

NORTH INLET - WINYAH BAY NATIONAL ESTUARINE RESEARCH RESERVE



Management Plan 2011 - 2016



This management plan has been developed in accordance with NOAA regulations, including all provisions for public involvement. It is consistent with the congressional intent of Section 315 of the Coastal Zone Management Act of 1972, as amended, and the provisions of the South Carolina Coastal Zone Management Program.

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Cover photo of green heron by George Cathcart, taken at the NI-WB Reserve, September 2009.

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Looking west over the Baruch Marine Field Lab, Oyster Landing is in the foreground and Winyah Bay can be seen in the distance. Photo courtesy of Dr. Timothy A. Mousseau.

ACRONYMS

ACE	Ashepoo-Combahee-Edisto River System
BMFL	Baruch Marine Field Lab
BWBF	Belle W. Baruch Foundation
BMP	Best Management Practice
C-CAP	Coastal Change Analysis Program
CDMO	Centralized Data Management Office
CELCP	Coastal and Estuarine Land Conservation Program
CFR	Code of Federal Regulations
CSC	Coastal Services Center, NOAA
CTP	Coastal Training Program
CZM	Coastal Zone Management
CZMA	Coastal Zone Management Act
ENSO	El Niño Southern Oscillation
ERD	Estuarine Reserves Division
GIS	Geographic Information System
GRF	Graduate Research Fellowship
HBDC	Hobcaw Barony Discovery Center
HOA	Home Owners Association
IPCC	International Panel on Climate Change
K-12	Kindergarten through 12th grade
KEEP	K-12 Estuarine Education Program
LID	Low Impact Development
NAO	North Atlantic Oscillation
NI-WB	North Inlet – Winyah Bay
NERR	National Estuarine Research Reserve
NERRS	National Estuarine Research Reserve System
NOAA	National Oceanic and Atmospheric Administration
NOS	National Ocean Service (in NOAA)
OCRM	Office of Ocean and Coastal Resource Management (in NOAA)
SCDHEC	South Carolina Department of Health and Environmental Control
SCDNR	South Carolina Department of Natural Resources
SC-OCRM	South Carolina Office of Ocean and Coastal Resource Management
SWMP	System-Wide Monitoring Program
USC	University of South Carolina
USFWS	United States Fish and Wildlife Service

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EXECUTIVE SUMMARY

The North Inlet – Winyah Bay National Estuarine Research Reserve (NERR or Reserve) encompasses 18,916 acres of tidal marshes and estuarine waters along the north coast of South Carolina. Most of the Reserve is located on Hobcaw Barony, the 17,500 acre property of the Belle W. Baruch Foundation, a private, 501 (c) (3) operating foundation that manages its land in perpetuity for conservation, research and education. The North Inlet – Winyah Bay NERR represents a state-federal partnership between the National Oceanic and Atmospheric Administration (NOAA) and the University of South Carolina (USC). It is administered by USC’s Belle W. Baruch Institute for Marine and Coastal Sciences that also operates the Baruch Marine Field Laboratory on the Hobcaw Barony property. The North Inlet – Winyah Bay Reserve is part of the National Estuarine Research Reserve System (NERRS), a network of protected areas established to provide opportunities for long-term research and education in support of informed coastal management. The NERRS currently consists of 28 Reserves in 23 states and territories.

This management plan replaces the Reserve’s original management plan published in 1992. It includes information about the Reserve, its facilities, staff positions and future needs. It also identifies the Reserve’s mission and describes three priority issues that are impacting or likely to impact the Reserve and its resources over the next several years. Goals, objectives and strategies to address these issues in an integrated cross-program approach are also presented. The management plan is designed to be used as a working framework for Reserve staff, other researchers, and partnering organizations that share our goals to address the priority issues.

The mission of the North Inlet – Winyah Bay NERR is:

“To promote stewardship in the North Inlet and Winyah Bay watersheds through science and education”

Reserve goals and objectives to address this mission are:

GOAL 1: UNDERSTAND AND MINIMIZE THE IMPACTS OF COASTAL GROWTH ON WATER AND HABITAT QUALITY AND ECOLOGICAL COMMUNITIES.

Objective 1.1. Water quality in the North Inlet - Winyah Bay NERR is monitored and maintained.

Objective 1.2. The habitat quality in the North Inlet - Winyah Bay NERR is maintained and, where possible, enhanced.

Objective 1.3. The natural, cultural, and economic resources in the North Inlet and Winyah Bay watersheds are protected and valued.

GOAL 2: UNDERSTAND AND COMMUNICATE THE IMPACTS OF NATURALLY OCCURRING SHORT-TERM, STOCHASTIC AND LONG-TERM, LARGE-SCALE CLIMATE EVENTS ON COASTAL ECOSYSTEMS AND HUMAN COMMUNITIES.

Objective 2.1. Climate variability and its effects on ecosystem processes and resources in the North Inlet and Winyah Bay estuaries are better understood.

Objective 2.2. The skills and abilities of local communities and coastal decision-makers to plan for, mitigate, and adapt to long-term and stochastic climatic events are increased.

GOAL 3: UNDERSTAND AND REDUCE THE IMPACTS OF INVASIVE SPECIES AND HABITAT LOSS ON BIODIVERSITY.

Objective 3.1. Native species are conserved and their habitats are protected and restored in the North Inlet and Winyah Bay watersheds.

Objective 3.2. Invasive species in the North Inlet and Winyah Bay watershed are detected, monitored and controlled.

An integrated, cross-program or sector approach is required to achieve the Reserve's goals and objectives. Reserve program chapters present these integrated approaches and are grouped by program focus areas.

Research focus areas include:

- ▶ Continue, and where possible enhance, the characterization of physical, chemical, biological and ecological conditions within the Reserve.
- ▶ Facilitate and conduct research at the Reserve that is relevant to coastal resource management needs and increases the basic understanding of estuarine ecosystem functioning.
- ▶ Ensure that the scientific, coastal management and education communities have access to, and use the data, synthesis products, tools and techniques generated at the Reserve.

Education focus areas include:

- ▶ Increase estuarine and ocean literacy and educate the community and general public audiences of all ages about the value of estuarine ecosystems and ways to protect them.
- ▶ Make North Inlet-Winyah Bay NERR the go-to resource for local estuarine information.
- ▶ Raise local awareness of global climate change and its effects.
- ▶ Raise awareness of native species conservation and restoration.

Coastal Training Program focus areas include:

- ▶ Maintain watershed integrity in the North Inlet and Winyah Bay watersheds.
- ▶ Promote scientific understanding among CTP audiences as a foundation for decision making.
- ▶ Increase understanding of link between decision making and health of human and natural resources.
- ▶ Increase the consideration of climate change and associated coastal hazard risks by municipal and county staff and officials during decision-making pertaining to coastal development, resource management, and risk management and mitigation.

Stewardship focus areas include:

- ▶ Protect the water quality of the NI-WB Reserve through community education and outreach in the Reserve target watershed.
- ▶ Promote stewardship and good coastal conservation practices in the communities of the North Inlet and Winyah Bay watersheds.
- ▶ Evaluate habitat quality and species distributions within the NI-WB NERR to identify current and potential conservation issues.
- ▶ Monitor and control invasive species and maintain biodiversity.

The integrated approaches outlined in this management plan will help the North Inlet – Winyah Bay NERR achieve its goals and objectives over the next several years, moving closer to a vision of sustainable and ecologically productive estuaries.



High marsh and salt panne habitats near the educational boardwalk at the NI-WB NERR.

CHAPTER 1 - INTRODUCTION TO THE NATIONAL ESTUARINE RESEARCH RESERVE SYSTEM

The National Estuarine Reserve System was created by the Coastal Zone Management Act (CZMA) of 1972, as amended, 16 U.S.C. Sec. 1461, to augment the Federal Coastal Zone Management (CZM) Program. The CZM Program is dedicated to comprehensive, sustainable management of the nation's coasts.

The reserve system is a network of protected areas established to promote informed management of the Nation's estuaries and coastal habitats. The reserve system currently consists of 28 reserves in 23 states and territories, protecting over one million acres of estuarine lands and waters.

Mission

As stated in the NERRS regulations, 15 C.F.R. Sec. 921.1(a), the National Estuarine Research Reserve System mission is:

The establishment and management, through Federal-state cooperation, of a national system of estuarine research reserves representative of the various regions and estuarine types in the United States. National Estuarine Research Reserves are established to provide opportunities for long-term research, education, and interpretation.

Goals

Federal regulations, 15 C.F.R. Sec. 921.1(b), provide five specific goals for the reserve system:

- (1) Ensure a stable environment for research through long-term protection of National Estuarine Research Reserve resources;*
- (2) Address coastal management issues identified as significant through coordinated estuarine research within the System;*
- (3) Enhance public awareness and understanding of estuarine areas and provide suitable opportunities for public education and interpretation;*
- (4) Promote Federal, state, public and private use of one or more Reserves within the System when such entities conduct estuarine research; and*
- (5) Conduct and coordinate estuarine research within the System, gathering and making available information necessary for improved understanding and management of estuarine areas.*

National Estuarine Research Reserve System Strategic Goals 2005 – 2010

The reserve system began a strategic planning process in 1994 in an effort to help NOAA achieve its environmental stewardship mission to “sustain healthy coasts.” In conjunction with the strategic planning process, ERD and Reserve staff has conducted a multi-year action planning process on an annual basis since 1996. The resulting three-year action plan provides an overall vision and direction for the Reserve system. As part of this process, the Reserve system developed a vision: Healthy estuaries and watersheds where coastal communities and ecosystems thrive; and mission: To practice and promote coastal and estuarine stewardship through innovative research and education, using a system of protected areas. The following goals are outlined in the 2005-2010 Strategic Plan.

Goals

1. Strengthen the protection and management of representative estuarine ecosystems to advance estuarine conservation, research and education.
2. Increase the use of Reserve science and sites to address priority coastal management issues.
3. Enhance peoples’ ability and willingness to make informed decisions and take responsible actions that affect coastal communities and ecosystems.

Biogeographic Regions

NOAA has identified eleven distinct biogeographic regions and 29 subregions in the U.S., each of which contains several types of estuarine ecosystems (15 C.F.R. Part 921, Appendices I and II). When complete, the Reserve system will contain examples of estuarine hydrologic and biological types characteristic of each biogeographic region. As of 2010, the Reserve system includes 28 reserves (Figure 1).

Reserve Designation and Operation

Under Federal law (16 U.S.C. Sec. 1461), a state can nominate an estuarine ecosystem for Research Reserve status so long as the site meets the following conditions:

1. The area is representative of its biogeographic region, is suitable for long-term research and contributes to the biogeographical and typological balance of the System;
2. The law of the coastal State provides long-term protection for the proposed Reserve’s resources to ensure a stable environment for research;
3. Designation of the site as a Reserve will serve to enhance public awareness and understanding of estuarine areas, and provide suitable opportunities for public education and interpretation; and
4. The coastal State has complied with the requirements of any regulations issued by the Secretary [of Commerce].

Reserve boundaries must include an adequate portion of the key land and water areas of the natural system to approximate an ecological unit and to ensure effective conservation.

If the proposed site is accepted into the reserve system, it is eligible for NOAA financial assistance on a cost-share basis with the state. The state exercises administrative and management control, consistent with its obligations to NOAA, as outlined in a memorandum of understanding. A reserve may apply to NOAA's ERD for funds to help support operations, research, monitoring, education/interpretation, stewardship, development projects, facility construction, and land acquisition.

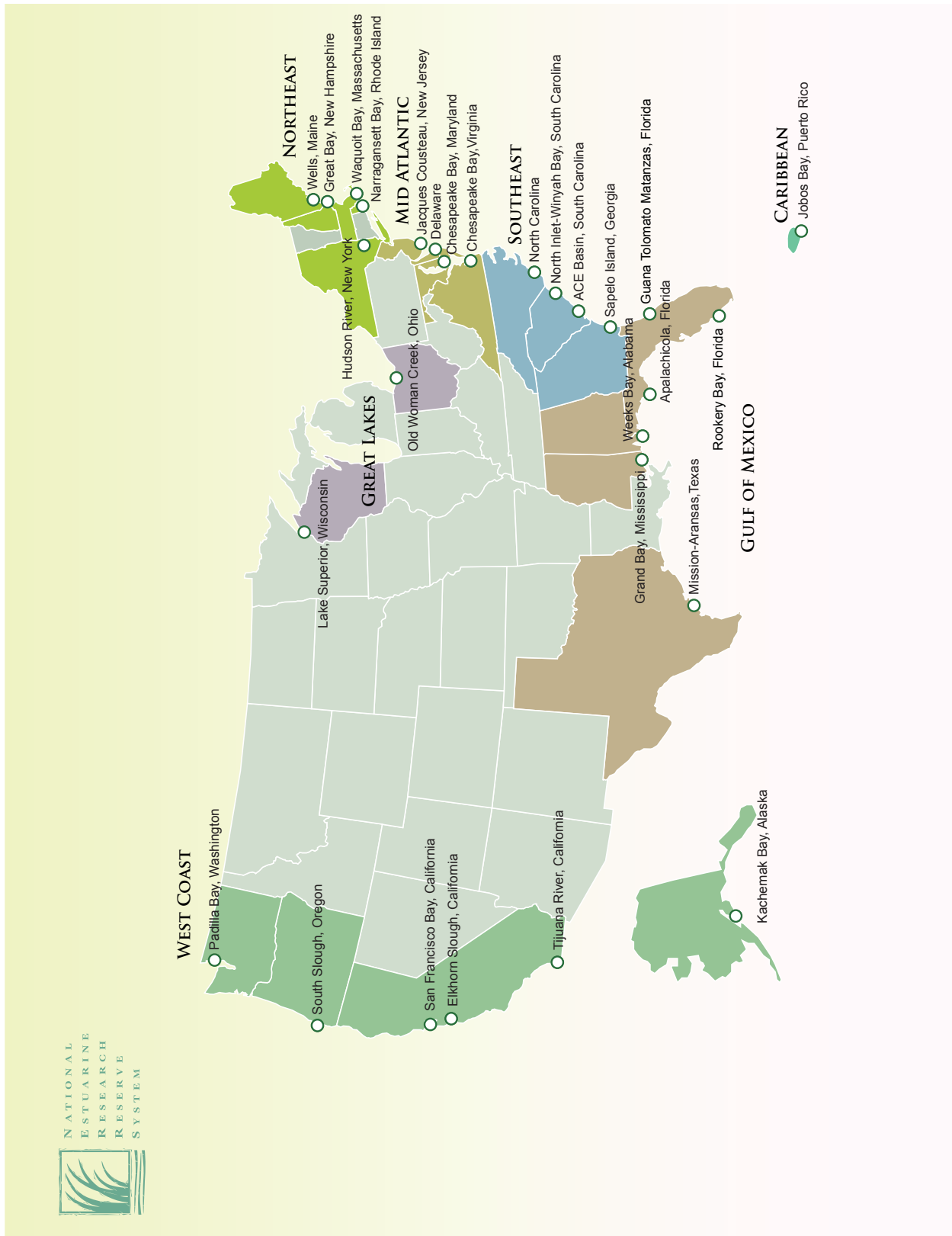


Figure 1. Location of the 28 Reserves in the National Estuarine Research Reserve System.

CHAPTER 2 - INTRODUCTION TO THE NORTH INLET-WINYAH BAY NATIONAL ESTUARINE RESEARCH RESERVE

The North Inlet – Winyah Bay National Estuarine Research Reserve (North Inlet – Winyah Bay NERR or NI-WB NERR or the Reserve) was designated in 1992 and is located in Georgetown County, South Carolina, about 30 miles south of Myrtle Beach and 50 miles north of Charleston (Figure 2). It encompasses 18,916 acres of tidal marshes and wetlands, much of which is on Hobcaw Barony, the 17,500-acre property of the Belle W. Baruch Foundation, a private, 501 (c) (3) operating foundation that manages its lands in perpetuity for conservation, research and education. The NI-WB NERR is administered by the Belle W. Baruch Institute for Marine and Coastal Sciences of the University of South Carolina that has facilities on the main university campus in Columbia, SC and at the coast.

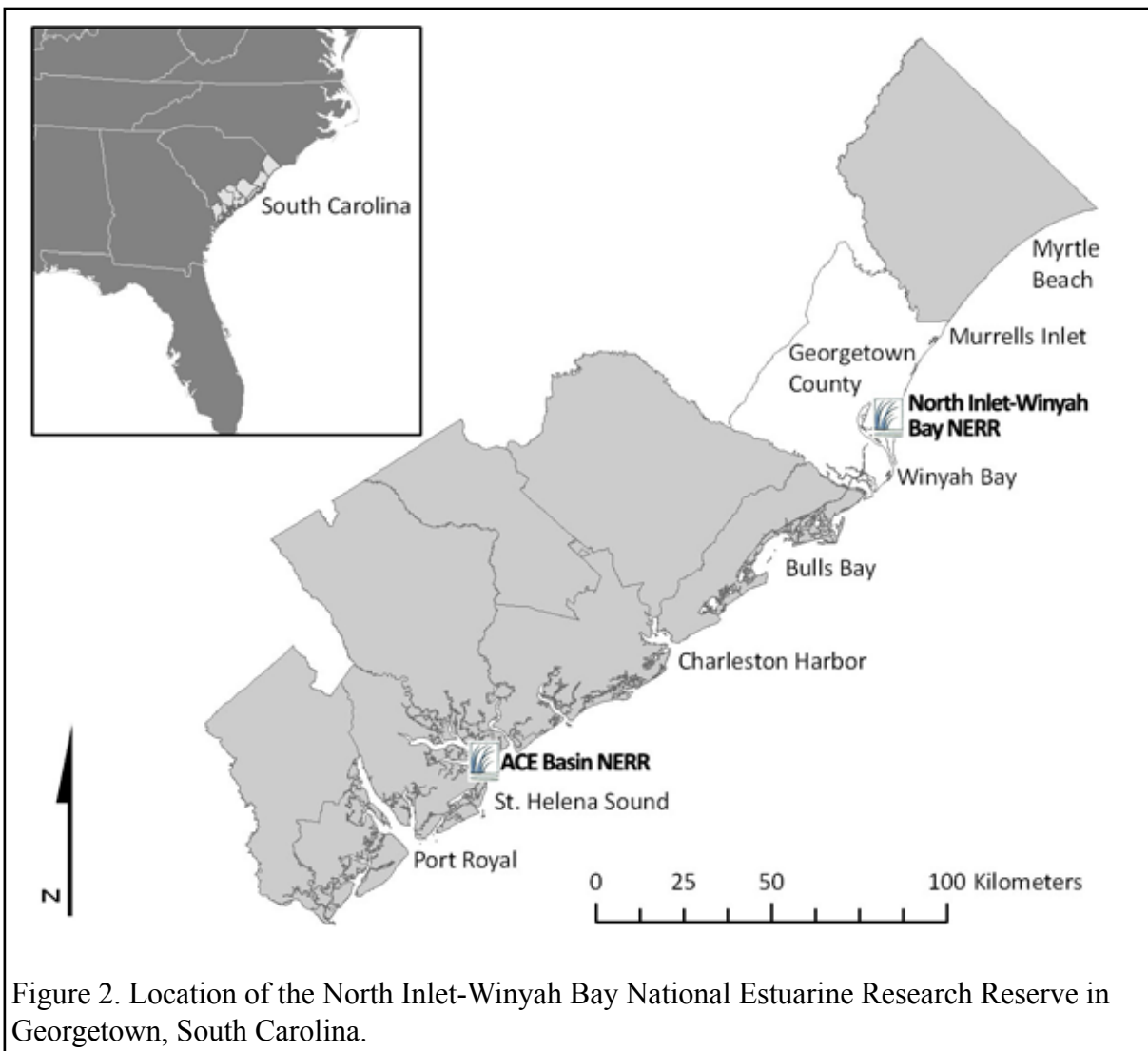


Figure 2. Location of the North Inlet-Winyah Bay National Estuarine Research Reserve in Georgetown, South Carolina.

Purpose and Scope of the Management Plan

This is the second management plan for North Inlet – Winyah Bay NERR and replaces the original management plan completed in 1992 when the Reserve was designated. It includes information on the Reserve, identifies our mission, and addresses three issues that have been identified as Reserve priorities. Goals, objectives and strategies to address these issues are also presented in the management plan. This issue-based approach requires that the strategies integrate education, research, monitoring, management, and/or stewardship components. Thus, even though the plan includes separate chapters by Reserve program areas or sectors (education and training, research and monitoring, and stewardship), it should be recognized that the sectors will be working together to achieve the Reserve objectives. The management plan is designed to be used as a framework for NI-WB NERR staff, other researchers, and partnering organizations that share our goals to address the priority resource issues that have been identified in this plan.

Reserve Description and Boundaries

The North Inlet – Winyah Bay NERR is in the South Atlantic subregion of the Carolinian biogeographic region in NOAA's Biogeographic Classification Scheme. The Reserve includes portions of two separate but connected estuaries: North Inlet, a small ocean-dominated estuary that is minimally impacted by human activities, and Winyah Bay, a classic estuary fed with freshwater by four major rivers (Figure 3).

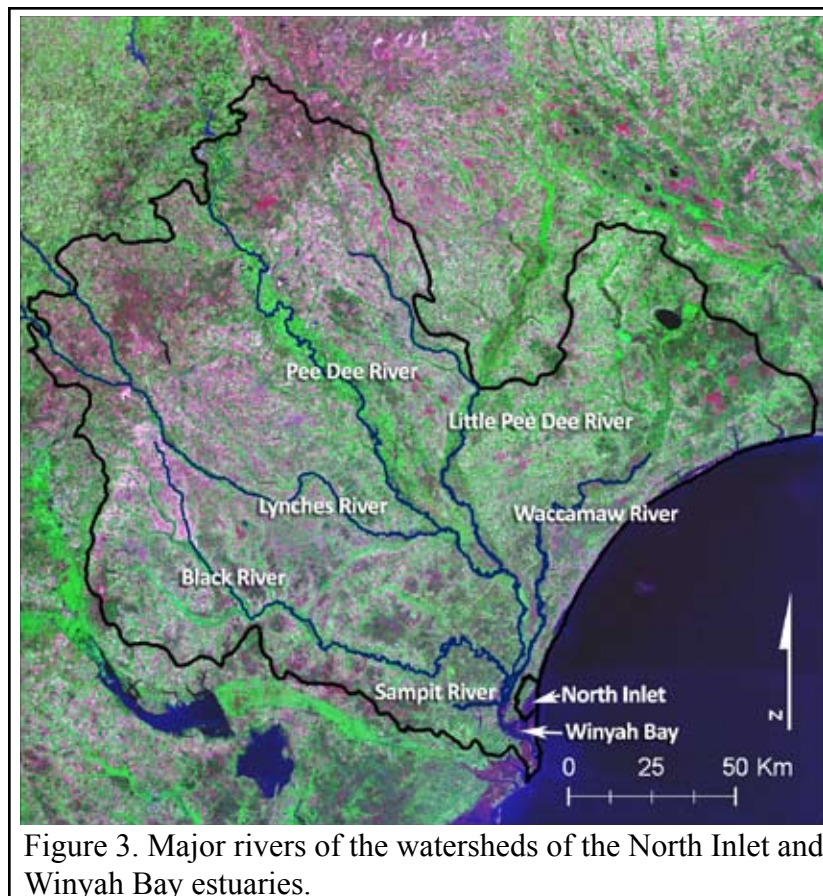


Figure 3. Major rivers of the watersheds of the North Inlet and Winyah Bay estuaries.

The Winyah Bay watershed is the third largest on the east coast and encompasses approximately 18,000 square miles. More than 16,000 square miles of this drainage area are associated with the Pee Dee-Yadkin river system which originates in the Blue Ridge Mountains of North Carolina and flows across the Piedmont region of both North and South Carolina and into Winyah Bay through the Pee Dee River. The Waccamaw River originates in Lake Waccamaw in the coastal plain of North Carolina and also receives water from the Pee Dee. The Black and Sampit Rivers drain much smaller subwatersheds within the coastal plain of South Carolina. Much of the land surrounding the lower portions of the watershed near the Reserve is in a forested or transitional-cultivated state (Figure 4). The city of Georgetown, located at the confluence of the four rivers as they enter Winyah Bay, includes residential, commercial and industrial developed areas.

In contrast to Winyah Bay, the North Inlet watershed is quite small, only about 37 square miles, most of which is currently in an undeveloped state. This contributes to the high water quality found throughout much of the North Inlet estuary. Most of the Reserve is classified as low marsh emergent wetland, dominated by salt marsh cordgrass, *Spartina alterniflora*. High marsh emergent wetland dominated by giant cordgrass, *Spartina cynosuroides* and black needlerush, *Juncus roemerianus*, is more common along the shores of Winyah Bay (Figure 5).

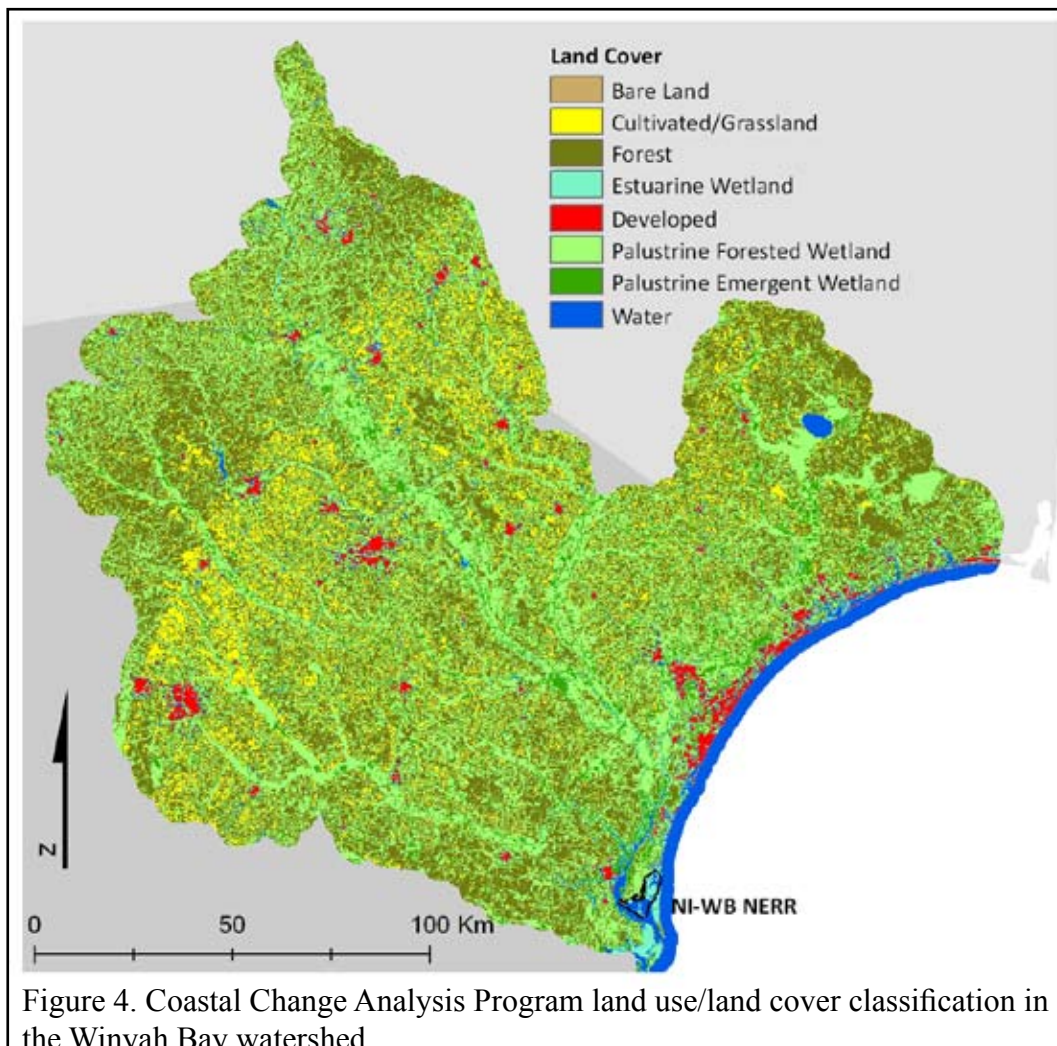


Figure 4. Coastal Change Analysis Program land use/land cover classification in the Winyah Bay watershed.

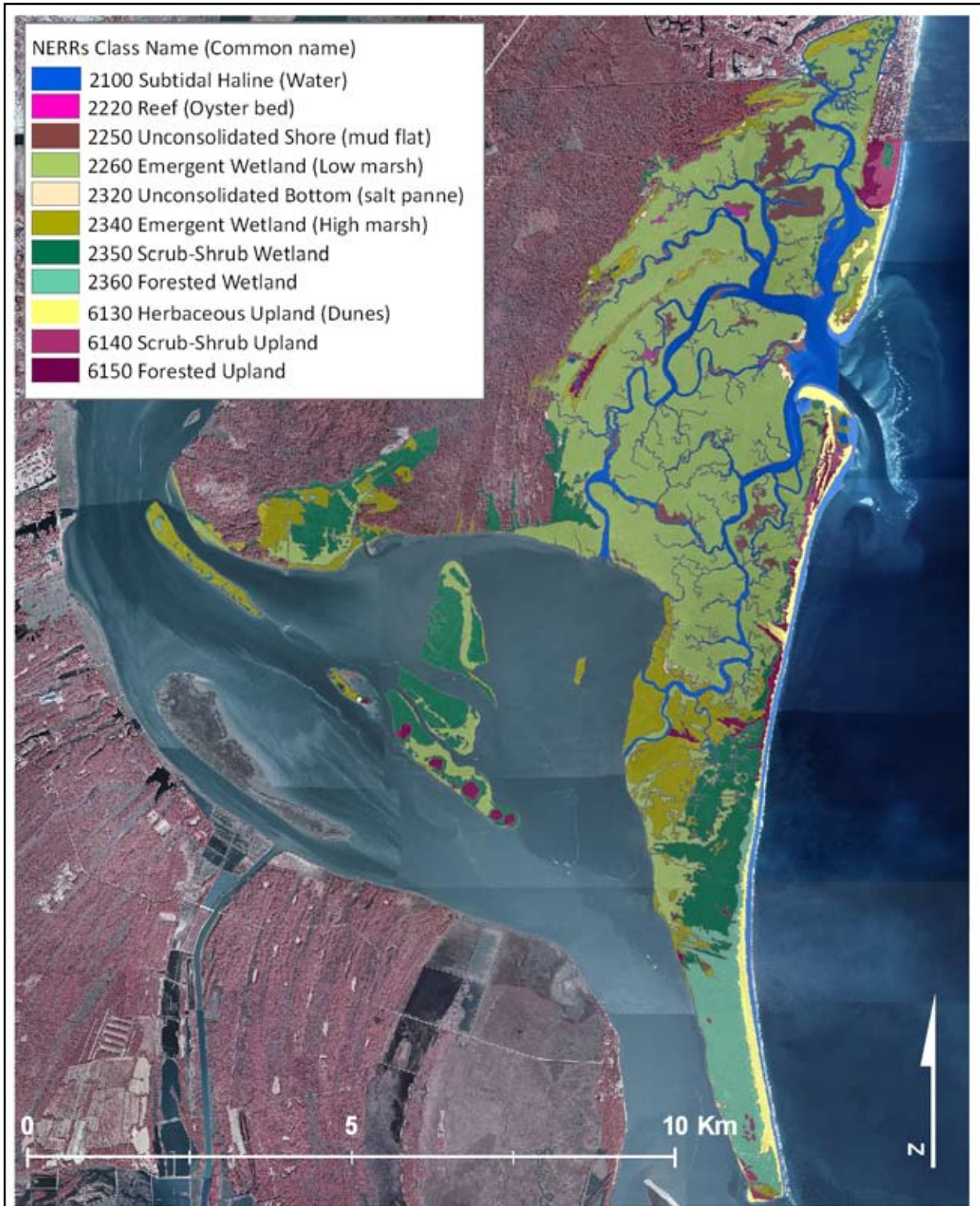


Figure 5. Major habitats of the North Inlet-Winyah Bay National Estuarine Research Reserve classified to the NERRS Comprehensive Habitat and Land Use Classification System.

The Reserve boundaries have not changed since designation in 1992 (Figure 6). The core, previously estimated at 9,000 acres, is now calculated to be 11,173 acres due to advancements made in GIS. The buffer acreage is 7,743 acres. Ownership of land within and surrounding the Reserve is shown in Figure 7. The core area of the Reserve is defined by NERRS regulations (15 C.F.R. Sec. 921.11(c)(3)) as containing “ecological units of a natural estuarine system which preserve, for research purposes, a full range of significant physical, chemical and biological factors contributing to the diversity of fauna, flora and natural processes occurring within the estuary.” The core area is “so vital to the functioning of the estuarine ecosystem that it must be under state control sufficient to ensure the long term viability of the Reserve for research on natural estuarine processes. [These areas] should encompass resources representative of the total ecosystem, and which if compromised, could endanger the research objectives of the Reserve.” The core of the Reserve includes the majority of North Inlet and the Mud Bay portion of Winyah Bay, which are the focus of research and resource protection efforts. The northern boundary of the North Inlet estuary portion of the Reserve begins in the northwest at the upper edge of the marsh abutting the uplands of the Belle W. Baruch Foundation property immediately west of the confluence of Bass Hole Bay and Debidue Creek. From this point the northern boundary line is Debidue Creek east to Debidue Island. The eastern border extends southward along Debidue Island to North Inlet, and then continues down Jones Creek to Haulover Creek where the boundary line follows Haulover Creek to Mud Bay. The core boundary line then extends southward and east of the marsh land into Mud Bay past Pumpkinseed Island to a point 150 yards north of the existing shipping channel. The southern boundary extends westward from this point, paralleling a line which crosses the southern end of the island complex of Malady Bush Island, Marsh Islands and Ranger Island at the mean low water mark, a line north of the existing shipping channel. West of Ranger Island, the boundary line continues north to Frazier Point. The landward boundary on the North Inlet segment of the Reserve is the uppermost reaches of existing *Spartina alterniflora* and includes the highlands surrounding the USC Baruch Marine Laboratory complex, Clambank Landing, and portions of Goat Island. The landward boundary on the Mud Bay segment of Winyah Bay is the dominant wetlands vegetation.

A buffer zone is defined by NOAA regulations as an “area adjacent to or surrounding the core and on which the integrity of the core depends. This area protects the core and provides additional protection for estuarine dependent species.” It may include an area for research and education facilities. The buffer area is comparatively undisturbed and is suitable for education, resource management, interpretive devices, and facilities. Presently, most of the Reserve’s buffer is located between the core area of wetlands and the upland forested ecosystem that is the ecotone region of transitional vegetation between the dominant marsh grasses and the forest. This zone is roughly 50 meters wide in most places. It includes portions of Debidue Island and marshlands immediately adjacent to the northern boundary line, and North Island, located south of North Inlet and west of Jones Creek. The buffer area also includes the waters of the Atlantic Ocean adjacent to the mouth of North Inlet and the waters of Winyah Bay north of the shipping channel. These waters are subject to state and Federal environmental protection laws and regulations. Aquatic areas within the Reserve can be reached by boat via tidal waters which are part of the public domain. The uplands associated with the Kimbel Living and Learning Center and the Hobcaw Barony Discovery Center at the entrance to Hobcaw Barony are also within the Reserve buffer.

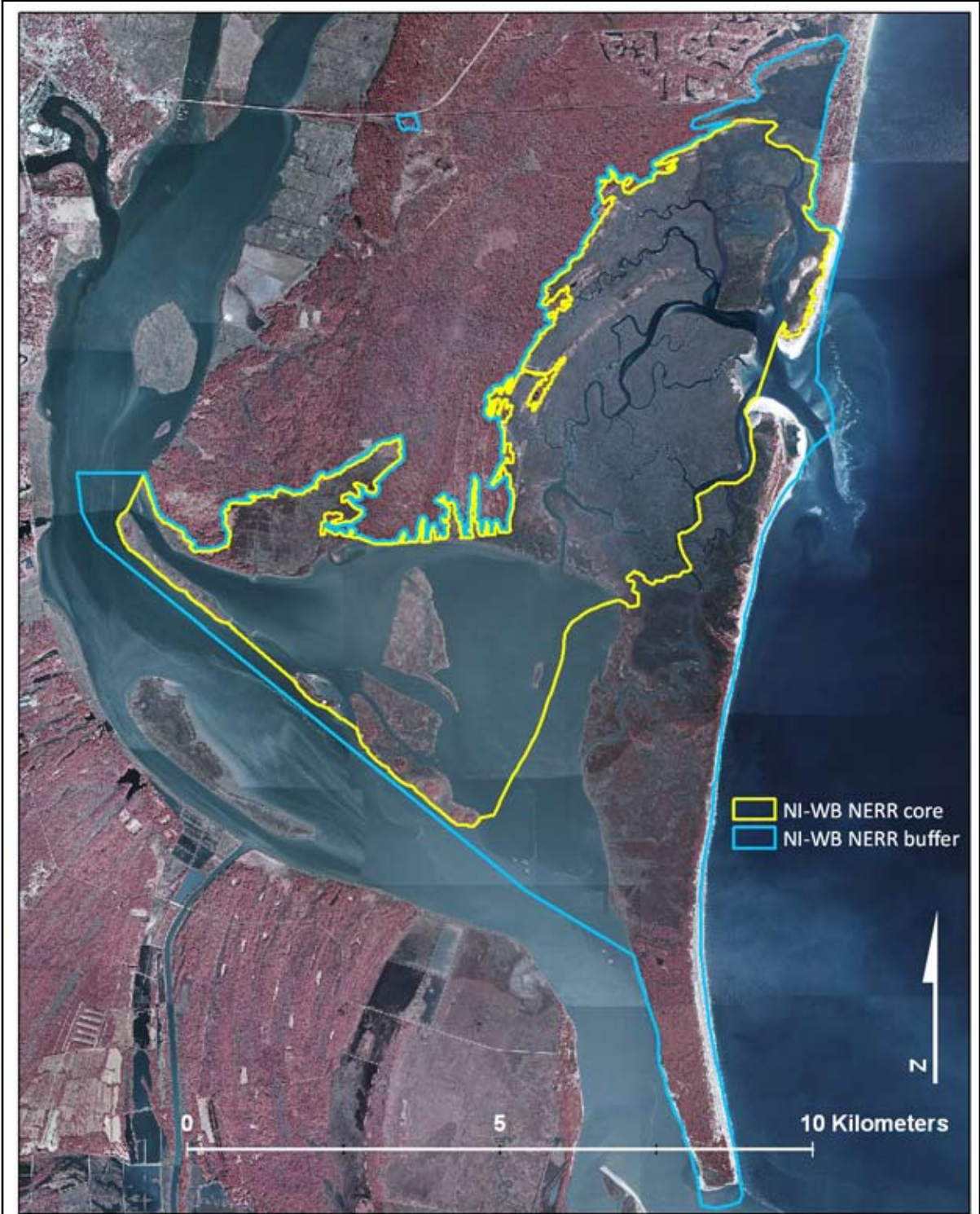


Figure 6. Core and buffer boundaries of the North Inlet-Winyah Bay National Estuarine Research Reserve.

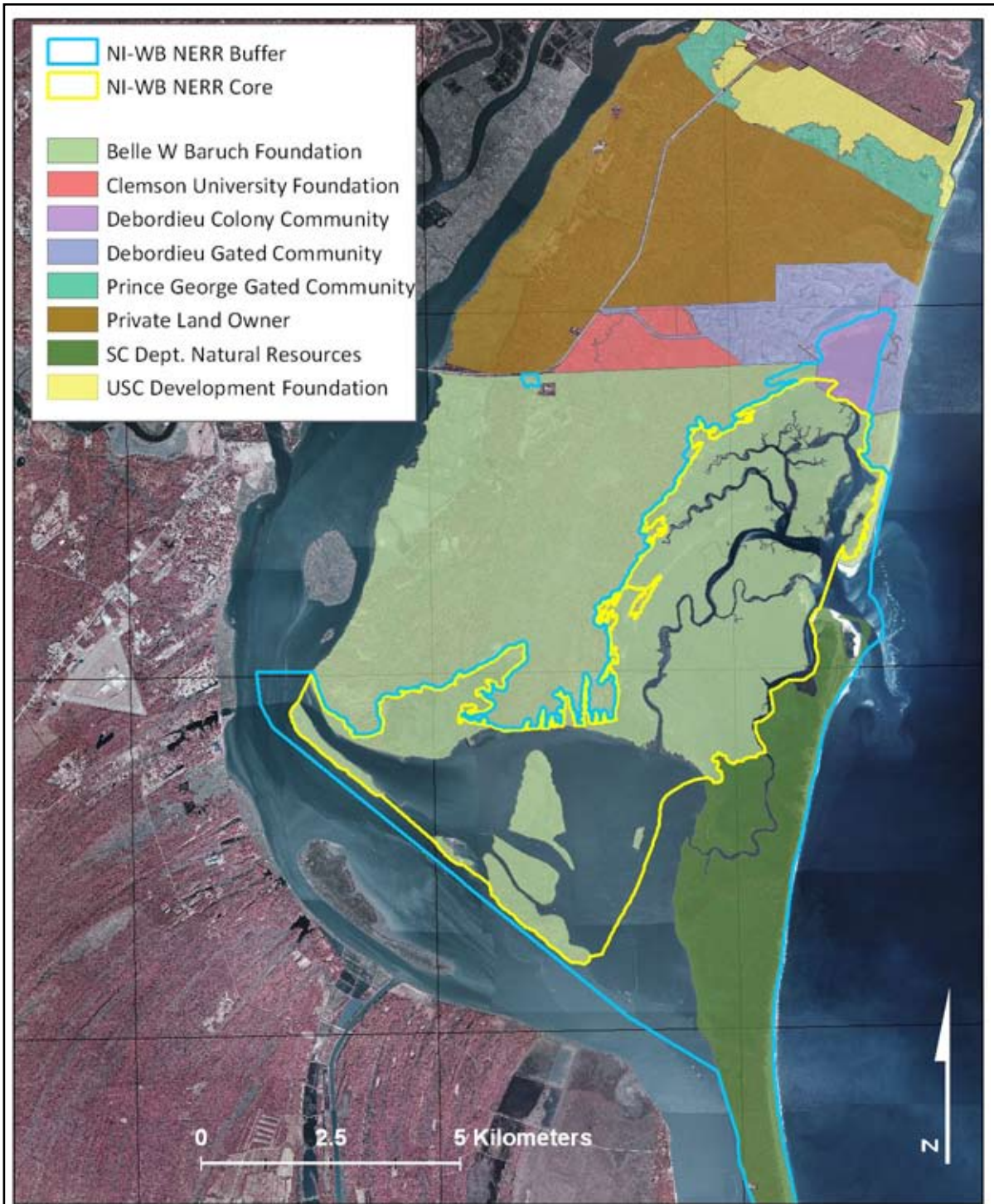


Figure 7. Ownership of the property surrounding the core and buffer boundaries of the North Inlet-Winyah Bay National Estuarine Research Reserve.

Historical Perspective

Hobcaw Barony, where the Reserve is located, has a rich and important history. The name “hobcaw” is a Native American word meaning “between the waters.” The Atlantic Ocean borders the property on the east and Winyah Bay surrounds Hobcaw Barony on the southern and eastern shores. Members of the Waccamaw tribe hunted deer and other game and enjoyed harvests of fish and shellfish from the estuaries. Numerous shell middens can be seen in the North Inlet marshes today and offer archeologists glimpses into this culture from 2,000 years ago.

The “barony” part of Hobcaw’s name refers to the land grant era in the 18th century. Lord Carteret, one of South Carolina’s eight Lords Proprietors was granted Hobcaw Barony by the king of England. The land grant was later sold and subdivided into separate tracts. Early income crops included timber, naval stores, indigo and then rice that reigned as the chief cash crop for nearly a century. Cypress swamps along the western side of the Hobcaw property were cleared, the wetlands were diked, water control structures called “rice trunks” were installed, and rice was planted and harvested by slaves who worked on the plantations. Today, slave cabins, rice mill ruins and former rice fields remain as reminders of this golden age of rice. The rice era declined with the emancipation of the slaves, competition from rice growers from the western states and with a series of hurricanes near the turn of the 19th century that altered the growing conditions in the fields.

A new era in Hobcaw’s history began in 1905 when Bernard M. Baruch, a native of South Carolina and Wall Street financier, started purchasing land and was able to piece together 11 of the 14 tracts that comprised the original King’s grant. Hobcaw became a winter retreat for the Baruch family and a place to hunt and entertain guests. Hundreds of distinguished authors, actors, congressman and honored military officials visited Hobcaw over the next several decades including Sir Winston Churchill and President Franklin D. Roosevelt. The entire Hobcaw Barony property, including all of its historic structures, is on the National Register of Historic Places.

Bernard and Annie Baruch had three children. Their eldest daughter Belle was very fond of Hobcaw and eventually purchased the entire property from her father and established a home here. It was through Belle’s vision and foresight that the entire property is protected today. The Belle W. Baruch Foundation was established in 1964 by the last will and testament of the late Belle Baruch who directed that her property be used for “the purpose of teaching and/or research in forestry, marine biology, and the care and propagation of wildlife and flora and fauna in South Carolina, in connection with colleges and/or universities in the State of South Carolina.” Clemson University established a long-term research facility on the Barony in 1968 and The University of South Carolina established the Belle W. Baruch Institute for Marine Biology and Coastal Research in 1969 and started conducting research on the Hobcaw property.

The North Inlet and Winyah Bay ecosystems have been recognized at the state and national levels as sites of particular interest for comparative ecological studies. The North Inlet estuary, an ecosystem which is relatively unperturbed by humans, has been the site of intensive study for more than forty years. The South Carolina Department of Health and Environmental Control

designated North Inlet as “Outstanding Resource Waters” (ORW), an area possessing unique ecological qualities. In addition, North Inlet is part of the Carolinian-South Atlantic Biosphere Reserve in the United States Man and the Biosphere Program. From 1980-1993, North Inlet estuary was part of the National Science Foundation’s Long-Term Ecological Research Program. The designation of the NI-WB NERR in 1992 has allowed the University of South Carolina to continue and expand opportunities for research, education and stewardship directed at resolving challenging coastal management issues.

Reserve Accomplishments

There have been a number of significant milestones for the NI-WB NERR since it was established in 1992. The program has grown from a small staff of five individuals, including a Manager who was part-time, a Research Coordinator, an Education Coordinator and two research technicians, to nine full-time and two part-time staff members. The Manager’s position has been full-time since 2001 and new positions were established including a full-time Stewardship Coordinator (2001), a Coastal Training Program Coordinator (2003) and full-time Education Specialist (2007.) The research and monitoring program has also grown from a Research Coordinator and two technicians to a Research Coordinator and three full-time research specialists and one part-time research assistant. The Reserve also shares a system administrator with the Baruch Marine Lab and NERRS Centralized Data Management Office (CDMO.)

Significant improvements to Reserve facilities have occurred since 1992. The NI-WB NERR was successful in securing a NOAA construction award to complete a 4,500 square-foot addition to the Baruch Marine Lab in 2002 that serves as the Reserve headquarters. NOAA Construction funds were also used to enhance educational facilities on site including construction of a salt marsh boardwalk and renovations to the Kimbel Lodge, a conference building used for public education and Coastal Training Program events. Most recently, the Reserve received a series of NOAA construction awards to plan and build an education center in cooperation with the Belle W. Baruch Foundation. This joint-use facility, the Hobcaw Barony Discovery Center, was completed in 2009. It has approximately 12,000 square feet of space and includes a large exhibit area, classroom, audio-visual room and offices for Reserve and Baruch Foundation education staff. Staff members of the NERRS CDMO also occupy space in the staff wing of the center. A screened outdoor classroom adjacent to the Kimbel Pond and Lodge was also completed in 2009.

Although the North Inlet site was already well known for its research productivity before the Reserve was established, the NI-WB NERR has provided a stable platform for additional research and long-term monitoring. The Reserve’s research and monitoring program has also experienced significant growth since 1992. Milestones include the successful establishment of the NERR System-wide Monitoring Program (SWMP) at our site (1993) and subsequent expansion of this program, including two monitoring sites that are linked via satellite for real-time data transmission. While the Reserve has continued long-term biological monitoring for zooplankton, nekton and benthos, programs established prior to designation, it has also initiated new monitoring programs. In 2005, the Reserve established a series of permanent sampling transects in North Inlet for long-term biomonitoring of emergent marsh vegetation according to NERRS protocols; this was expanded in 2007 to include measures of sediment elevation

change and porewater chemistry. These efforts position the Reserve to act as a sentinel site for salt marsh response to climate change and sea level rise in an area where marsh transgression of the uplands is not impeded by coastal development. In 2005 the Reserve also began routine monitoring of microplankton metabolism, designed to complement the SWMP nutrient monitoring program and track the ecological response of subtidal creeks to variability and change in salt marsh productivity. Within the broader watershed, the Reserve has been an active member of the Long Bay Workgroup since its inception in 2004, examining the occurrence and mechanisms of hypoxia formation along the Grand Strand.

The Reserve serves thousands of school age children each year and provides a variety of classes, seminars and other public events to engage adults and families in learning about estuaries and the discoveries being made by scientists in the Reserve. The addition of the marsh boardwalk in 1997 provided increased access and opportunities for visiting groups to learn about salt marshes. It is used regularly by the Reserve in its education programs for K-12 students and members of the public and also by the Belle W. Baruch Foundation during tours of the Hobcaw Barony property, conducted 2-4 times a week. The completion of the Hobcaw Barony Discovery Center in 2009 was a major milestone for the Reserve and enhances our presence and visibility in the local community. The Reserve also enhanced its visibility with the creation of a website that informs people about our research, monitoring, stewardship and education activities.

The transition of coastal issue workshops for decision-makers to a fully-implemented Coastal Training Program in 2003 represented another significant milestone for the Reserve. This training program has been very well received by the local communities that it serves and has resulted in more informed decisions and actions being taken by planners and local governments. A new audience needs assessment conducted in 2006 is being used to inform the direction for the program for the next several years.

The Reserve has also experienced success in the areas of resource management and stewardship. The Reserve worked with other conservation partners to develop the Coastal and Estuarine Land Conservation Program (CELCP) for South Carolina. The Reserve also worked with the NERRS to identify land conservation priorities for the NI-WB site as part of a system-wide project and shared these priorities with conservation partners in the state. Although the land conservation needs are significant, land acquisition opportunities that align with reserve priorities have not yet been realized. The Reserve has met with more success in taking an educational approach and works with neighbors in the watershed through stewardship activities, public education programs and trainings for decision-makers. One of the bigger success stories in this realm is through working with the Carolinas Beach Vitex Task Force. The Reserve helped form this group in 2002, remains an active member and maintains the task force website. Efforts of the task force have kept the invasive plant beach vitex from achieving its reputation as the “kudzu of the coast.” Education efforts combined with research, town and county imposed ordinances prohibiting the planting of beach vitex, and voluntary and mandatory eradication efforts by individual property owners and communities, have contributed to this success story. Additional information on Reserve accomplishments is included in the programmatic sections of the management plan.

CHAPTER 3 - MISSION, PRIORITY ISSUES, GOALS, OBJECTIVES AND STRATEGIES

The North Inlet – Winyah Bay NERR mission, our vision, and our priority issues, goals, objectives and strategies are presented in this chapter. They are the products of countless hours of strategic planning by Reserve staff members. During an initial planning session Reserve staff reflected on our reserve’s accomplishments and where we fell short. In addition, we identified and discussed external influences in the form of threats and opportunities. We also reviewed the NERRS Strategic Plan, and adopted a similar mission statement, focused on our estuarine watersheds. The mission statement was the easy part. The harder decision was how to frame our goals, objectives and strategies to achieve our mission. We decided on an issue-based, integrated sector approach, even though this approach presented some challenges in terms of addressing the programmatic requirements for management plans set forth in the regulations. We identified three primary issues that are impacting or could significantly impact our reserve in the future. Once the issues were identified, goals, objectives and strategies to address them were formulated.

This chapter provides the rationale behind the issues that have been identified as priorities to address over the next several years. It also includes agreed upon goals, objectives and strategies that the Reserve team plans to accomplish in a cross-program (sector) fashion. Reserve program areas or sectors taking the lead or assisting in meeting these objectives through reserve strategies are identified next to each strategy. Strategies to reach the objectives are further described in the programmatic chapters covering research and monitoring, education and stewardship.

Mission and Priority Issues

The mission of the North Inlet – Winyah Bay NERR is:

**“To promote stewardship in the North Inlet and
Winyah Bay watersheds through science and education”**

This mission supports our vision of sustainable and ecologically productive estuaries. The Reserve will address three priority issues over the next several years that will help us achieve this mission and vision. These issues and their relevance to the North Inlet – Winyah Bay NERR are described below.

PRIORITY ISSUE I - IMPACTS OF COASTAL GROWTH ON WATER AND HABITAT QUALITY AND ECOLOGICAL COMMUNITIES

South Carolina is among the fastest growing states in the nation. Population projections calculated by the SC Budget and Control Board's Office of Research and Statistics indicate that South Carolina's population will increase by over one million new residents by 2015, with rapid development at the periphery of the state's larger metropolitan areas and coastal resort/tourism centers (South Carolina Population...[cited 2010]). The state has roughly 182 miles of beaches and 200,000 acres of saltwater marshes that attract almost 30 million tourists—and the infrastructure and development to support them—annually.

A National Resource Inventory report released in 2000 indicated that between 1992 and 1997, 15.8 million acres of South Carolina's land were converted from farms and woodlands to a developed land status (U.S. Department of Agriculture 2000). Land was converted at six times the rate of population growth during that period, a rate of development that was the 9th fastest in the nation despite ranking only 40th among states in land mass. Development directly affects habitat quality and ecological communities as buildings and infrastructure replace natural areas, and also has indirect effects which are often overlooked and may be difficult to quantify. Runoff from impervious surfaces carries sediment, metals, and other toxic chemicals into ditches and small streams that feed into the waterways. The infilling of isolated wetlands compounds the runoff problem as the water holding and filtration capacity across the landscape is reduced. Development also forms barriers to the movement of species and materials between protected natural areas, creating a fragmented landscape which may have reduced ecosystem functioning.

The North Inlet (NI) watershed is currently largely in an undeveloped state. The land within the NI watershed is classified by the Coastal Change Analysis Program (C-CAP) as estuarine emergent wetland (29%), palustrine forested wetland (25%) and evergreen forest (18%). Only about 2% of this watershed is classified as low or medium intensity development. DeBordieu Colony is a gated residential community just north of the NERR, with high-end residential homes, condominiums, an 18-hole golf course, and a private boat ramp. Also in the NI watershed is the gated community Prince George with properties both east and west of Highway 17. This development includes beachfront and riverfront home sites and a private access boat slip and ramp on the Waccamaw River. The University of South Carolina Development Foundation also owns about 1,200 acres of forest, former rice fields and tidal marsh within the Prince George tract and plans to expand its Longleaf Environmental Education Center in the future. An additional planned development just north of DeBordieu, Bannockburn, will also be within the North Inlet watershed. Clemson University's Baruch Institute for Coastal Ecology and Forest Science has initiated a pre- and post development impact study on this property.

The Winyah Bay watershed encompasses the Yadkin-Pee Dee drainage basin and includes a small area of Virginia, and large portions of North and South Carolina, with a total drainage area of roughly 18,000 square miles, comprised of mostly rural forested and agricultural lands. Calculations of land cover based on the C-CAP data show that the majority of land is palustrine forested wetland (23%), evergreen forest (22%), cultivated land (19%), and scrub/shrub (12%). Approximately 3% of the land area is classified as low to high intensity development.

Within the City of Georgetown and Georgetown County, land use is much more diverse (with associated anthropogenic impacts), including large industries such as International Paper Company, 3V Chemical, a breakbulk and bulk cargo port facility, several marinas, and municipalities and associated infrastructure - including a variety of mixed-use businesses and single and multi-family residences. The Atlantic Intracoastal Waterway follows a portion of the Waccamaw River and maintenance dredging of this waterway and also the shipping channel for the Port of Georgetown is conducted on a regular basis.

Population Growth and Land Cover Change in the North Inlet and Winyah Bay Watersheds

The population of Georgetown County reached 63,520 in 2010 according to the U.S. Census Bureau. The population of the county increased by 9.5% between 1980 and 1990, by 20.5% between 1990 and 2000, and by 13.8% from 2000 to 2010. Current projections by the Waccamaw Regional Council of Governments anticipate that the County of Georgetown will increase its 2000 population an additional 30.1% by the year 2030 (Waccamaw Regional ... [cited 2010]). The Waccamaw Neck, the narrow strip of land between the Waccamaw River and the Atlantic Ocean which includes the resort town of Pawley's Island, Litchfield Beach, and Murrell's Inlet, is one of the fastest growing areas of Georgetown County. A 2003 population estimate of the Waccamaw Neck included 16,000 residents, a number that has tripled in the past 30 years.

The majority of landcover change from 1996 to 2001 within the Winyah Bay watershed was from evergreen forest to shrub/scrub (21% of total change), from shrub scrub to evergreen forest (14% of total change), from palustrine forested wetland to palustrine shrub scrub wetland (13% of total change) and from evergreen forest to grassland (11% of total change). These changes probably reflect forestry practices. About 3% of the total land change in the Winyah Bay watershed was undeveloped land to developed land. In comparison, within the Waccamaw Neck area adjacent to the NI-WB NERR, about 39% of the total land cover change was from undeveloped land to developed land.

There is a delicate balance between sustaining the growth and development that drive the state economy while protecting the natural resources that attract that growth and tourism. Faced with this rapid growth scenario, the NI-WB NERR is committed to maintaining and enhancing water and habitat quality in the Reserve and promoting stewardship of the resources in the North Inlet and Winyah Bay watersheds. To address this priority issue, Goal 1 of the Reserve is to focus efforts on research, monitoring, education, and resource management programs that will strategically minimize impacts of current and anticipated development in the region.

**GOAL 1: UNDERSTAND AND MINIMIZE THE IMPACTS OF COASTAL GROWTH
ON WATER AND HABITAT QUALITY AND ECOLOGICAL COMMUNITIES**

PRIORITY ISSUE II - IMPACTS OF NATURALLY OCCURRING SHORT-TERM, STOCHASTIC AND LONG-TERM, LARGE-SCALE CLIMATE EVENTS ON COASTAL ECOSYSTEMS AND HUMAN COMMUNITIES

Natural resources, from the scale of individual species to integrated ecosystems, are profoundly influenced by climate. The effects of climate operate through local weather variables such as temperature, precipitation, wind, and ocean currents, as well as the interactions among these. Improved coastal decision making through increased ecological understanding of estuaries requires knowledge of how these various forces interact at the local scale to generate the pronounced physical and biological variability characteristic of estuarine ecosystems. In particular, the ability to predict and manage for the impacts of growth in the watershed on estuarine resources (Issue I) requires the ability to discriminate between natural and anthropogenically-induced sources of estuarine variability.

Sources of climate impacts that are particularly relevant to understanding physical and ecological variability in the Reserve include both long-term global climate changes (increases in temperature and sea level), as well as pronounced climate variability associated with short-term, local weather events (tropical storms and hurricanes) and large-scale interplanetary phenomena (El Niño – Southern Oscillation and the North Atlantic Oscillation).

Global Warming and Sea Level Rise

On average, the Earth's surface atmosphere has warmed by approximately 0.7 °C (~ 1 °F) over the last 100 years (IPCC 2007). This warming trend is in part both natural and a result of human influence. Most of the increase over the last 100 years occurred during two main periods of warming, between 1910 and 1945 and from 1976 onwards. It is the rate of warming during this latter period, which is greater than at any other time during the last 1,000 years, that can be most directly linked to human influences (Houghton et al. 2001). Human activities that lead to enhanced global warming, particularly fossil fuel use and deforestation, continue to occur, and as a result, average global surface temperatures are projected to further increase anywhere from 1.5 to 5.8 °C by 2100.

Concurrent with a warming of the atmosphere, records of global ocean temperatures indicate the mean temperature of the ocean surface has increased by approximately 0.3 °C over the last 45 years (Levitus et al. 2000). As with surface air temperatures, this rate of warming is highly variable in time and space. Data collected within the Reserve for the last 20+ years indicate average annual water temperatures have increased approximately 1.5 °C since 1982, with the greatest degree of warming occurring in the late winter – early spring period.

With the rise in global temperatures, the volume of oceanic water has subsequently increased. This is due both to the melting of the polar ice caps and land-based glaciers as well as to the fact that water expands as it warms. Consistent with the global rise in temperature, global mean sea level has risen at an average rate of 1.8 mm per year since 1961 (IPCC 2007). Locally, the coast of South Carolina has experienced relative rates of sea level rise that are greater than 3 mm per year, on average, for the last 80 years (Morris 2002). Further global warming is predicted to accelerate this rate of sea level rise (IPCC 2007).

Large-Scale Climate Variability

In addition to the long-term trends in climate, large-scale undulations in atmospheric flow (the so-called ‘planetary-scale waves’) profoundly affect regional climate variability. The transient behavior of atmospheric planetary-scale waves, which displace air north and south around the planet, generates anomalies in climate on seasonal to decadal time-scales over large geographic regions. The best known of such large-scale climate patterns are the El Niño – Southern Oscillation (ENSO) and the North Atlantic Oscillation (NAO), both of which have documented, significant impact on the climate of the southeastern United States.

The ENSO phenomenon involves atmospheric exchanges of air between the eastern and western hemispheres centered in tropical and subtropical latitudes coupled to parallel changes in tropical Pacific sea-surface temperatures. Precipitation anomalies are the most important effects of ENSO for our location: positive El Niño periods bring increased moisture to the southeastern U.S., while negative El Niño periods (“La Niña” years) are correlated to drought conditions in our region. This region’s longest drought in the past ~ 50 years spanned 1998 – 2002, and was associated with a strong La Niña event from 1998-2001. In mid-2002, the drought ended rapidly with a dramatic rainfall increase; an El Niño event followed from late 2002 through 2003.

The NAO phenomenon refers to a north-south alternation in atmospheric mass between the subtropical Atlantic and the Arctic. Transitions from one extreme phase of the NAO to the other produce large changes in wind speed and direction over the Atlantic, resulting in corresponding changes in heat and moisture transport. Variations in the NAO are strongly correlated to seasonal temperature patterns in the southeastern U.S. In particular, strong positive NAO periods correspond to higher than normal winter-time temperatures in our region.

Tropical Storms and Hurricanes

Superimposed on the large-scale climate fluctuations are the intense weather events associated with tropical storms and hurricanes that are a familiar feature of the South Atlantic region. Inter-annual variability in storm-event frequency for this region is pronounced. For example, after a relatively quiescent period of storm activity (only three tropical storms or hurricanes made landfall between 2000-2003), seven named storms passed near or through the state of South Carolina in 2004 alone. Much of the long-term variability, it now appears, is related to the large-scale oscillations in climatological conditions discussed above, with La Niña events positively correlating to increased hurricane formation in the tropical Atlantic (Pielke & Landsea 1999). While it is difficult to identify long-term climate change effects on hurricane frequency, future storm intensities will likely increase as a result of warmer sea-surface temperatures associated with global warming (IPCC 2007).

Goal 2 of the Reserve management plan addresses the need to quantify the effects of short-term and long-term climate variability on estuarine ecosystems.

GOAL 2: UNDERSTAND THE IMPACTS OF NATURALLY OCCURRING SHORT-TERM, STOCHASTIC AND LONG-TERM, LARGE-SCALE CLIMATE EVENTS ON COASTAL ECOSYSTEMS AND HUMAN COMMUNITIES.

PRIORITY ISSUE III - IMPACTS OF INVASIVE SPECIES AND HABITAT LOSS ON BIODIVERSITY

The ecosystem functions provided by estuaries, including protection from flooding, water filtration, and economic and recreational services, are a product of the complex communities of species that have evolved over millions of years to be uniquely suited to the estuarine habitat. The loss of species from these communities can drastically reduce or eliminate ecosystem functions. The spread of new, non-native, species into the ecosystem can also disrupt the system by outcompeting and replacing native species, often causing major changes to habitat structure which may make habitats unsuitable for species within the community. The maintenance of biodiversity and control of invasive species in estuarine ecosystems will help insure the continued health and functioning of these systems.

Biodiversity

Biodiversity is the variability within and among living organisms and the systems they inhabit. This concept encompasses the wide variety of plants, animals, and microorganisms, the genetic differences within each species, and also the variety of ecosystems found on the earth. In general, species biodiversity makes ecosystems less vulnerable to shocks and disturbances, more resilient, and supplies humans with needed services.

The Living Planet Index (Humphrey et al. 2008) aggregates trends of about 3,000 wild populations of species based on published data from around the world. It shows a consistent decline in average species abundance of about 40% between 1970 and 2000. Inland water species declined by 50%, and marine and terrestrial species both declined by around 30%. The World Conservation Union (ICUN) estimates that between 12% and 52% of species within well-studied higher taxa are threatened with extinction and that over the past few hundred years humans have increased species extinction rates by as much as 1,000 times the background rates typical over Earth's history (Baillie et al. 2004).

Universal threats to biodiversity include habitat loss and degradation, invasive species, pollution, overpopulation, overexploitation and consumption, and global climate change. Estuarine species are susceptible to threats that originate both from land, such as siltation, nutrient loading, and pollution of air and water by toxic chemicals, and from marine pressures such as overharvest and marine debris and pollution. The loss of habitat due to direct and indirect effects of urban growth is of particular concern to the NI-WB NERR (Priority Issue I).

Invasive Species

A species is regarded as invasive if it has been introduced by human action to a location, area, or region where it did not previously occur naturally (i.e., is not native), becomes capable of establishing a breeding population in the new location without further intervention by humans, and becomes a pest in the new location, threatening the local biodiversity.

Invasive species create serious resource management problems throughout the Southeastern United States. They threaten natural diversity, habitat for fish, wildlife and native plants, soil stability, and ecosystem processes. This can lead to long-term negative impacts on both

the environment and local economy. Estuarine ecosystems are at risk from both marine and terrestrial invasive species.

Marine invasions are primarily due to fouled hulls and ship ballast which can carry marine organisms including bacteria, algae, invertebrates, fish, eggs, cysts and planktonic larvae. The waters off the state of South Carolina experience about 24 million gallons of foreign discharge per year, a relatively small contribution to the approximately 21 billion gallons of foreign ballast discharged into U.S. waters annually. However, invasive species can also travel via currents and smaller watercraft following their initial establishment in neighboring waters. There are several aquatic species that are likely to invade the North Inlet – Winyah Bay NERR in the future, such as *Perna viridis* (green mussel), that has been detected in Georgia and Florida.

Most terrestrial invasive species are plants and arrive for a variety of reasons including accidental transport on airplanes and ships, introductions for use as crops, livestock forage or forestry species and introduction of weed seeds as contaminants in other products. The most common reason for introduction, however, is horticultural use as ornamentals or to serve a specific purpose such as dune stabilization or erosion control.

Management of invasive species depends on many factors including life-history, degree of establishment, likelihood of spreading, and potential ecological and economic effects. Invasive species such as *Phragmites australis* (reed grass) and *Vitex rotundifolia* (beach vitex) are already established in the North Inlet and Winyah Bay watersheds and are in need of control. Species that are potential invaders and those that are currently in low numbers, such as *Petrolisthes armatus* (green porcelain crab), require monitoring.

The protection of native species and their habitats and control of invasive species are essential components of the NI-WB NERR’s management plan. To address this issues, the third goal of the Reserve is to understand and reduce the impacts of invasive species and habitat loss on biodiversity.

<p style="text-align: center;">GOAL 3: UNDERSTAND AND REDUCE THE IMPACTS OF INVASIVE SPECIES AND HABITAT LOSS ON BIODIVERSITY</p>
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Reserve Goals, Objectives and Strategies to Address Priority Issues

The Reserve has identified three goals to focus on over the next several years to address the identified priority issues. These goals and specific objectives and strategies to reach them are presented below. Reserve program areas with primary and assistance responsibilities for meeting the strategies are indicated in parentheses next to each strategy (R=Research, E=Education, S=Stewardship, CTP=Coastal Training Program, M=Management). Integrated approaches that will be utilized to accomplish the Reserve goals and objectives are described in the chapters dealing with research and monitoring, education, and stewardship. Approaches in these separate chapters are organized by program focus areas and include Reserve strategies that will be addressed by that program, in most cases in concert with other sectors.

It should be noted that careful thought went into determining the geographical scope for the objectives and strategies. Some apply specifically to the Reserve itself while others address desired outcomes for the North Inlet and Winyah Bay watersheds. We have also introduced a new term, “target watershed” to reflect a geographic region based on subwatersheds within the Winyah Bay drainage basin that are likely to have the most direct impact on the NI-WB NERR (Figure 8). The target watershed is particularly useful in addressing Best Management Practices (Strategy 1.1.3), land conservation priorities with partners (Strategy 1.3.1), and invasive species control (Strategy 3.2.2).

GOAL 1: UNDERSTAND AND MINIMIZE THE IMPACTS OF COASTAL GROWTH ON WATER AND HABITAT QUALITY AND ECOLOGICAL COMMUNITIES

Objective 1.1. Water quality in the North Inlet-Winyah Bay NERR is monitored and maintained.

Strategy 1.1.1 Quantify temporal and spatial variation in water quality such that changes in quality can be detected. (R)

Strategy 1.1.2 Work toward minimizing the increase of impervious cover in communities in the Reserve target watershed. (CTP lead; S assist)

Strategy 1.1.3 Promote the use of innovative stormwater Best Management Practices (BMPs) in new development and re-development in communities in the Reserve target watershed. (CTP lead; R, S, E assist)

Strategy 1.1.4 Provide educational programs and information on water quality for K-12 and community audiences. (E lead; S, CTP, R assist)

Strategy 1.1.5 Work with local stakeholders to develop a plan for maintaining the integrity of the North Inlet watershed. (M, S co-lead; CTP, R, E assist)

Strategy 1.1.6 Conduct and facilitate research quantifying impacts of coastal growth and stormwater management practices on water quality conditions. (R lead; S, CTP assist)

Objective 1.2. The habitat quality in the North Inlet—Winyah Bay NERR is maintained and, where possible, enhanced.

Strategy 1.2.1 Quantify salt marsh vegetation extent, community structure, and productivity to enable detection of potential future impacts of coastal growth. (R lead; S assist)

Strategy 1.2.2 Quantify estuarine faunal community abundance and diversity to enable detection of potential future impacts of coastal growth on recruitment and productivity. (R)

Strategy 1.2.3 Monitor marine debris in North Inlet and develop education and outreach programs to prevent the introduction of marine debris. (S lead; E assist)

Strategy 1.2.4 Provide educational programs and information on the importance of estuarine habitat for K-12 and community audiences. (E lead; S, CTP, R assist)

Objective 1.3. The natural, cultural, and economic resources in the North Inlet and Winyah Bay watersheds are protected and valued.

Strategy 1.3.1 Work with partners to develop a land conservation plan for the Reserve that identifies conservation and acquisition priorities in the Reserve target watershed. (M, S co-lead)

Strategy 1.3.2 Provide education, outreach, and training programs and materials about watershed connectivity, the impacts of different types of land use on estuarine ecosystems and resources, and how community members can protect these resources. (E, S co-lead; R, CTP assist)

Strategy 1.3.3 Promote community awareness and stewardship of the North Inlet-Winyah Bay NERR, the NERR System, and the resources and services offered through the NERRS. (E, S co-lead; M, CTP assist)

GOAL 2: UNDERSTAND AND COMMUNICATE THE IMPACTS OF NATURALLY OCCURRING SHORT-TERM, STOCHASTIC AND LONG-TERM, LARGE-SCALE CLIMATE EVENTS ON COASTAL ECOSYSTEMS AND HUMAN COMMUNITIES

Objective 2.1. Climate variability and its effects on ecosystem processes and resources in the North Inlet and Winyah Bay estuaries are better understood.

Strategy 2.1.1 Quantify scales (periodicities) of climate variability and change operating at the local-to-regional level, and understand their consequences for water quality conditions within the Reserve. (R lead)

Strategy 2.1.2 Quantify impacts of long-term climate variability (e.g., El Nino Southern Oscillation) and change (e.g., sea-level rise) on salt marsh vegetation and sediment dynamics. (R lead; S assist)

Strategy 2.1.3 Conduct and facilitate research quantifying natural variability in key estuarine ecosystem processes and the impacts of climate change on these processes (R lead)

Objective 2.2. The skills and abilities of local communities and coastal decision-makers to plan for, mitigate, and adapt to long-term and stochastic climatic events are increased.

Strategy 2.2.1 Increase the Reserve's role in coastal training and community education pertaining to the effects of climate variability and change on estuarine resources and coastal hazards. (CTP lead; E, R, S assist)

Strategy 2.2.2 Work with local stakeholders to plan for the impacts of climate events and change on the communities in the Reserve target watershed. (CTP, S, M co-lead)

GOAL 3: UNDERSTAND AND REDUCE THE IMPACTS OF INVASIVE SPECIES AND HABITAT LOSS ON BIODIVERSITY

Objective 3.1. Native species are conserved and their habitats are protected and restored in the North Inlet and Winyah Bay watersheds.

Strategy 3.1.1 Facilitate the implementation of inventory programs for threatened, endangered and key species in the North Inlet-Winyah Bay NERR. (S lead; R assist)

Strategy 3.1.2 Quantify the distribution and connectivity of estuarine habitats and assess threats to critical habitats in the Reserve. (S lead)

Strategy 3.1.3 Provide education programs and materials for resource users on biodiversity and native species conservation issues. (S lead; E assist)

Strategy 3.1.4 Work with partners to identify and implement priority restoration science projects. (S lead; R assist)

Objective 3.2. Invasive species in the North Inlet and Winyah Bay watershed are detected, monitored and controlled.

Strategy 3.2.1 Implement invasive species monitoring strategies for species that currently threaten or could be a future threat to Reserve resources. (S lead; R assist)

Strategy 3.2.2 Work with partners on invasive species removal and habitat restoration programs for high priority species and critical habitats in the Reserve target watershed. (S lead; R assist)

Strategy 3.2.3 Develop partnerships and expand the role of the Reserve in education, training, and outreach related to native and invasive species issues. (S, CTP co-lead; E assist)

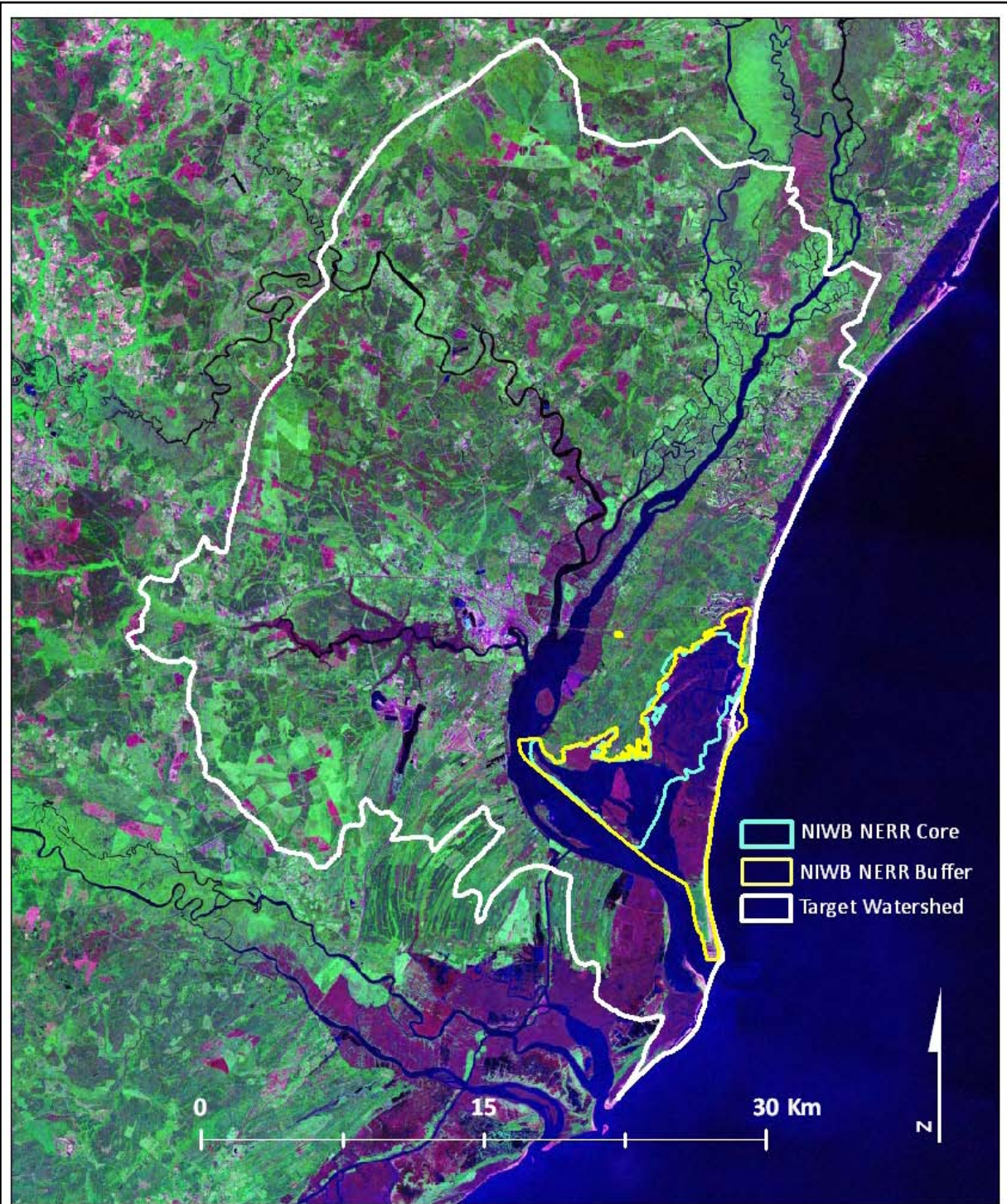


Figure 8. Target watershed which reflects a geographic region based on subwatersheds within the Winyah Bay drainage basin that are likely to have the most direct impact on the NI-WB NERR.

CHAPTER 4 - ADMINISTRATION AND OPERATIONS

National Estuarine Research Reserve System Administrative Framework

The Estuarine Reserves Division of the Office of Ocean and Coastal Resource Management (OCRM) administers the reserve system. The Division establishes standards for designating and operating reserves, provides support for reserve operations and system-wide programming, undertakes projects that benefit the reserve system, and integrates information from individual reserves to support decision-making at the national level. As required by Federal regulation, 15 C.F.R. Sec. 921.40, OCRM periodically evaluates reserves for compliance with Federal requirements and with the individual reserve's Federally-approved management plan.

The Estuarine Reserves Division currently provides support for three system-wide programs: the System-Wide Monitoring Program, the Graduate Research Fellowship Program, and the Coastal Training Program. They also provide support for reserve initiatives on restoration science, invasive species, K-12 education, and reserve specific research, monitoring, education and resource stewardship initiatives and programs.

North Inlet – Winyah Bay NERR Administrative Plan

The South Carolina Office of Ocean and Coastal Resource Management (SC-OCRM, formerly the South Carolina Coastal Council), Department of Health and Environmental Control (DHEC), was the lead fiscal agent for the ACE Basin and North Inlet-Winyah Bay NERRs from the time both reserves were originally designated until the 2002 fiscal year. In 2002, the South Carolina Research Foundation, an affiliate of the University of South Carolina (USC), became the fiscal agent for NI-WB NERR and as such, receives the grant awards from NOAA under the Federal Coastal Zone Management Act. The Belle W. Baruch Institute for Marine and Coastal Sciences (formerly the Belle W. Baruch Institute for Marine Biology and Coastal Research) at USC is the management agency for the Reserve and is responsible for implementation of the management plan and the day-to-day operation of the NERR program. SC-OCRM is still involved with Reserve activities and holds a seat on the Reserve's Advisory Committee and is a key partner with the Reserve's Coastal Training Program. A new Memorandum of Agreement between NOAA and the University of South Carolina was signed in 2010 and reflects these changes since the NI-WB NERR was established in 1992 (Appendix B).

The NI-WB NERR also works closely with the Belle W. Baruch Foundation that owns and manages the Hobcaw Barony property, a portion of which is in the Reserve boundaries. The Reserve Headquarters, the Hobcaw Barony Discovery Center, and other NERR facilities are also located on the Baruch Foundation property. The Baruch Foundation, USC, and Clemson University entered into a twenty-five year Tripartite Agreement in 1975 under which USC operates a research facility and laboratory for the purpose of studying the marsh and estuarine areas on the Foundation's property. This agreement would have expired in the year 2000

and was replaced with a new “Research and Property Use” agreement between the Baruch Foundation and USC, signed in November 1999 (Appendix C.) The new agreement was for 15 years (until December 31, 2015) and had the renewal option of an additional ten years upon mutual agreement of both parties. In planning for the Hobcaw Barony Discovery Center, a joint-use education facility of USC and the Baruch Foundation, an additional agreement between USC and the Baruch Foundation was signed in 2008 outlining the purpose of the new facility and responsibilities of both parties in its operation (Appendix D). In this additional agreement and through a Belle W. Baruch Foundation Board of Trustees Resolution on August 11, 2008 (Appendix E), the “Research and Property Use” agreement was extended another twenty-five years, until the year 2033, so that both agreements will expire at the same time. The “Research and Property Use” agreement clearly defines responsibilities of the University and its employees engaged in research and education on the property as well as services provided by the Foundation. The marsh-marine area defined for USC use and forest-marine area for Clemson University changed from what was previously identified in the Tripartite Agreement. Thousand Acre Rice Field had formerly been defined as marsh-marine for primary use by USC in cooperation with the Foundation, and other rice fields along the western edge of the property were designated “forest-marine” for use by Clemson University. Additionally, the southern end of Debidue Beach owned by the Foundation had been designated “forest-marine” for primary use by Clemson University. All of these areas are designated as “Foundation Reserve” in the new agreement and are reserved for the use of the Foundation.

The Baruch Foundation has legal management authority over the upland portions of the Hobcaw Barony property. It shares management authority of the intertidal areas and waterways with various state and federal regulatory agencies including the South Carolina Department of Natural Resources (SCDNR), SC-OCRM, and the US Army Corps of Engineers. Any new research proposed for the Baruch Foundation’s property through USC or Clemson goes through a formal approval process to ensure that the research is compatible with the Foundation’s mission and does not negatively impact the environment. This approval process also ensures that the Foundation is kept informed of all research activities conducted on its property.

Staffing

The three core staff positions required by NOAA to operate a NERR, Reserve Manager, Education Coordinator, and Research Coordinator, have been in place since the NI-WB NERR was designated in 1992. Prior to 2001, the Reserve Manager also held an appointment as Director of the Baruch Marine Field Laboratory. A full-time Reserve Manager was hired in July 2001 to oversee the reserve program. A full-time Resource Coordinator (Stewardship Coordinator) position was also established in 2001 to facilitate stewardship activities for the Reserve. The Stewardship Coordinator has also provided geographic information system (GIS) services applicable to resource management issues. In addition to these core positions, the Reserve currently employs three full-time research specialists to carry out the NERR System-wide Monitoring Program and other research and monitoring activities for the Reserve. The Reserve has also supported an education specialist and communications system administrator on a part-time basis in recent years. A full-time Coastal Training Program Coordinator was added to the staff in June 2003 and a full-time education specialist was hired in August 2007. All

Reserve staff members are employees of the University of South Carolina. Several staff members at the Baruch Marine Field Lab (BMFL) as well as at the Baruch Institute office on the USC main campus in Columbia also provide support services to the NERR. These services include boat and vehicle maintenance, coordination of visiting scientists and college groups, and grant management. An organizational chart showing the relationships between the Reserve's different administrative entities and its staff is depicted in Figure 9. Current staff positions and associated primary roles and responsibilities are described below.

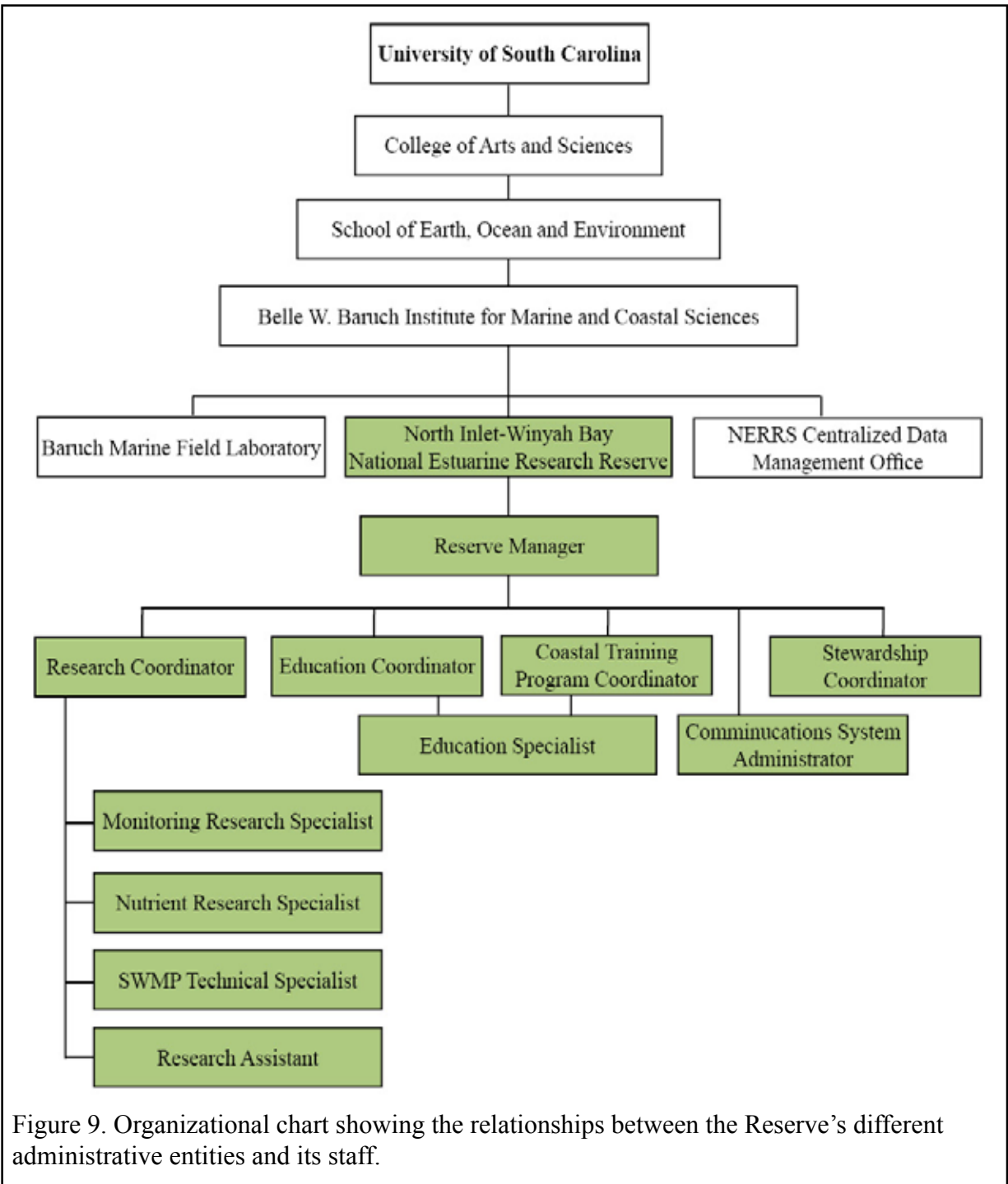


Figure 9. Organizational chart showing the relationships between the Reserve's different administrative entities and its staff.

Reserve Manager

- ▶ Provide oversight of the Reserve's research and monitoring, education and stewardship programs, including supervision of staff with primary coordination responsibilities for these programs, and ensure program consistency with Reserve goals and objectives, annual work plans, NERRS performance measures, and other NERRS requirements
- ▶ Prepare and manage annual budget and work plan for Reserve operations and seek additional funds to support program activities
- ▶ Coordinate local program management with NOAA's Estuarine Reserves Division to ensure consistency with federal guidelines, prepare required reports, attend meetings, and coordinate activities with other NERR sites, as appropriate
- ▶ Communicate with and organize meetings for the Reserve's Advisory Committee and prepare and present summaries of Reserve accomplishments
- ▶ Work with partners at local, state and federal levels to improve cooperation and coordination in implementing NI-WB NERR and NERR system-wide goals and objectives

Research Coordinator

- ▶ Oversee the Reserve's research and monitoring program, including supervision of research and monitoring staff, and ensure program consistency with the NI-WB NERR management plan, annual operating plans and NERRS requirements
- ▶ Analyze and interpret data and develop products that can be shared with scientific and educational communities
- ▶ Seek funding to expand research and monitoring to advance the goals and objectives of the NI-WB NERR
- ▶ Facilitate new research and monitoring by other investigators that can enhance the research goals of the Reserve
- ▶ Work with NERRS colleagues and other partners at local, state, and national levels to enhance research and monitoring goals of the Reserve and the NERR System

Monitoring Research Specialist

- ▶ Oversee the maintenance and scheduled deployment and retrieval of YSI dataloggers and assist with the scheduled deployment and retrieval of automated water samplers
- ▶ Manage NERR emergent vegetation monitoring project in coordination with the Research Coordinator and other research staff, including field sampling and laboratory analysis
- ▶ Coordinate and participate in the NERR fauna monitoring programs, including field sampling and laboratory analysis of plankton and nekton as well as microbial metabolism monitoring, including field sampling and laboratory analysis of bacterial production and respiration
- ▶ Participate in data management and the statistical analysis and interpretation of water quality and biological data, including the data submission to the NERRS CDMO and presentation and publication of research and monitoring results
- ▶ Manage day-to-day operation of NERR Monitoring Laboratory, including scheduling

of monitoring equipment use, determining research and monitoring supply needs and facilitating necessary repairs and purchases

Nutrient Research Specialist

- ▶ Maintain, deploy and retrieve automated water samplers according to predetermined schedule and whenever additional research opportunities arise
- ▶ Conduct laboratory analyses of water samples for nutrients, carbon and chlorophyll using analytical equipment including Technicon autoanalyzers, Shimadzu carbon analyzer, Turner fluorometer
- ▶ Process nutrient and water quality data, including data quality assessment/quality control and data submission to the NERRS CDMO
- ▶ Manage analytical services laboratory, including maintenance and upkeep of analytical equipment, implementation of laboratory sample management and quality assurance program, ordering and stocking of lab supplies, maintenance of de-ionized water system, oversight and coordination of general use equipment, and training of students and visiting researchers in analytical procedures and equipment use
- ▶ Assist with NERR fauna monitoring programs

SWMP Technical Specialist

- ▶ Maintain meteorological sampling station, including trouble shooting of problems, downloading and processing of data, and submitting data and metadata to the NERRS CDMO
- ▶ Participate in NERR biological monitoring programs and other Reserve research and monitoring programs that may arise
- ▶ Provide support in the collection and processing of hydrographic and water chemistry datasets
- ▶ Participate in the statistical analysis and interpretation of monitoring data, including presentation and publication of research and monitoring results

Research Assistant

- ▶ Provide field and laboratory assistance with the emergent vegetation monitoring project and fauna monitoring
- ▶ Provide assistance with NERR water quality monitoring including deployment and retrieval of dataloggers, water samplers, and the analyses of water quality samples as needed
- ▶ Assist with data quality assurance/quality control of NERR research and monitoring datasets

Education Coordinator

- ▶ Oversee the Reserve's public education program, including supervision of education program staff and volunteers, and ensure program consistency with the NI-WB NERR management plan, annual operating plans and NERRS requirements
- ▶ Plan, design, conduct, and evaluate the Reserve's core education programs for different audiences including students, teachers and families
- ▶ Assist in the planning and implementation of training workshops, courses and other programs for environmental professionals
- ▶ Develop instructional and interpretive materials and displays that incorporate the results from estuarine research
- ▶ Coordinate Reserve education program activities with NERR system-wide initiatives and with other local and regional organizations that provide environmental education programs in South Carolina

CTP Coordinator

- ▶ Develop, market, and implement training activities and provide relevant materials for coastal decision-maker audiences to address priority coastal issues based on audience training needs
- ▶ Provide or facilitate technical assistance for decision-maker audiences
- ▶ Develop, administer and analyze periodic audience needs assessments and incorporate the results into program planning efforts
- ▶ Coordinate program evaluation and implementation of system-wide CTP performance measures and apply results to improve the program
- ▶ Contribute to annual action plans and performance reports for the NI-WB NERR, prepare program summaries and presentations for regularly scheduled meetings of the NI-WB NERR Advisory Committee, and participate in NERR CTP activities at state, regional, and national levels

Education Specialist

- ▶ Assist in the implementation of educational field trips and outreach programs for K-12 classes and in the development and implementation of teacher professional development programs
- ▶ Develop and conduct community education programs that integrate research results and address key Reserve resource issues
- ▶ Assist in the development of printed and multi-media educational and interpretive materials and exhibits for a variety of audiences
- ▶ Provide assistance to the Coastal Training Program in workshop planning and implementation and other duties as needed

Stewardship Coordinator

- ▶ Plan, develop and coordinate resource management and conservation projects for the Reserve in collaboration with the NERR team, The Belle W. Baruch Foundation, and other key community partners and volunteers, as appropriate
- ▶ Develop and apply GIS tools and products to address resource conservation issues
- ▶ Recruit, coordinate and supervise students and volunteers to work on resource management projects and coordinate related stewardship outreach activities
- ▶ Establish and maintain effective working relationships with agencies and organizations that have management responsibilities in the NERR and surrounding watersheds, track relevant permit applications that may impact the NERR, and provide science-based information and recommendations to the NERR Manager and appropriate agencies to protect or improve habitat and water quality in the NERR
- ▶ Contribute to annual operations plan and performance reports for the NERR, prepare program summaries and presentations for the North Inlet-Winyah Bay NERR Advisory Committee, and participate in NERR stewardship activities at state, regional, and national levels

Communications System Administrator

- ▶ Maintain network servers and other equipment that supports e-mail, Internet, websites, phone and other linked communication services at the Baruch Marine Field Laboratory, NERR Headquarters, Hobcaw Barony Discovery Center and Kimbel Living and Learning Center on the Hobcaw Barony property
- ▶ Provide regular back-up services for data stored on NERR servers
- ▶ Provide technical support to NERR staff regarding procurement and efficient operation of communications hardware and software

Future Staffing Needs

It is anticipated that a volunteer program, currently coordinated by the Baruch Foundation with assistance provided by the NERR, will expand over the next few years as the Reserve's education program grows in partnership with the Baruch Foundation at the Hobcaw Barony Discovery Center. A full-time volunteer coordinator will likely be needed as this program expands. An Education Specialist currently shares duties between the Reserve's public education program and the Coastal Training Program. Both of these programs would benefit from increased staffing; ideally with full-time positions dedicated to support each program. Additionally, the Stewardship Coordinator has historically doubled as the Reserve's GIS analyst. Presently, we do not have a need for a full-time GIS analyst; however, the stewardship program would benefit from an assistant trained in GIS, thus freeing up the Stewardship Coordinator to devote more time to resource conservation activities.

Advisory Committees

The structure for the NI-WB NERR Advisory Committee as outlined in the original management plan has been followed and has served the Reserve well over the years. The Advisory Committee meets twice a year, learns of recent Reserve accomplishments and upcoming activities, and provides the Reserve with input on issues of concern to represented constituent groups. Committee member group composition as outlined in the original management plan has remained basically unchanged with a few exceptions. From time to time, the committee voted to expand membership to include representatives from groups that were not previously represented, mostly due to the fact that they did not exist in 1992 and have become important forces in the Georgetown community in recent years. The Director of the Baruch Institute, USC, serves as Chair of the Committee. A representative of ERD-NOAA and the Dean of the USC College of Arts and Sciences serve as ex-officio, non-voting members. The composition of the Advisory Committee is summarized in Table 1. Their primary roles include:

- ▶ Represent the interests of the users of the Reserve, its neighbors and the users of information and educational materials generated by the Reserve
- ▶ Assist in seeking support for the research and education programs
- ▶ Advise on matters of policy relating to planning and operation of the Reserve

Representatives on the Advisory Committee are eligible to serve as long as they are interested. Reserve staff and committee members can make recommendations for additions to the Advisory Committee. Committee decisions concerning membership and other matters are made by consensus. In the event that consensus is not reached, decisions are made by a majority vote of members present.

Education and Research sub-committees of the Advisory Committee have met on an as-needed basis over the years. These sub-committees were particularly active when the Reserve was new and trying to make connections with different segments of the community. The Reserve plans to re-establish an education advisory committee to assist in further development of K-12 student and teacher programs. This is one of the required steps for implementation of the NERRS K-12 Estuarine Education Program (KEEP).

As the NERR System began taking a more targeted approach to training of local decision makers through the development of the Coastal Training Program (CTP), the NI-WB NERR teamed up with the ACE Basin NERR, South Carolina Sea Grant Consortium, SC-OCRM and the NOAA Coastal Services Center to coordinate CTP efforts in South Carolina. These groups formed the South Carolina CTP Coordinating Committee (later renamed the South Carolina CTP Advisory Committee) and have met at least annually since 2003 to plan and coordinate training for decision makers on relevant coastal issues. These key partners have also contributed training space, technical assistance and expertise, and financial resources to the training programs hosted by the NERR. This committee will continue to provide an important advisory role for the NERR Coastal Training Programs in South Carolina.

Table 1. Composition of the North Inlet – Winyah Bay National Estuarine Research Reserve Advisory Committee

Represented Group	Number of Representatives
Belle W. Baruch Institute for Marine and Coastal Sciences, University of South Carolina – Director serves as Chair	1
Belle W. Baruch Foundation	1
Belle W. Baruch Institute of Coastal Ecology and Forest Science, Clemson University	1
Marine scientific/management community	1
Education community	2
Management of harbor-related industries	1
Labor from harbor-related industries	1
Recreational fishing community	1
Georgetown County Chamber of Commerce	1
South Carolina Ports Authority	1
Environmental interest groups	2
DeBordieu Community Association	1
Yawkey Wildlife Center – SC Department of Natural Resources	1
Waccamaw Council of Governments	1
Georgetown County Council	1
Georgetown County Planning Department	1
Georgetown City Council	1
South Carolina Sea Grant Consortium	1
ACE Basin National Estuarine Research Reserve	1
Waccamaw National Wildlife Refuge	1
General public	2
College of Arts and Sciences – Dean serves as ex-officio member	1
Estuarine Reserves Division, NOAA – Program Specialist serves as ex-officio member	1

CHAPTER 5 - FACILITIES PLAN

Background and Accomplishments

The Reserve has operated out of facilities owned and maintained by the Baruch Institute, USC, on the Baruch Foundation property since it was designated in 1992. These facilities have transitioned from temporary office and research space in trailers and reconfigured cottages, used after Hurricane Hugo destroyed the Baruch Marine Field Lab (BMFL) in fall 1989, to a state-of-the-art 16,000 square foot research laboratory completed in 1993. NOAA construction funds, matched with state funds, were used to construct a 4,500 square foot addition to the BMFL that has served as the Reserve Headquarters since 2002. Up until 2009, this building housed most of the NERR staff and provided office space for the NERRS Centralized Data Management Office (CDMO). The headquarters building includes six offices, a monitoring lab, classroom and library.



The marsh boardwalk is used for public programs sponsored by the Reserve and the Baruch Foundation.

The Reserve also matched state resources with NOAA Acquisition and Construction funds to construct a marsh boardwalk using an environmentally friendly recycled material. This boardwalk includes interpretive signs and is used in a number of public programs sponsored by the Reserve and also the Baruch Foundation. NOAA Acquisition and Construction funds were also used to make improvements to the Kimbel Lodge that serves as a primary location for Reserve-sponsored public education classes and training events for decision makers.

Most recently, the Reserve received construction awards to complete different phases of an Education and Training Center project. This project involved significant expansion of an existing Hobcaw Barony Visitor Center operated by the Belle W. Baruch Foundation. The new joint-use facility, renamed the Hobcaw Barony Discovery Center, was completed in 2009. It includes about 1,800 square feet of dedicated exhibit space, an audiovisual room, classroom, and office space for Reserve and Baruch Foundation education staff. It also

includes a wing to house the NERRS CDMO staff. Phase III of this project involved final design and fabrication of exhibits for the new center. Exhibits were completed and installed in June 2009 and the Hobcaw Barony Discovery Center opened to the public July 1, 2009. An outdoor classroom adjacent to the Kimbel Pond and referred to as the “Pond Shelter,” was also completed in 2009 as part of this construction project. A ceremony was held in September 2009 to dedicate these exciting new educational facilities.

Anticipated Facility Needs

The NI-WB NERR is very fortunate to have excellent research facilities, a new education center, and access to USC housing and conference facilities on the Hobcaw Barony property. One major concern is the age of some of these facilities and the lack of green design in the older buildings, particularly the Baruch Marine Field Lab (1993) and Kimbel Living and Learning Center (original three cottages and Kimbel Lodge constructed in 1977). The Reserve would like to be able to retrofit some of these facilities with greener technologies and products, as available and contingent on funding opportunities. Other projected facility needs include an additional cottage for visiting and resident scientists and students and a laundry or a combined laundry/recreation building for the housing complex. An interpretive trail near the Kimbel Pond with signage and a demonstration flood gate is also desired to complement the educational programming associated with the Hobcaw Barony Discovery Center and Pond Shelter. The Reserve would also benefit greatly from improved boat access to Winyah Bay from the Hobcaw Barony property. An accessible dock on Winyah Bay would enhance the Reserve's education and research programs. Table 2 provides a list of desired construction projects, estimated costs and projected time frames.

Table 2. Desired construction projects, estimated costs and projected time frames.

Construction Project	Estimated Cost	Desired Initiation Year
Kimbel Pond Interpretive trail with demonstration flood gate	\$100,000	2011
Laundry or combined laundry/recreation building	\$40,000 – laundry or \$150,000 – combined laundry/ recreation building	2011
Winyah Bay Access Dock	\$150,000	2012
Green Retrofits		
Phase 1 – Planning - assess potential retrofits and estimated costs	\$50,000	2012
Phase 2 – Install green retrofits	Unknown until Phase 1 completed	2013
Cottage for visiting scientists	\$275,000	2014



The existing Hobcaw Barony Visitor Center was significantly expanded in 2009 as a joint-use facility and renamed the Hobcaw Barony Discovery Center (HBDC).



The expanded HBDC includes about 1,800 square feet of dedicated exhibit space, an audiovisual room, classroom, and office space for Reserve and Baruch Foundation education staff.



The "Pond Shelter", an outdoor classroom adjacent to the Kimbel Pond, was also completed in 2009 as part of the HBDC construction project.



An interpretive trail near the Kimbel Pond with signage and a demonstration flood gate would complement current educational programming.



The Reserve would like to be able to retrofit some of the older facilities, such as the Baruch Marine Field Lab, with greener technologies and products.



An additional cottage for visiting and resident scientists and students and a combined laundry/recreation building would expand available facilities.

CHAPTER 6 - RESOURCE MANAGEMENT, REGULATORY AUTHORITIES AND LAND CONSERVATION

The NI-WB NERR works in cooperation with the Belle W. Baruch Foundation (BWBF) and other partners to ensure that the resources in the Reserve are managed and protected to the fullest extent possible. Authority for resource protection within the Reserve resides with a number of different state and federal agencies. Allowable uses, public access, prohibited and restricted uses and land conservation planning and partnerships are summarized in this chapter.

Allowable Uses and Public Access

Traditional uses of North Inlet and Winyah Bay include hunting, boating, fishing and shellfishing in accordance with state and Federal laws. Public access to the Reserve follows existing policies in that the public has access to the North Inlet and Winyah Bay portions of the Reserve by boat, including power boats. According to state and Federal laws no tidal waters can be restricted to public access. The public also is provided access to the Reserve through programs provided by the NI-WB NERR, the BWBF, and other partners on the Hobcaw Barony property. The Hobcaw Barony Discovery Center located at the property entrance is open Monday-Friday, 9:00 am - 5:00 pm. This education facility provides opportunities for members of the public to learn about the North Inlet - Winyah Bay NERR and its research, education and stewardship activities.

Traditional existing activities in the NI-WB NERR will continue at levels currently permitted under local and state laws. It is not within the authority of the Reserve to establish special regulations, nor is it the intent, objective or desire of the NI-WB NERR to restrict in any manner the legal traditional uses of public waterways that are currently under state and Federal jurisdiction and included in the Reserve.

Prohibited and Restricted Uses

Public recreational activities are not allowed on the upland areas of the Hobcaw Barony property. Since Hobcaw Barony is in private ownership of the BWBF, no hunting or trapping is allowed on the upland portions of the property without approval by the Baruch Foundation.

Public access and use of the upland portions of the Reserve is restricted by the BWBF. Visitors authorized by the BWBF, Baruch Institute or the Reserve, including scientists, students, and special groups, may enter through the electronic gate at the main entrance of Hobcaw Barony. Scientific permit requests are carefully reviewed through the system now in place in the Baruch Institute of USC. The Baruch Institute obtains a permit each year from the SC Department of Natural Resources, Marine Resources Division, to collect biological samples in the North Inlet and Winyah Bay area. If new research projects are not covered by this permit, the investigator will have to obtain a special permit from the appropriate governmental agency such United

States Fish and Wildlife Service (USFWS) or NOAA. Approved permits must be in possession of permit holders at all times. In addition to state and federal permits, written permission must be obtained from the BWBF prior to conducting research on the Hobcaw Barony property.

Applicable Authorities, Resource Protection Regulations and Enforcement

The South Carolina Coastal Management Act defines the critical area as all coastal waters, tidelands, beaches, and primary ocean front sand dunes within the coastal zone of the state. With the exception of the high ground portion of the few scattered islands located in Winyah Bay, most of the core area of the NI-WB NERR is classified as critical area. Any activity which occurs in the core area of the Reserve will be regulated by permit through the South Carolina Coastal Zone Management Program. A permit is required for any activity which impacts a critical area; in order to receive a permit the activity must be evaluated in accordance with a strict set of policies and regulations. In summary, the policies for wetland areas prohibit the permanent alteration of productive salt, brackish, or freshwater wetlands unless there is an overriding public interest, no feasible alternatives, and all environmental impacts are minimized. Regulated activities include not only major activities, such as dredging or filling, but also activities such as the installation of pipelines, powerlines, docks, intake structures, and many others.

Activities in the non-critical area portions of the Reserve are permitted through the Federal Coastal Zone Management Act and the South Carolina Coastal Zone Management Act. Consistency is required in all direct and regulated state and federal activities which occur in the coastal zone of South Carolina. The coastal zone encompasses the eight counties on the coast of the Atlantic Ocean. Therefore, any activity which requires a state or federal permit must undergo a coastal zone management consistency determination before the permit can be issued. The policies utilized to make a consistency determination are similar to those required for critical areas. The entire NI-WB NERR site falls within the coastal zone of South Carolina. Therefore, any activity which requires a permit must be consistent with the coastal zone management program and the specific policies of the NERR.

The NI-WB NERR cooperates with existing surveillance and enforcement activities provided by the BWBF, and state and Federal agencies. The BWBF is responsible for security on the private lands of Hobcaw Barony and cooperates with DHEC, responsible for law enforcement of shellfishing in the state. The South Carolina Department of Natural Resources (SCDNR) is responsible for enforcing boating laws, the Federal Marine Mammal Protection and Endangered Species Acts, enforcement of upland game and fish laws, search rescue, etc. within the Reserve. US Fish and Wildlife Service special agents also patrol the area for routine law enforcement activities related to Federal statutes such as the Migratory Bird Treaty Act and the Endangered Species Act.

The NI-WB NERR has the ability to protect resources by a variety of means. The Reserve contacts SC-OCRM regarding problematic activities conducted within the Reserve. Reserve staff also reviews any permit request affecting the Reserve resources. Public education and training programs for coastal decision-makers promote compatible uses of the Reserve and raise awareness of the need to protect sensitive resources.

Land Conservation

Conservation Project Areas

The Reserve engaged in its first significant effort to define land conservation priorities in 2002 as part of a NERRS land conservation project that resulted in the publication *A Land Acquisition Inventory of the NERRS* (Wellenberger 2002). Reserves were asked to identify and characterize priority areas for conservation. The North Inlet - Winyah Bay NERR identified five project areas and ranked them based on a variety of factors including ecological benefits and acquisition concerns. Two of the priority areas (southern end of Debidue Beach and Thousand-Acre rice field, both within the Reserve boundary) that formerly were in imminent danger of changing ownership or experiencing significant habitat modification have remained unchanged and are no longer considered priorities. The other areas, however, are still of high priority to the Reserve in terms of protecting water and habitat quality, especially in North Inlet. These project areas, the Sampit, Winyah, and the North Inlet Watershed, are shown in Figure 10 in relation to land areas that have conservation protection in the Reserve target watershed. Of primary interest to the Reserve is the development of conservation corridors, particularly those that link land within the North Inlet watershed and also lands along the Waccamaw River from the Waccamaw National Wildlife Refuge to the Reserve. The landscape setting and conservation concerns for each of the three project areas are briefly described below.

Sampit Project Area: The Sampit project area encompasses 23,349 ha of land in southern Georgetown County (Figure 11). The Sampit River forms the waterfront of the city of Georgetown where it is bordered by the ArcelorMittal steel mill (in which production has been stopped indefinitely), and the International Paper Company kraft paper mill. The Winyah Generating Station, a coal-fired power plant, is also located in this project area. At least 2,400 home sites have been proposed in four development projects on land bordering Winyah Bay and the Sampit River, however none of the projects are currently active due to economic concerns.

Winyah Project Area: The Winyah project area is located in northern Georgetown County and includes portions of the Black, Pee Dee and Waccamaw Rivers (Figure 12). The majority of the 27,152 ha of land in this area is evergreen forest. Palustrine forested wetlands and palustrine emergent wetlands occur along the river floodplains. A large portion of the land in this area is owned by lumber or pulp and paper companies. This land could potentially be used for low density residential development if sold to developers, increasing urban sprawl. Currently Wedgefield Plantation is the only large development in this project area. A planned development was approved in 2007 for 5,930 homes, but no work has progressed due to economic concerns and the future of this development is unknown. Several tracts of land are under conservation easements managed by Ducks Unlimited or The Nature Conservancy. As mentioned above, the Reserve would like to work with partners to complete a conservation corridor connecting land along the Waccamaw and Pee Dee Rivers from the Waccamaw National Wildlife Refuge to the Reserve boundary.

North Inlet Watershed Project Area: This project area includes 2,086 ha that is within the watershed of the North Inlet estuary (Figure 13). Currently, this area is almost completely undeveloped palustrine wetland. The Prince George development encompasses 1,900 acres between the Atlantic and the Waccamaw River, 1,280 of which are currently owned by the University of South Carolina Development Foundation and used for environmental research and education. The remaining 620 acres is limited to 150 home sites. A planned development was approved in 2002 for up to 3,300 homes, a resort hotel, golf course, equestrian center, and offices and commercial space. This development has not moved forward, but the potential impacts of future development of this type on the North Inlet watershed and estuary is of concern to the Reserve. A conservation corridor within the North Inlet watershed is of high priority to the Reserve.

Conservation Partnerships

The Reserve contributed to the Coastal and Estuarine Land Conservation Program (CELCP) planning process for South Carolina and our conservation priorities were considered in the development of the CELCP plan for the state. SC DHEC OCRM is the lead agency for South Carolina's CELCP program. Authorization of CELCP in 2009 included language that stipulated at least 15% of the CELCP allocations benefit NERR sites. This has heightened local awareness of the leveraging role our reserve can contribute to land conservation efforts. The Reserve was invited to contribute to a proposal submitted for CELCP funds in FY2010 and again in FY2011 for a project that will protect forested wetlands in the Winyah Bay watershed.

In 2009 the NI-WB NERR became a member of the Winyah Bay Focus Area Task Force comprised of federal, state, and private partners committed to conservation of resources in the Winyah Bay watershed. Key conservation partners on this Task Force include the USFWS, SCDNR, the Pee Dee Land Trust, and The Nature Conservancy.

Conservation Education

Education has been the focus of the Reserve's land conservation efforts to date and these efforts are reflected in our priority issues, goals, objectives and strategies. In particular, the Reserve plans to focus efforts through the Coastal Training Program, public education, and stewardship efforts to encourage property owners and developers to utilize practices that minimize their impacts on the environment. The NI-WB NERR also plans to continue working with conservation partners to encourage and support critical land purchases and conservation easements; however, the NI-WB NERR currently does not have the expertise to take the lead in these efforts.

In addition to these education efforts, over the next few years the Reserve will be reexamining current Reserve boundaries, especially the buffer area which includes minimal upland areas adjacent to the core marshlands and waterways. In the face of rising sea level and increasing coastal development, it is prudent to examine these boundaries to ensure they are adequate to protect resources in the NI-WB NERR.

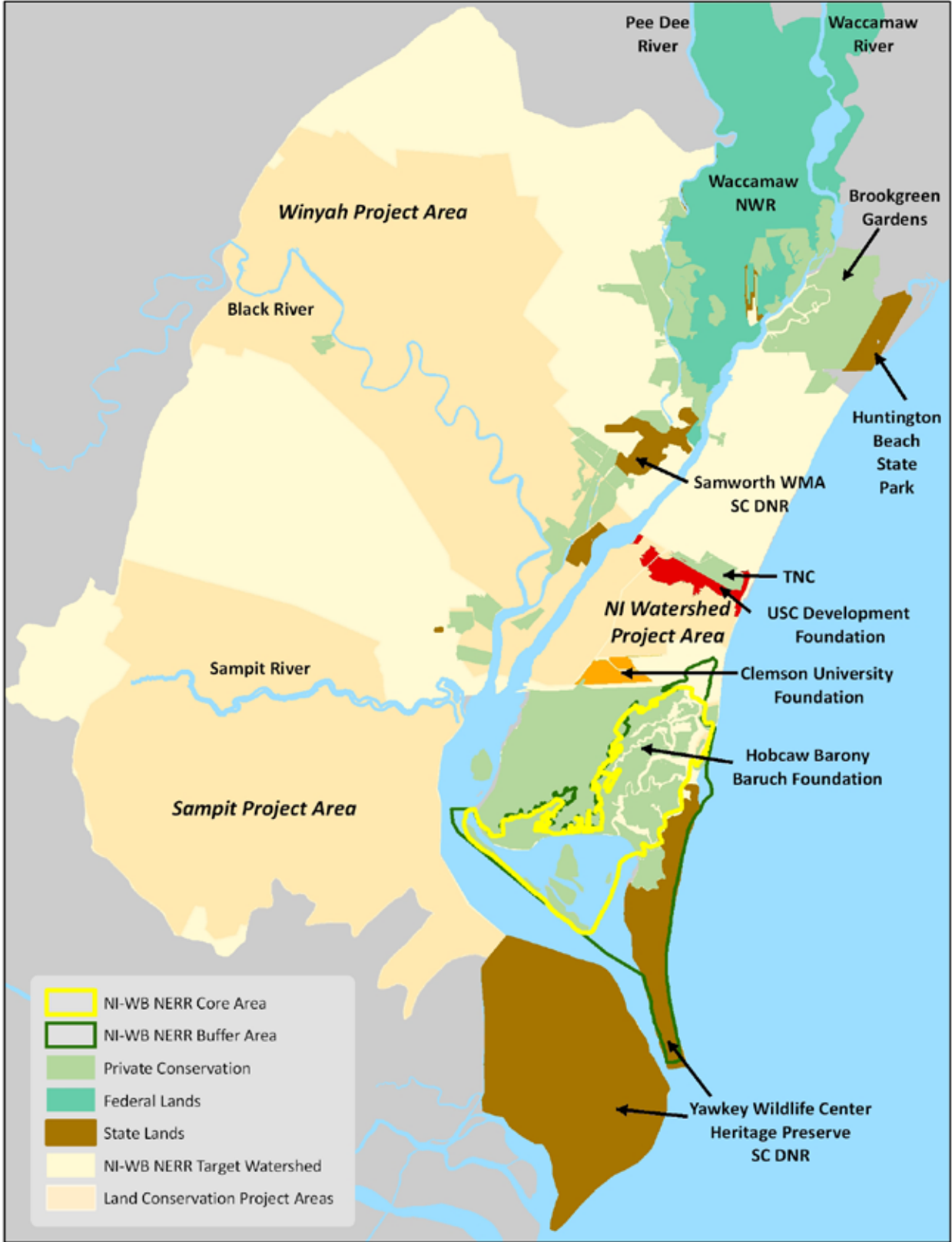
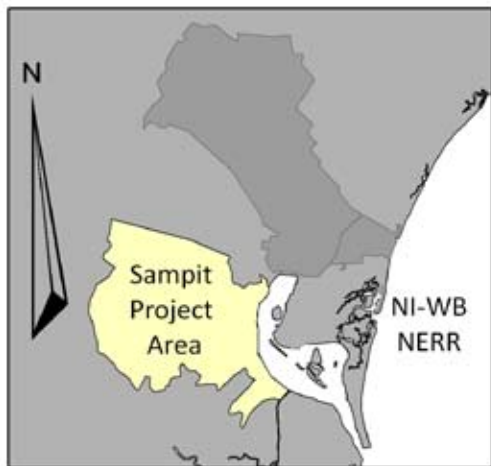
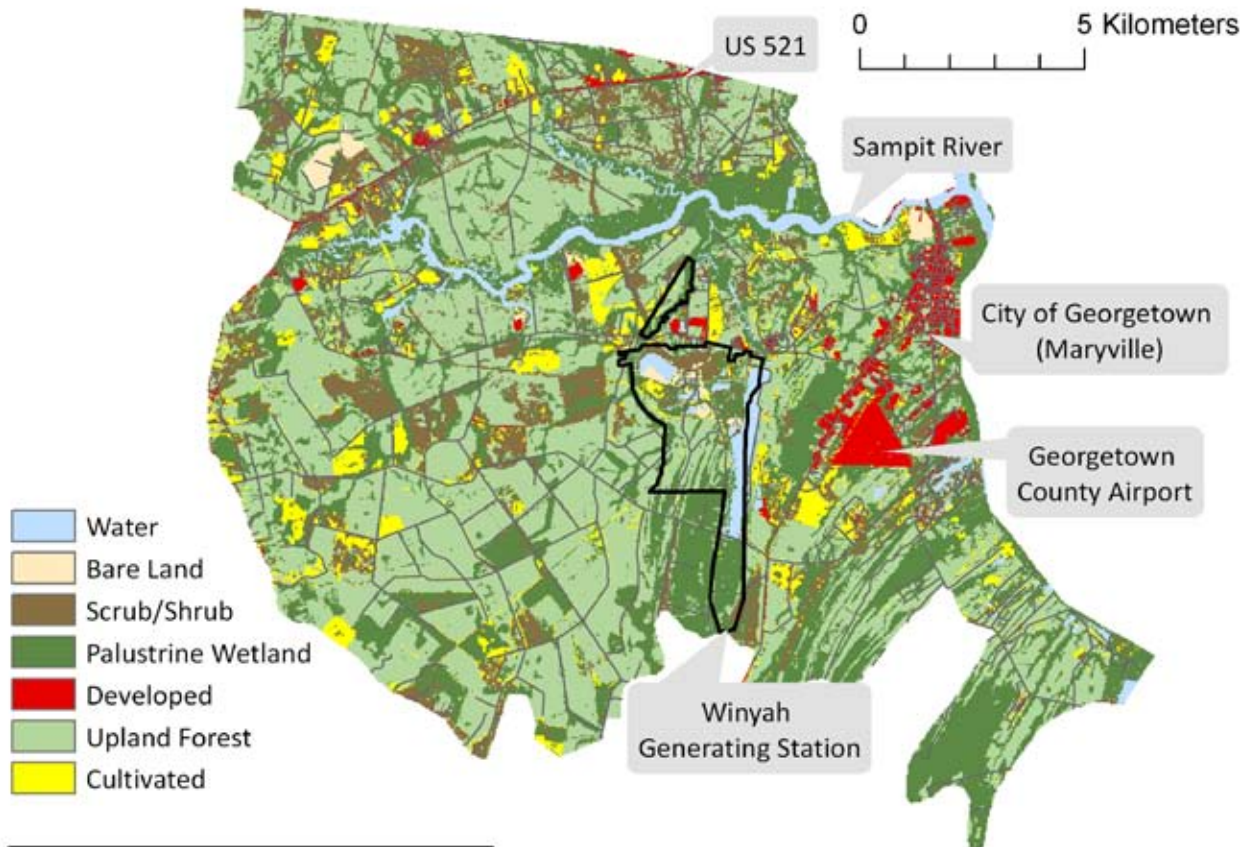


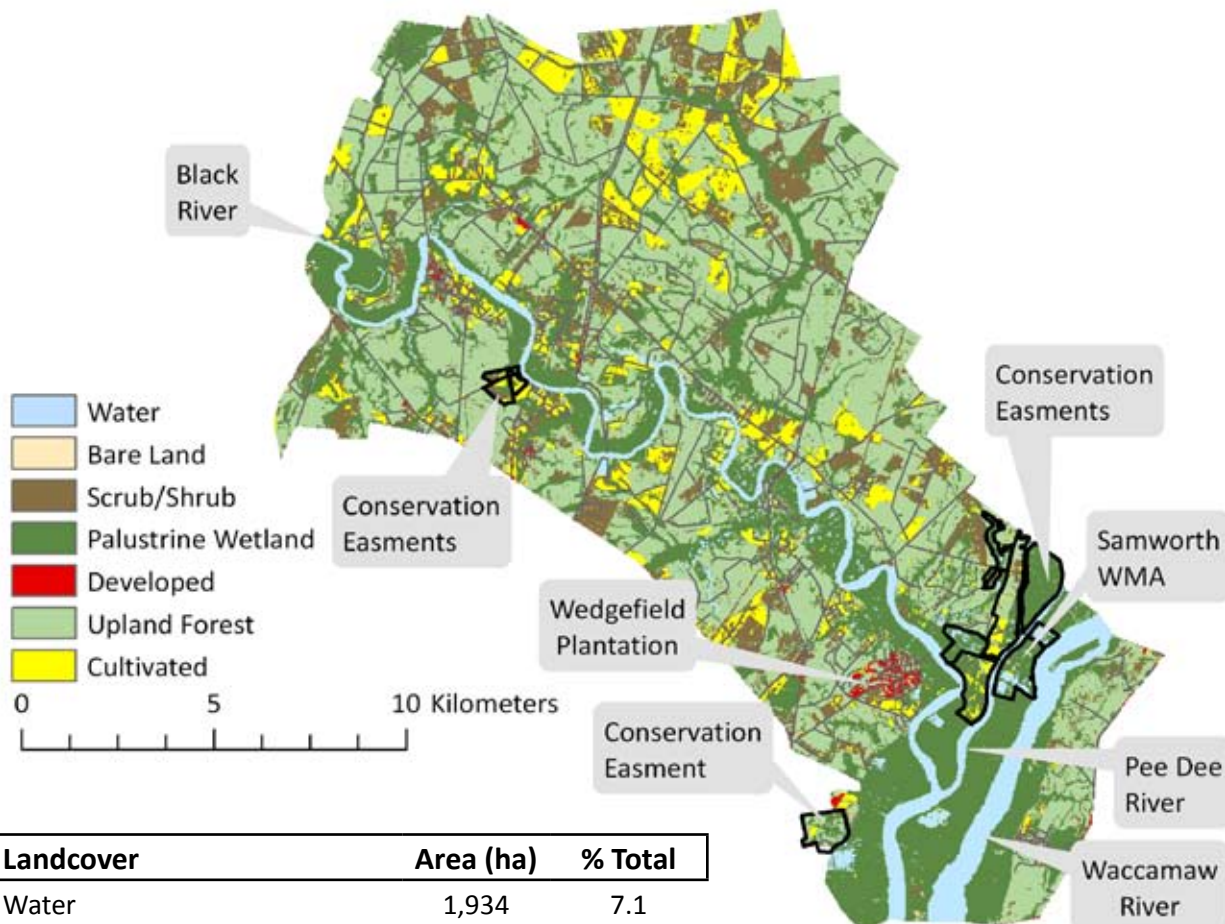
Figure 10. Land conservation planning project areas Sampit, Winyah, and North Inlet Watershed and currently conserved land areas in the NI-WB target watershed.



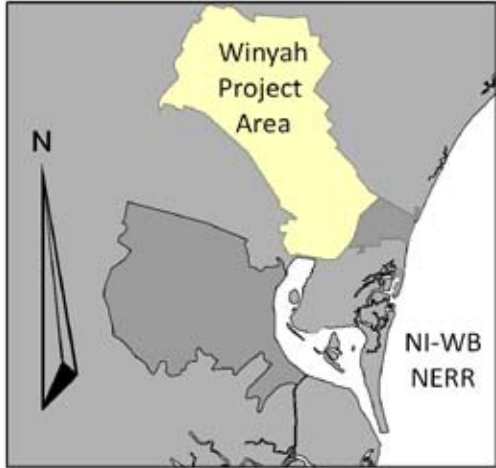
Landcover area is calculated from The Coastal Change Analysis Program (C-CAP) data for 2001. The largest three landcover categories are highlighted in the table at right.

Landcover	Area (ha)	% Total
Water	814	3.5
Bare Land	98	0.4
Unconsolidated Shore	75	0.3
Scrub/Shrub	2,777	11.9
Palustrine Scrub/Shrub Wetland	605	2.6
Palustrine Forested Wetland	4,295	18.4
Palustrine Emergent Wetland	1,835	7.9
Low Intensity Developed	314	1.3
Medium Intensity Developed	38	0.2
High Intensity Developed	38	0.2
Developed Open Space	407	1.7
Mixed Forest	147	0.6
Evergreen Forest	10,394	44.5
Deciduous Forest	66	0.3
Grassland	1,107	4.7
Pasture/Hay	214	0.9
Cultivated	127	0.5

Figure 11. Landcover and landscape features in the Sampit land conservation project area.

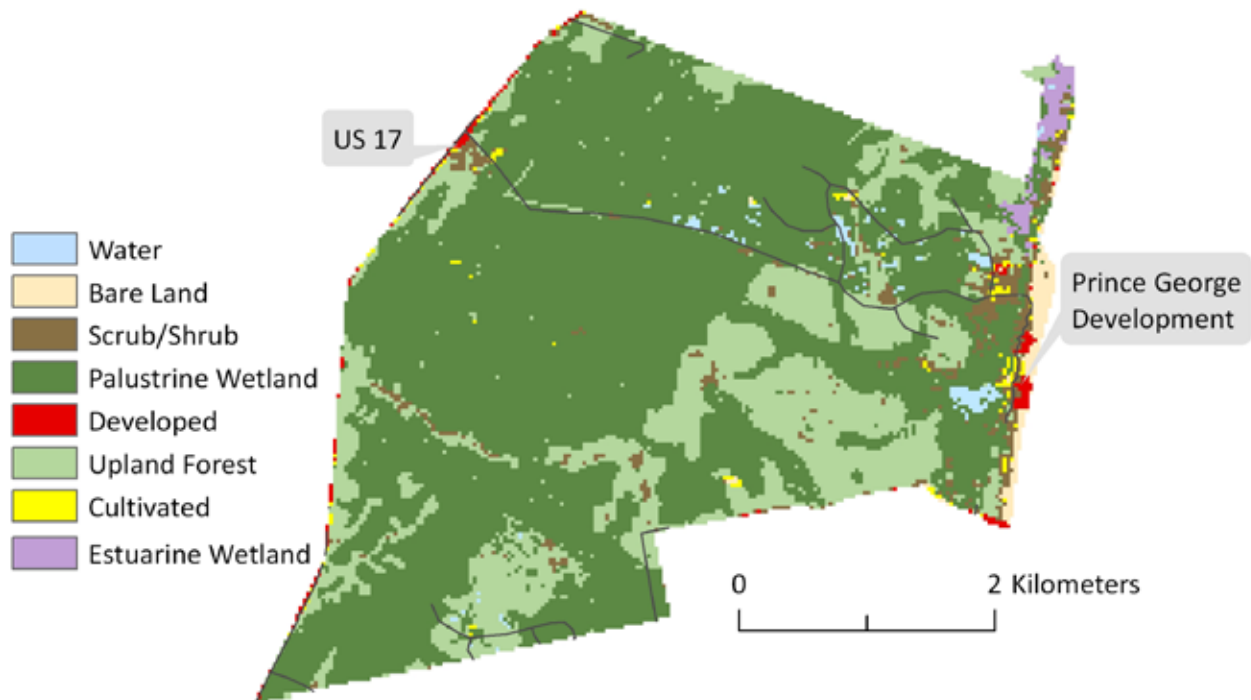


Landcover	Area (ha)	% Total
Water	1,934	7.1
Bare Land	4	0.0
Unconsolidated Shore	4	0.0
Scrub/Shrub	3,067	11.3
Palustrine Scrub/Shrub Wetland	513	1.9
Palustrine Forested Wetland	3,688	11.3
Palustrine Emergent Wetland	3,605	13.3
Low Intensity Developed	130	0.5
Medium Intensity Developed	4	0.0
High Intensity Developed	1	0.0
Developed Open Space	90	0.3
Mixed Forest	172	0.6
Evergreen Forest	11,722	43.2
Deciduous Forest	14	0.1
Grassland	1,421	5.2
Pasture/Hay	512	1.9
Cultivated	272	1.0

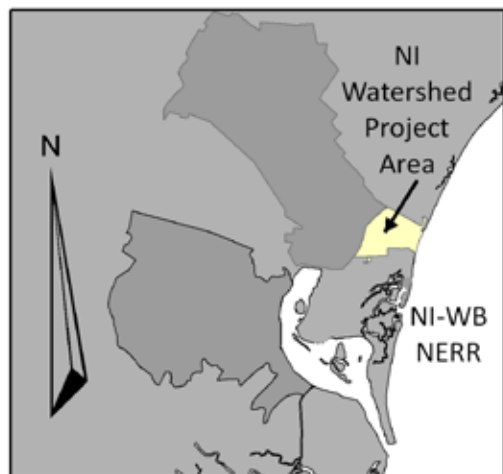


Landcover area is calculated from The Coastal Change Analysis Program (C-CAP) data for 2001. The largest three landcover categories are highlighted in the table at left.

Figure 12. Landcover and landscape features in the Winyah land conservation project area.



Landcover	Area (ha)	% Total
Water	16	0.8
Bare Land	19	0.9
Unconsolidated Shore	2	0.1
Scrub/Shrub	65	3.1
Palustrine Scrub/Shrub Wetland	205	9.8
Palustrine Forested Wetland	875	41.9
Palustrine Emergent Wetland	378	18.1
Low Intensity Developed	13	0.6
Medium Intensity Developed	1	0.0
High Intensity Developed	0	0.0
Developed Open Space	1	0.0
Mixed Forest	2	0.1
Evergreen Forest	480	23.0
Deciduous Forest	0	0.0
Grassland	12	0.6
Pasture/Hay	0	0.0
Cultivated	0	0
Estuarine Emergent Wetland	16	0.8
Estuarine Scrub/Shrub Wetland	1	0.0



Landcover area is calculated from The Coastal Change Analysis Program (C-CAP) data for 2001. The largest three landcover categories are highlighted in the table at left.

Figure 13. Landcover and landscape features in the North Inlet Watershed land conservation project area.

CHAPTER 7 - RESEARCH AND MONITORING

The National Estuarine Research Reserve System Research and Monitoring Plan

The reserve system provides a mechanism for addressing scientific and technical aspects of coastal management problems through a comprehensive, interdisciplinary, and coordinated approach. Research and monitoring programs, including the development of baseline information, form the basis of this approach. Reserve research and monitoring activities are guided by the reserve system research and monitoring plan 2006-2011 which identifies goals, priorities, and implementation strategies. This approach, when used in combination with the education and outreach programs, will help ensure the availability of scientific information that has long-term, system-wide consistency and utility for managers and members of the public to use in protecting or improving natural processes in their estuaries. Research within the reserves is designed to fulfill the reserve system goals as defined in program regulations. These include:

- ▶ Address coastal management issues identified as significant through coordinated estuarine research within the System;
- ▶ Promote Federal, state, public and private use of one or more reserves within the System when such entities conduct estuarine research; and
- ▶ Conduct and coordinate estuarine research within the System, gathering and making available information necessary for improved understanding and management of estuarine areas.



The NI-WB weather station is located at Oyster Landing, adjacent to the long-term water quality and nutrient monitoring station.

Reserve System Research Funding Priorities

Federal regulations, 15 C.F.R. Sec. 921.50(a), specify the purposes for which research funds are to be used:

- ▶ *Support management-related research that will enhance scientific understanding of the Reserve ecosystem,*
- ▶ *Provide information needed by Reserve management and coastal management decision-makers, and*
- ▶ *Improve public awareness and understanding of estuarine ecosystems and estuarine management issues.*

The reserve system has identified the following five priority research areas to complement the funding priorities outlined above:

1. Habitat and ecosystem processes
2. Anthropogenic influences on estuaries
3. Habitat conservation and restoration
4. Species management
5. Social science and economics

Reserve System Research Goals

The reserve system research goals are embedded in Goal 2 of the Reserve System Strategic Plan 2005-2010, 'Increase the use of reserve science and sites to address priority coastal management issues,' and are outlined in the 2006-2011 Reserve System Research and Monitoring Plan. They include:

- ▶ Biological, chemical, physical, and ecological conditions of reserves are characterized and monitored to describe reference conditions and to quantify change.
- ▶ Scientists conduct research at reserves that is relevant to coastal management needs and increases basic understanding of estuarine processes.
- ▶ Scientists have access to NERRS datasets, science products and results.
- ▶ The scientific, coastal management and education communities, as well as the general public, use data, products tools, and techniques generated at the NERRS.

Currently, there are two reserve system-wide efforts to fund estuarine research. The Graduate Research Fellowship Program (GRF) supports students to produce high quality research in the reserves. The fellowship provides graduate students with funding for 1-3 years to conduct their research, as well as an opportunity to assist with the research and monitoring program at a reserve. Projects must address coastal management issues identified as having regional or national significance; relate them to the reserve system research focus areas; and be conducted at least partially within one or more designated reserve sites. Proposals must focus on the following areas: 1) Eutrophication, effects of non-point source pollution and/or nutrient dynamics; 2) Habitat conservation and/or restoration; 3) Biodiversity and/or the effects of invasive species; 4) Mechanisms for sustaining resources within estuarine ecosystems; or 5) Economic, sociological, and/or anthropological research applicable to estuarine ecosystem management.

Students work with the research coordinator or manager at the host reserve to develop a plan to participate in the reserve's research and/or monitoring program. Students are asked to provide up to 15 hours per week of research and/or monitoring assistance to the reserve; this training may take place throughout the school year or may be concentrated during a specific season.

Secondly, research is funded through the Science Collaborative, a NERRS program that focuses on integrating science into the management of coastal natural resources. Currently administered through the University of New Hampshire, the program integrates and applies the principles of

collaborative research, information and technology transfer, graduate education, and adaptive management with the goal of developing and applying science-based tools to detect, prevent, and reverse the impacts of coastal pollution and habitat degradation in a time of climate change. The program is designed to enhance the NERRS ability to support decisions related to coastal resources through collaborative approaches that engage the people who produce science and technology with those who need it. In so doing, the NERRS Science Collaborative seeks to make the process of linking science to coastal management decisions, practices, and policies more efficient, timely, and effective.

System-Wide Monitoring Program

It is the policy of North Inlet – Winyah Bay NERR to implement each phase of the System-Wide Monitoring Plan initiated by ERD in 1989, and as outlined in the reserve system regulations and strategic plan:

Phase I: Environmental Characterization, including studies necessary for inventory and comprehensive site descriptions;

Phase II: Site Profile, to include a synthesis of data and information; and

Phase III: Implementation of the System-wide Monitoring Program.

The System-wide Monitoring Program provides standardized data on national estuarine environmental trends while allowing the flexibility to assess coastal management issues of regional or local concern. The principal mission of the monitoring program is to develop quantitative measurements of short-term variability and long-term changes in the integrity and biodiversity of representative estuarine ecosystems and coastal watersheds for the purposes of contributing to effective coastal zone management. The program is designed to enhance the value and vision of the reserves as a system of national references sites. The program also takes a phased approach and focuses on three different ecosystem characteristics.

1. **Abiotic Variables:** The monitoring program currently measures pH, conductivity, salinity, temperature, dissolved oxygen, turbidity, water level and atmospheric conditions. In addition, the program collects monthly nutrient and chlorophyll a samples and monthly diel samples at one SWMP data logger station. Each reserve uses a set of automated instruments and weather stations to collect these data for submission to a centralized data management office.
2. **Biotic Variables:** The reserve system is focusing on monitoring biodiversity, habitat and population characteristics by monitoring organisms and habitats as funds are available.
3. **Watershed and Landuse Classifications:** This component attempts to identify changes in coastal ecological conditions with the goal of tracking and evaluating changes in coastal habitats and watershed land use/cover. The main objective of this element is to examine the links between watershed land use activities and coastal habitat quality.

These data are compiled electronically at a central data management “hub”, the Centralized Data

Management Office (CDMO) at the Belle W. Baruch Institute for Marine and Coastal Sciences of the University of South Carolina. They provide additional quality control for data and metadata and they compile and disseminate the data and summary statistics via the Web (<http://cdmo.baruch.sc.edu>) where researchers, coastal managers and educators readily access the information. The metadata meets the standards of the Federal Geographical Data Committee.

Implementation of the System-Wide Monitoring Program at the North Inlet – Winyah Bay NERR

Routine environmental monitoring within North Inlet has occurred, in some fashion, since 1980, when a National Science Foundation Long-Term Ecological Research Site was established (LTER; 1980-1993). Abiotic (Phase I) monitoring under the NERRS SWMP auspices began in 1993, with the establishment of two long-term water quality monitoring sites, one in North Inlet (Oyster Landing site) and one in a tidal creek of Winyah Bay (Thousand Acre Marsh site). A third long term monitoring site was added in 1998 (Debidue Creek), and the fourth site in 2001 (Clambank Creek site). The location of the four SWMP stations is shown in Figure 14. At each station, YSI 6600 EDS data loggers are continuously deployed to record pH, conductivity, salinity, temperature, dissolved oxygen, turbidity, and water level data at 15 minute intervals, as per NERRS SWMP protocols. The 15 minute data from Oyster Landing and Debidue Creek stations are transmitted on an hourly basis to the NOAA Geostationary Operational Environmental Satellites (GOES) to provide near real-time data accessibility.

Routine nutrient and chlorophyll a monitoring was initiated at each of the four sites at the same time the stations were established for long-term water quality monitoring. Nutrients and chlorophyll a are sampled at exactly 20 day intervals, as opposed to the NERRS-recommended “approximately monthly intervals.” This decision, approved by the NERR SWMP Oversight Committee and NERR Data Management Committee, was made so as to minimize sampling bias with respect to spring – neap tidal periodicity over the annual cycle. On these 20 day intervals, both duplicate low tide grab sampling and diel sampling (2 hr and 4 min intervals over 26 hr) are conducted at each of the four stations. Diel sampling is accomplished through the deployment of ISCO model 3600 automated water samplers at each of the four stations. In addition to the currently required measurements of Tier 1 SWMP dissolved inorganic nutrients (NH₄⁺, NO₂⁻, NO₃⁻ and PO₄⁻³) and chlorophyll a, the Reserve has also been measuring a suite of proposed Tier 2 nutrients. To date, this includes dissolved organic carbon, total suspended solids, organic and inorganic suspended solids (determined by difference before and after combustion at 450°C), as well as total nitrogen and total phosphorus in both the particulate and dissolved phases, which allow organic nitrogen and phosphorus fractions to be determined as the difference between total and inorganic fractions.

Meteorological conditions at North Inlet have been measured by the Baruch Marine Field Laboratory since 1982. In 1997, meteorological measurements were modified slightly to conform to the newly established NERR SWMP protocols for meteorological data collection. The NI-WB weather station is located at Oyster Landing, adjacent to the long-term water quality and nutrient monitoring station. Air temperature, wind speed and direction, relative humidity, barometric pressure, rainfall, total short-wave global radiation (280 - 2800 nm wavelengths)

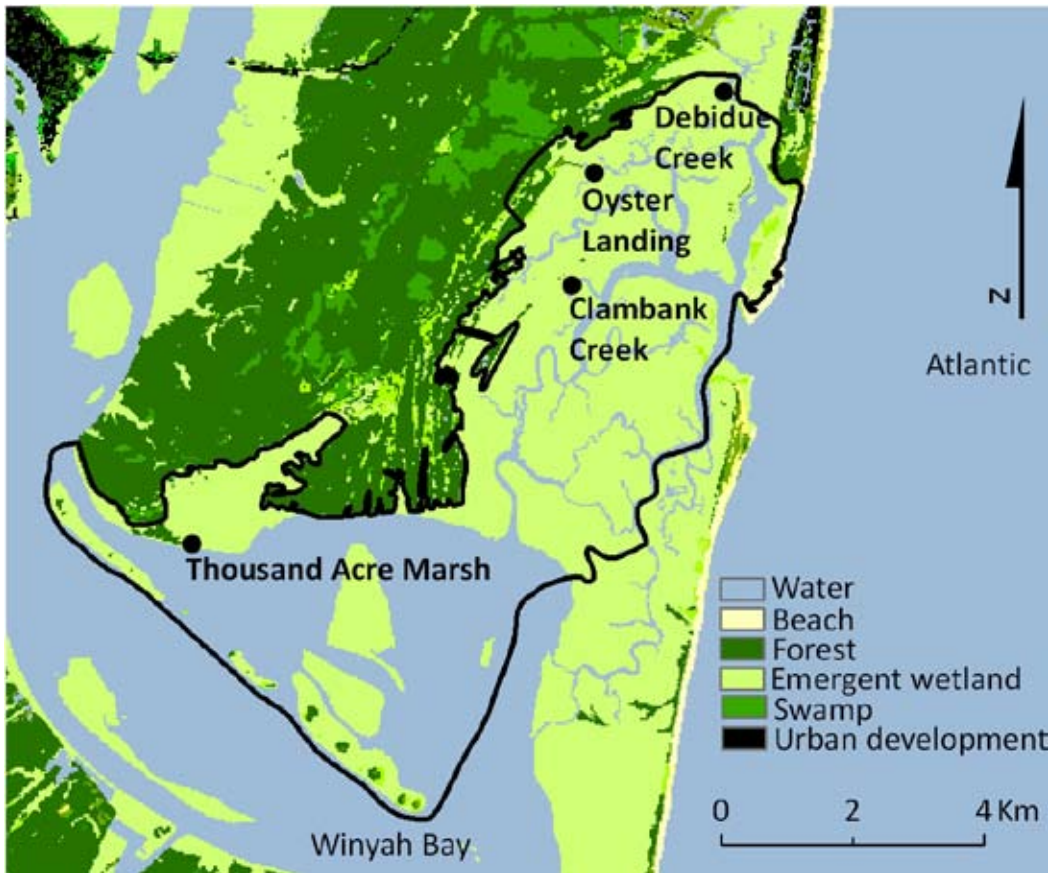


Figure 14. Locations and images of the four System Wide Monitoring Program (SWMP) stations in the North Inlet-Winyah Bay National Estuarine Research Reserve.

and photosynthetic active radiation (400-700 nm wavelengths). Sensors are all located on an aluminum tower at a height of approximately 3.5 meters. Sensors are connected to a Campbell Scientific CR-1000 data logger that records the meteorological conditions every 5 seconds continuously throughout the year, producing averages for 15 minute, hourly, and daily data.

Other Monitoring Programs Conducted by the Reserve

Estuarine fauna monitoring: Routine monitoring of dominant estuarine macrofauna in North Inlet began in the early 1980s with funding from a National Science Foundation's Long-Term Ecological Research grant. This monitoring was continued by the Reserve beginning in 1993. The on-going goals of this program are: to quantify the long-term composition and abundance of estuarine macrofauna within the Reserve in order to characterize and understand short-term variability and long-term changes in the abundance and community composition of both resident and transient estuarine species; to provide researchers and resource managers reference data from a relatively pristine estuary for comparisons with anthropogenically-impacted estuarine sites; and to provide base-line data for other faunal research conducted within North Inlet. There are currently two components to the Reserve's fauna monitoring program:

Zooplankton: Defined by two size fractions: a 153 μ m mesh net towed obliquely through the water column collects copepods and small invertebrate larvae; and a 365 μ m mesh net mounted on an epibenthic sled collects the larvae of fishes, shrimps and crabs as well as other large zooplankton species. 153 μ m tows are collected in duplicate. 365 μ m tows are collected in triplicate. Samples are collected biweekly since 1981 at mid ebb tide in Town Creek and identified to lowest practical taxa and life stage.

Motile nekton: Comprised of resident and transient fishes, shrimps and crabs greater than 20 mm. Biweekly (spring, summer and fall) or monthly (winter) collections have been made since 1984 using a combination of seining a drainage pool at low tide and/or enclosing a one acre area of flooded marsh at high tide and collecting all fauna leaving the area with the ebbing tide in a 0.25 inch mesh net. Sample catches are processed for species richness, individual species abundance and biomass, individual species lengths, and total catch abundance and biomass. Sampling is conducted in the Oyster Landing basin, adjacent to the Reserve's long-term water quality, nutrient and weather monitoring station.

Salt marsh emergent vegetation monitoring: As part of the NERRS system-wide initiative in biological monitoring (phase 2 of SWMP), the Reserve initiated a long-term vegetation monitoring program in 2005. The long-term goal of this program is to assess the effects of rising sea level on the spatial dynamics of emergent vegetation



Salt marsh vegetation monitoring will be used to assess the effects of sea-level rise on the marsh.

communities within the salt marshes of the North Inlet – Winyah Bay NERR. Specifically, this project seeks to quantify how salt marsh macrophyte community structure (species composition, relative abundance) varies along an elevation gradient, from creek bank to upland forest edge, in response to long-term changes in tidal height and flooding frequency due to sea level rise. In accordance with established NERRS protocols, a stratified sampling approach using fixed transects and repeated measurements within permanent sample plots are employed. Two segments have been established along the central axis of upper Crabhaul Creek, upstream of the Oyster Landing long-term water quality, nutrient and weather monitoring station and NOAA/NOS tide gauge. Within each segment, 3 fixed transects were randomly established from creek bank to the western, upland edge of the marsh platform. Each segment delineates a total 20 permanent sampling plots. Groundwater wells and porewater equilibrators are installed adjacent to each permanent plot. Sediment Elevation Tables (SETs) have been installed adjacent to plots



Water column respiration and heterotrophic production rates in the tidal creeks and open-water portions of the estuary are being studied through a combination of routine field measurements and manipulative experiments.

through a combination of routine field measurements and manipulative experiments. The focus of this effort is on the tidal creeks and open-water portions of the estuary as these represent the conduit for material exchanges between the land-margin and coastal ocean. Routine sampling is conducted on both ebbing and flooding tides at the Oyster Landing site in conjunction with the 20-day water chemistry sampling. Respiration rates are derived from the consumption of dissolved oxygen (determined by automated Winkler titration) during short-term (3 – 12 h) dark incubations of creek water contained in replicate 300 mL borosilicate glass BOD bottles at in situ temperatures. Heterotrophic bacterial production are derived from incorporation rates of ³H-leucine into the trichloroacetic acid-insoluble fraction of macromolecules in replicate water samples (plus 1 killed control) incubated with 35 nM (final concentration) of ³H-leucine (~ 5TBq mmol⁻¹) at in situ temperatures for 1 h. The long-term goal of this program is to quantify the role of the pelagic microbial community in the biogeochemical dynamics of carbon, nutrients and oxygen in the creek waters of North Inlet, and thus improve our understanding of how key ecological processes within the ecosystem respond to long-term changes associated with climate change and changes in salt marsh productivity and organic export associated with sea level rise.

at the lower and upper ends of each transect. Vegetation sampling includes: percent cover for each species or cover category; species' shoot/stem density; species' maximum canopy height, which is conducted annually at the end of the growing season. Water table height and salinity at low tide is sampled biweekly, porewater chemistry (nutrients, dissolved organic carbon, and sulfide concentrations) is sampled monthly during summer, SET measurements are conducted bimonthly.

Micro-plankton metabolism monitoring:

Beginning in July 2005 the Reserve established a program that seeks to quantify and understand the short-term variability and potential for long-term change in water column respiration and heterotrophic production rates

North Inlet – Winyah Bay Reserve Research and Monitoring Plan, 2011 - 2016

Research at the NI-WB Reserve is designed to fulfill the NERR System's goals and funding priorities, as outlined in the NERRS Strategic Plan and discussed above. The Reserve's research and monitoring activities for the following five years are structured to address local- to regional-scale coastal priority issues, as outlined in Chapter 3 of this document, within the broader context of addressing nationally significant coastal research and resource management needs. As such, the focus of research and monitoring activities at the Reserve are consistent with, and contribute to, the overall NERRS Research Plan and are well aligned with the recent U.S. Commission on Ocean Policy recommendation that NOAA adopt an ecosystem-based approach to the development of coastal and ocean policy that is based on the best available science for marine and estuarine ecosystems. Planned research and monitoring activities at the Reserve fall under the three basic categories or focus areas for monitoring, research, and data analysis and data transfer, which collectively are designed to integrate across all three of the priority issues identified in this management plan.

Research Focus Area 1: Continue, and where possible enhance, the characterization of physical, chemical, biological and ecological conditions within the Reserve.

Consistent, comprehensive and reliable long-term monitoring programs that provide high-quality data are essential for addressing ecosystem changes due to the impacts of coastal growth in the Reserve's watersheds; elucidating the effects of climate variability on estuarine functioning; and maintaining the biodiversity of the Reserve's aquatic resources. To this end, the collection of NERR SWMP data (including the Tier II nutrient parameters) and the continuation of currently existing efforts at biological and ecological monitoring will be vital. While salt marsh emergent vegetation biomonitoring now represents a long-term commitment for the Reserve, an expansion to include better measures of vegetation dynamics and sediment processes is deemed critical to its success as a monitoring program. In addition, the adoption and implementation of the NERRS Habitat Mapping and Change classification system will be critical to emergent vegetation biomonitoring efforts, to linking watershed land use activities to coastal water quality changes, as well as to effectively manage the Reserve's habitat resources. This includes developing a remote-sensing strategy for the Reserve that supports and enhances ongoing biological monitoring and planned habitat classification efforts. To the extent that internal 315 funds and/or externally-acquired grant monies are available, efforts at increasing the scope of monitoring activities within the Reserve will focus on: 1) Expanded water quality monitoring coverage in Winyah Bay. Presently, Winyah Bay is woefully under-sampled, both by the Reserve and by outside state, federal or academic entities. This knowledge deficiency exists despite the fact that Winyah Bay is the third largest estuary on the east coast of the U. S.; 2) Targeted monitoring of groundwater and surface water inputs of nutrients and organic matter from the North Inlet watershed. Combined with existing nutrient monitoring efforts, this will enable major routes of nutrient input to the North Inlet estuary to be delineated and quantified, and thus enhance our ability to link planned future development in the watershed to North Inlet water quality changes; 3) Expanded efforts at biological monitoring of key lower trophic levels (e.g., autotrophic and heterotrophic microbial communities) and higher trophic levels that represent threatened, endangered or invasive species, as well as expanded ecological monitoring of key

process-based measurements (e.g. rates of primary production, organic matter decomposition, and nutrient regeneration). Ecological monitoring will better enable the Reserve to fully implement an ecosystems-based approach to coastal resource management as well as increase our predictive understanding of how the North Inlet – Winyah Bay ecosystems may respond to long-term changes associated with coastal land-use and climate alterations.

STRATEGIES THAT ADDRESS THIS FOCUS AREA:

Strategy 1.1.1 Quantify temporal and spatial variation in water quality such that changes in quality can be detected.

Strategy 1.2.1 Quantify salt marsh vegetation extent, community structure, and productivity to enable detection of potential future impacts of coastal growth.

Strategy 1.2.2 Quantify estuarine faunal community abundance and diversity to enable detection of potential future impacts on recruitment and productivity.

Strategy 2.1.1 Quantify scales (periodicities) of climate variability and change operating at the local-to-regional level, and understand their consequences for water quality conditions within the Reserve.

Strategy 2.1.2 Quantify impacts of long-term climate variability (e.g., El Nino – Southern Oscillation) and change (e.g., sea-level rise) on salt marsh vegetation and sediment dynamics.

Strategy 3.1.1 Facilitate the implementation of inventory programs for threatened, endangered and key species in the North Inlet – Winyah Bay NERR.

Strategy 3.2.1 Implement invasive species monitoring strategies for species that currently threaten or could be a future threat to Reserve resources.

Research Focus Area 2: Facilitate and conduct research at the Reserve that is relevant to coastal resource management needs and increases the basic understanding of estuarine ecosystem functioning.

A key priority for the Research and Monitoring Program over the next five years is to increase the amount of discrete, hypothesis-driven research that the Reserve facilitates, supports and conducts. This research will directly build from, and feedback into, the ongoing and future monitoring work conducted by the Reserve. In addition to facilitating research within the Reserve by outside academic scientists and state agencies, the Reserve will work to enhance the quantity and quality of internally derived research through: 1) fostering a vigorous Graduate Research Fellowship program at the Reserve; and 2) actively seeking additional research funds through the submission of grant proposals to external funding agencies. Consistent with both the NERRS Strategic Plan and NERRS Research Plan, research activities at the Reserve will focus on both basic and applied sciences. Estuarine ecosystems involve complex sets of interactions among organisms and among organisms and their surrounding physical-chemical environment, in both benthic and pelagic habitats. Managing for, and mitigating against, the impacts of long-term changes associated with either coastal development or climate change requires a comprehensive understanding of the basic interactions and ecological processes of estuarine environments, as well as their connectivity with land, ocean and atmosphere. Based on the bulk of past and current research activities taking place within the Reserve, research areas to be targeted by Reserve research staff during the next five years will include a focus on estuarine biogeochemical processes, the role of pelagic microbial communities in driving the

biogeochemical processing of carbon and nutrients along the land-estuary-ocean interface, and the environmental factors that regulate these processes. This information represents a critical gap in our understanding of how key ecological processes affecting estuarine water quality may respond to future alterations associated with coastal land-use and climate alterations. Research conducted by the Reserve must, however, also be responsive to the direct needs of the coastal management and decision-makers in our local communities. As such, research priorities for the following five years will also be driven by identified priority management needs, and which directly contribute to informed decisions for protecting coastal resources through sound science. In this regard, the priority for Reserve-lead research will be that specifically targeting mechanisms and processes linking coastal growth/land-use changes and stormwater management practices to potential alterations in estuarine water quality. This will include an emphasis on the effects that the creation of stormwater detention ponds in the coastal zone have on downstream water quality conditions and processes, which represents a priority topic identified in the most recent CTP needs assessment. In addition, given the spread of invasive species and current rates of habitat loss affecting threatened and endangered species, the Reserve will also seek to collaborate and partner on implementing priority restoration science projects in the Reserve target watershed. Finally, the Reserve must maintain a certain degree of flexibility in its research and monitoring activities so that it may be in a position to respond to anthropogenic or climatic events or opportunities to leverage existing research and monitoring efforts and partnerships that cannot be foreseen in advance.

STRATEGIES THAT ADDRESS THIS FOCUS AREA:

Strategy 1.1.6 Conduct and facilitate research quantifying impacts of coastal growth and stormwater management practices on water quality conditions.

Strategy 2.1.1 Quantify scales (periodicities) of climate variability and change operating at the local-to-regional level, and understand their consequences for water quality conditions within the Reserve.

Strategy 2.1.2 Quantify impacts of long-term climate variability (e.g., El Nino – Southern Oscillation) and change (e.g., sea-level rise) on salt marsh vegetation and sediment dynamics.

Strategy 2.1.3 Conduct and facilitate research quantifying natural variability in key estuarine ecosystem processes and the impacts of climate change on these processes.

Strategy 3.1.4 Work with partners to identify and implement priority restoration science projects.

Strategy 3.2.2 Work with partners on invasive species removal and habitat restoration programs for high priority species and critical habitats in the Reserve target watershed.

Research Focus Area 3: Ensure that the scientific, coastal management and education communities have access to, and use the data, synthesis products, tools and techniques generated at the Reserve.

Cross-sector collaboration is a critical component of the Reserve's operation and its strategies for achieving the management goals put forward in this document. To that end, a key priority for the Research and Monitoring Sector is to improve the accessibility and use of the Reserve's data, synthesis products and expertise in education, coastal training, and stewardship programs within the Reserve. This will involve providing science-based information for, and assistance with, the

production and dissemination of educational materials and web based products that use science generated at the Reserve. An important component of this will be to update and expand synthesis of existing Reserve data sets and data visualization products in a manner that is appropriate and accessible to the diverse audiences that are served by the Reserve's education and outreach activities, as well as compile a database for accessing past and current research projects and data from the Reserve. Finally, in order to promote and disseminate the research and monitoring activities conducted by the Reserve at the regional to national and international scales, publications in the academic literature will continue to be vital, as will increased participation in regional to national scientific and resource management conferences.

STRATEGIES THAT ADDRESS THIS FOCUS AREA:

Strategy 1.1.3 Promote the use of innovative stormwater Best Management Practices (BMPs) in new development and re-development in communities in the Reserve target watershed.

Strategy 1.1.4 Provide educational programs and information on water quality for K-12 and community audiences.

Strategy 1.1.5 Work with local stakeholders to develop a plan for maintaining the integrity of the North Inlet watershed.

Strategy 1.2.4 Provide educational programs and information on the importance of estuarine habitat for K-12 and community audiences

Strategy 1.3.2 Provide education, outreach, and training programs and materials about watershed connectivity, the impacts of different types of land use on estuarine ecosystems and resources, and how community members can protect these resources

Strategy 2.2.1 Increase the Reserve's role in coastal training and community education pertaining to the effects of climate variability and change on estuarine resources and coastal hazards



Meteorological conditions are measured every 5 seconds continuously throughout the year, producing averages for 15 minute, hourly, and daily data.

CHAPTER 8 - EDUCATION AND TRAINING

The National Estuarine Research Reserve System Education Plan



Students learn about estuarine systems 'first hand' through reserve formal and non-formal education programs.



Professional development programs for teachers include the use of established coastal and estuarine science curricula aligned with state and national science education standards and frequently involve both on-site and in-school follow-up activity.

The reserve system provides a vehicle to increase understanding and awareness of estuarine systems and improve decision-making among key audiences to promote stewardship of the nation's coastal resources. Education and interpretation in the reserves incorporates a range of programs and methodologies that are systematically tailored to key audiences around priority coastal resource issues and incorporate science-based content. Reserve staff members work with local communities and regional groups to address coastal resource management issues, such as non-point source pollution, habitat restoration and invasive species. Through integrated research and education programs, the reserves help communities develop strategies to deal successfully with these coastal resource issues.

Formal and non-formal education and training programs in the NERRS target K-12 students, teachers, university and college students and faculty, as well as coastal decision-maker audiences such as environmental groups, professionals involved in coastal resource management, municipal and county zoning boards, planners, elected officials, landscapers, eco-tour operators and professional associations.

K-12 and professional development programs for teachers include the use of established coastal and estuarine science curricula aligned with state and national science education standards and frequently involves both on-site and in-school follow-up activity. Reserve education activities are guided by national plans that identify goals, priorities, and implementation strategies for these programs. Education and training programs, interpretive exhibits and community outreach programs integrate elements of NERRS science, research and monitoring activities and ensure a systematic, multi-faceted, and locally focused approach to fostering stewardship.

Reserve System Education Goals

The National Estuarine Research Reserve System's mission includes an emphasis on education, interpretation, and outreach. Education policy at the North Inlet-Winyah Bay Reserve is designed to fulfill the reserve system goals as defined in the regulations (15 C.F.R Sec. 921.32(b)). Education goals include:

- ▶ Enhance public awareness and understanding of estuarine areas and provide suitable opportunities for public education and interpretation;
- ▶ Conduct and coordinate estuarine research within the system, gathering and making available information necessary for improved understanding and management of estuarine areas.

Reserve System Education Objectives

Education-related objectives in the Reserve System Strategic Plan 2005-2010 include:

1. People are aware of the ecological, economic, historical, and cultural importance of estuarine resources.
2. People understand how human choices and natural disturbances impact social, economic, and estuarine ecological systems.
3. People apply science-based information when making decisions that could impact coastal and estuarine resources.

K-12 and Public Education Programming at the North Inlet-Winyah Bay NERR

Educational programming at the NI-WB NERR strives to serve as a link between Reserve research, monitoring, and stewardship components, and highlights current research activities, coastal issues, and the value of estuarine resources. The Reserve's education program offers unique learning experiences for audiences of all ages. One of the primary education goals of our Reserve is to promote and enhance public awareness, understanding, and responsible use of our local estuarine resources. This education begins at the early elementary level and continues through high school with a variety of on and off site activities, and also includes public education programs for adult audiences in several formats. Seasonal education activity schedules are produced three to four times annually and are distributed through the Hobcaw Barony Discovery Center, mailing list requests, and posted on the Reserve, the University of South Carolina, Hobcaw Barony, NERRS and community event websites and program calendars.



Students learn about water quality and monitoring equipment on the Reserve's marsh boardwalk.

K-12 Education

School outreach, such as job shadowing, career days and science festivals, provides additional opportunities to share Reserve resources with elementary and middle school students. Salt marsh field studies for middle and high school students, Boy and Girl Scout groups, and home-schooled students are also in demand. Estuary-Net, a telecommunications high school water quality monitoring pilot project, was implemented in area schools in several counties in 1996, and both classroom and field activities remain strong components of this curriculum. Participating schools received training in their classrooms on water quality issues and the use of monitoring equipment and were provided all the necessary sampling equipment required to monitor a field study site (or sites) of their choice. Students collected data about their site which was compared with data from other sources including the NERRS System-Wide Monitoring Program (SWMP). Upon completion of the Estuary-Net pilot project, interest among local teachers was strong enough to continue to offer the program using environmental education grant funds from a community industry. After these funds were depleted, the desire to continue the program remained strong, with some teachers continuing the program even after moving to schools outside the NI-WB education program's target area. The water quality outreach program has continued as a mainstay of high school education efforts, especially for environmental science and chemistry courses, and incorporates cross-sector information that includes water quality monitoring data and research activities along with stewardship concepts, and enforces the Estuaries 101 curriculum. The NERRS K12 Estuarine Education Program (KEEP) is in place at the Reserve and a market analysis of current environmental education providers is being conducted and will be followed by a needs assessment of the target school district. The findings of these surveys will be used to further implement system-wide components such as 'Teachers



Reserve staff participate in 'Estuary Live', an internet based virtual field trip of Reserves.

on the Estuary' (TOTE) professional development trainings, experiential and distance learning, new programming, and program evaluations. With continued participation as a lead service provider in the Coastal Waccamaw Stormwater Education Consortium (CWSEC), the education staff also offers a variety of resources for K-12 students in local Municipal Separate Stormwater Systems (MS4) communities. These outreach programs include information on water quality, stormwater runoff, and best management practices. A recent needs assessment conducted by the CWSEC concluded that municipalities require less need for K12 stormwater education and future programming offered by the Reserve will reflect these changing needs for increased adult education.

New technology has allowed our educational outreach to expand in recent years. The NI-WB Reserve has participated as a host site in several past National Estuaries Day celebrations of 'Estuary Live', an internet-based virtual field trip of Reserves across the country. As a live host site, Reserves have opportunities to reach thousands of students across the country, as

well as around the world, with internet broadcasts transmitted via satellite to computers in the classroom. Collaborations with the North Carolina and ACE (Ashepoo-Combahee-Edisto) Basin NERR sites, the National Weather Service, and ‘NOAA in the Carolinas’ have provided multi-day broadcasts showcasing both of our state’s Reserves. As part of expanded and systematic outreach efforts, new outlets to utilize this technology include future collaborations with regional NERRS sites, archived specialty segments on estuarine and ocean topics (with accompanying teacher resources) and the revamped and enhanced estuaries.gov website. The K-12 programming also utilizes the online Estuaries 101 curriculum in both classroom and field activities, and a NERRS middle school curriculum on estuaries is also in development.

Opportunities and demand for distance learning may become more important in future Reserve education programming as decreasing school budgets often discourage off-site field trips for many schools. In addition, many sensitive habitats and long-term monitoring sites are also carefully protected from overuse; plans are underway to conduct a visitor use study with the Reserve’s Stewardship Coordinator and establish areas dedicated to long-term education applications. As part of the needs assessment of the school district, the Reserve would like to determine the feasibility of increased on-site outreach to local schools to help address these recurring issues.

Public Education

The NI-WB Reserve provides a number of educational programs targeted at adult audiences including lectures on current research and short courses on estuarine and salt marsh ecology. Example topics include oysters and clams, crabs and shrimp, plankton, coastal birds, sea turtles, beach night life, life in the oyster reef, and kayaking and biking trips that incorporate research and stewardship components.

New educational programming offered jointly through the education providers at the Hobcaw Barony Discovery Center (HBDC) is targeting local and visiting multi-generational family units; these programs incorporate new exhibits and classroom spaces including the pond shelter and dock, and integrate historical uses, non-estuarine coastal habitats, and multi-component hands-on activities that include art, language, and science. As of July 2010, the Center has been open for one year and even though there have been no formal evaluations of new public programming, education staff have been incorporating audience feedback in subsequent offerings. Public visitation has increased from previous years and repeat participants from target audiences, especially watershed neighbors, are being reported. Table 3 provides a summary of K12 programs offered and the number of visitors to the HBDC for the past four years.

A popular and long-running public program called “The Fishes of North Inlet Estuary” allows participants to assist with and learn about a long-term ecological study on the nekton that utilize the estuary. Participants interact with researchers during the program and assist in sorting the collected samples. This program also provides a consistent and predetermined event for volunteer and student intern requests. Other research-based programs incorporating volunteers and interns include water monitoring, marsh vegetation, shorebird surveys, and long-term plankton studies.

Reserve staff share information about our site and the NERR system during local festivals and events, and open houses for the public. Programs once targeted specifically for younger audiences have been expanded to include audiences of all ages. Public lectures and forums that address topics and issues of current public interest and concern are also an important part of the Reserve’s programming. The education staff works closely with the Coastal Training Program to share information on watershed issues, and is currently one of the education providers for the Coastal Waccamaw Stormwater Education Consortium K-12 and community education programming. An important component of the outreach the CTP and education coordinators share are presentations for the homeowners associations of our watershed neighbors in the North Inlet Estuary. Education staff have also been working actively with the Stewardship Coordinator developing and leading activities designed for the newly created ‘Winyah Naturalist’ Course, co-sponsored with other state education providers and targeted to adult audiences.

Table 3. North Inlet-Winyah Bay NERR education outreach programming summary by fiscal year.

	FY 06-07	FY 07-08	FY 08-09	FY 09-10
Annual K12 Education Outreach*				
Total # Students Reached	928	4,662	1,796	1,087
Total # K12 Programs Offered	44	37	67	32
HBDC Visitation-all programming	8,314	8,185	7,163	11,110

*Data compiled from NIWB NERR program data, NERRS Performance Measures, Baruch Foundation Annual Reports, 2006-2010, and EstuaryLive 2007 web statistics.

This Summary Table reflects the number of Reserve K12 students reached and programs offered through both on-site and off-site programming, web statistics from the ‘NOAA in the Carolinas’ EstuaryLive internet broadcast with the ACE Basin NERR in September 2007, and records of visitation to the Hobcaw Barony Discover Center before, during, and after new construction was completed in July 2009.

North Inlet-Winyah Bay Reserve Education Plan, 2011 - 2016

The NI-WB NERR management plan is designed to address three primary issues in an integrated approach. Each sector will work independently, as well as in concert with others to address these issues through specific strategies. Education focus areas, their significance and approaches to address them, and relevant management plan strategies to address these objectives from an education program perspective are summarized in this section. A formal needs assessment has not been developed by education staff but a market analysis, in collaboration with the ACE Basin NERR, is scheduled for completion by late 2010. A formal, grant-funded market analysis of regional coastal environmental education outlets was completed by another local provider in 2006 and provided a foundation for the recent KEEP market analysis. Current program drivers and areas where the Reserve could best serve the community are based on this review, through informal evaluations of most requested programming from K-12 educators, and from program registration requests.

Education Focus Area 1: Increase estuarine and ocean literacy and educate the community and general public audiences of all ages about the value of estuarine ecosystems and ways to protect them.

The Education program will work with the research and monitoring program to provide and incorporate SWMP data and associated resources into user-friendly products that showcase the long-term monitoring of water quality and meteorological data. Public education and K-12 programs will include watershed concepts and water quality education, and the use of real-time and local water quality data will be encouraged in classrooms and beyond through the Estuaries 101 curriculum and KEEP. To foster the protection of habitat quality, education programming will also emphasize the importance of community composition and habitat diversity-especially as related to our local ecosystems. The Education, Stewardship and Coastal Training Program sectors will work together to include hands-on, or ‘what you can do’ components in all educational programming, and provide target audiences with tangible take-home messages that can be used in their individual homes and communities. The Reserve will also teach by example by using green practices-such as energy and water conservation, use of native flora, and recycling-in the workplace and in programming.

All sectors of the NI-WB NERR encourage and foster resource stewardship in North Inlet and Winyah Bay watersheds. A key concept is connectivity-no matter where a person lives, they are part of a watershed. Public and K-12 programming at the Reserve includes various aspects of this concept in outreach and education activities. Within the North Inlet watershed, two Home Owners Associations (HOAs) have already been targeted as important audiences to work with in this regard. These communities are DeBordieu Colony, which borders Hobcaw Barony, and Prince George, which is just north of DeBordieu. The NI-WB NERR currently works closely with DeBordieu Colony on a number of programs and projects and has initiated dialogue with members of the Prince George community to assess their interests. In recent years, customized presentations at DeBordieu on watersheds, homeowner best management practices, estuarine ecology, and invasive species have been presented to various groups within the community, and community members have been very active with our outreach and education programming

events. DeBordieu residents have served or currently serve on the NI-WB NERR Advisory Committee and play a key role in communicating the needs of the residents and providing the Reserve information about issues of concern.

STRATEGIES THAT ADDRESS THIS FOCUS AREA:

Strategy 1.1.3 Promote the use of innovative stormwater Best Management Practices (BMPs) in new development and re-development in communities in the Reserve target watershed.

Strategy 1.1.4 Provide educational programs and information on water quality for K-12 and community audiences.

Strategy 1.1.5 Work with local stakeholders to develop a plan for maintaining the integrity of the North Inlet watershed.

Strategy 1.2.4 Provide educational programs and information on the importance of estuarine habitat for K-12 and community audiences.

Strategy 1.3.2 Provide education, outreach, and training programs and materials about watershed connectivity, the impacts of different types of land use on estuarine ecosystems and resources, and how community members can protect these resources.

Strategy 1.3.3 Promote community awareness of the North Inlet-Winyah Bay NERR, the NERR System, and the resources and services offered through the NERRS.

Education Focus Area 2: Make North Inlet-Winyah Bay NERR the go-to resource for local estuarine information.

The completed renovation and expansion the Hobcaw Barony Discovery Center (HBDC) educational facility will most effectively address promoting community awareness about the NI-WB NERR, the NERR System, and our resources. New exhibits on watersheds, NERRS research and monitoring, stewardship, and education and training programs are highlighted in the expanded facility. The new home of the Centralized Data Management Office (CDMO) is included within this expansion and offers another opportunity to showcase the importance of the NERRS, the SWMP, and data collection and dissemination. Current Baruch Foundation staff and programs will join forces with the NI-WB NERR education staff to offer a variety of programs that highlight history, natural and cultural resources, and human relationships within our watersheds. The Reserve will continue to create and disseminate literature and materials through a variety of methods, including local media, the web, exhibits and displays at local festivals and events (such as public beach/river/marsh cleanups), and other high-visibility projects.

The K12 Estuary Education Program (KEEP) will share estuary knowledge through experiential activities such as site based programs and field studies, technology and web-based programs, and teacher education and professional development.

The NI-WB NERR, in partnership with local education providers, recently implemented the ‘Winyah Master Naturalist’ training program (similar to a Master Gardener certification), and the Reserve’s Stewardship, Education and Coastal Training Program sectors collaborated on course logistics, training topics, and instruction. The volunteers completing the course are encouraged

to work on selected stewardship and education activities in the Reserve watersheds and share their knowledge with others.

STRATEGY THAT ADDRESSES THIS FOCUS AREA:

Strategy 1.3.3 Promote community awareness of the North Inlet-Winyah Bay NERR, the NERR System, and the resources and services offered through the NERRS.

Education Focus Area 3: Raise local awareness of global climate change and its effects.

To assist coastal communities and decision makers in planning and preparing both people and the estuarine ecosystem for naturally occurring climate events, a primary outcome is to increase the Reserve's role in informing communities about the effects of climate change. The CTP is the vehicle to educate the coastal decision maker audience through training events, resources, and guidance that focus on topics such as climate change and community resiliency. With guidance from the research, stewardship and coastal training staff, education staff can also facilitate the transfer of watershed-specific research products to non-technical adult audiences. Education staff will echo similar messages in public education programs highlighting the transfer of watershed-specific research findings and education about coastal processes. Both the CTP and Education staff will continue to participate in regional education efforts that incorporate the informational products from integrated coastal and ocean observing systems and other research collaboratives. The Hobcaw Barony Discovery Center also houses exhibits and computer visualizations on climate change and sea level rise and their impacts on our local systems.

STRATEGY THAT ADDRESSES THIS FOCUS AREA:

Strategy 2.2.1 Increase the Reserve's role in coastal training and public education pertaining to the effects of climate variability and change on estuarine resources and coastal hazards.

Education Focus Area 4: Raise awareness of native species conservation and restoration.

Within the overarching issue of maintaining biodiversity and controlling invasive species, a variety of education activities coordinated by both Stewardship and Education sectors will incorporate information and expand knowledge about biodiversity, native and invasive species, native species conservation, and restoration science. The Reserve works closely with the Beach Vitex Task Force, the Winyah Bay Focus Area Task Force, the South Carolina Oyster Reef Enhancement (SCORE) program, the South Carolina United Turtle Enthusiasts (SCUTE), and other such groups that focus on invasive species detection and eradication, native species restoration, and protection of threatened and endangered species. The Stewardship, Education and Coastal Training Program sectors are working together with local education providers to offer a 'Winyah Master Naturalist' course that will be an ideal outlet for this type of education and training, with a built-in volunteer base. This is only one such outlet; other options include the Reserve's website (which is also host to the Beach Vitex Task Force website), printed materials disseminated through the Hobcaw Barony Discovery Center, and programs and research lectures that incorporate information on these topics. Public education programs also

include current natural resource regulations such as species catch and size limits, as well as encourage catch and release conservation practices. Dune and oyster reef restoration, marsh vegetation monitoring, and marsh bird monitoring projects are also excellent opportunities to educate and involve volunteers and the community about these issues.

STRATEGIES THAT ADDRESS THIS FOCUS AREA:

Strategy 3.1.3 Provide education programs and materials for resource users on biodiversity and native species conservation issues.

Strategy 3.3.3 Develop partnerships and expand the role of the Reserve in education, training, and outreach related to native and invasive species issues.



Public programs such as the 'Bike to the Boardwalk' trip incorporate information on salt marsh ecology and NERRs research.



The Winyah Naturalist course trains community members to become stewards of the NI-WB Reserve estuary and watershed.

The National Estuarine Research Reserve System Coastal Training Program

The Coastal Training Program (CTP) provides up-to-date scientific information and skill-building opportunities to coastal decision-makers who are responsible for making decisions that affect coastal resources. Through this program, National Estuarine Research Reserves can ensure that coastal decision-makers have the knowledge and tools they need to address critical resource management issues of concern to local communities.

Coastal Training Programs offered by reserves relate to coastal habitat conservation and restoration, biodiversity, water quality and sustainable resource management and integrate reserve-based research, monitoring and stewardship activities. Programs target a range of audiences, such as land-use planners, elected officials, regulators, land developers, community groups, environmental non-profits, business and applied scientific groups. These training programs provide opportunities for professionals to network across disciplines, and develop new collaborative relationships to solve complex environmental problems. Additionally, the CTP provides a critical feedback loop to ensure that professional audiences inform local and regional science and research agendas. Programs are developed in a variety of formats ranging from seminars, hands-on skill training, participatory workshops, lectures, and technology demonstrations. Participants benefit from opportunities to share experiences and network in a multidisciplinary setting, often with a reserve-based field activity.



The Reserve partnered with SC Sea Grant to demonstrate bioswale installation and design at Oak Terrace Preserve, an innovative low impact development.

Partnerships are important to the success of the program. Reserves work closely with State Coastal Programs, Sea Grant College extension and education staff, and a host of local partners in determining key coastal resource issues to address, as well as the identification of target audiences. Partnerships with local agencies and organizations are critical in the exchange and sharing of expertise and resources to deliver relevant and accessible training programs that meet the needs of specific groups.

The Coastal Training Program requires a systematic program development process, involving periodic review of the reserve niche in the training provider market, audience assessments, development of a three to five year program strategy, a marketing plan and the establishment of an advisory group for guidance, program review and perspective in program development. The Coastal Training Program implements a performance monitoring system, wherein staff report data in operations progress reports according to a suite of performance indicators related to increases in participant understanding, applications of learning and enhanced networking with peers and experts to inform programs.

Coastal Training Program at the North Inlet-Winyah Bay NERR

The NI-WB NERR began full implementation of its CTP in summer 2003. Core program partners of the CTP since this time include the:

- ▶ ACE Basin NERR
- ▶ South Carolina Department of Health and Environmental Control's Office of Ocean and Coastal Resource Management (SC DHEC-OCRM)
- ▶ South Carolina Sea Grant Consortium
- ▶ National Oceanographic and Atmospheric Administration's Coastal Services Center (NOAA CSC)

These agencies constitute the South Carolina Coastal Training Program Advisory Committee, which provides oversight, guidance, and coast-wide coordination for the CTPs that are administered by the two South Carolina NERRs. Each of these entities represents great partnership potential as they leverage significant intellectual and technical resources.

In 2002, in preparation for the implementation of the CTP, the NI-WB staff conducted a market analysis of coastal decision maker training providers in coastal South Carolina and determined that municipal and county officials in the two counties closest to the Reserve (Georgetown and Horry Counties) were underserved. Thus, local leaders – elected, appointed, employed, or volunteer – who make decisions that affect the coastal environment were identified as the primary target audience for the NI-WB CTP. As the program has grown, these local leaders have remained a primary target audience, recognizing the influence their decisions have on Reserve priority issues. Since then, government staff and the private professional sector (architects, engineers, developers, and realtors) have emerged as priority audiences. They have been frequently engaged in CTP programming and represent significant opportunities for the realization of CTP goals as they play large roles in local decision-making processes, particularly through their relationships with government officials.



Workshop attendees participate in a hands-on mapping activity to explore alternative development scenarios in order to preserve natural habitat.

In March 2003, and again in June 2006, the NI-WB CTP conducted training needs assessments of target audiences. In 2003, the assessment targeted municipal and county officials in Charleston, Georgetown and Horry Counties, whereas the 2006 assessment was conducted in partnership with the ACE Basin NERR and covered all six coastal counties in SC, and targeted additional audiences such as the private sector. These needs assessments were designed to collect audience input on all aspects of training, including topic interest, training format, and delivery styles.

The 2003 needs assessment revealed priority topics that fell largely under categories of land use planning and coastal growth management. These are:

1. Stormwater runoff (with an emphasis on contaminants) and watershed protection
2. Beach processes and erosion control (with an emphasis on coastal hazards)
3. Urban and land use planning

The 2006 needs assessment revealed that these essentially remain priority categories, but also revealed more detailed priorities within these categories. The updated priorities that are captured within the 2008-2011 CTP Strategy Document are summarized as follows:

1. Coastal Growth Management (with emphasis on land use planning and low impact development)
2. Pollution Management (as it relates to stormwater and best management practices)
3. Water Resources (with emphasis on wetlands, buffers, water supply, and management and protection of these resources)
4. Beach and Shoreline Management (with emphasis on shoreline stabilization, hazards, and change)

As the North Inlet-Winyah Bay CTP evolves with the changing needs of local coastal decision makers, certain fundamental aspects of the program are likely to remain constant. The importance of reaching diverse audiences with the same content and information cannot be overstated, particularly audiences whose decisions related to a particular issue are complementary, such as engineers and stormwater managers, or developers and planners. Likewise, the importance of including action-oriented, collaborative exercises or demonstrations to illustrate training concepts, regardless of the training topic, is paramount.

A number of important lessons can be distilled from CTP experience. A consequential amount of turnover in key local decision maker positions is evident, and the importance of repeating select training topics and concepts is apparent—either as a mantra to be repeated at the beginning of each event on the subject or as independent, easily-repeatable training programs or pre-packaged sessions. Training experience has also affirmed the importance of couching coastal environmental issues in socioeconomic terms. While it is important to promote science-based decision making, CTP recognizes that economics play a particularly important role in a tourism- and development-driven region; and that framing issues in relation to society is crucial considering the vast expanse of natural resources that drive the tourism industry and upon whose health that industry depends.

North Inlet-Winyah Bay Reserve CTP Plan, 2011 - 2016

The North Inlet-Winyah Bay CTP is designed to address the Reserve's goals and objectives while also reflecting the needs and emerging priorities within the target CTP communities. Extensive effort has been invested into evaluating the CTP at a local and national level, monitoring it for adequate performance, and determining local priorities and preferences for training. In addition to the priorities listed below, which are congruent with Reserve management plan goals and objectives, the CTP is also guided by a separate program strategy document, which is reviewed by a national program oversight committee. The CTP strategy document integrates management plan objectives, but it also incorporates additional specific priorities identified in the results of needs assessments of local target audiences. Together, these two documents inform CTP planning and program implementation. Management plan objectives addressed by the CTP fall into the following general focus areas.

CTP Focus Area 1: Maintain watershed integrity in the North Inlet and Winyah Bay watersheds.

Growth and continued land development in the North Inlet and Winyah Bay watersheds, as in all coastal counties of South Carolina, is inevitable, and support for this growth among local decision makers is often strong and rooted in visions of economically thriving communities. As development occurs, the hydrology of the landscape is altered with the increase of impervious surfaces (such as roads, rooftops, parking lots and driveways), the elimination of vegetative buffers along waterways, and the redirecting of storm and flood waters through stormwater ponds, ditches, and other infrastructure. The loss of hydrologic functions, such as water filtration and groundwater recharge, threatens the integrity of the North Inlet and Winyah Bay watersheds, and the communities around them. Additional threats to water quality come from the non-point source pollution that arises from runoff in developed areas. However, research shows that the implementation of some stormwater Best Management Practices (BMPs) or more comprehensive Low Impact Development (LID) practices can significantly mitigate the impacts of development on a watershed, and may actually enhance water quality.

The CTP will continue to deliver technical training through workshops and demonstrations to the private professional sector (developers, architects, engineers) on how to install and implement BMPs on the ground, as well as plan for more comprehensive LID approaches. CTP involvement with other local decision makers (municipal and county-level staff and officials) will focus on the integration of these practices into land use planning and decisions. CTP will also partner with Education, Research and Stewardship sectors on educating the community about the relationship between development and water quality issues, striving to promote BMP implementation by individuals throughout communities in the North Inlet and Winyah Bay watersheds. CTP will provide information through traditional workshops, small community meetings, service on and assistance to stormwater advisory boards and committees.

STRATEGIES THAT ADDRESS THIS FOCUS AREA:

Strategy 1.1.2 Work toward minimizing the increase of impervious cover in communities in the Reserve target watershed.

Strategy 1.1.3 Promote the use of innovative stormwater Best Management Practices (BMPs) in new development and re-development in communities in the Reserve target watershed.

Strategy 1.1.4 Provide educational programs and information on water quality for K-12 and community audiences.

Strategy 1.1.5 Work with local stakeholders to develop a plan for maintaining the integrity of the North Inlet watershed.

Strategy 1.1.6 Conduct and facilitate research quantifying impacts of coastal growth and stormwater management practices on water quality conditions.

Strategy 1.2.4 Provide educational programs and information on the importance of estuarine habitat for K-12 and community audiences.

CTP Focus Area 2: Promote scientific understanding among CTP audiences as a foundation for decision making.

The CTP will focus on communicating, translating and integrating science during CTP training events and encourage CTP audiences to develop a strong foundation in the sciences that relate to training topics in order to promote science-based decision making.

In presenting information during training events, CTP strives to incorporate accurate and relevant scientific research and strives to translate it in a non-threatening, easy-to-understand manner. Promoting scientific understanding is particularly important when presenting on topics that: (a) suggest actions or behavior change, such as the implementation of Best Management Practices or Low Impact Development; (b) require perceived significant economic investment for a misperceived economic return, such as green building or green technology; (c) relate to highly controversial and misunderstood science, such as global climate change and sea level rise; or (d) indicate decisions that need to be made that will significantly affect a large number of people, such as land use planning and development ordinances. While the CTP does not seek to produce scientific experts through its training events, it is important that target audiences comprehend the scientific rationale behind the topics that are presented and are able to make scientifically-sound, informed decisions based on that information, as well as be able to communicate the reasoning for their decisions to their constituents. In addition to this CTP focus area, the Reserve is also committed to promoting scientific literacy among the general public, as evidenced by its public education programs and efforts to incorporate Reserve-generated research into those programs.

The CTP will partner with the Research sector to bring Reserve research and other credible science into training events, and to communicate technical information to technically-savvy CTP audiences such as architects and engineers. The CTP will also partner with the Education and Stewardship sectors on best approaches for communicating scientific information to local decision-makers and less-specialized audiences. Efforts will focus on audience perceptions of topics and developing appropriate levels of scientific translation based on pre-existing attitudes and levels of knowledge.

STRATEGIES THAT ADDRESS THIS FOCUS AREA:

Strategy 1.1.2 Work toward minimizing the increase of impervious cover in communities in the Reserve target watershed.

Strategy 1.1.3 Promote the use of innovative stormwater Best Management Practices (BMPs) in new development and re-development in communities in the Reserve target watershed.

Strategy 1.1.4 Provide educational programs and information on water quality for K-12 and community audiences.

Strategy 1.1.5 Work with local stakeholders to develop a plan for maintaining the integrity of the North Inlet watershed.

Strategy 1.1.6 Conduct and facilitate research quantifying impacts of coastal growth and stormwater management practices on water quality conditions.

Strategy 1.2.4 Provide educational programs and information on the importance of estuarine habitat for K-12 and community audiences.

Strategy 1.3.2 Provide education, outreach, and training programs and materials about watershed connectivity, the impacts of different types of land use on estuarine ecosystems and resources, and how community members can protect these resources.

Strategy 1.3.3 Promote community awareness of the North Inlet-Winyah Bay NERR, the NERR System, and the resources and services offered through the NERRS.

Strategy 2.2.1 Increase the Reserve's role in coastal training and community education pertaining to the effects of climate variability and change on estuarine resources and coastal hazards.

Strategy 2.2.5 Work with local stakeholders to plan for the impacts of climate events and change on the communities in the Reserve target watershed.

Strategy 3.2.3 Develop partnerships and expand the role of the Reserve in education, training, and outreach related to native and invasive species issues.

CTP Focus Area 3: Increase understanding of the link between decision making and the health of human and natural resources.

The CTP will strive to promote personal responsibility and stewardship in decision making by increasing knowledge of relationships between land use decisions and the health of humans, ecosystems and natural resources. This will be done in part with an emphasis on demonstrations and hands-on field activities during CTP training events.

Without a strong connection to local issues or places, it is often difficult for people to understand the significance of environmental issues as they relate to them. To promote this connectivity and dependence on the local landscape, it is important for audiences to understand the basics of environmental issues and how they are tied to them. One of the most effective ways to promote this understanding is through experiential, hands-on learning. The 2006 audience needs assessment confirmed participant interest in hands-on field and demonstration sites to accompany information presented during workshops. The CTP will strive to provide as much demonstration and hands-on experience where relevant, in partnership with the Reserve Stewardship and Education sectors. Not only does this increase a participant's comprehension of and connectivity to an issue, but experiential learning also reinforces concepts taught with other methods of training.

STRATEGIES THAT ADDRESS THIS FOCUS AREA:

Strategy 1.1.2 Work toward minimizing the increase of impervious cover in communities in the Reserve target watershed.

Strategy 1.1.3 Promote the use of innovative stormwater Best Management Practices (BMPs) in new development and re-development in communities in the Reserve target watershed.

Strategy 1.1.4 Provide educational programs and information on water quality for K-12 and community audiences.

Strategy 1.1.5 Work with local stakeholders to develop a plan for maintaining the integrity of the North Inlet watershed.

Strategy 1.1.6 Conduct and facilitate research quantifying impacts of coastal growth and stormwater management practices on water quality conditions.

Strategy 1.2.4 Provide educational programs and information on the importance of estuarine habitat for K-12 and community audiences.

Strategy 1.3.2 Provide education, outreach, and training programs and materials about watershed connectivity, the impacts of different types of land use on estuarine ecosystems and resources, and how community members can protect these resources.

Strategy 3.2.3 Develop partnerships and expand the role of the Reserve in education, training, and outreach related to native and invasive species issues.

CTP Focus Area 4: Increase the consideration of climate change and associated coastal hazard risks by municipal and county staff and officials during decision-making pertaining to coastal development, resource management, and risk management and mitigation.

Compelling research indicates that climate change and sea level rise present a considerable threat to coastal and low-lying regions worldwide. The South Carolina coast and its inhabitants are particularly susceptible to these threats given the low-lying topography, as well as the rapid rate of population growth and development in the region. As population and coastal growth pressures increase, the need for the consideration of climate change and shoreline change implications by local decision makers becomes crucial. Decisions about where and how coastal counties growth should occur have major implications for the future health and sustainability of coastal communities, as well as for the Reserve that is surrounded by those communities. Paramount to the successful initiation of a dialogue with local decision makers about climate change is the need to understand public perceptions and misperceptions about climate change and sea level rise, and dispel common myths about the science on this topic. The CTP will work with other Reserve sectors, and especially with state partners (such as the SC DHEC-OCRM, ACE Basin NERR and SC Sea Grant) to continue to develop inquiry-based programs such as focus groups and small group discussions to characterize local perceptions about climate change-related issues, synthesize scientifically accurate and locally relevant research pertaining to climate change, and then develop trainings around these findings. Trainings will include workshops and individual meetings with local decision makers to explore options for addressing climate change issues, with a focus on alternative forms of coastal development, strategic land-use planning, and adaptation and mitigation strategies.

STRATEGIES THAT ADDRESS THIS FOCUS AREA:

Strategy 2.2.1 Increase the Reserve's role in coastal training and community education pertaining to the effects of climate variability and change on estuarine resources and coastal hazards.

Strategy 2.2.2 Work with local stakeholders to plan for the impacts of climate events and change on the communities in the North Inlet-Winyah Bay target watershed.

CHAPTER 9 - STEWARDSHIP

The National Estuarine Research Reserve System Stewardship Program

Stewardship programs in the reserve system integrate aspects of research, monitoring, education, coastal training, and resource management to provide long term protection for the natural resources within the reserves and within their respective watershed communities. The focus of the stewardship program at each reserve is guided by their unique resources and issues and their state partnership. Although there are no sector-specific NERR system-wide initiatives for the stewardship program, the stewardship sector has taken a lead in restoration science and habitat mapping. These two emerging national efforts are briefly summarized below.

Restoration Science

In response to the “Estuary Restoration Act of 2000”, the National Oceanic and Atmospheric Administration’s Estuarine Reserves Division conducted an internal review to determine the ability of the reserve system to address the critical need for estuarine habitat restoration nationwide. A Habitat Restoration Inventory showed that restoration and restoration science were occurring throughout the reserve system. The NERRS Restoration Science Strategy Framework was developed as a national plan to contribute to the successful restoration of estuaries through science and education. The strategy lists eight focus areas for the reserve system: project planning, innovative technologies, monitoring, local reference sites, information transfer, policy, constituent building and regional science coordination. Not all reserve sites have restoration opportunities within their boundaries, but it has been recognized that the reserves could serve as regional “centers of expertise” for restoration science and as controls for scientific research projects, or to gauge success of off-site habitat restoration, enhancement or creation projects.

Habitat Mapping

Geospatial data is necessary to better understand relationships between land use in the watershed and short-term variability and long-term changes in estuarine habitats, as well as the effects of climate change and sea level rise on estuarine habitat distribution. The NERRS Habitat and Land Use Classification System was developed to facilitate the sharing of habitat data among reserves. Reserves will develop baseline habitat maps in a GIS environment using the NERRS Habitat and Land Use Classification System, and the data will ultimately be housed in the Centralized Data Management Office database. Habitat maps will be updated every five to ten years so that regional and national change analysis can be used to examine the effects of climate change and land use on estuarine habitats, and to inform stewardship priorities. Each reserve will also develop a *Land Use, Cover, and Change Plan* that will identify priority areas for conducting habitat mapping and measuring elevation, develop strategies for future habitat mapping, describe potential data applications and dissemination strategies, determine existing gaps in personnel, training, and hardware/software, and estimate the budget requirements for plan implementation.

Stewardship Program at the North Inlet-Winyah Bay NERR

Early in the history of the North Inlet – Winyah Bay NERR, stewardship was primarily an assumed component of management and consisted of resource protection in support of research. In 2001, with the hiring of a full-time stewardship coordinator, stewardship became one of the core components of Reserve function. The first stewardship coordinator was responsible for compiling spatial data to support management decisions, working with public organizations on issues ranging from hazard mitigation to invasive species, and conducting decision-maker workshops on resource management issues in cooperation with other Reserve staff.

The stewardship program at the North Inlet – Winyah Bay NERR today continues to focus on resource management issues and integrates the tools of research, monitoring, GIS, and education to address these issues. Watershed development, invasive species, habitat alteration, resource over/misuse, climate change and sea level rise all pose significant threats to Reserve resources. The degradation of water quality and habitat loss associated with watershed development is of increasing concern as the population of the area continues to grow. The introduction and spread of non-native species can reduce biodiversity by displacing natives and by altering habitat suitability for associated species. Habitat alteration can occur as the result of development through direct conversion, such as filling in wetlands, but also can occur as the unintentional result of resource use, for example beach visitors disturbing shore bird nesting areas. Climate change and associated sea level rise will alter habitat distribution as temperature, precipitation, and tidal flooding regimes are affected. The maintenance of critical habitat types is dependent upon our responses to a changing landscape. The measures necessary to meet these stewardship challenges range in complexity from short-term, immediate action projects, to long-term monitoring programs and projects designed to slowly integrate new concepts and estuarine conservation practices into the local community.

Past stewardship activities have focused on invasive species monitoring and control, habitat restoration, and habitat mapping. Current and future issues that will be addressed include distribution and status monitoring of species of concern, education opportunities for community members to learn about and become involved in resource management, and the development of conservation projects that address timely resource management issues.



Volunteers from the community are trained to help with a marsh bird monitoring program at the Reserve.



Participants in the Winyah Naturalist Course learn about the dune ecosystem.

North Inlet – Winyah Bay Reserve Stewardship Plan, 2011 - 2016

Stewardship projects at the NI-WB NERR are intended to fulfill the NERR System-wide goals as outlined in the NERRS Strategic Plan, as well as to address local- to regional-scale coastal priority stewardship issues. The Reserve's stewardship activities for the following five years incorporate education, research and management activities to address the three Reserve priority issues in the following focus areas.

Stewardship Focus Area 1: Protect the water quality of the NI-WB Reserve through community education and outreach in the Reserve target watershed.

It is projected that development of the North Inlet and Winyah Bay watersheds will expand as existing housing communities continue to build-out and new communities are scheduled for construction (see Priority Issue 1). As development increases, the amount of impervious surfaces, such as roof tops and roads, also increases. Impervious areas channel pollutants directly into water bodies without their being processed by first passing through the soil. This non-point source pollution from urban/suburban areas is now recognized as the primary threat to water quality in the United States. Scientists generally agree that stream degradation occurs at relatively low levels of imperviousness of 10 to 20%. It is the goal of the NI-WB NERR to work with local stakeholders, including home owners, land developers, and municipal and county-level staff and officials to minimizing the increase of impervious cover in the Reserve target watershed and surrounding communities.

Community education and outreach on water quality issues will be expanded by working with the Education, Research, and Coastal Training Program sectors to use real local water quality data in educational programs, and by emphasizing the 'what you can do' component of educational programs. The Stewardship sector will work with the Reserve Manager and Research, Education, and CTP sectors to initiate the development of a plan to maintain the health of the North Inlet estuary. Local partners will also be collaborators in the identification and implementation of options for water quality enhancement and restoration activities designed to enhance habitat quality.

STRATEGIES THAT ADDRESS THIS FOCUS AREA:

Strategy 1.1.2 Work toward minimizing the increase of impervious cover in communities in the Reserve target watershed.

Strategy 1.1.3 Promote the use of innovative stormwater Best Management Practices (BMPs) in new development and re-development in communities in the Reserve target watershed.

Strategy 1.1.4 Provide educational programs and information on water quality for K-12 and community audiences.

Strategy 1.1.5 Work with local stakeholders to develop a plan for maintaining the integrity of the North Inlet watershed.

Strategy 1.1.6 Conduct and facilitate research quantifying impacts of coastal growth and stormwater management practices on water quality conditions.

STEWARDSHIP FOCUS AREA 2: PROMOTE STEWARDSHIP AND GOOD COASTAL CONSERVATION PRACTICES IN THE COMMUNITIES OF THE NORTH INLET AND WINYAH BAY WATERSHEDS.

A well informed community that is aware of and concerned about estuarine conservation issues is increasingly important as the residential population along the South Carolina coast continues to grow, and area tourism expands. Community education strategies will be developed and evaluated with the Education and CTP sectors to address resource issues at the Reserve and in the local watershed. Education and training programs will be conducted for recreational and commercial resource users, and the importance of habitat diversity and protection, the potential threats of invasive species, and the use of native flora in landscaping will be demonstrated in public education programs. The ‘what you can do’ component of educational programs will be emphasized so audiences appreciate the scale of their impacts. Volunteers will be trained and involved in long-term stewardship projects in the Reserve and local community. The Reserve will sponsor public short-term participation projects, such as beach and marsh sweeps. The dissemination of Reserve literature and program materials will be increased using a variety of media and the web, and by hosting display tables at local events. Coastal process content and information on climate change and community resiliency will be built into community education programs in order to increase community members’ knowledge of the effects of climate variability and change on estuarine resources and coastal hazards.

STRATEGIES THAT ADDRESS THIS FOCUS AREA:

Strategy 1.1.4 Provide educational programs and information on water quality for K-12 and community audiences.

Strategy 1.1.5 Work with local stakeholders to develop a plan for maintaining the integrity of the North Inlet watershed.

Strategy 1.2.4 Provide educational programs and information on the importance of estuarine habitat for K-12 and community audiences.

Strategy 1.3.1 Work with partners to develop a land conservation plan for the Reserve that identifies conservation and acquisition priorities in the Reserve target watershed.

Strategy 1.3.2 Provide education, outreach, and training programs and materials about watershed connectivity, the impacts of different types of land use on estuarine ecosystems and resources, and how community members can protect these resources.

Strategy 1.3.3 Promote community awareness of the North Inlet-Winyah Bay NERR, the NERR System, and the resources and services offered through the NERRS.

Strategy 2.2.1 Increase the Reserve’s role in coastal training and community education pertaining to the effects of climate variability and change on estuarine resources and coastal hazards.

Strategy 2.2.2 Work with local stakeholders to plan for the impacts of climate events and change on the communities in the Reserve target watershed.

Stewardship Focus Area 3: Evaluate habitat quality and species distributions within the NI-WB NERR to identify current and potential conservation issues.

The collection of baseline information about habitat distribution and quality, and information about the distribution and status of key species is necessary to evaluate conservation and restoration issues within the Reserve. The North Inlet baseline habitat map will be used for periodic habitat change analysis and to examine the distribution and connectivity of estuarine habitats. This objective is consistent with Phase III of SWMP, and is one of the two high priority topics of the Stewardship sector. Inventory programs for species of concern will also be implemented as needed. Critical habitat areas of threatened, endangered and key species will be identified through surveys, mapping, and collaborations with researchers and local, state and regional partners, and gaps in the knowledge of threatened, endangered and key species will be identified. Current resource use of North Inlet will be assessed to determine potential threats to critical habitats.

STRATEGIES THAT ADDRESS THIS FOCUS AREA:

Strategy 1.2.1 Quantify salt marsh vegetation extent, community structure, and productivity to enable detection of potential future impacts of coastal growth.

Strategy 1.2.3 Monitor marine debris in North Inlet and develop education and outreach programs to prevent the introduction of marine debris.

Strategy 2.1.2 Quantify impacts of long-term climate variability (e.g., El Nino Southern Oscillation) and change (e.g., sea-level rise) on salt marsh vegetation and sediment dynamics.

Strategy 3.1.1 Facilitate the implementation of inventory programs for threatened, endangered and key species in the North Inlet-Winyah Bay NERR.

Strategy 3.1.2 Quantify the distribution and connectivity of estuarine habitats and assess threats to critical habitats in the Reserve.

Stewardship Focus Area 4: Monitor and control invasive species and maintain biodiversity.

Invasive species are those whose introduction cause or are likely to cause economic or environmental harm or harm to human health. After habitat loss, the major threat to endangered species is invasive species. Invasive species of concern to the South Carolina coast include the plants beach vitex (*Vitex rotundifolia*), common reed (*Phragmites australis*), Chinese tallow tree (*Triadica sebifera*), and cogon grass (*Imperata cylindrica*), the aquatic plants hydrilla (*Hydrilla verticillata*) and water hyacinth (*Eichhornia crassipes*), the marine invertebrates Indo-Pacific crab (*Charybdis hellerii*), green porcelain crab (*Petrolisthes armatus*), giant barnacle (*Megabalanus coccopoma*), and Asian green mussel (*Perna viridis*). The Reserve will continue to participate in Beach Vitex Task Force efforts to monitor and eliminate this invasive plant species, and will also continue to host, update, and maintain the Task Force web site. The Reserve will also participate in a regional effort among southern NERR sites to jointly address invasive species issues through the gathering and sharing of information on monitoring, removal, and control of invasive species. Invasive species removal programs may be more successful when coupled with projects to restore habitat function and native species, therefore the Reserve

will work with partners to identify priority restoration science projects in the North Inlet and Winyah Bay watersheds and will ensure compliance of restoration projects with the NERRS restoration science initiative.

STRATEGIES THAT ADDRESS THIS FOCUS AREA:

Strategy 3.1.3 Provide education programs and materials for resource users on biodiversity and native species conservation issues.

Strategy 3.1.4 Work with partners to identify and implement priority restoration science projects.

Strategy 3.2.1 Implement invasive species monitoring strategies for species that currently threaten or could be a future threat to Reserve resources.

Strategy 3.3.2 Work with partners on invasive species removal and habitat restoration programs for high priority species and critical habitats in the Reserve target watershed.

Strategy 3.3.3 Develop partnerships and expand the role of the Reserve in education, training, and outreach related to native and invasive species issues.



Volunteers help with projects such as monitoring sea turtle nests.

REFERENCES

- Baillie, J.E.M., C. Hilton-Taylor and S.N. Stuart (Editors) 2004. 2004 IUCN Red List of Threatened Species. A Global Species Assessment. IUCN, Gland, Switzerland and Cambridge, UK. 191 pages.
- Houghton, J. 2001. The science of global warming. *Interdisciplinary Science Reviews* 26:247-257.
- Humphrey, S., J. Loh and S. Goldfinger (Editors) 2008. Living Planet Report 2008. WWF International, Gland, Switzerland. 48 pages.
- IPCC. 2007. Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [Solomon, S., D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M. Tignor and H.L. Miller (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, 996 pages.
- Levitus, S., J.I. Antonov, T.P. Boyer and C. Stephens. 2000. Warming of the world ocean. *Science* 287:2225-2229.
- Morris, J.T., P.V. Sundareshwar, C.T. Nietch, B. Kjerfve and D.R. Cahoon. 2002. Responses of coastal wetlands to rising sea level. *Ecology* 83:2869-2877.
- Pielke, R.A and C.N. Landsea. 1999. La Nina, El Nino, and Atlantic hurricane damages in the United States. *Bulletin of the American Meteorological Society* 80:2027-2033.
- South Carolina Population Projections 2006-2035 [Internet]. Columbia (SC): South Carolina Budget and Control Board, Office of Research and Statistics, c2002-2010 [cited 2010 March 30]. Available from: <http://www.sccommunityprofiles.org/census/projection.php>.
- U.S. Department of Agriculture. 1997. Summary Report: 1997 National Resources Inventory (revised December 2000), Natural Resources Conservation Service, Washington, DC, and Statistical Laboratory, Iowa State University, Ames, Iowa. 89 pages.
- Waccamaw Regional Council of Governments Demographics & Statistics [Internet]. Georgetown (SC): Waccamaw Regional Council of Governments, c2003-2010 [cited 2010 April 5]. Available from: <http://www.wrcog.org/demograph.htm>.
- Wellenberger, P. 2002. A Land Acquisition Inventory of the NERRS. Prepared for the National Oceanic and Atmospheric Administration. 126 pages.

APPENDIX A- CODE OF FEDERAL REGULATIONS

Part 921 - National Estuarine Research Reserve System Regulations

Code of Federal Regulations

Title 15, Volume 3, Revised as of January 1, 2003
From the U.S. Government Printing Office via GPO Access
[CITE: 15CFR921]

TITLE 15--COMMERCE AND FOREIGN TRADE

CHAPTER IX--NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION,
DEPARTMENT OF COMMERCE

PART 921--NATIONAL ESTUARINE RESEARCH RESERVE SYSTEM
REGULATIONS

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Authority: Section 315 of the Coastal Zone Management Act, as amended (16 U.S.C. 1461).

Source: 58 FR 38215, July 15, 1993, unless otherwise noted.

Sec. 921.1 Mission, goals and general provisions.

(a) The mission of the National Estuarine Research Reserve Program is the establishment and management, through Federal-state cooperation, of a national system (National Estuarine Research Reserve System or System) of estuarine research reserves (National Estuarine Research Reserves or Reserves) representative of the various regions and estuarine types in the United States. National Estuarine Research Reserves are established to provide opportunities for long-term research, education, and interpretation.

(b) The goals of the Program are to:

1. Ensure a stable environment for research through long-term protection of National Estuarine Research Reserve resources;
2. Address coastal management issues identified as significant through coordinated estuarine research within the System;
3. Enhance public awareness and understanding of estuarine areas and provide suitable opportunities for public education and interpretation;
4. Promote Federal, state, public and private use of one or more Reserves within the System when such entities conduct estuarine research; and
5. Conduct and coordinate estuarine research within the System, gathering and making available information necessary for improved understanding and management of estuarine areas.

(c) National Estuarine Research Reserves shall be open to the public to the extent permitted under state and Federal law. Multiple uses are allowed to the degree compatible with each Reserve's overall purpose as provided in the management plan (see Sec. 921.13) and consistent with paragraphs (a) and (b) of this section. Use levels are set by the state where the Reserve is located and analyzed in the management plan. The Reserve management plan shall describe the uses and establish priorities among these uses. The plan shall identify uses requiring a state permit, as well as areas where uses are encouraged or prohibited. Consistent with resource protection and research objectives, public access and use may be restricted to certain areas or components within a Reserve.

(d) Habitat manipulation for research purposes is allowed consistent with the following limitations. Manipulative research activities must be specified in the management plan, be consistent with the mission and goals of the program (see paragraphs (a) and (b) of this section) and the goals and objectives set forth in the Reserve's management plan, and be limited in nature and extent to the minimum manipulative activity necessary to accomplish the stated research objective. Manipulative research activities with a significant or long-term impact on Reserve resources require the prior approval of the state and the National Oceanic and Atmospheric Administration (NOAA). Manipulative research activities which can reasonably be expected to have a significant adverse impact on the estuarine resources and habitat of a Reserve, such that the activities themselves or their resulting short- and long-term consequences compromise the representative character and integrity of a Reserve, are prohibited. Habitat manipulation for resource management purposes is prohibited except as specifically approved by NOAA as: (1) A

restoration activity consistent with paragraph (e) of this section; or (2) an activity necessary for the protection of public health or the preservation of other sensitive resources which have been listed or are eligible for protection under relevant Federal or state authority (e.g., threatened/endangered species or significant historical or cultural resources) or if the manipulative activity is a long-term pre-existing use (i.e., has occurred prior to designation) occurring in a buffer area. If habitat manipulation is determined to be necessary for the protection of public health, the preservation of sensitive resources, or if the manipulation is a long-term pre-existing use in a buffer area, then these activities shall be specified in the Reserve management plan in accordance with Sec. 921.13(a)(10) and shall be limited to the reasonable alternative which has the least adverse and shortest term impact on the representative and ecological integrity of the Reserve.

(e) Under the Act an area may be designated as an estuarine Reserve only if the area is a representative estuarine ecosystem that is suitable for long-term research. Many estuarine areas have undergone some ecological change as a result of human activities (e.g., hydrological changes, intentional/unintentional species composition changes--introduced and exotic species). In those areas proposed or designated as National Estuarine Research Reserves, such changes may have diminished the representative character and integrity of the site. Although restoration of degraded areas is not a primary purpose of the System, such activities may be permitted to improve the representative character and integrity of a Reserve. Restoration activities must be carefully planned and approved by NOAA through the Reserve management plan. Historical research may be necessary to determine the "natural" representative state of an estuarine area (i.e., an estuarine ecosystem minimally affected by human activity or influence). Frequently, restoration of a degraded estuarine area will provide an excellent opportunity for management oriented research.

(f) NOAA may provide financial assistance to coastal states, not to exceed, per Reserve, 50 percent of all actual costs or \$5 million whichever amount is less, to assist in the acquisition of land and waters, or interests therein. NOAA may provide financial assistance to coastal states not to exceed 70 percent of all actual costs for the management and operation of, the development and construction of facilities, and the conduct of educational or interpretive activities concerning Reserves (see subpart I). NOAA may provide financial assistance to any coastal state or public or private person, not to exceed 70 percent of all actual costs, to support research and monitoring within a Reserve. Notwithstanding any financial assistance limits established by this Part, when financial assistance is provided from amounts recovered as a result of damage to natural resources located in the coastal zone, such assistance may be used to pay 100 percent of all actual costs of activities carried out with this assistance, as long as such funds are available. Predesignation, acquisition and development, operation and management, special research and monitoring, and special education and interpretation awards are available under the National Estuarine Reserve Program. Predesignation awards are for site selection/feasibility, draft management plan preparation and conduct of basic characterization studies. Acquisition and development awards are intended primarily for acquisition of interests in land, facility construction and to develop and/or upgrade research, monitoring and education programs. Operation and management awards

provide funds to assist in implementing, operating and managing the administrative, and basic research, monitoring and education programs, outlined in the Reserve management plan. Special research and monitoring awards provide funds to conduct estuarine research and monitoring projects with the System. Special educational and interpretive awards provide funds to conduct estuarine educational and interpretive projects within the System.

(g) Lands already in protected status managed by other Federal agencies, state or local governments, or private organizations may be included within National Estuarine Research Reserves only if the managing entity commits to long-term management consistent with paragraphs (d) and (e) of this section in the Reserve management plan. Federal lands already in protected status may not comprise a majority of the key land and water areas of a Reserve (see Sec. 921.11(c)(3)).

(h) To assist the states in carrying out the Program's goals in an effective manner, NOAA will coordinate a research and education information exchange throughout the National Estuarine Research Reserve System. As part of this role, NOAA will ensure that information and ideas from one Reserve are made available to others in the System. The network will enable Reserves to exchange information and research data with each other, with universities engaged in estuarine research, and with Federal, state, and local agencies. NOAA's objective is a system- wide program of research and monitoring capable of addressing the management issues that affect long-term productivity of our Nation's estuaries.

[58 FR 38215, July 15, 1993, as amended at 62 FR 12540, Mar. 17, 1997; 63 FR 26717, May 14, 1998].

Sec. 921.2 Definitions

(a) Act means the Coastal Zone Management Act of 1972, as amended, 16 U.S.C. 1451 et seq.

(b) Assistant Administrator means the Assistant Administrator for Ocean Services and Coastal Zone Management or delegee.

(c) Coastal state means a state of the United States, in or bordering on, the Atlantic, Pacific, or Arctic Ocean, the Gulf of Mexico, Long Island Sound, or one or more of the Great Lakes. For the purposes of these regulations the term also includes Puerto Rico, the Virgin Islands, Guam, the Commonwealth of the Northern Marianas Islands, the Trust Territories of the Pacific Islands, and American Samoa (see 16 U.S.C. 1453(4)).

(d) State agency means an instrumentality of a coastal state to whom the coastal state has delegated the authority and responsibility for the creation and/or management/operation of a National Estuarine Research Reserve. Factors indicative of this authority may include the power to receive and expend funds on behalf of the Reserve, acquire and sell or convey real and personal property interests, adopt rules for the protection of the Reserve, enforce rules applicable to the Reserve, or develop and implement research and education programs for the reserve. For the purposes of these regulations, the terms ``coastal state" and ``State agency" shall be synonymous.

(e) Estuary means that part of a river or stream or other body of water having unimpaired connection with the open sea, where the sea water is measurably diluted with fresh water derived from land drainage. The term also includes estuary-type areas with measurable freshwater influence and having unimpaired connections with the open sea, and estuary-type areas of the Great Lakes and their connecting waters (see 16 U.S.C. 1453(7)).

(f) National Estuarine Research Reserve means an area that is a representative estuarine ecosystem suitable for long-term research, which may include all of the key land and water portion of an estuary, and adjacent transitional areas and uplands constituting to the extent feasible a natural unit, and which is set aside as a natural field laboratory to provide long-term opportunities for research, education, and interpretation on the ecological relationships within the area (see 16 U.S.C. 1453(8)) and meets the requirements of 16 U.S.C. 1461(b). This includes those areas designated as National Estuarine Sanctuaries or Reserves under section 315 of the Act prior to enactment of the Coastal Zone Act Reauthorization Amendments of 1990 and each area subsequently designated as a National Estuarine Research Reserve.

Sec. 921.3 National Estuarine Research Reserve System Biogeographic Classification Scheme and Estuarine Typologies.

(a) National Estuarine Research Reserves are chosen to reflect regional differences and to include a variety of ecosystem types. A biogeographic classification scheme based on regional variations in the nation's coastal zone has been developed. The biogeographic classification scheme is used to ensure that the National Estuarine Research Reserve System includes at least one site from each region. The estuarine typology system is utilized to ensure that sites in the System reflect the wide range of estuarine types within the United States.

(b) The biogeographic classification scheme, presented in appendix I, contains 29 regions. Figure 1 graphically depicts the biogeographic regions of the United States.

(c) The typology system is presented in appendix II..

Sec. 921.4 Relationship to other provisions of the Coastal Zone Management Act, and to the Marine Protection, Research and Sanctuaries Act.

(a) The National Estuarine Research Reserve System is intended to provide information to state agencies and other entities involved in addressing coastal management issues. Any coastal state, including those that do not have approved coastal management programs under section 306 of the Act, is eligible for an award under the National Estuarine Research Reserve Program (see Sec. 921.2(c)).

(b) For purposes of consistency review by states with a federally approved coastal management program, the designation of a National Estuarine Research Reserve is deemed to be a Federal activity, which, if directly affecting the state's coastal zone, must be undertaken in a manner consistent to the maximum extent practicable with the approved state coastal management program as provided by section 1456(c)(1) of the Act, and implementing regulations at 15 CFR part 930, subpart C. In accordance with section 1456(c)(1) of the Act and the applicable regulations NOAA will be responsible for certifying that designation of the Reserve is consistent with the state's approved coastal management program. The state must concur with or object to the certification. It is recommended that the lead state agency for Reserve designation consult, at the earliest practicable time, with the appropriate state officials concerning the consistency of a proposed National Estuarine Research Reserve.

(c) The National Estuarine Research Reserve Program will be administered in close coordination with the National Marine Sanctuary Program (Title III of the Marine Protection, Research and Sanctuaries Act, as amended, 16 U.S.C. 1431-1445), also administered by NOAA. Title III authorizes the Secretary of Commerce to designate discrete areas of the marine environment as National Marine Sanctuaries to protect or restore such areas for their conservation, recreational, ecological, historical, research,

educational or esthetic values. National Marine Sanctuaries and Estuarine Research Reserves may not overlap, but may be adjacent.

Sec. 921.10 General.

(a) A coastal state may apply for Federal financial assistance for the purpose of site selection, preparation of documents specified in Sec. 921.13 (draft management plan (DMP) and environmental impact statement (EIS)), and the conduct of limited basic characterization studies. The total Federal share of this assistance may not exceed \$100,000. Federal financial assistance for preacquisition activities under Sec. 921.11 and Sec. 921.12 is subject to the total \$5 million for which each Reserve is eligible for land acquisition. Notwithstanding the above, when financial assistance is provided from amounts recovered as a result of damage to natural resources located in the coastal zone, such assistance may be used to pay 100 percent of all actual costs of activities carried out with this assistance, as long as such funds are available. In the case of a biogeographic region (see appendix I) shared by two or more coastal states, each state is eligible for Federal financial assistance to establish a separate National Estuarine Research Reserve within their respective portion of the shared biogeographic region. Each separate National Estuarine Research Reserve is eligible for the full complement of funding. Financial assistance application procedures are specified in subpart I.

(b) In developing a Reserve program, a state may choose to develop a multiple-site Reserve reflecting a diversity of habitats in a single biogeographic region. A multiple-site Reserve allows the state to develop complementary research and educational programs within the individual components of its multi-site Reserve. Multiple-site Reserves are treated as one Reserve in terms of financial assistance and development of an overall management framework and plan. Each individual site of a proposed multiple-site Reserve shall be evaluated both separately under Sec. 921.11(c) and collectively as part of the site selection process. A coastal state may propose to establish a multiple-site Reserve at the time of the initial site selection, or at any point in the development or operation of the Reserve. If the state decides to develop a multiple-site National Estuarine Research Reserve after the initial acquisition and development award is made for a single site, the proposal is subject to the requirements set forth in Sec. 921.33(b). However, a state may not propose to add one or more sites to an already designated Reserve if the operation and management of such Reserve has been found deficient and uncorrected or the research conducted is not consistent with the Estuarine Research Guidelines referenced in Sec. 921.51. In addition, Federal funds for the acquisition of a multiple-site Reserve remain limited to \$5,000,000 (see Sec. 921.20). The funding for operation of a multiple-site Reserve is limited to the maximum allowed for any one Reserve per year (see Sec. 921.32(c)) and preacquisition funds are limited to \$100,000 per Reserve. Notwithstanding the above, when financial assistance is provided from amounts recovered as a result of damage to natural resources located in the coastal zone, such assistance may be used to pay 100 percent of all actual costs of activities carrier out with this assistance, as long as such funds are available.

[58 FR 38215, July 15, 1993, as amended at 63 FR 26717, May 14, 1998].

Sec. 921.11 Site selection and feasibility.

(a) A coastal state may use Federal funds to establish and implement a site selection process which is approved by NOAA.

(b) In addition to the requirements set forth in subpart I, a request for Federal funds for site selection must contain the following programmatic information:

1. A description of the proposed site selection process and how it will be implemented in conformance with the biogeographic classification scheme and typology (Sec. 921.3);
2. An identification of the site selection agency and the potential management agency; and
3. A description of how public participation will be incorporated into the process (see Sec. 921.11(d)).

(c) As part of the site selection process, the state and NOAA shall evaluate and select the final site(s). NOAA has final authority in approving such sites. Site selection shall be guided by the following principles:

1. The site's contribution to the biogeographical and typological balance of the National Estuarine Research Reserve System. NOAA will give priority consideration to proposals to establish Reserves in biogeographic regions or subregions or incorporating types that are not represented in the system. (see the biogeographic classification scheme and typology set forth in Sec. 921.3 and appendices I and II);
2. The site's ecological characteristics, including its biological productivity, diversity of flora and fauna, and capacity to attract a broad range of research and educational interests. The proposed site must be a representative estuarine ecosystem and should, to the maximum extent possible, be an estuarine ecosystem minimally affected by human activity or influence (see Sec. 921.1(e)).
3. Assurance that the site's boundaries encompass an adequate portion of the key land and water areas of the natural system to approximate an ecological unit and to ensure effective conservation. Boundary size will vary greatly depending on the nature of the ecosystem. Reserve boundaries must encompass the area within which adequate control has or will be established by the managing entity over human activities occurring within the Reserve. Generally, Reserve boundaries will encompass two areas: Key land and water areas (or "core area") and a buffer zone. Key land and water areas and a buffer zone will likely require significantly different levels of control (see Sec. 921.13(a)(7)). The term "key land and water areas" refers to that core area within the Reserve that is so vital to the functioning of the estuarine ecosystem that it must be under a level of control sufficient to

ensure the long-term viability of the Reserve for research on natural processes. Key land and water areas, which comprise the core area, are those ecological units of a natural estuarine system which preserve, for research purposes, a full range of significant physical, chemical and biological factors contributing to the diversity of fauna, flora and natural processes occurring within the estuary. The determination of which land and water areas are "key" to a particular Reserve must be based on specific scientific knowledge of the area. A basic principle to follow when deciding upon key land and water areas is that they should encompass resources representative of the total ecosystem, and which if compromised could endanger the research objectives of the Reserve. The term buffer zone refers to an area adjacent to or surrounding key land and water areas and essential to their integrity. Buffer zones protect the core area and provide additional protection for estuarine-dependent species, including those that are rare or endangered. When determined appropriate by the state and approved by NOAA, the buffer zone may also include an area necessary for facilities required for research and interpretation. Additionally, buffer zones should be established sufficient to accommodate a shift of the core area as a result of biological, ecological or geomorphological change which reasonably could be expected to occur. National Estuarine Research Reserves may include existing Federal or state lands already in a protected status where mutual benefit can be enhanced. However, NOAA will not approve a site for potential National Estuarine Research Reserve status that is dependent primarily upon the inclusion of currently protected Federal lands in order to meet the requirements for Reserve status (such as key land and water areas). Such lands generally will be included within a Reserve to serve as a buffer or for other ancillary purposes; and may be included, subject to NOAA approval, as a limited portion of the core area;

4. The site's suitability for long-term estuarine research, including ecological factors and proximity to existing research facilities and educational institutions;
5. The site's compatibility with existing and potential land and water uses in contiguous areas as well as approved coastal and estuarine management plans; and
6. The site's importance to education and interpretive efforts, consistent with the need for continued protection of the natural system.

(d) Early in the site selection process the state must seek the views of affected landowners, local governments, other state and Federal agencies and other parties who are interested in the area(s) being considered for selection as a potential National Estuarine Research Reserve. After the local government(s) and affected landowner(s) have been contacted, at least one public meeting shall be held in the vicinity of the proposed site. Notice of such a meeting, including the time, place, and relevant subject matter, shall be announced by the state through the area's principal newspaper at least 15 days prior to the date of the meeting and by NOAA in the Federal Register.

(e) A state request for NOAA approval of a proposed site (or sites in the case of a multi-site Reserve) must contain a description of the proposed site(s) in relationship to each of the site selection principals (Sec. 921.11(c)) and the following information:

1. An analysis of the proposed site(s) based on the biogeographical scheme/typology discussed in Sec. 921.3 and set forth in appendices I and II;
2. A description of the proposed site(s) and its (their) major resources, including location, proposed boundaries, and adjacent land uses. Maps are required;
3. A description of the public participation process used by the state to solicit the views of interested parties, a summary of comments, and, if interstate issues are involved, documentation that the Governor(s) of the other affected state(s) has been contacted. Copies of all correspondence, including contact letters to all affected landowners must be appended;
4. A list of all sites considered and a brief statement of the reasons why a site was not preferred; and
5. A nomination of the proposed site(s) for designation as a National Estuarine Research Reserve by the Governor of the coastal state in which the state is located.

(f) A state proposing to reactivate an inactive site, previously approved by NOAA for development as an Estuarine Sanctuary or Reserve, may apply for those funds remaining, if any, provided for site selection and feasibility (Sec. 921.11a) to determine the feasibility of reactivation. This feasibility study must comply with the requirements set forth in Sec. 921.11 (c) through (e).

Sec. 921.12 Post site selection.

(a) At the time of the coastal state's request for NOAA approval of a proposed site, the state may submit a request for funds to develop the draft management plan and for preparation of the EIS. At this time, the state may also submit a request for the remainder of the predesignation funds to perform a limited basic characterization of the physical, chemical and biological characteristics of the site approved by NOAA necessary for providing EIS information to NOAA. The state's request for these post site selection funds must be accompanied by the information specified in subpart I and, for draft management plan development and EIS information collection, the following programmatic information:

1. A draft management plan outline (see Sec. 921.13(a) below); and
2. An outline of a draft memorandum of understanding (MOU) between the state and NOAA detailing the Federal-state role in Reserve management during the initial period of Federal funding and expressing the state's long-term commitment to operate and manage the Reserve.

(b) The state is eligible to use the funds referenced in Sec. 921.12(a) after the proposed site is approved by NOAA under the terms of Sec. 921.11.

Sec. 921.13 Management plan and environmental impact statement development.

(a) After NOAA approves the state's proposed site and application for funds submitted pursuant to Sec. 921.12, the state may begin draft management plan development and the collection of information necessary for the preparation by NOAA of an EIS. The state shall develop a draft management plan, including an MOU. The plan shall set out in detail:

1. Reserve goals and objectives, management issues, and strategies or actions for meeting the goals and objectives;
2. An administrative plan including staff roles in administration, research, education/interpretation, and surveillance and enforcement;
3. A research plan, including a monitoring design;
4. An education/interpretive plan;
5. A plan for public access to the Reserve;
6. A construction plan, including a proposed construction schedule, general descriptions of proposed developments and general cost estimates. Information should be provided for proposed minor construction projects in sufficient detail to allow these projects to begin in the initial phase of acquisition and development. A categorical exclusion, environmental assessment, or EIS may be required prior to construction;
7. (i) An acquisition plan identifying the ecologically key land and water areas of the Reserve, ranking these areas according to their relative importance, and including a strategy for establishing adequate long-term state control over these areas sufficient to provide protection for Reserve resources to ensure a stable environment for research. This plan must include an identification of ownership within the proposed Reserve boundaries, including land already in the public domain; the method(s) of acquisition which the state proposes to use--acquisition (including less-than-fee simple options) to establish adequate long-term state control; an estimate of the fair market value of any property interest--which is proposed for acquisition; a schedule estimating the time required to complete the process of establishing adequate state control of the proposed research reserve; and a discussion of any anticipated problems. In selecting a preferred method(s) for establishing adequate state control over areas within the proposed boundaries of the Reserve, the state shall perform the following steps for each parcel determined to be part of the key land and water areas (control over which is necessary to protect the integrity of the Reserve for research purposes), and for those parcels required for research and interpretive support facilities or buffer purposes:
 - (A) Determine, with appropriate justification, the minimum level of control(s) required [e.g., management agreement, regulation, less-than-fee simple property interest (e.g., conservation easement), fee simple property acquisition, or a combination of these approaches]. This does not preclude the future necessity of increasing the level of state control;
 - (B) Identify the level of existing state control(s);
 - (C) Identify the level of additional state control(s), if any, necessary to meet the

minimum requirements identified in paragraph (a)(7)(i)(A) of this section;
(D) Examine all reasonable alternatives for attaining the level of control identified in paragraph (a)(7)(i)(C) of this section, and perform a cost analysis of each; and
(E) Rank, in order of cost, the methods (including acquisition) identified in paragraph (a)(7)(i)(D) of this section.

(ii) An assessment of the relative cost-effectiveness of control alternatives shall include a reasonable estimate of both short-term costs (e.g., acquisition of property interests, regulatory program development including associated enforcement costs, negotiation, adjudication, etc.) and long-term costs (e.g., monitoring, enforcement, adjudication, management and coordination). In selecting a preferred method(s) for establishing adequate state control over each parcel examined under the process described above, the state shall give priority consideration to the least costly method(s) of attaining the minimum level of long-term control required. Generally, with the possible exception of buffer areas required for support facilities, the level of control(s) required for buffer areas will be considerably less than that required for key land and water areas. This acquisition plan, after receiving the approval of NOAA, shall serve as a guide for negotiations with landowners. A final boundary for the reserve shall be delineated as a part of the final management plan;

8. A resource protection plan detailing applicable authorities, including allowable uses, uses requiring a permit and permit requirements, any restrictions on use of the research reserve, and a strategy for research reserve surveillance and enforcement of such use restrictions, including appropriate government enforcement agencies;
9. If applicable, a restoration plan describing those portions of the site that may require habitat modification to restore natural conditions;
10. If applicable, a resource manipulation plan, describing those portions of the Reserve buffer in which long-term pre-existing (prior to designation) manipulation for reasons not related to research or restoration is occurring. The plan shall explain in detail the nature of such activities, shall justify why such manipulation should be permitted to continue within the reserve buffer; and shall describe possible effects of this manipulation on key land and water areas and their resources;
11. A proposed memorandum of understanding (MOU) between the state and NOAA regarding the Federal-state relationship during the establishment and development of the National Estuarine Research Reserve, and expressing a long-term commitment by the state to maintain and manage the Reserve in accordance with section 315 of the Act, 16 U.S.C. 1461, and applicable regulations. In conjunction with the MOU, and where possible under state law, the state will consider taking appropriate administrative or legislative action to ensure the long-term protection and operation of the National Estuarine Research Reserve. If other MOUs are necessary (such as with a Federal agency, another state agency or private organization), drafts of such MOUs must be included in the plan. All necessary MOU's shall be signed prior to Reserve designation; and

12. If the state has a federally approved coastal management program, a certification that the National Estuarine Research Reserve is consistent to the maximum extent practicable with that program. See Secs. 921.4(b) and 921.30(b).

(b) Regarding the preparation of an EIS under the National Environmental Policy Act on a National Estuarine Research Reserve proposal, the state and NOAA shall collect all necessary information concerning the socioeconomic and environmental impacts associated with implementing the draft management plan and feasible alternatives to the plan. Based on this information, the state will draft and provide NOAA with a preliminary EIS.

(c) Early in the development of the draft management plan and the draft EIS, the state and NOAA shall hold a scoping meeting (pursuant to NEPA) in the area or areas most affected to solicit public and government comments on the significant issues related to the proposed action. NOAA will publish a notice of the meeting in the Federal Register at least 15 days prior to the meeting. The state shall be responsible for publishing a similar notice in the local media.

(d) NOAA will publish a Federal Register notice of intent to prepare a draft EIS. After the draft EIS is prepared and filed with the Environmental Protection Agency (EPA), a Notice of Availability of the draft EIS will appear in the Federal Register. Not less than 30 days after publication of the notice, NOAA will hold at least one public hearing in the area or areas most affected by the proposed national estuarine research reserve. The hearing will be held no sooner than 15 days after appropriate notice of the meeting has been given in the principal news media by the state and in the Federal Register by NOAA. After a 45-day comment period, a final EIS will be prepared by the state and NOAA.

Sec. 921.20 General.

The acquisition and development period is separated into two major phases. After NOAA approval of the site, draft management plan and draft MOU, and completion of the final EIS, a coastal state is eligible for an initial acquisition and development award(s). In this initial phase, the state should work to meet the criteria required for formal research reserve designation; e.g., establishing adequate state control over the key land and water areas as specified in the draft management plan and preparing the final management plan. These requirements are specified in Sec. 921.30. Minor construction in accordance with the draft management plan may also be conducted during this initial phase. The initial acquisition and development phase is expected to last no longer than three years. If necessary, a longer time period may be negotiated between the state and NOAA. After Reserve designation, a state is eligible for a supplemental acquisition and development award(s) in accordance with Sec. 921.31. In this post-designation acquisition and development phase, funds may be used in accordance with the final management plan to construct research and educational facilities, complete any remaining land acquisition, for program development, and for restorative activities identified in the final management

plan. In any case, the amount of Federal financial assistance provided to a coastal state with respect to the acquisition of lands and waters, or interests therein, for any one National Estuarine Research Reserve may not exceed an amount equal to 50 percent of the costs of the lands, waters, and interests therein or \$5,000,000, whichever amount is less, except when the financial assistance is provided from amounts recovered as a result of damage to natural resources located in the coastal zone, in which case the assistance may be used to pay 100 percent of all actual costs of activities carrier out with this assistance, as long as such funds are available.

[58 FR 38215, July 15, 1993, as amended at 62 FR 12540, Mar. 17, 1997; 63 FR 26717, May 14, 1998].

Sec. 921.21 Initial acquisition and development awards.

(a) Assistance is provided to aid the recipient prior to designation in:

1. Acquiring a fee simple or less-than-fee simple real property interest in land and water areas to be included in the Reserve boundaries (see Sec. 921.13(a)(7); Sec. 921.30(d));
2. Minor construction, as provided in paragraphs (b) and (c) of this section;
3. Preparing the final management plan; and
4. Initial management costs, e.g., for implementing the NOAA approved draft management plan, hiring a Reserve manager and other staff as necessary and for other management-related activities. Application procedures are specified in subpart I.

(b) The expenditure of Federal and state funds on major construction activities is not allowed during the initial acquisition and development phase. The preparation of architectural and engineering plans, including specifications, for any proposed construction, or for proposed restorative activities, is permitted. In addition, minor construction activities, consistent with paragraph (c) of this section also are allowed. The NOAA-approved draft management plan must, however, include a construction plan and a public access plan before any award funds can be spent on construction activities.

(c) Only minor construction activities that aid in implementing portions of the management plan (such as boat ramps and nature trails) are permitted during the initial acquisition and development phase. No more than five (5) percent of the initial acquisition and development award may be expended on such activities. NOAA must make a specific determination, based on the final EIS, that the construction activity will not be detrimental to the environment.

(d) Except as specifically provided in paragraphs (a) through (c) of this section, construction projects, to be funded in whole or in part under an acquisition and development award(s), may not be initiated until the Reserve receives formal designation (see Sec. 921.30). This requirement has been adopted to ensure that substantial progress

in establishing adequate state control over key land and water areas has been made and that a final management plan is completed before major sums are spent on construction. Once substantial progress in establishing adequate state control/acquisition has been made, as defined by the state in the management plan, other activities guided by the final management plan may begin with NOAA's approval.

(e) For any real property acquired in whole or part with Federal funds for the Reserve, the state shall execute suitable title documents to include substantially the following provisions, or otherwise append the following provisions in a manner acceptable under applicable state law to the official land record(s):

1. Title to the property conveyed by this deed shall vest in the [recipient of the award granted pursuant to section 315 of the Act, 16 U.S.C. 1461 or other NOAA approved state agency] subject to the condition that the designation of the [name of National Estuarine Reserve] is not withdrawn and the property remains part of the federally designated [name of National Estuarine Research Reserve]; and
2. In the event that the property is no longer included as part of the Reserve, or if the designation of the Reserve of which it is part is withdrawn, then NOAA or its successor agency, after full and reasonable consultation with the State, may exercise the following rights regarding the disposition of the property:
 - (i) The recipient may retain title after paying the Federal Government an amount computed by applying the Federal percentage of participation in the cost of the original project to the current fair market value of the property;
 - (ii) If the recipient does not elect to retain title, the Federal Government may either direct the recipient to sell the property and pay the Federal Government an amount computed by applying the Federal percentage of participation in the cost of the original project to the proceeds from the sale (after deducting actual and reasonable selling and repair or renovation expenses, if any, from the sale proceeds), or direct the recipient to transfer title to the Federal Government. If directed to transfer title to the Federal Government, the recipient shall be entitled to compensation computed by applying the recipient's percentage of participation in the cost of the original project to the current fair market value of the property; and
 - (iii) Fair market value of the property must be determined by an independent appraiser and certified by a responsible official of the state, as provided by Department of Commerce regulations at 15 CFR part 24, and Uniform Relocation Assistance and Real Property Acquisition for Federal and Federally assisted programs at 15 CFR part 11.

(f) Upon instruction by NOAA, provisions analogous to those of Sec. 921.21(e) shall be included in the documentation underlying less-than-fee-simple interests acquired in whole or part with Federal funds.

(g) Federal funds or non-Federal matching share funds shall not be spent to acquire a real property interest in which the state will own the land concurrently with another entity unless the property interest has been identified as a part of an acquisition strategy

pursuant to Sec. 921.13(7) which has been approved by NOAA prior to the effective date of these regulations.

(h) Prior to submitting the final management plan to NOAA for review and approval, the state shall hold a public meeting to receive comment on the plan in the area affected by the estuarine research reserve. NOAA will publish a notice of the meeting in the Federal Register at least 15 days prior to the public meeting. The state shall be responsible for having a similar notice published in the local newspaper(s).

Sec. 921.30 Designation of National Estuarine Research Reserves.

(a) The Under Secretary may designate an area proposed for designation by the Governor of the state in which it is located, as a National Estuarine Research Reserve if the Under Secretary finds:

1. The area is a representative estuarine ecosystem that is suitable for long-term research and contributes to the biogeographical and typological balance of the System;
2. Key land and water areas of the proposed Reserve, as identified in the management plan, are under adequate state control sufficient to provide long-term protection for reserve resources to ensure a stable environment for research;
3. Designation of the area as a Reserve will serve to enhance public awareness and understanding of estuarine areas, and provide suitable opportunities for public education and interpretation;
4. A final management plan has been approved by NOAA;
5. An MOU has been signed between the state and NOAA ensuring a long-term commitment by the state to the effective operation and implementation of the area as a National Estuarine Research Reserve;
6. All MOU's necessary for reserve management (i.e., with relevant Federal, state, and local agencies and/or private organizations) have been signed; and
7. The coastal state in which the area is located has complied with the requirements of subpart B.

(b) NOAA will determine whether the designation of a National Estuarine Research Reserve in a state with a federally approved coastal zone management program directly affects the coastal zone. If the designation is found to directly affect the coastal zone, NOAA will make a consistency determination pursuant to Sec. 307(c)(1) of the Act, 16 U.S.C. 1456, and 15 CFR part 930, subpart C. See Sec. 921.4(b). The results of this consistency determination will be published in the Federal Register when the notice of designation is published. See Sec. 921.30(c).

(c) NOAA will publish the notice of designation of a National Estuarine Research Reserve in the Federal Register. The state shall be responsible for having a similar notice published in the local media.

(d) The term state control in Sec. 921.30(a)(3) does not necessarily require that key land and water areas be owned by the state in fee simple. Acquisition of less-than-fee simple interests e.g., conservation easements) and utilization of existing state regulatory measures are encouraged where the state can demonstrate that these interests and measures assure adequate long-term state control consistent with the purposes of the research reserve (see also Secs. 921.13(a)(7); 921.21(g)). Should the state later elect to purchase an interest in such lands using NOAA funds, adequate justification as to the need for such acquisition must be provided to NOAA.

Sec. 921.31 Supplemental acquisition and development awards.

After National Estuarine Research Reserve designation, and as specified in the approved management plan, a coastal state may request a supplemental acquisition and/or development award(s) for acquiring additional property interests identified in the management plan as necessary to strengthen protection of key land and water areas and to enhance long-term protection of the area for research and education, for facility and exhibit construction, for restorative activities identified in the approved management plan, for administrative purposes related to acquisition and/or facility construction and to develop and/or upgrade research, monitoring and education/interpretive programs. Federal financial assistance provided to a National Estuarine Research Reserve for supplemental development costs directly associated with facility construction (i.e., major construction activities) may not exceed 70 percent of the total project cost, except when the financial assistance is provided from amounts recovered as a result of damage to natural resources located in the coastal zone, in which case the assistance may be used to pay 100 percent of the costs. NOAA must make a specific determination that the construction activity will not be detrimental to the environment. Acquisition awards for the acquisition of lands or waters, or interests therein, for any one reserve may not exceed an amount equal to 50 percent of the costs of the lands, waters, and interests therein of \$5,000,000, whichever amount is less, except when the financial assistance is provided from amounts recovered as result of damage to natural resources located in the coastal zone, in which case the assistance may be used to pay 100 percent of all actual costs of activities carrier out with this assistance, as long as such funds are available. In the case of a biogeographic region (see appendix I) shared by two or more states, each state is eligible independently for Federal financial assistance to establish a separate National Estuarine Research Reserve within their respective portion of the shared biogeographic region. Application procedures are specified in subpart I. Land acquisition must follow the procedures specified in Secs. 921.13(a)(7), 921.21(e) and (f) and 921.81.

[58 FR 38215, July 15, 1993, as amended at 62 FR 12540, Mar. 17, 1997; 63 FR 26717, May 14, 1998].

Sec. 921.32 Operation and management: Implementation of the management plan.

(a) After the Reserve is formally designated, a coastal state is eligible to receive Federal funds to assist the state in the operation and management of the Reserve including the management of research, monitoring, education, and interpretive programs. The purpose of this Federally funded operation and management phase is to implement the approved final management plan and to take the necessary steps to ensure the continued effective operation of the Reserve.

(b) State operation and management of the Reserves shall be consistent with the mission, and shall further the goals of the National Estuarine Research Reserve program (see Sec. 921.1).

(c) Federal funds are available for the operation and management of the Reserve. Federal funds provided pursuant to this section may not exceed 70 percent of the total cost of operating and managing the Reserve for any one year, except when the financial assistance is provided from amounts recovered as a result of damage to natural resources located in the coastal zone, in which case the assistance may be used to pay 100 percent of the costs. In the case of a biogeographic region (see Appendix I) shared by two or more states, each state is eligible for Federal financial assistance to establish a separate Reserve within their respective portion of the shared biogeographic region (see Sec. 921.10).

(d) Operation and management funds are subject to the following limitations:

1. Eligible coastal state agencies may apply for up to the maximum share available per Reserve for that fiscal year. Share amounts will be announced annually by letter from the Sanctuary and Reserves Division to all participating states. This letter will be provided as soon as practicable following approval of the Federal budget for that fiscal year.
2. No more than ten percent of the total amount (state and Federal shares) of each operation and management award may be used for construction-type activities.

[58 FR 38215, July 15, 1993, as amended at 62 FR 12541, Mar. 17, 1997].

Sec. 921.33 Boundary changes, amendments to the management plan, and addition of multiple-site components.

(a) Changes in the boundary of a Reserve and major changes to the final management plan, including state laws or regulations promulgated specifically for the Reserve, may be made only after written approval by NOAA. NOAA may require public notice, including notice in the Federal Register and an opportunity for public comment before approving a boundary or management plan change. Changes in the boundary of a Reserve involving the acquisition of properties not listed in the management plan or final EIS require public notice and the opportunity for comment; in certain cases, a categorical exclusion, an environmental assessment and possibly an environmental impact statement may be

required. NOAA will place a notice in the Federal Register of any proposed changes in Reserve boundaries or proposed major changes to the final management plan. The state shall be responsible for publishing an equivalent notice in the local media. See also requirements of Secs. 921.4(b) and 921.13(a)(11).

(b) As discussed in Sec. 921.10(b), a state may choose to develop a multiple-site National Estuarine Research Reserve after the initial acquisition and development award for a single site has been made. NOAA will publish notice of the proposed new site including an invitation for comments from the public in the Federal Register. The state shall be responsible for publishing an equivalent notice in the local newspaper(s). An EIS, if required, shall be prepared in accordance with section Sec. 921.13 and shall include an administrative framework for the multiple-site Reserve and a description of the complementary research and educational programs within the Reserve. If NOAA determines, based on the scope of the project and the issues associated with the additional site(s), that an environmental assessment is sufficient to establish a multiple-site Reserve, then the state shall develop a revised management plan which, concerning the additional component, incorporates each of the elements described in Sec. 921.13(a). The revised management plan shall address goals and objectives for all components of the multi-site Reserve and the additional component's relationship to the original site(s).

(c) The state shall revise the management plan for a Reserve at least every five years, or more often if necessary. Management plan revisions are subject to (a) above.

(d) NOAA will approve boundary changes, amendments to management plans, or the addition of multiple-site components, by notice in the Federal Register. If necessary NOAA will revise the designation document (findings) for the site.

Sec. 921.40 Ongoing oversight and evaluations of designated National Estuarine Research Reserves.

(a) The Sanctuaries and Reserve Division shall conduct, in accordance with section 312 of the Act and procedures set forth in 15 CFR part 928, ongoing oversight and evaluations of Reserves. Interim sanctions may be imposed in accordance with regulations promulgated under 15 CFR part 928.

(b) The Assistant Administrator may consider the following indicators of non-adherence in determining whether to invoke interim sanctions:

1. Inadequate implementation of required staff roles in administration, research, education/interpretation, and surveillance and enforcement. Indicators of inadequate implementation could include: No Reserve Manager, or no staff or insufficient staff to carry out the required functions.
2. Inadequate implementation of the required research plan, including the monitoring design. Indicators of inadequate implementation could include: Not

- carrying out research or monitoring that is required by the plan, or carrying out research or monitoring that is inconsistent with the plan.
3. Inadequate implementation of the required education/interpretation plan. Indicators of inadequate implementation could include: Not carrying out education or interpretation that is required by the plan, or carrying out education/interpretation that is inconsistent with the plan.
 4. Inadequate implementation of public access to the Reserve. Indicators of inadequate implementation of public access could include: Not providing necessary access, giving full consideration to the need to keep some areas off limits to the public in order to protect fragile resources.
 5. Inadequate implementation of facility development plan. Indicators of inadequate implementation could include: Not taking action to propose and budget for necessary facilities, or not undertaking necessary construction in a timely manner when funds are available.
 6. Inadequate implementation of acquisition plan. Indicators of inadequate implementation could include: Not pursuing an aggressive acquisition program with all available funds for that purpose, not requesting promptly additional funds when necessary, and evidence that adequate long-term state control has not been established over some core or buffer areas, thus jeopardizing the ability to protect the Reserve site and resources from offsite impacts.
 7. Inadequate implementation of Reserve protection plan. Indicators of inadequate implementation could include: Evidence of non-compliance with Reserve restrictions, insufficient surveillance and enforcement to assure that restrictions on use of the Reserve are adhered to, or evidence that Reserve resources are being damaged or destroyed as a result of the above.
 8. Failure to carry out the terms of the signed Memorandum of Understanding (MOU) between the state and NOAA, which establishes a long-term state commitment to maintain and manage the Reserve in accordance with section 315 of the Act. Indicators of failure could include: State action to allow incompatible uses of state-controlled lands or waters in the Reserve, failure of the state to bear its fair share of costs associated with long-term operation and management of the Reserve, or failure to initiate timely updates of the MOU when necessary.

Sec. 921.41 Withdrawal of designation.

The Assistant Administrator may withdraw designation of an estuarine area as a National Estuarine Research Reserve pursuant to and in accordance with the procedures of section 312 and 315 of the Act and regulations promulgated thereunder.

**APPENDIX B- MEMORANDUM OF AGREEMENT BETWEEN THE NATIONAL
OCEANIC AND ATMOSHPERIC ADMINISTRATION AND THE UNIVERSITY
OF SOUTH CAROLINA**

Memorandum of Agreement
Between the
National Oceanic and Atmospheric Administration
And the
University of South Carolina
Detailing the state-federal roles in the
Management of the North Inlet–Winyah Bay National Estuarine Research Reserve

This Memorandum of Agreement states the provisions for the cooperative management of the North Inlet–Winyah Bay National Estuarine Research Reserve (NERR) in the state of South Carolina, between the University of South Carolina and the National Oceanic and Atmospheric Administration (NOAA) Office of Ocean and Coastal Resource Management.

WHEREAS, this Memorandum of Agreement supersedes the previous Memorandum of Understanding between the state of South Carolina and NOAA concerning the administration of the North Inlet–Winyah Bay National Estuarine Research Reserve made on August 28, 1992.

WHEREAS, the state of South Carolina has determined that the waters and related coastal habitats of North Inlet–Winyah Bay NERR provide unique opportunities for study of natural and human processes occurring within the estuarine ecosystems of the state to contribute to the science of estuarine ecosystem processes, enhance environmental education opportunities, and provide scientific information for effective coastal zone management in the state of South Carolina; and

WHEREAS, the state of South Carolina has determined that the resources of the North Inlet–Winyah Bay NERR and the values they represent to the citizens of South Carolina and the United States will benefit from the management of these resources as part of the National Estuarine Research Reserve System; and

WHEREAS, the National Oceanic and Atmospheric Administration has concurred with that finding and pursuant to its authority under section 315 of the Coastal Zone Management Act of 1972, as amended (CZMA, 16 U.S.C. 1461) and in accordance with implementing regulations at 15 CFR 921.30 has designated the North Inlet–Winyah Bay NERR; and

WHEREAS, the Belle W. Baruch Institute of the University of South Carolina is responsible for managing the North Inlet–Winyah Bay NERR and acknowledges the value of state-federal cooperation for the long-term management of the reserve in a manner consistent with the purpose of their designation; and

WHEREAS, the management plan describes the goals, objectives, strategies/actions, administrative structure, and institutional arrangements for the reserve, including this MOA and others;

NOW THEREFORE, in consideration of the mutual agreements herein, NOAA and the University of South Carolina agree to the following:

ARTICLE I: STATE-FEDERAL ROLES IN RESERVE MANAGEMENT

A. University of South Carolina Role in Reserve Management

The University of South Carolina shall:

1. be responsible for compliance with all federal laws and regulations, and ensure that the North Inlet–Winyah Bay NERR management plan is consistent with the provisions of the CZMA and implementing regulations;
2. ensure protection of the natural and cultural resources of the reserve, and ensure enforcement of the provisions of state law, including rules and regulations of the South Carolina Coastal Management Program;
3. ensure adequate, long-term protection and management of lands included within the reserve boundary;
4. annually apply for, budget, and allocate funds received for reserve operations, research and monitoring, education and stewardship; and as necessary, land acquisition and reserve facility construction;
5. conduct and coordinate research and monitoring programs that encourage scientists from a variety of institutions to work together to understand the ecology of the reserve ecosystem to improve coastal management;
6. conduct and maintain programs that disseminate research results via materials, activities, workshops, and conferences to resource users, state and local agencies, school systems, general public, and other interested parties;
7. provide staff, and endeavor to secure state funding for the manager, education coordinator and research coordinator;
8. secure facilities and equipment required to implement the provisions within the reserve management plan;
9. ensure adequate funding for facilities operation and maintenance;
10. maintain effective liaison with local, regional, state, and federal policy makers, regulators and the general public;
11. serve as principal contact for issues involving proposed boundary changes and/or amendments to the reserve management plan;

12. respond to NOAA's requests for information, particularly cooperative agreement and grant progress reports and evaluation findings, including necessary actions and recommendations, made pursuant to Section 312 of the CZMA; and
13. expend funds in accordance with federal and state laws, the reserve management plan, and annual funding guidance from NOAA.

B. Federal Role in Reserve Management

NOAA's Office of Ocean and Coastal Resource Management shall:

1. administer the provisions of the Sections 315 and 312 of the CZMA to ensure that the reserve operates in accordance with goals of the reserve system and the North Inlet–Winyah Bay reserve management plan;
2. review and process applications for financial assistance from the University of South Carolina consistent with 15 CFR 921, for management and operation, and as appropriate, land acquisition and facility construction;
3. advise the University of South Carolina of existing and emerging national and regional issues that have bearing on the reserve and reserve system;
4. maintain an information exchange network among reserves, including available research and monitoring data and educational materials developed within the reserve system;
5. to the extent possible, facilitate NOAA resources and capabilities in support of reserve goals and programs.

C. General Provisions

1. Nothing in this agreement or subsequent financial assistance awards shall obligate either party in the expenditure of funds, or for future payments of money, in excess of appropriations authorized by law.
2. Upon termination of this agreement or any subsequent financial assistance awards to the University of South Carolina any equipment purchased for studies to further this agreement will be disposed of in accordance with 15 CFR 24.32.
3. A free exchange of research and assessment data between the parties is encouraged and is necessary to ensure success of cooperative studies.

D. Other Provisions

1. Nothing in this agreement diminishes the independent authority or coordination responsibility of either party in administering its respective statutory obligations. Nothing in this agreement is intended to conflict with current written directives or

policies of either party. If the terms of this agreement are inconsistent with existing written directives or policies of either party entering this agreement, then those portions of the agreement which are determined to be inconsistent with such written directives and policies shall be invalid; but the remaining terms not affected by the inconsistency shall remain in full force and effect. At the first opportunity for revision of this agreement, all necessary changes shall be made by either an amendment to this agreement or by entering in a new superseding agreement, whichever is deemed expedient to the interested parties. Should disagreement arise on the interpretation of the provisions and/or amendments of this agreement that cannot be resolved by negotiations at the operating level of each party, the area(s) of disagreement shall be stated in writing by each party and promptly presented to a mutually approved mediator for non-binding mediation. If the parties cannot agree on the choice of a mediator or if the mediation does not resolve the dispute to the mutual approval of the parties, the parties are free to pursue any other legal remedies that are available.

ARTICLE II: REAL PROPERTY ACQUIRED FOR PURPOSE OF THE RESERVE

As well as acknowledging the rest of the requirements set forth at 15 CFR 921, the University of South Carolina specifically acknowledges and will fully comply with conditions set forth at 15 CFR 921.21 (e), which specify the legal documentation requirements concerning the use and disposition of real property acquired for reserve purposes with federal funds under Section 315 of the CZMA.

ARTICLE III: PROGRAM EVALUATION

The NOAA Office of Ocean and Coastal Resource Management will schedule periodic evaluations of the University of South Carolina performance in meeting the terms of this agreement, financial assistance awards, and the reserve management plan. Where findings of deficiency occur, NOAA may initiate action in accordance with the designation withdrawal or interim sanctions procedures established by the CZMA and applicable regulations at 15 CFR 921.40-41.

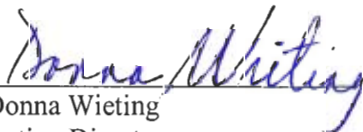
ARTICLE IV: EFFECTIVE DATE, REVIEW, AMENDMENT AND TERMINATION

- A. This agreement is effective on the date of the last signature on this agreement and shall be in effect until terminated by either party.
- B. The Parties will review this Agreement at least once every three years to determine whether it should be revised or terminated. The Agreement may only be amended by the mutual written consent of both parties.
- C. This agreement may be terminated by mutual consent of both parties, or by NOAA if NOAA withdraws designation of the reserve within the reserve system, pursuant to applicable provisions of the CZMA and its implementing regulations as described under 15 CFR 923 Subpart L, or if NOAA finds that the University of South Carolina fails to comply with this MOA. The agreement may be terminated by the University of South Carolina with or without

cause. Should this agreement be terminated, reimbursement of unexpended funds from financial assistance awards shall be determined on a pro rata basis according to the amount of work done by the parties at the time of termination. Additionally, reimbursement for land purchased and facilities constructed with NOAA funds shall be consistent with terms and special award conditions of financial assistance awards.

- D. If any clause, sentence or other portion of this MOA shall become illegal, null or void for any reason, the remaining portions of this MOA shall remain in full force and effect.
- E. No waiver of right by either party of any provision of this MOA shall be binding unless expressly confirmed in writing by the party giving the waiver.

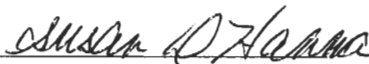
IN WITNESS THEREOF, the parties have caused this agreement to be executed.



Donna Wieting
Acting Director
Office of Ocean and Coastal
Resource Management
National Ocean Service
National Oceanic and
Atmospheric Administration
U.S. Department of Commerce

OCT -6 2010

Date



Susan D. Hanna
Associate Secretary
Board of Trustees
University of South Carolina

DEC 03 2010

Date

**APPENDIX C- RESEARCH AND PROPERTY USE AGREEMENT BETWEEN
THE BELLE W. BARUCH FOUNDATION AND THE UNIVERSITY OF SOUTH
CAROLINA**

AGREEMENT

BELLE W. BARUCH FOUNDATION

AND

UNIVERSITY OF SOUTH CAROLINA

STATE OF SOUTH CAROLINA)
) RESEARCH AND PROPERTY USE AGREEMENT
COUNTY OF GEORGETOWN)

This agreement is entered into on November 5, 1999 between THE BELLE W. BARUCH FOUNDATION (hereinafter called the "Foundation") and the UNIVERSITY OF SOUTH CAROLINA (hereinafter called the "University") for the purpose of furthering research and education in the areas of estuarine management, marine science and the care and propagation of the wildlife, flora and fauna of South Carolina.

The Foundation was created under the Will of Belle W. Baruch, deceased, duly admitted to probate by the Surrogate Court of the County of New York, New York and is an operating, tax-exempt charitable organization by rulings of the U.S. Internal Revenue Service in 1964 and 1973. The Foundation owns over 16,000 acres of forestry lands and marine property in Georgetown County, South Carolina.

The University is a State owned major research and teaching university in the State of South Carolina. On February 22, 1975, the Foundation and the University, along with Clemson University, entered into a Tripartite Agreement under which the University operates a research facility and laboratory for the purpose of studying the marsh and estuarine areas on the Foundation's property. The Tripartite Agreement provides for the coordination of the activities of the Foundation and the University and the provision of professional advice by the University to the Foundation. Under its terms the Tripartite Agreement will expire on February 22, 2000.

The Foundation and the University recognize that the Tripartite Agreement has been of mutual value to both in carrying out their respective missions and also has benefited the public by the educational programs, research studies and resources which have resulted from this agreement. Both parties have determined that the relationship between them should continue and carry forward under the terms of a new Agreement.

Now, therefore, in consideration of the mutual agreements contained herein, the Foundation and the University agree as follows:

1. USE OF PROPERTY:

Subject to the terms and conditions of this Agreement and in order to further the missions of both parties, the Foundation hereby permits and allows the University to use and occupy, in conjunction with the Foundation, the areas within that portion of the Foundation's property described as Marsh-Marine areas, more particularly the locations marked in red on a map of the Foundation's property attached hereto as Exhibit "A". In

addition, the University, in conjunction with the Foundation, shall have the use, occupancy and management responsibility of and for the Kimbel Conference Center and the Marine Field Laboratory and associated structures and grounds. The University recognizes the interest of the Foundation in a similar agreement entered into with Clemson University with regard to the Forest-Wetlands areas of the Foundation's property and the Foundation's intent to encourage other educational institutions to study and use the Foundation's property for appropriate research and education and will cooperate with the Foundation in carrying out these intentions. The University agrees that its use and/or occupancy of the properties outlined herein shall be conducted in a manner serving and in furtherance of the Foundation's purposes and to preserve and conserve the ecological, environmental and historical importance and qualities of the Foundation's property. The Foundation agrees that its allowance to others of the right to make use of the Marsh-Marine areas described herein will be consistent with the effective use of this property by the University and that it will consult with the University on all such planned additional uses to avoid any undue interference with the University's projects and programs. In case of dispute between the Foundation and the University on the use of the marsh-marine area, the decision of the Foundation Board shall be final.

Access roads and water routes to and within the property of the Foundation and parking sites therein(except those areas expressly excluded) may be used by the University in common with Clemson University, the Foundation and other permittees of the Foundation. The Foundation shall have the authority to regulate traffic for the efficient and safe use of the properties including the right to limit access and to require the use of cards or other appropriate identification for entry and access purposes. The University shall not allow use of the property by its personnel or others for recreational or commercial purposes without specific written permission from the Foundation.

The following areas are specifically excluded from this agreement and are reserved for the use of the Foundation.

- a. Hobcaw and Bellefield houses and all yards and grounds within the fenced areas surrounding such houses.
- b. The Visitor Center and related Education Building and the parking areas in conjunction therewith.
- c. The one-thousand acre rice field and smaller former rice field marked on Exhibit "A" in yellow, which includes a spoil area.
- d. All land between the bridges on Highway 17.
- e. The southern portion of Debidue Island owned by the Foundation, including any sandbars and accretions thereto.
- f. All other residences, buildings and structures, including but not limited to the hangar and other farm buildings and all historic structures such as the former slave villages.

Both parties recognize that certain of the Foundation's property included herein is subject to a life estate granted under the Last Will and Testament of Belle W. Baruch to Ella A. Severin. All uses of the areas subject to such life estate must be consistent therewith, including the allocation of all appropriate income therefrom.

2. INCOME AND INCOME PRODUCING ACTIVITIES:

It is the intention of the Foundation to manage its properties in accordance with the wishes of the Settlor of this Trust. In carrying out such obligation, the Foundation will manage its forestry and marine assets in a manner consistent therewith, but it may, in an appropriate manner, engage in the sale, harvest, replanting, and cultivation of its timber resources in a manner to earn income thereon. All such income derived from the sale of such assets shall belong to the Foundation. In like manner, the Foundation may engage in the sale or harvest of marine resources. All income or revenue from such resources shall belong to the Foundation. If the University in carrying out its research or other activities on the property of the Foundation, receives any income from the sale of timber, marine resources, fish, shellfish or other resources, the income or revenue from such resources shall belong to the Foundation unless otherwise agreed to between the parties in writing. The Foundation will inform the University of any sale or other activities related to the production of income and/or natural resources within the marsh and estuarine areas designated herein to be used and occupied by the University. The Foundation Board may, at its discretion, seek the advice of the University as to the potential environmental impact of such activities.

3. SAFETY REGULATIONS:

The University shall prepare and submit for approval by the Foundation Board comprehensive safety regulations pertaining to its area(s) of responsibility. These shall include, without being limited to: fire rules and precautions, emergency warning systems and communications procedures. The University will cooperate with the Foundation to assure that University personnel and invitees comply with all regulations as to road use, admission restrictions, the registration and use of all required identification or card items, and will assist the Foundation in drafting and enforcing safety regulations with respect to the use of water routes and other marine properties. Such rules and regulations must comply with the requirements of SCOSHA.

4. PROTECTION OF PROPERTY:

Both parties to this agreement recognize that the availability of the diverse environmental and ecological characteristics of the Foundation's property and its wildlife, flora and historical assets for the purpose of education and research are of great value to the State of South Carolina and to the public. To the greatest extent possible, it is important that these qualities be conserved and preserved. The University will take such steps as are necessary to assure that its activities will not adversely affect these qualities.

5. OPERATIONS AND ACTIVITIES;

The University shall, in accordance with the policies herein specified for prior approval by the Foundation Board, conduct research and provide education in marine science, estuarine management and the care and propagation of the wildlife, flora and fauna within the Marsh-Marine areas described in this Agreement. Both parties recognize that wildlife and fauna may move across large areas and recognize the right of others researching such wildlife and fauna to enter other areas necessary to such studies.

All activities conducted by the University on the Foundation's property must be approved before the commencement of such activities by the Foundation Board or a special committee selected by the Foundation Board to which such authority has been delegated. All such approvals must be in writing. In lieu of specific approval, the Foundation may issue a general approval policy for limited projects.

The University and the Foundation will meet on a regular basis, but not less frequent than annually, to discuss the University's research projects and other efforts on Foundation property. The University will provide the Foundation with a copy of the annual report of the Baruch Marine Science Institute and with copies of other research papers, articles and materials which the Foundation shall request respecting the University's research and activities undertaken on the Foundations property.

6. MAINTENANCE, REPAIRS AND IMPROVEMENTS:

The University shall keep and maintain in good order and repair all buildings, fixtures and appurtenances occupied by it under this agreement and any equipment or other property of the Foundation located or used therein. The University shall further keep and maintain in good order and safe condition, free from obstruction, the entries, drives and parking areas of all such buildings.

The maintenance of all other buildings, roads and other capital improvements on the Foundation's property shall be the responsibility of the Foundation. The University shall attempt to recover that portion of such costs related to its activities and should it recover any part of such costs through grants, appropriations or other means of funding, such funds shall be used to cover or reimburse the Foundation for such costs.

The parties recognize that future expansion or alteration of buildings may be necessary to carry out the purposes of this Agreement. The University shall not make any alterations, installations, additions or improvements in its area without the approval of the Foundation Board, in writing and prior to the commencement of any such improvement or addition. The Foundation Board will cooperate in every way possible to enhance such improvements as are consistent with the University's mission and responsibilities hereunder and with other activities or plans of the Foundation or any of its other permittees.

All buildings, structures and improvements now or hereafter erected by the University on Foundation property, including any fixtures and appurtenances thereto, shall be part of the realty and freehold, and shall not be removed at any time from the property without the written consent of the Foundation Board, which may be denied for any reason. Upon the termination of this agreement, all such buildings, structures, improvements, fixtures and appurtenances shall be the property of the Foundation and shall remain in place, except to the extent that any hazardous conditions relevant thereto shall be found to exist, in which case removal and correction of all such hazardous materials and/or conditions shall be at the expense of the University. All moveable scientific, research, office and other equipment including moveable furniture and furnishings shall remain the property of the University and may be removed by the University at any time without prior approval by the Foundation. Any damage to the Foundation's property from the use of or removal of any equipment or other property by the University shall be repaired by the University at its sole expense and cost. Any equipment purchased by the University with funds provided by the Foundation shall be deemed the property of the Foundation unless otherwise agreed to in writing.

The University shall not have any power to do any act or make any contract or agreement that will in any way bind the Foundation or its property, nor shall it have power to create any lien, mortgage or other encumbrance on any property of the Foundation including but not limited to the Marsh-Marine areas or any part thereof.

7. UTILITIES, SERVICES AND INSURANCE:

The University shall pay or cause to be paid all charges for utilities and services (including but not limited to heat, electric current or power, telephone or other communications, water, pumps and wells, sewer or septic tank costs and refuse removal), furnished to it and/or to the occupants of any building, structure or improvement occupied by it. The Foundation is not liable for nor is it required to provide any such utilities or services.

The University shall be responsible at its cost for the purchase and maintenance of adequate insurance on all buildings, improvements and appurtenances occupied by it including losses from fire, storm, water damage or other destructive hazards or shall provide the Foundation with assurances that such items are adequately covered by the State of South Carolina Sinking Fund or other State plan. In the event of damage to or destruction of any such building, the proceeds from such insurance shall be applied to the repair and/or replacement of such buildings, improvements and appurtenances. The University, at its cost, shall also purchase and maintain adequate insurance against any claim or liability arising from personal injury or property loss occurring on properties occupied by it and/or to any of its employees or permittees on the property of the Foundation. At least annually, the University will provide written proof of such insurance to the Foundation or written proof of adequate coverage under a State plan.

8. GENERAL RESTRICTIONS:

The University or any of its agents or employees shall not use any of the Foundation's property for any purpose, or permit any condition or activity thereon which:

- (a) has not been authorized by this agreement or by the Foundation Board in writing in accordance with its terms,
- (b) is prohibited under any applicable law or regulation by any governmental authority having jurisdiction over the functions and uses of the University, the Foundation or any of the Foundation's property,
- (c) interferes in any way with the Foundation's purpose, or the legitimate interests of the Foundation or its permittees, or
- (d) would in any way jeopardize or threaten to jeopardize the Foundation's status as an operating Foundation described in Sec. 4942 or as a tax exempt organization under Sec. 501(c)(3) of the Internal Revenue Code.

Moreover,

(i) No part of the property or any use thereof or of any funds received or payable under this agreement shall inure or be payable to any private shareholder or individual or otherwise to or for any purpose which is not an exempt purpose within the meaning of Sec. 501(c)(3) of the Internal Revenue Code as now in force or hereafter amended, and which is further not exclusively within the scope of the exempt purposes of the Foundation.

(ii) No part of the property or any use thereof or of any funds received or payable under this agreement shall be used directly or indirectly for the carrying on of propaganda or otherwise attempting to influence legislation or to influence the outcome of any public election or other political activity.

(iii) No person shall, on the ground of race, creed, sex, color or national origin be excluded from participation in, be denied the benefits of, or be subject to invidious discrimination in the performance of this Agreement.

9. ASSIGNMENTS:

The University shall not assign, mortgage or encumber any interest herein granted.

10. GOVERNING LAW:

This agreement shall be governed by and construed in accordance with the laws of the State of South Carolina. It is understood, however, that the Foundation and its Trustees are subject to the jurisdiction of the Surrogate's Court of the County of New York, New York and that this agreement may require the approval of such Court. If it is determined that such approval is necessary, this Agreement shall not become effective until such approval is obtained, except that if the preceding Tripartite agreement terminates, the parties may elect to proceed temporarily under the terms of this Agreement or to temporarily extend the terms of the Tripartite Agreement.

11. TERM OF THIS AGREEMENT OR TERMINATION HEREOF:

This Agreement shall commence in effect on January 1, 2000 and continue in full force and effect for fifteen (15) years thereafter, ending on December 31, 2015 unless sooner terminated as provided in this Agreement. The parties hereto, by mutual agreement in writing, may extend the term of this Agreement for an additional ten(10) years, ending on December 31, 2025, unless sooner terminated.

This Agreement may be terminated at any time by mutual agreement between the University and the Foundation. In the event that either party hereto shall fail to perform its material obligations under this Agreement, the other party may give written notice of such default specifying that if such default is not corrected within thirty (30) days it will elect to terminate this Agreement. If by fire, storm, water damage or other act of nature, the facilities or premises necessary to the mission of either party or to the purposes of this Agreement are destroyed either party may elect to terminate this Agreement.

If this Agreement is terminated for any reason or its term expires without renewal, the University shall be allowed a reasonable amount of time to terminate its long-term research and its occupancy of the Marsh-Marine areas and of all buildings, structures and improvements then in use by it. The University shall have the right to re-enter the Foundation's property for a reasonable time solely for the purpose of completing the orderly termination of long term research projects, provided that in such instances, the University will notify the Foundation prior to such entry. The University shall have the right to publish all data collected at the time of termination and any additional data collected in the process of the orderly termination of long-term research.

12. CHANGES IN AGREEMENT:

This Agreement contains the entire agreement between the parties with respect to the subject matter hereof. Accordingly, all prior agreements, including the Tripartite agreement, will terminate and cease to be in effect when this agreement takes effect. Neither this Agreement nor any provision hereof may be changed, amended, modified, waived, discharged or terminated except by mutual agreement of the parties evidenced by a written instrument signed by the parties hereto, except in accordance with the terms of this Agreement.

If, as a result of any tax ruling, determination or advice issued to the Foundation from the Internal Revenue Service, or by the South Carolina Department of Revenue, or as a result of any judicial or SCOSHA determination relevant hereto, this Agreement or any provision hereof shall, in the opinion of the Foundation, require modification in order to conform to such ruling or determination, the parties hereto agree to enter into and execute such modifications. In the event that the University shall disagree with the Foundation as to the need for or the terms of or the extent of any such modification of this Agreement, the parties will submit the matter to the Attorney General of South Carolina for his opinion which shall be binding upon the parties.

No delay or omission by any party hereto to exercise any right or power accruing as a result of any non-compliance or default by the other party with respect to any of the terms hereof shall impair any such right or power or be construed to be a waiver thereof. No waiver by either party of any of the terms hereof shall be construed to be a waiver of any succeeding default or breach of such term or of any other of the terms, covenants or agreements herein contained.

The termination of this agreement shall not discharge, release or in any way affect any liability or obligation of either party hereto which may accrue by reason of such termination or of any other matter which may have accrued prior to such termination. This Agreement shall bind and inure to the benefit of the parties hereto and their respective successors.

IN WITNESS WHEREOF, this Agreement has been duly executed in the State of South Carolina this 5th day of November, 1999.

The Belle W. Baruch Foundation

Eles A. Sevin

[Signature]

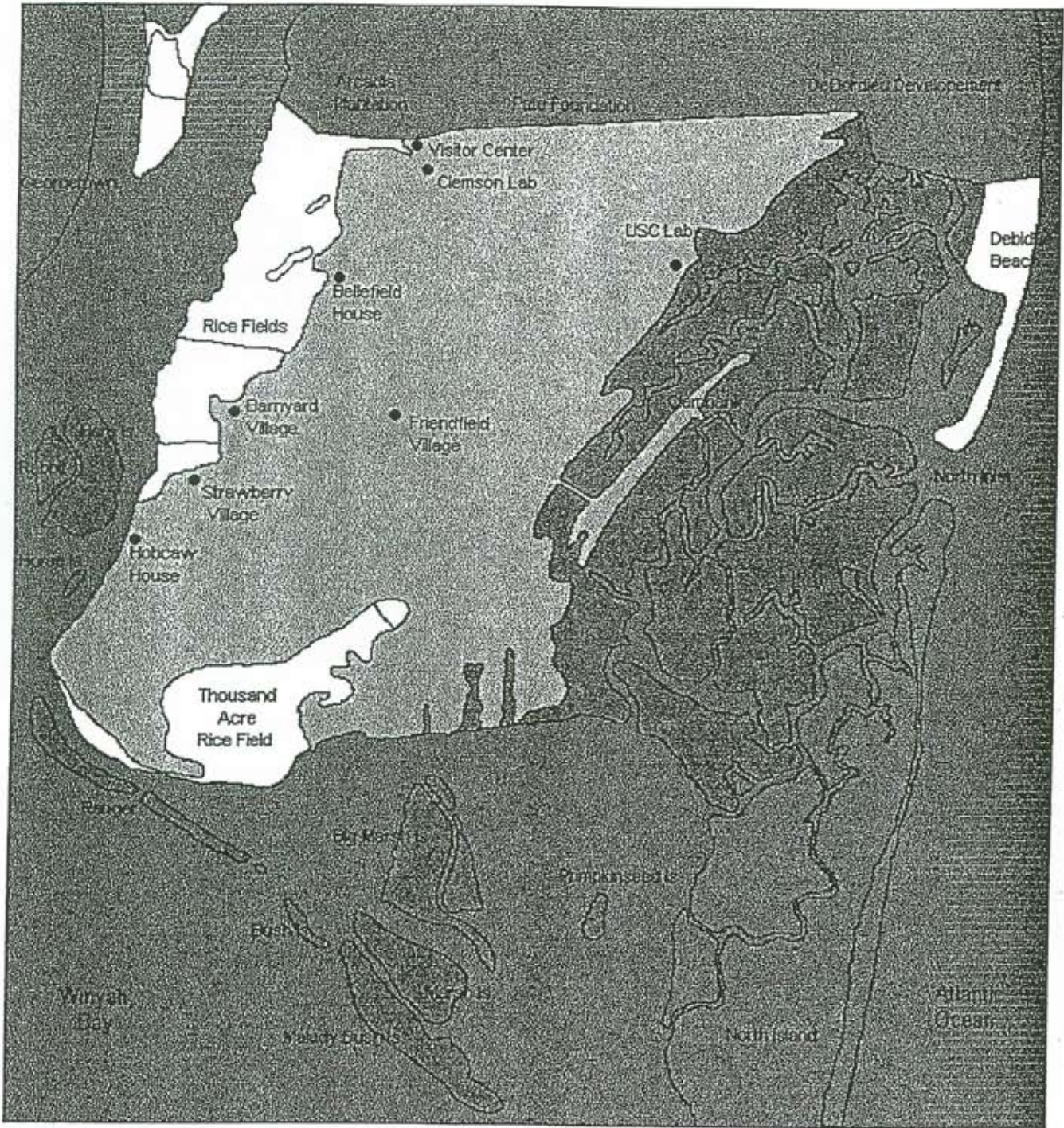
[Signature]

Trustees of the
Belle W. Baruch Foundation

University of South Carolina

By: *[Signature]*
By its President

Georgetown County, S.C.
November 5, 1999



Legend

- | | | | |
|---|--------------------|---|-----------------------------|
|  | Foundation Reserve |  | USC Marsh Marine Area |
|  | Other Ownership |  | Clemson Forest Wetland Area |

Exhibit A : Research and Property Use Agreement

**APPENDIX D- HOBCAW BARONY DISCOVERY CENTER AGREEMENT
BETWEEN THE BELLE W. BARUCH FOUNDATION AND THE UNIVERSITY
OF SOUTH CAROLINA**

THIS AGREEMENT IS SUBJECT TO ARBITRATION TO RESOLVE ANY DISPUTE.

STATE OF SOUTH CAROLINA)
) **AGREEMENT**
COUNTY OF GEORGETOWN)

PARTIES

The Parties to this agreement are the Belle W. Baruch Foundation (the "Foundation"), a 501(c)(3) operating foundation; and the University of South Carolina (USC), an entity of the state of South Carolina.

BACKGROUND

The Foundation was created in 1964 by the Last Will and Testament of Belle W. Baruch which stated that the purpose of the Foundation is the "teaching and/or research in forestry, marine biology, and the care and propagation of wildlife and flora and fauna in South Carolina, in connection with the colleges and universities in the state of South Carolina."

The Baruch estate endowed the Foundation with income for operational expenses, and devised to it approximately 17,500 acres of land in Georgetown County, South Carolina known as Hobcaw Barony.

The Foundation has operated in accordance with the purposes established by the Will since its creation.

The University of South Carolina is a state owned teaching and research university. USC has operated research facilities at Hobcaw Barony for many years that include the Baruch Marine Field Laboratory and, since 1992, has administered the North Inlet - Winyah Bay National Estuarine Research Reserve, for the purposes set forth in the Foundation's charter, including studies of neighboring and adjacent marsh and estuaries along the Atlantic Ocean coast.

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The Parties, consistent with the furtherance of their respective missions as it relates to their activities on the Foundation's property at Hobcaw Barony, have decided to enter into an agreement to build, fund, and operate, a facility to be known as the Hobcaw Barony Discovery Center (the "HBDC"). The HBDC will be a joint-use educational facility located near the entrance to Hobcaw Barony near Georgetown, South Carolina. The Parties will share space in the HBDC building, and will collaborate on the development of programs and staffing requirements for the facility.

PURPOSE

The Parties agree that the goals and objectives of the operation of the proposed HBDC include:

1. the creation of programs to enhance education about coastlines and estuaries including ecological, cultural, historical, sociological, aesthetic, and economic aspects of their nature;
2. providing a center for learning about a broad range of coastal and marine issues;
3. jointly developing funding programs for such purposes; and
4. sharing the HBDC facilities to achieve these common goals.

AGREEMENT

In order to achieve the stated goals and objectives, the Parties agree as follows:

1. Operational Issues.

Budget.

To collaborate in the preparation of an annual operating budget for the HBDC for the fiscal year that will begin on July 1 of each calendar year. The

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budget for HBDC shall not include any staff expense because all HBDC staff members will be employees of the respective parties to this agreement. The Foundation's Board of Trustees shall approve the proposed budget for each year and any budgetary revisions proposed during any fiscal year; and the Foundation shall receive all operating funds prescribed by the budget so adopted, and shall be responsible for the administration of the accrued budgets. The budget shall include a line item expense for capital repairs and improvements, and any surplus of such annual expense shall be accumulated from year to year, notwithstanding the fact that other surplus funds are reconciled annually, until the parties agree that the amount of such accumulated funds are sufficient for such purposes without the necessity of annual contributions for capital improvements.

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In the event the Parties are unable to agree upon a proposed budget for any year, the HBDC will continue to operate on the budget of the prior year until a current budget is agreed upon by the parties and approved by the Foundation's Board of Trustees.

The Foundation will fund its share of the operational budget on a quarterly basis, and will bill USC quarterly for its share of the operational expenses that are prescribed by the budget for each year. Payment from each organization shall be made within thirty (30) days of the beginning of each quarter; and a penalty of two percent (2%) per month will be assessed for late payments by either party. If any party is more than one hundred twenty (120) days past due in paying its share of the operational expenses, the other party may declare this agreement terminated, and this agreement will terminate.

Any unexpended surplus funds shall be reconciled at the end of each fiscal year and applied to the budget for the next fiscal year.

2. **Staff.**

Executive Director.

The Executive Director of the Foundation shall be designated as Executive Director for the HBDC and shall have overall executive authority for the operation of the HBDC. The Executive Director so appointed shall be an employee of the Foundation and not an employee of the HBDC.

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Employee Allocation.

The Parties agree that they will each provide, fund, and dedicate the services of at least one full-time employee or full-time equivalent to the operational activities of the HBDC.

Employees.

Any employee of the Foundation or of USC who is assigned to work at the HBDC will remain an employee of such parent organization in all respects, as the HBDC will have no employees of its own. The responsibility for all wages, insurance of any kind, payroll taxes, other benefits of any kind, for all employees shall remain the responsibility of the Foundation or of USC for the respective employees of each.

3. **Space and Space Expense Allocation.**

As a part of the development of the annual budget, the Parties will agree to an appropriate allocation of space inside the HBDC building to be used exclusively by one party or the other during the next ensuing fiscal year.

Expenses for the annual space allocation to each party for its exclusive use during the following fiscal year shall be calculated and included in the quarterly operational expense billings to party. Such calculation shall be made by using the square footage allocation agreed to for each party, and shall include all regular operational expenses of HBDC. Such operational expenses as the costs of regular maintenance, utilities, etc. and the total expenses so calculated shall be allocated between the parties based upon the percentage allocation of the space occupied and used by each. It is acknowledged by the Parties that some of the space in the building may be allocated for joint use and not allocated to either for purposes of allocating expenses for such space usage, and the expenses for any such shared space shall be allocated equally between the parties to this agreement. The parties hereto may agree to sublease space in the building to any suitable organization as long as the activities of the proposed subtenant are consistent with those of the parties in the operation of HBDC.

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4. **Liability Exclusion.**

The Parties agree that although they have made the agreements contained hereinto cooperate and to participate in the operation and program development for the HBDC, they specifically agree that, to the extent permitted by South Carolina law, each Party will be and remain entirely responsible for the actions and conduct of their respective employees who may work at the HBDC or who may use the HBDC facilities. Consistent with the recognition of the status of their respective employees as described herein, the Parties further agree that each party will be responsible for any claims made against that party for the wrongful

acts or omissions of its employees to the extent permitted by South Carolina law, and will maintain reasonable and appropriate liability coverage for all their respective activities, including their involvement in the operation of the HBDC.

5. **Termination.**

Unless otherwise terminated, this agreement shall terminate at the same time the Research and Property Use Agreement between the parties terminates, but no sooner than twenty-five years (25) from the date of this agreement unless otherwise agreed in writing by the parties. The parties further agree to extend the term of the existing Research and Property Use Agreement between them for a period of twenty-five years (25) years beyond the date of this agreement so that this agreement and the Property Use Agreement will expire at the same time.

NSA
10/3/08

Upon termination of this agreement for any lawful reason, USC shall vacate the premises on the dates of termination, and full right of the ownership of the real property occupied by HBDC shall be retained by the Foundation.

6. **Arbitration Required.**

The parties agree that any dispute arising from or related to this agreement shall be resolved by the submission of such dispute(s) to ARBITRATION. If the parties are unable to agree upon the process for the arbitration within thirty (30) days of a notice from one party to the other demanding arbitration, the matter shall then be submitted to the American Arbitration Association and the Rules of the Association shall be used to resolve the dispute. The requirement for dispute resolution by arbitration can only be waived, in writing, by the agreement of all parties to this agreement in writing.

In witness whereof the parties set their hands and seals this 3rd day of October, 2008.

WITNESS:

Lee G. Brockington
Richard M. Langford

WITNESS:

Barbara Salmons
Vera Stone

THE BELLE W. BARUCH FOUNDATION

By: [Signature]
Its: Executive Director

THE UNIVERSITY OF SOUTH
CAROLINA

By: [Signature]
Its: SUSAN D. HANNA
TREASURER
UNIVERSITY OF S.C.

**APPENDIX E- BELLE W. BARUCH FOUNDATION BOARD OF TRUSTEES
RESOLUTION**

STATE OF SOUTH CAROLINA)
)
COUNTY OF GEORGETOWN)

BELLE W. BARUCH FOUNDATION
BOARD OF TRUSTEES RESOLUTION

Whereas the Board of Trustees of the Belle W. Baruch Foundation and the University of South Carolina have previously entered into a Research Agreement which has been in effect for more than twenty-five years and was renewed for a period of fifteen years with a joint authority to extend the agreement for ten more years if mutually agreeable to the parties, and

Whereas the University of South Carolina in carrying out research under the said agreement has already constructed certain laboratory and office facilities on a part of the Foundation's property known as Hobcaw Barony, and


Whereas the University of South Carolina is expanding these facilities in cooperation with the Foundation to enlarge their research and teaching capacities by enlarging their building and adding other facilities, and

Whereas the University of South Carolina has requested the Board of Trustees to consider a longer term agreement between the parties to justify the considerable investment the University of South Carolina is making for these new facilities,

Now, therefore it is the sense of the Board of Trustees of the Belle W. Baruch Foundation that they would favorably consider an extended agreement for a total of twenty-five years from the date of this resolution, provided that appropriate terms can be arranged, all within the sole discretion of the Board of Trustees.

Resolved and passed by a unanimous vote of all Trustees of the Board at their regular meeting at Hobcaw Barony on August 11, 2008.

Board of Trustees
Belle W. Baruch Foundation


by: George R. Geer, Jr.
Chairman

Georgetown, SC
August 11, 2008

APPENDIX F- PUBLIC INPUT PROCESS

Public Input Process

Development of this management plan included direct contributions and input from several North Inlet – Winyah Bay Reserve staff members and comments and input from Estuarine Reserves Division (ERD) staff. Reserve Advisory Committee members also provided valuable input to the revised plan over the course of its development during regularly scheduled meetings and some members reviewed and commented on sections of the plan before a draft was completed and submitted to ERD for final review.

The revised plan was approved by ERD in September 2010 and a Federal Register Notice allowing a 30 day public comment period was published on October 26, 2010. Reserve Advisory Committee members were notified of the Federal Register Notice and the additional opportunity to comment. No comments were received during the 30 day public comment period.

**APPENDIX G- CERTIFICATION LETTER FROM SOUTH CAROLINA
DEPARTMENT OF HEALTH AND ENVIRONMENTAL CONTROL – OCEAN
AND COASTAL RESOURCE MANAGEMENT**



C. Earl Hunter, Commissioner

Promoting and protecting the health of the public and the environment.

December 10, 2010

Ms. Wendy Allen
North Inlet – Winyah Bay National Estuarine Research Reserve Manager
P. O. Box 1630
Georgetown, SC 29442

Re: North Inlet – Winyah Bay NERR Management Plan

Dear Ms. Allen,

We appreciate the opportunity to review the draft 2011 – 2016 Management Plan for North Inlet - Winyah Bay National Estuarine Research Reserve (NI-WB NERR). The plan reflects significant work on the part of your staff, and we are very supportive of the activities and approaches that you have outlined. The NI-WB Management Plan emphasizes our shared goals for the preservation, restoration and enhancement of South Carolina's coastal resources for their conservational, recreational, ecological, and research values.

Interactions between our programs were formally described in a recent Memorandum of Agreement and letter of support (dated November 4, 2010). With these continued and enhanced interactions between our programs through your Advisory Panel and specific research and outreach efforts (e.g. sea level rise and habitat research, coastal training initiatives, and conservation efforts, including the Coastal and Estuarine Land Conservation Program), we look forward to continuing our strong partnership and collaborations in the years to come.

Thank you again for the opportunity to review the management plan. Do not hesitate to contact our NERR State CZ Coordinator, Curtis Joyner, at 843-953-0205 or joynercm@dhec.sc.gov should you have any questions.

Sincerely,


Carolyn Boltin-Kelly
Deputy Commissioner

Cc: Braxton Davis, Director Policy and Planning Division
Curtis Joyner, NERR State CZ Coordinator