wiregrass Woodlands.

Land Owners/Use

Forestry and agriculture are the predominant land uses within this focus area.

Existing Conservation Lands

Approximately 14,540 acres have been protected largely through state partners in the Black River watershed. In addition to owning and managing over 2,200 acres in its Black River Preserve, The Nature Conservancy monitors conservation easements on 262 acres of privately-owned land. The N.C. Coastal Land Trust has conserved over 650 acres through conservation easements and owns one 57-acre preserve on the South River. TNC has also conserved over 330 acres along the South River. The U.S. Fish and Wildlife Service has one conservation easement along the river.

Key Contacts

NC Coastal Land Trust, The Nature Conservancy, Sampson, Bladen, Pender and Cumberland County Soil and Water Districts, Sandhills Area Land Trust, U.S. Fish and Wildlife Service, NC Wildlife Resources Commission.

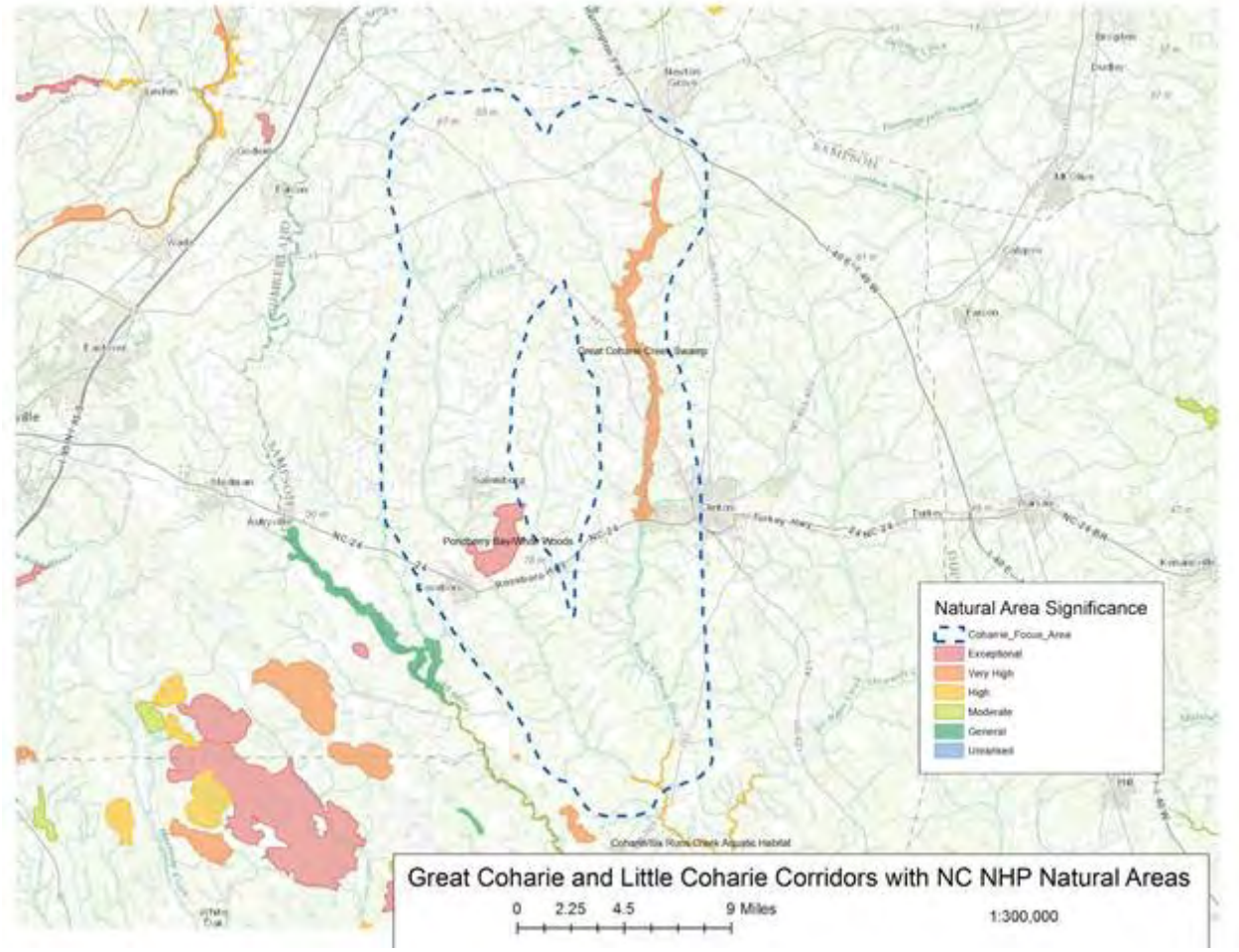
Objectives/ Action

- Target high priority parcels for protection, particularly mature Bottomland Hardwoods. Greatest need is protection of Bottomland Hardwoods upstream of Beattys Bridge
- Work within existing Soil and Water Conservation Districts and USDA's Natural Resources Conservation Service programs in promoting conservation opportunities to farmland owners, particularly to reduce nutrients to waterways.
- Monitor for invasive exotic plants.

5. Great Coharie Creek Corridor & Little Coharie Creek Corridor

Geographic Extent:

This focus area includes the 16-mile long corridor of the Great Coharie Creek, its aquatic habitat and its associated floodplain, beginning in northern Sampson County and continuing until its confluence downstream with the Black River. It also includes the Little Coharie Creek Corridor, its aquatic habitat and associated floodplain, running from the headwaters beginning in northern Sampson County and continuing until the Little Coharie joins with Great Coharie Creek just above the Black River.



Conservation Importance:

Little Coharie Creek, along with Great Coharie Creek and Six Runs Creek form the Black River, and have been identified by the Natural Heritage Program as the Coharie / Six Runs Creek Aquatic Habitat. Areas within the focal area have been designated as Natural Heritage Areas because they support rare species populations, including bluff oak (*Quercus austrina*). Notable examples of Cypress Savanna and Cypress Gum Swamp natural communities, as well as some longleaf pine forest, are also within the focus area.

Important Species (Flora/Fauna)

Fauna

Meske's skipper *(Hesperia meskei*), Edwards' hairstreak (*Satyrium edwardsii*), broadtail madtom (*Noturus sp.*), thinlip chub (*Cyprinella sp.*), Eastern lampmussel (*Lampsilis radiata*), pod lance (*Elliptio folliculata*), Eastern creekshell (*Villosa delumbis*).

Flora

Pondberry (*Lindera melissifolia*), Leavenworth's goldenrod (*Solidago leavenworthii*).

Guilds

Dry-Wet Hardwood and Mixed Forests, Forested Floodplains and Non-Riverine Wet Flats, Cypress-Gum Swamp Forests, Wet Hardwood Forests, Wet-Mesic Hardwood Forests, Dry-Hydric Hardwood and Mixed Forests, Sparsely Settled Mixed Habitats, Wet-Xeric Longleaf-Wiregrass Woodlands.

Land Owners/Use

Forestry and agriculture are the predominant land uses within this focus area.

Existing Conservation Lands

The State of North Carolina's Ecosystem Enhancement Program owns the 4,694-acre Great Coharie Creek Tract. The Plant Conservation Program owns the 2,077-acre Pondberry Bay Tract. The U.S. Fish and Wildlife Service owns a 279-acre conservation easement.

Key Contacts

Ecosystem Enhancement Program, DENR Stewardship Program, Plant Conservation Program, USFWS.

Objectives/ Action

- Implement the Great Coharie Watershed Plan (Local Watershed Plan Fact Sheet)
- Protecting floodplains is important for corridor function and ecosystem integrity. Maintain or increase use of prescribed fire in longleaf pine forests, particularly protected examples such as Pondberry Bay.

6. Lumber/Little Pee Dee Corridor

Geographic Extent

In North Carolina, largely following Lumber River from state line upstream to NC 401. This reaches the boundary of the Sandhills Conservation Partnership focus area. In South Carolina, following Lumber River to confluence of Lumber and Little Pee Dee Rivers.

Conservation Importance

The Lumber River is one of the state's four Natural and Scenic Rivers and an 81 mile portion of it is additionally designated a National Wild and Scenic River (only one of five in NC), so designated because the National Park Service determined it to have "outstandingly remarkable" resources, which include recreation, fish, wildlife, scenery and botany. Wild and Scenic sections include from State Route 1412/1203 (river mile 0) to the Scotland/Robeson County lines at the end of the Maxton Airport Swamp (river mile 22) and from Back Swamp (river mile 56) to the North/South Carolina border (river mile 115). Its northwestern tip includes part of Sandhills Game Land and its longleaf pine communities, another rare and diminishing habitat. Naked Creek subwatershed of the Lumber River watershed designated Outstanding Resource Waters, the first 68.6 miles of the Lumber River designated as High Quality Waters. Conservation importance also includes Blackwater Swamps; Sandridges (e.g. Big Sandy Ridge); connectivity to Sandhills; point bars, oxbows, sloughs and levees; Blackwater Bottomland Hardwoods.

Important Species

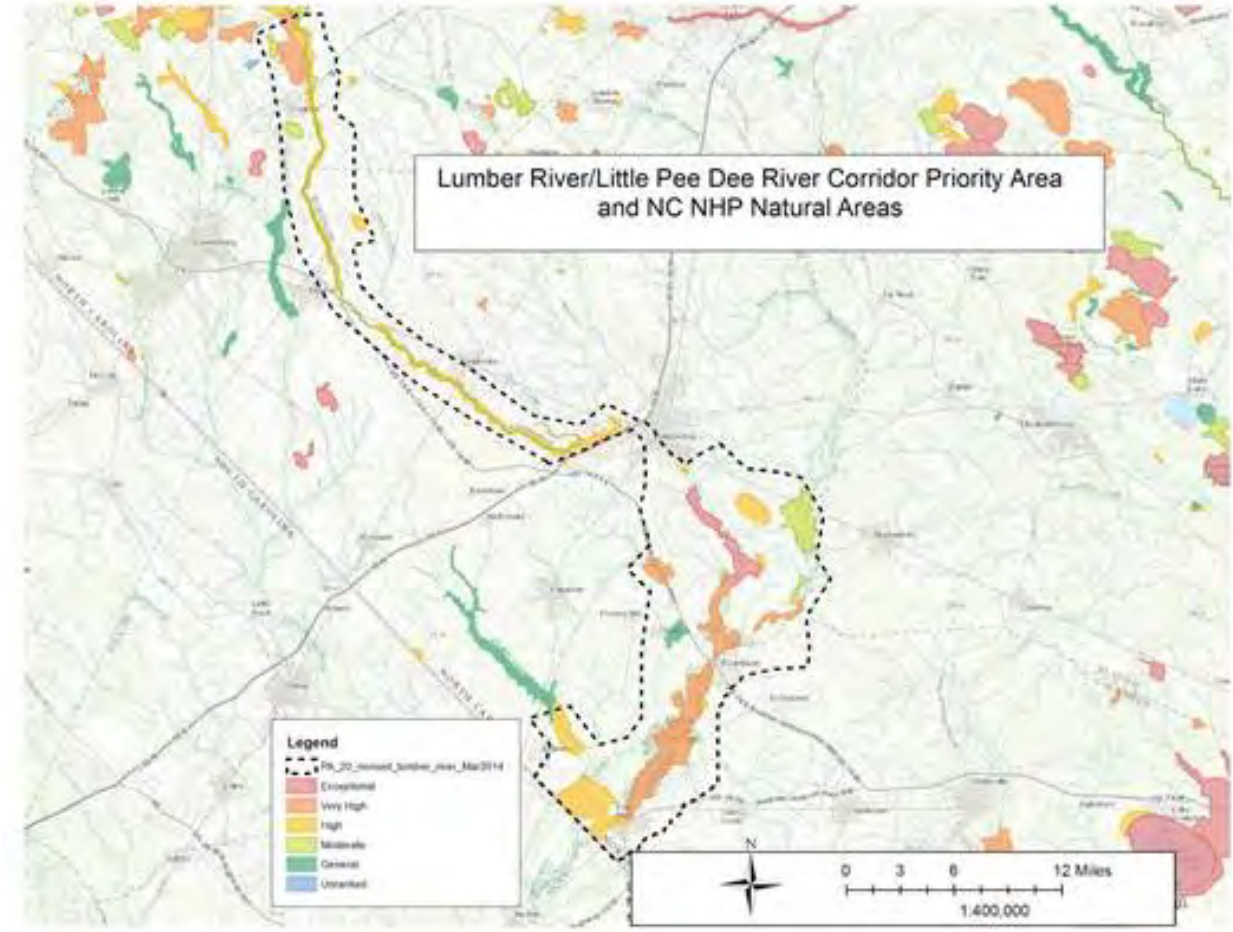
Fauna

Gulf coast spiny softshell (*Apalone spinifera aspera),* eastern coral snake (*Micrurus fulvius*), timber rattlesnake (Crotalus horridus), river frog (historic), coachwhip (*Masticophis flagellum*), Carolina bogmint (*Macbridea caroliniana*), Townes' clubtail (Stylurus scudderi) (historic), sandbar tiger beetle (*Cicindela blanda),* rafinesques big-eared bat (*Corynorhinus rafinesquii macrotis)* southeastern myotis (*Myotis austroriparius*), swallowtail kite (*Elanoides forficatus*), wood stork (*Mycteria americana*), yellow-crowned night heron (*Nyctanassa violacea*), red-headed woodpecker (winter habitat), anhinga (*Anhinga anhinga*), Cape Fear threetooth (*Triodopsis soelneri*), santee crayfish (*Procambarus blandingii*), snail bullhead (*Ameiurus brunneus*), thinlip chub (*Cyprinella sp.* (cf. zanema)), Everglades pygmy sunfish (*Elassoma evergladei*), banded pygmy sunfish (*Elassoma zonatum*), blackbanded sunfish (*Enneacanthus chaetodon*), pinewoods darter (*Etheostoma mariae*), lined topminnow (*Fundulus lineolatus*), dollar sunfish (*Lepomis marginatus*), spotted sunfish (*Lepomis punctatus*), ironcolor shiner (*Notropis chalybaeus*), taillight shiner (*Notropis maculatus*), broadtail madtom (*Noturus sp. cf. leptacanthus*).

Flora

Woody goldenrod (*Chrysoma pauciflosculа*), threadleaf sundew (*Drosera filliformis*),

NHP Natural Areas



Land Owners/Use

North Carolina Division of Parks and Recreation, Lumber River Conservancy. Primary uses include recreation and forestry.

Existing Conservation Lands

The Lumber River State Park currently contains 11,064 acres of land and 115 miles of natural and scenic waters. The Lumber River Conservancy owns and monitors multiple conservation easements.

Threats

Nutrients, development, pollution from industrial sources and agricultural sources.

Key Contacts

NC Division of Parks and Recreation, NC Wildlife Resources Commission, Lumber River Conservancy, Winyah Rivers Foundation

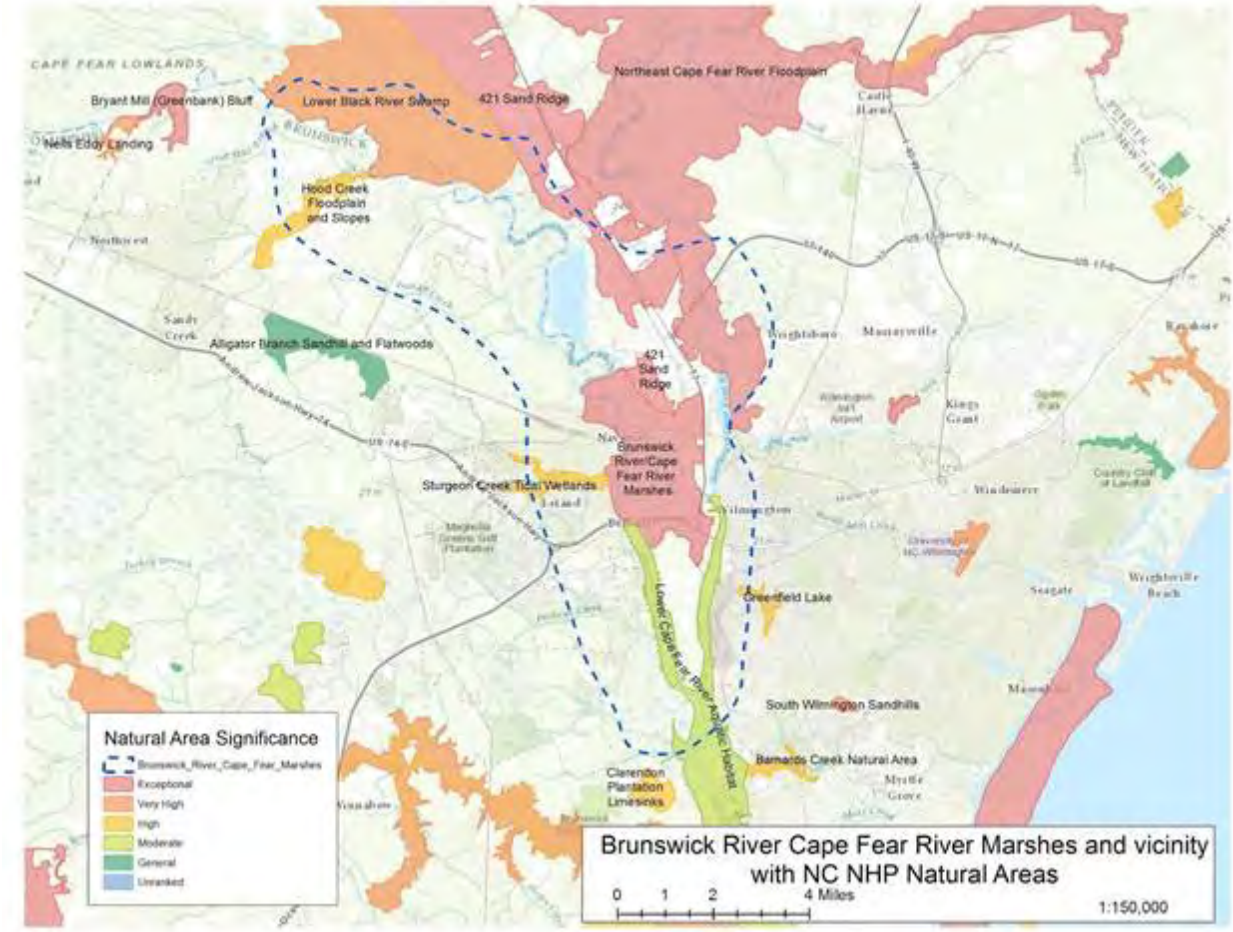
Objectives/ Action

- Implement the Little Pee Dee River Management Plan.
- Increase riparian buffer connectivity/protection. Lumber River Basinwide Water Quality Plan of March 2010 includes recommends this objective for Mill Branch AU # 14-6 and Porter Swamp AU # 14-27 as they both impaired for biological and ecological integrity due to habitat degradation resulting partly from nonpoint source pollution. Possible funding through the CWMTF or the DWQ Nonpoint Source 319(h) Program. Both streams are in an EEP targeted local watershed and, therefore, could be restored through mitigation projects.
- Reduce nutrient input-implement BMPs.
- Monitor/minimize aquatic/terrestrial invasives.
- Protect mature bottomland hardwood & sand ridges from development and incompatible uses if clay-based bays are added, some hydrologic restoration of ditches would be necessary. Other recommendations specific to clay-based bays: many need fire and some may need work to remove invading off-site species such as loblolly pine. Protect upland buffers for the bays, incorporating appropriate management strategies for the amphibians and reptiles.
- *Notes: Most aquatic species of concern are upstream of Lumberton; biologists recommended extending corridor to Sandhills. The question was whether to be inclusive and extend the focus area out to basins, or draw a narrower corridor along the mainstem, along the lines of the Landscape Habitat Indicator Guild Core Areas. An even more extensive boundary was considered that would include ecologically important clay-based Carolina Bays, such as Antioch Bay, and rare variants of Mesic Pine Savanna natural communities; the Steering Committee will have to provide some guidance.*

7. Brunswick River/ Cape Fear River Marshes and vicinity

Geographic Extent

This Focus Area comprises an extensive area of regularly flooded, freshwater tidal flat systems along the Cape Fear and Brunswick Rivers. From just south of Eagles Island and the confluence of the Cape Fear and Brunswick Rivers, the Focus Area extends northward and widens as it takes in the Northeast Cape Fear River through northern New Hanover County and the Cape Fear River to its junction with the Black River in southern Pender County and then west along the Cape Fear River almost to Riegelwood.



Conservation Importance

This focus area is important for Tidal Freshwater Marsh and Tidal Cypress-Gum Swamp natural communities and is one of the largest Tidal Cypress-Gum Swamp natural communities. Carolina bishopweed (*Ptilimnium ahlesii*) is a recently described species from the area. Based on what is currently known about the species, there would appear to be a lot of prime habitat here, and almost nowhere else in the state. The Brunswick River/Cape Fear River Marshes are the largest areas of tidal freshwater marsh habitat in North Carolina.

Important Species

Fauna

Dukes' skipper (*Euphyes dukesi*), rare skipper (*Problema bulenta*), glossy crayfish snake *(Regina rigida),* and black swamp snake *(Seminatrix pygaea).*

The Lower Cape Fear River Aquatic Habitat is brackish and contains numerous rare animals including the endangered shortnose sturgeon (*Acipenser brevirostrum*), Atlantic Sturgeon *(A. oxyrhynchus),* American shad *(Alosa sapidissima),* striped bass *(Morone saxatilis)*, the state threatened American alligator *[Alligator mississippiensis T (S/A)]* and on occasion the endangered manatee (*Trichechus manatus*).

Flora

Spoonflower (*Peltandra sagittifolia*), ribbed bishopweed (*Ptilimnium ostatum*), Carolina bishopweed (*Ptilimnium species*)

Guilds

Freshwater Marshes, General Marshes, Sparsely Settled Mixed Habitats, Forested Floodplains and Non-Riverine Wet Flats, Cypress Gum Swamp Forests.

Notable NHP Natural Areas

421 Sand Ridge (southern portion), Brunswick River/Cape Fear River Marshes, Greenfield Lake, Hood Creek Floodplain and Slopes, Lower Black River Swamp (downstream portion), Lower Cape Fear River Aquatic Habitat, Northeast Cape Fear River Floodplain (downstream portion), Sturgeon Creek Tidal Wetlands

Land Owners/Use

Mix of industrial, residential, commercial and conservation. The freshwater tidal marshes and swamp forest are the key features of this focus area. Large portions of these marshes and wetlands have been altered by past ditching and construction of dikes and roads making the remaining naturally wet areas all the more important to the river system. Wetland laws and cost currently make development in the marsh and swamp forest prohibitive. Land use in the marsh and swamp forest is predominately hunting, fishing, birding, recreational paddling and boating and recently the eco-tourism industry.

Existing Conservation Lands

Conservation lands within this focus area include the Eagles Island Conservation Area (approximately 750 acres), Sutton Lake Game Lands (1,410 acres leased to NCWRC by Progress Energy), the Northeast Cape Fear River NCCLT Easement (501 acres), NCCLT easement adjacent to the Sutton Game Land (287 acres), the Cape Fear River DuPont Easement to The Conservation Fund (1,342 acres) and the Cape Fear Wetlands Game Area and Roan Island (1,752 acres and 2,740 respectively and owned by NCWRC). In addition the US Army Corps of Engineer manages approximately 800 acres of land on the southern end of Eagles Island which is used for dredge material deposits.

Key Contacts

Cape Fear River Partnership, North Carolina Wildlife Resource Commission, Eagles Island Conservation Coalition, Cape Fear RC&D, North Carolina Coastal Land Trust, The Conservation Fund, New Hanover Soil and Water Conservation District and the USACOE.

Threats

Increased salinity, increased tidal amplitude and sea-level rise are significant threats to this focus area. Increased salinity has changed the face of Eagles Island and the river's riparian flats causing the transition of the cypress-gum forest to open marsh communities as the salinity moves upstream. Increased tidal amplitude due to dredging the Cape Fear River is one cause of increase salinity in PPK and of salinity moving further up the basin. Marsh plants are transitioning from freshwater plants to salt marsh plants on Eagles Island and perhaps north. Phragmites *(Phragmites australis)* is established in the disturbed areas of Eagles Island and presumably other disturbed areas such as along roadbeds and bridges in the focus area. Industrialization and development such as the proposed new state port, the Titan cement plant (if permitted) and others in the future are certain to change this focus area. While development in the marshes is unlikely, development on higher ground that is contiguous to marshes is likely and has the potential of affecting the marshland. Loss of access to upper reaches by anadromous fish due to dams in the Cape Fear River and its tributaries. While this is not a new threat, it continues to keep the potential population of several species of anadromous fish at dangerously low numbers, due to their inability to complete their natural reproductive cycle.

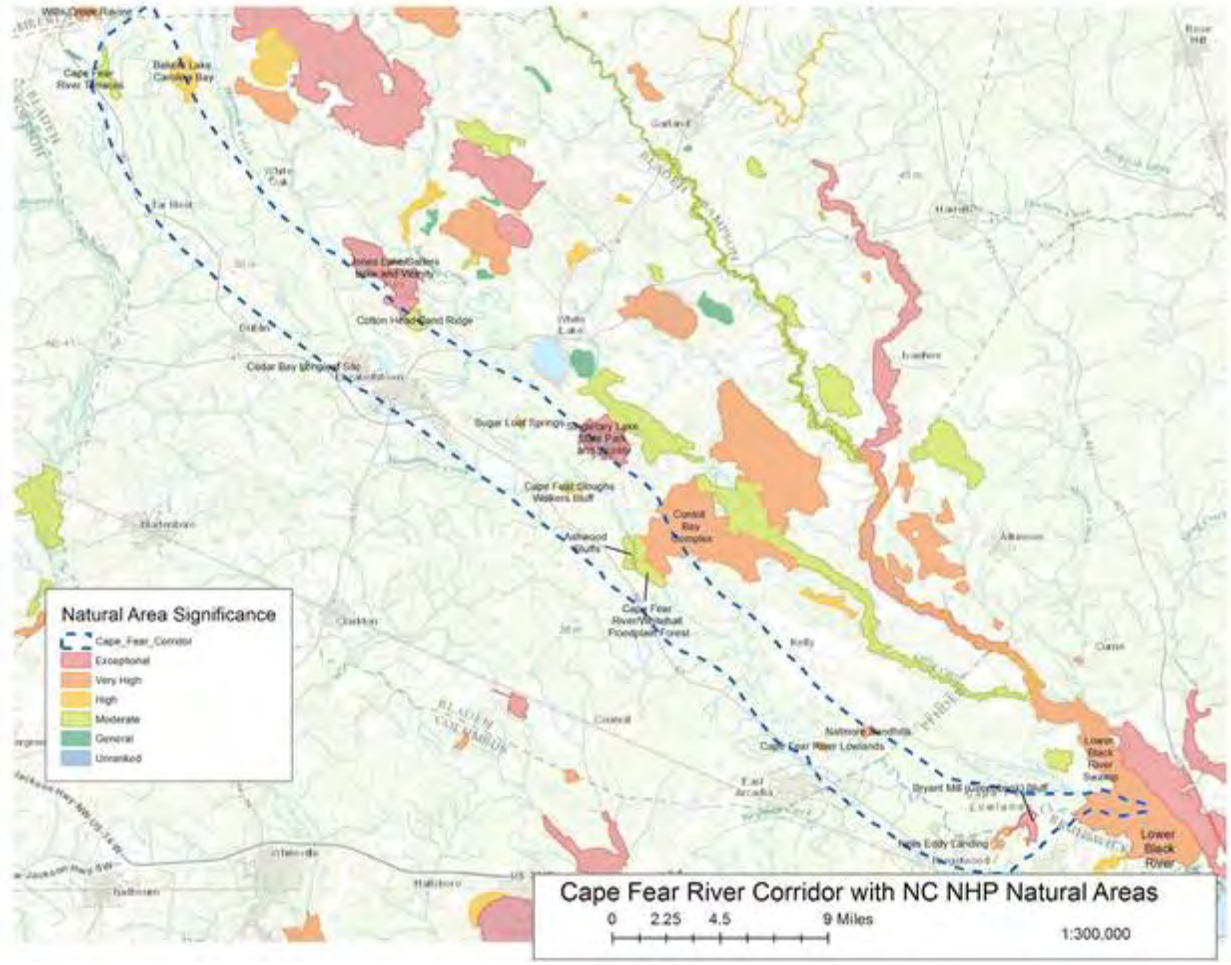
Objectives/ Action

- Implement the Cape Fear River Partnership Action Plan
- Shifts in habitat related to sea level rise and global warming are a set of issues that should be discussed with respect to maintaining landscape connections. Maintain high-quality, intact example of Tidal Freshwater Marsh natural community. Allow to adapt to changing climate conditions, and persist as long as it can as sea level rises to serve as a reservoir of Tidal Freshwater Marsh species to move upstream.
- Phragmites is currently along the road at Eagles Island, but has the potential to spread. This would be a good time to act to control this invasive exotic species, and monitor for it in fringing marshes.
- Increase areas of longleaf pine forest ecosystem and increase prescribed fire in the suppressed longleaf pine natural areas, including the longleaf pine habitats associated with 421 Sand Ridge,.

8. Cape Fear River Corridor

Geographic Extent

This focal area includes the aquatic habitat and riparian buffers of the Cape Fear River Corridor from south of Fayetteville to its confluence with the Black River.



Conservation Importance

Nursery area, sturgeon nursery area, DMF importance. Best known location for Swallow-tailed Kite in North Carolina. Natural communities, including Coastal Plain Marl Outcrops, and the best example of Coastal Plain Cliff in North Carolina.

Important Species

Fauna

Atlantic sturgeon (*Ascipenser oxyrinchus*), shortnose sturgeon (*Ascipenser brevirostrum*), American alligator (*Alligator mississippiensis*), swallow-tailed kite (*Elanoides forficatus),* a cane borer moth *(Apameine new genus 2 sp. 1),* Southeastern myotis *(Myotis austroriparius),* Rafinesque's big-eared bat *(Corynorhinus rafinesquii macrotis)*

Flora
Carolina spleenwort (*Asplenium heteroresiliens*), swamp panic grass *(Phanopyrum gymnocarpon),* social sedge *(Carex socialis),* Carolina grass-of-parnassus *(Parnassia grandifolia), c*utleaf water-milfoil *(Myriophyllum pinnatum),*

Guilds
Dry-Wet Hardwood and Mixed Forests, Forested Floodplains and Non-Riverine Wet Flats, Salt-influenced Marshes, Freshwater Marshes, Brownwater Levee Hardwood Forests, Cypress-Gum Swamp Forests, Rich Bottomland and Basic-Mesic Forests, Wet Hardwood Forests, Wet-Mesic Hardwood Forests, Dry-Hydric Hardwood and Mixed Forests, Sparsely Settled Mixed Habitats.

Land Owners/Use
This stretch of the river is predominantly rural with land use focused on row crop agriculture, concentrated animal feeding operations and forestry.

Existing Conservation Lands
Bladen Lakes State Forest, Whitehall Plantation Game Lands, NC Coastal Land Trust Conservation Easements, Wetlands Reserve Program Easement

Key Contacts
Cape Fear River Partnership, NC Forest Service, NC Wildlife Resources Commission, Cape Fear River Watch, NOAA NMFS, DENR Division of Marine Fisheries

Threats
Potential threats to water quality and/or ecological integrity of the both rivers and their floodplains due to excess nutrients and fecal coliform bacteria from leaking or breached animal waste lagoons. Other threats include the continued impediments to migratory fish passage to historical spawning grounds that exist at Lock and Dam #2 and #3.

Objectives/ Action
Implement the Cape Fear River Partnership Action Plan.

Part II
Terrestrial

Section One
Terrestrial Priority Habitats

Longleaf Pine

Description

The Cape Fear Arch Conservation contains the full diversity of longleaf pine natural communities, ranging from the dry sandhills to the very wet savannas. These fire-adapted habitats are in some ways better known for their diverse herbaceous layer than the forest canopy that is typically widely spaced with the single pine species. That is, when the frequent low-intensity fires that these ecosystems evolved with are still taking place; the past century's emphasis on fire suppression caused forests to grow more densely, crowding out sunlight and greatly reducing the variety of woodland plant and animal species. Many of the botanical wonders of the Cape Fear Arch, including some of the more well-known carnivorous plants, are associated with the longleaf pine habitat.

Threats

Currently, the greatest threat comes from development pressure. Historically, conversion and exploitation destroyed most of this once extensive ecosystem, and these forces continue to consume the remnants. Among protected examples, inadequate fire and it consequences are the greatest ecological threat. Species such as Venus flytrap will be shaded out within about six years, without fire or other processes to maintain open habitat structure. For particular species, especially insects, too frequent or too extensive burning (whether by wildfire or prescribed burns) can have major effects when coupled with loss of landscape integrity resulting from habitat loss.

Opportunities

Prescribed burning is crucial for retaining these systems in both the present and the expected climate. It is important in preparing for climate change because excess fuel loads increase the risk of destructive wild fire during droughts. Beginning prescribed burning programs in moist periods is important, as reducing fuel loads safely while avoiding ecological damage takes time. Sites that have had regular fire will be safer from wild fire, will make it easier to control wild fire, and will allow prescribed burning to continue into drier conditions. Regular burning will also promote healthy, diverse communities and species, which will allow the best potential for communities to adapt to changing climate.

Because so few examples remain, protecting and expanding remaining examples is crucial with or without climate change. Because these systems are likely to withstand the stresses of changing climate well, restoring more of them in the near future would produce more resilient natural landscapes. Protecting and restoring landscape connections is important to allow movements of mobile species and to improve the viability of small populations. The need for this is particularly important for disturbance-maintained habitats such as longleaf pine ecosystems and will increase with the stresses of a changing climate.

Cape Fear Arch Endemic Species and Natural Communities

An uplift of sand and limestone deposits called the Cape Fear Arch Geological Uplift occurs from Cape Lookout, North Carolina to Cape Romain, South Carolina and westward towards Fayetteville. This uplifted area provides the setting for a number of plants and animals considered endemic to the Cape Fear Arch region, which means they are found nowhere else. A partial list of endemic plants and animals in the Cape Fear Arch is provided in Appendix A, and the reader can see that a number of them are associated with longleaf habitats, such as pine savannas. Lake Waccamaw and the Waccamaw River also provide habitat for an impressive collection of animals endemic to the region. Because of the unique species and natural communities, the coastal plain of southeastern North Carolina and northeastern South Carolina is considered one of the most biologically diverse areas along the Eastern United States. The Venus Fly trap is one of the more recognizable endemic species on the list.

Natural Communities

Blackwater Bottomland Hardwoods (Evergreen Subtype) - Primarily Waccamaw River and Juniper Creek
Sand and Mud Bar (Blackwater Drawdown Bar Subtype) - Waccamaw River
Coastal Fringe Evergreen Forest (Typic Subtype)
Sandy Pine Savanna (Rush Featherling Subtype)
Very Wet Loamy Pine Savanna
Wet Pine Flatwoods (Sand Myrtle Subtype) - Primarily in Boiling Spring Lakes/MOTSU area

Savanna Indigo-bush (*Amorpha confusa*) in the Green Swamp
The Cape Fear Arch contains all of the world's natural populations. Columbus and Brunswick Counties contain 54 of the 57 known populations. Photo by Laura Robinson

Pocosin

Description

While pocosins occur in neighboring states, North Carolina contains most of the world's pocosins, and the Cape Fear Arch contains some of the best examples. It is the evergreen shrubs and wet organic soils that characterize pocosins, often with pond pine providing the canopy. Many pocosins in the Cape Fear Arch are associated with Carolina bays, but there are also some extensive pocosins on broad terraces between streams and rivers, and their height (which represents accumulated deposition of organic materials over many years), provides the story of their name, which is said to mean "swamp on a hill".

Threats

Pocosins where the canopy has been harvested often do not regenerate. Ditching for drainage and for road construction alters natural communities, increases wildfire damage, and likely exacerbates effects of droughts. Loss of natural fire has altered communities and ecosystem processes. Deep peat fires in artificially drained areas cause lasting damage to communities. Another consideration is conversion: While deeper peats resist conversion, pine plantations do replace Pond Pine Woodland in some places.

Opportunities

Restoring hydrology by reversing the effects of artificial drainage is probably the most important action to protect pocosins. Drainage increases the damage caused by wildfires, and is likely to exacerbate the effects of increased drought. Many pocosins which have retained their natural character despite the presence of ditches may be more affected in the future, as droughts become more frequent. Impounding effects of roads also alter hydrology in some peatlands, and may have increasing impact if rainfall events become more extreme.

Prescribed burning is difficult in pocosins, and safe techniques have not been worked out to burn many examples. Conducting prescribed burns in favorable conditions would reduce the risk of uncontrollable wildfires during droughts, with their accompanying peat fires and widespread smoke problems.

Coastal Plain Floodplain Forest

Description

Coastal Plain Floodplain forests – The WRC Wildlife Action Plan notes that Coastal Plain floodplain forest habitat includes levee forest, cypress-gum swamps, bottomland hardwoods, and alluvial floodplains with small poorly defined fluvial features (such as Small Stream Swamps), as well as semipermanent impoundments (beaver ponds and mill ponds), sand and mud bars, and oxbow lakes. Floodplain forest may be associated with blackwater rivers (originating in the Coastal Plain) or brownwater rivers (originating in the Piedmont or Mountains but flowing into the Coastal Plain). The rivers and floods are what make river-floodplain habitats different from others, and the floods are an important and beneficial part of life. The floodplain forest systems of the Coastal Plain in the southeast are now only small fragments and sections of the original millions of acres present before European settlement and have been lost or altered by development, drainage, agriculture and logging. Several of the species of wildlife that once called large floodplain systems home are gone or greatly reduced in numbers.

Opportunities

Blackwater bottomland hardwoods, cypress-gum swamps, levee forest communities. Protect/Expand Remaining Examples; Control Invasive Species (Species that are not already widespread may be easier to target than some of the worst invaders.); Maintain natural hydrology (Restore if necessary); Determine if groundwater extraction is affecting systems

Levee Forests

Description

Levee Forest communities in blackwater systems occur on natural levee deposits along channels of large rivers. Dominant trees include wetland hardwoods such as laurel oak, overcup oak, willow oak, river birch, sweetgum, red maple and American elm. Loblolly pine may be common, especially in disturbed sites. These areas are seasonally to intermittently flooded, and typical of blackwater river systems, there is a highly variable flow regime with floods of short duration and periods of very low flow. The shrub layer ranges from sparse to dense and the herb layer is usually well developed. These areas are greatly affected by the forces of the river and are the rarest of the blackwater floodplain natural communities. Brownwater Levee Forests, in contrast to blackwater levee habitats, tend to have periods of sustained high flow and the water is high in pH, nutrients and mineral sediment.

Threats

Harvesting of canopy trees, groundwater depletion; invasive species. 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.

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

Opportunities

Protect/Expand Remaining Examples; control invasive species (species that are not already widespread may be easier to target than some of the worst invaders.); maintain natural hydrology (restore if necessary); determine if groundwater extraction is affecting systems.

Bottomland Hardwoods in Blackwater

Description

Bottomland Hardwoods in blackwater systems occur on high parts of the floodplain away from the channel and are dominated by laurel oak, water oak, willow oak, overcup oak, red maple, sweetgum, loblolly pine, and occasionally Atlantic white cedar (Schafale and Weakley 1990). Shrub layers can be very dense and switch cane can be common. Flooding occurs in these sites occasionally but they are seldom disturbed by flowing water like levees. Blackwater rivers carry little inorganic sediment so flooding does not provide a substantial nutrient input as it does in brownwater systems (Schafale and Weakley 1990). These areas may carry fires (due to dense lower layers of vegetation) when dry and the occurrence of fire would affect the plant community composition and structure. Bottomland hardwoods in brownwater systems are found throughout the Coastal Plain and typical trees include swamp chestnut oak, cherrybark oak, laurel oak, water oak, willow oak, Shumard's oak, sweetgum, green ash, shagbark hickory, bitternut hickory, water hickory and American elm (Schafale and Weakley 1990). These systems are seasonally to intermittently flooded and the water table may be high for long periods even when the site is not flooded.

Threats

Harvesting of canopy trees, groundwater depletion; invasive species. 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.

Opportunities

Protect/Expand Remaining Examples; control invasive species (species that are not already widespread may be easier to target than some of the worst invaders.); maintain natural hydrology (restore if necessary); determine if groundwater extraction is affecting systems.

Cypress-Gum Swamp

Description

Cypress-Gum Swamps occur in the wettest forested parts of the floodplain, in sloughs, in backswamps, and in the flat, featureless floodplains. These areas may be flooded well into the growing season, sometimes almost permanently. They are dominated the few tree species able to tolerate such long term flooding -- bald cypress, pond cypress, and swamp black gum. Carolina water ash and red maple are essentially the only understory trees. Shrubs, and usually herbs, are sparse.

Threats

Harvesting of canopy trees, groundwater depletion; invasive species.
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.

Opportunities

Protect/Expand Remaining Examples; Control Invasive Species (Species that are not already widespread may be easier to target than some of the worst invaders.); maintain natural hydrology (restore if necessary).

Depressional Wetlands

Description

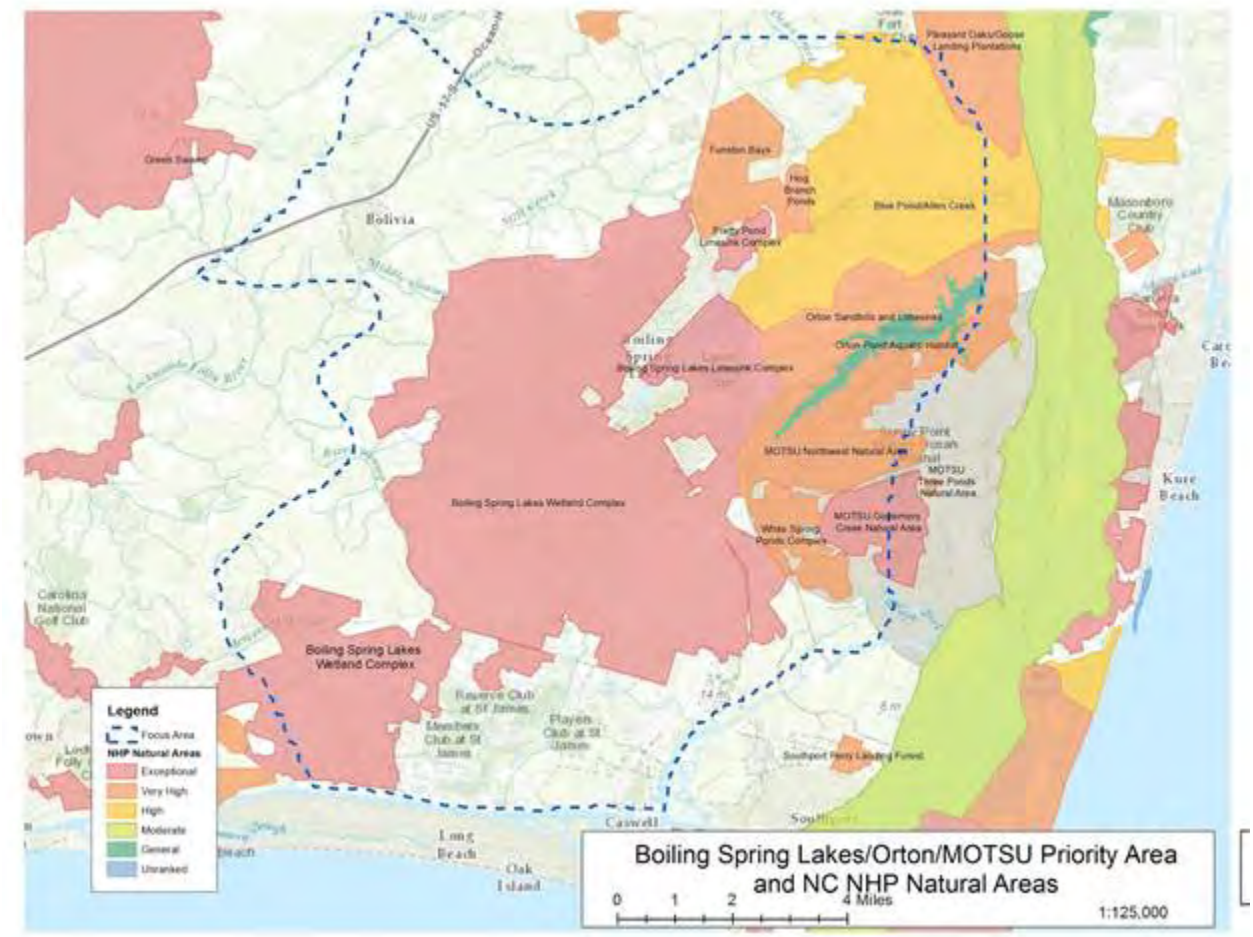
Another habitat associated with rare plants and animals, depressional wetlands are particularly important to amphibians, like gopher frogs. That being said, half a dozen of more rare plant species often occur in a single pond in the Cape Fear Arch. As with all communities that occur as small patches, the surrounding landscape is of great importance. The relationship of water table levels and groundwater withdrawal to depressional wetlands is not well understood.

Section Two
Terrestrial Focal Areas

1. Boiling Springs Lake / Orton Plantation/Sunny Point

Geographic Extent

Bounded by the Cape Fear River to the east, Town Creek Watershed boundary to the north, Lockwood Folly watershed boundary to the west, and the IntraCoastal Waterway to the south.



Conservation Importance

All longleaf pine community types associated with sandy Coastal Plain occur in this focus area, and some of the forests are old growth examples. This focus area also has one of the best examples of limesink pond communities in the state. Global majority of two plant communities only exist within the Boiling Spring Lakes Preserve (Rush Featherling Subtype of Sandy Pine Savanna and Sand Myrtle Subtype of Wet Pine Flatwoods). There are also numerous rare plant and animal species. Any one of these biological factors would make this focus area an important place for conservation; the importance is magnified by the "cluster" of several large natural areas adjacent or nearly adjacent. The landscape remains a viable, if challenging, opportunity for conservation of Longleaf/Carolina bay landscape.

Important Species

Fauna

Worth noting in this focus area are the populations of Red-cockaded Woodpecker (*Picoides borealis*) and Carolina Gopher Frog (*Lithobates capito*). The list of rare plants is over 50 species in length, so not included here in its entirety. There are also six globally rare moths, including the sand myrtle geometer (*Cyclophora* sp 1), which is known only from the population at Boiling Spring Lakes and the populations found in the Pine Barrens of New Jersey. There are also eight rare reptiles in this focus area, and two globally critically imperiled gastropods.

Flora

There are important populations of numerous rare savanna and flatwoods plant species found here, including Rough-leafed Loosestrife (*Lysimachia asperulifolia*), Venus Flytrap (*Dionaea muscipula*), and Savanna milkweed (*Asclepias pedicellata*), as well as rare plants associated with the depressional wetlands/limesink ponds.

Land Owners/Use

The Boiling Spring Limesink complex natural area contains incredible rare plant diversity, red-cockaded woodpeckers, and high quality examples of small depression ponds, coastal fringe hardwoods and wet pine flatwoods. A portion of the limesink complex area is upland and has been developed as the core of residential Boiling Spring Lakes, while the larger BSL Wetland Complex is still undeveloped. Orton Plantation is privately owned and managed. Sunny Point is a military installation, also known as MOTSU, or the Military Ocean Terminal at Sunny Point.

Existing Conservation Lands

The NC Dept of Agriculture Plant Conservation Program owns and manages a 7,225-acre nature preserve around Boiling Springs Lake. NC Coastal Land Trust holds a conservation easement on 6,400 acres at Orton Plantation. Military Ocean Terminal at Sunny Point (Sunny Point) is a military installation with a variety of high-quality habitats, and a management approach to help conserve those habitats and rare species, particularly with prescribed fire, compatible with military mission. The NC Wildlife Resources Commission also recently became a more active partner in the focus area, acquiring new game lands with particular interest in Carolina Gopher Frog conservation.

Key Contacts

Collaborative partnership between: The Nature Conservancy- BSL, The Plant Conservation Program

Objectives/ Action.

- Build on efforts to burn longleaf habitats and pocosins at appropriate return intervals.
- Continue to acquire land to reduce fragmentation, maintain connectivity, and buffering patch habitats such as depressional wetlands.
- Maintain key areas of working forest as working forest (e.g. smoke buffers adjacent to actively managed lands, important connectors, etc.).
- Determine the effect of groundwater table levels on depressional wetlands.
- Develop recovery plan for the endangered red-cockaded woodpecker in this region.

2. Juniper Creek

Geographic Extent

Juniper Creek and its headwaters, including Green Swamp and Honey Island Swamp, are the key features in this priority area, located in Brunswick and Columbus Counties, NC.

Conservation Importance

This area of Brunswick and Columbus Counties contain very high biological diversity, as well as a variety of intact, high-quality examples of natural communities, from longleaf pine savanna to bottomland hardwoods. The focus area contains a number of distinct Natural Heritage Areas, including: Green Swamp, Camp Branch Savanna Remnant, Juniper Bay Savanna, Juniper Creek Floodplain, and the Juniper Creek/Driving Creek Aquatic Habitat. There is one very rare natural community in this landscape (Very Wet Longleaf Pine Savanna at Myrtle Head Savanna), as well as examples of the Wet Loamy Pine Savanna (particularly in the Green Swamp). There are also good and extensive examples of pocosin peatlands, bottomland hardwoods, and cypress-gum swamps, as well as other rare communities, such as pocosin openings and floating bogs. The Blackwater Bottomland Hardwoods (Evergreen Subtype) is important to note for its rarity, and the example along Juniper Creek is one of the best (the other Blackwater Bottomland Hardwoods are more common types, but are high quality and extensive). A major focus of this priority area is the Juniper Creek and its floodplain, as both an aquatic system and its floodplain swamp system. Juniper Creek provides landscape connectivity to Waccamaw River Corridor. Note the number and diversity of rare species present, (the list below is only partial). In some cases, most of the known global occurrences of certain rare species, such as Savanna Indigo-bush (*Amorpha confusa*), are within this priority area.

Important Species

Fauna

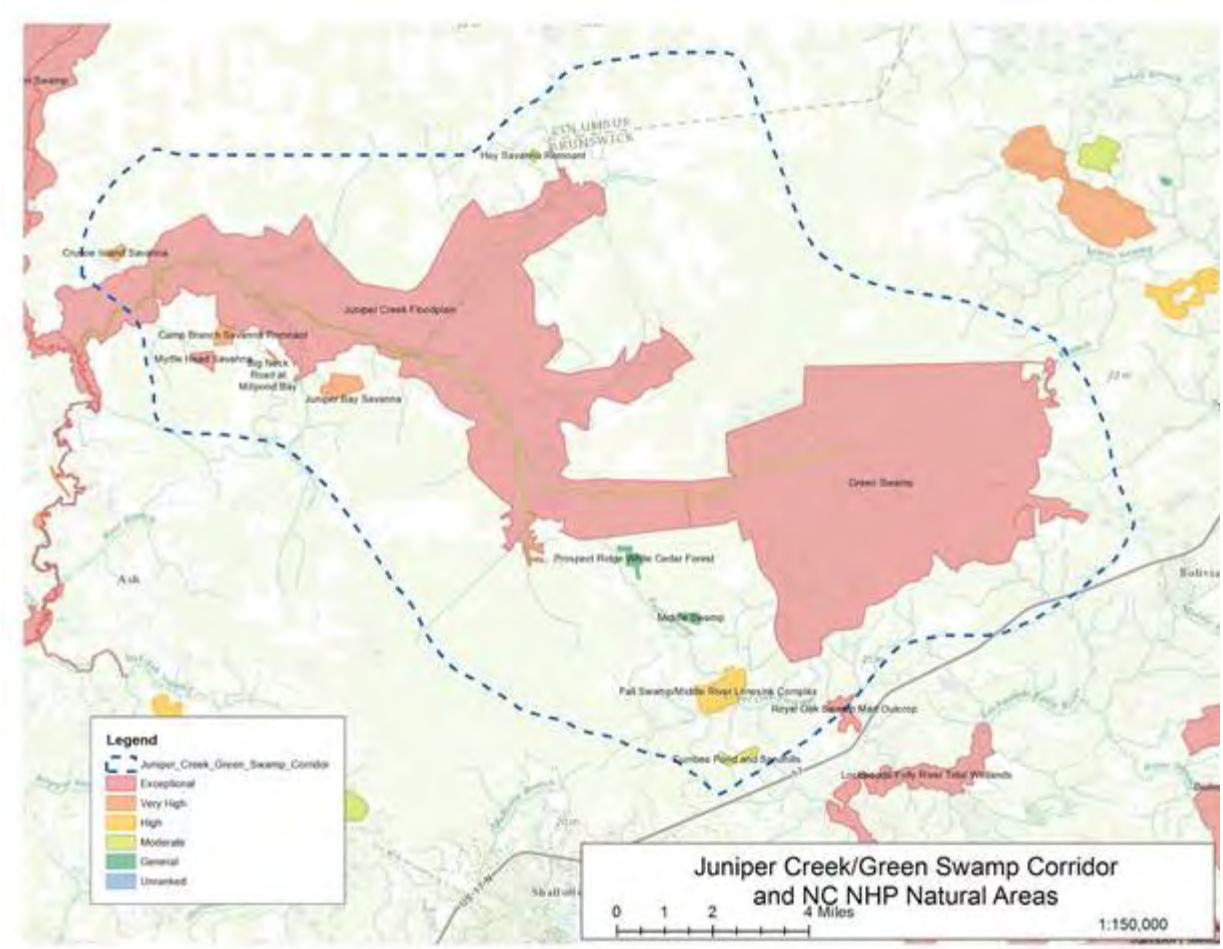
Golden Topminnow (*Fundulus chrysotus)*, Carolina Pygmy Sunfish *(Elassoma boehlkei),* Blackbanded Sunfish *(Enneacanthus chaetodon),* Bachman's Sparrow*(Peucaea aestivalis),* Cape Fear Threetooth *(Triodopsis soelneri),* Banded Sunfish *(Enneacanthus obesus*), Plymouth Gentian *(Sabatia kennedyana),* Nubile Short-wing Grasshopper *(Melanoplus nubilus),* Dusky Roadside-Skipper*(Amblyscirtes alternate),* Waccamaw Crayfish (*Procambarus braswelli),* Hessel's Hairstreak *(Callophrys hesse*li), Star-nosed Mole - Coastal Plain population (*Condylura cristata pop*. 1), Little Beggar Moth (*Eubaphe meridiana*),Brenda's Hypagyrtis Moth(*Hypagyrtis brendae*), Four-lined Chocolate (*Argyrostrotis quadrifilaris*), Eastern Henslow's Sparrow *(Ammodramus henslowii susurrans).*

Flora

Carolina Grass-of-parnassus *(Parnassia caroliniana),* Wireleaf Dropseed *(Sporobolus teretifolius),* Waccamaw River Spiderlily*(Hymenocallis pygmaea),* Bog Bluestem (*Andropogon mohrii*),Savanna Indigo-bush *(Amorpha confusa),* Leconte's Thistle *(Cirsium lecontei),* Chapman's Three-awn *(Aristida simpliciflora),* Rough-leaf Loosestrife*(Lysimachia asperulifolia),* Spring Sneezeweed*(Helenium vernale),* Baldwin's Nutrush *(Scleria baldwinii),* Giant Spiral Orchid*(Spiranthes longilabris),* Sessile Yellow Stargrass (*Hypoxis sessilis*), Coastal Plain St. John's-wort (*Hypericum brachyphyllum*), Eaton's Ladies'-tresses*(Spiranthes eatonii),* Florida Ladies'-tresses*(Spiranthes floridana).*

Guilds

Atlantic White Cedar Forest, Dry-Hydric Hardwood and Mixed Forests, Forested Floodplains and Non-Rivene This area of Brunswick and Columbus Counties contain very high biological diversity, as Wet Flats, Herbaceous Peatlands and Pitcher Plant Meadows, Savannas and Wet Sandy Herbaceous Swales, Sedge Mires, Sparsely Settled Mixed Habitats, Wet-Mesic Hardwood Forests, Wet-Mesic Pine Woodlands, Wet-Xeric Longleaf-Wiregrass Woodlands, Wet Acidic Shrublands.



Land Owners/Use

The majority of land in this corridor is protected. There are still a few tracts of land in private ownership between the Columbus County Game Lands and Juniper Creek Game Lands.

Existing Conservation Lands

The majority of this focal area is under conservation ownership. The Nature Conservancy owns and manages 16,178 acres of land known as the Green Swamp Preserve. The Wildlife Resources Commission owns 18,361 acres of adjacent land to the west referred to as Juniper Creek Game Lands as well as a portion of the Columbus County Game Lands (approximately 1,800 acres) that is near the

confluence of Juniper Creek and the Waccamaw River. The Wildlife Resources Commission also owns and manages the 1,967 acre Pinch Gut Game Lands immediately to the east of the Green Swamp Preserve.

Key Contacts

The Nature Conservancy, Wildlife Resources Commission.

Threats

Transportation infrastructure, fire suppression, historic ditching (affecting hydrology), incompatible residential/commercial development in vicinity (smoke issues).

Objectives/ Action

- Pursue acquisition opportunities to conserve remaining links in the Juniper Creek corridor.
- Continue and expand prescribed fire program within focus area, including increasing partnership opportunities between TNC and WRC.
- Enhance habitat quality through habitat restoration, particularly restoration of natural hydrologic regime, and restoring longleaf pine in plantation areas with good natural cover..
- Work towards eliminating proposed routing of Interstate 74 through the focus area.
- Maintain key areas of working forest as working forest (e.g. smoke buffers adjacent to actively managed lands, important connectors, etc).
- Grow partnerships with TIMOs in restoring longleaf pine where applicable.
- Keep key areas of working forest as working forest (e.g. smoke buffers adjacent to actively managed lands, important areas for foraging or connectivity, etc).
- Look for ways to maintain or restore ecological connectivity to adjacent focal areas
- Develop recovery plan for the endangered Red-cockaded Woodpecker in this region.

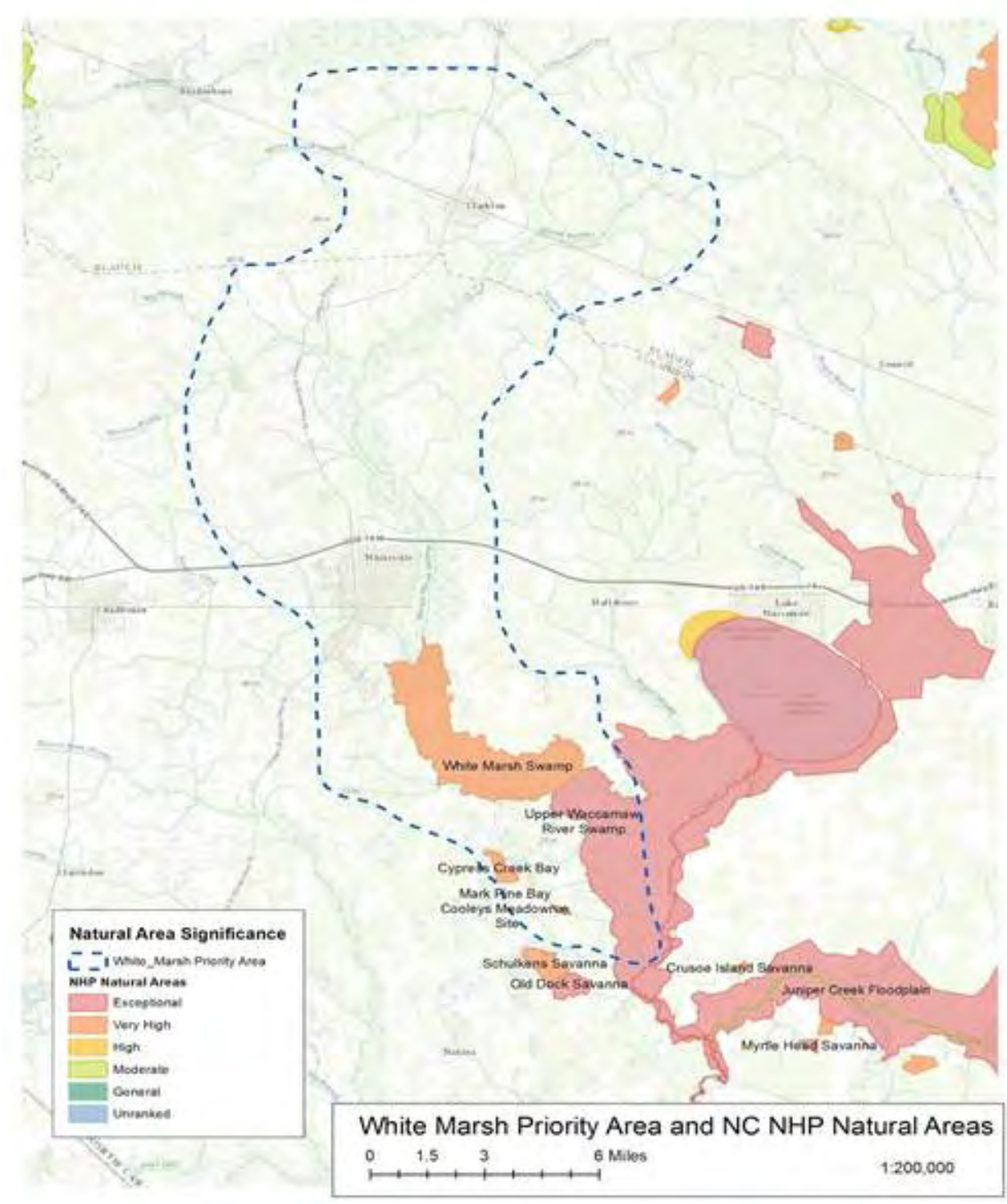
3. White Marsh System

Geographic Extent

White Marsh is a freshwater wetland system consisting of open marsh along with cypress-gum swamp that provides excellent wintering habitat for waterfowl. It runs along the southeastern side of the City of Whiteville in Columbus County to the western edge of Lake Waccamaw. The White Marsh watershed (HUC 0304020602) contains part of the Town of Chadbourn plus all of Whiteville and Brunswick. It is estimated to be the most populated watershed in the Waccamaw subbasin.

Conservation Importance

The White Marsh system discharges into the Waccamaw River. Water quality in the White Marsh is classified as Class C-- denotes freshwater protected for secondary recreation, fishing, wildlife, fish and aquatic life propagation and survival and other uses. Protecting these headwaters and the quality of water discharged from the White Marsh watershed into the Waccamaw system is of utmost importance. White Marsh is also important because of the habitat it provides for over wintering waterfowl, as well as habitat for one of the largest populations of Grassleaf Arrowhead in North Carolina.



Important Species

Threadleaf Sundew (*Drosera filiformis*), Grassleaf Arrowhead (*Sagittaria weatherbiana*), Cooley's meadowrue (*Thalictrum cooleyi*), Beadle's Coreopsis (*Coreopsis palustris*), Carolina Grass-of-Parnassus *(Parnassia caroliniana*), White-seeded Beadsedge (*Rhynchospora divergens*), Wireleaf Dropseed (*Sporobolus teretifolius*), Hooded Pitcherplant (*Sarracenia minor var. minor*), Colonial Waterbirds

Land Owners/Use

A large portion of the White Marsh watershed is made up of forested wetlands known as White Marsh Swamp and Bogue Swamp. These wooded swamps have mainly two types of trees, Tupelo and Cypress. These bottomland hardwood swamps have not been as hydrologically altered as have the pine stands because they are harvested during periods of drought. However, recent droughts have resulted in vast clear-cuts of these areas.

Existing Conservation Lands

TNC has acquired 61 acres along the White Marsh swamp and 456 acres along White Marsh and the Waccamaw River.

Key Contacts

The Nature Conservancy; Columbus County; City of Whiteville

Threats

Harvests of large timber stands in the floodplain have the potential for degraded water quality. More recently, over 18,600 acres of timberland in the White Marsh have been offered for sale by property owner, Riverstone Properties, LLC. The potential for additional clearcutting and/or land use change resulting from this offered sale is a threat to the watershed.

The White Marsh has been identified as impaired for mercury. There are 5 permitted NPDES wastewater dischargers with a total maximum daily flow of 4.03 MGD. Of these, three have violated their permit limit for Mercury (Tabor City WWTP, Red Springs WWTP and White Marsh WWTP). Tabor City WWTP was issued an administrative order by USEPA in October 2009 to reduce Mercury emissions and must develop a Mercury Minimization Plan and submit monthly monitoring reports to EPA.

Objectives/ Action

- Protection of floodplain. Work to protect mature forest, and avoid type conversion (for instance, conversion from cypress-gum swamp to another forest type), and hydrologic modification, such as ditching. Above Whiteville, there will be limited natural habitat, and protecting water quality is the key strategy.
- Work with landowners to encourage the continued purchase of easements and preserves.
- Work with forestry interests to encourage improved buffering along stream stretches.
- Work with NCDENR Division of Water Resources and WWTPs to address existing water quality impairment and protect Class C and Swamp Waters.

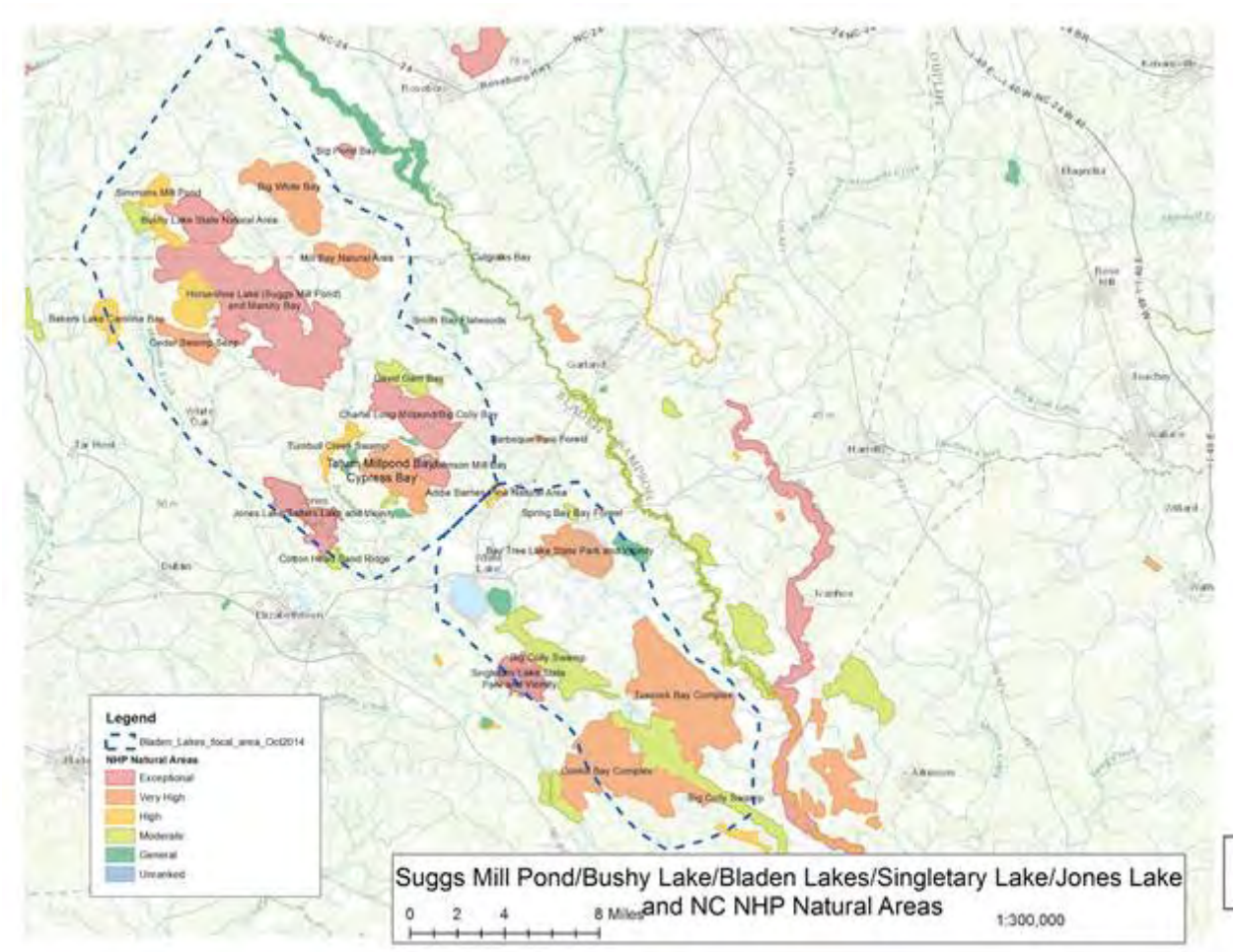
4. Bladen Lakes/Bay Complex

Geographic Extent

Extends across much of Bladen County north of the Cape Fear River, and the southeast corner of Cumberland County. Contains a number of state-owned conservation lands, including Suggs Mill Pond Game Land, Bushy Lake State Natural Area, Jones Lake State Park, Bladen Lakes State Forest, and Singletary Lake State Park.

Conservation Importance

Carolina bays and peatland pocosins are prominent ecological features, and pocosin and longleaf pine natural communities are the natural communities that would be important in the landscape. Some of the larger and best-developed Carolina bays occur here, and the landforms include overlapping bays with dunes and sand ridges.



Important Species

Fauna

Bachman's Sparrow (*Peucaea aestivalis*)*, Belle's Sanddragon (*Progomphus bellei*) , Black-throated Green Warbler - Coastal Plain Population (*Setophaga virens waynei*)*, Eastern Fox Squirrel (*Sciurus niger*)*, Grisatra Underwing (*Catocala grisatr*a), Hessel's Hairstreak (*Callophrys hesseli*), Pine Barrens

Treefrog (*Hyla andersonii*)*, Red-cockaded Woodpecker (*Picoides borealis*)*, Southeastern Myotis (*Myotis austroriparius*)*, Star-nosed Mole - Coastal Plain Population (*Condylura cristata* pop. 1)*,

Flora
Batesburg Hawthorn (*Crataegus munda*), Big Three-awn Grass (*Aristida condensate*), Threadleaf Sundew (*Drosera filiformis*), Venus Flytrap (*Dionaea muscipula*)
(* denotes SWAP species)

Guilds

Core area for Atlantic White Cedar Forest. Forested Floodplain and Nonriverine Wet Flats, and Dry Hydric Hardwood and Mixed Forests guilds. Also contains portions of Wet Acidic Shrublands, Wet Xeric Longleaf Wiregrass Woodlands, Xeric Mesic Longleaf Pine and Mixed Oak Woodlands, and Sparsely Settled Mixed Habitats Guilds.

Existing Conservation Lands

Suggs Mill Pond Game Land, Bushy Lake State Natural Area, Jones Lake State Park, Bladen Lakes State Forest, Bay Tree Lake State Park, Singletary Lake State Park, and lands encumbered by conservation easements (USDA Wetland Reserve Program, The Nature Conservancy, North American Land Trust).

Key Contacts

NC Wildlife Resources Commission, NC State Parks, NC Forest Service, The Nature Conservancy

Objectives/ Action

- Increase areas of longleaf pine forest ecosystem, and increase prescribed fire in the suppressed longleaf pine natural areas (and pocosins). Turnbull Creek connects adjoining Suggs Mill Pond/Bushy Lake Complex and Jones Lake/Salter Lake priority areas to the Cape Fear River.
- Increase emphasis on incorporating wildlife conservation in management among public and private landowners and managers in the region.
- Develop recovery plan for the endangered Red-cockaded Woodpecker in this region.

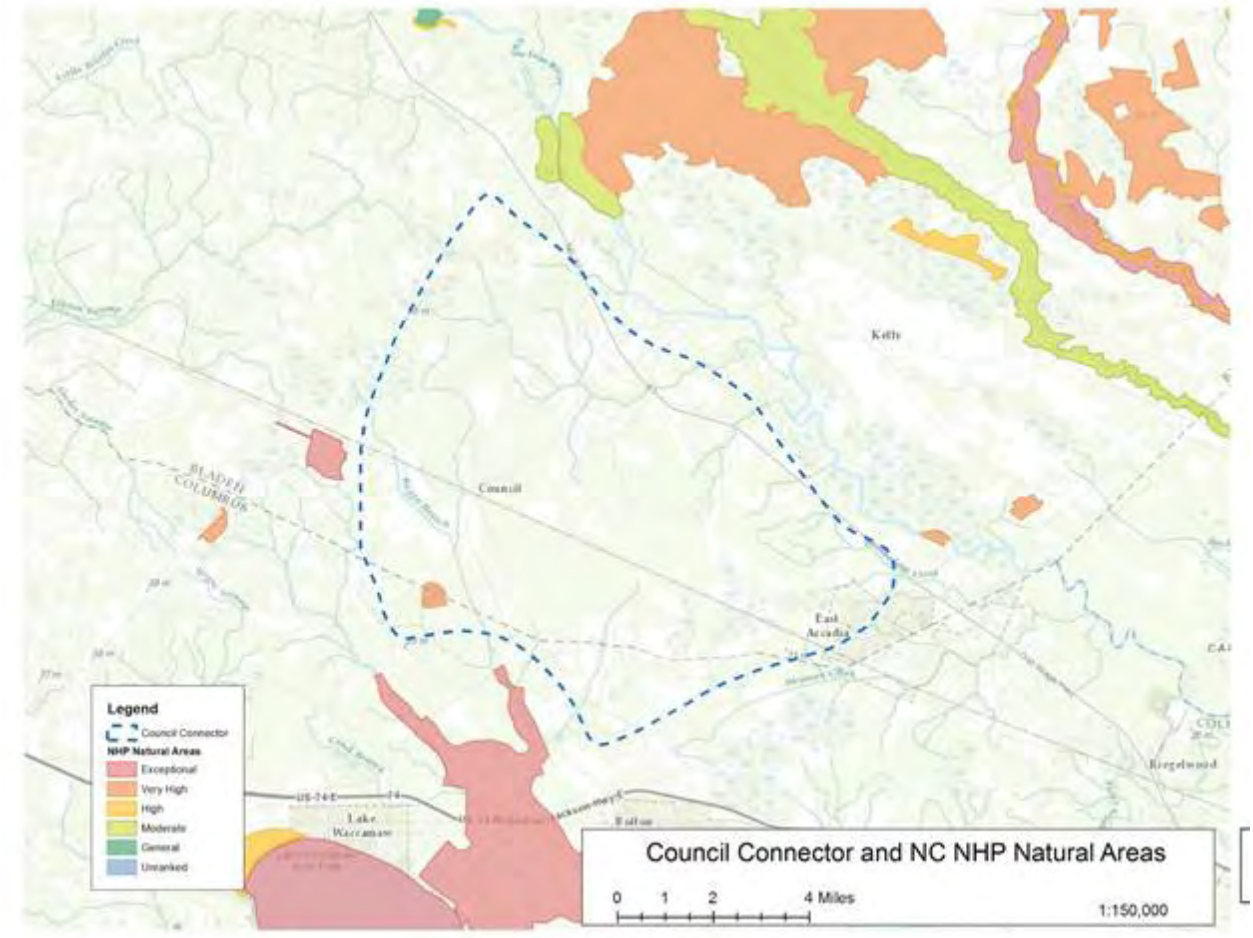
5. Council Connector

Geographic Extent

Drawn to connect the Lake Waccamaw/Waccamaw River Priority Area to the Cape Fear River Corridor, and by extension the Bladen Lakes/Jones Lake Priority Area

Conservation Importance

The Council Connector is a rural landscape that connects the Lake Waccamaw/Waccamaw River ecosystem to the Bladen Lakes landscape. Maintaining the rural landscape and ecological connectivity should help species to adapt to changes in habitat that might result from climate change or other disturbances. The headwaters of the Waccamaw River are also located in the focal area.



Important Species

Fauna

Potentially black bear and other wide-ranging species. Animal records include Mabee's salamander (*Ambystoma mabeei*), and Eastern Diamondback Rattlesnake *(Crotalus adamanteus*). These animal records are also historic.

Flora

There are a number of historic records for longleaf pine savanna species, including Chaffseed (*Schwalbea americana*), Pineland Plantain (*Plantago sparsiflora*), Twisted-leaf Goldenrod (*Solidago tortifolia*), Savanna Indian-plantain (*Arnoglossum ovatum*), and Carolina Grass-of-Parnassus (*Parnassia caroliniana*).

Existing Conservation Lands

At present, the Council Connector does not contain any permanently protected land. There are a number of private lands, including forest lands, in the landscape.

Objectives/ Action

- Keep key areas of working forest as working forest (e.g. smoke buffers adjacent to actively managed lands, important areas for foraging or connectivity, etc).
- Look for ways to maintain or restore ecological connectivity to adjacent focal areas.
- Grow partnerships with TIMOs in restoring longleaf pine where applicable and appropriate.
- Protect riparian buffers.

Part III
Coastal Zone

The definition of the Coastal Zone is variable by state with the exception that the seaward boundary is 3 nautical miles from the coast line (http://coastalmanagement.noaa.gov/mystate/docs/StateCZBoundaries.pdf). The definition of the coastal zone for North Carolina according to the Division of Coastal Management is:

"North Carolina's coastal zone includes the 20 counties that in whole or in part are adjacent to, adjoining, intersected by or bounded by the Atlantic Ocean or any coastal sound(s).

The definition for South Carolina's coastal zone is "South Carolina's coastal zone includes all lands and waters in the counties which contain any one or more of the critical areas including coastal waters, tidelands, beaches, and primary oceanfront sand dunes". A working definition for describing the Coastal Zone Priority Habitats of the Cape Fear Arch is modified from the US Coastal Zone Management Act of 1972. The Coastal Zone includes coastal waters and adjacent shore areas that are influenced by marine processes that does or may include waves, tides, wind, storms, and sea level change. The Priority Habitats include the nearshore ocean, barrier islands, beaches and dunes, coastal forest including maritime forest, saltwater and transitional marshes, tidal creeks, and estuaries. The Focal Areas (Table 1) may include one or several of the Priority Habitats.

The Focal Areas may include one or several of the Priority Habitats. For instance, Bald Head Island, which is part of the Smith Island Complex, is a Focal Areas that is comprised of multiple priority habitats including nearshore, barrier island, beach/dune, salt marsh, coastal forest (maritime forest), and tidal creeks (Table 1).

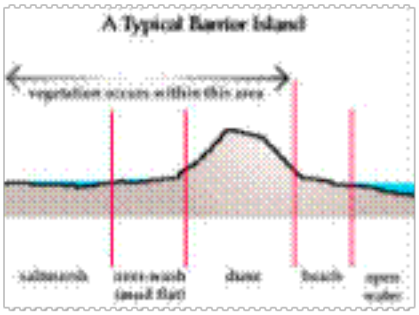
Table 1 – Coastal Zone Priority Habitats and Focal Areas

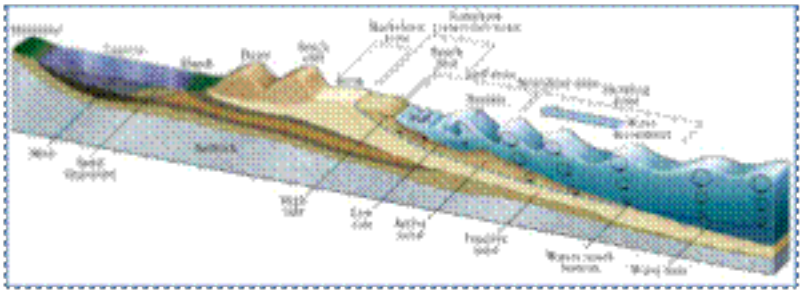
Priority Habitat	Focal Areas								
	Bald Head	Masonboro	Lea/Hutaff	Lockwood Folly	Brunswick Islands	Winyah Bay	NHC Tidal Creeks	Lower Cape Fear	Town Creek
Nearshore	x	x	x		x				
Barrier Island	x	x	x		x	x			
Beach/Dune	x	x	x		x				
Salt Marsh	x	x	x	x	x	x	x		
Coastal Forest	x					x		x	x
Tidal Creek	x			x		x	x		
Estuarine						x		x	
Freshwater Marsh/Wetland				x				x	x

Section One
Coastal Priority Habitats

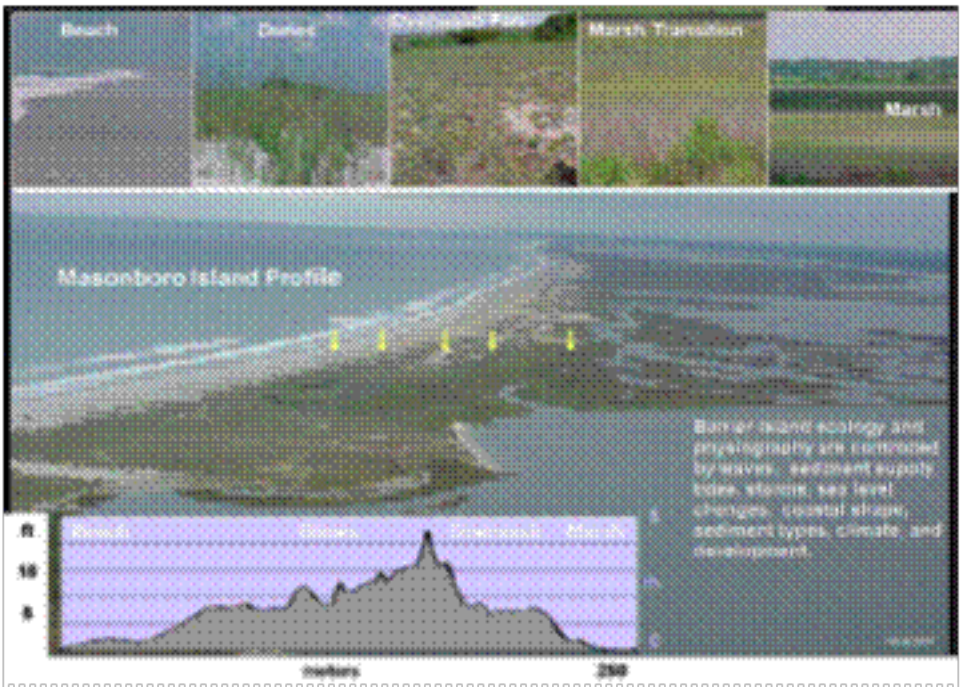
Barrier Island

A barrier island is a long, narrow, offshore deposit of sand or sediment that parallels the coastline. Some barrier islands can extend for 100 miles (160 km) or more. The islands are separated from the main land by a shallow sound, bay or lagoon. Barrier islands are often found in chains along the coastline and are separated from each other by tidal inlets. Barriers are the first line of defense during storms that threaten coastal communities, and are critical for reducing the devastating effects of wind and waves and absorbing storm energy. Barrier islands provide marine habitat that supports commercially important fish species, as well as birds, sea turtles and other wildlife species.





Barriers have multiple habitat zones including:
Beach – ocean side of island with sand deposited and moved by wave and wind action; the beach includes the area from spring high tide to 29' of water depth – zone of sand movement
Dunes – a mound or ridge of sand shaped by wind and stabilized by plants; may be impacted by storms
Barrier Flat – a relatively flat area that separates the exposed or seaward part of a barrier island from the lagoon behind it. Overwash fans form when storms move sediment through the dunes and into the marsh.
Maritime Forest –coastal forests whose structure and composition are shaped by salt spray, extreme disturbance events, and the climate of the immediate coast; climax community of a barrier island.
Salt Marsh – low-lying wetland area on sound side of barrier islands that are inundated and drained by salt water during tidal flux and that consists of both high and low marshes



Threats & Processes

Sea Level Rise: Sea level rise will affect barrier islands in a variety of ways including coastal erosion, salt water intrusion, increased storm impacts and damages, loss of habitat, changing species composition, and possible impacts to fisheries. Together, these changing conditions could have detrimental impacts to the larger economy and ecology of the region.

Development pressure: Tourism is necessary for the economy of coastal regions. With tourism comes development and other anthropogenic impacts (air pollution, decreased water quality). Barrier islands are a naturally dynamic ecosystem that requires movement of sand to react and sustain habitats; as static development increases, there is a decreased ability for natural processes to shape the land. These natural processes build habitats that are intrinsically capable of protecting structures and the mainland when development is approached sustainably. However, resilience is decreased when natural processes are ignored or interrupted in the development process.

Invasive species: Invasive species are defined as non-native organisms that displace or outcompete native organisms. On barrier islands the following species are considered invasive.

- Redbay Ambrosia beetle – spreads laurel wilt, which can negatively impact maritime forest canopies
- Nutria – large rodent that is detrimental to salt marsh plants and stability
- Red Lionfish (Pterois volitans)
- Snakehead (Channa argus)
- Flathead Catfish
- Viviparus georgianus Vivaparus japonicus Vivaparus subpurpureus Bellamya japonica
- (Pylodictus olivaris)

- Red Shiner (Cyprinella lutrensis)
- Black Carp (Mylopharyngodon piceus)
- Swamp Eels
- Asian Clam (Corbicula fluminea)
- Red-rim Melania (Melanoides tuberculatus)
- (family Synbranchidae)
- Rudd (Scardinius erythropthalmus)
- Hydrilla (Hydrilla verticillata)
- Beach Vitex – displaces native dune species without fulfilling the stabilization role of natives.
- Giant Salvinia (Salvinia molesta)
- Alligatorweed (Alternanthera philoxeroides) • Creeping waterprimrose
- (Ludwigia uruguayensis "hexapetala") • Parrotfeather (Myriophyllum aquaticum)

Additional details here: http://www.midatlanticpanel.org/resources/publications/marp_03-31-05_Presentation_2_6079.pdf

Opportunities
Preserved properties: Provide pristine habitat and a reserve for species from anthropogenic impacts. Preserves can provide fringe benefits to adjacent areas and may increase economic gains.
Current preserves: Masonboro Island, portions of Bald Head Island/Smith Island Complex, portions of Lea Hutaff.

Sustainable development: Developing barrier islands using sustainable practices into the future could protect habitat, preserve ecological function, and ecosystem services including protection from climate change impacts. Additionally, sustainable development could positively impact tourism related to natural resources enjoyment (fishing, hiking, swimming, etc.)

Working waterfronts/shorelines: Preserving working waterfronts and the associated history could increase tourism and economic value of waterfront areas.

Stewardship and outreach: Educating the public about the ecosystem services and value of barrier island habitats is key to protecting these vital areas. Charismatic species, such as sea turtles, provide a gateway for people to understand all the threats to barrier island ecosystems as well as barrier island dynamics.

Marsh

Definition

A marsh is a wetland which is dominated by grasses. There are salt and freshwater marshes in the Cape Fear Arch Region. More predominant are the salt marshes which line much of the North Carolina Intracoastal Water Way. Marshes buffer the mainland from storms, filter out pollutants, and act as a nursery for many fish species.

Threats

Sea-level rise could impact marshes by inundation of saltwater or saltwater intrusion. Development along the coast can cause heavy pollution in marsh areas. The plant species that exist there are capable of filtering pollutants out of the water, however, there is still harm to the ecosystem. Also landfill to build on marsh lands removes vital habitat and restricts the ability of the marsh to do its job. Saltwater intrusion effects below ground and above ground. Impacts of saltwater intrusion in the Cape Fear River fresh water marshes is evident by the death of cypress trees near the airport.

There are also some invasive species that are prevalent in marsh systems. Phragmites is an invasive species which competes with black needle rush and spartina.

Opportunities

Over 80 percent of commercially important fishes spend some of their life history in wetlands, including marshes. Wetland and marsh protection is vital for the survival of our coast, economically and biologically. Living shorelines and oyster reef restoration are ways to help protect the marsh system.

Estuarine

Definition

An estuary is a partially enclosed body of water where freshwater rivers and saltwater from the ocean mix. These are transition areas which are vital habitat for many organisms. Common features of an estuary include salt marshes and bays.

Threats

Sea level rise is changing the structure of the estuary, from saltwater intrusion upstream losing storm protection. Over half the U.S. Population lives in coastal areas-- including estuarine areas. Continual development and agriculture in estuarine regions exposes the watershed to pollution and stormwater runoff. Additionally, physical building will increase impervious surfaces and lose the storm protection properties that estuaries have. Estuaries are a driver of the economy because they support such a diverse number of species. Many of these are hunted or harvested commercially or recreationally. Coastal watershed counties provide 69 million jobs and 7.9 trillion to the GDP nationally.

Opportunities

Estuaries provide natural resources used for tourism and recreation. There are more than 150 species of wildlife that depend on estuaries such as alligators, marine mammals, migratory birds and waterfowl. These areas provide critical nesting and spawning habitat for many marine organisms.

Maritime Forest

Definition

Maritime Wetland Forests occur in wet sites on barrier islands and near the sounds on the mainland. Maritime Swamp Forests and Maritime Shrub Swamps occur on barrier islands in dune swales which are sheltered from the most extreme salt spray and from seawater overwash. The soils are saturated for much of the year and may be flooded for substantial periods. Maritime Swamp Forests have a canopy of tall wetland trees which varies from place to place. Dominants include swamp black gum, red maple, ash, water oak, sweetgum, loblolly pine, and bald cypress. Maritime Shrub Swamps have a canopy of tall shrubs or small trees, usually red bay or swamp dogwood, which may be tangled together with vines. They are apparently wetter than Maritime Swamp Forests but also may be kept in shrub dominance by periodic disturbance. Estuarine Fringe Loblolly Pine Forests occur on wet flats adjacent to salt or brackish marshes along the sounds. There is often a fairly dense layer of shrubs and greenbriars. All of the dominant plants are species that occur in disturbed wet sites elsewhere in the Coastal Plain, but these communities appear to be of natural origin. It may be that periodic natural disturbances such as salt water intrusion prevent succession to hardwoods. It has been suggested that fire occurred naturally in these communities and that the natural aspect was open and grassy rather than shrubby.

Threats

While the climate is expected to be warmer, and rainfall change estimates vary widely, the most important effects on these systems will be rising sea level and an increase in storms. Most occur on the widest, oldest, and most stable parts of the barrier islands. They are in the least likely places to become new inlets. Riggs (2010 presentation to the Sea Level Rise symposium) showed maps indicating that even if the Outer Banks collapses and most of it is lost, the wide areas that support most of the Maritime Forests will remain as islands. However, erosion of foredunes and the resulting increased salt spray may be a significant impact. Additionally, many of the barrier islands in the Cape fear arch region that are not protected lands, no longer have extensive Maritime Forest structure. Intrusion of salt water into perched aquifers may be a problem even for swales that remain intact, but the likelihood of this is quite uncertain.

Many of these systems occur in wet areas in well-protected swales, edges of relict dunes, and edges of freshwater sounds and have a high potential for disturbance by storm winds, salt spray, and migrating sand dunes -- all factors that are likely to increase with climate change. Rising sea level and erosion of dunes are likely to cause inundation of many examples, converting them to marshes, wet grasslands, or open water. Rising water tables may allow them to spread to higher elevations at the expense of Maritime Upland Forests, and possibly even cause new examples to appear. But the net change is likely to be a loss of acreage. Likewise, the extensive examples along the sounds (Estuarine Fringe Loblolly Pine Forest) are low-lying and are very likely to be inundated or affected by increased salinity.

While less threatened by development than most maritime communities, Maritime Wetland Forests may be destroyed by impoundment, ditching, and by lowering of the water table resulting from extensive well pumping. Overall, sea level rise may be the biggest threat, outside of development.

Increased natural disturbance by wind, salt spray, and storm surge intrusion will be significant. Some of these communities consist of species that can recover from these disturbances, but increased frequency will result in death and regeneration, more time spent in recovery stages, and shifts toward the most tolerant species. If erosion breaches swales and exposes them to sea water intrusion or overwash in storms, they likely will become Maritime Grasslands. If they are low enough have irregular tidal inundation, they will become brackish marshes.

The acreage completely lost from this system by community shifts and destruction may be catastrophic. Any loss will be very significant for these already-rare communities. New sites for these communities may be generated as the coastal landscape changes, but only in places not already destroyed by development.

Many maritime plants disperse readily and occur commonly in wetlands in the Coastal Plain, but the naturally and artificially fragmented distribution of wet maritime forests may limit such latitudinal migration.

Opportunities

Most of the maritime swamps on the barrier islands are under conservation, as are many of the estuarine fringe communities. Substantial opportunities to protect additional examples are limited. There is value in protecting additional examples in the broader, more stable parts of barrier islands, where these communities have the best chance of surviving. There is value in protecting estuarine fringe examples where there is opportunity for them to migrate inland.

Hydrological alteration is seldom a concern in estuarine fringe communities but is significant on the barrier islands. Ground water pumping, ditching, and impoundment associated with development are threats which can be mitigated. Control of ground water extraction is likely to be difficult, as coastal towns seek water sources from perched aquifers that are shrinking by erosion and salt water intrusion.

Landscape connectivity may be a concern locally. Most barrier island examples occur in complexes that are distant from each other, but connections within the complexes can be threatened both naturally by rising sea level and by human actions such as hydrological alteration.

References:

N.C. Coastal Resources Commission's Science Panel on Coastal Hazards. 2010. North Carolina Sea Level Rise Assessment Report. NC Department of Environment and Natural Resources, Raleigh, NC.

Tidal Creeks

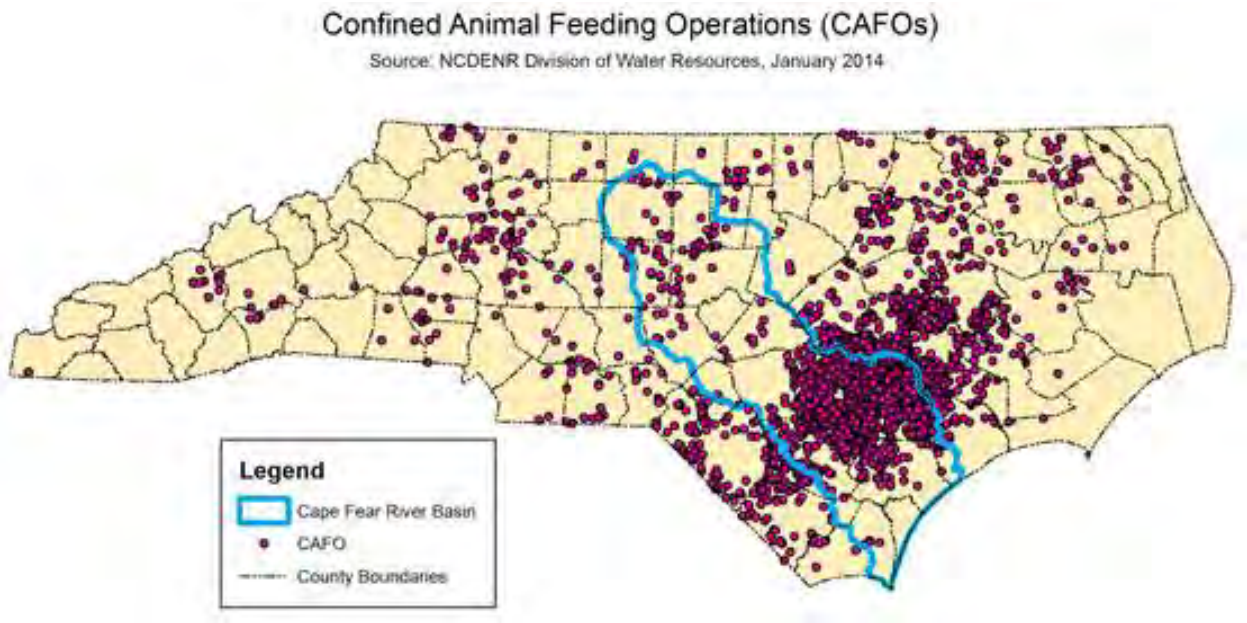
Tidal Creeks

Tidal Creeks are small coastal tributaries that lie in the transition zones between terrestrial uplands, freshwater streams and the open estuary. Tidal creeks are also affected by ocean tides.

Threats

Sea level rise and climate change are a threat to these areas. Because these creeks are smaller bodies of water, they can be subject to higher temperatures (and decreased pH), than larger bodies of water. Organisms in tidal creeks may experience heat shock. In addition, sea level rise leads to salt water intrusion. The upper reaches of the tidal creek will be affected by the increased salt content in the water.

This can cause plant and animal die offs.
Many areas which contain tidal creeks have heavy agricultural growth surrounding them shown in the figure below. This developement impacts the water quality of the tidal creeks and can cause shellfish area closures. In addition, canyonizing or erosion of the creek banks is also a growing problem.

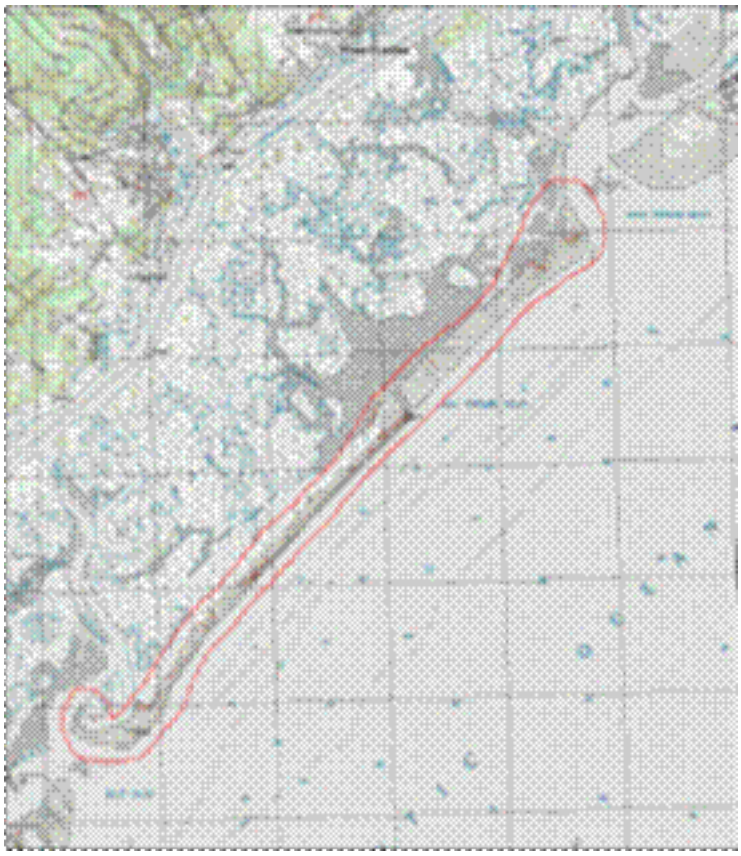


Opportunities

Restoring the hydrology as well as creating barriers for storm water runoff into the tidal creeks.

Section Two
Coastal Zone Focal Areas

1. Lea Hutaff



Geographical Extent

Lea and Hutaff Islands are undeveloped barrier islands, and associated saltmarsh, located between Figure 8 Island and Topsail Island. The islands are now joined following the closure of Old Topsail Inlet. This barrier island is characterized by large, open expanses of bare sand caused by overwash during the hurricanes of 1996, 1998 and 1999. Remnants of primary dunes exist in a few locations along the island. The saltmarsh is a typical tidally flooded saltmarsh and creek system. This barrier island is one of North Carolina's few undisturbed and relatively pristine barrier islands.

Conservation Importance

In migration up to 3,000 shorebirds representing 21 species pass through this site, including 500-1,000 DUNL.

Important Species

Open, bare sandy beaches with remnant dunes dominated by *Uniola paniculata* and *Iva imbricata*. Piping plover (*Charadrius melodus)*, American oystercatcher (*Haematopus palliatus)*, black skimmer (*Rynchis niger*), least tern (*Sternula antillarum*), Wilson's plover (*Charadrius wilsonia*), loggerhead sea turtles (*Caretta caretta*)

Land Owners/Land Use

Both Lea and Hutaff Islands are privately owned. National Audubon Society and the NC Coastal Land Trust are currently negotiating with landowners to acquire Lea Island.

Existing Conservation Lands

Most of Lea Island is protected as the Lea Island State Natural Area. More recently, the Audubon North Carolina acquired a 35.7 acre tract on Lea Island in 2010. Audubon North Carolina has designated Lea Hutaff Island as an Important Birding Area.

Key Contacts

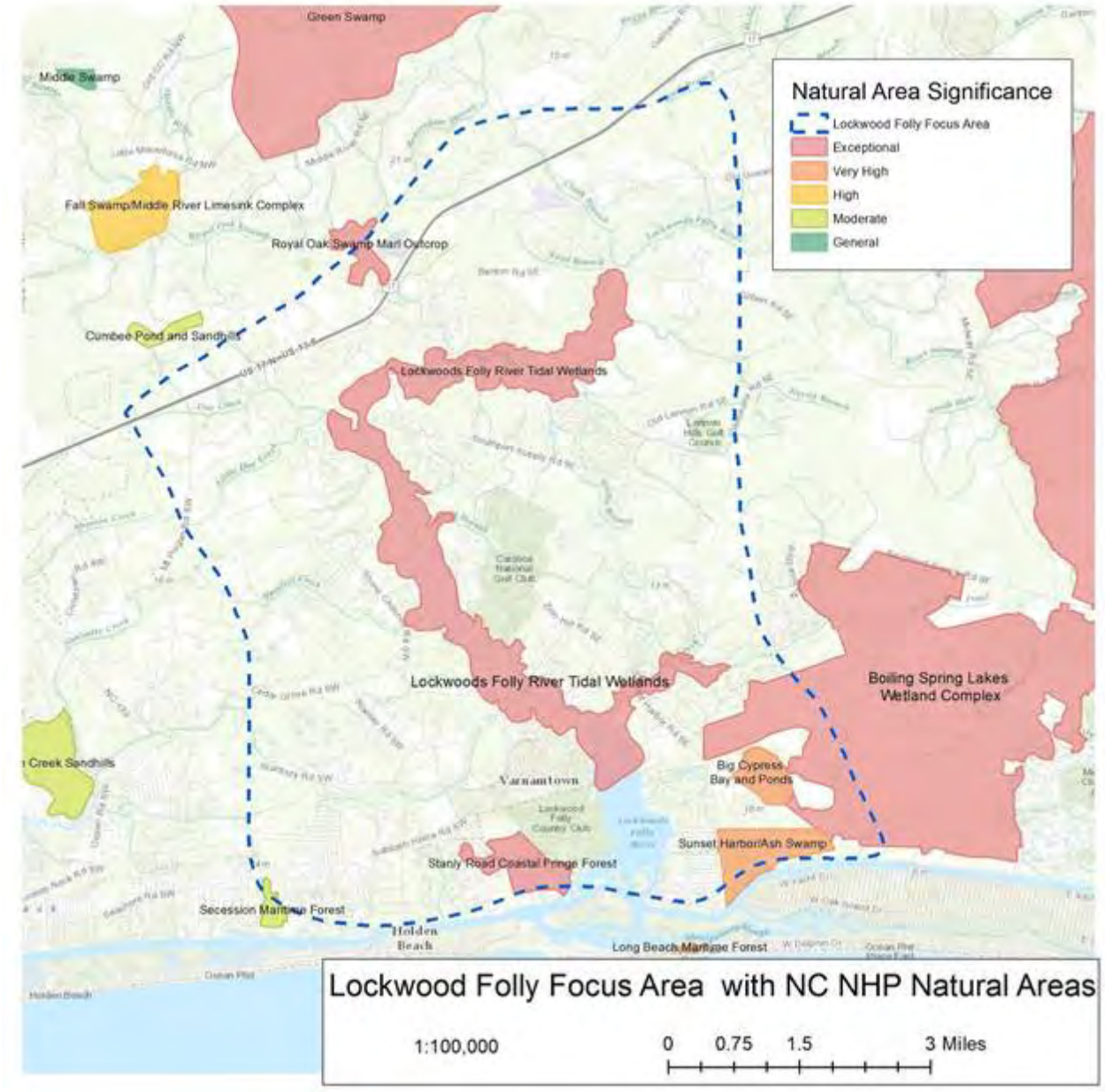
Audubon North Carolina; Walker Golder; Coastal Land Trust; US Fish and Wildlife Service; State of North Carolina

Objectives/Actions:

2. Lockwood Folley

Geographical Extent

The Lockwood Folley watershed encompasses ~150 mi^2 (388 km^2) in south-central Brunswick County. It originates as swamp-fed blackwater tributaries that transition downstream into tidally influenced waters that eventually empty into the IntraCoastal Waterway (ICWW) and then to the Atlantic through the Lockwood Folley Inlet between Oak Island and Holden Beach.



Conservation Importance

The lower Lockwood Folley estuary from the ICWW up through the brackish water marsh has historically been rich in shellfish beds. However, the varied habitats from upper to lower watershed that include upland forests, floodplain wetlands with hardwood forests, and tidally influenced freshwater marshes that transition to salt marshes are also important as nutrient sources, nursery grounds, and refuge for numerous species. The small estuary is a classic example hiliting all of the types of tidally influenced marshes that are present in the North Carolina Coastal Plain.

Important Species

Oyster (*Crassostrea virginica*), painted bunting (*Passerina ciris*), and on the ocean side of the inlet loggerhead sea turtles (*Caretta caretta*)

Land Owners/Land Use

The Lockwood Folley watershed is ~73% forested lands with bottomland hardwood wetlands and pine plantations dominant. Seventeen percent of the watershed includes developed land that is dominantly residential and golf courses and other open spaces. Development has concentrated along the roads and the estuary margins. Soils mostly have low permeability and drainage is low, which is an issue for infiltration.

Existing Conservation Lands

No existing lands in direct conservation.

Key Contacts

North Carolina Coastal Federation (www.nccoast.org), Brunswick County (www.brunswickcountync.gov)

Objectives

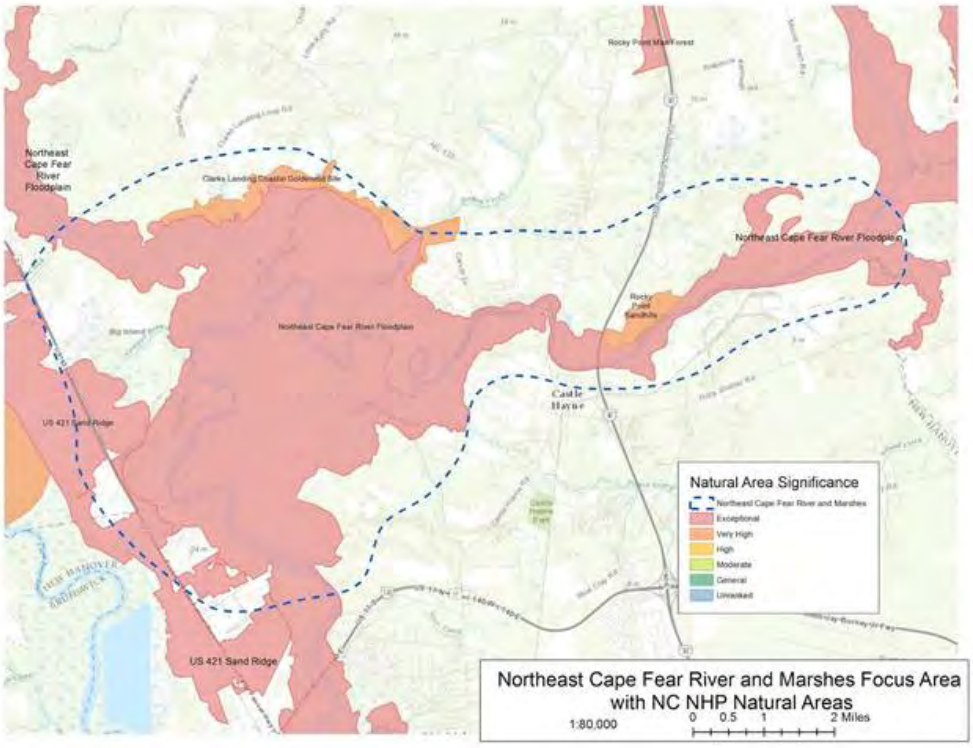
Ultimate objective is to reduce bacteria levels within the watershed through stormwater management techniques. Fifty-five percent of the SA waters are closed to shellfishing with the remainder conditionally closed or conditionally open. Stormwater runoff is the primary pollutant in the watershed and directly responsible for degraded water quality within the shellfish harvesting Class SA waters and resultant shellfish closures. Closures began in the 1980's and it is recommended that current stormwater be reduced on most all of the developed lands using best management practices that will infiltrate/treat stormwater. As most all of the development is residential (including golf courses), it has been determined that Low Impact Development strategies are critical and that at least 40% of developments be left as open space. A focus should be to reduce the sources of fecal coliform bacteria. Although wildlife is the largest source, pet waste (2^{nd} largest source) is easier to manage and should be targeted followed by septic systems, boaters, and livestock. A reported 86% reduction in Total Maximum Daily Load is needed to restore water quality for shellfish waters.

Reference: Implementation Plan for the Restoration of the Shellfish Harvesting Areas in the Lockwoods Folly River, Lumber River Basin, Brunswick County, North Carolina: Stantec Counsulting Services and NC Coastal Federation.

3. Northeast Cape Fear River Floodplain and Marshes

Geographic Extent

This focus area includes the north and south sides of the NE Cape Fear River from the General Electric Plant in Castle Hayne in New Hanover County east to the NC Coastal Land Trust's 1,200 acre conservation easement over the Five Eagle Partners Tract in Pender County.



Existing Conservation Lands

A portion of the Cape Fear River Wetlands Game Lands (over 4,000 acres) owned and managed by NC Wildlife Resources Commission lies within this Focus Area along with a 700 acre fee title nature preserve owned by NC Coastal Land Trust.

Key Contacts

North Carolina Coastal Land Trust, North Carolina Wildlife Resources Commission, Cape Fear River Watch, The Nature Conservancy

Landowners/Land Use

The NC Coastal Land Trust completed a Northeast Cape Fear River Riparian Corridor Plan in July 2002 that specifically identified priority conservation parcels along the river in New Hanover and Pender County based on a set of criteria. The criteria included parcel acreage, length of riparian frontage, and quality of riparian buffer, natural heritage significance and proximity to existing conservation lands. Within this Focus Area, there are 6 high priority parcels identified in New Hanover County and 12 priority parcels in Pender County. There is one large parcel (approx. 4,000-acres) in New Hanover County and one large parcel (over 1,000 acres) in Pender County that are of considerable ecological significance. Forestry is the predominant land use within Pender County while there is considerable industrial and residential use close to, or on the river in New Hanover County.

Conservation Issues

The NC Natural Heritage Program designated a large portion of the Northeast Cape Fear River floodplain as a natural heritage area of exceptional significance for its relatively undisturbed and extensive floodplain forest, which includes some of the best examples of natural communities such as Tidal Swamp (Cypress-Gum Subtype), as well as rare species, including a population of Oenothera riparia that is considered the best in North Carolina . The Natural Heritage Program has identified several distinct natural community types within this extensive floodplain system including tidal cypress-gum swamp and freshwater marsh, Nonriverine Swamp Forest, pond pine woodland, wet pine flatwoods and isolated longleaf pine ridges, along with excellent examples of globally rare Peatland Atlantic White Cedar Forest and Swamp Island Evergreen Forest. Within the focus area is also an important habitat for Coastal Goldenrod *(Solidago villosicarpa*), which is only known from a handful of locations worldwide.

Important Species

Coastal Goldenrod *(Solidago villosicarpa*), Round-leaf Water-hyssop (*Bacopa rotundifoli*a), Long's Bittercress (*Cardamine longii*), Kidney Sedge (*Carex reniformis*), Green Fly Orchid *(Epidendrum magnoliae*), Riverbank Evening-primrose (*Oenothera riparia*), Blue Water-hyssop (*Bacopa caroliniana*), a spanglegrass (*Chasmanthium nitidum*), Southeastern Myotis (*Myotis austroriparius*), Gray-green Clubtail (*Arigomphus pallidus*), Phantom Darner (*Triacanthagyna trifida*).

Threats

Potential threats to air quality, water quality and/or ecological integrity of river floodplain system due to proposed cement plant on the banks of the river, future residential and commercial development adjacent to the river, expansion of existing mining activities.

Objectives

- Target the larger high priority parcels for conservation with willing sellers. Work with partners to identify lead agency/organization for specific parcels.
- Develop education/pr material on the importance of the Northeast Cape Fear River. Identify target audiences to distribute material.

4. Bald Head Island and Smith Island Complex

Geographic Extent

The Smith Island Complex, made up of southern most Bald Head Island and the Cape Fear, Middle Island, and Bluff Island. The Cape Fear River entrance is to the West.

Conservation Importance

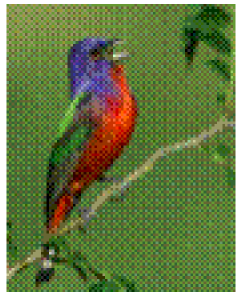
Bald Head Island provides nesting ground for the largest concentration of federally threatened southeast Atlantic loggerhead sea turtles. Bald Head Island also contains 51% of all bird species documented in North Carolina. Bald Head is part of the Smith Island land complex comprised of Bluff, Middle and Bald Head Island. These islands contain all features of a complex barrier island ecosystem including beach, dune, dune swale, maritime forest, salt marsh, mud flats, and submerged aquatic vegetation habitats. The globally endangered maritime forest is a climax ecosystem, which is disappearing at an accelerated rate due to coastal development.

Maritime Forest contains canopy trees of live oak, laurel oak and red cedar. These protect the understory from salt spray and wind damage. Other trees include sabal palm and loblolly. The understory consists of yaupon, American holly, red bay, wax myrtle, and numerous vines like smilax.

Important Species (Flora/fauna)

Green sea turtle (*Chelonia mydas*), leatherback sea turtle (*Dermochelys coriacea*), right whale (*Eubalaena*), humpback whale (*Megaptera novaeangliae)*, Atlantic sturgeon (*Acipenser oxyrinchus*), red knot (*Calidris canutus*), sea beach amaranth (*Amaranthus pumilus*), piping plover (*Charadrius melodus)*, American oystercatcher (*Haematopus palliatus)*, black skimmer (*Rynchis niger*), least tern (*Sternula antillarum*), Wilson's plover (*Charadrius wilsonia*), loggerhead sea turtles (*Caretta caretta*

Loggerhead Sea Turtle (*Caretta caretta*; BHC Threatened)



Painted Bunting (*Passerina ciris*; Audubon)

Seabeach Amaranth (*Amaranthus pumilus*; Threatened)

<u>Land owners/ Land Use</u>

Residential, recreational, commercial, conservation/land trust, state preserve

<u>Existing Conservation Lands</u>

186 acres of Bald Head Wood Maritime forest preserve, 22 acres of preserved land including the Ibis Sanctuary on Middle Island, 32 properties preserved in the Smith Island Land Trust.

<u>Key contacts</u>

Bald Head Island Conservancy; http://www.bhic.org/
Smith Island Land trust; Suzanne Dorsey

<u>Objectives</u>

- Form partnerships

5. Town Creek and Lower Cape Fear River

Written by Janice Allen

Geographic Extent

Town Creek and its tributaries which flow south and east of Highway 17 into the lower Cape Fear River.

Conservation Importance

The NC Coastal Land Trust completed a Town Creek Riparian Corridor Plan in 2001 that specifically identified priority conservation parcels along the creek in Brunswick County based on a set of criteria. The criteria included parcel acreage, length of riparian frontage, and quality of riparian buffer, natural heritage significance and development potential. Within this Focus Area, there are 7 high priority parcels identified for future conservation. Two of the seven parcels are over 1,000 acres. There is one large parcel (over 10,000-acres) along the Lower Cape Fear River of considerably high conservation significance. Presently, forestry appears to be the predominant land use on the eight total parcels. There is a high diversity of freshwater mollusks, including the Greenfield ramshorn snail, which is found nowhere else in the world. It has a near neutral pH, and is believed to be *one of the most pristine creeks in the lower Cape Fear*.

Important Species:

Greenfield ramshorn snail (*Helisoma eucosmium*), American alligator (*Alligator mississippiensis*)

Land Owners/Use

Mixture of forestry and agricultural use, old rice plantations along Lower Cape Fear

Existing Conservation Lands

Over 17,500 acres protected through fee title and conservation easement acquisitions along Town Creek and Lower Cape Fear River.

Key Contacts

N.C. Coastal Land Trust; N.C. Division of Forest Resources; Brunswick County; N.C. Ecosystem Enhancement Program

Objectives

- N.C. Coastal Land Trust is focusing on conservation efforts along Town Creek headwaters.
- Target the larger high priority parcels for conservation with willing sellers. Work with partners to identify lead agency/organization for specific parcels.
- Develop education/pr material on the natural and cultural history of the Town Creek/Lower Cape Fear system.Identify target audiences to distribute material.
- Identify expert(s) on invasive aquatic plants and develop strategy to eradicate *Brazilian elodea*.

6. Masonboro Island

Geographic Extent
Barrier island between Wrightsville Beach and Pleasure Island. This focus area includes the upland and intraditidal araes of Masonboro Island, the extensive marsh, creek and sound system landward of the island, and the series of dredge spoil islands parallel to the island along the Intracoastal Waterway

Conservation Importance
Largest pristine barrier island remaining on the southern North Carolina coast. Considered a significant shellfish growing area for the American Oyster.

Important Species (Flora/Fauna)
Loggerhead sea turtle (*Caretta caretta*), piping plover (*Charadrius meoldius*), and green sea turtle (*Chelonia mydas*). Largest nesting population of Wilson's plover (C*haradrius wilsonia*). Carolina diamondback terrapin (*Malaclemys terrapin*), Seabeach amaranth (*Amaranthus pumilus*) and tough bumelia (*Sideroxylon tenax*)

Land Owners/Use
The State of North Carolina holds title to approximately 5,500 acres, which is used as a natural laboratory for the primary purpose of research and education. The Division of Parks and Recreation holds title to 150 acres. The upland and water areas are used extensively for recreational activities such as boating, walking, surfing, sunbathing, kayaking and fishing, with the heaviest concentration of use around the easily accessible north and south tips of the Island. Approximately 25 acres within the geographic extent is still in private ownership.

Existing Conservation Lands
Approximately 5,500 acres of Masonboro Island and the surrounding marshes are protected under the National Oceanic and Atmospheric Administration's National Estuarine Research Reserve System. It is also dedicated as a State Nature Preserve. Portions of this land were originally acquired by the Society for Masonboro Island and the North Carolina Coastal Land Trust.

Key Contacts
North Carolina National Estuarine Research Reserve, North Carolina Coastal Land Trust

Objectives
- The North Carolina Coastal Land Trust continues to solicit private owners to determine interest in selling to the State.
- Work with landowners.

7. Winyah Bay

Geographic Extent

Winyah Bay in South Carolina represents the southernmost focal area in the Cape Fear Arch region. It is the third largest estuary on the east coast with a watershed that encompasses approximately 18,000 acres, most of which is located in the coastal regions of North and South Carolina.

Conservation Importance

Four major rivers, Waccamaw, Sampit, Black and Pee Dee, drain into Winyah Bay which makes it the third largest watershed on the east coast of the United States.

North Inlet is an ocean-dominated estuary with barrier beach. It features high water quality and extensive salt marshes surrounded by a small, forested watershed that is currently in a relatively undeveloped state. Winyah Bay, in contrast, is a salt wedge estuary with saltwater moving along the bottom with the large volume of freshwater from the watershed flowing on top.

Important Species (Flora/Fauna)

Important aquatic species include white shrimp (*Litopenaeus vannamei*), blue crab (*Callinectes sapidus*), red drum (*Sciaenops ocellatus*), American shad (*Alosa sapidissima*), Atlantic and shortnose sturgeon *(Ascipenser sp.*), loggerhead sea turtle (*Caretta caretta)*, green sea turtle (*Chelonia mydas*), bottlenose dolphin (*Tursiops*) and several species of ducks. The river corridors and adjacent uplands provide important habitat for migratory songbirds, wading birds, Red-cockaded Woodpeckers, and Swallow-tailed Kites. This area also provides critical habitat for black bear.

The brackish waters and marshes provide habitat to many threatened and endangered species, including sea turtles, sturgeons, least terns and wood storks. Pumpkinseed Island is an important rookery for white ibis, great and snowy egrets, and herons.

Land Owners/Use

Most the Winyah Bay watershed is classified as palustrine forested wetland and evergreen forest and is in private ownership. Industrial forest ownership has changed hands in recent years from paper companies to large, out-of-state timber investment companies with short-term ownership strategies, presenting challenges and opportunities for conservation actions.

Existing Conservation Lands

Approximately 135,000 acres of land in the southern coastal portion of the Winyah Bay watershed has protected status either through fee title or conservation easements. This region includes the Waccamaw National Wildlife Refuge, Brookgreen Gardens, Huntington Beach State Park, Hobcaw Barony where the North Inlet – Winyah Bay National Estuarine Research Reserve is located, and the Yawkey Wildlife Center, among other protected tracts. The Winyah Bay Task Force is comprised of private, state and federal conservation partners and is actively engaged in conservation planning for the Winyah Bay region. 18,916 acres of reserve.

Key Contacts

Winyah Bay Task Force Partners: USFWS (Craig Sasser), TNC (Maria Whitehead), SCDNR (Jamie Dozier), Ducks Unlimited (Chris Vaughn), NRCS (Debbie Mann), Lowcountry Open Land Trust (Ashley Demosthenes), Pee Dee Land Trust (David Harper), North Inlet-Winyah Bay National Estuarine Research Reserve (Wendy Allen), private landowner (Robert Scofield),Wendy Allen; Reserve Manager 843-904-9026

Objectives/Actions

8. New Hanover County Tidal Creeks

Geographic Extent

Bradley Creek, Futch Creek, Foy Creek, Hewletts Creek, Pages Creek, Howe Creek, and Whiskey Creek. They drain directly into the Intracoastal Waterway along the New Hanover County Coast. Dominant communities include salt marsh and brackish marsh.

Conservation Importance

Many of these tidal creeks used to be important shellfishing areas-- today, most of them are at least seasonally closed. Additionally, these areas are primary nursing areas and need to be conserved.

Important Species

Diamondback terrapin (*Malaclemys terrapin centrata*), Eastern painted bunting (*Passerina ciris ciris*), and the American oyster (*Crassostrea virginica*).

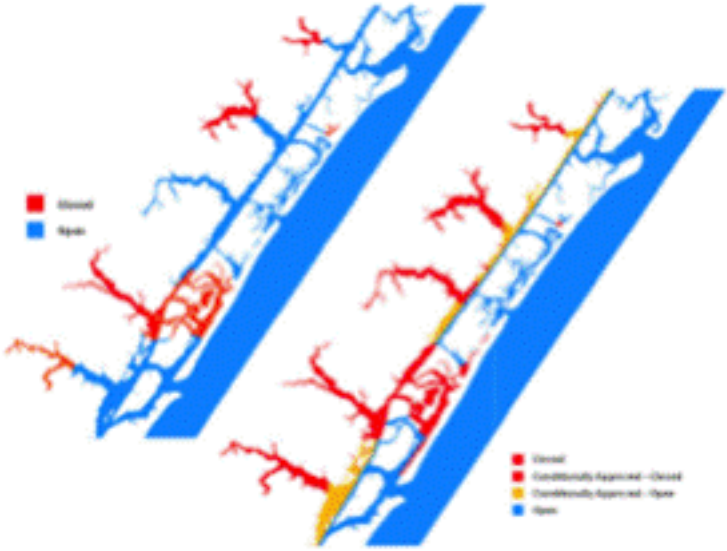
Land Owners/Use

Primarily residential with some commercial

Existing Conservation Lands

Key Contacts

New Hanover County; N.C. Coastal Federation; N.C. Coastal Land Trust.



Objectives

- Acquire / preserve buffers
- Stormwater retrofits
- Low impact development
- Quality redevelopment
- Small craft (non-motorized) public access on each creek
- Recreational opportunities
- Public education
- Leadership by City / County to restore water quality / shellfishing