
WACCAMAW NATIONAL WILDLIFE REFUGE

DRAFT COMPREHENSIVE CONSERVATION PLAN AND ENVIRONMENTAL ASSESSMENT

*Georgetown, Horry, and Marion Counties,
South Carolina*

**U.S. Department of the Interior
Fish and Wildlife Service**

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I. Background

INTRODUCTION

This Draft Comprehensive Conservation Plan and Environmental Assessment (Draft CCP/EA) for Waccamaw National Wildlife Refuge (Waccamaw NWR) was prepared to guide management actions and direction for the refuge. Fish and wildlife conservation will receive first priority in refuge management; wildlife-dependent recreation will be allowed and encouraged as long as it is compatible with, and does not detract from, the mission of the refuge or the purposes for which it was established.

A planning team developed a range of alternatives that best met the goals and objectives of the refuge and that could be implemented within the 15-year planning period. This Draft CCP/EA describes the Fish and Wildlife Service's proposed plan, as well as other alternatives considered and their effects on the environment. This Draft CCP/EA will be made available to State and Federal Government agencies, conservation partners, and the general public for review and comment. Comments from each entity will be considered in the development of the Final CCP.

PURPOSE AND NEED FOR THE PLAN

The purpose of the Draft CCP/EA is to develop a proposed action that best achieves the refuge purpose; attains the vision and goals developed for the refuge; contributes to National Wildlife Refuge System mission; addresses key problems, issues and relevant mandates; and is consistent with sound principles of fish and wildlife management.

Specifically, the plan is needed to:

- Provide a clear statement of refuge management direction;
- Provide refuge neighbors, visitors, and government officials with an understanding of Service management actions on and around the refuge;
- Ensure that Service management actions, including land protection and recreation/education programs, are consistent with the mandates of the National Wildlife Refuge System; and
- Provide a basis for the development of budget requests for operations, maintenance, and capital improvement needs.

FISH AND WILDLIFE SERVICE

The Service traces its roots to 1871 and the establishment of the Commission of Fisheries involved with research and fish culture. The once independent commission was renamed the Bureau of Fisheries and placed in the Department of Commerce and Labor in 1903.

The Service also traces its roots to 1886 and the establishment of a Division of Economic Ornithology and Mammalogy in the Department of Agriculture. Research on the relationship of birds and animals to agriculture shifted to delineation of the range of plants and animals so the name was changed to the Division of the Biological Survey in 1896.

The Department of Commerce, Bureau of Fisheries, was combined with the Department of Agriculture, Bureau of Biological Survey, on June 30, 1940, and transferred to the Department of the

Interior as the Fish and Wildlife Service. The name was changed to the Bureau of Sport Fisheries and Wildlife in 1956 and finally to the U.S. Fish and Wildlife Service in 1974.

The U.S. Fish and Wildlife Service is responsible for conserving, enhancing, and protecting fish and wildlife and their habitats for the continuing benefit of people through Federal programs relating to wild birds, endangered species, certain marine mammals, inland sport fisheries, and specific fishery and wildlife research activities (142 DM 1.1).

As part of its mission, the Service manages more than 540 national wildlife refuges covering over 95 million acres. These areas comprise the National Wildlife Refuge System, the world's largest collection of lands set aside specifically for fish and wildlife. The majority of these lands, 77 million acres, is in Alaska. The remaining acres are spread across the other 49 states and several United States territories. In addition to refuges, the Service manages thousands of small wetlands, national fish hatcheries, 64 fishery resource offices, and 78 ecological services field stations. The Service enforces Federal wildlife laws, administers the Endangered Species Act, manages migratory bird populations, restores nationally significant fisheries, conserves and restores wildlife habitat, and helps foreign governments with their conservation efforts. It also oversees the Federal Aid program that distributes hundreds of millions of dollars in excise taxes on fishing and hunting equipment to State fish and wildlife agencies.

NATIONAL WILDLIFE REFUGE SYSTEM

The mission of the National Wildlife Refuge System, as defined by the National Wildlife Refuge System Improvement Act of 1997 is:

“...to administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife and plant resources and their habitats within the United States for the benefit of present and future generations of Americans.”

The National Wildlife Refuge System Improvement Act of 1997 established, for the first time, a clear legislative mission of wildlife conservation for the National Wildlife Refuge System. Actions were initiated in 1997 to comply with the direction of this new legislation, including an effort to complete comprehensive conservation plans for all refuges. These plans, which are completed with full public involvement, help guide the future management of refuges by establishing natural resources and recreation/education programs. Consistent with this Act, approved plans will serve as the guidelines for refuge management for the next 15 years. The Act states that each refuge shall be managed to:

- Fulfill the mission of the National Wildlife Refuge System;
- Fulfill the individual purposes of each refuge;
- Consider the needs of wildlife first;
- Fulfill requirements of comprehensive conservation plans that are prepared for each unit of the Refuge System;
- Maintain the biological integrity, diversity, and environmental health of the Refuge System; and
- Recognize that wildlife-dependent recreation activities, including hunting, fishing, wildlife observation, wildlife photography, and environmental education and interpretation, are legitimate and priority public uses; and allow refuge managers authority to determine compatible public uses.

The following are just a few examples of your national network of conservation lands. Pelican Island National Wildlife Refuge, the first refuge, was established in 1903 for the protection of colonial nesting birds in Florida, such as the snowy egret and the brown pelican. Western refuges were established for American bison (1906), elk (1912), prong-horned antelope (1931), and desert bighorn sheep (1936) after over-hunting, competition with cattle, and natural disasters decimated once abundant herds. The drought conditions of the 1930s “Dust Bowl” severely depleted breeding populations of ducks and geese. Refuges established during the Great Depression focused on “waterfowl production areas,” i.e., protection of prairie wetlands in America’s heartland. The emphasis on waterfowl continues today but also includes protection of wintering habitat in response to a dramatic loss of bottomland hardwoods. By 1973, the Service began to focus on establishing refuges for endangered species.

Approximately 38 million people visited national wildlife refuges in 2002, most to observe wildlife in their natural habitats. As the number of visitors grows, there are significant economic benefits to local communities. In 2001, 82 million people, 16 years and older, fished, hunted, or observed wildlife, generating \$108 billion. In a study completed in 2002, on 15 refuges, visitation had grown 36 percent in 7 years. At the same time, the number of jobs generated in surrounding communities grew to 120 per refuge, up from 87 jobs in 1995, pouring more than \$2.2 million into local economies. The 15 refuges in the study were Chincoteague (Virginia); National Elk (Wyoming); Crab Orchard (Illinois); Eufaula (Alabama); Charles M. Russell (Montana); Umatilla (Oregon); Quivira (Kansas); Mattamuskeet (North Carolina); Upper Souris (North Dakota); San Francisco Bay (California); Laguna Atacosa (Texas); Horicon (Wisconsin); Las Vegas (Nevada); Tule Lake (California); and Tensas River (Louisiana) – the same refuges identified for the 1995 study. Other findings also validate the belief that communities near refuges benefit economically. Expenditures on food, lodging, and transportation grew to \$6.8 million per refuge, up 31 percent from \$5.2 million in 1995. For each Federal dollar spent on the Refuge System, surrounding communities benefited with \$4.43 in recreation expenditures and \$1.42 in job-related income (Caudill and Laughland, unpubl. data).

Volunteers continue to be a major contributor to the success of the Refuge System. In 2002, volunteers contributed more than 1.5 million hours on refuges nationwide, a service valued at more than \$22 million.

The wildlife and habitat vision for national wildlife refuges stresses that wildlife comes first; that ecosystems, biodiversity, and wilderness are vital concepts in refuge management; that refuges must be healthy and growth must be strategic; and that the refuge system serves as a model for habitat management with broad participation from others.

The National Wildlife Refuge System Improvement Act of 1997 stipulates that comprehensive conservation plans be prepared in consultation with adjoining Federal, State, and private landowners and that the Service develop and implement a process to ensure an opportunity for active public involvement in the preparation and revision of the 15-year plans.

All lands of the Refuge System will be managed in accordance with an approved CCP that will guide management decisions and set forth strategies for achieving refuge unit purposes. The CCP will be consistent with sound resource management principles, practices, and legal mandates, including Service compatibility standards, and other Service policies, guidelines, and planning documents (602 FW 1.1).

LEGAL AND POLICY CONTEXT

LEGAL MANDATES, ADMINISTRATIVE AND POLICY GUIDELINES, AND OTHER SPECIAL CONSIDERATIONS

Administration of national wildlife refuges is guided by the mission and goals of the National Wildlife Refuge System, congressional legislation, Presidential executive orders, and international treaties. Policies for management options of refuges are further refined by administrative guidelines established by the Secretary of the Interior and by policy guidelines established by the Director of the Fish and Wildlife Service. Refer to Appendix III for a complete listing of relevant legal mandates.

Treaties, laws, administrative guidelines, and policy guidelines assist the refuge manager in making decisions pertaining to soil, water, air, flora, fauna, and other natural resources; historical and cultural resources, research and recreation on refuge lands, and provide a framework for cooperation between Waccamaw NWR and other partners, such as the South Carolina Department of Natural Resources (SCDNR), The Nature Conservancy (TNC), South Eastern Wildlife and Environmental Education (SEWEE) Association, Historic Ricefield Association (HRA), Winyah Bay Focus Area Task Force and private landowners.

Select legal summaries of treaties and laws relevant to administration of the National Wildlife Refuge System and management of the Waccamaw NWR are provided in Appendix III.

Lands within the National Wildlife Refuge System are closed to public use unless specifically and legally opened. No refuge use may be allowed unless it is determined to be compatible. A compatible use is a use that, in the sound professional judgment of the refuge manager, will not materially interfere with, or detract from, the fulfillment of the mission of the Refuge System or the purposes of the refuge. All programs and uses must be evaluated based on mandates set forth in the National Wildlife Refuge System Improvement Act of 1997. Those mandates are to:

- Contribute to ecosystem goals, as well as refuge purposes and goals;
- Conserve, manage, and restore fish, wildlife, and plant resources and their habitats;
- Monitor the trends of fish, wildlife, and plants;
- Manage and ensure appropriate visitor uses as those uses benefit the conservation of fish and wildlife resources and contribute to the enjoyment of the public; and
- Ensure that visitor activities are compatible with refuge purposes.

The Act further identifies six priority wildlife-dependent recreational uses: hunting, fishing, wildlife observation, wildlife photography, and environmental education and interpretation. As priority public uses of the Refuge System, they receive priority consideration over other public uses in planning and management.

BIOLOGICAL INTEGRITY, DIVERSITY, AND ENVIRONMENTAL HEALTH POLICY

The Improvement Act directs the Service to ensure that the biological integrity, diversity, and environmental health of the Refuge System are maintained for the benefit of present and future generations of Americans.” The policy is an additional directive for refuge managers to follow while achieving refuge purpose(s) and Refuge System mission. It provides for the consideration and protection of the broad spectrum of fish, wildlife, and habitat resources found on refuges and associated ecosystems. When evaluating the appropriate management direction for refuges, refuge managers will use sound professional judgment to determine their refuges’ contribution to biological

integrity, diversity, and environmental health at multiple landscape scales. Sound professional judgment incorporates field experience; knowledge of refuge resources; role of the refuge within an ecosystem; applicable laws; and best available science, including consultation with others both inside and outside the Service.

NATIONAL AND INTERNATIONAL CONSERVATION PLANS AND INITIATIVES

Multiple partnerships have been developed among government and private entities to address the environmental problems affecting regions. There is a large amount of conservation and protection information that defines the role of the refuge at the local, national, international, and ecosystem levels. Conservation initiatives include broad-scale planning and cooperation between affected parties to address declining trends of natural, physical, social, and economic environments. The conservation guidance described below, along with issues, problems, and trends, was reviewed and integrated where appropriate into this Draft CCP/EA.

This Draft CCP/EA supports, among others, the Partners in Flight Plan, the North American Waterfowl Management Plan, the Western Hemisphere Shorebird Reserve Network, and the National Wetlands Priority Conservation Plan.

North American Bird Conservation Initiative. Started in 1999, the North American Bird Conservation Initiative (NABCI) is a coalition of government agencies, private organizations, academic institutions, and private industry leaders in the United States, Canada, and Mexico. NABCI works to ensure the long-term health of North America's native bird populations by fostering an integrated approach to bird conservation to benefit all birds in all habitats. NABCI includes the North American Waterfowl Management Plan, Partners in Flight, Waterbird Conservation for the Americas, and the U.S. Shorebird Conservation Plan.

North American Waterfowl Management Plan. The North American Waterfowl Management Plan (NAWMP) is an international action plan to conserve migratory birds throughout the continent. NAWMP's goal is to return waterfowl populations to their 1970s levels by conserving wetland and upland habitat. Canada and the United States signed NAWMP in 1986 in reaction to critically low numbers of waterfowl. Mexico joined in 1994 making it a truly continental effort. NAWMP is a partnership of Federal, Provincial/State and municipal governments, non-governmental organizations, private companies, and many individuals, all working towards achieving better wetland habitat for the benefit of migratory birds, other wetland-associated species, and people.

NAWMP's projects are international in scope, but implemented at regional levels through 12 habitat joint ventures. The Atlantic Coast Joint Venture includes South Carolina and involves Federal, Provincial/State and local agencies, and private conservation organizations. The Winyah Bay Focus Area is a project of the Atlantic Coast Joint Venture and represents a creative, cooperative initiative to protect a nationally significant South Atlantic coastal wetland ecosystem, which is made up largely by the refuge acquisition boundary. The refuge plays a significant role in contributing to the protection of habitat and wildlife species across the North American landscape.

Partners in Flight Bird Conservation Plan. Managed as part of the Partners in Flight Plan, the South Atlantic Coastal Plain physiographic area represents a scientifically based land bird conservation planning effort that ensures long-term maintenance of healthy populations of native land birds, primarily non-game land birds. Non-game land birds have been vastly under-represented in conservation efforts, and many are exhibiting significant declines. This plan is voluntary and non-regulatory, and focuses on relatively common species in areas where conservation actions can be most effective, rather than the frequent local emphasis on rare and peripheral populations.

U.S. Shorebird Conservation Plan. The U.S. Shorebird Conservation Plan is a partnership effort throughout the United States to ensure that stable and self-sustaining populations of shorebird species are restored and protected. The plan was developed by a wide range of agencies, organizations, and shorebird experts from separate regions of the country, and identifies conservation goals, critical habitat conservation needs, key research needs, and proposed education and outreach programs to increase awareness of shorebirds and the threats they face.

Northern American Waterbird Conservation Plan. This plan provides a framework for the conservation and management of 210 species of waterbirds in 29 nations. Threats to waterbird populations include destruction of inland and coastal wetlands, introduced predators and invasive species, pollutants, mortality from fisheries and industries, disturbance, and conflicts arising from abundant species. Particularly important habitats of the Service's Southeast Region include pelagic areas, marshes, forested wetlands, and barrier and sea island complexes. Fifteen species of waterbirds are federally listed, including breeding populations of wood storks, Mississippi sandhill cranes, whooping cranes, interior least terns, and Gulf coast populations of brown pelicans. A key objective of this plan is the standardization of data collection efforts to better recommend effective conservation measures.

RELATIONSHIP TO STATE WILDLIFE AGENCY

A provision of the National Wildlife Refuge System Improvement Act of 1997, and subsequent agency policy, is that the Service shall ensure timely and effective cooperation and collaboration with other State fish and game agencies and Tribal governments during the course of acquiring and managing refuges. State wildlife management areas and national wildlife refuges provide the foundation for the protection of species, and contribute to the overall health and sustenance of fish and wildlife species in the State of South Carolina.

The South Carolina Department of Natural Resources (SCDNR) is a State-partnering agency with the Service, charged with enforcement responsibilities relating to migratory birds and endangered species, as well as managing state natural resources, coastal marshes, and wildlife management areas. This agency directs the State's wildlife conservation program and provides public recreation opportunities on State wildlife management areas. The participation of the SCDNR throughout this Draft CCP/EA planning process provides ongoing opportunities for an open dialogue to improve the ecological sustainability of fish and wildlife in South Carolina. A key aspect of the planning process is the integration of common objectives between the Service and the State agency, where appropriate.

The Heritage Trust Program of the SCDNR was created in 1976 to preserve natural features and cultural remains, which are quickly disappearing as the State's rate of development and population increases. The program's purpose is to inventory, evaluate, and protect the elements considered the most outstanding representatives of South Carolina's heritage. The SCDNR manages 68 heritage preserves, 19 fishing lakes, 1 fish hatchery, and 20 wildlife management areas on over 83,000 acres. The 46 State parks and historic sites, located on over 72,000 acres, are administered by the South Carolina Department of Parks, Recreation, and Tourism. Additionally, the State agencies provide and direct public recreation opportunities, including an extensive hunting and fishing program on wildlife management areas and parks.

SCDNR's participation and contribution throughout this planning process will provide for ongoing opportunities and open dialogue to improve the ecological sustainment of fish and wildlife in the State of South Carolina. An essential part of comprehensive conservation planning is integrating common mission objectives where appropriate, such as at the Bucksport and Sandy Island Wildlife Management Areas (WMAs).

II. Refuge Overview

INTRODUCTION

Waccamaw NWR is located in South Carolina's "Lowcountry," about 60 miles north of Charleston, within Georgetown, Horry and Marion counties (Figure 1). Its 54,000-acre acquisition boundary contains portions of the Great and Little Pee Dee Rivers and the Waccamaw River. These river systems and associated wetlands comprise a large portion of the Winyah Bay drainage basin and are an important component of the Winyah Bay ecosystem. Waccamaw NWR is one of four refuges in the South Carolina Lowcountry Complex, along with Ace Basin, Cape Romain, and Santee.

As of 2007, Waccamaw Refuge has acquired 97 tracts, comprising a total of 10,590 acres within its authorized acquisition boundary. In 2006, the Service entered into a long-term lease agreement with the SCDNR, allowing the Bucksport WMA to be added to Waccamaw NWR, bringing the acreage of lands administered by the refuge up to 18,251 acres. The Service continues to actively acquire lands from willing sellers within the refuge's acquisition boundary, and private and public partners within the Winyah Bay Focus Area have protected other significant tracts within Waccamaw's acquisition boundary (Figure 2). The refuge is divided into three management units (Figure 3). Each unit is defined by a dominant habitat type. Unit 1 includes 34,784 acres and is made up entirely of alluvial and black water floodplain forested wetlands. Unit 2 consists of 12,046 acres and is made up of approximately 6,362 acres of upland longleaf pine forest and tidal forested and emergent wetlands. Unit 3 is 2,902 acres and contains historic rice fields, many of which remain intact and are managed for wintering waterfowl.

The wetland diversity of this refuge is what sets it apart from most others found along the east coast. Waccamaw NWR's tidal freshwater wetlands are some of the most diverse freshwater wetland systems found in North America today, and offer important habitats for abundant migratory birds, fish, and resident wildlife. Over 400 species of animals are supported by the variety of habitats in the refuge acquisition area, including several endangered species. Birds such as the swallow-tailed kite, osprey, wood stork, white ibis, prothonotary warbler, and many species of waterfowl can be observed on a seasonal basis, while mammals, like the American black bear, frequent Waccamaw NWR's forests year-round. Notably, the refuge acquisition area supports the highest density of nesting swallow-tailed kites in South Carolina and is the northernmost documented nesting for this raptor within its range.

Additionally, Waccamaw NWR's wetlands play a critical role in the filtration and storm water retention of the primary drinking water resource for the greater Grand Strand region.

REFUGE HISTORY AND PURPOSE

The lands and waters that comprise Waccamaw NWR have a rich history. Humans have used the area's natural resources in various ways since prehistoric times to survive. Early Native Americans lived off the land and waters – and their wildlife and fish resources – for many centuries prior to the arrival of European colonists who settled the area.

The area's American Indian tribes included the Seewees, the Santees, the Sampits, the Winyahs, the Pee Dees, and the Waccamaws. As early as 1683, in the Winyah Bay area, British colonists established trade relations with these groups. Indian groups were decimated by European-introduced diseases, liquor, and intertribal and colonial conflicts. By 1715, the Waccamaws consisted of 610 individuals dispersed among six villages on Waccamaw Neck. The Winyahs were reduced to one

Figure 1. Location of Waccamaw NWR

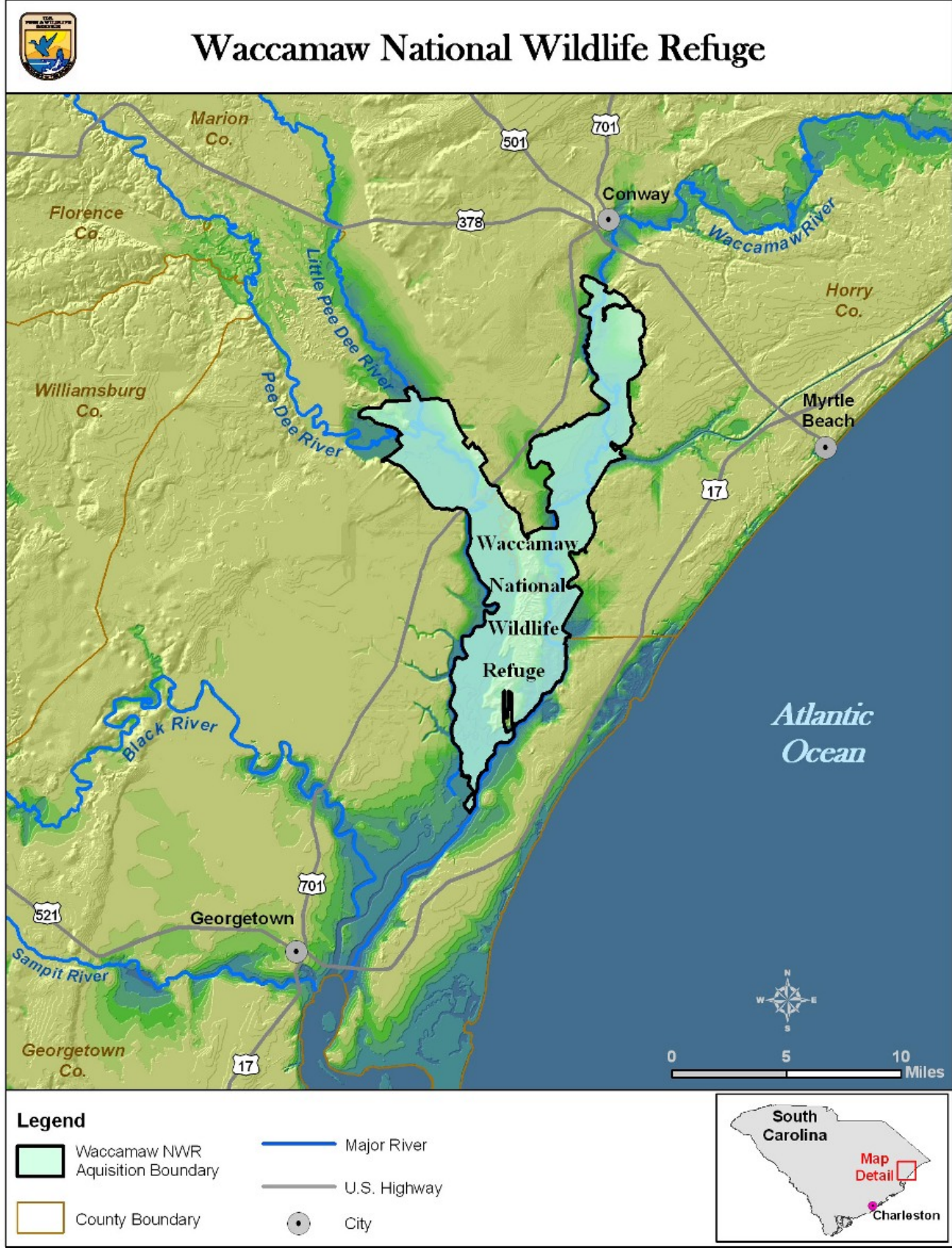


Figure 2. Protected lands within authorized acquisition boundary of Waccamaw NWR

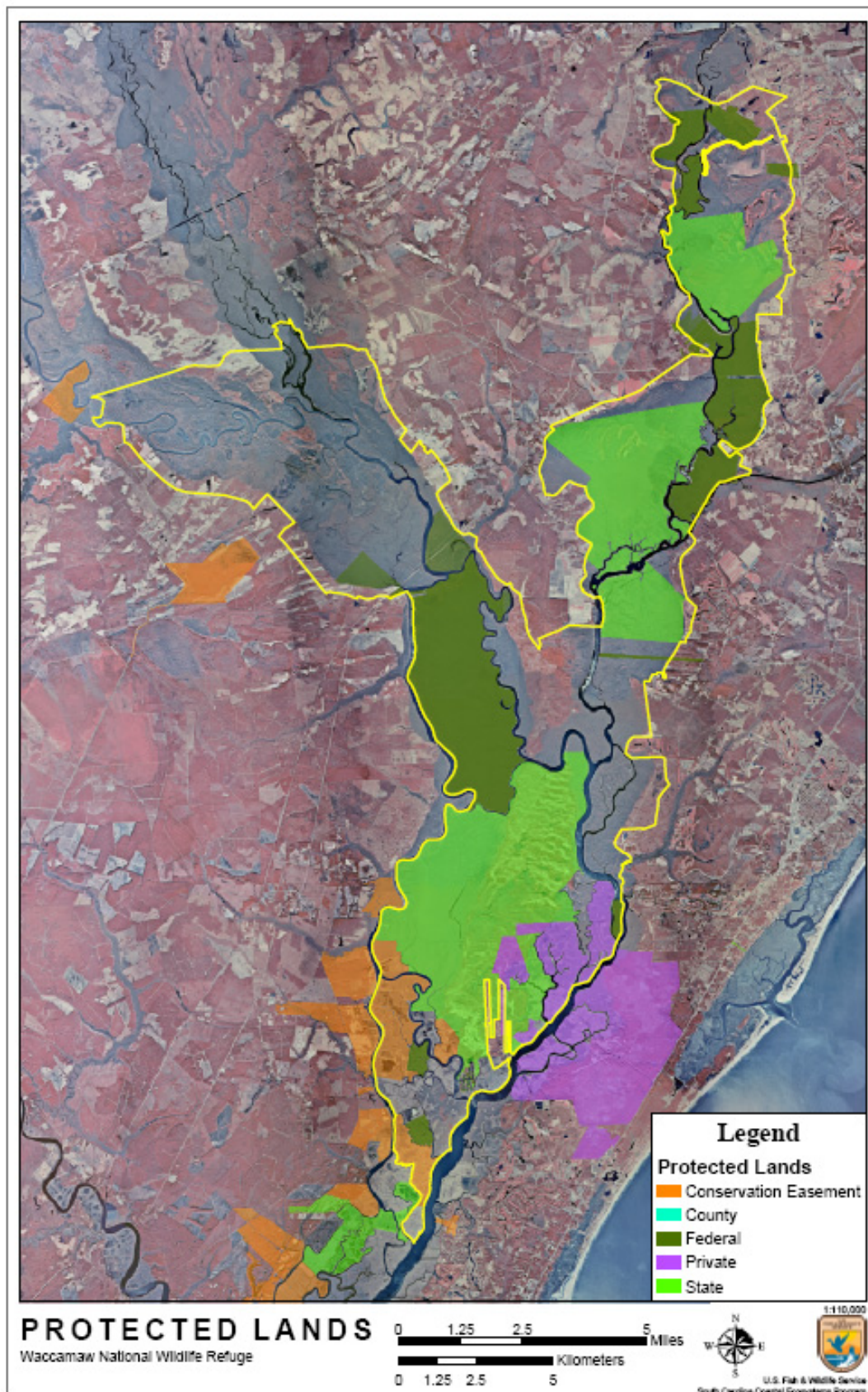
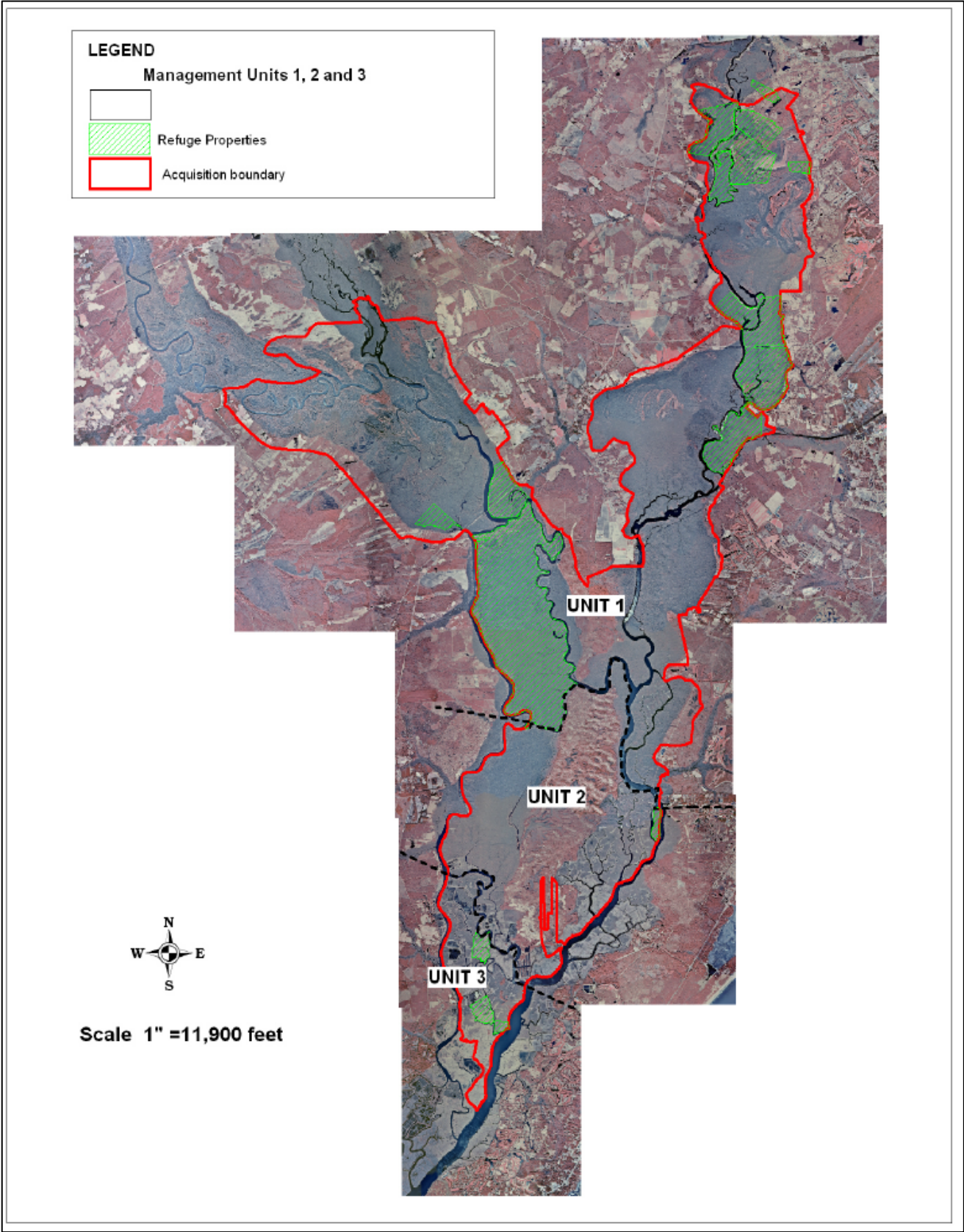


Figure 3. Management units of Waccamaw NWR



village of 106 individuals. In 1720, the Yamasee War ended both the Indian threat and trade in the area. Colonists turned to the preparation of naval stores as their main economic pursuit. From 1700-1720, the English established settlements at Georgetown, on the Winyah Bay, and up the Black, Pee Dee and Waccamaw watersheds. By 1705, large-scale rice cultivation formed the foundation of the Carolina lowland economy. Rice agricultural practices transformed the landscape with the widespread clearing of forested wetlands and construction of dike and tidal gates. By 1850, a number of plantations existed along the Waccamaw, Pee Dee, and Black Rivers.

From 1792 to the 1880s, several families operated ten rice plantations on Sandy Island. The plantations were Oak Hampton, Ruinville, Brickville, Mount Arena, Sandy Knowe, Oak Lawn, Oatland, Holly Hill, Pipe Down, and Hassell Hill. Many of the plantation owners who fled their estates during the Civil War returned to their lands in 1865-66. The newly freed African-American Sandy Islanders formed communities at Mount Arena, Brickville, Ruinville, and Pipe Down. They continued to work the Island's rice fields under contract, providing themselves with wages and a portion of the harvest.

From 1893-1911, a string of hurricanes devastated the area's already economically stressed rice economy. These storms destroyed much of the infrastructure of the rice fields, as well as the rice crop nearly ready for harvest. On Sandy Island, freed slaves continued to grow rice on lands that were given to them by their former owner and the rice grown by them was of major economic importance until the mid-1940s. By the early 20th century, many of the area's rice plantations had fallen into disrepair. A number of these estates were bought by wealthy individuals primarily for waterfowl hunting and other sporting purposes.

The National Wildlife Refuge System Improvement Act states that each refuge is to be managed to fulfill the purpose for which it was established but also the mission of the National Wildlife Refuge System. If there is a conflict between the two, the purposes for which the refuge was established takes precedence.

Waccamaw NWR was established in 1997. Its establishing and acquisition authorities include the Fish and Wildlife Service Coordination Act of 1958 (16 USC 661-667-E), Emergency Wetlands Resources Act of 1986 (16 U.S.C. 3901(b)), and the Fish and Wildlife Act of 1956 (16 U.S.C. 742f(b)(1)). The refuge was established to:

- Protect and manage diverse habitat components within an important coastal river ecosystem for the benefit of threatened and endangered species, freshwater and anadromous fish, migratory birds, and forest wildlife, including a wide array of plants and animals associated with bottomland hardwood habitats; and
- Provide compatible wildlife-dependent recreational activities, including hunting, fishing, wildlife observation, wildlife photography, and environmental education and interpretation for present and future generations.

Waccamaw NWR has operated under the following management goals:

- Provide habitat for waterfowl, shorebirds, wading birds, raptors, neo-tropical migratory birds, and resident species;
- Provide opportunities for environmental education, interpretation, hunting, fishing, and wildlife-dependent recreation opportunities;

-
- Protect, restore, and enhance the biodiversity of aquatic resources, wetlands, and their associated habitats on a landscape-scale;
 - Protect, enhance, and manage migratory bird populations and the habitats upon which they depend;
 - Manage national wildlife refuges to serve as models for effective conservation of natural resources; and
 - Increase and enhance public awareness, support, and participation to carry out the Service's mission through cooperative outreach efforts.

In sum, the Waccamaw NWR was established to protect a biologically diverse system of wetland and upland habitats for the benefit of numerous plants and animals that form an integral part of the ecological functions and productivity of the Winyah Bay Focus Area. Waccamaw NWR is also managed to provide public access to traditional, wildlife-dependent outdoor recreational activities. Objectives are achieved using habitat management tools that include timber management, water management, prescribed burning, removal of noxious non-native species, protected sanctuary where appropriate, and partnerships, as well as environmental education and interpretation.

SPECIAL DESIGNATIONS

Waccamaw NWR does not contain any lands under special designation by the Federal Government, such as congressionally designated wilderness areas, oil and gas activities, federally designated wild and scenic rivers, demonstration areas, or research natural areas.

The State of South Carolina has designated the Little Pee Dee River as a Type I Natural State Scenic River between U.S. Highway 378 to the confluence with Great Pee Dee River. The Great Pee Dee River is also a Type 1 Natural State Scenic River from U.S. Highway 378 down to the confluence of the Black River.

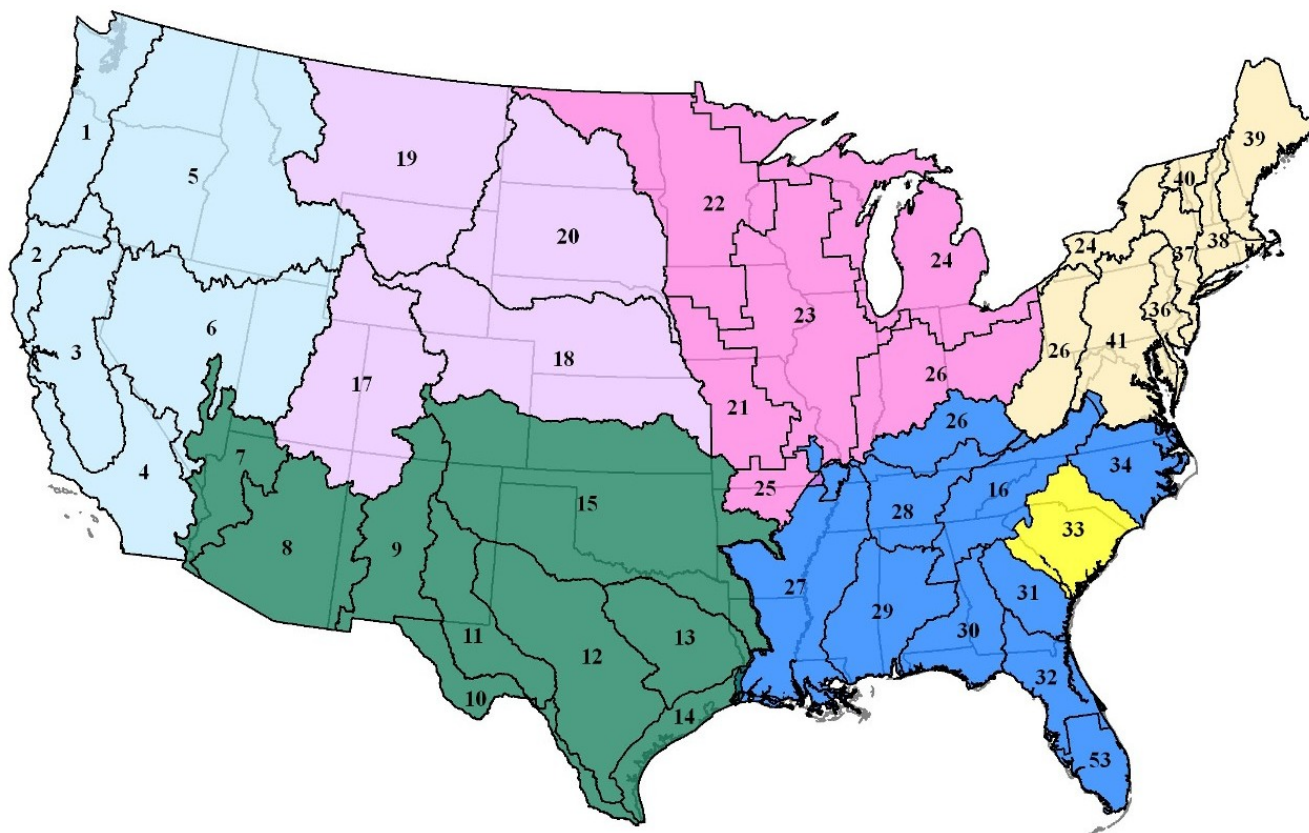
ECOSYSTEM CONTEXT

In approaching its mission to conserve wildlife and their habitats throughout the country, the Fish and Wildlife Service has found it useful to divide the entire United States into 53 distinct ecosystems, drawn primarily along watershed boundaries (Figure 4). Waccamaw NWR lies within the Savannah/Santee/Pee Dee Rivers Ecosystem, which spans portions of South Carolina, North Carolina, and Georgia (USFWS, no date-b).

An ecosystem is a geographic area including all the living organisms (people, plants, animals, and microorganisms), their physical surroundings, such as soil, water, and air, and the natural cycles that sustain them. All of these elements are interconnected. Managing any one resource affects the others in that ecosystem. Ecosystems can be small (a single stand of aspen) or large (an entire watershed including hundreds of forest stands across many different ownerships).

The Fish and Wildlife Service has adopted an ecosystem approach to conservation because it can't just look at a single animal, species, or piece of land in isolation from all that is around it. Conservation will not be achieved within the boundaries of a national wildlife refuge, aquatic resources will not be restored with a national fish hatchery, and listing an endangered species is not going to conserve the system. All of these are interconnected. If one is disturbed or managed, all of the others will be affected.

Figure 4. U.S. Fish and Wildlife Service designated ecosystems in the conterminous United States with Savannah/Santee/Pee Dee Rivers Ecosystem (#33) highlighted



The ecosystem approach is comprehensive. It is based on all of the biological resources within a watershed and it considers the economic health of communities within that watershed. A watershed is the total land area from which water drains into a single stream, lake, or ocean.

The goals of the Savannah-Santee-Pee Dee Ecosystem Team are (USFWS, no date-c):

1. To protect, restore, and enhance the biodiversity of aquatic resources, wetlands, and their associated habitats on a landscape scale.
2. To recover and enhance threatened, endangered, and species of special concern and the habitats upon which they depend.
3. To protect, enhance, and manage migratory bird populations and the habitats upon which they depend.
4. To manage national wildlife refuges and national fish hatcheries to serve as models of effective conservation of natural resources.
5. To increase and enhance public awareness, support, and participation in carrying out the Service's mission through cooperative outreach efforts.

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6. To protect, enhance, and manage interjurisdictional and diadromous fish populations (those that regularly migrate between freshwater and saltwater) and the habitats upon which they depend.
 7. To perpetuate healthy native plant and animal communities threatened by invasive native and non-native plants and animals.

REGIONAL CONSERVATION PLANS AND INITIATIVES

The State Wildlife Grants (SWG) Program began in Fiscal Year 2002. Under this new program, Congress provided a historic opportunity for State fish and wildlife agencies and their partners to design and implement a more comprehensive approach to the conservation of America's wildlife. A requirement of SWG was that each State completes a Comprehensive Wildlife Conservation Strategy (CWCS) by October 1, 2005. Development of the CWCS is intended to identify and focus management on "species in greatest need of conservation." Congress expects SWG funds be used to manage and conserve declining species and avoid their potential listing under the Endangered Species Act.

In May 2002, SCDNR began a process to develop the CWCS that was funded through the SWG Program. The SCDNR committed to developing the CWCS and begin implementing the conservation actions by October 1, 2005. The goal of the CWCS was to emphasize a cooperative, proactive approach to conservation while working with Federal, State and local governments; local businesses; and conservation-minded individuals to join in the effort of maintaining the fish and wildlife resources of South Carolina (SCDNR, no date).

South Carolina's 2005 CWCS deemed the following actions to be critical: (1) increase baseline biological inventories with emphasis on natural history, distribution, and status of native species; (2) increase commitment by natural resource agencies, conservation organizations, and academia toward establishing effective conservation strategies; (3) increase financial support and technological resources for planning and implementation of these strategies; and (4) create public-private partnerships and educational outreach programs for broad-scale conservation efforts (SCDNR 2006).

South Carolina possesses diverse wildlife. Its habitats range from the Appalachian Mountains to the Atlantic Ocean and include many different taxonomic animal groups. SCDNR wanted to address as many of those groups as possible for inclusion in the list of priority species for the CWCS; as such, 12 taxonomic groups are included: mammals, birds, reptiles, amphibians, freshwater fishes, diadromous fishes, marine fishes, marine invertebrates, crayfish, freshwater mussels, freshwater snails, and insects (both freshwater and terrestrial).

The CWCS identified 1,240 species to include on the State's Priority Species List. Reports were prepared for each species, guild or indicator; in these reports, authors described the species, their status, population and abundance, habitat needs, challenges, conservation accomplishments, and conservation actions. This approach allows for identification of both general conservation strategies for wildlife and habitats in South Carolina, as well as development of species-based conservation strategies. SCDNR also identified habitats critical for the priority species considered in the CWCS. Both terrestrial and aquatic habitats were considered and reports were prepared for 38 habitats (terrestrial and marine) organized within five ecoregions, as well as 13 ecobasins, which characterize the freshwater aquatic habitats of the State.

Eight categories of conservation strategies (Conservation Action Areas, or CAAs) were developed: Education and Outreach; Habitat Protection; Invasive and Nonnative Species; Private Land Cooperation; Public Land Management; Regulatory Actions; Survey and Research Needs; and Urban and Developing

Lands. Within each CAA, actions were condensed from the recommendations prepared for each animal on the Priority Species List. Some of the actions identified will affect all species included in the CWCS; others may affect only a few species. Each of these actions was prioritized and measures that indicate success of implementing the action were identified.

The CWCS considers monitoring to be crucial. Project leaders are required to produce annual progress reports for review by a steering committee and the CWCS coordination team. These reports will be evaluated for insight into adaptive management needs and reassessments of the CWCS.

South Carolina's CWCS also places strong emphasis on partnerships. Successful conservation efforts are advanced through a strong collaborative involvement between all resource stakeholders, whether private or public, governmental or non-governmental. Task forces were convened to assist in determining important natural resource issues in South Carolina. Taxa teams were assembled to determine challenges to species and conservation actions to address those challenges. SCDNR also held public meetings to gather input from the citizens of the State. Prior to submission of the CWCS, SCDNR began creating Conservation Action Committees around the CAAs identified above.

ECOLOGICAL THREATS AND PROBLEMS

HABITAT LOSS AND FRAGMENTATION

Threats to wildlife in South Carolina and the nation first began to be recognized a century ago in the form of habitat destruction from unrestrained logging and the spread of agriculture, as well as unregulated harvest for sporting and commercial purposes. After World War II, the challenges associated with sustaining wildlife populations began to accelerate and change dramatically. Many States, among them South Carolina, entered a period of rapid, sustained economic expansion and human population growth. During these "boom times," South Carolina's economy and workforce began to shift away from ones based primarily on agriculture. Migration into the State from other States (and later from other countries) increased substantially and the urban populations began to dominate the rural population demographically (SCDNR 2006).

Statewide, more than 100,000 acres per year were converted from forests, farmland, and other open space to urban uses from 1992 to 1997, making South Carolina the ninth-ranked state nationally in terms of total land area developed annually (USDA 1997). According to the same report, the National Resources Inventory, prepared by the Natural Resources Conservation Service (NRCS) of the U.S. Department of Agriculture (USDA), the growth rate from 1982 to 1992 was only 40,000 acres per year. Thus, land conversion was accelerating during this 15-year period. These recent urban land conversion rates represent a major burst of growth; this development trend and the conversion of rural lands to urbanized uses – with their attendant impact on habitat for wildlife – continue unabated today.

Strong economic forces are also transforming South Carolina's agricultural economy. Rising costs and falling prices are creating hardships for many family farms. As of 1997, there were approximately 4.5 million acres in agricultural production in South Carolina, representing an 18 percent drop since 1982. Long-term declines in farmland are even more dramatic: in 1954, 124,203 farms were producing goods in South Carolina, and 57 percent of the land in the State consisted of farms. By 1992, the number of farms in the State had been reduced to only 20,242, comprising 23 percent of South Carolina's land use (SCDNR 2006).

As South Carolina's population continues to grow, placing ever greater pressure on undeveloped lands in the State, and driving conversion from rural to urban land uses, new challenges threaten its fish and wildlife. Additionally, long-standing downward trends in numbers of some species that previously had

been overlooked have become more evident. In a recent state-by-state analysis of biodiversity conducted for the Nature Conservancy, South Carolina ranked 14th among all States in total number of native plant and animal species and 15th in terms of risks to native species. In a planning exercise conducted in 1994, SCDNR biologists estimated that as many as one third of the State's vertebrate species were already then, or would soon be, experiencing serious declines (SCDNR 2006).

Elimination and fragmentation of coastal habitats have decimated wildlife species throughout the Atlantic Coast, and are recognized by the Service as serious threats to wildlife in South Carolina. The species most adversely affected by fragmentation are those that are area sensitive or require special habitat. Fragmentation affects migratory songbirds, sea turtles, beach mice, and many other species, primarily through high rates of nesting failure and predation. While more than 200 species of breeding migratory songbirds, shorebirds, waterfowl, and raptors are found in this region, some of these species have declined significantly, such as the red-cockaded woodpecker and Bachman's warbler. These species need the benefits of large, managed forest blocks to recover and sustain their existence.

Fragmentation of bottomland hardwood forests has left many of the remaining forested tracts as biological oases surrounded by inhospitable agricultural lands. Intensive agriculture has removed most of the forested corridors along sloughs that formerly connected forest patches. The loss of connectivity between the remaining forested tracts hinders the movement of a large range of wildlife between tracts, and reduces the functional value of many remaining smaller forest tracts. The severed connections also result in a loss of gene flow needed to maintain genetic viability and diversity within wildlife populations. Thus, remaining populations are rendered even more vulnerable to habitat modification and degradation. Particularly for wide-ranging species, reestablishing travel corridors to allow movement is of critical importance.

ALTERATIONS TO HYDROLOGY

The natural hydrology of a region is directly responsible for the connectedness of forested wetlands and indirectly responsible for the complexity and diversity of habitats through its effects on topography and soils. Natural resource managers recognize the importance of dynamic hydrology to forested wetlands and waterfowl-habitat relationships.

In addition to the loss of vast acreage of bottomland-forested wetlands and other habitat types, there have been significant alterations in the region's hydrology due to development, river channel modification, flood control levees, reservoirs, and deforestation, as well as degradation to aquatic systems from excessive sedimentation and contaminants.

Large-scale, man-made hydrological alterations have changed the spatial and temporal patterns of flooding throughout the entire Savannah/Santee/Pee Dee Rivers Ecosystem, in terms of both extent and duration of flooding, in comparison with the natural hydrology regime. This curtailment of the flooding regime has had an enormous impact on the forested wetlands and their associated wetland-dependent species.

In coastal estuaries, the saline stratification and location of the saltwater wedge can be impacted due to atypical levels of freshwater influxes. Factors affecting the level of freshwater inflow include erosion, sediment load changes, river runoff and pollution, dredging, and severe weather disturbances.

Southeastern states have the greatest numbers of imperiled and vulnerable freshwater fish species in the country. Channel modifications and pollution have gradually eliminated large populations of native aquatic species, including fish, mussels, snails, insects, and crustaceans. Barriers to movement prevent anadromous fish from reaching spawning grounds and key habitat areas. Many

other aquatic species have similarly become isolated. Without avenues for migration, impacts from land surface pollution runoff are exacerbated. Restoration of the structure and functions of a natural wetland is complicated by the fact that wetlands depend on a dynamic interface of hydrologic regimes to maintain water, vegetation, and animal complexes and processes.

PROLIFERATION OF INVASIVE AQUATIC PLANTS AND ANIMALS

Compounding the problems faced by aquatic systems is the growing threat from invasive aquatic vegetation like alligator weed and water hyacinth. Static water levels caused by the lack of annual flooding and reduced water depths resulting from excessive sedimentation have created conditions favorable for the establishment and proliferation of several species of invasive aquatic plants. Additionally, the introduction of exotic vegetation capable of aggressive growth is further threatening viability of aquatic systems. These invasive aquatic species threaten the natural aquatic vegetation important to aquatic systems, and choke waterways to a degree that often prevents recreational use.

Various species of non-native wildlife and fish also flourish in this southern coastal climate. Animals such as feral hogs, flathead and blue catfish, and Asian clams have caused extensive habitat damage and alterations.

PHYSICAL RESOURCES

CLIMATE

Coastal South Carolina where the refuge is located has a humid, warm-temperate climate typical of the southeastern United States. The area's climate is influenced by the coastal waters of the Atlantic Ocean. The average yearly rainfall, as measured in Georgetown from 1971-2000, is 56 inches, with rainfall reasonably well distributed throughout the year, although summer is the wettest season (NOAA, no date). August is the wettest month at 7.4 inches and April is the driest at 2.67 inches. Thunderstorms occur on about 50 days each year, and most occur in summer. The refuge is subject to the effects of tropical storms and hurricanes from June through September. Snowfall is rare. In 90 percent of winters, there is no measurable snowfall. When snow does fall, it is usually little more than a trace and of short duration.

January is usually the coldest month, with an average temperature of 48 degrees Fahrenheit, with an average daily minimum of 38 degrees (NOAA, no date). July is normally the hottest, with temperatures averaging about 80 degrees, with an average daily maximum of 90 degrees. Winters are mild, with temperatures seldom remaining below freezing for long. Summers are hot and humid with average relative humidity at about 85 percent. The prevailing wind is from the south-southwest, and the average wind speed is highest in spring at 10 mph.

GEOLOGY AND TOPOGRAPHY

Wetlands dominate the landscape of the refuge acquisition area. Of the refuge's 49,500 acres, approximately 88 percent are classified as wetland habitats. The remaining 12 percent of land is upland forest. Geographically, the refuge is situated in a coastal zone within the primary floodplains of the Great Pee Dee and Waccamaw Rivers. The southern portion of the area consists of emergent tidal wetlands. The central and northern portions are mostly hardwood-forested wetlands, except for Sandy Island, which contains most of the area's upland forests and is characterized by a rolling ridge and swale topography. Elevations range from near sea level to 76 feet above the mean sea level, which is the highest point in Georgetown County.

SOILS

Large portions of the refuge acquisition area are dominated by poorly drained, acidic soils with a perched water table due to a subsurface clayey hard pan. The surface soils are generally sandy to loamy and sub-surface soils silty to clayey. Nearly all of these soils are used for wildlife habitat.

The following soil types and series predominate in the refuge acquisition area (NRCS, no date):

- Levy – entisol, silty clay loam, acidic, very deep, very poorly drained
- Hobonny – histosol, muck, very acidic, very deep, very poorly drained
- Lakeland – entisol, sand, acidic, deep, excessively drained
- Rutlege – inceptisol, loamy sand, very deep, very poorly drained
- Chastain – inceptisol, loam, acidic, very deep, poorly drained
- Johnston – inceptisol, mucky loam, acidic, very deep, very poorly drained.

HYDROLOGY AND WATER QUALITY

Three major rivers, the Waccamaw, Great Pee Dee and Little Pee Dee, are the main sources of freshwater inflow to the refuge acquisition area. The Little Pee Dee River is a Type I Natural State Scenic River between U.S. Highway 378 to the confluence with Great Pee Dee River. The Great Pee Dee River is also a Type 1 Natural State Scenic River from U.S. Highway 378 down to the confluence of the Black River.

Two of the rivers, Waccamaw and Little Pee Dee, are classified as blackwater rivers because of their tea-colored water, the result of tannin leached from vegetation adjoining the rivers. Blackwater rivers originate in the Coastal Plain, are typically acidic, low in suspended sediments, and support a diversity of native animal species. In contrast, alluvial rivers like the Great Pee Dee originate in the Piedmont and carry high sediment loads. These rivers and their tributaries combine to form an incredibly diverse wetland landscape. The Little Pee Dee River flows into the Great Pee Dee River just inside the northern boundary of the refuge acquisition area, the Lynches River flows into the Great Pee Dee River about 27-river-miles to the north, and the Waccamaw River flows through the refuge acquisition area.

The flows of each river fluctuate from month-to-month and year-to-year. However, long-term discharge records show consistent seasonal flow patterns. The lowest average flows typically occur from September through November, with the highest flows occurring from February through April (USFWS 1997). Overbank flooding is common during the high flow periods.

Water regimes depend on daily tidal fluctuations, flooding related to seasonal high-volume river flows, state of dike disrepair, bed elevations and channelization, encroachment of aquatic plants, past and present forestry and agricultural practices, alteration in runoff caused by man-made development, and natural phenomena, such as hurricanes, tropical storms, and heavy rain.

Water quality within the Great Pee Dee River Basin ranges from excellent to degraded, depending on local point source water discharges, non-point source runoff, and natural conditions. Rivers and tributaries in the refuge acquisition area generally have naturally occurring low levels of dissolved oxygen (DO) and low pH (USFWS 1997). Because of the Waccamaw River's low DO levels the State of South Carolina has established a site-specific standard of 4 milligrams per liter (mg/l) rather than 5 mg/l for the river. The refuge acquisition area is relatively undisturbed due to its proximal isolation from the rapid growth and development of the Grand Strand, with no evidence of industrial pollution. One known

contaminant problem is that of mercury. High levels of mercury were found in several species of fish in 1994, but not in river water or sediment samples. Although one or more sources for this high level of mercury have yet to be identified, significant contributions to atmospheric deposition have been linked to coal-fired power plants, of which there are several located within the local air shed.

AIR QUALITY

Georgetown County has generally good air quality and is considered to be in attainment with the National Ambient Air Quality Standards (NAAQS), including lead, particulate matter below 2.5 microns in diameter (PM-2.5), particulate matter below 10 microns in diameter (PM-10), and sulfur dioxide. In 2003, there was no exceedance of NAAQS for these parameters. Georgetown County's median Air Quality Index in 2003 was 28 on a scale where 0-50 is good, 50-100 is moderate, 100-200 is unhealthful, 200-300 is very unhealthful, and 300-500 is hazardous. The residents of Georgetown and Horry counties were exposed to less air pollution than those of any other county in all of South Carolina (Scorecard 2005).

BIOLOGICAL RESOURCES

HABITAT

Wetlands comprise nearly 88 percent of the refuge acquisition area and are of national and regional importance. The area's wetlands meet the assessment threshold criteria of the National Wetlands Priority Conservation Plan. Accordingly, they are listed as part of the Winyah Bay wetland system in the Service's Regional Wetlands Concept Plan for the Southeast Region (USFWS 1997). Furthermore, riparian and bottomland hardwood forested wetlands were recently identified as a nationally threatened ecosystem having experienced a 70-84 percent decline.

Twelve land cover types, including 8 wetland types, an upland type, and an open water category, have been identified for the refuge acquisition area (USFWS 1997) (Figure 5). All habitats in the refuge acquisition area are fresh water.

As noted earlier, the refuge acquisition area is divided into three units. Unit 1 is the northernmost and largest unit consisting of approximately 34,784 acres (not including open water). Ninety-three percent of this area is wetlands, consisting primarily of large, unbroken tracts of deciduous forested wetlands located along floodplains of the Waccamaw and Great Pee Dee Rivers. Unit 2 is the most ecologically diverse and covers approximately 12,046 acres (not including open water). It consists of about 32 percent uplands and 68 percent wetlands. All wetland types described below are found in this unit. Unit 3 is the southernmost and smallest unit, covering approximately 2,902 acres (not including open water) of which 99 percent is wetland. Virtually the entire unit shows the influence of historic rice culture. The abandoned rice fields are in various successional stages of regrowth by emergent vegetation, trees, and shrubs. The majority of managed wetlands are located in this unit. The habitat types and acreage of each by unit are summarized in Table 1.

Figure 5. Wetland habitats at Waccamaw NWR

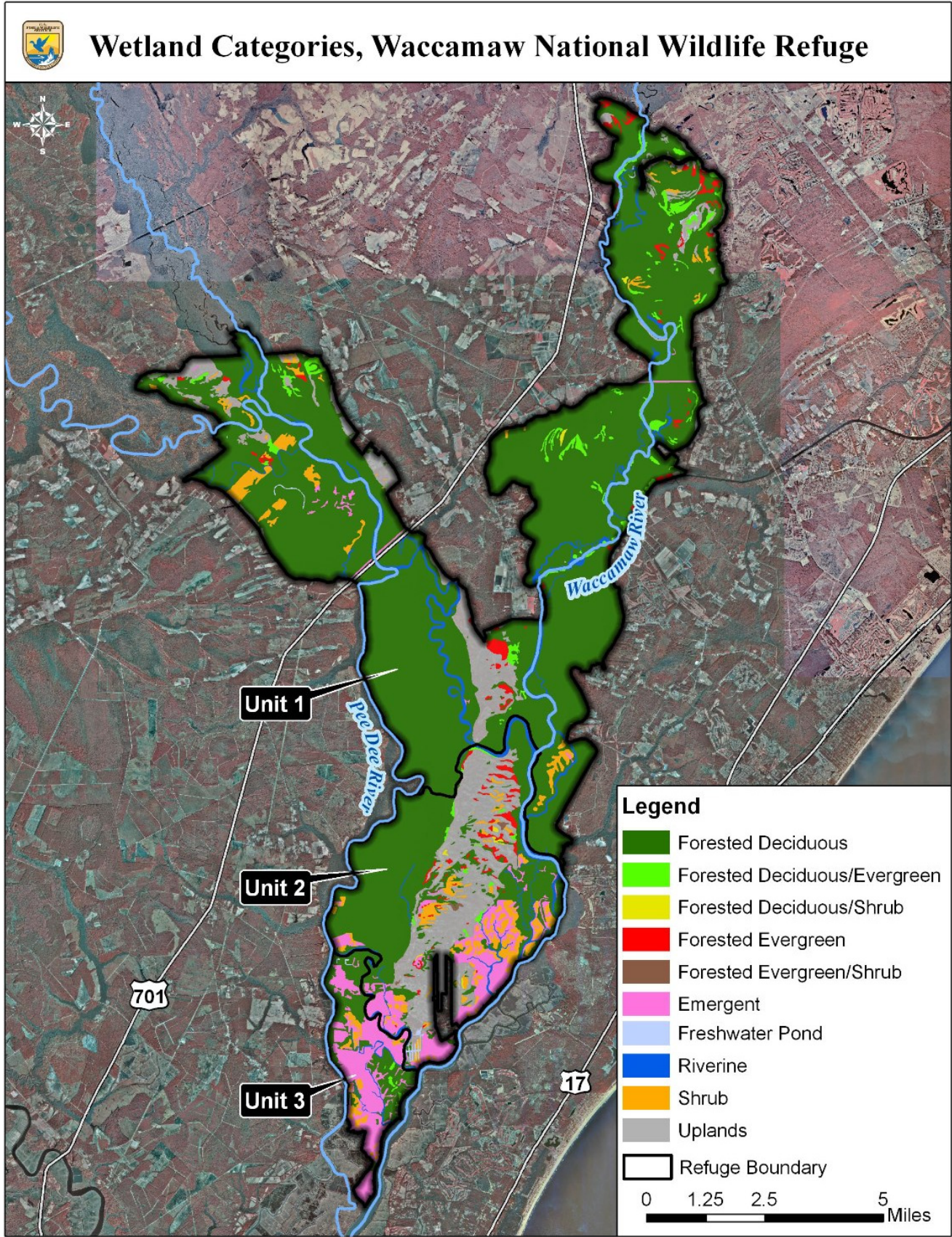


Table 1. Habitat types and acreage within the Waccamaw NWR acquisition boundary

Habitat Type	Unit 1 (acres)	Unit 2 (acres)	Unit 3 (acres)
Forested Deciduous Wetlands	29,799	5,428	1,185
Forested Deciduous/Evergreen Wetlands	832	92	31
Forested Deciduous/Shrub Wetlands	21	33	0
Forested Evergreen Wetlands	476	299	0
Forested Evergreen/Shrub Wetlands	0	34	0
Emergent Wetlands	143	1,563	1,472
Shrub Wetlands	725	942	189
Riverine Wetlands	1,967	776	135
Freshwater Ponds	49	39	6
Total Wetlands	34,012	9,206	3,018
Uplands	2,598	3,764	0
Total Area	36,610	12,970	3,018

Source: USFWS, National Wetlands Inventory online

Open Water

This category includes all unvegetated water bodies, consisting mainly of rivers. Most of the open water is regulated by the State of South Carolina.

Freshwater Marsh

This category includes freshwater wetlands dominated by emergent vegetation. The majority of this type is tidally influenced. Freshwater marshes remain flooded or saturated except during extremely dry weather periods. Most of the freshwater marshes are crisscrossed with abandoned dikes and canals that were constructed for rice cultivation during the 18th and 19th centuries. Plant diversity is greater here than within any other wetland habitat type in the refuge acquisition area. Among the most common species are giant cutgrass, pickerelweed, wild rice, jewelweed, water parsnip, smartweeds, yellow pond-lily, water hemlock, arrowhead, rose mallow, soft-stem bulrush, giant cordgrass, cattail, loosestrife, white water lily and alligator weed. Woody vegetation, such as tag alder, bald cypress, buttonbush, tupelo and black gum, may be interspersed on the old rice field levees.

Managed Wetlands

This category includes former rice field areas impounded by dikes and levees, where the hydrology is usually manipulated for the purpose of raising plants attractive to waterfowl. The hydrologic regimes are controlled by the impoundment managers. Most impoundments are managed for emergent vegetation, including waterfowl foods such as smartweed, panic grass, wild millet, red root, water shield, spikerush, arrow-arrum, white water lily, southern naiad, Asiatic dayflower, soft-stem bulrush, wild rice, and water grass. Cultivated grains may also be planted during drawdown periods.

Deciduous Forested Wetlands – Temporarily and Seasonally Flooded Tidal

Areas included in this category are periodically influenced by tidal fluctuations. Flooding, often from a combination of extreme lunar tides and high river flows, normally occurs in the winter through late spring. Inundation may last only a few days or weeks in winter and early spring to well into the summer season. These areas are the most diverse of the tidally influenced forested habitats within the study area. Common trees include red maple, overcup oak, swamp chestnut oak, water oak, laurel oak, water hickory, green ash, sweet gum, river birch, swamp tupelo, bald cypress, and loblolly pine.

Deciduous Forested Wetlands – Semipermanently Flooded Tidal

These areas remain flooded or saturated throughout most years except during extreme drought periods. Water depth may periodically fluctuate as a result of tidal influences. Plant community composition is relatively homogeneous. Dominant species include swamp tupelo, bald cypress, green ash, water tupelo, and red maple.

Deciduous Forested and Shrub Wetlands – Regularly Flooded Tidal

These areas remain flooded or saturated throughout most years. Water depths fluctuate regularly with tides. Tree species composition is very similar to the immediately preceding habitat type. Shrub-dominated habitats within this type include species such as swamp privet, buttonbush, and tag alder.

Deciduous Forested and Shrub Wetlands – Temporarily Flooded or Saturated

These areas remain flooded or saturated throughout the winter and for brief periods during the spring. Diurnal tides have little or no influence on the hydrology of this wetland type. This habitat type usually occurs at the higher elevations within the floodplain. Typical plant species include swamp chestnut oak, water oak, cherrybark oak, loblolly pine, several species of hickories, white oak, tulip poplar, ironwood, sycamore, and sweetgum.

Deciduous Forested and Shrub Wetlands – Seasonally and Semipermanently Flooded

These areas are flooded for very long periods during the growing season to almost continuously throughout the year. Diurnal tides have little or no influence on the hydrology of this wetland type. Typical species in the drier portions of this type include water oak, green ash, American elm, and sweetgum. In the wetter areas, overcup oak, water hickory, water tupelo, swamp tupelo, and bald cypress predominate.

Evergreen Forested and Shrub Wetlands

Most of these areas are rarely flooded but may be periodically saturated to the surface. This type usually occurs at the very highest elevations within the floodplain, on poorly drained flats, and in

depressions outside of the floodplain. Within the floodplain, these areas are at the driest end of the wetland spectrum and are vegetated by species such as loblolly pine, spruce pine, live oak, and American holly. Outside of the floodplain, these areas are commonly called bay swamps, pine savannahs, or wet pine flatwoods and are vegetated by pond pine, loblolly bay, sweet bay, red bay, titi, fetter-bush, wax myrtle, zenobia, and sweet gallberry.

Upland Forests

This category includes any area that does not meet the definition of wetland or deepwater habitat as classified by Cowardin et al. (1979). A large portion of this habitat type occurs on Sandy Island. The upland plant communities on Sandy Island are highly diverse and include a maritime sandhill community, longleaf pine savannahs, and flatwoods with intermittent inclusions of small evergreen and deciduous depressions, pocosins, freshwater depression meadows, broad-leafed deciduous swamps, and pond pine woodlands. The maritime sandhill community on Sandy Island appears to be the only known site of its type in the State. The predominant vegetation community on Sandy Island is the longleaf pine/turkey oak type. Longleaf pine forests and savannahs were recently identified as a national critically endangered ecosystem.

WILDLIFE

Mammals

Temporarily flooded bottomland forests provide ideal habitat for many species of mammals. Food and cover are abundant and diverse, and a variety of mammalian species are present. About 40 species of mammals potentially inhabit the refuge acquisition area (USFWS 1997). They include the black bear, which is primarily associated with upland forests joined by extensive forested wetland corridors. Seven species of bats may be found. Additionally, the refuge acquisition area contains roosting and foraging habitat for at least two rare bats: the Rafinesque's big-eared bat and the southeastern myotis. Both species hold State-listed rankings of concern. Other mammals include forest wetland inhabitants, such as deer, bobcat, raccoon, beaver, mink, river otter, marsh rabbit, and squirrel.

Amphibians and Reptiles

About 100 species of amphibians and reptiles are likely to occur within and adjacent to the refuge acquisition boundary. Aquatic salamanders common to the area include the greater siren, eastern lesser siren, two-toed amphiuma, dwarf water dog, and broken-striped newt. The most common terrestrial salamanders are the marbled salamander and the South Carolina slimy salamander. The most commonly encountered frogs are the bull frog, southern leopard frog, and green treefrog. The American alligator is the largest reptile in the area. The brown water snake and eastern cottonmouth are probably the most widespread and abundant snakes. The Florida cooter and the yellowbelly slider are the most commonly encountered turtles.

Fish

The area is noted for its abundant and productive fishery. Within the refuge acquisition boundary, the Waccamaw and Great Pee Dee Rivers provide unimpeded upstream and downstream movement for all associated fish species. The composition of fish populations reflects the area's varying flooding regimes and physical and chemical characteristics of the water, as well as their proximity to tidal influence. About 70 species of fish are associated with the refuge acquisition boundary, including fresh water, anadromous (fish that move up the rivers from the sea to spawn), catadromous (fish that

live in fresh water and return to the sea to spawn), estuarine-dependent, and marine fish (USFWS 1997). Anadromous fish known to occur include the striped bass, American shad, hickory shad, blueback herring, Atlantic sturgeon, and shortnose sturgeon. One catadromous fish species, the American eel, is known to occur in the area. There is excellent year-round recreational fishing for freshwater fish, such as the largemouth bass, redbreast sunfish, bluegill, redear sunfish, warmouth, pumpkinseed, black crappie, chain pickerel, redbfin pickerel, bowfin, and numerous species of native catfish, as well as one introduced species, the flathead catfish.

Birds

Colonial nesting birds, raptors, woodpeckers, shorebirds, and passerine birds all use bottomland hardwood habitat. Some species are relatively restricted to bottomland hardwood habitat, including barred owl, red-shouldered hawk, wood duck, yellow crowned night heron, yellow-billed cuckoo, acadian flycatcher, American redstart, and the prothonotary, Swainson's and northern parula warblers. Other birds prefer bottomland hardwood sites because of food availability, such as woodpeckers that use areas of dead or dying timber.

Floodplain forests of the South Atlantic Coastal Region support a rich assemblage of breeding birds, over 50 percent of which are neotropical migratory birds. Bald cypress-tupelo forests provide important breeding habitat for numerous insectivorous species of flycatchers, vireos, and warblers. A large number of species are also dependent on mature southern pine forests, including northern bobwhite, Bachman's sparrow, wintering Henslow's sparrow, southeastern American kestrel, brown-headed nuthatch, and prairie warbler. The refuge acquisition area also provides habitat for wild turkey. Approximately 200 species of birds have been recorded in the refuge acquisition boundary.

Neotropical Migratory Birds

The mosaic of wetland habitats on the refuge acquisition boundary, along with a specialized flora composition associated with each component, provides habitat for breeding neotropical migratory birds. This wetland habitat diversity is important to several high-priority species, such as the swallow-tailed kite, black-throated green warbler, Swainson's warbler and prothonotary warbler. Additionally, contiguous forested wetland ecosystems, such as represented within the Great Pee Dee and Waccamaw watershed, serve as important habitat for transient neotropical migratory species, as well as feeding, foraging, and nesting habitat for other temperate migratory and resident species.

Swallow-tailed kite nesting activity has increased significantly throughout the refuge acquisition boundary over the past ten years. Nest surveys, conducted by SCDNR from 1999 through 2004, documented that the refuge acquisition boundary had the highest nesting density in South Carolina from 2001- 2004. Fledgling survival rates were also higher within the Great Pee Dee River corridor than anywhere else in the State. The nests within the refuge acquisition boundary also represent the northernmost nests ever documented within their nesting range (SCDNR Report 2004).

It is unclear whether a population of black-throated green warblers currently exists anywhere in the Winyah Bay Focus Area, and the refuge acquisition boundary is not likely to directly contribute to the conservation of this species. The preferred habitat for Swainson's warblers corresponds closely with the Deciduous Forested Wetlands – Temporarily and Seasonally Flooded Tidal type, which is found in the refuge acquisition area around Bull Island and along the Great Pee Dee drainage. This, along with larger, more contiguous patches upstream along the Great Pee Dee River outside of the refuge acquisition area, can support this species. The prothonotary warbler is the highest priority species most likely to have healthy populations occurring in forested wetland patches of less than 6,000 acres. The refuge acquisition boundary can undoubtedly support one large population.

Waterfowl

South Carolina's coastal wetlands, in particular the Winyah Bay drainage area, play an important role for many species of migrating waterfowl by providing wintering grounds and staging areas for migrating waterfowl that winter elsewhere. From 1954 to 1987, South Carolina wintered an average of 30 percent of the dabbling ducks within the Atlantic Flyway (USFWS 1997). Since 1970, South Carolina has wintered an average of 54 percent of American green-winged teal, 50 percent of the northern shovelers, 35 percent of the mallards, 32 percent of the northern pintails and American wigeon, and 31 percent of the gadwall in the flyway.

The Winyah Bay drainage area, which includes the entire refuge acquisition boundary, has gained national recognition for its importance to migratory waterfowl by having the most extensive, intact wetland complexes in the southeastern United States. Acre-for-acre, the managed wetlands in this area winter more ducks than any comparable habitat in South Carolina. River systems, such as the Great Pee Dee and Waccamaw, serve as flight corridors for waterfowl migrating along the coastal wetland wintering grounds. In addition, the extensive forested floodplains of these systems provide resting and feeding areas for waterfowl during their stopovers.

Waccamaw NWR provides year-round nesting and brood rearing habitat for wood ducks. There is an abundance of wood ducks in the refuge acquisition area and Sandy Island likely serves as an important roost and sanctuary.

Marsh and Wading Birds

All of the priority marshbirds that are found in the refuge acquisition boundary require tall emergent vegetation as part of their habitat. All are breeding species, except the American bittern. Breeding populations of pied-billed grebe and American coot are considered of regional conservation interest. Among the marshbirds of conservation interest, the king rail is of highest concern, followed by the least bittern and purple gallinule.

Most waterfowl-oriented management, especially for wintering populations, is geared away from promoting tall emergent vegetation. Most available habitat at Waccamaw NWR is supported in former rice fields where there appears to be substantial tall emergent habitat available, which should support king rails and least bitterns in healthy numbers.

Nesting long-legged wading birds have plenty of habitat but the issue remains of how much disturbance these nesting birds can tolerate. Species of conservation interest in the South Atlantic Coastal Plain include little blue heron, tricolored heron, black-crowned night heron, yellow-crowned night heron, wood stork, and white ibis.

Shorebirds

Shorebirds suspected or known to occur within the refuge acquisition boundary include the killdeer, greater and lesser yellowlegs, spotted sandpiper, common snipe, and American woodcock.

THREATENED AND ENDANGERED SPECIES

Six federally listed threatened and endangered species are known to occur or potentially occur within the refuge acquisition boundary. These include two species of birds, one species of fish, and three species of plants (USFWS 1997). The peregrine falcon, which occurs occasionally at Waccamaw NWR, and was once listed as endangered, is now considered to be recovered and was de-listed by the Service in 1999.

Red-cockaded woodpecker (*Picoides borealis*) – Endangered

Red-cockaded woodpeckers are known to nest in the refuge acquisition boundary with the principal population residing in the mature pine forest of Sandy Island. Specific data on this population and its status are lacking because the area was privately owned until recently and access to conduct surveys was not provided.

Wood stork (*Mycteria americana*) – Endangered

Although no nesting has been documented on refuge-owned lands, nesting is occurring within the refuge acquisition boundary, including one known rookery that is immediately adjacent to a refuge-owned tract. In addition to nesting habitat, the contiguous mature block of wetland ecosystems provides suitable habitat for wood storks to forage and roost. Wood storks have been observed foraging and loafing on refuge-owned tracts throughout the refuge acquisition boundary.

Shortnose sturgeon (*Acipenser brevirostrum*) – Endangered

The shortnose sturgeon is found in the rivers and creeks. The waters throughout the Winyah Bay drainage, including within and above the refuge acquisition boundary, contain important spawning habitat.

Pondberry (*Lindera melissifolia*) – Endangered

The pondberry is a plant that inhabits seasonally flooded wetlands, sandy sinks, pond margins, and swampy depressions. There are 40 currently known populations of pondberry in the southeastern United States. Although not known to occur in the refuge acquisition boundary, potential habitat is present on Sandy Island and in other pineland areas.

Canby's dropwort (*Oxypolis canbyi*) – Endangered

The Canby's dropwort inhabits a variety of coastal plain habitats, including natural ponds dominated by pond cypress, grass-sedge dominated bays, wet pine savannahs, shallow pineland ponds, and cypress-pine swamps. There are currently 53 known populations of Canby's dropwort in the southeastern United States. Although not known to occur in the refuge acquisition boundary, potential habitat is present on Sandy Island and in other pineland areas.

American chaffseed (*Schwalbea americana*) – Endangered

American chaffseed is an inhabitant of pine flatwoods and savannahs with a history of frequent burning. There are 145 known occurrences of American chaffseed, with 63 of these now considered extirpated. Known occurrences are widely dispersed across the Atlantic and Gulf of Mexico coastal plains. Although not known to occur in the refuge acquisition boundary, potential habitat is present on Sandy Island and in other pineland areas.

Bald eagle (*Haliaeetus leucocephalus*) – Recently de-listed as Threatened

The number of occupied breeding areas for bald eagles in South Carolina was at a low of 13 in 1977, when studies began, and had increased to 181 in 2003. The bald eagle is primarily associated with coasts, rivers, and lakes, usually nesting near bodies of water where it feeds. There is one documented nest within the refuge acquisition boundary, which is nearby to one of the refuge-owned parcels in Unit 3. Eagles have been documented feeding and roosting throughout the refuge acquisition boundary. In addition, a few migratory bald eagles have been noted passing through the area.

Species of Concern

Ten species of plants and animals, considered by the Service to be Species of Special Concern, are known to occur or potentially occur within the refuge acquisition boundary. These species include the Bachman's sparrow (*Aimophila aestivalis*), Rafinesque's big-eared bat (*Plecotus rafinesquii*), Southeastern myotis bat (*Myotis austroriparius*), Carolina pygmy sunfish (*Elassoma boehlkei*), eulophia (*Pteroglossaspis ecristata*), Sarvis holly (*Ilex amelanchier*), pondspice (*Listea aestivalis*), Carolina birds-in-a-nest (*Macbridea caroliniana*), Carolina grass-of-parnassus (*Parnassia caroliniana*) and Well's pixie moss (*Pyxidanthra barbulata* var. *brevifolia*).

INVASIVE SPECIES

Invasive species include native and non-native species of plants and animals that tend to aggressively colonize lands and ecological niches, displacing native plants and animals of higher value. Not all invasive species are non-native (i.e., originating outside of North America). Some invasive species of both plants and animals are indeed indigenous to the area or native to North America, but are still considered invasive and problematic because they spread quickly and become abundant, to the detriment of native flora and fauna, and thus indigenous biodiversity.

Two of the most important invasive upland plant species at Waccamaw NWR are kudzu and Chinese privet. Kudzu is native to Asia and was introduced to North America in the late 1800s for erosion control, although it is also used for ornamental purposes. This fast-growing vine persists along roadbanks and appears to be spreading into disturbed areas, fields, and the edges of forests; it is now widespread in the southeastern United States. It reproduces both by seeds and its tuberous roots and is difficult to eradicate (USACE 2002). Chinese privet was introduced from China and Europe in the early to mid-1800s for use as an ornamental. This shade-tolerant, aggressive shrub often forms dense thickets, particularly in bottomland forests and along fencerows. It colonizes by root sprouts and spreads widely by abundant bird- and other animal-dispersed seeds (Miller 2003).

Water hyacinth and phragmites are the two main invasive aquatic plants known to occur on the refuge. Water hyacinth, a native of South America, was first introduced to the United States at the Cotton States Exposition in New Orleans in 1884. Since then, this free-floating herb has become widely naturalized in the southeast, often forming monotypes across large areas. Water hyacinth invades lakes, ponds, rivers, marshes, and other wetland habitats. It reproduces mainly by vegetative means and can form dense floating mats of vegetation. These mats restrict light penetration, reducing the availability of light for submerged plants and aquatic invertebrates, and depleting oxygen levels (Invasive and Exotic Species 2006). *Phragmites australis*, or common reed, is particularly widespread in brackish and freshwater marsh habitats along the Atlantic Coast. Its origins are unclear, and recent genetic research shows that both native and introduced varieties occur in North America. Vegetative spread by below-ground rhizomes can result in dense clones of phragmites, with up to 200 stems per square meter. Invasion by phragmites alters the structure and function of marsh ecosystems by changing species composition, nutrient cycles, and hydrological regimes. Dense stands decrease native biodiversity and quality of wetland habitat, particularly for migrating wading birds and waterfowl (Invasive Species 2003).

One of the most important invasive animal species is the feral hog. Feral hogs are currently limited to the lower portions of the refuge acquisition boundary. These animals were introduced to the eastern United States from Eurasia by early European settlers as a source of food. The feral swine population that exists today is a combination of domestic, escaped, or neglected domestic swine, Eurasian wild boar, or feral pigs that have been captured for the purpose of starting wild, free-living

populations. The rooting and wallowing activities of wild pigs cause serious erosion to river banks and areas along streams. Wild hogs carry diseases, such as swine brucellosis (APHIS 2005). They also compete for food with native wildlife, particularly acorns, which are an important food for both wild turkey and deer. Furthermore, feral hogs create wallows in wet sites, impinging on the integrity of the plant and soil community (Georgia Wildlife Web 2000).

Two other invasive animal species of concern are the flathead catfish and the Arkansas blue catfish. Both species were introduced into South Carolina rivers in the early 1990s, and both have had significant adverse impacts on native fish populations, particularly the redbreast sunfish.

CULTURAL RESOURCES

Cultural resources include historic properties as defined in the National Historic Preservation Act (NHPA), cultural items as defined in the Native American Graves Protection and Repatriation Act (NAGPRA), archaeological resources as defined in the Archaeological Resources Protection Act (ARPA), sacred sites as defined in Executive Order 13007, *Protection and Accommodation of Access To "Indian Sacred Sites"* to which access is provided under the American Indian Religious Freedom Act (AIRFA), and collections. As defined by the NHPA, a historic property or historic resource is any prehistoric or historic district, site, building, structure, or object included in, or eligible for inclusion in, the National Register of Historic Places (NRHP), including any artifacts, records, and remains that are related to and located in such properties. The term also includes properties of traditional religious and cultural importance (traditional cultural properties), which are eligible for inclusion in the NRHP as a result of their association with the cultural practices or beliefs of an American Indian tribe. Archaeological resources include any material of human life or activities that is at least 100 years old, and that is of archaeological interest.

Waccamaw NWR follows these legal mandates to protect the public's interest in preserving the cultural legacy that may potentially occur on the refuge. Whenever construction work is undertaken that involves any excavation with heavy earth-moving equipment, such as tractors, graders, and bulldozers used in the development of moist-soil units, the refuge contracts with a qualified archaeologist or cultural resources expert to conduct an archaeological survey of the site. The results of these surveys are submitted to the Service's Regional Historic Preservation Officer, as well as the South Carolina State Historic Preservation Office (SHPO). The South Carolina SHPO is a program of the South Carolina Department of Archives and History and the State Historic Preservation Officer is Director of that Department (SHPO, no date).

The SHPO reviews the surveys and determines whether cultural resources will be impacted, that is, whether any properties listed in or eligible for listing in the NRHP will be affected. If cultural resources are actually encountered during construction activities, the refuge is to notify the SHPO immediately. To date, the Yauhannah Bluff tract is the only refuge property that has been recommended as eligible for listing in the National Register of Historic Places. This determination was made after a phase 2 archaeological survey was conducted in 2006, to mitigate potential impacts associated with the construction of an environmental education center on this tract (Archaeological Investigations at the Yourhaney Plantation (38GE18), Yauhannah Bluff, Waccamaw National Wildlife Refuge, Georgetown County, SC May 1, 2006).

PREHISTORIC AND HISTORIC BACKGROUND

The area of the Waccamaw, Great Pee Dee, and Little Pee Dee Rivers, with its ecology and diverse flora and fauna, possesses a rich historical past. Small highly mobile groups initially settled the southeast during the Paleoindian Period ca. 12,000-10,000 Before Present (B.P.), carrying with them

a unique and specialized stone tool kit. The geographic extent of the Paleoindians' territories are poorly understood, but are thought to range from 50 to 250 miles in extent and often appear to center around quarries of high-quality stone (USFWS 1997). Isolated finds of fluted points have been reported from Horry, Marion, and Georgetown counties.

Between 8000-5000 B.P., Archaic Period sites were located along swamp margins and terraces overlooking floodplains. The period is generally characterized by increasing population, defined territories and decreased mobility, development of stone containers and ceramics, and increased reliance on locally available lithic raw materials and plants. Late in the period, small-scale gardening of domesticates, such as squash and gourd, appeared.

Sedentary villages began to appear during the Woodland Period (ca. 3000-500 B.P.), as well as burial and temple mound complexes. Woodland groups increasingly relied on agricultural crops. Maize became the major crop and staple toward the end of the period. Chiefdom level societies appeared through the southeast.

The Contact and Historic Periods date ca. 500-200 B.P. The area's American Indian tribes at the time included the Seewees, the Santee, the Sampits, the Winyahs, the Pee Dees, and the Waccamaws. As early as 1683 in the Winyah Bay area, British colonists established trade relations with these groups. The focus of colonial trade was enslaved Indians bound primarily for the West Indies, skins, and white-tailed deer pelts. Indian groups were depleted by European-introduced diseases, liquor, and inter-tribal and colonial conflicts. By 1715, the Waccamaws consisted of 610 individuals dispersed among six villages; the Winyahs were reduced to one village of 106 individuals. In 1720, the Yamasee War ended both the Indian threat and trade in the area.

European presence in the Lowcountry began tentatively in the first half of the sixteenth century. A short-lived Spanish settlement, San Miguel de Guadalupe, was established near the southern tip of Waccamaw Neck in 1526. A second Spanish settlement, Santa Elena, became the capital of the Spanish colony "La Florida," from 1577-1578 near present-day Beaufort, South Carolina.

Charleston was settled by the English in 1670. From 1700-1720, the English established settlements, including Georgetown, on the Winyah Bay and up the Black, Pee Dee and Waccamaw watersheds. Initial impetus for these settlements was fur, deer, skin, Indian slave trade, and the manufacture of naval stores. By 1705, large-scale rice cultivation formed the foundation of the Lowcountry economy. Enslaved Africans replaced Indians as the labor force and by 1708 formed the majority of the colonial population. Rice agricultural practices transformed the landscape with the widespread clearing of forested wetlands and construction of dikes and tidal gates.

By 1850, many plantations existed along local rivers. From 1792 to the 1880s, several families operated ten rice plantations on Sandy Island. Many of the plantation owners who fled their estates during the Civil War returned to their lands in 1865-66. The newly freed African-American Sandy Islanders formed communities on the island. They continued to work the island's rice fields under contract and eventually also bought land on the island. Sandy Island culture has a rich oral tradition and history and it represents one of the last remaining "Gullah" communities in South Carolina.

From 1893-1911 a series of hurricanes devastated the area's already foundering rice economy. These storms destroyed much of the infrastructure of the rice fields, as well as the rice crop itself. On Sandy Island, rice continued to be of major economic importance until the mid-1940s. By the early 20th century, many of the area's rice plantations had fallen into disrepair. A number of these estates were bought primarily for waterfowl hunting and other sporting purposes.

To date, the Yauhannah Bluff Tract is the only refuge property that has been systematically surveyed for cultural and archaeological resources. This tract was originally identified in 1972, prior to refuge acquisition. According to the site form, “slipware, potsherds, flakes, and projectile points” were collected. A portion of this site was examined by researchers from Coastal Carolina University in the early to mid-1990s through the excavation of shovel tests and test units. In 2002, Yauhannah Bluff was acquired by the Service and the entire tract was surveyed by New South Associates, using a shovel test pit method. In 2006, a Phase 2 data recovery survey was conducted by New South Associates on portions of the tract closest to the Great Pee Dee River, as a precursor to a future environmental education center. The area surveyed is also the area which an earlier archaeologist believed was the location of an early 18th century Indian trading post. This area also contained remains of a plantation main house complex, dating from the 18th to early 19th centuries. While prehistoric remains also existed in this area, the densest portion of that occupation was determined to be to the west of the Phase 2 survey area during the test pit survey. Artifacts were found dating as early as the Early Archaic Period on up through the Mississippian Period (Adams and Botwick 2002).

SOCIOECONOMIC ENVIRONMENT

Waccamaw NWR includes portions of Georgetown, Horry and Marion counties between the cities of Georgetown and Conway, about 16 miles north of Winyah Bay. Three primary urban centers are associated with the study area: the cities of Georgetown, Conway, and Myrtle Beach. The major area of growth is the Grand Strand, a 60-mile stretch of coastline between the Atlantic Ocean and the Waccamaw River in Georgetown and Horry Counties. The Grand Strand is one of the nation’s top vacation destinations, stretching from Pawley’s Island north to the town of Little River near the South Carolina-North Carolina State line. The area has both a large resident population and a large tourist population, both of which are rapidly growing.

Georgetown County is about half as densely populated as the State (69 people per-square-mile vs. 133 people per-square-mile) but growing faster. In 2004, the county’s estimated population was 59,790, about one percent of South Carolina’s population of 4,198,068 (USCB 2006). The county population grew by 7.2 percent from 2000 to 2004, compared to South Carolina’s 4.6 percent growth in the same four years. From 1990 to 2000, Georgetown County grew 20.5 percent compared to South Carolina’s 15.1 percent in the same decade.

Horry County is more densely populated as the State (173 people per-square-mile vs. 133 people per-square-mile) and also growing faster. In 2004, the county’s estimated population was 217,608, about five percent of South Carolina’s population of 4,198,068 (USCB 2006). The county population grew by 10.7 percent from 2000 to 2004, compared to South Carolina’s 4.6 percent growth in the same four years. From 1990 to 2000, Horry County grew 36.5 percent compared to South Carolina’s 15.1 percent in the same decade.

Marion County is also about half as densely populated as the State (72 people per-square-mile vs. 133 people per-square-mile) but growing more slowly. In 2004, the county’s estimated population was 35,086, about 0.8 percent of South Carolina’s population of 4,198,068 (USCB 2006). The county population declined by 1.1 percent from 2000 to 2004, compared to South Carolina’s 4.6 percent growth in the same four years. From 1990 to 2000, Marion County grew 4.6 percent, compared to South Carolina’s 15.1 percent growth in the same decade.

In 2004, of the data available, accommodation and food services were the largest of twenty major economic and employment sectors in Georgetown and Horry Counties, followed by retail trade (STATS Indiana 2006). Horry County is promoting rapid growth and development, while Georgetown

County is striving to provide an environment more conducive to a slower pace of development. Manufacturing was the largest sector in Marion County. Employment by major industrial sectors is shown in Table 2.

Table 2. Employment of civilian population 16 years and older by industry

Industry	Georgetown County	Horry County	Marion County
Agriculture, Forestry, Hunting	2.2%	0.3%	N/A
Mining	0.2%	0.1%	N/A
Construction	7.4%	8.5%	3.0%
Manufacturing	9.4%	4.1%	28.3%
Wholesale Trade	1.8%	1.9%	N/A
Retail Trade	13.7%	17.1%	13.0%
Transportation and Warehousing	1.5%	1.5%	3.8%
Utilities	0.4%	0.3%	N/A
Information	0.8%	1.5%	N/A
Finance and Insurance	2.2%	3.8%	2.8%
Real Estate	2.8%	4.0%	0.3%
Professional and Technical Services	N/A	2.6%	N/A
Management of Companies	N/A	0.4%	N/A
Waste Services	4.6%	4.8%	N/A
Educational Services	0.3%	0.3%	10.2%
Health Care and Social Assistance	8.7%	7.5%	8.4%
Arts, Entertainment, Recreation	3.5%	5.0%	0.5%
Accommodation and Food Services	15.3%	23.6%	6.6%
Other Services	2.3%	2.5%	1.8%
Public Administration	5.5%	3.5%	7.3%

Source: STATS Indiana 2006 (Note: N/A = data not available)

South Carolina's statistics are slightly below the national averages for persons below the poverty line, median household and per capita income, and educational attainment levels (USCB 2006). Georgetown and Horry Counties conform to this profile, but Marion County fares a little worse (Table 3). In terms of race and ethnicity, whites and blacks dominate both the county and the State populations.

REFUGEE ADMINISTRATION AND MANAGEMENT

LAND PROTECTION AND CONSERVATION

The increasing human population in the Grand Strand area brings a host of challenges to the area in general and to the refuge in particular. Higher resident and tourist populations will require more resorts, services, and commercial development, especially along the ocean shore and major rivers. Additional demands for housing, government services, and infrastructure will also be required, including increasing demand for recreational areas and more extensive transportation systems. These demands, in turn, will exert greater pressures on the area's natural environment. Human population, real estate development, and economic growth are contributing factors to the decline of

wildlife and wildlife habitat; open space, such as rice plantations and timber plantations; and traditional lifestyles within local communities (e.g., Sandy Island residents). These factors are affecting land use within and outside the refuge acquisition boundary.

At present, no major interstate highway traverses the refuge acquisition area. The primary roads in the vicinity include U.S. Highways 17 and 501 (both multi-lane) and State Highway 544 and U.S. Highway 701 (both two-lane). The only primary highway that crosses the refuge acquisition area is U.S. Highway 701. Due to the large seasonal population attracted to the Grand Strand, transportation is an important key to the economy of the local area. However, because of the rapid growth in the area, many of the area's highways suffer from extreme traffic congestion. The South Carolina Department of Transportation is considering several highway construction projects to improve traffic flows and to establish more efficient hurricane evacuation routes. One proposed new construction project is the South Conway Bypass that would potentially join U.S. Highway 701 with State Highway 544, with a portion of the construction potentially located within the refuge acquisition boundary. Another project is a road widening of U.S. Highway 701 and bridge replacement.

The refuge does not have management jurisdiction over any of the waterways within and outside the refuge acquisition boundary. The State-managed waterways have a variety of wildlife disturbances, including motor boats, jet skis, houseboats and associated dumping, and other recreational pressures. The Atlantic Intracoastal Waterway, which overlays a portion of the Waccamaw River, serves as an important route for commercial and recreational boat traffic.

Riverfront properties along the Pee Dee River, a South Carolina State-designated Scenic River, are being developed into single family residences with associated docks and boat ramps.

Land Acquisition

The Service acquires lands and interest in lands, such as easements, and management rights in lands through leases or cooperative agreements, consistent with legislation or other congressional guidelines and executive orders, for the conservation of fish and wildlife and to provide wildlife-dependent public use for recreational and educational purposes.

The Service's policy is to acquire land from willing sellers, and only when other protective means, such as local zoning restrictions or regulations, are not appropriate, available, or effective. When land is needed to achieve fish and wildlife conservation objectives, the Service seeks to acquire the minimum interest necessary to reach those objectives. If fee title is required, the Service gives full consideration to extended use reservations, exchanges, or other alternatives that will lessen the impact on the owner and the community. Donations of desired lands or interests are encouraged.

The Service, like all Federal agencies, has the power of eminent domain, which allows the use of condemnation to acquire lands and interest in lands for the public good. This power, however, requires congressional approval and is seldom used. The Service usually acquires lands from willing sellers. In all fee title acquisition cases, the Service is required by law to offer 100 percent of the property's appraised market value, as established by an approved appraisal that meets professional standards and Federal requirements.

The refuge currently is composed of 10,590 acres in fee title with \$14 million in acquisitions since 1997. An additional 7,661 acres are leased from the SCDNR, bringing the total of refuge-managed lands to 18,251 acres. The refuge acquisition boundary is 54,480 acres. There are approximately

150 land ownerships within the refuge acquisition area, many of which are small tracts ranging from under an acre to several hundred acres. About 40 percent of the area is contained in a few large tracts owned by the timber industry.

Most notable acquisitions for the refuge include several International Paper Company parcels, Bull Island, Thoroughfare Island, and the Causey Tract, a recently acquired, 380-acre tract on the east side of the refuge. The Causey Tract is located near Conway and is within just a few miles of Coastal Carolina University and Horry-Georgetown Technical College. Plans are underway to develop this tract as the refuge's first recreation area. In addition to these noteworthy tracts, the Yauhannah Bluff tract was acquired in 2002, and plans are underway to build a state-of-the-art environmental education center on this tract, which will provide a view shed of Bull Island, the Great Pee Dee River, and Yauhannah Lake. Future acquisitions or leases may include the portion of Sandy Island owned by Brookgreen Gardens, Longwood Island, and any tracts available that adjoin the Causey Tract.

Protecting Scenic Values on the Pee Dee River

The portion of the Little Pee Dee River between the Highway 378 Bridge and the confluence of the river with the Great Pee Dee River has been designated as a State Scenic River. The South Carolina Department of Natural Resources promotes the conservation, protection, and enhancement of the State's natural resources. A scenic river or river segment is defined as essentially free flowing and possesses shoreline largely undeveloped and with limited road access. Adjacent lands are partially or predominantly used for agriculture, silviculture, or other dispersed human activities that do not substantially disturb the natural character of the river corridor.

Scenic rivers must be managed in a manner that best maintains and enhances the scenic values of the river and the adjacent land while at the same time preserving the right of riparian landowners to use the river for customary agricultural, silvicultural, or other similar purposes. The refuge's goal should be to seek a pristine, unencumbered viewshed and to prevent further degradation. Because these effects may occur outside the refuge, there is little direct action that the refuge can take to control local development.

Private Lands Program

The importance of Waccamaw NWR to waterfowl and other migratory birds is well known; however, the potential to provide additional habitat for the benefit of Federal trust species (i.e., migratory birds) on nearby private lands has not been fully explored. The Partners for Fish and Wildlife Program is the Service's primary mechanism for delivering voluntary on-the-ground habitat improvement projects on private lands for the benefit of Federal trust species. Technical and financial assistance is provided to landowners to help meet the habitat needs of Federal trust species on private lands. The objectives of the Partners for Fish and Wildlife Program are to promote and implement habitat

Table 3. Comparison of demographic statistics for Georgetown, Horry, and Marion Counties, South Carolina, and the USA

Location	Median Household Income	Per Capita Income	% Below Poverty	% High School Graduates	% Bachelor Degree	% White	% Black	% Hispanic	% Asian	% Native American
Georgetown County	\$35,312	\$19,805	17.1	75.2	20.0	59.7	38.6	1.6	0.2	0.1
Horry County	\$36,470	\$19,949	12.0	81.1	18.7	81.0	15.5	2.6	0.8	0.4
Marion County	\$26,526	\$13,878	23.2	68.0	10.2	41.7	56.3	1.8	0.3	0.3
South Carolina	\$37,082	\$18,795	14.1	76.3	20.4	67.2	29.5	2.4	0.9	0.3
USA	\$41,994	\$21,587	12.4	80.4	24.4	75.1	12.3	12.5	3.6	0.9

Source: USCB, 2006

improvement projects that benefit Federal trust species; provide conservation leadership; promote partnerships; encourage public understanding and participation; and work with USDA to implement its conservation programs. Habitat improvement practices include habitat restoration, enhancement, and establishment. The highest funding priority status is awarded to proposed projects on private lands that will complement activities on National Wildlife Refuge System lands or contribute to the resolution of problems on refuges that are caused by off-refuge land use practices.

Wildland Fire Management

It is the policy of the Service to use fire when it is the most appropriate management tool for reaching habitat objectives. Wildfires, however, would be aggressively suppressed unless such natural fires are a part of an approved fire management plan. Protection of people and property is the top priority within the fire management program.

Opportunities to use prescribed fire as a management tool on the refuge are limited. However, emergent wetlands and upland forest habitat types are most likely to benefit from the use of prescribed fire as a management tool. Management of emergent wetlands can be accomplished through some combination of prescribed burning on 3-year cycles and/or managing water levels.

Burning, mowing, and/or disking are used on some wetlands to manipulate vegetation or to control woody shrub encroachment. Burning is an important management tool in some managed wetland areas to reduce tree and shrub encroachment for the establishment of moist-soil plants that provide food for wintering waterfowl. A program of prescribed fire is used on maritime sandhills and longleaf pine communities as a management tool for reducing fuel loadings and manipulating vegetation to meet refuge objectives.

VISITOR SERVICES

Executive Order 12996 and the National Wildlife Refuge System Improvement Act of 1997 recognized six priority public uses on national wildlife refuges as long as they are compatible with the purposes for which the refuge was established. These include hunting, fishing, wildlife observation, wildlife photography, and environmental education and interpretation, which “have been and are expected to continue to be generally compatible uses.” However, these uses are by no means the only permitted public uses of national wildlife refuges; other uses have been and can continue to be permitted, provided that they are determined to be compatible with the refuge purposes, including walking dirt/gravel roads, biking dirt/gravel roads, canoeing, horseback riding, and general boating. Horseback riding is confined to gravel roads only. All-terrain vehicles are not permitted.

Popular recreation uses include hunting, and recreational and commercial fishing. Hunting for white-tailed deer, waterfowl, and small game is very popular. Recreational fishing is primarily limited to the main river systems and smaller tributaries that are not blocked and not considered private property. Recreational boating, waterskiing, canoeing, kayaking, swimming, bird watching, and wildlife observation are also very popular activities conducted in this area. Boat access within and adjacent to the refuge is provided by eight State- or county-maintained public boat launching ramps and four privately owned commercial marinas, making these activities more feasible. Boat landings exist near Bull Island on the Waccamaw and Pee Dee Rivers.

Nearby ecological attractions include: Conway River walk, Huntington Beach State Park, Lewis Ocean Bay Heritage Preserve, Myrtle Beach State Park, Sandy Island, Washo Reserve, Samworth WMA, and Waccamaw River Heritage Preserve. Other nature-based tourist attractions available in the local area include the Bellefield Nature Center, Brookgreen Gardens, Francis Marion National

Forest and the SEWEE Center at Cape Romain NWR. Overnight camping facilities are located at the Myrtle Beach and Huntington Beach State Parks and other commercial campgrounds. Several nature-based guided and self-guided tours are offered nearby.

According to the Myrtle Beach Area Chamber of Commerce, a large seasonal tourist population is attracted to the Grand Strand's extensive beaches and over 90 golf courses. In 2003, an estimated 13 million tourists visited the Grand Strand area (USFWS 2005).

Most visitors to the Grand Strand area are from out-of-state and typically visit for a period of four to seven days. Over 50 percent of the area's tourists make return visits. Although most visitors concentrate on beach activities, many seek a diverse recreational experience. The basic appeal of the Grand Strand is its family-oriented recreational activities, including beaches, water parks, golf courses, fishing, historical sites, cultural events, hiking, and tennis/sports. As more people are attracted to the area, visitor activities that are not related to water have also grown in importance.

Nature-based tourism is being targeted at both the State and local levels. Aggressive marketing programs are being developed by the South Carolina Department of Parks, Recreation and Tourism to foster tourism and job growth in rural areas and small towns. These programs are expected to attract even more visitors, both foreign and domestic, in the foreseeable future.

Anticipated demand for non-motorized boating (kayak, canoe), bird watching, nature photography, hiking, camping, and environmental education and interpretation is expected. Visitors also expect to be able to participate in these activities and feel safe during gun hunting season in the fall and winter. Some areas are currently set aside for these activities; however, more areas will need to be acquired.

Fishing

About 70 species of fish are associated within the refuge acquisition boundary area, and fishing is very popular on State jurisdiction waters within the acquisition boundary. These waters provide excellent year-round recreational fishing for freshwater fish, such as largemouth bass, redbreast sunfish, bluegill, redear sunfish, warmouth, pumpkinseed, black crappie, chain pickerel, redbfin pickerel, bowfin, and numerous native species of catfish, as well as two introduced species, the flathead and the Arkansas blue catfish.

The Waccamaw and the Great Pee Dee Rivers furnish unimpeded upstream and downstream movement for all associated fish species. Currently, the rivers provide areas where visitors with boats can fish. These waters provide nursery areas for freshwater and estuarine species, such as red drum, tarpon, striped mullet, and flounder. The rivers, in turn, are connected to a myriad of oxbows, creeks, and small feeder streams interspersed throughout the floodplains and forested wetlands, forming a dynamic aquatic system that supports populations of both sport and commercial fish.

The State of South Carolina has jurisdiction over all the creeks and rivers bisecting the refuge; therefore, the refuge has little control over this major public use program. There are several popular county and private boat launches along the Great Pee Dee River and the Waccamaw River. The refuge does not have its own boat launching facilities. Access to most of the refuge is facilitated by State and private boat ramps along the Great Pee Dee and Waccamaw Rivers, and access does not appear to be limited by boat launching facilities. Currently, the two rivers within the acquisition boundary provide the only areas where refuge visitors with boats can fish. Bank fishing on refuge-owned parcels is allowed; however, these opportunities are limited because there are few road access areas for anglers.

Recreational fishing success is dependent on river elevations, turbidity, and daily tidal influences. Recreational fishing is primarily limited to the main river systems and smaller tributaries that are not blocked and not considered private property. Freshwater commercial fishing within the refuge acquisition boundary has also been a traditional livelihood for many native South Carolinians. Seasonal shad fishing and year-round cat fishing contribute substantially for many family incomes, including the families that reside on Sandy Island.

Littering, gray water discharge primarily from house boats, and jet skis are continual issues that degrade the angler experience within the refuge boundary waterways.

Hunting

Hunting is a primary public use of the refuge. Hunting activities range from waterfowl to both small and big game hunting, with waterfowl and big game hunting being the most popular. Waccamaw NWR has one of the more liberal hunt programs of all the refuges in South Carolina (due in part to hunting being included as one of the purposes for which the refuge was established). The refuge has an approved hunt plan dated February 2007 (USFWS 2007). A hunting brochure describing all the hunt species and regulations is available. The brochure also serves as a permit and is required of all hunters. All refuge hunters under the age of 16 must show proof of successfully completing a State approved hunter education program and must be directly supervised by a properly licensed adult of a least 21 years of age. The refuge has a Youth Turkey Hunt. Hunters must wear a hat, coat, or vest of solid visible fluorescent orange during all big game hunts (deer, hog) except wild turkey. Non-toxic shot is required.

Waccamaw NWR offers a variety of hunting opportunities for white-tailed deer, turkey, feral hog, squirrel, and waterfowl in accordance with State regulations and seasons (USFWS 2007). Hunting is allowed throughout Units 1 and 3. A refuge self-issuing permit and hunter safety training are required.

Big game hunting, primarily for white-tailed deer, has been a traditional recreational use in the local area and on the refuge. Moreover, deer hunts have proven to be not only compatible with refuge objectives but also beneficial in meeting them: deer harvest is essential to maintain the herd at or below habitat carrying capacity on refuge lands (USFWS 2007). Overpopulation leads to starvation, increased car-deer collisions, poor overall herd health, and damaged habitat. Both still hunting and dog drives have been traditionally used on private lands. Because of the extensive tracts of land and seasonal vehicular accessibility, many of the forested wetlands throughout the acquisition boundary have been hunted by hunting clubs, which routinely conduct organized dog drives. The refuge allows hunting of white-tailed deer with archery, muzzle loader, and modern weapons.

Hunting feral hogs is also permitted at Waccamaw NWR. This extremely invasive introduced non-native species is found on all three refuge units. Feral hogs can harbor several infectious diseases, some of which may be fatal to native wildlife. They degrade wildlife habitat by rooting and wallowing. Damage includes erosion along waterways and wetlands and the loss of native plants. Additionally, feral hogs compete directly for food with native species, such as deer, bears, turkeys, squirrels, and many other birds and mammals. Furthermore, they are predators of reptiles, small mammals, and deer fawns, as well as ground-nesting birds, such as turkeys (USFWS 2007).

The refuge also supports a small wild turkey hunt, which is limited to four half-day hunts for four youths during the spring. Youth hunters are selected annually through a lottery system, which allows each hunter one half-day hunt on tracts adjacent to the Great Pee Dee River.

Hunting of small game (snipe, waterfowl, rabbit, gray squirrel, raccoon, and opossum) is permitted in designated areas with seasonal regulations that may vary by refuge units. Dogs can be used only for duck, snipe, raccoon, and squirrel.

Waterfowl hunting has traditionally concentrated around the managed wetlands and rice fields, which often attract large concentrations of wintering waterfowl. The refuge currently does not own or manage any managed wetlands. Waterfowl hunting on refuge-owned lands is limited to Saturdays only in bottomland hardwood habitats located along the Great Pee Dee River within Unit 1. Waterfowl hunting on public waters throughout the refuge acquisition boundary is not controlled by the refuge.

Wildlife Observation and Photography

Wildlife viewing and photography programs are being developed on the refuge to the extent that funding and staffing will allow. Several areas of the refuge provide potential visitors with opportunities for good wildlife observation, photography, and hiking experiences. The Cox Ferry Lake Recreation Area is currently under construction and to date most of the funding for this project has been made available through private donations. This recreation area is closed to hunting and once open will allow year-round access for wildlife observation and wildlife photography. In addition to the new recreation area, a new environmental education center has been designed and is under contract and should be open to the public in 2008. Hiking trails on this site, along with tracts located nearby, will offer numerous other opportunities for wildlife observation and wildlife photography. Sensitive areas where wildlife disturbance or conflicts with other user groups could become problematic may be closed to the public on a seasonal or permanent basis to resolve these issues. The potential for partnerships, lease agreements, or other arrangements that would allow visitors to observe and/or photograph red-cockaded woodpeckers on the Sandy Island properties exists and the refuge continues to pursue these partnerships.

When appropriate, wildlife observation areas will be developed to allow visitors opportunities to view focus species, such as bald eagles, swallow-tailed kites, wading birds, waterfowl, and deer. At this time, tools, such as spotting scopes, binoculars, remote cameras trained on wildlife, videos that show wildlife that visit during different times of the year, and web sites, are not provided.

Potential conflicts between wildlife observation/photography opportunities and hunting activities have been eliminated by closure of one area to hiking during designated refuge hunts. During hunting periods, hiking/wildlife observation is permitted on at least one day/week.

Hiking is permitted along the Great Pee Dee River and Bull Creek at the Highway 701 Bridge just north of Yauhannah Lake. Excellent opportunities for wildlife observation and wildlife photography can be found by boating through Big and Little Bull creeks.

Environmental Education and Interpretation

Currently, Waccamaw Refuge participates in an Earth Stewards Program developed by the SEWEE Cooperating Association. Earth Stewards is a nine week program with classes being taught twice weekly on freshwater ecosystems. Teachers are trained to conduct most of the in-classroom lesson plans with refuge and SEWEE Association staff conducting the lesson plans dealing with live animals. There are a total of three field trips to the refuge. All programs are correlated to State education standards. Plantersville and Brown's Ferry Elementary Schools participate in this program. The refuge has been participating in Earth Stewards since 2002.

A second environmental education program with Waccamaw NWR staff participation is the EIC Program (Environment in Context of Learning). The refuge and SEWEE Association staff serve as mentors for students from the Waccamaw Middle School. The program consists of classroom presentations and a field trip to Sandy Island where students participate in four environmental education activities. Sandy Island, within the refuge acquisition boundary, is currently owned by the South Carolina Department of Transportation and managed by the Nature Conservancy.

Refuge and SEWEE staffs also conduct environmental education programs for the Georgetown Family YMCA and day care centers sponsored by local churches.

Waccamaw NWR does not have a Visitor Services' Plan. After the CCP is completed, the refuge will develop a step-down Visitor Services' Plan. Descriptions of specific materials, signs, exhibits and displays, and themes to promote the six priority public uses adopted by the Service would be addressed in this step-down plan. It would address specific visitor service activities, including facility requirements, site design, conceptual themes, and handicapped accessibility. This plan would also address the specific services (e.g., eco-tourism opportunities, such as guided tours) the refuge could provide local communities, as well as the cooperative partnerships to increase awareness of fish and wildlife resources and systematically improve visitor experiences within the area.

Issues related to refuge management will be addressed in the step-down plan. Current and future staffing needs to implement the recommendations within the plan will also be addressed. The plan will include budgetary needs and current databases, as well as explore opportunities for funding and partnerships to help the refuge accomplish the recommendations within the plan. The plan will include a system for monitoring and evaluating the effectiveness of the visitor services' program annually. The plan will be comprehensive, covering all aspects of the visitor services' program in detail, including fee programs, universal accessibility, use of dedicated areas such as wilderness, use of concessions, etc.

The refuge office/visitor contact station is currently housed in a small office in Georgetown previously occupied by the SCDNR. The facilities, although small, have an impressive array of literature and brochures providing visitors with information on the refuge, other South Carolina refuges, and the National Wildlife Refuge System, as well as a number of other publications of local/area interest (i.e., shell fishing guidelines and coastal boating regulations). A large bulletin board provides visitors with other pertinent information and images of the refuge. The Service emblem is prominently displayed on the outside of the building and a "Waccamaw National Wildlife Refuge" sign is visible in front of the building, facing the street.

Refuge personnel assist visitors including many who are seeking information on SCDNR areas of expertise. Partly due to continuing acquisition of refuge tracts and mainly due to funding and staffing shortages, information/interpretive kiosks, entrance signs, and directional signs are not yet in place.

Refuge regulations are communicated primarily via refuge hunt brochures, the tear sheet, boundary/closed area signs, and by personal contacts in the field, refuge office and over the telephone.

As time allows, SEWEE Center staff and the refuge manager provide various interpretation programs on an "as needed" basis. The refuge manager provides presentations for civic groups and organizations. There is a strong demand for staff participation at local events, such as Bass Pro Shop events. Two videos, "Winyah Bay Focus Area Task Force" (20 minutes) and "Voices of Winyah Bay" (15 minutes) are distributed by the refuge manager to promote issues and land protection for the refuge and partners. The primary interpretive message of these videos is to protect lands and cultural values from future development.

There are currently no interpretive facilities at the refuge; however, a new environmental education center has been designed and is currently under contract to build in 2008. Refuge and complex staffs have developed a list of preferred themes and messages that will be explored and developed in more detail as part of the exhibit design process for the new environmental education center. Messages will be developed about the rice culture, Native American people, waterfowl, fishing, the black bear, neotropical migratory birds, etc. Once a full-time refuge park ranger is hired at Waccamaw NWR, the refuge manager will pursue the development of interpretive kiosks, signs, brochures, and trails for the refuge.

PERSONNEL, OPERATIONS, AND MAINTENANCE

Waccamaw NWR is relatively new and lacks sufficient facilities, lands, staff, and funds to support the full complement of services that could be potentially managed on the refuge. The refuge has two permanent full-time employees: a Refuge Manager (GS-12) and an Assistant Refuge Manager (GS-11). The refuge shares one full-time law enforcement officer with the four refuges in the complex. The assistant refuge manager is also a dual function (collateral duty) officer. One day of each week, SEWEE Association staff provides assistance with environmental education and outreach within the local area. Waccamaw NWR's annual budget in FY07 is anticipated to be approximately \$323,000. Waccamaw NWR is part of the South Carolina Lowcountry Refuge Complex and, consequently, this allows for sharing of personnel and equipment between refuges when necessary to meet many of the challenges associated with a new and expanding refuge.

The refuge headquarters, contact station, and a maintenance yard are temporarily located in Georgetown in a rented office building. A new refuge office and visitor center is planned and construction may begin in 2007. The new facility will be located between the cities of Georgetown and Conway on Highway 701 at Yauhannah Bluff. The facility will offer opportunities for information, interpretation, and environmental education. Waccamaw NWR presently is accessible by boat and lacks facilities and signage except for boundary signs – the most visible indication of the national wildlife refuge. No refuge roads are open for the public's use at this time.

Partnerships and Volunteers

Waccamaw NWR currently has an active volunteer program, but it is not formally managed. Volunteers are recruited informally by word of mouth and just walk-ins. Individuals assist the refuge staff in activities such as grass mowing, boundary posting, habitat management, and many other refuge management needs. No formal training is provided to the volunteers.

Waccamaw NWR enjoys active, productive partnerships with a number of agencies, institutions, and individuals. Among these are the SCDNR, The Nature Conservancy (TNC), SEWEE Association, Historic Ricefield Association (HRA), and Winyah Bay Focus Area Task Force (of the North American Waterfowl Management Plan).

The refuge is part of a dynamic and growing partnership with the SEWEE Association, which also supports programs at the Cape Romain and ACE Basin refuges. The SEWEE Association supports the environmental education at Waccamaw NWR. The SEWEE Association provides financial and technical support and serves as a liaison between the refuge and local communities.

Currently, the refuge does not have an official Friends Group, named as such, but the SEWEE Association fulfills many of the functions of a Friends Group.

III. Plan Development

PUBLIC INVOLVEMENT AND THE PLANNING PROCESS

Generally speaking, scoping refers to the process by which the planning team gathers input from a variety of internal and external sources as to what the key issues, concerns, and opportunities are that need to be addressed in the comprehensive conservation plan. Internal scoping sources include the refuge staff itself, and other Service biologists and professionals in the region. External scoping sources include concerned private citizens; research and educational institutions; members of conservation, sportsmen and civic groups; refuge neighbors; members of the community; and State, Tribal, and local agencies. These various interests are sometimes referred to collectively as stakeholders, that is, those individuals and groups that have a stake in how the refuge is managed. In developing the Draft CCP/EA for Waccamaw NWR, the planning team conducted both internal and external scoping.

The first step in developing the refuge's Draft CCP/EA was a Biological Review that took place starting June 4, 2003. The review team included eight Service biologists and managers and non-Service managers/biologists. The review involved on-site evaluations to help the refuge meet its purpose and determine the role(s) this refuge could play regarding wildlife needs/objectives at various geographical scales (i.e., local, ecosystem, regional, and national). The approach was to take a holistic look for achieving refuge and landscape-level conservation needs, while still giving priority to accomplishing the original purpose of refuge establishment. The Biological Review report (USFWS 2003) includes background information on the refuge that was evaluated by reviewers, as well as the recommendations developed by the review team. In keeping with the terminology and expected outcomes of the Draft CCP/EA process, these recommendations took the form of goals, objectives, and strategies for the management of the refuge's biological resources. These preliminary goals, objectives, and strategies were studied by the planning team and modified and adapted for this Draft CCP/EA.

A Visitor Services Review was conducted in 2005 in preparation for the upcoming Draft CCP/EA. The 3-member review team consisted of Service personnel from the Region – Visitor Services and Outreach, a representative of Cape Romain NWR, and a representative of Santee NWR. The review team met with refuge staff to discuss the visitor services' program. The staff explained what the visitor services' program is currently doing to provide recreational, educational, and interpretive opportunities on the refuge. The refuge manager and assistant refuge manager conducted a tour with the review team of all the different public use areas on the refuge. After the refuge tour and discussions with some of the staff and the Sewee Center Director, the review team met to discuss the current status of the programs and to make recommendations. On the final day of the review, the team presented the recommendations to the staff and had an open discussion of the pros and cons of the various recommendations. Later the team prepared a report (USFWS 2005) with a number of recommendations for improving and expanding upon visitor services' facilities and operations.

The nucleus of the CCP planning team itself – composed of the refuge manager and a contractor with experience in preparing CCP's – met for the first time on February 1-2, 2006, for a tour of the refuge and an overview of its habitat and wildlife resources and public use programs, facilities, and opportunities. At this time, the planning team also conducted additional internal scoping and prepared a preliminary schedule and plans for public involvement.

Scoping continued with two open houses and public meetings on May 1-2, 2006. Since the refuge itself does not have meeting or conference facilities, the scoping meetings were held at the J.B. Beck Administrative and Education Center in Georgetown and at the Coastal Carolina University Center for Marine and Wetland Studies in Conway. Approximately 15 members of the public attended the open house and scoping meeting on each day. Attendees were able to mingle at leisure with refuge staff, ask questions, provide comments, and look at exhibits and maps on hand. Contractor Eveline Martin, a consultant with Mangi Environmental Group, tasked to assist the Service in its planning effort, gave a PowerPoint slide presentation and talk on the CCP process. The public was able to express its concerns about the refuge and ideas and suggestions for its future management in writing on a comment form that was distributed for attendees and other interested parties. Written comments could either be submitted right at the meeting, mailed subsequently, or sent via email. A total of 82 comment forms and letters was received during scoping for this Draft CCP/EA.

SUMMARY OF ISSUES, CONCERNS, AND OPPORTUNITIES

The planning team identified a number of issues, concerns, and opportunities related to fish and wildlife protection, habitat restoration, recreation, and management of threatened and endangered species. Additionally, the planning team considered Federal and State mandates, as well as applicable local ordinances, regulations, and plans. The team also directed the process of obtaining public input through two public open house/scoping meetings, open planning team meetings, comment forms, email communication, and personal contacts. All public and advisory team comments were considered; however, some issues important to the public fall outside the scope of the decision to be made within this planning process. The team has considered all issues that were raised through this planning process, and has developed a plan that attempts to balance the competing opinions regarding important issues. The team identified those issues that, in the team's best professional judgment, are most significant to the refuge. A summary of the significant issues follows.

FISH AND WILDLIFE POPULATION AND HABITAT MANAGEMENT

- Provide a complex of intensively and passively managed wood duck habitat.
- Maintain high-quality habitat for priority landbirds associated with mature forested wetlands.
- Provide high-quality breeding marshbird habitat.
- Provide secure nesting sites and ample foraging habitat for long-legged waders.
- Provide both northbound and southbound shorebird foraging sites.
- Provide secure nesting and roosting sites for bald eagles.
- Reduce deer herd density to improve herd health and improve habitat quality for other species.
- Encourage private landowners to provide additional moist-soil habitat and greentree reservoirs to complement the refuge habitat management programs.
- Control invasive species and protect native communities by keeping canals and water delivery systems functional.
- Develop a management plan for the control of feral hogs.
- Perpetuate, restore, and research longleaf pine ecosystems.
- Maintain a healthy fishery in the waters associated with the refuge.
- Use prescribed fire as a land management tool.
- Keep Waccamaw NWR a sanctuary for protecting and managing threatened and endangered species.
- Make the recovery of the redbreast sunfish a high priority.

RESOURCE PROTECTION

- Regulate jet skis and other significant recreational/social issues affecting wildlife.
- Restrict the type of boat traffic allowed. Boat wakes and noise are disruptive and damaging; would like to see a ban on jet skis and perhaps a speed limit on boats over 20 feet.
- Disallow activities in the refuge that are incompatible with its use, such as road building and residential and commercial development.
- Continue to cooperate with the South Carolina Department of Transportation on the Highway 701 connector (road for evacuation route) and other new road construction-related issues that may affect the refuge.
- Keep the refuge as it was intended, not an easy target for road building because of its remote location. Concern was expressed about the possible road that may be planned that would cut through the refuge.
- Keep the refuge clean and non-littered.
- Safeguard drinking water quality.
- Make encroaching development an important issue.

VISITOR SERVICES

- Establish an environmental education and interpretation center to provide ongoing programs for children and adults to learn and appreciate the refuge's flora and fauna.
- Develop a portable exhibit to be used in the current refuge entryway for visitors stopping at the office after hours. The exhibit can also be used as a loaner for special events.
- Involve the SEWEE Association in the development of interpretive media concepts. Conduct a design workshop to develop conceptual drawings and narratives.
- Concentrate initial efforts to develop facilities and programs at the Yauhannah Bluff Visitor Center site. After annual funding is secured, expand programs to include the Causey Tract (with build up to include the International Paper lands as they are acquired) and the Haulover site.
- Increase wildlife observation opportunities by enhancing the trail system, adding interpretive panels and brochures.
- Collect recreation fees for quota hunts, and any additional activities that qualify to be in the recreation fee program.
- Place kiosks at 3 boat launches and develop a "welcome/waiting" shelter at the Cox Ferry Lake Landing.
- Expand youth hunts to possibly include deer, small game, and/or waterfowl.
- Consider establishing a hunt for persons with disabilities as additional parcels of land (which are not island parcels) are acquired. The Yauhannah Tract may lend itself to this type of hunt program.
- Work with SCDNR and establish zones for various boat types and motor horse powers to help achieve a balance of allowed uses, to reduce user conflicts, and to reduce and minimize conflicts and wildlife disturbance.
- Host annual youth fishing day during National Fishing Week or National Wildlife Refuge Week.
- Improve access for bank fishing on the refuge for anglers with disabilities.
- Develop interpretive signs at Yauhannah Landing wildlife trail.
- Construct an observation/photography blind at Causey Tract.
- Establish and develop canoe trail route and post signs.
- Establish an "Adopt a swallow-tailed kite" program.
- Conduct environmental education programs for students visiting the refuge and visitor center. These are one-time field trips which are requested by teachers (not associated with Earth Stewards or the EIC programs).
- Maintain the area's excellent hunting, fishing, and outdoor recreation.

REFUGE ADMINISTRATION

- Continue to foster partnerships. Develop marketing and communication strategies for fostering fund raising and potential partnerships.
- Continue land acquisition.
- Hire a park ranger/staff to manage the visitor services, visitor center, outreach, and volunteer program.
- Hire a park ranger that would be dedicated to public use programs.
- Develop a volunteer program to assist with: greeting and orienting the public; conducting routine office assignments and maintenance activities around the Yauhannah Bluff; conducting environmental education programs; and seeking grants.
- Partner with Coastal Carolina University and/or Horry County Technical College and develop an on-going internship program for students in environmental studies program.

WILDERNESS REVIEW

All lands and waters of the Refuge System outside of Alaska and not currently designated as wilderness are subject to a wilderness review. Wilderness reviews are conducted concurrent with a CCP, and a summary of the review incorporated into the plan. The purpose of the wilderness review is to identify and recommend for congressional designation Refuge System lands and waters that merit inclusion in the National Wilderness Preservation System (NWPS).

The wilderness review process is conducted in three phases: inventory, study, and recommendation. The inventory phase is a broad look at the planning area to identify lands and waters that meet the minimum criteria for wilderness and warrant further study for wilderness designation. These criteria include every area of at least 5,000 contiguous roadless acres or roadless areas sufficient in size to make practicable their preservation and use in an unimpaired condition; or be a roadless island of any size. Areas meeting these criteria are considered wilderness inventory areas. Wilderness inventory areas are then further evaluated for naturalness, opportunities for solitude or primitive and unconfined recreation, and special or supplemental values. Those areas that meet these criteria are identified as wilderness study areas (WSAs).

In the study phase, each WSA is evaluated, through careful analysis of alternative management options, to determine its suitability for wilderness designation. The analysis considers all values (e.g., ecological, recreational, cultural, economic, symbolic), resources (e.g., wildlife, water, vegetation, minerals, soils), refuge uses, and refuge management activities within the WSA, and includes an evaluation of whether the WSA can be effectively managed to preserve its wilderness character.

The findings of the study determine whether a WSA, or portion of a WSA, will be recommended for designation as wilderness. Wilderness recommendations are forwarded or reported from the Director through the Secretary and the President to Congress in a wilderness study report.

The Service inventoried refuge lands within the planning area and found one area (Bull Island) that meets the eligibility criteria for a WSA as defined by the Wilderness Act. Therefore, this Draft CCP/EA includes an objective and strategies related to wilderness stewardship. The results of the wilderness review are included in Section C, Appendix VIII.

IV. Management Direction

INTRODUCTION

The Service manages fish and wildlife habitats, considering the needs of all resources in decision-making. But first and foremost, fish and wildlife conservation assumes priority in refuge management. A requirement of the National Wildlife Refuge System Improvement Act of 1997 is for the Service to maintain the ecological health, diversity, and integrity of refuges. Public uses are allowed if they are appropriate and compatible with wildlife and habitat conservation. The Service has identified six priority wildlife-dependent public uses. Hunting, fishing, wildlife observation, wildlife photography, and environmental education and interpretation are therefore emphasized in this Draft CCP/EA.

Described below is the proposed management direction for Waccamaw NWR over the next 15 years. This management direction contains the goals, objectives, and strategies that will be used to achieve the refuge vision.

Four alternatives for managing the refuge were considered: A - Current Management Direction (No Action); B - Habitat Restoration/Enhancements on Unit 1; C - Habitat Restoration/Enhancements on All Units; and D - Optimize Habitat Management and Visitor Services. Each of these alternatives is described in Section B, under Alternatives. The Service chose Alternative D (Optimize Habitat Management and Visitor Services) as the proposed management direction.

Implementing the proposed alternative will result in important benefits to both wildlife and habitat, as well as to the visiting public, within the refuge proper, its acquisition boundary, and the wider Winyah Bay and Savannah/Santee/Pee Dee Rivers ecosystems. Additional lands will be acquired and managed, more intensive habitat management through such means as prescribed fire will be conducted, environmental education and interpretation will be expanded through a new visitor center and in the community at large, and natural resources will receive greater protection.

VISION

Waccamaw NWR was established in 1997 to protect and manage diverse habitat components within an important coastal river ecosystem for the benefit of threatened and endangered species, freshwater and anadromous fish, migratory birds, and forest wildlife, including a wide array of plants and animals associated with bottomland hardwood habitats. Its intent was also to provide compatible wildlife-dependent recreational activities, including hunting, fishing, wildlife observation, wildlife photography, and environmental education and interpretation, for present and future generations.

Since its establishment, the refuge has focused on land acquisition within the authorized acquisition boundary, including purchase of Bull Island, the Causey Tract, Yauhannah Bluff, and five tracts from International Paper, for a total of 10,590 acres acquired within the 54,000-acre acquisition boundary. In addition to these fee simple purchases, the refuge has cooperated closely with partners in the conservation and management of other lands within the refuge's acquisition boundary. For example, 9,100-acre Sandy Island was acquired by the South Carolina Department of Transportation (SCDOT) and is managed jointly by the Nature Conservancy, a non-profit, non-governmental group, and SCDNR. In addition, 8,000 acres were acquired by SCDOT from Georgia Pacific (a forest products company) and transferred to SCDNR for management. A signed lease agreement between the

Service and SCDNR includes this tract in the refuge proper and has facilitated further cooperation. Overall, approximately 75 percent of the lands and habitat identified within the refuge's acquisition boundary has now been protected by the Service, partnering agencies, and private landowners.

The refuge will develop an administrative office and visitor center on Yauhannah Bluff and other public use facilities on the Causey Tract. These facilities will enable the refuge to expand its innovative environmental education and interpretive programs, which have been actively supported by the local community and school district. The refuge has also honored its commitment to promote hunting and fishing opportunities on newly acquired properties and will make a concerted effort to maintain these traditional uses. Waccamaw NWR will continue to utilize creative partnerships to purchase valuable habitats from willing sellers within the authorized acquisition boundary. Each of these proposed endeavors will assist Waccamaw NWR in achieving the purposes for which it was established.

GOALS, OBJECTIVES, AND STRATEGIES

The goals, objectives, and strategies presented are the Service's response to the issues, concerns, and needs expressed by the planning team, the refuge staff and partners, and the public and are presented in hierarchical format. Chapter V, Plan Implementation, identifies the projects associated with the various strategies.

These goals, objectives, and strategies reflect the Service's commitment to achieve the mandates of the National Wildlife Refuge System Improvement Act of 1997, the mission of the National Wildlife Refuge System, and the purposes and vision of Waccamaw NWR. The Service intends to accomplish these goals, objectives, and strategies within the next 15 years.

FISH AND WILDLIFE POPULATION MANAGEMENT

Goal: In support of national and regional plans, promote management actions that will support viable populations of native fish and wildlife species associated with blackwater and alluvial forested wetlands, with special emphasis on migratory birds, black bear, and threatened and endangered species.

Discussion: The waters, marshes, and dense bottomland forests of Waccamaw NWR attract and sustain populations of freshwater and anadromous fish, migratory waterfowl, neotropical migratory birds, and forest wildlife, including a wide variety of plants and animals associated with bottomland hardwood habitats. In addition, the refuge provides an actual or prospective home for certain plants and animals that are listed by the Service as threatened or endangered. Prominent birds and mammals, such as the bald eagle, wood stork, swallow-tailed kite, and black bear, are found on the refuge, as are many less conspicuous vertebrates and invertebrates.

Objective: Migratory Waterfowl

Within 5 years of CCP approval, improve wintering waterfowl habitat on approximately 600 acres on Unit 1 by restoring hydrology through plugging drainage ditches and leveling pine plantation beds. Also conduct restoration and enhancement on historic rice fields on approximately 400 acres in Units 2 and 3 over the life of the CCP.

Discussion: Coastal South Carolina has long been noted for its abundance of diverse and quality over-wintering habitats and their significance to migratory waterfowl. The Winyah Bay drainage area, which includes the entire refuge acquisition boundary, stands out as one of the most extensive, intact wetland complexes in the southeastern United States. The wetland habitats in the refuge acquisition area range from forested, riverine floodplains to an extensive freshwater deltaic fan. The deltaic fan,

in turn, contains a diversity of habitats, such as managed wetlands, abandoned and unmanaged tidal ricefields, creeks, and flats. Acre-for-acre, the managed wetlands of the Winyah Bay Focus Area winter more ducks than any comparable habitat in South Carolina. In addition to over-wintering habitats, the Waccamaw River serves as a flight corridor for waterfowl migrating along the coastal wetland wintering grounds. The forested wetlands, where mature trees are present, also provide important nesting habitat for wood ducks and hooded mergansers.

Strategies:

- Conduct monthly aerial waterfowl surveys (Nov-Feb) for freshwater marsh and forested wetland habitats.
- Conduct bi-monthly ground waterfowl surveys (Oct-Mar) for all managed wetland complexes on the refuge.
- As appropriate, consult with other refuges with experience in modifying hydrology by plugging ditches or leveling pine plantation beds to expedite each action and improve prospects for success.

Objective: Neotropical Migratory Birds

Within 10 years of CCP approval, increase scrub/shrub habitat by approximately 600 acres on Unit 1. Commence formal surveys of swallow-tailed kites and Swainson's warblers within 5 years of CCP approval.

Discussion: The refuge contains extensive, contiguous floodplain forested wetlands interspersed with a diversity of habitat components, such as isolated hummocks, remnant dikes, and a natural ridge and swale topography. This mosaic of habitats has a direct bearing on specific breeding nongame birds, particularly neotropical migratory birds, and their presence and use of existing habitats. Point count surveys have further demonstrated the importance of this wetland habitat diversity to several high-priority species, such as swallow-tailed kites and Swainson's warblers. Additionally, contiguous forested wetland ecosystems represented within the Great Pee Dee and Waccamaw watersheds undoubtedly serve as important habitat for transient neotropical migratory species, as well as feeding, foraging, and nesting habitat for other temperate migratory and resident species.

The Southeast Partners in Flight (PIF) Working Group, a consortium of State and Federal agencies, conservation organizations, and industrial and non-industrial landowners have worked over the last decade to establish priorities for the southeastern physiographic areas. These priorities are then stepped down to establish goals and objectives for each State. Within South Carolina, PIF cooperators have reviewed South Atlantic Coastal Plain priorities for each major drainage area. Within the Pee Dee-Waccamaw watershed, PIF has identified specific population and spatial goals for swallow-tailed kites, and black-throated green, Swainson's, and prothonotary warblers.

For swallow-tailed kites, PIF has targeted one population of between 80-100 pairs for the Pee Dee-Waccamaw drainage. This is part of a regional target for at least 13 populations of swallow-tailed kites within the southeast's forested floodplain systems outside of peninsular Florida. At least 100,000 acres of mostly mature forested wetlands are known to support 80-100 pairs of swallow-tailed kites within coastal plain systems. Swallow-tailed kites appear to do well where these largely forested areas are under active management, as they feed over open areas, including clearcuts, but are not found in healthy numbers in systems where much of the landscape has been converted to farmland or development. Kites also appear to require small patches of tall trees (90-100 feet in height) overlooking the forested floodplain for nesting. Protection and improved management

targeting future nest site characteristics within the refuge would provide an important anchor for increasing the stability of a now small swallow-tailed kite population within the Winyah Bay area.

Within the Pee Dee-Waccamaw drainage, spatial objectives for black-throated green, prothonotary, and Swainson's warblers would be covered by spatial objectives of the swallow-tailed kite. However, the habitats required by these species do differ. PIF's population goals for the entire Pee Dee-Waccamaw watershed for these species are:

- Black-throated green warbler: at least 1 healthy population.
- Swainson's warbler: at least 5 healthy populations.
- Prothonotary warbler: at least 5 healthy populations.

Spatial requirements for supporting a healthy Swainson's warbler population appears to be somewhere between 6,000 and 10,000 acres and should be adequately covered within the spatial objectives for swallow-tailed kite as described above. Swainson's warblers occur most frequently at the drier end of the forested wetland continuum, where dense understories of switchcane and other understory plants are best supported. The zone most optimal for supporting Swainson's warblers coincides with forested wetlands that historically were most likely to be converted to other uses (e.g., farmland and industrial pine). Where timber production is not a priority, as on the refuge, small clearcuts (from ½ acre to 5 acres) within a mostly mature forested system can produce excellent Swainson's warbler habitat as thickly vegetated regeneration advances between the sapling and the pole stage. The preferred habitat for Swainson's warblers corresponds closely to Deciduous Forested Wetlands--Temporarily and Seasonally Flooded Tidal. Within the refuge acquisition boundary, 4,810 acres of this forested wetland type is found mostly around Bull Island (along elevated levees) and along the Great Pee Dee drainage.

There does not appear to be a high-priority need for active forest management on most of Waccamaw NWR, at least for forested wetland-dependent migratory birds. Perhaps the most important management need is to ensure that substantial dense understory conditions are maintained on the temporarily seasonally flooded stands along the Great Pee Dee brownwater section of the refuge.

Strategies:

- Annually survey for nesting swallow-tailed kites.
- Identify forest stands considered potentially suitable for supporting dense patches of understory vegetation and determine whether some active management may be needed to open canopies.
- Work with adjacent landowners in both swallow-tailed kite surveys and managing stands for Swainson's warbler, while also searching for habitats that may support black-throated green warblers.
- Resist calls to impound forested wetlands for developing greentree reservoirs in areas that should support Swainson's warblers and other forest understory associated species.
- Develop and implement point count surveys in representative forest habitats in association with South Carolina/Fish and Wildlife Service Coastal Program in Charleston.

Objective: Black Bear

Target refuge acquisition and habitat restoration efforts within wetland corridors to improve connectivity between bear populations. Also conduct annual surveys of black bears within 5 years of CCP approval, in addition to enlisting public participation in gathering sightings.

Discussion: Temporarily flooded bottomland forests provide ideal habitat for many species of mammals. Food and cover are abundant and diverse, and a variety of mammalian species are present. This includes South Carolina's largest native omnivore, the black bear, which is primarily associated with upland forests joined by extensive forested wetland corridors. There are two populations of the American black bear in South Carolina, one located in the mountainous region and the other in the northern coastal plain. The coastal population, conservatively estimated at 200-300 bears, occurs primarily in Georgetown and Horry counties.

The best habitat for black bears is managed forest dominated by hardwoods and containing a variety of mast-producing tree and shrub species intermixed with early successional vegetation, such as blackberries and pokeberries. Bears typically require extensive, rugged country with limited road systems to reduce human/bear interaction and dense thickets, swamps, and bays. The bulk of their omnivorous diet consists of hard and soft mast, insects, animal matter, and succulent plants.

Black bears need large expanses of forest interspersed with early successional areas which provide food and escape cover. Early successional areas also furnish a backup source of food during poor mast-producing years. A minimum of 5,000 acres of such habitat is required before bear management practices may be of any benefit. Waccamaw NWR and surrounding wildlands more than meet this minimum requirement, but protecting corridors between larger patches of habitat will be essential to conserving bear populations in fast-growing Georgetown and Horry counties.

Strategies:

- Consult authorities on black bear management, including the SCDNR Wildlife Management Section's black bear management strategies at: <http://www.dnr.sc.gov/wildlife/publications/pdf/bear.pdf>.
- In managing hardwood forests like those that predominate at Waccamaw NWR, 110-year-old rotations are adequate when den capability is retained.
- Stands selected for harvest should be small (no more than 25 acres) and widely dispersed.
- Retain at least 5 to 10 percent old growth in protective zones and use inclusions.
- On wet sites where bedding and drainage are applied, retain large, dense titi bays, pocosins, bottomland hardwoods, and swamps (up to one-third of the unit area) for escape and foraging cover.
- Retain gum-cypress swamps.
- Retain trees with large cavities (openings 5 inches in diameter or more) whenever they occur with some sheltering stems around.
- Protect 300-foot-wide streamside zones.
- Do not regenerate more than 10 percent of a management unit in any 10-year period.
- Manage timber for a combination of 65-70 percent oak-hardwood mast producing age and 20-30 percent early successional growth. This provides abundant soft mast and herbaceous foods at early stages of stand development.
- Conduct thinnings; thinnings encourage seed production by stimulating the development of full, vigorous crowns and by maintaining suitable understories. (Possible benefits must be weighed against the detrimental effects of disturbance and road construction.)
- In areas of thin understory development, thin early and as frequently as silviculturally practical.
- Avoid use of herbicides and retain important mast-producing understory species.
- Do not develop pure stands through intermediate cuts.
- Prescribed burning cycles of 3-5 years in appropriate habitats reduce large sprouts to new growth and remove much of the "rough" that suppresses desirable herbaceous growth. In

general, burning improves palatability and nutrition of understory plants and stimulates some types of fruit production.

- In stands selected for harvesting, retain and release some groups of large diameter trees with the potential to develop elevated cavities in remote areas. (One of the main aims of bear management is to maintain the availability of suitable winter dens.)
- Limit access to areas managed for bear, as well as surrounding areas. There should be a maximum of one mile of road per five square miles of habitat. Close roads using gates.
- Close and reseed logging roads following harvests.

Objective: Threatened and Endangered Species

Proposed hydrology restoration on Unit 1 will enhance existing wood stork rookery. Restore wood stork feeding areas on Unit 3 and red-cockaded woodpecker nesting and foraging habitat on Unit 2.

Discussion: Six (formerly eight including the peregrine falcon and bald eagle, since delisted) federally listed threatened and endangered species are known to occur or potentially occur within the proposed boundary of the refuge. These include three species of birds, one species of fish, and three species of plants. They are as follows:

Red-cockaded woodpecker (*Picoides borealis*) - Endangered. Red-cockaded woodpeckers are known to nest in the refuge acquisition boundary, with the principal population residing in the mature pine forest of Sandy Island. Specific data on this population and its status are lacking because the area was privately owned until recently and access to conduct surveys was not provided.

Wood stork (*Mycteria americana*) - Endangered. Wood stork nesting has been observed within the refuge acquisition boundary; however, there are no rookeries currently on refuge lands. The contiguous mature blocks of wetland ecosystems provide suitable habitat for wood storks to nest, forage, and roost. Wood storks have been observed foraging and loafing on refuge lands and throughout the refuge acquisition boundary. Nesting has not been documented immediately adjacent to one refuge tract.

Shortnose sturgeon (*Acipenser brevirostrum*) - Endangered. The shortnose sturgeon is found in the rivers and creeks.

Pondberry (*Lindera melissifolia*)- Endangered. Although not known to occur in the refuge acquisition boundary, potential habitat is present on Sandy Island and in other pineland areas.

Canby's dropwort (*Oxypolis canbyi*)- Endangered. Although not known to occur in the refuge acquisition boundary, potential habitat is present on Sandy Island and in other pineland areas.

American chaffseed (*Schwalbea americana*) - Endangered. Although not known to occur in the refuge acquisition boundary, potential habitat is present on Sandy Island and in other pineland areas.

Bald eagle (*Haliaeetus leucocephalus*) – (Recently De-listed as Threatened). The number of occupied breeding areas for bald eagles in South Carolina was at a low of 13 in 1977, when studies began, and has increased to 181 in 2003, fledging 224 young (Murphy, SCDNR personal correspondence 2003). The bald eagle is primarily associated with coasts, rivers, and lakes, usually nesting near bodies of water where it feeds (U.S. Fish and Wildlife Service 1992b). There is one documented nest within in the refuge acquisition boundary immediately adjacent to a refuge tract. Eagles have also been documented feeding and roosting in the area. In addition, a few migratory bald eagles have been noted moving through the area.

Species of Concern: Ten species of plants and animals, considered by the Service to be Species of Concern, are known to occur or potentially occur within the refuge acquisition boundary. Species of concern are those species for which available data suggest that a proposal to list the species may be appropriate, but conclusive data on vulnerability and threat are not currently available to support listing action. These species include the Bachman's sparrow (*Aimophila aestivalis*); Rafinesque's big-eared bat (*Plecotus rafinesquii*); Southeastern myotis bat (*Myotis austroriparius*); Carolina pygmy sunfish (*Elassoma boehlkei*); eulophia (*pteroglossapis ecristata*); Sarvis holly (*Ilex amelanchier*); pondspice (*Listea aestivalis*); Carolina birds-in-a-nest (*Macbridea caroliniana*); Carolina grass-of-parnassus (*Parnassia caroliniana*); and Well's pixie moss (*Pyxidanthera barbulata* var. *brevifolia*).

Strategies:

- Conduct a thorough assessment of the red-cockaded woodpecker (RCW) population size and condition of its habitat.
- Use prescribed fire and thinning to establish and maintain RCW habitat on the refuge's pine-dominated areas with sandy soils.
- Provide for secure nesting rookery and feeding sites for wood storks by implementing the Southeast Regional Wood Stork management Guidelines around known nesting sites.
- Provide for secure nesting and roosting sites for bald eagles by implementing the Southeast Regional Bald Eagle Management Guidelines around known nest sites.

Objective: Wood Duck

Improve brood habitat on 10 acres in Unit 1 within 7 years of CCP approval. Improve brood and wintering habitat on 300 acres in Units 2 and 3 within 10 years of CCP approval. Increase number of maintained wood duck nest boxes up to a total of 50 within 5 years of plan approval. Establish a long-term banding site within 7 years of CCP approval.

Discussion: The Southeastern Region of the Fish and Wildlife Service encourages and promotes management activities to increase wood duck productivity on Service lands. Additionally, the region places high priority on banding objectives for wood ducks. Wood duck nest boxes can make a positive contribution to the wellbeing of this species, if they are properly constructed, located and erected, predator proofed, and managed (maintained). Research studies have documented a lack of suitable natural cavities in the southeast.

Waccamaw NWR provides year-round nesting and brood-rearing habitat for wood ducks. The complex of open water, tidal rice fields, forested wetlands, bottomland hardwoods, beaver ponds, and scrub/shrub and aquatic vegetation on Waccamaw NWR provides the necessary habitat for the life cycle requirements of wood ducks. There is an abundance of wood ducks on Waccamaw NWR according to Service personnel and SCDNR personnel. The Sandy Island Unit of Waccamaw NWR likely serves as an important wood duck roost and/or sanctuary. Waccamaw NWR does have a wood duck nest box program; however, a wood duck banding program has yet to be established.

Strategies:

- Conduct aerial surveys annually during fall/winter to determine numbers and specific locations of wood duck roost(s).
- Erect and maintain Area Closed to Hunting signs in the general area of the roosts.

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- Become familiar with and follow the Service's handbook entitled, "Increasing Wood Duck Productivity-Guidelines for Management and Banding for Refuge Lands (Southeast Region)" updated in 2003 by the Division of Migratory Birds.
 - Erect nest boxes in refuge-owned tidal wetlands throughout Units 1, 2, and 3 in line with the budgetary and personnel capability to assure annual maintenance, repair, and checking/refurbishing of boxes.
 - Maintain dense scrub/shrub vegetation, retain beaver ponds and manage for stands of emergent or floating vegetation (50-70 percent vegetated: 30-50 percent open water) in managed wetland habitats.
 - Integrate waterbird objectives and strategies for king rail, least bittern, and purple gallinule habitat where feasible with habitat needs for wood duck broods.

Objective: Colonial Nesting Water Birds

Proposed hydrology restoration on Unit 1 within five years of CCP approval will enhance opportunities for colonial nesting water bird rookeries. Restore colonial water bird feeding areas on Unit 3 within seven years of CCP approval. Inventory, map, and monitor on an annual basis within five years of CCP approval.

Discussion: Generally speaking, colonial nesting water birds have plenty of habitats available on the refuge, but the issue of how much disturbance these nesting birds can tolerate is a key to protecting the species. If the refuge staff find nesting areas at remote sites (from the standpoint of public use), it may be worthwhile to occasionally monitor the site(s) for potential disturbance problems and make entry adjustments accordingly. In other situations where colonies form and there is existing public use nearby, there is less reason for concern. The main issue is change in public use around established colony sites.

Species of conservation interest in the South Atlantic Coastal Plain include little blue heron, tricolored heron, black-crowned night-heron, yellow-crowned night-heron, wood stork, and white ibis. Daily observations of these species, their numbers, and use of the refuge would provide valuable information for guiding future management decisions, again in line with what is needed for brooding wood duck and later use by migrating and wintering waterfowl.

Strategies:

- Provide for both secure nesting sites and ample foraging habitat.
- Locate nesting sites for colonial waterbird species each year and determine if special measures are needed to reduce disturbance.
- Determine use of managed wetlands and flooded agriculture during post-breeding periods, concurrently with southbound shorebird surveys.

Objective: Marshbirds

Continue to maintain freshwater tidal emergent marsh used by marshbirds. Acquire approximately 300 acres of tidal or managed wetlands in Units 2 and 3 within seven years of CCP approval. Conduct intensive marshbird surveys during nesting season.

Discussion: All of the priority marshbirds that are found at Waccamaw NWR require tall emergent vegetation as part of their habitat. All are breeding species, except American bittern. Breeding populations of pied-billed grebe and American coot are considered of regional conservation interest,

even though wintering populations are considered secure. Of the marshbirds of conservation interest, king rail is of highest concern, followed by least bittern and purple gallinule.

Most waterfowl-oriented management, especially for wintering populations, is geared away from promoting tall emergent vegetation. Tall emergent vegetation, including cattail, big bulrush, and other species can be aggressive and take over impoundments without careful control. However, the number of species that require tall emergent vegetation suggests that some degree of middle ground is required to cover both the needs of waterfowl and priority marshbirds.

During the last several decades in the eastern United States, overall loss of freshwater emergent wetlands has been underway as development pressures increase, especially away from immediate coastlines. The king rail, in particular, is thought to have declined dramatically in inland areas and is now considered to be a species in potentially serious trouble away from coastal areas. The least bittern likely has never been common in the inner coastal plain, but is likely also suffering from freshwater wetland losses in recent decades. The purple gallinule is close to the northern edge of its distribution at Waccamaw NWR, but is also a species that may be in decline locally, if not regionally. All these factors considered together suggest that Waccamaw NWR is well-positioned to support healthy habitat for these and other marshbird species, when in the surrounding areas such habitat is now likely very scattered and in decline.

Most of the available habitat at the refuge is supported in former rice fields, where dikes have deteriorated and water flow is completely influenced by river water levels. Nevertheless, there appears to be substantial tall emergent habitat available, which should support at least king rails and least bitterns in healthy numbers.

The king rail, by being the highest priority marshbird, may serve as an umbrella species for the other priority marshbirds. It may be the most habitat-specialized of the species nesting in tall emergent vegetation. Its nests are constructed near the soil, usually where standing water depths are about 10 inches. Higher water levels have the potential to flood out the species and little or no standing water potentially exposes nests to greater depredation pressure from raccoons, etc. These conditions should support nesting least bitterns as well, with nests usually placed higher in the vegetation making this species more tolerant of deeper flooding.

Density estimates for breeding pairs of king rails are extremely variable and more work is needed here to allow us to establish specific population and habitat objectives. However, from the data that do exist, it appears realistic that to support one pair at least five acres of tall emergent vegetation are required. Other estimates suggest 20 acres may be necessary to support a pair, but there is no information to determine the relative quality of habitat or the accuracy of these estimates. Assuming that a minimum of five acres and a maximum of 20 acres is necessary to support at least one pair and all the marshland acres are in suitable condition for king rails (see below), then somewhere between 31-126 pairs of king rails could be supported at Waccamaw NWR. At the low end of habitat area, close to 100 percent should be in tall emergent vegetation with water on the surface but no more than 10 inches in depth, preferably with some topographic variation within the patch.

Small patches of tall emergent marshes may suffer from elevated depredation pressure, so more emphasis should be given to maintaining suitable marshland in larger patches wherever possible. In these larger patches, it is desirable to manage and maintain some proportion of open water and short emergent vegetation. Such conditions should also be favored by breeding pied-billed grebes, purple gallinules, and American coots.

Strategies:

- Focus specific attention to promoting tall emergent vegetation in a way that would support a sizeable breeding king rail (between 40-180 pairs) and least bittern population spread across all four units.
- Promote 50-70 percent in tall emergent vegetation, with remaining 30-50 percent in open water, floating vegetation, and submergent aquatic vegetation in support of breeding purple gallinules, pied-billed grebes, and American coots, as well as brooding wood duck and wintering waterfowl.
- Reinitiate marshbird call-back survey points used by SCDNR in the early 1990s and contribute to ongoing secretive marshbird survey data presently coordinated by Courtney Conway, BRD-University of Arizona.

Objective: White-tailed Deer

Over lifetime of CCP, reduce deer herd density to improve herd health and improve habitat quality for other species.

Discussion: Based on the first deer population health evaluation completed in July 2005, the herd was found to be in excess of nutritional carrying capacity based on the syndrome of parasitism/malnutrition, which tends to be largely dependent on deer density. In addition, when habitat carrying capacity is exceeded, competition for limited food resources results in over-browsing by deer. Severe over-browsing alters plant species composition, distribution, and abundance, and reduces understory structural diversity. Ultimately, these changes may negatively affect other mammal species and bird species that use the understory for nesting and/or foraging.

Strategies:

- Strive to maintain a well-balanced and healthy deer herd to prevent overpopulation and habitat destruction.
- Maintain or increase current levels of deer hunts.
- Enlist the services of the Southeastern Cooperative Wildlife Disease Study Group to evaluate the overall deer herd health once every five years.
- Collect age, sex, and general health data on samples of harvested deer to gauge overall herd condition.

Objective: Reptiles and Amphibians

Restore isolated wetlands within five years of CCP approval to improve breeding areas of amphibians. Increase managed wetland habitats by approximately 300 acres on Unit 3 within seven years of CCP approval that would benefit reptiles and amphibians. Within five years of CCP approval, determine presence/absence of amphibian and reptile species on refuge.

Discussion: About 100 species of amphibians and reptiles are likely to occur on the refuge or within the refuge acquisition boundary. Aquatic salamanders common to the area include the greater siren, eastern lesser siren, two-toed amphiuma, dwarf water dog, and broken-striped newt. The most common terrestrial salamanders are the marbled salamander and the slimy salamander. The most commonly encountered frogs are the bull frog, southern leopard frog, and green treefrog. The American alligator is the largest reptile in the area. The brown water snake and eastern cottonmouth

are probably the most widespread and abundant snakes. The Florida cooter and the yellowbelly slider are the most commonly encountered turtles.

Strategy:

- Conduct baseline amphibian/reptiles surveys using various methods (e.g., pitfall traps, cover boards, and vocalization surveys) for major refuge habitat types.

Objective: Invasive Animal Species

Increase control of feral hogs by hunting and trapping.

Discussion: Feral hogs are currently limited to the lower portions of the refuge acquisition boundary and the most effective control has been through public hunting programs. The rooting and wallowing activities of feral hogs cause serious erosion to river banks and areas along streams. Wild hogs carry diseases such as swine brucellosis. They also compete for food with native wildlife, particularly mast such as acorns, which are an important food for both wild turkey and deer. Furthermore, feral hogs create wallows in wet sites, impinging on the integrity of the plant and soil community.

Strategies:

- Increase hunting pressure by the combination of deer and feral hog archery hunts and feral hog-only archery and muzzleloader hunts.
- Continue as much as possible the practice of incidental take of feral hogs by Service personnel during performance of routine duties.
- Explore the possibility of issuing special use permits for one or more local parties willing to trap feral hogs on the refuge.
- Develop an outreach program that focuses on the impact and potential sources of invasive species like feral hogs and techniques for eradication.
- Partner with other agencies and cooperate with neighbors to find and implement the most effective means of reducing and permanently controlling the feral hog population.

HABITAT MANAGEMENT

Goal: Conserve, manage, and enhance natural diversity, abundance, and ecological functions of refuge habitats in support of national and regional plans, with special emphasis on managing towards old growth bottomland forest habitats.

Discussion: As shown in Table 1, Waccamaw NWR habitats are dominated by blackwater and alluvial forested wetlands, also described as semi-permanently flooded tidal deciduous forested wetlands and seasonally flooded tidal deciduous forested wetlands, respectively. These habitats form dense stands of vegetation throughout the floodplains of the Great Pee Dee, Little Pee Dee, and Waccamaw Rivers and support diverse fauna, among them neotropical migratory birds, waterfowl, black bear, and threatened and endangered species.

Objective: Open Water

Monitor water quality, contaminants, impacts of jet skis, and vegetation trends on open water throughout the refuge using partnerships.

Discussion: This category includes all non-vegetated freshwater bodies. Among these are bays, lakes, ponds, and rivers. Approximately 2,430 acres of open water occur in the refuge acquisition boundary. Most of the open water is regulated by the State of South Carolina.

Water quality within the Great Pee Dee River Basin ranges from excellent to degraded, depending on local point source water discharges, non-point source runoff, and natural conditions. The refuge area itself is relatively undisturbed with no industrial activity. Thus, significant water quality issues and problems typical of industrialized areas are not expected to be present. However, some areas of localized water quality degradation may be present due to municipal wastewater discharges and the presence of environmental contaminants from upstream sources, such as leaking underground fuel storage tanks and old or illegal garbage dumps containing agricultural chemicals, discarded automotive batteries and oil products, and other contaminant-bearing substances.

The rivers and tributaries within the study area are generally characterized by naturally occurring low levels of dissolved oxygen (DO) and low pH. While naturally occurring low DO and pH do not preclude a diverse and abundant endemic aquatic community, these characteristics do result in riverine systems that are much more sensitive to anthropogenic (human) inputs of pollutants and contaminants due to the systems' reduced assimilative capacity. Because of the Waccamaw River's naturally occurring low DO levels, the State of South Carolina has established a site-specific standard of 4 mg/l rather than 5 mg/l for the river.

South Carolina's Water Classifications system establishes appropriate classified water uses to be achieved and protected. The Little Pee Dee River is classified as ORW (Outstanding Resource Waters), which are waters of exceptional recreational or ecological importance or of unusual value. The Great Pee Dee River is classified FW (freshwaters suitable for primary and secondary contact recreation, as a source for drinking water supply after conventional treatment, fishing, and industrial and agricultural uses) from the North Carolina State line to its confluence with Thoroughfare Creek. Downstream of Thoroughfare Creek, the Great Pee Dee River is classified SB, tidal saltwaters suitable for primary and secondary contact recreation, crabbing, and fishing, except harvesting of clams, mussels, or oysters for market purposes or human consumption. Similarly, the Waccamaw River is classified FW upstream of U.S. Highway 17 Bridge and SHF (Shellfish Harvesting Waters) downstream.

The refuge is still relatively undisturbed due to its comparative isolation from the rapid growth and development of the Grand Strand. Nonetheless, non-point source urban runoff and coastal resort development pose recognizable threats to the area's water quality and associated aquatic habitats. The extensive development of golf courses in the Grand Strand and Waccamaw Neck areas, particularly along the river systems that border the eastern side of the study area, has resulted in surface water contamination and runoff into adjacent aquatic habitats. Furthermore, the demand for clean water and wastewater treatment created by high-density resort development is placing additional burdens on the system. Three water intake facilities and two treated wastewater discharges are located within the refuge vicinity. The wastewater discharges, in particular, may potentially impact the water quality in the immediate vicinity of the discharges via the input of high levels of chlorine, fecal coliform, and nutrients, such as phosphorus and ammonia, as well as other pollutants and contaminants. Another potential additional impact associated with water service facilities is the fragmentation of forested wetlands from the clearing and ditching required for the installation and maintenance of water intake stations. As the coastal population grows, it is foreseeable that these demands have the potential to increase substantially, and may result in accumulative impacts on the associated aquatic habitats.

One known contaminant in the area is mercury. In 1994, the South Carolina Department of Health and Environmental Control issued a fish consumption advisory for 13 rivers in South Carolina,

including the Great and Little Pee Dee and Waccamaw Rivers. This advisory was prompted by the detection of elevated levels of mercury in several species of fish throughout these river systems. Ironically, high levels of mercury have not been found in the river water or in riverbed sediment samples. No known identifiable source for this high level of mercury has been determined, and 29 other States are experiencing the same phenomena.

Strategies:

- Consult and work with the South Carolina Department of Health and Environmental Control 1993 to develop an appropriate water quality monitoring protocol for the refuge, which would include locations to be monitored, frequency, sampling methods, and parameters to be measured.
- At a minimum, collect long-term data on the following water quality parameters: dissolved oxygen, suspended solids, dissolved solids, turbidity, pH, oil and grease, nutrients (nitrogen and phosphorus) and mercury. Mercury concentrations should be monitored in water column, sediments, and fish tissues.
- In monitoring and assessing jet skis impacts, select a minimum of two sites with similar physical attributes but varying by amount of jet skis use; the site with little or less jet skis use will serve as the experimental control. These sites should be observed over time and extent of jet skis use closely tracked.

Objective: Freshwater Marshes

Monitor water quality, jet skis impacts, and vegetation trends on freshwater marshes throughout the refuge using partnerships.

Discussion: This category includes freshwater wetlands dominated by emergent vegetation. The majority of this habitat type is tidally influenced. Freshwater marshes remain flooded or saturated except during extremely dry weather cycles. Most of the freshwater marshes are crisscrossed with abandoned dikes and canals that were constructed for rice cultivation during the 18th and 19th Centuries. Plant diversity is greater here than within any other wetland habitat type in the refuge area. Among the most common species are giant cutgrass, pickerelweed, jewelweed, water parsnip, yellow pond-lily, water hemlock, arrowhead, rose mallow, soft-stem bulrush, cattail, white water lily, and alligator weed. Woody vegetation, such as tag alder, bald-cypress, buttonbush, tupelo, and black gum, may be interspersed on the old rice field levees. Approximately 2,923 acres of this habitat occur within the refuge acquisition area.

Strategies:

- Consult and work with the South Carolina Department of Health and Environmental Control 1993 to develop an appropriate water quality monitoring protocol for the refuge, which would include locations to be monitored, frequency, sampling methods, and parameters to be measured.
- At a minimum, collect long-term data on the following water quality parameters: dissolved oxygen, suspended solids, dissolved solids, turbidity, pH, oil and grease, nutrients (nitrogen and phosphorus) and mercury. Mercury concentrations should be monitored in water column, sediments, and fish tissues.

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- In monitoring and assessing jet skis impacts, select a minimum of two sites with similar physical attributes but varying by amount of jet skis use; the site with little or less jet skis use will serve as the experimental control. These sites should be observed over time and extent of jet skis use closely tracked.

Objective: Managed Wetlands

Acquire, restore, develop, and improve moist-soil and submerged aquatic vegetation (SAV) management, and infrastructure and monitoring on a total of 1,029 existing and newly acquired acres within 10 years of CCP approval.

Discussion: This category includes former rice field areas impounded by dikes or levees, where the hydrology is usually manipulated for the purpose of promoting plant species that are beneficial to waterfowl. The hydrological regimes are controlled by the impoundment managers. Most impoundments are managed for emergent vegetation, including waterfowl foods such as smartweed, fall panicum, wild millet(s), Asiatic and dayflower. Cultivated grains may be also planted during drawdown periods. Approximately 629 acres of managed wetlands occur within the southernmost portions of the refuge acquisition boundary.

Strategies:

- Acquire lands suitable for developing managed wetlands, to eventually provide 500 acres of well-managed moist-soil and/or permanent water impoundments to help meet migrating and wintering needs of dabbling and other wetland birds.
- In the short term (1-5 years), provide at least one to three moist-soil impoundments (100-200 acres) to help meet forage and special use requirements of dabbling ducks. "Prior converted" croplands that are adjacent to the boundary of the refuge, near refuge bottomland hardwoods and available from willing sellers, should be considered for meeting this objective.
- In the long term (3-10 years), an additional 200-400 of managed wetlands should be developed.

Objective: Upland Forests

Within the 15-year life of the CCP, prescribe burn 6,362 acres of upland forest on a 3-year cycle while maintaining unique plant communities.

Discussion: This category includes any area that does not meet the definition of wetland or deepwater habitat as classified by Cowardin et al. (1979). Approximately 6,362 acres of upland forest occur within the refuge acquisition boundary. The majority of these uplands occur on Sandy Island. The upland plant communities on Sandy Island are diverse and include a maritime sandhill community, longleaf pine savannahs, and flatwoods with intermittent inclusions of small evergreen and deciduous depressions, pocosins, freshwater depression meadows, broad-leaved deciduous swamps, and pond pine woodlands. The maritime sandhill community on Sandy Island appears to be the only known site of this type in the State. The predominant vegetative community on Sandy Island is the longleaf pine/turkey oak type typically found within the Lakeland Fine Sand Ridges and covers approximately 3,000 acres. This is a natural pine stand that is developing into a mature forest community. Many of the longleaf pines are well in excess of 100 years old. Longleaf pine forests and savannahs, such as those on Sandy Island, were recently identified as a nationally critically endangered ecosystem. Of the 74 million acres that once existed, less than four million

acres exist now in scattered remnants, and not many of these contain the entire components of the ecosystem. Most of the other upland acreage within the refuge acquisition area is pine forest lands under silvicultural management within Unit 1.

Strategies:

- Work closely with the fire management staff from nearby refuges and South Carolina Division of Forestry to conduct prescribed burns on refuge lands.
- Monitor the effects of fire on upland forest vegetation.
- Avoid prescribed burns near known red-cockaded woodpecker cavities during nesting season.

Objective: Bottomland Hardwoods

Over the course of the CCP, thin 461 acres of bottomland hardwoods where needed to develop understory vegetation and encourage oaks, mimicking tree fall gaps, and convert other forest types to bottomland hardwoods where soils are appropriate.

Discussion: These areas normally remain flooded or saturated throughout the winter and for brief periods during the spring. Diurnal tides have little or no influence on the hydrology of this wetland type. This habitat usually occurs at the higher elevations within the floodplain. Typical plant species include swamp chestnut oak, water oak, cherrybark oak, loblolly pine, several species of hickories, white oak, tulip poplar, ironwood, sycamore, and sweetgum.

Strategies:

- Manage stands for old growth mast producing hardwoods to provide habitat for wintering and resident waterfowl and key neotropical migratory birds, including swallow-tailed kites.
- Restore hydrology on newly acquired tracts to improve natural flooding and dewatering and other wetland functions.
- Control beavers where necessary to alleviate hydrological manipulation during the growing season.
- Replant trees targeting top mast producing hardwoods in areas altered by previous land uses.

Objective: Cypress-Gum Forest

Where opportunities exist on the 25,077 acres of cypress-gum forest on the refuge, harvest overabundant red maple to ensure cypress and gum regenerate, manage for old growth cypress and tupelo, and ensure natural water regime.

Discussion: These areas remain flooded or saturated throughout most years except during extreme drought periods. Water depth may periodically fluctuate as a result of tidal influences. Plant community composition is relatively homogeneous. Dominant species include swamp tupelo, bald-cypress, green ash, water tupelo, and red maple. Approximately 25,077 acres of this habitat type occur in the refuge acquisition area.

Strategies:

- Manage stands for old growth cypress and tupelo to provide bird and bat roosting and nesting habitat on Waccamaw NWR.

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- Thin dense tupelo stands that are suppressing pockets of cypress regeneration as a method of restoring this species component.
 - Using commercial sales or herbicide or mechanical techniques, manage the structure of the stands to provide quality habitat for the management species.
 - Monitor the stand structure and composition and the response to management actions for refinement of goals, objectives, and practices in relation to wildlife population trends in these stands.

Objective: Controlling Invasive Plant Species

Within 5 years of CCP approval, map areas of invasive plant species on the entire refuge and develop control/eradication plans for each species.

Discussion: Invasive species control on Waccamaw NWR has primarily been limited to annual treatment of terrestrial plants on known sites of infestation throughout the refuge. The primary focus has been on kudzu and Chinese privet on upland sites where access and current funding have allowed effective control. Aquatic invasive plants are known to occur in isolated locations throughout the refuge; however, no herbicide application(s) have been performed to date. These plant species include water hyacinth and phragmites.

The fast-growing kudzu vine persists along roadbanks and appears to be spreading into disturbed areas, fields, and the edges of forests; it is now widespread in the southeastern United States. It reproduces both by seeds and its tuberous roots and is difficult to eradicate. The aggressive Chinese privet shrub often forms dense thickets, particularly in bottomland forests and along fencerows. It colonizes by root sprouts and spreads widely by abundant bird- and other animal-dispersed seeds.

Water hyacinth often forms monotypes across large areas. Water hyacinth invades lakes, ponds, rivers, marshes, and other wetland habitats. It reproduces mainly by vegetative means and can form dense floating mats of vegetation. These mats restrict light penetration, reducing the availability of light for submerged plants and aquatic invertebrates, and depleting oxygen levels. Phragmites is particularly widespread in brackish and freshwater marsh habitats along the Atlantic Coast. Vegetative spread by below-ground rhizomes can result in dense clones of phragmites with up to 200 stems per square meter. Invasion by phragmites alters the structure and function of marsh ecosystems by changing species composition, nutrient cycles, and hydrological regimes. Dense stands decrease native biodiversity and quality of wetland habitat, particularly for migrating wading birds and waterfowl.

Strategies:

- Protect, enhance, and restore native communities by treating and managing plant pest species as funds and staff time allow.
- Monitor, record, and map significant infestations by invasive plant species.
- Develop control/eradication plans for each species.
- Experiment with integrated approaches to invasive plant management, including the use of chemical, mechanical, and cultural methods.

RESOURCE PROTECTION

Goal: Identify, acquire, conserve and protect natural and cultural resources through partnerships, land protection programs, stewardship, and law enforcement.

Discussion: Four objectives are presented under the Resource Protection goal at Waccamaw NWR: land acquisition, cultural resources, law enforcement, and private lands. The land acquisition program, which has understandably dominated management efforts at this new refuge since its establishment, involves acquiring and protecting resource-rich lands within the refuge acquisition boundary. The cultural resources program, while not especially active to date due to resource constraints, aims to protect the refuge's ample cultural resources. Law enforcement helps prevent and solve infractions that can damage refuge resources. The private lands program works with private landowners within the refuge acquisition boundary to enhance wildlife habitat on their properties.

Objective: Land Acquisition

Continue to cooperate closely with partners to identify willing sellers within the acquisition boundary, while seeking funds outside of the Land and Water Conservation Fund (LWCF) to secure these properties. In addition, work with partners to identify and protect corridors intended to facilitate black bear movement. This may include refuge expansion and using available LWCF funding for acquisition.

Discussion: Waccamaw NWR is currently just over 18,000 acres in size. In 2006, a lease agreement between the Fish and Wildlife Service and SCDNR was approved by the South Carolina Budget and Control Board, adding the 7,661-acre Bucksport WMA to the refuge, bringing its total acreage to just over 18,000 acres. By incorporating this additional land into the refuge, much of the core area along the Waccamaw River (Unit 1) will be protected. Lands along the Big and Little Pee Dee Rivers need to be the next focus for refuge land acquisition. Connecting wetland corridors for black bear movement to and from the refuge is also a high priority for land acquisition. Special consideration should be given to adding key corridors that may not currently be within the refuge acquisition boundary.

Strategies:

- Acquire strategic bottomland hardwoods within the refuge acquisition boundary along the Big and Little Pee Dee Rivers to connect river wildlife corridors.
- Work with TNC and other partners to acquire a portion of the Haulover Tract and other strategic tracts along the Great Pee Dee River.
- Add key wetland corridors to the refuge acquisition boundary through a minor expansion.
- Identify areas where highest priority corridors for migratory birds and large mammals should be added to the current acquisition boundary.

Objective: Cultural Resources

Within 15 years of CCP approval, develop and begin to implement a Cultural Resources Management Plan.

Discussion: The area in which the refuge is located has abundant cultural resources and a rich history. Waccamaw follows standard National Historic Preservation Act Section 106 procedures to protect the public's interest in preserving the cultural and historic legacy that may potentially occur on the refuge. Whenever construction work is undertaken that involves any excavation with heavy earthmoving equipment, such as tractors, graders and bulldozers, the refuge contracts with a qualified archaeologist or cultural resources expert to conduct an archaeological survey of the subject property. The results of this survey are submitted to the Service's Regional Historic Preservation Officer and the State Historic Preservation Office (SHPO). The SHPO reviews the surveys and determines whether cultural resources will be impacted, that is, whether any properties listed in or eligible for listing in the National Register of Historic Places will be affected. If cultural

resources are actually encountered during construction activities, the refuge is to notify the SHPO immediately. To date, only one tract on the refuge has been determined to be eligible for the National Register of Historic Places. This tract of land is the Yauhannah Bluff Tract, which is the future site for the new environmental education center. Both Phase 1 and 2 archaeological surveys have been conducted on this site.

Strategies:

- Conduct a Phase I archaeological survey of the non-flooded areas of the refuge by qualified personnel, as a necessary first step in cultural resources management.
- Conduct a Phase II investigation if archaeological resources are identified during the Phase I survey. In this second phase, the eligibility of identified resources for listing on the National Register of Historic Places is evaluated prior to any disturbance.
- Conduct a Phase III data recovery if the resources identified in Phases I and II are determined to be eligible. This will recover data and mitigate the adverse effects of any undertaking.
- Prepare a Cultural Resources Management Plan for the refuge.
- Follow procedures outlined in the Cultural Resources Management Plan for consultation with the Service's Regional Historic Preservation Office, the State Historic Preservation Office, and potentially interested American Indian tribes.
- Follow procedures detailed in the Cultural Resources Management Plan for inadvertent discoveries of human remains.
- Ensure archaeological and cultural values are described, identified, and taken into consideration prior to implementing undertakings.
- Develop a step-down plan for surveying lands to identify archaeological resources and for developing a preservation program.

Objective: Law Enforcement

Provide 1.0 FTE position for the refuge in addition to one dual function or seasonal officer.

Discussion: The Service currently has one full-time law enforcement (LE) officer who covers the four refuges (including Waccamaw) in the South Carolina Lowcountry Complex and one collateral duty LE specifically assigned to Waccamaw NWR. The typical areas of concern include trespass, trash/refuse dumping, compliance with hunting regulations, vandalism, arson wildfires, and wildlife disturbance.

Strategies:

- Continue to cooperate with law enforcement authorities in Georgetown, Horry, and Marion Counties on preventing and solving crime within and adjacent to the refuge acquisition boundary.
- Work closely with State conservation officers during hunting and fishing seasons.

Objective: Private Lands

Continue to work with 3-5 landowners at any one time within acquisition boundary to enhance and protect habitat and wildlife resources on their properties.

Discussion: The importance of the Waccamaw NWR to waterfowl and other migratory birds is well known, and, the potential to provide additional habitat for the benefit of Federal Trust species (i.e., migratory birds) on nearby private lands has been very successful on lands adjoining the refuge. The

Partners for Fish and Wildlife Program is the Service's primary mechanism for delivering voluntary on-the-ground habitat improvement projects on private lands for the benefit of Federal trust species. Under this program, technical and financial assistance is provided to landowners to help meet the habitat needs of Federal trust species on private lands. The objectives of the Partners for Fish and Wildlife Program are to promote and implement habitat improvement projects that benefit Federal trust species; provide conservation leadership; promote partnerships; encourage public understanding and participation, and work with USDA to implement its conservation programs. Habitat improvement practices include habitat restoration, enhancement, and establishment. The highest funding priority status is awarded to proposed projects on private lands that will complement activities on National Wildlife Refuge System lands or contribute to the resolution of problems on refuges that are caused by off-refuge land use practices.

In 1997, the South Carolina Partners program was established to provide landowner incentives and technical assistance in an effort to improve wetland management practices on private lands near Waccamaw NWR. The Partners program is currently made up of State, Federal, and private partners, including Duck Unlimited, NRCS, SCDNR, Historic Ricefields Association, and the Fish and Wildlife Service. One of the primary targets of these funds has been to replace old inferior water control structures with the rice trunk style water control structures.

In addition to collaborating with South Carolina Partners, the refuge staff has been very involved in landowner technical assistance on private lands throughout the acquisition boundary and beyond. In 1999, the refuge played a significant role in assisting a group of landowners with a water management problem on a major wood stork rookery located along the Waccamaw River. Through funding from the Service's Partners for Fish and Wildlife program, a new water control structure was installed, which improved the hydrology of the rookery and ultimately has protected the fourth largest rookery in South Carolina.

Strategies:

- Encourage private landowners to provide additional moist-soil habitat and greentree reservoirs to complement the refuge habitat management programs.
- Continue to work closely with the South Carolina Partners for Fish and Wildlife office to identify and prioritize areas eligible for enrollment in the Partners for Fish and Wildlife Program.
- Educate neighboring landowners on the problems and issues facing the refuge.

Objective: Bull Island Wilderness Study Area

Include Bull Island as a Wilderness Study Area (WSA), maintain its wilderness character, and within ten years of CCP approval, prepare a wilderness study report on whether Bull Island should be recommended for formal designation as a unit of the National Wilderness Preservation System (NWPS).

Discussion: All lands and waters of the Refuge System outside of Alaska and not currently designated wilderness are subject to a wilderness review, the results of which are summarized in Section C, Appendix VIII. The purpose of the wilderness review is to identify and recommend for congressional designation Refuge System lands and waters that merit inclusion in the NWPS.

The wilderness review process is conducted in three phases: inventory, study, and recommendation. The inventory phase is a broad look at the planning area to identify lands and waters that meet the minimum criteria for wilderness and warrant further study for wilderness designation. These criteria include every area of at least 5,000 contiguous roadless acres or roadless areas sufficient in size to make practicable their preservation and use in an unimpaired condition; or be a roadless island of

any size. Areas meeting these criteria are considered wilderness inventory areas. Wilderness inventory areas are then further evaluated for naturalness, opportunities for solitude or primitive and unconfined recreation, and special or supplemental values. Those areas that meet these criteria are identified as wilderness study areas (WSAs).

The findings of the study determine whether a WSA, or portion of a WSA, will be recommended for designation as wilderness. Wilderness recommendations are forwarded or reported from the Director of the Fish and Wildlife Service through the Secretary of the Department of the Interior and the President to Congress in a wilderness study report. The Service inventoried refuge lands within the planning area and found one area (4,600-acre Bull Island) that meets the eligibility criteria for a WSA as defined by the Wilderness Act.

Bull Island was intensively logged but the last logging operations took place close to 100 years ago. The island has recovered from past logging activity and now exhibits century-old bottomland hardwood forests and forested wetlands. The island is one of the most remote areas on the refuge and provides excellent opportunities for solitude or primitive and unconfined types of wildlife-dependent recreation. Continuing to manage Bull Island as wilderness is in keeping with the establishing purposes of Waccamaw NWR, and management will be able to effectively maintain the island's wilderness character.

Strategies:

- Continue to maintain the wilderness character of Bull Island while it is a WSA by generally prohibiting motorized access and motorized equipment (by the Service, as well as the public).
- Motorized access and use of motorized equipment within the WSA may be authorized by the refuge manager only if such access and use constitute the minimum tool necessary to accomplish wilderness objectives.
- Attempt to use primitive tools for work within the WSA where possible.
- Notify the public that Bull Island is now a WSA and that only access by foot will be permitted pending a final decision on wilderness designation.
- Consult expertise within the Service's Regional Office in the preparation of a wilderness study report for submittal to the Director of the Fish and Wildlife Service and subsequently to the President and Congress.

VISITOR SERVICES

Goal: Provide opportunities for quality, wildlife-dependent public uses, leading to greater understanding and enjoyment of fish, wildlife, and habitats contained within the Winyah Bay Focus Area.

Discussion: Popular recreation uses on the refuge include hunting, and recreational and commercial fishing. Hunting for white-tailed deer, waterfowl, and small game is very popular. Recreational fishing is primarily limited to the main river systems and smaller tributaries that are not blocked and not considered private property. Recreational boating, waterskiing, canoeing, kayaking, swimming, bird watching and wildlife observation are also very popular activities conducted in this area. Boat access within and adjacent to the refuge is provided by eight state- or county-maintained public boat launching ramps and four privately owned commercial marinas, making these activities more feasible.

The refuge headquarters, contact station, and a maintenance yard are temporarily located in Georgetown in a rented office building. A new refuge office and visitor center is planned for construction by 2007, to be located between Georgetown and Conway on Highway 701 at Yauhannah Bluff. The facility will offer opportunities for information, interpretation, and environmental education, as well as participation with local communities.

Objective: Visitor Services' Plan

Within 3 years of CCP completion, develop a Visitor Services' Plan to be used in expanding public use facilities and opportunities on the refuge.

Discussion: The refuge will develop a step-down Visitor Services' Plan. Descriptions of specific materials, signs, exhibits and displays, and themes to promote the six priority public uses adopted by the Service will be addressed in this step-down management plan. It will address specific visitor service activities, including facility requirements, site design, conceptual themes, and handicapped accessibility. This plan will also address the specific services, such as eco-tourism opportunities, the refuge could provide local communities, as well as cooperative partnerships to increase awareness of fish and wildlife resources and systematically improve visitor experiences within the area.

Issues related to refuge management will be addressed in the step-down plan. Current and future staffing needs to implement the recommendations within the plan will also be addressed. The plan will include budgetary needs and current databases, such as RONS and SAMMS, and will explore opportunities for funding and partnerships to help the refuge accomplish the recommendations within the plan. The plan will include a system for monitoring and evaluating the effectiveness of the visitor services' program annually. The plan should be comprehensive, covering all aspects of the program in detail, including fee programs, universal accessibility, use of dedicated areas such as wilderness, and use of concessions.

Strategies:

- Once there is dedicated visitor services' staff stationed at Waccamaw NWR, collect recreation fees for quota hunts, and any additional activities that qualify to be in the recreation fee program.
- Work with local communities, visiting public, and other special use groups to educate them on refuge management and regulations.
- Develop operations and maintenance projects to support plans.
- As visitor use sites are developed, attempt to concentrate appropriate visitor use activities on a few sites that can be more easily managed and maintained by limited staff and resources.

Objective: Visitor Center

Build and staff new visitor center at designated site on Yauhannah Bluff by 2008. Develop up to four nature trails associated with the visitor center at Yauhannah Bluff within 3 years of opening of the visitor center. Also develop a riverfront boardwalk and canoe/kayak access to Big Pee Dee River.

Discussion: The refuge office/visitor contact station is currently housed in a small office previously occupied by the SCDNR. Plans are underway to build a new visitor center and associated trails at Yauhannah Bluff.

Strategies:

- Develop an information kiosk for after-hour use at the Yauhannah Bluff refuge entrance (site of new office/visitor center).
- Fund audio/visual program and design in conjunction with interior exhibit planning for the proposed visitor center.
- Work closely with Regional Office recreation staff and one or more specialized exhibit contractors in planning, design, and installation of exhibits in the new visitor center. Take advantage of latest technologies to develop hands-on, interactive exhibits.
- Outfit a wet lab with state-of-the-art equipment accompanied by the latest technologies for audio/visual enhancements. The wet lab will provide a setting for a working classroom in which students can bring in field samples for processing and value-added learning experiences.

Objective: Hunting

Continue to provide seasonal hunting for deer, hog, turkey (including youth hunt), raccoon, squirrel, waterfowl, and snipe consistent with refuge and State regulations. Potentially open waterfowl hunting on the Jackson Bluff Tract; potentially open a youth waterfowl hunt on managed wetlands; potentially open a mobility-impaired hunt for deer and hog.

Discussion: Hunting is a primary use of the refuge. Hunting activities range from waterfowl to both small and big game hunting, with waterfowl and big game hunting being the most popular. Waccamaw NWR has one of the more liberal hunt programs of all the refuges in South Carolina (due in part to the traditional hunt uses of the refuge river systems dating back several hundred years). The refuge has an approved hunting plan dated November 21, 2003. A hunting brochure describing all the hunt species and regulations is available. The brochure serves as a permit and is required of all hunters. Waccamaw NWR offers a variety of hunting opportunities for white-tailed deer, turkey, feral hog, squirrel, and waterfowl in accordance with State regulations and seasons. Hunting is allowed on Bull Island and Big Swamp units. A refuge self-issuing permit and hunter safety training are required. The refuge also has a youth turkey hunt.

The refuge allows hunting of white-tailed deer with archery, muzzle loader, and modern weapons. Hunting of hogs and turkey is also permitted on designated hunting areas and small game may be harvested; snipe, waterfowl, rabbit, gray squirrel, raccoon, and opossum are permitted on designated hunting areas. Dogs may be used only for duck, snipe, raccoon, squirrel, and hog hunts.

Strategies:

- Update Hunt Plan annually.
- Maintain a quality public hunting program.
- Monitor all the hunts and make adjustments as needed.
- Youth Waterfowl Hunt Program would be a series of programs/classes to train young people in the proper ethics and safety factors of hunting, culminating with a day set aside for youth only.
- Prepare news releases for hunts as appropriate and send to major newspapers throughout South Carolina.
- Continue to emphasize safety and conservation messages in refuge hunting program.

Objective: Fishing

Maintain entire refuge open to fishing consistent with State regulations, except for Causey and Yauhannah Bluff tracts. Potentially allow mobility-impaired fishing access on Causey and Yauhannah Bluff tracts.

Discussion: About 70 species of fish are found within the refuge acquisition boundary. The area waters provide excellent year-round recreational fishing for freshwater fish, such as largemouth bass, redbreast sunfish, bluegill, redear sunfish, warmouth, pumpkinseed, black crappie, chain pickerel, redbfin pickerel, bowfin, and numerous native species of catfish, as well as one introduced species, the flathead catfish. Not surprisingly, fishing is very popular in the area.

The Waccamaw and the Great Pee Dee Rivers provide unimpeded upstream and downstream movement for all associated fish species. The rivers provide areas where visitors with boats can fish. These waters furnish nursery areas for freshwater fish species, as well as estuarine species, such as red drum, tarpon, striped mullet, and flounder. The rivers are connected to a myriad of oxbows, creeks, and small feeder streams interspersed throughout the floodplains and forested wetlands, forming a dynamic aquatic system that supports populations of sport and commercial fish. The State has jurisdiction over all the creeks and rivers bisecting the refuge; therefore the refuge has little control over this major public use program.

There are several popular county and private boat launches along the Great Pee Dee and Waccamaw Rivers. The refuge itself does not have or manage any boat launching facilities. Access to most of the refuge is controlled by State and private boat ramps along the Great Pee Dee and Waccamaw Rivers. Currently, the two rivers within the acquisition boundary provide the only areas where visitors with boats can fish. Bank fishing on refuge-owned parcels is allowed; however, these opportunities are limited because there is no road access for anglers. A boat is needed to access most bank locations, and most anglers with boats simply prefer to remain in their boats.

Recreational fishing success is dependent on river elevations, turbidity, and daily tidal influences. Recreational fishing is primarily limited to the main river systems and smaller tributaries that are not blocked and not considered private property. Freshwater commercial fishing within the refuge acquisition boundary has also been a traditional livelihood for many native South Carolinians. Seasonal shad fishing and year-round cat fishing contribute substantially to the incomes of many families, including the families that reside on Sandy Island.

Strategies:

- Develop an updated Fishing Plan as appropriate.
- Address fishing access/opportunities in the general refuge brochure and on the website.
- Work with SCDNR and establish zones for various boat types and motor horsepower to help achieve a balance of allowed uses, to reduce user conflicts, and to reduce and minimize conflicts and wildlife disturbance.
- Create a lake system if opportunities allow with future land acquisition, to provide better fishing opportunities for the non-boating public.
- Host annual youth fishing day during National Fishing Week or National Wildlife Refuge Week.
- Keep basic fishing information records, such as the number of local versus out-of-State anglers.

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- Continue to work with other law enforcement entities during fishing seasons to evaluate game fish populations and violations.
 - Improve access for bank fishing on the refuge for anglers with disabilities, including information and interpretive signs.

Objective: Environmental Education

In partnership with SEWEE Association, continue on- and off-site environmental education programs in Georgetown County Public Schools, including five elementary schools and one high school. Utilize new visitor center and Causey Tract public use area for expanded environmental education. Also, potentially partner with Coastal Carolina on Cox Ferry Lake Recreation Area, and utilize up to four nature trails near new visitor center for environmental education. Potentially use Sandy Island trails for environmental education. Expand environmental education into other schools in Georgetown County and into public schools in Horry and Marion Counties.

Discussion: Currently, Waccamaw NWR participates in an Earth Stewards Program, which was developed by the Cape Romain Refuge and SEWEE Cooperating Association. Earth Stewards is a 9-week program, with classes being taught twice weekly on freshwater ecosystems. Teachers are trained to conduct most of the in-classroom lessons, with refuge and SEWEE Association staff conducting the lessons dealing with live animals. There are a total of three field trips to the refuge. All programs are correlated to State education standards. Plantersville and Brown's Ferry Elementary Schools participate in this program. The refuge is in the third year of Earth Stewards.

A second environmental education program with Waccamaw NWR staff participation is the EIC Program (Environment in Context of Learning). The refuge and SEWEE Association staff serve as mentors for students from the Waccamaw Middle School. The program consists of classroom presentations and a field trip to Sandy Island where students participate in four environmental education activities. Sandy Island is managed by The Nature Conservancy and is within the refuge acquisition boundary.

Refuge and SEWEE staffs also conduct environmental education programs for the Georgetown Family YMCA and day care centers in local churches.

Waccamaw NWR is new (less than 10 years old) and is currently conducting more environmental education programs for area youth than many well-established refuges. This highlights the emphasis the refuge staff has placed on working with and educating the local community about the importance of the refuge.

Strategies:

- Continue to work with SEWEE Association on the Earth Stewards Program and EIC Program.
- Continue to provide environmental education programs to Family YMCA and local churches as grant monies are available through the SEWEE Association and other partners.
- Develop basic lesson plans for off-site programs.
- South Carolina Coastal Refuge Complex's supervisory park ranger should work with refuge and SEWEE Association staff and volunteers to develop key messages to be included in all refuge education and outreach programs.

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- Once a public use position has been dedicated to the refuge and the visitor center is operational, staff should expand the Earth Stewards program to key elementary schools in Georgetown and Conway. The Cox Ferry Recreation Area would be an ideal field trip onto the refuge for students of the Conway schools.
 - Refuge and SEWEE Association staff should contact area school principals and arrange to meet at teacher staff meetings to discuss the new visitor center and what it will have to offer their students.
 - After the visitor center is fully operational, invite principals, teachers, and other personnel (e.g., bus drivers, cooks, and janitors) to a weekend open house at the new visitor center. This could be coordinated with the SEWEE Association.
 - Conduct environmental education programs for students visiting the refuge and visitor center. These are one-time field trips which are requested by teachers (not associated with Earth Stewards or the EIC programs.)
 - Work with SEWEE Association to apply for grants to fund and hire an educator dedicated solely to Waccamaw NWR.
 - Develop and conduct teacher workshops.
 - Partner with Coastal Carolina University and/or Horry County Technical College to develop an on-going internship program for students in the environmental studies program.
 - Develop outdoor labs at strategic sites on refuge (e.g., Yauhannah Bluff, Cox Ferry Recreation Area, and Sandy Island).
 - Conduct workshops specific to science educators.
 - Partner with the other South Carolina coastal refuges to develop an environmental education program that would allow students from the same school/class to conduct activities on each refuge throughout the school year. Students could be provided with key topics about each refuge, thus strengthening their understanding of the National Wildlife Refuge System.
 - Conduct environmental education training for Service employees (perhaps in partnership with SEWEE Center).

Objective: Interpretation

Continue to provide interpretive programs to groups upon request and provide information to the public at the refuge office and on the website. There is potential for interpretive opportunities related to the wetland restoration site on Jackson Bluff and interpretive activities on Sandy Island. More interpretive opportunities will be provided in and around the new visitor center and the Cox Ferry Recreation Area. Interpretive materials will be located on existing trails at Yauhannah Tract and strategic boat landings within the acquisition boundary.

Discussion: There are currently no interpretive facilities at the refuge. The refuge and complex staff have developed a list of preferred themes and messages to be explored and developed in more detail as part of the exhibit design process for the proposed visitor center. Messages will be developed about the rice culture, Native American people, migratory birds, bottomland forests, etc. Once a full-time person is hired at Waccamaw NWR, the refuge manager will pursue the development of interpretive kiosks, signs, brochures, and trails for the refuge. Interpretive messages will be about key resource issues, such as the uniqueness of black water. Two documentary videos, "Winyah Bay Focus Area Task Force" (20 minutes) and "Voices of Winyah Bay" (15 minutes) are distributed by the refuge manager to promote issues and land protection for the refuge and partners. The primary interpretive message of these videos is to protect lands and cultural values from future development.

Strategies:

- Erect exhibit panel kiosks at the one or two boat landings that visitors would likely use to access various tracts within the refuge. The exhibit panels should include a revised version of the tear sheet map with pertinent information about hours of use, access points (including listing and location of public landing sites), closed areas, and other regulatory or restrictive information. It should also include basic descriptive information about the refuge, its habitats, and important species.
- Develop interpretive signs at Yauhannah Landing wildlife trail.
- Enlist the expertise of Waccamaw Indian people, Gullah residents, TNC, plantation managers, and Native Plant Society to develop exhibits and interpretive materials.
- Make sure all proposed indoor and outdoor exhibits are consistent (design, messages, themes, graphic standards, etc.).
- Enlist the support of an interpretive specialist to set goals and objectives, design messages, themes, and displays, and gather cost estimates for indoor and outdoor exhibits at Yauhannah Bluff. Use messages and site rendering as a marketing tool.
- Possible themes include:
 - Swallow-tailed kites
 - Black water forested wetlands, tidal forested, and emergent wetlands
 - Yauhannah – The Great Bluff
 - Rice farming
 - Longleaf pine-woodpecker-fire managements
 - Atlantic white cedar
 - Wood stork rookery
- Develop a brochure(s) interpreting routes and trails for all the refuge.
- Install a brochure rack at the visitor center complex gate for after-hours.

Objective: Wildlife Observation and Photography

Maintain Yauhannah Tract trails open to the public for observation and photography outside of hunting season. Continue to develop the Causey Tract public use area. When new visitor center is opened, additional opportunities will be developed along with new trails. Trails on Sandy Island will also provide opportunities. Canoe trails on the Waccamaw and Big Pee Dee Rivers and the addition of trails on the Haulover Tract will provide added opportunities within 15 years of CCP approval.

Discussion: Several areas of the refuge provide potential visitors with abundant opportunities for wildlife observation, photography and hiking experiences. These areas (with the exception of one hiking trail near the proposed visitor center site) have not been designated or identified on any refuge literature or signage. Some of these are in sensitive areas (for either wildlife disturbance or conflicts with human interaction). There is a potential for partnerships, lease agreements, or other arrangements that would allow visitors to observe and/or photograph red-cockaded woodpeckers on the Sandy Island properties.

When appropriate, wildlife observation areas will be developed to provide opportunities to view salient species such as bald eagles, swallow-tailed kites, wading birds, and waterfowl. At this time, tools, such as spotting scopes, binoculars, remote cameras trained on wildlife, videos that show wildlife that visit during other times of the year, and web sites, are not available.

Potential conflicts between wildlife observation/photography and hunting activities have been eliminated by closure of one area to hiking during designated refuge hunts. During hunting periods, hiking/wildlife observation is permitted on at least one day per week. Conversely, two areas have been set aside for year-round public access; however, they are closed to all hunting activities.

Hiking is permitted along the Great Pee Dee River and Bull Creek at the Highway 701 Bridge just north of Yauhannah Lake. Excellent opportunities for wildlife observation and photography can be found by boating through Big and Little Bull Creeks.

Strategies:

- Evaluate establishing swallow-tailed kite tours. If appropriate, add wildlife observation areas to provide visitors with opportunities to see swallow-tailed kites, bald eagles, wading birds, waterfowl, etc.
- Develop a bird check list.
- Construct an observation/photography blind at Causey Tract.
- Establish and develop canoe trail route and post signs.
- Provide and manage volunteer-led special birding tours.
- Explore ecotourism opportunities that would enlist volunteers leading visitors on canoe or kayak tours with these watercraft supplied by a commercial outfitter under Special Use Permit.

REFUGE ADMINISTRATION

Goal: Provide for sufficient staffing, facilities, and infrastructure to implement a comprehensive refuge management program to protect and manage the natural and cultural values of the refuge's habitats and fulfill the refuge's purposes, goals, and objectives.

Discussion: This goal refers to the refuge having the ways and means to implement proposed programs on behalf of habitat, wildlife, and visitor use. To date, the refuge's small staff has necessarily focused its efforts on basic and essential tasks, such as trying to augment protected lands within the acquisition boundary, both by purchase and through cooperative agreements and active collaboration with other governmental and non-governmental conservation agencies and institutions. Adequately administering the expansive vision in this CCP for Waccamaw NWR will require adequate resources.

Objective: Staffing

In addition to current staff of three (refuge manager, assistant refuge manager, and one law enforcement officer shared with complex), add one park ranger upon opening of the visitor center, one biotech and/or Student Career Employment Program (SCEP) within 5 years of CCP approval, 1 full-time law enforcement officer, 1 administrative assistant, and 1 maintenance person within 7-10 years of CCP approval. Convert assistant manager to biologist.

Discussion: At present, Waccamaw NWR's wildlife and visitor management efforts are severely hampered by persistent staffing shortages. The positions listed in the objective above will allow for realization of the objectives and strategies identified in this CCP. The refuge does not have a single maintenance person for repair and maintenance of equipment and facilities or habitat management.

Strategies:

- Secure funding to hire all necessary positions.
- Hire a park ranger/staff to manage the visitor services, visitor center, outreach, and volunteer program.
- Hire an environmental education SCEP student or biotech when the visitor center opens to assist with the operation of this facility.
- Administrative assistant will be based at the refuge office/visitor center and serve as the primary office manager with potential collateral duties related to visitor services.
- Maintenance person will have a range of responsibilities, including interior and exterior maintenance of new office and visitor center, as well as maintenance facilities themselves; equipment maintenance; road maintenance; grass mowing (if necessary) and maintenance of landscaping; installation and maintenance of proposed docks; and various habitat enhancement and restoration projects.

Objective: Facilities

Construct new administrative office at designated site on Yauhannah Bluff by 2008, but keep existing maintenance yard in Georgetown for the foreseeable future. Maintain existing and create new Causey Tract facilities. Add one dock each at Yauhannah Bluff and Cox Ferry Recreation Area and weather shelter at the latter. Add boardwalks at Cox Ferry Recreation Area and potential dock at Sandy Island, in addition to kiosks at Causey Tract and at other strategic locations. Add new maintenance facilities at Yauhannah Bluff.

Discussion: At present, the refuge has very limited facilities – rented office space, which doubles as a visitor contact station, and a small maintenance yard – all concentrated at one off-refuge site in Georgetown. The proposals in this CCP will substantially expand, diversify, and disperse Waccamaw NWR's facilities.

Strategies:

- Construct new Yauhannah Bluff facilities, including administrative offices, visitor center, interpretive trail from the main parking area to the visitor center, trail from visitor center to the outdoor classroom and canoe launch, and the River Bluff boardwalk, with interpretive signs.
- Construct new Cox Ferry Recreation Area facilities, including demolition of old buildings and pier, pole shed conversion to outdoor classroom, trailhead (parking, restrooms, leaflet dispenser, brochures, and canoe launch), and wayside exhibit and directional signs, on Highway 544.
- Work closely with architects, landscape architects, engineers, recreation, and interpretive specialists in planning, designing, and developing these facilities.
- Hire new maintenance person with responsibility for primary maintenance of these facilities.

Objective: Partnerships

Continue to cooperate with partners such as the SEWEE, SCDNR, TNC, Historic Ricefield Association, and Winyah Bay Focus Area Task Force. Seek additional partnerships and/or volunteers/interns for increased visitor services and habitat enhancement on all units. Add a partnership funded environmental education coordinator.

Discussion: The refuge is part of a dynamic and growing partnership with the SEWEE Association, which also supports programs at the Cape Romain and ACE Basin Refuges. The SEWEE Association supports the environmental education program at Waccamaw Refuge; it also provides financial and technical support and serves as liaison between the refuge and local communities.

For the calendar year 2004, the SEWEE Association had gross profits of \$93,123, which included memberships, donations, and sales. Most of the profits came from grants managed by the SEWEE Association director. Currently, the largest portion of disbursements from the SEWEE Association goes to the SEWEE Visitor Center, which supports the Cape Romain Refuge and Francis Marion Forest. There will be significantly larger disbursements to Waccamaw Refuge once the visitor center is open and the book store is operational.

The SEWEE Association was the instrumental partner in planning, scheduling, and implementation of the Earth Stewards Program at Plantersville and Brown's Ferry Elementary Schools. SEWEE also provided guidance and support for the Environment in Context of Learning (EIC) Program with Waccamaw Middle School. Additional off-site programs in Georgetown County were provided by SEWEE Association employees.

Partnership projects include those accomplished through Cooperating Conservation Initiatives, Challenge Cost-Share, and other partnerships, such as those with nonprofits, State agencies, local schools, etc. Monetary contributions are funds that have been transferred directly to the refuge or some type of account jointly managed by the refuge and partners. Cash value of in-kind contributions includes the value of things like materials and labor from the refuge or partners which is applied to a project.

Strategies:

- Continue participation with a coalition of partners including: landscape/ecosystem approach (Winyah Bay Focus Area/SSPD Ecosystem); MOUs, easements/ agreements/ technical assistance (Clemson, SCDNR, TNC).
- Develop marketing and communication strategies for fostering fund raising and potential partnerships. Involve the SEWEE Association in the development of interpretive media concepts. Conduct a design workshop to develop conceptual drawings and narratives.
- Develop long-term internship programs with Coastal Carolina University and Horry County Technical School.
- Continue partnership with SEWEE Association to assist with environmental education programs.
- Ensure that SEWEE Association will have necessary space in new visitor center for book store and storage.
- Ensure the conservation partnership projects are nominated for recognition (e.g., Annual Regional Director, NWRS awards, and Take Pride in America).

V. Plan Implementation

INTRODUCTION

Refuge lands are managed as defined under the National Wildlife Refuge System Improvement Act of 1997. Congress has distinguished a clear legislative mission of wildlife conservation for all national wildlife refuges. National wildlife refuges, unlike other public lands, are dedicated to the conservation of the Nation's fish and wildlife resources and wildlife-dependent recreational uses. Priority projects emphasize the protection and enhancement of fish and wildlife species first and foremost, but considerable emphasis is placed on balancing the needs and demands for wildlife-dependent recreation and environmental education and interpretation.

To accomplish the purpose, vision, goals, and objectives contained in this CCP for Waccamaw NWR, this section identifies projects, funding and personnel needs, volunteers, partnership opportunities, step-down management plans, a monitoring and adaptive management plan, and plan review and revision.

PROPOSED PROJECTS

Listed below are the proposed project summaries and their associated costs for fish and wildlife population management, habitat management, resource protection, visitor services, and refuge administration over the next 15 years. This proposed project list reflects the priority needs identified by the public, planning team, and refuge staff based upon available information. These projects were generated for the purpose of achieving the refuge's objectives and strategies. The primary linkages of these projects to those planning elements are identified in each summary.

The projects described below are the top ten priorities, grouped according to the goals for the refuge.

FISH AND WILDLIFE POPULATION MANAGEMENT

Priority #10 – Black Bear Migration Corridors

Convert an existing static refuge acquisition boundary expansion to a "floating expansion acquisition boundary" to allow for future acquisition needs as they relate to black bear migration corridors and wetland protection. This priority is addressed in the Black Bear Objective.

HABITAT MANAGEMENT

Priority #7 – Hire Full-time Biologist

Secure funding and hire a full-time GS-11 biologist. This biologist would develop wetland and wildlife research opportunities on the refuge, as well as assist with land acquisition and enhancement opportunities within the acquisition boundary. This person would also coordinate with SCDNR's efforts to develop large-scale habitat protection initiatives connecting State and Federal lands.

Priority #9 – Acquire or Lease Managed Wetland Habitats

Acquire or lease available managed wetland habitats within the refuge acquisition boundary to improve waterfowl and marshbird habitats. This priority is addressed in the Migratory Waterfowl and Marshbird Objectives.

RESOURCE PROTECTION

Priority #5 – Lease/Acquire Portions of Sandy Island

Develop management agreement(s) with Brookgreen Gardens and/or The Nature Conservancy to add portions of Sandy Island to the refuge. Through MOUs or lease agreements, these portions of Sandy Island would be administered as part of the Waccamaw NWR. In conjunction with the addition of these lands, a concessionaire agreement would be developed to provide public access to the island. The refuge would also develop nature trails, as well as expand the fire program to improve and maintain the longleaf pine habitats that exist on Sandy Island. This priority is addressed by the Land Acquisition Alternative.

Priority #6 – Acquire Haulover Tract

Acquire the Haulover Tract through the help of The Nature Conservancy and other partners. The Haulover Tract will provide opportunities for a new trail system adjacent to the new environmental education center, as well as protect land holdings adjacent to the new center. The potential for a canoe/kayak launch site could be incorporated adjacent to the existing or future bridge system. This priority is addressed by the Land Acquisition Alternative.

VISITOR SERVICES

Priority #2 – Cox Ferry Lake Recreation Area

Construct the Cox Ferry Lake Recreation Area. This facility will include a system of nature trails, boardwalks, weather shelters, information kiosks, canoe/kayak launch facility, rest rooms, and public dock system. This facility will complement the environmental education center at Yauhannah Bluff and will serve as an educational "outpost" for Horry County Schools. This priority is addressed in the Visitor Center Objective.

Priority #8 – Expand Public Access, Recreation Opportunities, and Environmental Education Programs for Horry County

Acquire additional lands around the Cox Ferry Lake Recreation Area in order to expand public access, recreation opportunities, and environmental education programs for Horry County. By adding more land around existing refuge facilities, the refuge could protect valuable habitats from encroaching urban sprawl, diversify facilities including canoe trails, and provide fishing opportunities which would greatly enhance the visitor experience that is currently provided on refuge-owned tracts.

REFUGE ADMINISTRATION

Priority #1 – New Environmental Education Center and Office Complex

Build new state-of-the-art environmental education (visitor) center and office complex at Yauhannah Bluff. The new center will include a wet lab, multi-use room, interpretive exhibits, nature trails, boardwalks, and a public dock access facility. This priority is addressed in the Facilities Objective of the Refuge Administration Goal, as well as the Visitor Center Objective of the Visitor Services' Goal.

Priority #3 – Hire Full-time Park Ranger

Secure funding for and hire a GS-7/9/11 full-time park ranger to assist with public use programs on Yauhannah Bluff and the Cox Ferry Recreation Area. This person will also assist with writing grants, with environmental education programs, and helping to develop additional trail opportunities. This priority is addressed in the Staffing Objective.

Priority #4 – Hire Administrative Officer

Secure funding for and hire a full-time GS-7 administrative officer to assist with refuge budgets, administrative needs, and refuge operations. This priority is addressed in the Staffing Objective.

FUNDING AND PERSONNEL

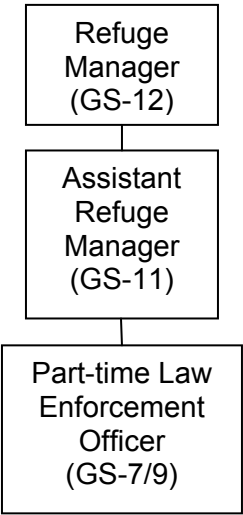
Table 4 below summarizes the projects described above, estimates first-year and recurring annual costs, and lists new staff positions.

Table 4. Summary of projects

PROJECT NUMBER	PROJECT TITLE	FIRST YEAR COST	RECURRING ANNUAL COST	STAFF (FTE'S)
Priority #1	New Environmental Education Center and Office Complex	\$2,225,181		
Priority #2	Cox Ferry Lake Recreation Area	\$350,000		-
Priority #3	Hire Full-time Park Ranger	\$35,752 - 67,878	\$35,752 - 67,878	1
Priority #4	Hire Administrative Officer	\$35,752 - 46,478	\$35,752 - 46,478	1
Priority #5	Lease portions of Sandy Island	\$150,000		
Priority #6	Acquire Haulover Tract	\$1,400,000		
Priority #7	Hire Full-time Biologist	\$52,912 - 68,787	\$52,912 - 68,787	1
Priority #8	Expand Public Access, Recreation Opportunities, and EE Programs for Horry County	\$2,000,000		
Priority #9	Acquire or Lease Managed Wetland Habitats	\$1,000,000		
Priority #10	Black Bear Migration Corridors	\$7,500,000		

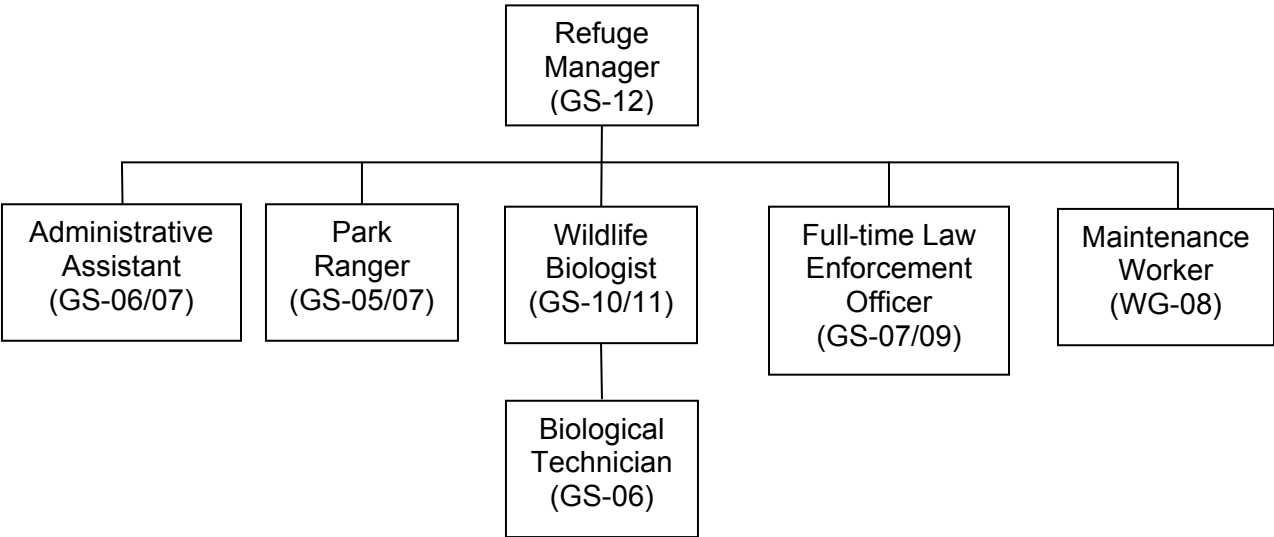
Waccamaw Refuge currently has a staff of three, as depicted in Figure 6 – the refuge manager, assistant refuge manager, and law enforcement officer (who is shared with the three other refuges in the South Carolina Lowcountry Complex – Ace Basin, Cape Romain, and Santee).

Figure 6. Current organizational chart for Waccamaw NWR



This CCP recommends adding one park ranger upon opening of the visitor center, one biotech and/or student through the Student Career Employment Program (SCEP) within 5 years of CCP approval; and one full-time law enforcement officer, one administrative assistant, and one maintenance person within 7-10 years of CCP approval. In addition, the assistant manager position would be converted to a biologist.

Figure 7. Proposed future organizational chart for Waccamaw NWR



PARTNERSHIP/VOLUNTEERS OPPORTUNITIES

A key element of this CCP is to establish partnerships with local volunteers, landowners, private organizations, and State and Federal natural resource agencies. In the immediate vicinity of the refuge, opportunities exist to establish new and strengthen existing partnerships with TNC, the Historic Ricefield Association, Southeastern Wildlife and Environmental Education Association, and Winyah Bay Focus Area Task Force, in addition to local schools and school districts. At the regional and State level, partnerships may be established or enhanced with organizations such as SCDNR and other State and Federal agencies.

STEP-DOWN MANAGEMENT PLANS

A CCP is a strategic plan that guides the future direction of the refuge. A step-down management plan provides specific guidance on activities, such as habitat, fire, and visitor services' management. These plans (Table 5) are also developed in accordance with the National Environmental Policy Act, which requires the identification and evaluation of alternatives and public review and involvement prior to their implementation.

Table 5. Waccamaw NWR step-down management plans related to the goals and objectives of the comprehensive conservation plan

Step-down Management Plan	Completion (or revision) Date
Cultural Resources Management Plan (CRMP)	2023
Visitor Services' Plan	2011
Hunting Plan	2007 (revise and update annually)
Fishing Plan	2013
Law Enforcement Plan	2012
Facilities Management Plan	2010
Integrated Pest Management Plan	2004 (revise and update annually)

MONITORING AND ADAPTIVE MANAGEMENT

Adaptive management is a flexible approach to long-term management of biotic resources that is directed over time by the results of ongoing monitoring activities and other information. More specifically, adaptive management is a process by which projects are implemented within a framework of scientifically driven experiments to test the predictions and assumptions outlined within a plan.

To apply adaptive management, specific survey, inventory, and monitoring protocols will be adopted for the refuge. The habitat management strategies will be systematically evaluated to determine management effects on wildlife populations. This information will be used to refine approaches and determine how effectively the objectives are being accomplished. Evaluations will include ecosystem team and other appropriate partner participation. If monitoring and evaluation indicate undesirable effects for target and non-target species and/or communities, then alterations to the management projects will be made. Subsequently, the refuge's CCP will be revised. Specific monitoring and evaluation activities will be described in the step-down management plans.

PLAN REVIEW AND REVISION

This CCP will be reviewed annually in development of the refuge's annual work plans and budget. It will also be reviewed to determine the need for revision. A revision will occur if and when conditions change or significant information becomes available, such as a change in ecological conditions or a major refuge expansion. The CCP will be augmented by detailed step-down management plans to address the completion of specific strategies in support of the refuge's goals and objectives. Revisions to the CCP and the step-down management plans will be subject to public review and NEPA compliance.

SECTION B. ENVIRONMENTAL ASSESSMENT

I. Background

INTRODUCTION

This Environmental Assessment (EA) for Waccamaw NWR has been prepared in compliance with the National Environmental Policy Act. It discusses the purpose and need for the Comprehensive Conservation Plan (CCP) for the refuge in Georgetown, Horry, and Marion Counties, South Carolina, and provides an analysis of the environmental impacts that could be expected from each of the management proposals outlined in the CCP. This analysis assists the Fish and Wildlife Service in determining if it will need to prepare an Environmental Impact Statement (EIS) or a Finding of No Significant Impact (FONSI) for the refuge's proposed CCP.

The U.S. Fish and Wildlife Service is the Nation's primary conservation agency concerned with the protection and long-term management of wildlife resources. The Service administers the National Wildlife Refuge System, a system of more than 540 national wildlife refuges embracing over 95 million acres, much of which is primarily managed for the enhancement of migratory bird populations and federally listed threatened and endangered fish, wildlife, and plants.

PURPOSE AND NEED FOR ACTION

The purpose of the CCP and EA is to establish and implement management direction for Waccamaw NWR for the next 15 years.

The EA is needed to set forth and evaluate a range of reasonable management alternatives for the refuge. Each alternative was generated with the potential to be fully developed into a final CCP and to describe the predicted biological, physical, social, and economic impacts of implementing each alternative. The Fish and Wildlife Service will select an alternative to be fully developed for this refuge.

The Service identified issues, concerns, and needs through discussions with the public, agency managers, conservation partners, and others. In particular, the Service's planning team identified a range of alternatives, evaluated the possible consequences of implementing each, and selected Alternative D as the proposed management action. In the opinion of the Service and the planning team, Alternative D is the best approach to guide the refuge's direction.

There is no current plan that identifies priorities and ensures consistent and integrated management of the refuge, thus necessitating the need for this CCP. The National Wildlife Refuge System Improvement Act of 1997 requires that all national wildlife refuges have a CCP in place within 15 years.

DECISION FRAMEWORK

Based on the assessment described in this document, the Fish and Wildlife Service will select an alternative to implement the CCP for Waccamaw NWR. The finalized CCP will include a Finding of No Significant Impact (FONSI), which is a statement explaining why the selected alternative will not have a significant effect on the quality of the human environment. This determination is based on an evaluation of the Service and Refuge System mission, the purpose(s) for which the refuge was established, and other legal mandates. Assuming no significant impact is found, implementation of the CCP will begin and will be monitored annually and revised when necessary.

PLANNING STUDY AREA

Waccamaw NWR is located in South Carolina's "Lowcountry," about 60 miles north of Charleston, within Georgetown, Horry and Marion Counties (Figure 1). Its 54,000-acre acquisition boundary contains portions of the Great and Little Pee Dee Rivers and the Waccamaw River. These river systems and associated wetlands comprise a large portion of the Winyah Bay drainage basin and are an important component of the Winyah Bay ecosystem. Waccamaw NWR is one of four refuges in the South Carolina Lowcountry Complex, along with Ace Basin, Cape Romain, and Santee.

This environmental assessment will identify management on refuge lands, as well as those lands proposed for acquisition by the Service.

AUTHORITY, LEGAL COMPLIANCE, AND COMPATIBILITY

The Service developed this Draft CCP/EA in compliance with the National Wildlife Refuge System Improvement Act of 1997 and Part 602 (National Wildlife Refuge System Planning) of the Fish and Wildlife Service Manual. The actions described within this document also meet the requirements of the National Environmental Policy Act of 1969. The refuge staff achieved compliance with this Act through the involvement of the public and the incorporation of this EA in the Draft CCP, with a description of the alternatives considered and an analysis of the environmental consequences of the alternatives (Chapters III and IV in this section). When final, the CCP will strive to achieve the vision and purposes of Waccamaw NWR.

The Final CCP's overriding consideration will be to carry out the purposes for which the refuge was established. The laws that established the refuge and provided the funds for acquisition state the purposes. Fish and wildlife management is the first priority in refuge management, and the Service allows and encourages public use (wildlife-dependent recreation) as long as it is compatible with, or does not detract from, the refuge's mission and purposes.

The National Wildlife Refuge System Administration Act of 1966, as amended by the National Wildlife Refuge System Improvement Act of 1997, states that national wildlife refuges must be protected from incompatible or harmful human activities to ensure that Americans can enjoy Refuge System lands and waters. Before activities or uses are allowed on a national wildlife refuge, the uses must be found to be compatible. A compatible use "...will not materially interfere with or detract from the fulfillment of the mission of the Refuge System or the purposes of the refuge." In addition, "wildlife-dependent recreational uses may be authorized on a refuge when they are compatible and not inconsistent with public safety."

An interim compatibility determination is a document that assesses the compatibility of an activity during the period of time the Service first acquires a parcel of land to the time a formal, long-term management plan for that parcel is prepared and adopted. The Service has completed an interim compatibility determination for the six priority general public uses of the system, as listed in the National Wildlife Refuge System Improvement Act of 1997. These uses are hunting, fishing, wildlife observation, wildlife photography, and environmental education and interpretation.

PUBLIC INVOLVEMENT AND THE PLANNING PROCESS

In accordance with Service guidelines and National Environmental Policy Act recommendations, public involvement has been a crucial factor throughout the development of the Draft CCP for Waccamaw NWR. This Draft CCP has been written with input and assistance from interested citizens, conservation organizations, and employees of local and State agencies. The participation of

these stakeholders and their ideas has been of great value in setting the management direction for Waccamaw NWR. The Service, as a whole, and the refuge staff, in particular, are very grateful to each one who has contributed time, expertise, and ideas to the planning process. The staff remains impressed by the passion and commitment of so many individuals for the lands and waters administered by the refuge.

The first step in developing the refuge's CCP was a Biological Review that took place in June 2003. The review team included eight Service biologists and managers and non-Service managers/biologists. The review involved on-site evaluations to help the refuge meet its purpose and determine the role(s) this refuge could play regarding wildlife needs/objectives at various geographical scales (i.e., local, ecosystem, regional, and national).

A Visitor Services' Review was conducted in 2005 in preparation for the upcoming CCP. The three-member review team consisted of Service personnel from the Region – Visitor Services and Outreach, a representative of Cape Romain NWR, and a representative of Santee NWR. The review team met with refuge staff to discuss the visitor services' program. Later the team prepared a report (USFWS 2005) with a number of recommendations for improving and expanding upon visitor services' facilities and operations.

The core members of the CCP planning team itself met for the first time in February 2006, for a tour of the refuge and an overview of its habitat and wildlife resources and public use programs, facilities, and opportunities. At this time, the planning team also conducted additional internal scoping and prepared a preliminary schedule and plans for public involvement.

Scoping continued with two open houses and public meetings on May 1-2, 2006. Since the refuge itself does not have meeting or conference facilities, the scoping meetings were held at the J.B. Beck Administrative and Education Center in Georgetown and at the Coastal Carolina University Center for Marine and Wetland Studies in Conway. Approximately 15 members of the public attended the open house and scoping meeting on each day. Members of the public were able to express concerns about the refuge and ideas and suggestions for its future management on a comment form that was distributed for attendees and other interested parties. Written comments could either be submitted right at the meeting, mailed subsequently, or sent via email. A total of 82 comment forms and letters were received during scoping for the Waccamaw NWR Draft CCP/EA.

A wide range of issues, concerns, and opportunities were identified and addressed during the planning process. Many issues that are very important to the public often fall outside the scope of the decision to be made within this planning process. In some instances, the Service cannot resolve issues some people have communicated to us. We have considered all issues throughout the planning process, and have developed a Draft CCP/EA that attempts to balance the competing opinions regarding important issues.

A complete summary of these issues and concerns is provided in Section C, Appendix IV.

II. Affected Environment

For a description of the affected environment, see Section A, Chapter II.

III. Description of Alternatives

FORMULATION OF ALTERNATIVES

Alternatives are different approaches or combinations of management objectives and strategies designed to achieve the refuge's purpose and vision, and the goals identified in the CCP; the priorities and goals of the Savannah/Santee/Pee Dee (SSPD) Ecosystem Team; the goals of the Refuge System; and the mission on the Fish and Wildlife Service. Alternatives are formulated to address the significant issues, concerns, and problems identified by the Service and the public during public scoping.

The four alternatives identified and evaluated represent different approaches to provide permanent protection, restoration, and management of the refuge's fish, wildlife, plants, habitats, and other resources, as well as compatible wildlife-dependent recreation. Refuge staff assessed the biological conditions and analyzed the external relationships affecting the refuge. This information contributed to the development of refuge goals and, in turn, helped to formulate the alternatives. As a result, each alternative presents different sets of objectives for reaching refuge goals. Each alternative was evaluated based on how much progress it would make and how it would address the identified issues related to fish and wildlife populations, habitat management, resource protection and conservation, visitor services, and refuge administration. A summary of the four alternatives is provided in Table 6.

DESCRIPTION OF ALTERNATIVES

Serving as a basis for each alternative, a number of goals and sets of objectives were developed to help achieve the refuge's purpose and the mission of the Refuge System. Objectives are desired conditions or outcomes that are grouped into sets and, for this planning effort, consolidated into four alternatives. These alternatives represent different management approaches for managing the refuge over a 15-year time frame while still meeting the refuge purposes and goals. The four alternatives are summarized below. A comparison of each alternative follows the general description.

ALTERNATIVE A – CURRENT MANAGEMENT (NO ACTION)

Under Alternative A, Waccamaw NWR would continue to be managed as it is at present – there would be no change to refuge management. Like the other alternatives, Alternative A would pursue the fish and wildlife population management goal: in support of national and regional plans, promote management actions that will support viable populations of native fish and wildlife species associated with blackwater and alluvial forested wetlands, with special emphasis on migratory birds, black bear, and threatened and endangered species.

No active, direct management of waterfowl populations would occur. With regard to neotropical migratory birds, the refuge would continue to conduct informal surveys on swallow-tailed kites and Swainson's warblers on an occasional basis. Incidental observations of black bear on the refuge would be compiled. Threatened and endangered species would continue to be protected on appropriate refuge habitats; refuge staff would document all sightings and presence of listed species. The refuge would maintain 15 wood duck boxes. No active management of colonial nesting water birds would take place, except for protection of existing rookeries on the refuge. We would continue to maintain freshwater tidal emergent marsh used by marshbirds.

Under Alternative A, the refuge would continue to manage its deer herd via annual hunting during the State season. No active management of reptiles and amphibians would occur. With regard to controlling invasive animal species, existing hunts for feral hogs on Units 1 and 3 would be maintained.

Alternative A would also pursue the CCP's habitat goal: to conserve, manage, and enhance natural diversity, abundance, and ecological functions of refuge habitats in support of national and regional plans, with special emphasis on managing towards old growth bottomland forest habitats. There would be no active management of 2,430 acres of open water or 2,923 acres of freshwater marsh on the refuge. Likewise, we would conduct no active management or monitoring of 629 acres of existing moist-soil and submerged aquatic vegetation on the refuge.

No active management of 6,362 acres of upland forest or 461 acres of bottomland hardwoods on the refuge would occur. Similarly, there would be no active management of 25,077 acres of cypress-gum forest, as well as no active management of invasive plant species.

This alternative would also pursue the CCP's resource protection goal: to identify, acquire, conserve, and protect natural and cultural resources through partnerships, land protection programs, stewardship, and law enforcement. The refuge would continue to cooperate closely with partners to identify willing sellers of properties within the acquisition boundary, while seeking funds outside of LWCF to secure these properties. The refuge would also continue to comply with Section 106 of the National Historic Preservation Act in the management of the refuge's cultural resources.

Alternative A would continue to provide 1.0 FTE position shared with the Refuge Complex and 2 dual function officers. It would also continue to work with 3-5 landowners at any one time within the acquisition boundary to enhance and protect habitat and wildlife resources on their properties. Bull Island would generally continue to be passively managed as wilderness (i.e., no motorized access and equipment unless specifically authorized) but it would not be included as a Wilderness Study Area and no wilderness study report would be prepared.

Alternative A also aims to pursue the visitor services' goal: to provide opportunities for quality, wildlife-dependent public uses, leading to greater understanding and enjoyment of fish, wildlife, and habitats contained within the Winyah Bay Focus Area. Under this goal, Alternative A would continue to serve the public without a Visitor Services' Plan. The refuge would also build and staff a new visitor center at the designated site on Yauhannah Bluff by 2008.

Each of the recreational uses as identified in the Improvement Act of 1997 would continue at Waccamaw NWR under Alternative A. The refuge would continue to provide seasonal hunting for deer, hog, turkey (including youth hunt), raccoon, squirrel, waterfowl, and snipe, consistent with refuge and State regulations. The refuge would be open to fishing consistent with State regulations, except for the Causey and Yauhannah Bluff tracts. In partnership with the SEWEE Association, on- and off-site environmental education programs would continue in Georgetown County Public Schools, including five elementary and one high school. The new visitor center and Causey Tract public use area would be used for expanded environmental education efforts. Interpretive programs would continue to be provided to groups upon request and information provided to the public at the refuge office and on its website. Yauhannah Tract trails would be maintained and opened to the public for observation and photography opportunities outside of the hunting season. The staff would continue to develop the Causey Tract (Cox Ferry Lake recreation Area) public use area.

Alternative A would also pursue the refuge administration goal: to provide for sufficient staffing, facilities, and infrastructure to implement a comprehensive refuge management program to protect and manage the natural and cultural values of the refuge's habitats and fulfill the refuge's purposes, goals, and objectives.

Waccamaw Refuge would maintain the current staff of three, including the refuge manager, assistant refuge manager, and law enforcement officer (shared with the Lowcountry Complex). An administrative office would be constructed on Yauhannah Bluff by 2008, but the existing maintenance yard would remain in Georgetown for the foreseeable future; the existing facilities on the Causey Tract would be maintained and new ones would be created. The staff would continue to cooperate with partners such as the SEWEE, SCDNR, TNC, Historic Ricefield Association, and Winyah Bay Focus Area Task Force.

ALTERNATIVE B – HABITAT RESTORATION/ENHANCEMENTS ON UNIT 1

The focus of Alternative B is habitat restoration efforts and enhancements on Unit 1, which consists of 34,784 acres and is made up entirely of alluvial and black water floodplain forested wetlands. Like the other alternatives, Alternative B would pursue the fish and wildlife population management goal: in support of national and regional plans, to promote management actions that will support viable populations of native fish and wildlife species associated with black water and alluvial forested wetlands, with special emphasis on migratory birds, black bear, and threatened and endangered species.

Under Alternative B, the refuge would aim to improve wintering waterfowl habitat on approximately 600 acres on Unit 1 by restoring hydrology through plugging drainage ditches and leveling pine plantation beds. With respect to neotropical migratory birds, Alternative B would be the same as Alternative A – that is, it would conduct informal surveys on swallow-tailed kites and Swainson's warblers on an occasional basis throughout the lifetime of the CCP – plus it would increase scrub-shrub habitat by approximately 600 acres on Unit 1.

Alternative B's passive management of black bears would be identical to Alternative A: incidental observations of black bear on the refuge would be compiled but not off the refuge. With regard to threatened and endangered species, Alternative B's proposed hydrology restoration on Unit 1 would enhance the existing wood stork rookery there. Management of wood ducks would be the same as Alternative A (maintain 15 wood duck boxes annually); additionally, Alternative B would improve brood habitat on 10 acres in Unit 1. The proposed hydrology restoration on Unit 1 would enhance opportunities for colonial nesting water bird rookeries. Management of marshbirds would be the same as Alternative A: continuing to maintain freshwater tidal emergent marsh that they use.

Under Alternative B, white-tailed deer would be managed as they are under Alternative A – a hunt during the annual State season. Restoration of isolated wetlands on the refuge would improve breeding areas for amphibians. The control of invasive animal species would be pursued using the same method as Alternative A, by maintaining existing hunts for feral hogs on Units 1 and 3.

Alternative B would also pursue the CCP's habitat goal: to conserve, manage, and enhance natural diversity, abundance, and ecological functions of refuge habitats in support of national and regional plans, with special emphasis on managing towards old growth bottomland forest habitats. Management of open water on the refuge would be the same passive management as in Alternative A. Likewise, there would be no active management or monitoring of freshwater marsh or moist-soil and submerged aquatic vegetation, upland forests, bottomland hardwoods, or cypress-gum forest on the refuge. The refuge would map areas of invasive plant species on Unit 1 and develop control/eradication plans for each species.

Alternative B would also pursue the CCP's resource protection goal: to identify, acquire, conserve and protect natural and cultural resources through partnerships, land protection programs, stewardship, and law enforcement. Land acquisition would be the same as Alternative A. The refuge would continue to cooperate closely with partners to identify willing sellers of properties within the acquisition boundary, while seeking funds outside of the LWCF to secure these properties.

Management of cultural resources would be identical to Alternative A – the refuge would continue to comply with Section 106 of the National Historic Preservation Act. Law enforcement would also be the same as Alternative A. This alternative would continue to provide 1.0 FTE shared with the Refuge Complex and two dual function officers. As for private lands management, Waccamaw NWR would continue to work with 3-5 landowners at any one time within the acquisition boundary to enhance and protect habitat and wildlife resources on their properties, as in Alternative A. Bull Island would generally continue to be passively managed as wilderness (i.e., no motorized access and equipment unless specifically authorized) but it would not be included as a Wilderness Study Area and no wilderness study report would be prepared.

Alternative B also pursues the visitor services' goal: to provide opportunities for quality, wildlife-dependent public uses, leading to greater understanding and enjoyment of fish, wildlife, and habitats contained within the Winyah Bay Focus Area. As with Alternative A, under Alternative B the refuge would continue to serve the public without a Visitor Services' Plan. Also like Alternative A, Alternative B would build and staff a new visitor center at the designated site on Yauhannah Bluff by 2008. However, in addition, Alternative B would develop up to four nature trails associated with the visitor center.

Alternative B would support each of the recreational uses as identified in the Improvement Act of 1997. Like Alternative A, it would continue to provide seasonal hunting for deer, hog, turkey (including youth hunt), raccoon, squirrel, waterfowl, and snipe consistent with refuge and State regulations. Moreover, Alternative B would also explore the potential of opening the Jackson Bluff Tract to waterfowl hunting. Fishing would be the same as Alternative A: keep the entire refuge open to fishing consistent with State regulations, except for the Causey and Yauhannah Bluff tracts.

In addition to conducting the environmental education program conducted under Alternative A, Alternative B would explore a potential partnership with Coastal Carolina on Jackson Bluff, and utilization of up to four nature trails near the new visitor center for environmental education. Interpretation under Alternative B would be the same as Alternative A, plus potential interpretive opportunities related to the wetland restoration site on Jackson Bluff. Added interpretive opportunities would be provided in and around the new visitor center and the Causey Tract. Interpretive programs would continue to be provided to groups upon request and information provided to the public at the refuge office and on its website. Wildlife observation and photography would be the same as Alternative A and when the new visitor center is opened, additional opportunities would be developed along with new trails. Yauhannah Tract trails would be maintained and opened to the public for observation and photography opportunities outside of hunting season. The staff would continue to develop the Causey Tract (Cox Ferry Lake Recreation Area) public use area.

Alternative B would also pursue the refuge administration goal: to provide for sufficient staffing, facilities, and infrastructure to implement a comprehensive refuge management program to protect and manage the natural and cultural values of the refuge's habitats and fulfill the refuge's purposes, goals, and objectives.

Staffing under Alternative B would be the same as Alternative A with the addition of one park ranger upon opening of the visitor center. Existing facilities would be maintained and one dock each would be added at the Yauhannah Bluff and Causey Tracts (Cox Ferry Lake Recreation Area), with a

weather shelter at the latter. The refuge would construct a new administrative office at designated site on Yauhannah Bluff by 2008 but keep the existing maintenance yard in Georgetown for the foreseeable future. The existing facilities would be maintained and new facilities would be created on the Causey Tract (Cox Ferry Lake Recreation Area). Existing partnerships would continue and the refuge would seek additional partnerships and/or volunteers/interns for increased visitor services and habitat enhancement on Unit 1.

ALTERNATIVE C – HABITAT RESTORATION/ENHANCEMENTS ON ALL UNITS

Alternative C emphasizes habitat restoration efforts and enhancements on all units of the refuge – Units 1, 2, and 3. Unit 1 consists of 34,784 acres and is made up entirely of alluvial and black water floodplain forested wetlands. Unit 2 includes 12,046 acres and is made up of approximately 6,362 acres of upland longleaf pine forest and tidal forested and emergent wetlands. Unit 3 is 2,902 acres and contains historic rice fields, many of which remain intact and are managed for wintering waterfowl.

Like the other alternatives, Alternative C would pursue the fish and wildlife population management goal: in support of national and regional plans, to promote management actions that will support viable populations of native fish and wildlife species associated with black water and alluvial forested wetlands, with special emphasis on migratory birds, black bear, and threatened and endangered species.

Like Alternative B, Alternative C would manage migratory waterfowl by improving wintering waterfowl habitat on approximately 600 acres on Unit 1 by restoring hydrology through plugging drainage ditches and leveling pine plantation beds. In addition, this alternative would restore and enhance historic rice fields on approximately 400 acres in Units 2 and 3 over the life of the CCP.

Management of neotropical migratory birds would be the same as Alternative B: within 10 years of CCP approval, scrub-shrub habitat would be increased by approximately 600 acres on Unit 1. Throughout the lifetime of the CCP, the refuge would also conduct informal surveys on swallow-tailed kites and Swainson's warblers on an occasional basis.

Under Alternative C, management for black bears would be more active than with the first two alternatives. Refuge acquisition and habitat restoration efforts within wetland corridors would be targeted to improve connectivity between bear populations.

Management of threatened and endangered species would generally be the same as Alternative B – restoring the hydrology on Unit 1 to enhance the existing wood stork rookery. However, in addition to this, Alternative C would also restore wood stork feeding areas on Unit 3 and red-cockaded woodpecker nesting and foraging habitat on Unit 2.

Wood duck management in Alternative C would include each of the activities identified in Alternatives A and B – maintaining 15 wood duck nest boxes and improving brood habitat on 10 acres in Unit 1 – plus improving brood and wintering habitat on 300 acres in Units 2 and 3. In addition, the refuge would increase wood duck nest boxes up to a total of 50 within 5 years of plan approval. With regard to colonial nesting water birds, management would include the same hydrology restoration on Unit 1 as proposed in Alternative B, plus the restoration of colonial water bird feeding areas on Unit 3.

Marshbird management under Alternative C would be the same as Alternatives A and B – continuing to maintain freshwater tidal emergent marsh used by marshbirds – plus acquiring approximately 300 acres of tidal or managed wetlands within Units 2 and 3 within seven years of CCP approval. White-tailed deer would continue to be managed through annual hunting during the State season, as in Alternatives A and B. Reptiles and amphibians would be managed as in Alternative B, that is,

isolated wetlands would be restored to improve breeding areas of amphibians. In addition, efforts would be made to increase managed wetland habitats by approximately 300 acres on Unit 3 within seven years of CCP approval, which would benefit reptiles and amphibians. Invasive animal species control would be exercised by maintaining existing hunts for feral hogs on Units 1 and 3 (as in Alternatives A and B) and adding hunting opportunities on Unit 2.

Alternative C would also pursue the CCP's habitat goal: to conserve, manage, and enhance natural diversity, abundance and ecological functions of refuge habitats in support of national and regional plans, with special emphasis on managing towards old growth bottomland forest habitats. Management of open water on the refuge would involve monitoring water quality, contaminants, jet skis impacts, and vegetation trends on open water throughout the refuge. This would be accomplished by using partnerships. Monitoring water quality, jet skis impacts, and vegetation trends on freshwater marshes would also be conducted throughout the refuge using partnerships. Waccamaw NWR would acquire, restore, develop, and improve moist-soil and submerged aquatic vegetation management, infrastructure, and monitoring on a total of 1,029 existing and newly acquired acres.

Under Alternative C, forest management would be somewhat intensified throughout the refuge. For the duration of the CCP, the refuge would prescribe burn 6,362 acres of upland forest on a 3-year cycle, while maintaining unique plant communities. On bottomland forests, the refuge would thin 461 acres of bottomland hardwoods where needed to develop understory vegetation and encourage oaks, mimicking tree fall gaps. Other forest types would be converted to bottomland hardwoods where soils are appropriate. Where opportunities exist on the 25,077 acres of cypress-gum forest, the refuge would harvest overabundant red maple to ensure that cypress and gum regenerate, manage for old growth cypress and tupelo, and ensure the natural water regime. The refuge would map areas of invasive plant species on the entire refuge and develop control/eradication plans for each species.

Alternative C would also pursue the CCP's resource protection goal: to identify, acquire, conserve, and protect natural and cultural resources through partnerships, land protection programs, stewardship, and law enforcement. Land acquisition would be the same as Alternatives A and B. The refuge would continue to cooperate closely with partners to identify willing sellers of properties within the acquisition boundary, while seeking funds outside of the LWCF to secure these properties.

Management of cultural resources under Alternative C would be identical to Alternatives A and B – the refuge would continue to comply with Section 106 of the National Historic Preservation Act. Law enforcement would also be the same as Alternatives A and B. The refuge would continue to provide 1.0 FTE position shared with the Refuge Complex and two dual function officers. As for private lands management, Waccamaw NWR would continue to work with 3-5 landowners at any one time within the acquisition boundary to enhance and protect habitat and wildlife resources on their properties, as in Alternatives A and B. Bull Island would generally continue to be passively managed as wilderness (i.e., no motorized access and equipment unless specifically authorized) but it would not be included as a Wilderness Study Area and no wilderness study report would be prepared.

Alternative C also pursues the visitor services' goal: to provide opportunities for quality, wildlife-dependent public uses, leading to greater understanding and enjoyment of fish, wildlife, and habitats contained within the Winyah Bay Focus Area. As with Alternatives A and B, under Alternative C the refuge would continue to serve the public without a Visitor Services' Plan. As under Alternatives A and B, the refuge would build and staff a new visitor center at the designated site on Yauhannah Bluff by 2008. However, in addition, Alternative C (like Alternative B) would develop up to four nature trails associated with the visitor center.

Alternative C would support each of the recreational uses as identified in the Refuge Improvement Act of 1997. Alternative C would expand hunting opportunities. It would explore the potential for a youth waterfowl hunt on managed wetlands. Like Alternative B, it would also potentially open waterfowl hunting on the Jackson Bluff Tract. And like Alternatives A and B, Alternative C would continue to provide seasonal hunting for deer, hog, turkey (including youth hunt), raccoon, squirrel, waterfowl, and snipe, consistent with refuge and State regulations. Fishing would be the same as with Alternatives A and B: keeping the entire refuge open to fishing consistent with State regulations, except for the Causey and Yauhannah Bluff tracts.

Under Alternative C, the environmental education offered by Alternatives A and B would be expanded. As with Alternatives A and B, in partnership with the SEWEE Association, on- and off-site environmental education programs would be expanded in Georgetown County Public Schools, including five elementary schools and one high school. The new visitor center and Causey Tract (Cox Ferry Lake Recreation Area) public use area would be utilized for increased environmental education. As with Alternative B, a potential partnership with Coastal Carolina on Jackson Bluff, and utilization of up to four nature trails near the new visitor center for environmental education may be developed. Finally, under Alternative C alone, the potential for Sandy Island trails being utilized for environmental education would be explored.

Interpretation would also be expanded under this alternative. In addition to each of the opportunities and activities described for Alternatives A and B, it would include the potential for interpretive activities on Sandy Island. Thus, it would also include potential interpretive opportunities related to the wetland restoration site on Jackson Bluff and added interpretive opportunities in and around the new visitor center and the Causey Tract (Cox Ferry Lake Recreation Area). Interpretive programs would continue to be provided to groups upon request and information provided to the public at the refuge office and on its website. Wildlife observation and photography would be the same as Alternative B with the addition of trails on Sandy Island.

Like Alternative B, when the new visitor center is opened, additional opportunities would be developed along with new trails. As with both Alternatives A and B, Yauhannah Tract trails would be kept open to the public for observation and photography opportunities outside of the hunting season, and the Causey Tract (Cox Ferry Lake Recreation Area) public use area would continue to be developed.

Alternative C would also pursue the refuge administration goal: to provide for sufficient staffing, facilities, and infrastructure to implement a comprehensive refuge management program to protect and manage the natural and cultural values of the refuge's habitats and fulfill the refuge's purposes, goals, and objectives. With regard to staffing, Alternative C would add the positions recommended by Alternative B (one Park Ranger), as well as one biotech and/or one SCEP student. Additional facilities would be built under Alternative C over and above those of Alternatives A and B – boardwalks at Causey Tract and a potential dock at Sandy Island, in addition to kiosks at Causey Tract and at other strategic locations. Finally, the refuge would attempt to develop partnerships as in Alternatives A and B. It would seek additional partnerships and/or volunteers/interns for increased visitor services and habitat enhancement on all three units.

*ALTERNATIVE D – OPTIMIZE HABITAT MANAGEMENT AND VISITOR SERVICES
(PROPOSED ALTERNATIVE)*

Alternative D, the Service's proposed alternative and the basis for the objectives and strategies in Section A, Chapter IV, would optimize habitat management and visitor services throughout the refuge. In general, this alternative would implement each of the measures, steps, and programs proposed under Alternative C, as well as augmenting existing visitor services' programs, facilities, and opportunities.

Like each of the other alternatives, Alternative D would pursue the fish and wildlife population management goal: in support of national and regional plans, to promote management actions that will support viable populations of native fish and wildlife species associated with black water and alluvial forested wetlands, with special emphasis on migratory birds, black bear, and threatened and endangered species.

Management of migratory waterfowl under Alternative D is identical to Alternative C. Alternative D would manage migratory waterfowl by improving wintering waterfowl habitat on approximately 600 acres on Unit 1 by restoring hydrology through plugging drainage ditches and leveling pine plantation beds. In addition, this alternative would restore and enhance historic rice fields on approximately 400 acres in Units 2 and 3 over the life of the CCP.

Like Alternatives B and C, management of neotropical migratory birds under Alternative D would entail increasing scrub-shrub habitat by approximately 600 acres on Unit 1. In addition to this, Alternative D would commence formal surveys of swallow-tailed kites and Swainson's warblers within five years of CCP approval.

Under Alternative D, management for black bears would be stepped up from that of the previous three alternatives. As in Alternative C, refuge acquisition and habitat restoration efforts within wetland corridors would be targeted to improve connectivity between bear populations. In addition, Alternative D would conduct annual surveys of black bears and attempt to enlist public participation in gathering, recording, and compiling sightings.

Management of threatened and endangered species would generally be the same as Alternative C – restoring the hydrology on Unit 1 to enhance the existing wood stork rookery, restoring wood stork feeding areas on Unit 3, and red-cockaded woodpecker nesting and foraging habitat on Unit 2.

Wood duck management under Alternative D would include everything Alternative C includes, and in addition, establish a long-term banding site within seven years of CCP approval. Like Alternative B, it would also improve brood habitat on 10 acres in Unit 1. Like Alternative C, it would improve brood and wintering habitat on 300 acres in Units 2 and 3 within ten years of CCP approval. It would also increase wood duck nest boxes up to a total of 50 within five years of CCP approval.

Concerning colonial nesting water birds, Alternative D expands on Alternative C by including inventory, mapping, and monitoring on an annual basis within five years of CCP approval. Like Alternative C, it would restore colonial water bird feeding areas on Unit 3 within seven years of CCP approval. Like Alternative B, it includes proposed hydrology restoration on Unit 1 within five years of CCP approval to enhance opportunities for colonial nesting water bird rookeries. With regard to marshbirds, Alternative D also expands on Alternative C by conducting intensive marsh bird surveys during the nesting season. Like Alternative C, the refuge would acquire approximately 300 acres of tidal or managed wetlands within Units 2 and 3, and like Alternative A, the refuge would continue to maintain freshwater tidal emergent marsh used by marshbirds.

Over the lifetime of the CCP, Alternative D calls for reducing deer herd density to improve herd health and improve habitat quality for other species. With respect to reptiles and amphibians, Alternative D would expand on Alternative C by determining the presence/absence of amphibian and reptile species on the refuge. Like Alternative C, Alternative D would increase managed wetland habitats by approximately 300 acres on Unit 3 to benefit reptiles and amphibians. Like Alternative B, it would restore isolated wetlands to improve breeding areas of amphibians. With regard to controlling invasive animal species, control of feral hogs by hunting and trapping would be increased.

Alternative D would also pursue the CCP's habitat goal: to conserve, manage, and enhance natural diversity, abundance, and ecological functions of refuge habitats in support of national and regional plans, with special emphasis on managing towards old growth bottomland forest habitats. Management of open water would be identical to Alternative C – involving the monitoring of water quality, contaminants, jet skis impacts, and vegetation trends on open water throughout the refuge. This would be accomplished by the use of partnerships. Monitoring water quality, jet skis impacts, and vegetation trends on freshwater marshes would also be conducted throughout the refuge by the use of partnerships. With respect to managed wetlands under Alternative D, Waccamaw NWR would acquire, restore, develop, and improve moist-soil and SAV management, and infrastructure and monitoring on a total of 1,029 existing and newly acquired acres.

Under Alternative D, management of upland forests, bottomland hardwoods, cypress-gum forests, and invasive plants would all be identical to Alternative C. For the duration of the CCP, the refuge would prescribe burn 6,362 acres of upland forest on a 3-year cycle, while maintaining unique plant communities. On bottomland forests, 461 acres of bottomland hardwoods would be thinned where needed to develop understory vegetation and encourage oaks, mimicking tree fall gaps. The refuge would also convert other forest types to bottomland hardwoods where soils are appropriate. With respect to cypress-gum forests, where opportunities exist on the 25,077 acres of this forest type, the refuge would harvest overabundant red maples to ensure that cypress and gum trees regenerate, manage for old growth cypress and tupelo, and ensure the natural water regime. The Service would map areas of invasive plant species on the entire refuge and develop control/eradication plans for each species.

Alternative D would also pursue the CCP's resource protection goal: to identify, acquire, conserve, and protect natural and cultural resources through partnerships, land protection programs, stewardship, and law enforcement. Land acquisition would expand on the proposals of Alternatives A, B, and C. The refuge would continue to cooperate closely with partners to identify willing sellers within the acquisition boundary, while seeking funds outside of the LWCF to secure these properties. In addition, the refuge would work with partners to identify and protect corridors intended to facilitate black bear movement. This may include refuge expansion and using available LWCF funding for acquisition.

Like Alternatives A, B, and C, Alternative D would preserve cultural resources by complying with Section 107 of the National Historic Preservation Act. In addition, within 15 years of CCP approval, the refuge would develop and begin to implement a Cultural Resources Management Plan.

The law enforcement objective under this alternative would be achieved by providing 1.0 FTE for the refuge in addition to two dual function or seasonal officers. As pertains to private lands management, Waccamaw NWR would continue to work with 3-5 landowners at any one time within the acquisition boundary to enhance and protect habitat and wildlife resources on their properties, as in the other alternatives.

Alternative D would include the 4,600-acre Bull Island as a Wilderness Study Area (WSA), maintain its wilderness character, and within ten years of CCP approval, prepare a wilderness study report on whether Bull Island should be formally designated as a unit of the National Wilderness Preservation

System (NWPS). While Bull Island is a WSA, the refuge would maintain its wilderness character by prohibiting motorized access and equipment, unless specifically authorized. If designated as wilderness, Bull Island would continue to be managed in a manner that preserves its wild character. This would include allowing natural processes, such as flooding and ecological succession, to proceed unimpeded. Forest thinning and prescribed fire would not generally be carried out, but fire suppression could be, if necessary, to protect human health, life, and property.

Alternative D also pursues the visitor services' goal: to provide opportunities for quality, wildlife-dependent public uses, leading to greater understanding and enjoyment of fish, wildlife, and habitats contained within the Winyah Bay Focus Area. Under this goal, Alternative D is the only alternative that would develop a Visitor Services' Plan (within three years of CCP approval) to be used in expanding public use facilities and opportunities on the refuge. Like Alternatives A, B, and C, Alternative D would build and staff a visitor center at the designated site on Yauhannah Bluff by 2008. However, up to four nature trails associated with the visitor center would be developed, as in Alternatives B and C. Alternative D would also construct a riverfront boardwalk and provide canoe/kayak access to Big Pee Dee River.

Alternative D expands on the hunting opportunities of Alternative C by considering a mobility-impaired hunt for deer and hog. Like Alternative C, Alternative D potentially includes a youth waterfowl hunt on managed wetlands. Like Alternative B, there is the potential to open waterfowl hunting on the Jackson Bluff Tract. Like Alternative A, Alternative D would continue to provide seasonal hunting for deer, hog, turkey (including youth hunt), raccoon, squirrel, waterfowl, and snipe consistent with refuge and State regulations.

Fishing under Alternative D would be the same as Alternatives A, B, and C, with the added potential of mobility-impaired fishing access on Causey and Yauhannah Bluff tracts. Like the first three alternatives, Alternative D would maintain the entire refuge open to fishing consistent with State regulations, except for the Causey and Yauhannah Bluff tracts.

Alternative D includes all the environmental education features of the previous three alternatives. That is, like Alternative A, in partnership with SEWEE Association, it would continue offsite and onsite environmental education programs in Georgetown County Public Schools, including five elementary and one high school. It would also utilize the new visitor center and Causey Tract public use area for expanded environmental education. Like Alternative B, it would potentially partner with Coastal Carolina on Jackson Bluff, and utilize up to four nature trails near the new visitor center for environmental education. Like Alternative C, it would consider the potential for Sandy Island trails being utilized for environmental education. In addition to these activities and projects, under Alternative D alone, environmental education would expand into other schools in Georgetown County and into Horry and Marion Counties' public schools.

Alternative D expands on the interpretation activities, projects, and opportunities included under Alternative C by adding interpretive materials on existing trails at the Yauhannah Tract and strategic boat landings within the acquisition boundary, as well as conducting special outreach events. Like Alternative C, Alternative D entails the potential for interpretive activities on Sandy Island. Like Alternative B, it includes potential interpretive opportunities related to the wetland restoration site on Jackson Bluff and added interpretive opportunities provided in and around the new visitor center and the Causey Tract (Cox Ferry Lake Recreation Area). Like Alternative A, Alternative D would continue to provide interpretive programs to groups upon request and information to the public at the refuge office and on the refuge website.

Alternative D expands on the wildlife observation and photography projects of Alternative C with the addition of canoe trails on the Waccamaw and Big Pee Dee Rivers and the addition of trails on the Haulover Tract within 15 years of CCP approval. Like Alternative C, it adds trails on Sandy Island. Like Alternative B, when the new visitor center is opened, additional opportunities would be developed along with new trails. Like Alternative A, Alternative D would maintain Yauhannah Tract trails open to the public for observation and photography outside of hunting season. It would also continue to develop the Causey Tract (Cox Ferry Lake Recreation Area) public use area.

Alternative C would also pursue the refuge administration goal: to provide for sufficient staffing, facilities, and infrastructure to implement a comprehensive refuge management program to protect and manage the natural and cultural values of the refuge's habitats and fulfill the refuge's purposes, goals, and objectives.

Staffing under Alternative D would be the same as Alternative C but would add one full-time law enforcement officer, one administrative assistant, and one maintenance person within 7-10 years of CCP approval. The assistant manager position would be converted to a biologist position. Like Alternative C, Alternative D would also include one new biotech and/or SCEP student. Like Alternative B, Alternative D would add one park ranger upon opening of the visitor center. Like Alternative A, Alternative D would retain the current positions of refuge manager, assistant refuge manager (converted to biologist), and law enforcement officer (shared with complex).

Facilities under Alternative D would expand on those proposed under Alternative C by adding new maintenance facilities at Yauhannah Bluff. Like Alternative C, this alternative would add boardwalks at the Causey Tract and a potential dock at Sandy Island, in addition to kiosks at Causey Tract and at other strategic locations. Like Alternative B, this alternative would add one dock each at Yauhannah Bluff and Causey tracts (Cox Ferry Lake Recreation Area) and a weather shelter at the latter. Like Alternative A, Alternative D would construct a new administrative office at the designated site on Yauhannah Bluff by 2008, but keep the existing maintenance yard in Georgetown for the foreseeable future. Alternative D would also maintain existing and create new Causey Tract facilities.

Partnerships under Alternative D would include all those initiatives listed under Alternative C and add a partnership-funded environmental education coordinator. Like Alternative C, Alternative D would seek additional partnerships and/or volunteers/interns for increased visitor services and habitat enhancement on for all units of the refuge. As in Alternative A, Alternative D calls for the refuge to continue to cooperate with partners such as the SEWEE, SCDNR, TNC, Historic Ricefield Association, and Winyah Bay Focus Area Task Force.

FEATURES COMMON TO ALL ALTERNATIVES

Although the alternatives differ in many ways, there are similarities among them as well. These common features are listed below to reduce the length and redundancy of the individual alternative descriptions. Each of the four management alternatives assessed in this EA would:

- Provide habitat for migratory waterfowl.
- Conduct surveys on swallow-tailed kites and Swainson's warblers.
- Compile observations or conduct surveys of black bears.
- Protect threatened and endangered species on appropriate refuge habitats; document all sightings and presence of listed species.
- Annually maintain at least 15 wood duck boxes.
- Protect rookeries of colonial nesting water birds.

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- Maintain freshwater tidal emergent marsh used by marshbirds.
 - Manage the deer herd via annual hunting during State season.
 - Provide habitat for reptiles and amphibians.
 - Control feral hogs by hunting.
 - Provide 2,430 acres of open water habitat.
 - Provide 2,923 acres of freshwater marsh.
 - Maintain a minimum of 629 acres of existing moist-soil and submerged aquatic vegetation.
 - Provide 6,362 acres of upland forest.
 - Provide 461 acres of bottomland hardwoods.
 - Provide about 25,000 acres of cypress-gum forest.
 - Continue to cooperate closely with partners to identify willing sellers within the acquisition boundary, while seeking funds outside of LWCF to secure these properties.
 - Continue to comply with Section 106 of the National Historic Preservation Act.
 - Continue to share law enforcement with other refuges in the Lowcountry Complex.
 - Continue to work with 3-5 landowners at any one time within acquisition boundary to enhance and protect habitat and wildlife resources on their properties.
 - Build and staff new visitor center at designated site on Yauhannah Bluff by 2008.
 - Continue to provide seasonal hunting for deer, hog, turkey (including youth hunt), raccoon, squirrel, waterfowl, and snipe consistent with refuge and State regulations.
 - Maintain entire refuge open to fishing consistent with State regulations, except for Causey and Yauhannah Bluff tracts.
 - In partnership with SEWEE Association, continue on- and off-site environmental education programs in Georgetown County public schools, including 5 elementary and one high school. Utilize new visitor center and Causey Tract (Cox Ferry Lake Recreation Area) public use area for expanded environmental education.
 - Continue to provide interpretive programs to groups upon request and provide information to the public at office and website.
 - Maintain Yauhannah Tract trails open to the public for observation and photography outside of hunting season. Continue to develop Causey Tract (Cox Ferry Lake Recreation Area) public use area.
 - Maintain a minimum staff of three, including refuge manager, assistant refuge manager, and law enforcement officer (shared with complex).
 - Construct new administrative office at designated site on Yauhannah Bluff by 2008, but keep existing maintenance yard in Georgetown for the foreseeable future. Maintain existing and create new Causey Tract facilities.
 - Continue to cooperate with partners such as the SEWEE, SCDNR, TNC, Historic Ricefield Association, and Winyah Bay Focus Area Task Force.

ALTERNATIVES CONSIDERED BUT ELIMINATED FROM FURTHER ANALYSIS

The alternative's development process under NEPA and the Refuge Improvement Act is designed to allow consideration of the widest possible range of issues and potential management approaches. During the alternative's development process, many different solutions were considered. The following alternative components were considered but not selected for detailed study in this CCP/EA for the reason(s) described.

PRE-SETTLEMENT CONDITIONS

This alternative is often used as a baseline in the development of CCP alternatives. Pre-settlement conditions typically refer to extant habitat conditions that existed prior to significant Euro-American settlement of North America over the last several centuries. In the case of Waccamaw NWR, most upland sites would be covered by hardwood forests, pine forests, and mixed forests. There would be no cropland or grassy fields. None of the development within the refuge's acquisition boundary, including roads, farms, bridges, and numerous buildings, would exist.

This alternative was considered by the planning team but rejected on the basis of its impracticability. The ecology and hydrology of the surrounding ecosystems have been thoroughly transformed from more than three centuries of Euro-American settlement. Large-scale, man-made hydrological alterations have permanently changed the spatial and temporal patterns of flooding throughout the entire Savannah/Santee/Pee Dee Rivers Ecosystem, in terms of both extent and duration of flooding, in comparison with the natural hydrology regime. This curtailment of the flooding regime has had an enormous impact on the forested wetlands and their associated wetland-dependent species.

CUSTODIAL MANAGEMENT OF THE REFUGE

Under this scenario, refuge staff would cease all active management of both upland and wetland habitat at Waccamaw NWR, employing "passive management" instead. Staff would allow natural succession to proceed unhindered on upland and bottomland sites and not control invasive species like kudzu, Chinese privet, phragmites, and water hyacinth. Fire management would be limited to fire suppression rather than use of prescribed fire to manipulate habitats and set back succession. No upland invasive plant species control would be carried out and no forest thinning would take place. Moist-soil units would cease to be actively managed. Staff would focus efforts on research and data collection related to successional trends and on management of public visitation to Waccamaw NWR.

This alternative was considered and dismissed because of the unsatisfactory outcomes it would have for both wildlife and habitat. Habitat quality and indigenous wildlife populations would be expected to decline, which would not fulfill the purposes of the refuge.

COMPARISON OF THE ALTERNATIVES BY ISSUE

Table 6. Comparison of alternatives by management issues for Waccamaw NWR

Issues	Alternative A (Current Management – No Action Alternative)	Alternative B Habitat Restoration/Enhancements on Unit 1	Alternative C Habitat Restoration/Enhancements on All Units	Alternative D (Proposed Alternative) Optimize Habitat Management and Visitor Services
Migratory Waterfowl	No active, direct management of waterfowl populations.	Within 5 years of CCP approval, improve wintering waterfowl habitat on approximately 600 acres on Unit 1 by restoring hydrology through plugging drainage ditches and leveling pine plantation beds.	Same as Alternative B plus restoration and enhancement on historic rice fields on approximately 400 acres in Units 2 and 3 over the life of the CCP.	Same as Alternative C.
Neotropical Migratory Birds	Throughout the lifetime of the CCP, conduct informal surveys on swallow-tailed kites and Swainson's warblers on an occasional basis.	Same as Alternative A plus within 10 years of CCP approval, increase scrub-shrub habitat by approximately 600 acres on Unit 1.	Same as Alternative B.	Same as Alternative B, plus commence formal surveys of swallow-tailed kites and Swainson's warblers within 5 years of CCP approval.
Black Bear	Compile incidental observations of black bear on the refuge.	Same as Alternative A.	Target refuge acquisition and habitat restoration efforts within wetland corridors to improve connectivity between bear populations.	Same as Alternative C plus conduct annual surveys of black bears within 5 years of CCP approval, in addition to enlisting public participation in gathering sightings.
Threatened and Endangered Species	Listed species continue to be protected on appropriate refuge habitats; document all sightings and presence of listed species on the refuge.	Proposed hydrology restoration on Unit 1 will enhance existing wood stork rookery.	Same as Alternative B, plus restore wood stork feeding areas on Unit 3 and RCW nesting and foraging habitat on Unit 2.	Same as Alternative C.

Issues	Alternative A (Current Management – No Action Alternative)	Alternative B Habitat Restoration/Enhancements on Unit 1	Alternative C Habitat Restoration/Enhancements on All Units	Alternative D (Proposed Alternative) Optimize Habitat Management and Visitor Services
Wood Duck	Maintain 15 wood duck boxes annually.	Same as Alternative A (maintain 15 wood duck boxes annually) and improve brood habitat on 10 acres in Unit 1 within 7 years of CCP approval.	Same as Alternative B and improve brood and wintering habitat on 300 acres in Units 2 and 3 within 10 years of CCP approval. Increase wood duck nest boxes up to a total of 50 within 5 years of plan approval.	Same as Alternative C and in addition establish a long-term banding site within 7 years of CCP approval.
Colonial Nesting Water Birds	No active management except for protection of existing rookeries on refuge.	Proposed hydrology restoration on Unit 1 within 5 years of CCP approval will enhance opportunities for colonial nesting water bird rookeries.	Same as Alternative B, plus restore colonial water bird feeding areas on Unit 3 within 7 years of CCP approval.	Same as Alternative C but with inventory, mapping, and monitoring on an annual basis within 5 years of CCP approval.
Marshbirds	Continue to maintain freshwater tidal emergent marsh used by marshbirds.	Same as Alternative A.	Same as Alternative A, plus acquire approximately 300 acres of tidal or managed wetlands within Units 2 and 3 within 7 years of CCP approval.	Same as Alternative C, with intensive marsh bird surveys during nesting season.
White-tailed Deer	Continue to manage deer herd via annual hunting during State season.	Same as Alternative A.	Same as Alternative A.	Over lifetime of CCP, reduce deer herd density to improve herd health and improve habitat quality for other species.
Reptiles and Amphibians	No active management of reptiles and amphibians.	Restoration of isolated wetlands within 5 years of CCP approval would improve breeding areas of amphibians.	Same as Alternative B, and increase managed wetland habitats by approximately 300 acres on Unit 3 within 7 years of CCP approval that would benefit reptiles and amphibians.	Same as Alternative C, plus within 5 years of CCP approval, determine presence/absence of amphibian and reptile species on refuge.

Issues	Alternative A (Current Management – No Action Alternative)	Alternative B Habitat Restoration/Enhancements on Unit 1	Alternative C Habitat Restoration/Enhancements on All Units	Alternative D (Proposed Alternative) Optimize Habitat Management and Visitor Services
Controlling Invasive Animal Species	Maintain existing hunts for feral hogs on Units 1 and 3.	Same as Alternative A.	Same as Alternative A with the addition of hunting opportunities on Unit 2.	Increase control of feral hogs by hunting and trapping.
Open Water	No active management of 2,430 acres of open water on refuge.	Same as Alternative A.	Monitor water quality, contaminants, jet skis impacts and vegetation trends on open water throughout the refuge by using partnerships.	Same as Alternative C.
Freshwater Marshes	No active management of 2,923 acres of freshwater marsh on refuge.	Same as Alternative A.	Monitor water quality, jet skis impacts and vegetation trends on freshwater marshes throughout the refuge by using partnerships.	Same as Alternative C.
Managed Wetlands	No active management or monitoring of 629 acres of existing moist-soil and submerged aquatic vegetation (SAV) on the refuge.	Same as Alternative A.	Acquire, restore, develop, and improve moist-soil and submerged aquatic vegetation (SAV) management, infrastructure, and monitoring on a total of 1,029 existing and newly acquired acres within 10 years of CCP approval.	Same as Alternative C.
Upland Forests	No active management of 6,362 acres of upland forest on the refuge.	Same as Alternative A.	For duration of CCP, prescribe burn 6,362 acres of upland forest on a 3-year cycle while maintaining unique plant communities.	Same as Alternative C.

Issues	Alternative A (Current Management – No Action Alternative)	Alternative B Habitat Restoration/Enhancements on Unit 1	Alternative C Habitat Restoration/Enhancements on All Units	Alternative D (Proposed Alternative) Optimize Habitat Management and Visitor Services
Bottomland Hardwoods	No active management of 461 acres of bottomland hardwoods on the refuge.	Same as Alternative A.	Over the course of the CCP, thin 461 acres of bottomland hardwoods where needed to develop understory vegetation and encourage oaks, mimicking tree fall gaps, and convert other forest types to bottomland hardwoods where soils are appropriate.	Same as Alternative C.
Cypress-Gum Forest	No active management of 25,077 acres of cypress-gum forest on the refuge.	Same as Alternative A.	Where opportunities exist on the 25,077 acres of cypress-gum forest on the refuge, harvest overabundant red maple to ensure cypress and gum regenerate, manage for old growth cypress and tupelo, and ensure natural water regime.	Same as Alternative C.
Invasive Plants	No active management of invasive plant species on refuge.	Within 5 years of CCP approval, map areas of invasive plant species on Unit 1 and develop control/eradication plans for each species.	Within 5 years of CCP approval, map areas of invasive plant species on the entire refuge and develop control/eradication plans for each species.	Same as Alternative C.
Land Acquisition	Continue to cooperate closely with partners to identify willing sellers within the acquisition boundary, while seeking funds outside of LWCF to secure these properties.	Same as Alternative A.	Same as Alternative A.	Same as Alternative A. In addition, work with partners to identify and protect corridors intended to facilitate black bear movement. This may include refuge expansion and using available LWCF funding for acquisition.

Issues	Alternative A (Current Management – No Action Alternative)	Alternative B Habitat Restoration/Enhancements on Unit 1	Alternative C Habitat Restoration/Enhancements on All Units	Alternative D (Proposed Alternative) Optimize Habitat Management and Visitor Services
Cultural Resources	Continue to comply with Section 106 of the National Historic Preservation Act.	Same as Alternative A.	Same as Alternative A.	Within 15 years of CCP approval, develop and begin to implement a Cultural Resources Management Plan.
Law Enforcement	Continue to provide 1.0 FTE shared with the refuge Complex and 2 dual function officers.	Same as Alternative A.	Same as Alternative A.	Provide 1.0 FTE for the refuge in addition to 2 dual function or seasonal officers.
Private Lands	Continue to work with 3-5 landowners at any one time within acquisition boundary to enhance and protect habitat and wildlife resources on their properties.	Same as Alternative A.	Same as Alternative A.	Same as Alternative A.
Wilderness	Continue to generally maintain the wilderness character of Bull Island, but do not take the necessary steps to formally recommend that it be designated as wilderness.	Same as Alternative A.	Same as Alternative A.	Include Bull Island as a Wilderness Study Area, maintain its wilderness character, and within 10 years of CCP approval, prepare a wilderness study report with a recommendation to Congress on whether Bull Island should be formally designated as a unit of the National Wilderness Preservation System.

Issues	Alternative A (Current Management – No Action Alternative)	Alternative B Habitat Restoration/Enhancements on Unit 1	Alternative C Habitat Restoration/Enhancements on All Units	Alternative D (Proposed Alternative) Optimize Habitat Management and Visitor Services
Visitor Services’ Plan	Continue to serve public without Visitor Services’ Plan.	Same as Alternative A.	Same as Alternative A.	Within 3 years of CCP completion, develop a Visitor Services’ Plan to be used in expanding public use facilities and opportunities on the refuge.
Visitor Center	Build and staff new visitor center at designated site on Yauhannah Bluff by 2008.	Same as Alternative A plus develop up to 4 nature trails associated with the visitor center at Yauhannah Bluff within 3 years of opening the visitor center.	Same as Alternative A.	Same as Alternative B plus addition of riverfront boardwalk and canoe/kayak access to Big Pee Dee River.
Hunting	Continue to provide seasonal hunting for deer, hog, turkey (including youth hunt), raccoon, squirrel, waterfowl, and snipe consistent with refuge and State regulations.	Same as Alternative A with the potential to open waterfowl hunting on the Jackson Bluff Tract.	Same as Alternative B with potential for a youth waterfowl hunt on managed wetlands.	Same as Alternative C with the potential of a mobility-impaired hunt for deer and hog.
Fishing	Maintain entire refuge open to fishing consistent with State regulations, except for Causey and Yauhannah Bluff tracts.	Same as Alternative A.	Same as Alternative A.	Same as Alternative A with added potential of mobility-impaired fishing access on Causey and Yauhannah Bluff tracts.

Issues	Alternative A (Current Management – No Action Alternative)	Alternative B Habitat Restoration/Enhancements on Unit 1	Alternative C Habitat Restoration/Enhancements on All Units	Alternative D (Proposed Alternative) Optimize Habitat Management and Visitor Services
Environmental Education	In partnership with SEWEE Association, continue on- and off-site environmental education programs in Georgetown County Public Schools, including 5 elementary schools and one high school. Utilize new visitor center and Causey Tract public use area for expanded environmental education.	Same as Alternative A plus potential partnership with Coastal Carolina on Jackson Bluff, and utilization of up to 4 nature trails near new visitor center for environmental education.	Same as Alternative B with potential for Sandy Island trails being utilized for environmental education.	Same as Alternative C plus expansion of environmental education into other schools in Georgetown County and into Horry and Marion counties' public schools.
Interpretation	Continue to provide interpretive programs to groups upon request and provide information to the public at office and website.	Same as Alternative A plus potential interpretive opportunities related to wetland restoration site on Jackson Bluff. Added interpretive opportunities will be provided in and around the new visitor center and the Causey Tract.	Same as Alternative B plus potential interpretive activities on Sandy Island.	Same as Alternative C plus adding interpretive materials on existing trails at Yauhannah Tract and strategic boat landings within the acquisition boundary and conducting special outreach events.
Wildlife Observation and Photography	Maintain Yauhannah Tract trails open to the public for observation and photography outside of hunting season. Continue to develop Causey Tract public use area.	Same as Alternative A and when new visitor center is opened, additional opportunities will be developed along with new trails.	Same as Alternative B with the addition of trails on Sandy Island.	Same as Alternative C with the addition of canoe trails on the Waccamaw and Big Pee Dee Rivers and the addition of trails on the Haulover Tract within 15 years of CCP approval.

Issues	Alternative A (Current Management – No Action Alternative)	Alternative B Habitat Restoration/Enhancements on Unit 1	Alternative C Habitat Restoration/Enhancements on All Units	Alternative D (Proposed Alternative) Optimize Habitat Management and Visitor Services
Staffing	Maintain current staff of three, including refuge manager, assistant refuge manager, and law enforcement officer (shared with complex).	Same as Alternative A and add one park ranger upon opening of the visitor center.	Same as Alternative B plus one biotech and/or SCEP student within 5 years of CCP approval.	Same as Alternative C plus 1 full-time law enforcement officer, 1 administrative assistant, and 1 maintenance person within 7-10 years of CCP approval. Convert assistant manager to biologist.
Facilities	Construct new administrative office at designated site on Yauhannah Bluff by 2008 but keep existing maintenance yard in Georgetown for the foreseeable future. Maintain existing and create new Causey Tract facilities.	Same as Alternative A and add 1 dock each at Yauhannah Bluff and Causey tracts and weather shelter at the latter.	Same as Alternative B and add boardwalks at Causey Tract and potential dock at Sandy Island, in addition to kiosks at Causey Tract and at other strategic locations.	Same as Alternative C plus add new maintenance facilities at Yauhannah Bluff.
Partnerships	Continue to cooperate with partners such as the SEWEE, SCDNR, TNC, Historic Ricefield Association, and Winyah Bay Focus Area Task Force.	Same as Alternative A and seek additional partnerships and/or volunteers/interns for increased visitor services and habitat enhancement on Unit 1.	Same as Alternative B but for all units of refuge.	Same as Alternative C and add a partnership funded environmental education coordinator.

IV. Environmental Consequences

OVERVIEW

This section analyzes and discusses the potential environmental effects or consequences that can be reasonably expected by the implementation of each of the four alternatives described in Chapter III of this environmental assessment. For each alternative, the expected outcomes are portrayed through the 15-year life of the CCP.

EFFECTS COMMON TO ALL ALTERNATIVES

A few potential effects will be the same under each alternative and are summarized under seven categories: environmental justice, climate change, other management, land acquisition, cultural resources, refuge revenue-sharing, and other effects.

ENVIRONMENTAL JUSTICE

Executive Order 12898, “Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations” was signed by President Clinton on February 11, 1994, to focus Federal attention on the environmental and human health conditions of minority and low-income populations, with the goal of achieving environmental protection for all communities. The Order directed Federal agencies to develop environmental justice strategies to aid in identifying and addressing disproportionately high and adverse human health or environmental effects of their programs, policies, and activities on minority and low-income populations. The Order is also intended to promote nondiscrimination in Federal programs substantially affecting human health and the environment, and to provide minority and low-income communities with access to public information and opportunities for participation in matters relating to human health or the environment.

None of the management alternatives described in this environmental assessment will disproportionately place any adverse environmental, economic, social, or health impacts on minority and low-income populations. Implementation of any action alternative that includes public use and environmental education is anticipated to provide a benefit to the residents residing in the surrounding communities.

CLIMATE CHANGE

The Department of the Interior issued an order in January 2001 requiring Federal agencies under its direction that have land management responsibilities to consider potential climate change impacts as part of long-range planning endeavors.

The increase of carbon within the earth’s atmosphere has been linked to the gradual rise in surface temperatures commonly referred to as global warming. In relation to comprehensive planning for national wildlife refuges, carbon sequestration constitutes the primary climate-related impact to be considered in planning. The Department of Energy’s *Carbon Sequestration Research and Development* (U.S. Department of Energy 1999) defines carbon sequestration as “...the capture and secure storage of carbon that would otherwise be emitted to or remain in the atmosphere.”

The land is a tremendous force in carbon sequestration. Terrestrial biomes of all sorts—grasslands, forests, wetlands, tundra, perpetual ice, and desert—are effective both in preventing carbon emissions

and in acting as a biological “scrubber” of atmospheric carbon monoxide. The conclusions of the Department of Energy’s report noted that ecosystem protection is important to carbon sequestration and may reduce or prevent the loss of carbon currently stored in the terrestrial biosphere.

Conserving natural habitat for wildlife is the heart of any long-range plan for national wildlife refuges. The actions proposed in this comprehensive conservation plan would conserve or restore land and water, and would thus enhance carbon sequestration. This, in turn, contributes positively to efforts to mitigate human-induced global climate changes.

OTHER MANAGEMENT

All management activities that could affect the refuge’s natural resources, including subsurface mineral reservations, utility lines and easements, soils, water and air, and historical and archaeological resources, would be managed to comply with all laws and regulations. In particular, any existing and future oil and gas exploration, extraction, and transport operations on the refuge would be managed identically under each of the alternatives. Thus, the impacts would be the same.

LAND ACQUISITION

Funding for land acquisition from willing sellers within the approved acquisition boundary of Waccamaw NWR would come from the Land and Water Conservation Fund, the Migratory Bird Conservation Fund, Corps of Engineers mitigation programs, or donations from conservation and private organizations. Conservation easements and leases can be used to obtain the minimum interests necessary to satisfy refuge objectives if the refuge staff can adequately manage uses of the areas for the benefit of wildlife. The Service can negotiate management agreements with local, State and Federal agencies, and accept conservation easements. Some tracts within the refuge acquisition boundary may be owned by other public or private conservation organizations. The Service would work with interested organizations to identify additional areas needing protection and provide technical assistance if needed. The acquisition of private lands is entirely contingent on the landowners and their willingness to participate.

CULTURAL RESOURCES

All alternatives afford additional land protection and low levels of development, thereby producing little negative effect on the refuge’s cultural and historic resources. Potentially negative effects could include logging, construction of new trails or facilities, and development of water impoundments. In most cases, these management actions would require review by the Service’s Regional Archaeologist in consultation with the State of South Carolina Historic Preservation Office, as mandated by Section 106 of the National Historic Preservation Act. Therefore, the determination of whether a particular action within an alternative has the potential to affect cultural resources is an on-going process that would occur during the planning stages of every project.

Service acquisition of land with known or potential archaeological or historical sites provides two major types of protection for these resources: protection from damage by Federal activity and protection from vandalism or theft. The National Historic Preservation Act requires that any actions by a Federal agency which may affect archaeological or historical resources be reviewed by the State Historic Preservation Office, and that the identified effects must be avoided or mitigated. The Service’s policy is to preserve these cultural, historic, and archaeological resources in the public trust, and avoid any adverse effects wherever possible.

Land acquisition, within the current acquisition boundary, by the Service would provide some degree of protection to significant cultural and historic resources. If acquisition of private lands does not

occur and these lands remain under private ownership, the landowner would be responsible for protecting and preserving cultural resources. Development of off-refuge lands has the potential to destroy archaeological artifacts and other historical resources, thereby decreasing opportunities for cultural resource interpretation and research.

REFUGE REVENUE-SHARING

Annual refuge revenue-sharing payments to Georgetown, Horry and Marion Counties would continue at similar rates under each alternative. If lands are acquired and added to the refuge, the payments would increase accordingly.

OTHER EFFECTS

Each of the alternatives would have similar effects or minimal to negligible effects on the soils; water quality and quantity; noise; transportation; human health and safety; children; hazardous materials; waste management; aesthetics and visual resources; and utilities and public services.

SUMMARY OF EFFECTS BY ALTERNATIVE

The following section describes the environmental consequences of adopting each refuge management alternative. Table 7 summarizes and addresses the likely outcomes for the specific issues, and is organized by broad issue categories.

ALTERNATIVE A – CURRENT MANAGEMENT (NO ACTION)

In general, implementing Alternative A, that is, continuing current management direction would have neutral to mildly beneficial impacts on the human environment, wildlife populations, and wildlife habitat at Waccamaw NWR. Populations of migratory waterfowl, wood duck, neotropical migratory birds, colonial nesting waterbirds, marshbirds, white-tailed deer, reptiles, amphibians, and threatened and endangered species on the refuge are unlikely to either increase or decrease substantially over the next 15 years as a result of this alternative. Black bear numbers could increase somewhat due to an increase in the acreage of protected and connected habitats on and near the refuge, although offsetting this positive trend would be the growth in the area's human population, traffic and general development, which would tend to exert downward pressure on bear numbers. The herd size of the area's most threatening invasive animal species – the feral hog – would probably not change significantly under this alternative.

Under Alternative A, the quantity and quality of the refuge's habitats – including open water, freshwater marsh, managed wetlands (moist-soil units and submerged aquatic vegetation), upland forests, bottomland hardwoods, and cypress-gum forest – would not change significantly. However, the continuing spread and infestation of invasive plant species could degrade the quality of aquatic, wetland, and upland habitats somewhat.

Cultural resources would continue to be protected from human activities (especially excavation) under Alternative A, according to the stipulations of the National Historic Preservation Act, but not from natural forces such as erosion, weathering, and flood damage. There would be no new knowledge about cultural resources gained under this alternative that could improve their management, interpretation, or appreciation.

The wilderness character of Bull Island would probably not be altered appreciably under this alternative. No facilities development would take place on the island, but it could still be subjected to

habitat improvement projects such as forest thinning and prescribed fire. If it were to be thinned, depending on the logging method(s) used, this could necessitate temporary skid roads and pads for timber harvesting equipment, which could potentially, at least temporarily, compromise Bull Island's wilderness character.

Certain visitor services and public use opportunities would remain unchanged under Alternative A. Hunting and fishing opportunities, for example, would stay the same as they are at present. However, with the construction and operation of the new visitor center and associated facilities at Yauhannah Bluff, environmental education and especially interpretation on the refuge would be increased substantially. Opportunities for wildlife observation and photography would also increase somewhat because of the ongoing development of the Causey Tract.

ALTERNATIVE B – HABITAT RESTORATION/ENHANCEMENTS ON UNIT 1

In general, implementing Alternative B, that is, undertaking habitat restoration and enhancements on Unit 1, would have beneficial impacts on the human environment, wildlife populations, and wildlife habitat of Unit 1 itself. Undertaking the refuge, as a whole, would also be generally beneficial, since Unit 1 constitutes the bulk – nearly two-thirds – of the total refuge area within the acquisition boundary. Populations of migratory waterfowl, neotropical migratory birds, wood duck, colonial nesting waterbirds, reptiles, amphibians, and the federally listed wood stork on Unit 1 may increase slightly as a result of the actions proposed under Alternative B. On the other hand, marshbirds and white-tailed deer populations would probably not change appreciably.

As in Alternative A, under Alternative B, black bear numbers could increase somewhat due to an increase in the acreage of protected and connected habitats on and near the refuge, although offsetting this positive trend would be the growth in the area's human population and traffic and general development, which would tend to exert downward pressure on bear numbers. The herd size of the area's most threatening invasive animal species – the feral hog – would probably not change significantly under this alternative.

Under Alternative B, the quantity and quality of the refuge's habitats – including open water, freshwater marsh, managed wetlands (moist-soil units and submerged aquatic vegetation), upland forests, bottomland hardwoods, and cypress-gum forest – would not change significantly, even on Unit 1. The continuing spread and infestation of invasive plant species could degrade the quality of aquatic, wetland, and upland habitats somewhat. However, under Alternative B, increased mapping, monitoring, and control efforts on Unit 1 could reduce encroachment by invasive species.

Cultural resources would continue to be protected from human activities (especially excavation) under Alternative B, according to the stipulations of the National Historic Preservation Act, but not from natural forces such as erosion, weathering, and flood damage. There would be no new knowledge about cultural resources gained under this alternative that could improve their management, interpretation, or appreciation.

The wilderness character of Bull Island would probably not be altered appreciably under this alternative. No facilities development would take place on the island, but it could still be subjected to habitat improvement projects, such as forest thinning and prescribed fire. If it were to be thinned, depending on the logging method(s) used, this could necessitate temporary skid roads and pads for timber harvesting equipment, which could potentially, at least temporarily, compromise Bull Island's wilderness character.

Overall, visitor services and public use opportunities would increase under Alternative B. This would be greatly assisted by the new visitor center on Yauhannah Bluff. The potential for opening a

waterfowl hunt on the Jackson Bluff Tract would increase hunting opportunities over those at present. Fishing opportunities would probably stay the same as they are at present.

A potential partnership with Coastal Carolina on Jackson Bluff and utilization of up to four nature trails near the new visitor center would increase the level of environmental education opportunities available to the public. The potential for interpretive opportunities related to the wetland restoration site on Jackson Bluff, plus added interpretive opportunities in and around the new visitor center and the Causey Tract, would increase overall interpretation on the refuge. Likewise, new trails at the visitor center would increase opportunities for wildlife observation and photography at Waccamaw NWR.

ALTERNATIVE C – HABITAT RESTORATION/ENHANCEMENTS ON ALL UNITS

In general, implementing Alternative C, that is, undertaking habitat restoration and enhancements on all units, would extend the beneficial impacts of Alternative B on the human environment, wildlife populations, and wildlife habitat from Unit 1 to the entire Waccamaw NWR. Populations of migratory waterfowl, neotropical migratory birds, wood duck, colonial nesting waterbirds, marshbirds, reptiles, amphibians, and the federally listed wood stork may increase slightly as a result of the actions proposed under Alternative C. On the other hand, white-tailed deer populations would probably not change appreciably.

As in Alternatives A and B, under Alternative C, black bear numbers may increase somewhat due to an increase in the acreage of protected and connected habitats on and near the refuge, although offsetting this positive trend would be the growth in the area's human population, traffic, and general development, which would tend to exert downward pressure on bear numbers. In Alternative C, there would be a greater emphasis on securing migration corridors for the black bear, which could help ensure its continued survival and population stability. The herd size of the area's most threatening invasive animal species – the feral hog – could potentially decrease under this alternative because its hunting would be encouraged.

Under Alternative C, the quantity and quality of the refuge's aquatic habitats – including open water, freshwater marsh, and managed wetlands (moist-soil units and submerged aquatic vegetation) – would either remain the same or improve slightly. The quantity of upland forests, bottomland hardwoods, and cypress-gum forests would not change significantly under this alternative. However, because of the proposed use of prescribed fire and thinning, the quality of these forest habitats may improve somewhat. The continuing spread and infestation of invasive plant species could degrade the quality of aquatic, wetland, and upland habitats somewhat. However, under Alternative C, increased mapping, monitoring, and control efforts could reduce encroachment by invasive species.

Cultural resources would continue to be protected from human activities (especially excavation) under Alternative C, according to the stipulations of the National Historic Preservation Act, but not from natural forces such as erosion, weathering, and flood damage. There would be no new knowledge about cultural resources gained under this alternative that could improve their management, interpretation, or appreciation.

The wilderness character of Bull Island would probably not be altered appreciably under this alternative. No facilities' development would take place on the island, but it could still be subjected to habitat improvement projects, such as forest thinning and prescribed fire. If it were to be thinned, depending on the logging method(s) used, this could necessitate temporary skid roads and pads for timber harvesting equipment, which could potentially, at least temporarily, compromise Bull Island's wilderness character.

Overall, visitor services and public use opportunities would increase under Alternative C. This would be greatly assisted by the new visitor center on Yauhannah Bluff. The potential for opening a waterfowl hunt on the Jackson Bluff Tract, as well as a youth waterfowl hunt, would increase hunting opportunities over those at present. Fishing opportunities would probably stay the same as they are at present.

A potential partnership with Coastal Carolina on Jackson Bluff, utilization of up to four nature trails near the new visitor center for environmental education, and use of Sandy Island trails would all increase the level of environmental education opportunities available to the public over those available under Alternatives A or B. The potential for interpretive opportunities related to wetland restoration site on Jackson Bluff, plus added interpretive opportunities in and around the new visitor center and the Causey Tract, in addition to interpretive opportunities on Sandy Island, would substantially increase overall interpretation on the refuge. Likewise, new trails at the visitor center and Sandy Island would increase opportunities for wildlife observation and photography at Waccamaw NWR.

ALTERNATIVE D – OPTIMIZE HABITAT MANAGEMENT AND VISITOR SERVICES (PROPOSED ALTERNATIVE)

In general, implementing Alternative C, that is, optimizing habitat management and visitor services throughout the refuge, would encompass the potential benefits of Alternatives B and C on the human environment, wildlife populations, and wildlife habitat, and would increase benefits further by expanding visitor services and public uses.

Populations of migratory waterfowl, neotropical migratory birds, wood duck, colonial nesting waterbirds, marshbirds, reptiles, amphibians, and the federally listed wood stork may increase slightly as a result of the actions proposed under Alternative D. On the other hand, white-tailed deer populations would probably not change appreciably.

As in each of the other alternatives, under Alternative C, black bear numbers could increase somewhat due to an increase in the acreage of protected and connected habitats on and near the refuge, although offsetting this positive trend would be the growth in the area's human population, traffic, and general development, which would tend to exert downward pressure on bear numbers. In Alternative D (like Alternative C) there would be a greater emphasis on securing migration corridors for the black bear, which could help ensure its continued survival and population stability. The herd size of the area's most threatening invasive animal species – the feral hog – could potentially decrease under this alternative because their hunting and trapping would be encouraged; this decrease could be greater than under Alternative C.

Under Alternative D, as in Alternative C, the quantity and quality of the refuge's aquatic habitats – including open water, freshwater marsh, and managed wetlands (moist-soil units and submerged aquatic vegetation) – would either remain the same or improve slightly. The quantity of upland forests, bottomland hardwoods, and cypress-gum forests would not change significantly in this alternative. However, because of the proposed use of prescribed fire and thinning, the quality of these forest habitats may improve somewhat. The continuing spread and infestation of invasive plant species could degrade the quality of aquatic, wetland, and upland habitats somewhat. However, under Alternative D, increased mapping, monitoring, and control efforts could reduce encroachment by invasive species.

Cultural resources would continue to be protected from human activities (especially excavation) under Alternative D, according to the stipulations of the National Historic Preservation Act, but not from natural forces such as erosion, weathering, and flood damage. Development of a Cultural Resources Management Plan within 15 years of CCP approval would lead eventually to improved management, knowledge, and preservation of the refuge's cultural resources.

The wilderness character of Bull Island would be ensured under this alternative, pending a final decision by the Director of the Fish and Wildlife Service, the President, and the Congress on whether to adopt the refuge's recommendation that it be designated a unit of the National Wilderness Preservation System. While this would be a benefit of Alternative D, one adverse effect of including Bull Island as a Wilderness Study Area would be to restrict management options, such as conducting forest thinning and prescribed fire on the island for the sake of wildlife habitat improvement.

Overall, visitor services and public use opportunities would increase more under this alternative than any of the others. Preparation and implementation of a Visitor Services' Plan would help organize and systematize the refuge's visitor services, with a probable increase in the quality and quantity of visitor experiences. As in the other alternatives, visitor services would be greatly expanded by the new visitor center on Yauhannah Bluff. The potential for opening a waterfowl hunt on the Jackson Bluff Tract, as well as a youth waterfowl hunt and a mobility-impaired deer and hog hunt, would substantially increase existing hunting opportunities. Public fishing opportunities would increase with the potential addition of mobility-impaired fishing access on Causey and Yauhannah Bluff tracts.

A potential partnership with Coastal Carolina on Jackson Bluff, utilization of up to four nature trails near the new visitor center for environmental education, and use of Sandy Island trails would all increase the level of environmental education opportunities available to the public over those available at present. These opportunities would also be provided by Alternatives A or B. However, only Alternative D would expand environmental education into other schools in Georgetown County and into public schools in Horry and Marion Counties.

Adding interpretive materials on existing trails at Yauhannah Tract and strategic boat landings within the acquisition boundary and conducting special outreach events would only occur under Alternative D. Like Alternative C, Alternative D would offer the potential for interpretive opportunities related to wetland restoration site on Jackson Bluff, plus added interpretive opportunities in and around the new visitor center and the Causey Tract, in addition to interpretive opportunities on Sandy Island. Overall, Alternative D would substantially increase the level of interpretation now occurring on the refuge.

With regard to wildlife observation and photography, like Alternative C, Alternative D would result in new trails at the visitor center and Sandy Island, thus increasing opportunities for wildlife observation and photography at Waccamaw NWR. Only Alternative D, however, calls for adding canoe trails on the Waccamaw and Big Pee Dee Rivers and trails on the Haulover Tract. Because of this, Alternative D would represent the greatest beneficial impact on wildlife observation and photography.

UNAVOIDABLE IMPACTS AND MITIGATION MEASURES

Under Alternative A – the No Action Alternative – there are numerous unavoidable long-term impacts, including law enforcement that is not adequate for protecting any significant visitor use; continued degradation of the biological functions of native plant communities and wildlife habitat due to the invasion of exotic (non-native) plants and nuisance animals; and a probable continued decline in biodiversity. Over time, if these issues are not addressed, they will continue to adversely impact the refuge's biophysical resources. There would also be short-term impacts on soils, water, and

COMPARISON OF THE ALTERNATIVES BY ISSUE

Table 7. Summary of environmental effects by alternative, Waccamaw NWR

Issues	Alternative A (Current Management – No Action Alternative)	Alternative B Habitat Restoration/Enhancements on Unit 1	Alternative C Habitat Restoration/Enhancements on All Units	Alternative D (Proposed Alternative) Optimize Habitat Management and Visitor Services
Migratory Waterfowl	Waterfowl populations on refuge unlikely to change over the 15-year life of the CCP.	Beneficial impact – minor increase in wintering waterfowl numbers on Unit 1.	Beneficial impact – minor increase in wintering waterfowl numbers on all 3 units.	Same as Alternative C.
Neotropical Migratory Birds	Neotropical migratory populations on refuge unlikely to change over the 15-year life of the CCP.	Beneficial impact – minor increase in neotropical migratory bird use of Unit 1.	Same as Alternative B.	Same as Alternative B, plus increase in knowledge of swallow-tailed kite and Swainson's warbler use of refuge.
Black Bear	Local black bear population likely to slowly increase as habitat values improve on and near refuge and in keeping with regional trends.	Same as Alternative A.	Same as Alternative A, but if migration corridors can be established, black bear population would be more secure.	Same as Alternative C, plus increase knowledge base of black bears in area.
Threatened and Endangered Species	All listed species would continue to be protected; status unlikely to change.	All listed species would continue to be protected; proposed hydrology restoration on Unit 1 may enhance existing wood stork rookery.	All listed species would continue to be protected and status is unlikely to change, except for wood stork, which would likely benefit from proposed actions.	Same as Alternative C.

Issues	Alternative A (Current Management – No Action Alternative)	Alternative B Habitat Restoration/Enhancements on Unit 1	Alternative C Habitat Restoration/Enhancements on All Units	Alternative D (Proposed Alternative) Optimize Habitat Management and Visitor Services
Wood Duck	Annual wood duck production likely to remain the same.	Annual wood duck production on refuge as a whole likely to remain the same or increase slightly because of proposed actions and increased production on Unit 1.	Proposed improvements to brood and wintering habitat on all three units, plus increase in nest boxes likely to lead to increase in wood duck production on refuge.	Same as Alternative C.
Colonial Nesting Water Birds	Existing rookeries on refuge would continue to be protected; populations and use of refuge unlikely to change.	Populations may increase because of proposed hydrology restoration on Unit 1.	Populations may increase even more than in Alternative B because of proposed hydrology restoration on Units 1 and 3.	Same as Alternative C and improved information base could improve future management and populations.
Marshbirds	Marshbird populations on refuge unlikely to change over the 15-year life of the CCP.	Same as Alternative A.	Marshbird populations on refuge would likely remain the same or increase slightly.	Same as Alternative C; information base would be improved with potential to assist future management.
White-tailed Deer	Deer population unlikely to change in size or health.	Same as Alternative A.	Same as Alternative A.	Population size more likely to decline to more appropriate level.
Reptiles and Amphibians	Reptile and amphibian populations unlikely to change.	Reptile and amphibian populations likely to increase slightly.	Reptile and amphibian populations likely to increase somewhat due to proposed restorations.	Same as Alternative C, plus refuge would improve knowledge and data base of herptiles.
Controlling Invasive Animal Species	Feral hog population on refuge unlikely to increase or decrease.	Same as Alternative A.	Feral hog population may decrease somewhat because of increased hunting.	Same as Alternative C but effect would be larger.
Open Water	Quantity of open water on refuge would not change; water quality could either be degraded or improved somewhat.	Same as Alternative A.	Same as Alternative A.	Same as Alternative A.

Issues	Alternative A (Current Management – No Action Alternative)	Alternative B Habitat Restoration/Enhancements on Unit 1	Alternative C Habitat Restoration/Enhancements on All Units	Alternative D (Proposed Alternative) Optimize Habitat Management and Visitor Services
Freshwater Marshes	Quantity of freshwater marshes on refuge would not change; quality of marshes could either be degraded or improved somewhat.	Same as Alternative A.	Same as Alternative A, but in addition, refuge may be better able to quantify impacts of boats and jet skis on marsh habitat.	Same as Alternative C.
Managed Wetlands	No change to the 629 acres of existing moist-soil and submerged aquatic vegetation on the refuge.	Same as Alternative A.	Moist-soil and sub-merged aquatic vegetation acreage would increase.	Same as Alternative C.
Upland Forests	Area of upland forest on the refuge would remain unchanged, as would habitat quality in this acreage.	Same as Alternative A.	Acreage of upland forest would not change; prescribed fire would help maintain and restore quality of upland forest habitat by reducing understory and overstocking.	Same as Alternative C.
Bottomland Hardwoods	No change in the quantity or quality of bottomland hardwoods on refuge.	Same as Alternative A.	Area of bottomland forest would remain the same or increase slightly; proposed thinning would decrease stand density and increase understory, improving stand structure and diversity.	Same as Alternative C.
Cypress-Gum Forest	No change in the quantity or quality of cypress-gum forest on refuge.	Same as Alternative A.	Area of cypress-gum forest would remain unchanged, but quality of forest habitat may improve slightly.	Same as Alternative C.

Issues	Alternative A (Current Management – No Action Alternative)	Alternative B Habitat Restoration/Enhancements on Unit 1	Alternative C Habitat Restoration/Enhancements on All Units	Alternative D (Proposed Alternative) Optimize Habitat Management and Visitor Services
Invasive Plants	Invasive plant species would continue to spread in both upland and wetland habitats on refuge, degrading these habitats and displacing native species, while generally having adverse effects on native wildlife.	Increased mapping, monitoring and control efforts on Unit 1 could reduce spread of invasive species and associated adverse effects there; elsewhere on refuge, invasive plants would continue to spread.	Increased mapping, monitoring, and control efforts throughout the refuge could reduce spread of invasive species and associated adverse effects.	Same as Alternative C.
Cultural Resources	Cultural resources would continue to be protected according to the National Historic Preservation Act.	Same as Alternative A.	Same as Alternative A.	Development of a CRMP would eventually lead to greater knowledge and protection.
Wilderness	Wilderness character of Bull Island would probably be maintained, but could be compromised temporarily by possible forest thinning and prescribed fire activities.	Same as Alternative A.	Same as Alternative A.	Include Bull Island as a Wilderness Study Area, maintain its wilderness character, and within 10 years of CCP approval, prepare a wilderness study report with a recommendation to Congress on whether Bull Island should be formally designated as a unit of the National Wilderness Preservation System.

Issues	Alternative A (Current Management – No Action Alternative)	Alternative B Habitat Restoration/Enhancements on Unit 1	Alternative C Habitat Restoration/Enhancements on All Units	Alternative D (Proposed Alternative) Optimize Habitat Management and Visitor Services
Visitor Services	The new visitor center at Yauhannah Bluff would substantially improve visitor services for the public.	Same as Alternative A.	Same as Alternative A.	Same as Alternative A. In addition, development and implementation of a Visitor Services' Plan would lead to greater public use opportunities on the refuge.
Hunting	Public hunting opportunities (for deer, hog, turkey, raccoon, squirrel, waterfowl, and snipe) would remain the same.	The potential to open waterfowl hunting on the Jackson Bluff Tract would increase hunting opportunities over those at present.	The potential to open waterfowl hunting on the Jackson Bluff Tract and a youth waterfowl hunt would further increase hunting opportunities over those at present.	The potential to open waterfowl hunting on the Jackson Bluff Tract, a youth waterfowl hunt, and a mobility-impaired hunt for deer and hog would increase hunting opportunities more than the other alternatives.
Fishing	Public fishing opportunities would remain the same.	Same as Alternative A.	Same as Alternative A.	Public fishing opportunities would increase with the potential addition of mobility-impaired fishing access on Causey and Yauhannah Bluff tracts.

Issues	Alternative A (Current Management – No Action Alternative)	Alternative B Habitat Restoration/Enhancements on Unit 1	Alternative C Habitat Restoration/Enhancements on All Units	Alternative D (Proposed Alternative) Optimize Habitat Management and Visitor Services
Environmental Education (EE)	Level of EE would increase somewhat due to the presence and operation of the new visitor center.	Potential partnership with Coastal Carolina on Jackson Bluff and utilization of up to 4 nature trails near new visitor center would increase level of EE opportunities available to the public.	The potential for Sandy Island trails being utilized for EE, in addition to the facilities and opportunities listed under Alternative B, would further increase level of EE on the refuge.	Expansion of EE into other schools in Georgetown County and into public schools in Horry and Marion Counties in addition to the facilities and programs listed under Alternatives B and C, make this the most expansive and beneficial in terms of EE of the four alternatives.
Interpretation	Level of interpretation would increase substantially due to the presence and operation of the new visitor center.	Potential for interpretive opportunities related to wetland restoration site on Jackson Bluff, plus added interpretive opportunities in and around the new visitor center and the Causey Tract, would increase overall interpretation on the refuge.	Addition of potential interpretive activities on Sandy Island would increase opportunities even more than under Alternative B.	Adding interpretive materials on existing trails at Yauhannah Tract and strategic boat landings within the acquisition boundary and conducting special outreach events, in addition to the activities and facilities described in Alternatives B and C, would give Alternative D the greatest potential beneficial impact on interpretation.

Issues	Alternative A (Current Management – No Action Alternative)	Alternative B Habitat Restoration/Enhancements on Unit 1	Alternative C Habitat Restoration/Enhancements on All Units	Alternative D (Proposed Alternative) Optimize Habitat Management and Visitor Services
Wildlife Observation and Photography	Wildlife observation and photography opportunities would increase slightly with continuing development of the Causey Tract.	New trails at visitor center would increase opportunities.	The addition of trails on Sandy Island would further increase opportunities and provide greater benefits.	Addition of canoe trails on the Waccamaw and Big Pee Dee Rivers and trails on the Haulover Tract under only this alternative, in addition to trails provided under Alternatives B and C, would represent the greatest beneficial impact on wildlife observation and photography.

potentially cultural resources from constructing the new visitor center and other projects. However, these impacts are unlikely to be significant, at least over the 15-year lifetime of the CCP. There would also be adverse impacts on public uses, mostly in terms not being able to adequately respond to rising demand for public use on the refuge. Many of the potential impacts on the refuge's environmental quality, habitat, and wildlife populations originate from human activities and development beyond the refuge's boundaries and are outside the jurisdiction of the Service.

Unavoidable adverse impacts under Alternatives B and C would be similar to those of Alternative A, though probably less severe in scope and intensity. Alternatives B and C would aim to restore and enhance habitat in Unit 1 and throughout the refuge, respectively. A portion of these efforts would include an intensified program to monitor and control invasive plant species that infest aquatic and upland habitats. Additionally, the proposed program to control feral hogs may reduce the long-term impacts of this species on habitat and native wildlife. Overall, the unavoidable adverse impacts associated with Alternatives B and C would probably not be significant.

Alternative D, the proposed alternative, also results in some unavoidable impacts. Generally, these impacts are expected to be minor and/or short term in duration, such as localized impacts to air, soils, water quality, and cultural resources from constructing the visitor center. However, the refuge will attempt to minimize these impacts whenever possible. As with the other three alternatives, other impacts stem from human actions outside the refuge and are beyond the ability of the Service to control.

The following sections describe the measures the refuge would employ to mitigate and minimize the potential impacts that would result from implementation of the proposed alternative.

WATER QUALITY FROM SOIL DISTURBANCE, USE OF HERBICIDES, AND FOREST MANAGEMENT

Soil disturbance and siltation due to water management activities; road and levee maintenance; forest management activities (thinning and prescribed fire); and the construction of observation towers, boat ramps, and the new headquarters and visitor center are expected to be minor and of short duration. To further reduce potential impacts, the refuge would use best management practices to minimize the erosion of soils into water bodies.

Foot traffic on new and extended foot trails is expected to have a negligible impact on soil erosion. To minimize the impacts from public use, the refuge would include informational signs that request trail users to remain on the trails in order to avoid causing potential erosion problems.

Forest management activities (thinning and prescribed fire) that expose and disrupt soils can temporarily degrade water quality from turbidity and siltation. The low relief and negligible topography of the refuge would tend to minimize erosion. Additionally, the refuge would use a number of methods and techniques that are standard practices in modern fire suppression and management to minimize impacts to soils and subsequent erosion and sedimentation.

Long-term herbicide use for exotic plant control could result in a slight decrease in water quality in areas prone to exotic plant infestation. Through the proper application of herbicides, however, this is expected to have a minor impact on the environment, with the benefit of reducing or eliminating exotic plant infestations.

WILDLIFE DISTURBANCE

Disturbance to wildlife is an unavoidable consequence of any public use program, regardless of the activity involved. While some activities, such as wildlife observation, may be less disturbing than others, all of the public use activities proposed under the proposed alternative would be planned to avoid unacceptable levels of impact.

The known and anticipated levels of disturbance from the proposed alternative are not considered to be significant. Nevertheless, the refuge would manage public use activities to reduce impacts. Providing access for fishing opportunities allows the use of a renewable natural resource without adversely impacting other resources. Hunting would also be managed with restrictions that ensure minimal impact on other resources. General wildlife observation may result in minimal disturbance to wildlife. If the refuge determines that impacts from the expected additional visitor uses are above the levels that are anticipated, those uses would be discontinued, restricted, or rerouted to other less sensitive areas.

Forest management activities, such as thinning and prescribed fire, would attempt to avoid and minimize adverse effects to sensitive wildlife species by conducting surveys beforehand. Times and places that might threaten sensitive species would be avoided.

VEGETATION DISTURBANCE

Negative impacts could result from the creation, extension, and maintenance of trails that require the clearing of nonsensitive vegetation along their length. This is expected to be a minor short-term impact.

Increased visitor use may increase the potential for the introduction of new exotic species into areas when visitors do not comply with boating regulations at the boat ramps and other access points, or with requests to stay on trails. The refuge would minimize this impact by enforcing the regulations for access to the refuge's water bodies, and by installing informational signs that request users to stay on the trails.

Forest management activities (thinning and prescribed fire) would also temporarily disturb vegetation including trees, understory plants, and ground cover (saplings, shrubs, forbs, grasses). These effects, which would also be localized and temporary, would be minimized by proper marking of areas and diligent monitoring.

USER GROUP CONFLICTS

As public use increases, unanticipated conflicts between different user groups could occur. If this should happen, the refuge would adjust its programs, as needed, to eliminate or minimize any public use issues. The refuge would use methods that have proven to be effective in reducing or eliminating public use conflicts. These methods include establishing separate use areas; different use periods; and limits on the numbers of users in order to provide safe, quality, appropriate, and compatible wildlife-dependent recreational opportunities.

EFFECTS ON ADJACENT LANDOWNERS

Implementation of the proposed alternative is not expected to negatively affect the owners of private lands adjacent to the refuge and within the acquisition boundary. Positive impacts that would be expected include higher property values, less intrusion of invasive exotic plants, and increased opportunities for viewing more diverse and abundant wildlife.

However, some negative impacts that might occur include a higher frequency of trespass onto adjacent private lands, and noise associated with increased traffic. To minimize these potential

impacts, the refuge would provide informational signs that clearly mark refuge boundaries; maintain the refuge's existing parking facilities; use law enforcement; and provide increased educational efforts at the visitor center.

LAND OWNERSHIP AND SITE DEVELOPMENT

Land acquisition efforts by the Service could lead to changes in land use and recreational use patterns. However, most of the non-Service-owned lands within the refuge's approved acquisition boundary are currently undeveloped. If these lands are acquired as additions to the refuge, they would be maintained in a natural state, managed for native wildlife populations, and opened to wildlife-compatible public uses, where feasible.

Potential development of the refuge's buildings, trails, and other improvements could lead to minor, short-term negative impacts on plants, soils, and some wildlife species. When building the observation towers, efforts would be made to use recycled products and environmentally sensitive treated lumber. The visitor center would be constructed to be aesthetically pleasing to the community and to avoid any additional impacts to native plant communities. All construction activities would comply with the requirements of Section 404 of the Clean Water Act (concerning placement of fill in "jurisdictional wetlands" and "waters of the United States"); Section 106 of the National Historic Preservation Act; Executive Order 11988, Floodplain Management; and other applicable regulatory requirements.

CUMULATIVE IMPACTS

A cumulative impact is defined as an impact on the natural or human environment, which results from the incremental impact of the proposed action when added to other past, present, and reasonably foreseeable future actions regardless of which agency (Federal or non-Federal) or person undertakes such other actions (40 Code of Federal Regulations, 1508.7).

Cumulative impacts are the overall, net effects on a resource that arise from multiple actions. Impacts can "accumulate" spatially, when different actions affect different areas of the same resource. They can also accumulate over the course of time, from actions in the past, the present, and the future. Occasionally, different actions counterbalance one another, partially canceling out each other's effect on a resource. But more typically, multiple effects add up, with each additional action contributing an incremental impact on the resource. In addition, sometimes the overall effect is greater than merely the sum of the individual effects, such as when one more reduction in a population crosses a threshold of reproductive sustainability, and threatens to extinguish the population.

A thorough analysis of impacts always considers their cumulative aspects, because actions do not take place in a vacuum: there are virtually always some other actions that have affected that resource in some way in the past, or are affecting it in the present, or will affect it in the reasonably foreseeable future. So any assessment of a specific action's effects must in fact be made with consideration of what else has happened to that resource, what else is happening, or what else will likely happen to it.

The refuge is not aware of any past, present, or future planned actions that would result in a significant cumulative impact when added to the refuge's proposed actions, as outlined in the proposed alternative.

Nevertheless, because of concerns expressed about the cumulative effects of hunting on certain national wildlife refuges, this section analyzes and discusses in some detail the cumulative impacts of the hunting program of each alternative on a variety of resources at Waccamaw NWR. The section draws heavily upon the cumulative impacts analysis in the Environmental Assessment for the 2007 Recreational Hunt Plan at Waccamaw National Wildlife Refuge (USFWS 2007).

ANTICIPATED IMPACTS ON WILDLIFE SPECIES

Migratory Birds

The Fish and Wildlife Service annually prescribes frameworks, or outer limits, for dates and times when hunting may occur and the number of birds that may be taken and possessed. These frameworks are necessary to allow State selections of season and limits for recreation and sustenance; aid Federal, State, and Tribal governments in the management of migratory game birds; and permit harvests at levels compatible with population status and habitat conditions. Because the Migratory Bird Treaty Act stipulates that all hunting seasons for migratory game birds are closed unless specifically opened by the Secretary of the Interior, the Service annually promulgates regulations (50 CFR Part 20) establishing the frameworks from which States may select season dates, bag limits, shooting hours, and other options for each migratory bird hunting season. The frameworks are essentially permissive in that hunting of migratory birds would not be permitted without them. Thus, in effect, Federal annual regulations both allow and limit the hunting of migratory birds.

Migratory game birds are those bird species so designated in conventions between the United States and several foreign nations for the protection and management of these birds. Under the Migratory Bird Treaty Act (16 U.S.C. 703-712), the Secretary of the Interior is authorized to determine when "hunting, taking, capture, killing, possession, sale, purchase, shipment, transportation, carriage, or export of any ... bird, or any part, nest, or egg" of migratory game birds can take place, and to adopt regulations for this purpose. These regulations are written after giving due regard to "the zones of temperature and to the distribution, abundance, economic value, breeding habits, and times and lines of migratory flight of such birds, and are updated annually (16 U.S.C. 704(a)). This responsibility has been delegated to the Service as the lead Federal agency for managing and conserving migratory birds in the United States. Acknowledging regional differences in hunting conditions, the Service has administratively divided the nation into four flyways for the primary purpose of managing migratory game birds. Each flyway (Atlantic, Mississippi, Central, and Pacific) has a Flyway Council, a formal organization generally composed of one member from each State and Province in that flyway. Waccamaw NWR is within the Atlantic Flyway.

The process for adopting migratory game bird hunting regulations, located in 50 CFR Part 20, is constrained by three primary factors. Legal and administrative considerations dictate how long the rulemaking process will last. Most importantly, however, the biological cycle of migratory game birds controls the timing of data-gathering activities and thus the dates on which these results are available for consideration and deliberation. The process of adopting migratory game bird hunting regulations includes two separate regulations-development schedules, based on "early" and "late" hunting season regulations. Early hunting seasons pertain to all migratory game bird species in Alaska, Hawaii, Puerto Rico, and the U.S. Virgin Islands; migratory game birds other than waterfowl (e.g. dove and woodcock); and special early waterfowl seasons, such as teal or resident Canada geese. Early hunting seasons generally begin prior to October 1. Late hunting seasons generally start on or after October 1 and include most waterfowl seasons not already established. There are basically no differences in the processes for establishing either early or late hunting seasons. For each cycle, Service biologists and others gather, analyze, and interpret biological survey data and provide this information to all those involved in the process through a series of published status reports and presentations to Flyway Councils and other interested parties (USFWS 2006). Under the proposed action, it is estimated that a maximum additional 100 wood ducks would be harvested each year on the refuge. This harvest impact represents 0.001 percent of South Carolina's 4-year average harvest of 80,440 wood ducks (USFWS Waterfowl Harvest and Population Data July 2006).

Waccamaw NWR entered into a long-term lease agreement in fiscal year 2006 with the South Carolina Department of Natural Resources, which allowed the 7,661-acre Bucksport Wildlife Management Area (WMA) to be combined with other fee title refuge lands. By adding this large block of land, the refuge is now able to better manage important riverine habitats, as well as provide a more consistent set of regulations for the visiting public. One primary condition of the lease agreement is that there would be no net loss of hunting opportunities now that these lands are administered under the National Wildlife Refuge System. To meet this lease agreement, the refuge proposes to offer waterfowl hunting on a more restricted basis than was previously allowed on Bucksport WMA. To make up lost waterfowl hunting days and overall reduction in hunting opportunities, the refuge proposes to offer additional hunting opportunities through hog hunts and the youth turkey hunt. Equally as important as uniform management throughout the refuge acquisition boundary, by adding the Bucksport WMA to the refuge, the refuge was able to create a contiguous 12,323-acre waterfowl sanctuary along the Waccamaw River. This area has now become an important resource for protecting wood duck populations in an area of the refuge where other managed wetlands do not exist.

Public waterfowl hunting provides an economical means for statistical data collection. Random checks of hunters can provide kill ratio, population composition, and bird habit data, as well as the possibility of organ collection (gizzards, etc.) for various studies. However, wildlife disturbance associated with waterfowl hunting has a negative impact on diurnal and nocturnal use of an area by waterfowl (Cronan 1957, McNeil et al., 1992, Paulus 1984). Because most of the refuge is bisected by a multitude of navigable, public waterways over which the refuge has no management authority, disturbance by public hunting on the creeks and rivers would exist with or without a refuge waterfowl hunt. Disturbance associated with a refuge hunt would have an additive effect on reducing waterfowl use within the hunt area; however, it would be minimal in areas where unrestricted public hunting already occurs in nearby public waters.

There are, however, management tools that can be used to minimize and/or mitigate disturbance and the interruption of use of refuge habitats by wintering waterfowl. Afternoon closure of hunting reduces disturbance (Gordon et al., 1989), as well as reducing the total take of waterfowl (Kirby et al., 1983). Managed wetlands that are not hunted provide areas utilized for resting and feeding when adjacent areas are hunted (Gordon et al., 1989, Paulus 1984). Privately owned, diked-managed wetlands, as well as natural bays, ponds, oxbows and tidal marshes within or adjacent to the refuge acquisition boundary that have been permanently set aside for waterfowl sanctuary, are few and far between and the few areas that have been set aside are heavily used by waterfowl during the day as resting/loafing areas. Many of these areas are now being impacted by land use changes as commercial development continues to grow throughout the region. As refuge tracts are acquired, consideration would be given to closing isolated water areas to provide much needed waterfowl rest sites on the refuge. Additionally, other mitigative management measures would be incorporated into the refuge hunt program, such as noon closure to waterfowl hunting and opening no more than 60 percent of the refuge to waterfowl hunting.

Because the Service is required to take abundance of migratory birds and other factors into consideration, it undertakes a number of surveys throughout the year in conjunction with the Canadian Wildlife Service, State and Provincial wildlife-management agencies, and others. To determine the appropriate frameworks for each species, the Service considers factors such as population size and trend, geographical distribution, annual breeding effort, the condition of breeding and wintering habitat, the number of hunters, and the anticipated harvest. After frameworks are established for season lengths, bag limits, and areas for migratory game bird hunting, migratory game bird management becomes a cooperative effort of State and Federal governments. After Service establishment of final frameworks for hunting seasons, the States may select season dates, bag limits, and other regulatory options for the hunting seasons. States may always be more conservative

in their selections than the Federal frameworks but never more liberal. Season dates and bag limits for national wildlife refuges open to hunting are never longer or larger than the State regulations. In fact, based upon the findings of an environmental assessment developed when a national wildlife refuge opens a new hunting activity, season dates and bag limits may be more restrictive than the State allows. At Waccamaw NWR, hunting season length is more restrictive for waterfowl and snipe than the State allows.

NEPA considerations by the Service for hunted migratory game bird species are addressed by the programmatic document, "Final Supplemental Environmental Impact Statement: Issuance of Annual Regulations Permitting the Sport Hunting of Migratory Birds (FSES 88- 14)," filed with the Environmental Protection Agency on June 9, 1988. The Service published a notice of availability in the *Federal Register* on June 16, 1988 (53 FR 22582), and its Record of Decision on August 18, 1988 (53 FR 31341). Annual NEPA considerations for waterfowl hunting frameworks are covered under a separate Environmental Assessment, "Duck Hunting Regulations for 2006-07," and an August 24, 2006, Finding of No Significant Impact. Further, in a notice published in the September 8, 2005, *Federal Register* (70 FR 53376) the Service announced its intent to develop a new Supplemental Environmental Impact Statement for the migratory bird hunting program. Public scoping meetings were held in the spring 2006, as announced in a March 9, 2006, *Federal Register* notice (71 FR 12216). More information may be obtained from: Chief, Division of Migratory Bird Management, U.S. Fish and Wildlife Service, Department of the Interior, MS MBSP-4107-ARLSQ, 1849 C Street, NWR, Washington, DC 20240.

Although woodcock are showing declines in numbers on their breeding grounds, habitat loss is considered to be the culprit, not hunting. This assertion was tested in a study conducted by the U.S. Geological Survey's Patuxent Wildlife Research Center in 2005 (McAuley and Clugston, no date). Results showed no significant differences in woodcock survival between hunted and non-hunted areas. Furthermore, the authors concluded that hunting was not having a considerable impact on woodcock numbers in the northeast (McAuley and Clugston 2005).

Woodcock was one of the species of migratory birds that was permitted to be hunted on Bucksport WMA prior to the long-term lease agreement between SCDNR and Waccamaw NWR. Because of low numbers of woodcock found throughout the refuge, a decision was made to offer snipe hunting in place of woodcock hunting, which would help maintain a no net loss of hunting opportunities, a primary condition on the lease agreement. Snipe hunting is proposed for only the tidal wetland marshes in Unit 3 and on a much more restricted basis (two days a week for one month of the season or approximately eight days) than allowed by South Carolina State regulations. In addition to restricted hunting days, non-toxic shot is required to be used by hunters. This refuge restriction further restricts hunters, possibly even more than days open, due to the lack of availability of smaller shot sizes in non-toxic shot. Other factors, such as weather, daily tidal cycles, and private lands, which are rarely hunted for snipe, would have additive impacts on hunter success.

Based on the U.S. Fish and Wildlife Service Harvest Report, snipe harvest estimates for South Carolina for 2004 and 2005 were 9,800 and 23,600 respectively. Hunter's total season harvest average for both seasons was 3.2/hunter in 2004 and 13.5/hunter in 2005. Total harvest of snipe for the Atlantic Flyway was 45,700 in 2004, and 50,200 in 2005. Although flyway harvest did not vary significantly between 2004 and 2005, seasonal harvest variations for South Carolina demonstrate how weather may be a significant factor in hunter success throughout the State.

Resident Big Game

Deer

Home range size in mammals often decreases as population density increases (Sanderson 1966). Bridges (1968) and Smith (1970) both observed a threefold increase in home-range size following a die-off in a Florida deer population. Adult bucks generally have larger home ranges than does and these ranges can vary in size due to many environmental factors. In Florida, minimum home ranges averaged 622.8 hectares (1,539 acres) for two mature bucks, and 153.0 hectares (606 acres) for two does, and 153.0 hectares (378 acres) for a buck fawn (Smith 1970). Deer hunting does not have regional population impacts due to restricted home ranges of white-tailed deer. Therefore, only local impacts are likely to occur from deer hunting on Waccamaw NWR.

Deer herd health checks are conducted every five years on most national wildlife refuges by the Southeast Cooperative Wildlife Disease Study at the University of Georgia. In 2005, the health check report stated that “Although continuation of current herd density may result in declines in herd health or higher rates of disease-induced mortality, the data suggest that some level of covert mortality may be present. These losses will predominantly affect younger animals, 4-12 months of age, mainly during winter and early spring, and will be associated with parasitism by stomach worms (*Haemonchus contortus*) and lungworms (*Dictyocaulus viviparus*). Any significant increase in density likely would result in declines in population health from this density-dependent parasitism/malnutrition syndrome.” The 18,251 acres of refuge lands currently open to deer hunting have averaged less than 15 deer harvested per season.

Harvest and survey data confirm that decades of deer hunting on surrounding private lands (using bait and a longer season) have not had a local cumulative adverse effect on the deer population. SCDNR estimates that 14,028,896 deer were harvested in South Carolina in 2005 (SCDNR Harvest Records 2005). Harvest records by each county indicate that Georgetown County harvested 3,464 deer in 2005. This total harvest also computes to 115.4 acres/deer or 5.5 deer/square mile. For Horry County, 4,113 deer were harvested in 2005, which also computes to 129.7 acres/deer or 4.9 deer/square mile (SCDNR 2005). These harvest records fluctuate from year-to-year and are down somewhat from a peak in 2002. Harvest rates on refuge lands have been significantly lower than private lands adjoining the refuge due to the allowance of baiting, longer seasons, and no restrictions of method of take on private lands.

Feral Hogs

Feral hogs are an extremely invasive, introduced non-native species and are not considered a game species by the State of South Carolina. No bag limits are established for feral hogs. Hunting of feral hogs provides the refuge with another management tool in reducing this detrimental species, and at the same time, is widely enjoyed by local hunters. Cumulative effects to an exotic, invasive species should not be of concern because the refuge would like to extirpate this species on refuge lands. Hunting of hogs is not considered adverse to the biological integrity of the refuge, is not likely to create conflict with other public uses, and is within the wildlife-dependent public uses to be given priority consideration. Since hogs are exotic, they are a priority species for refuge management only in terms of their negative impacts on refuge biota and need for eradication. Georgetown County, South Carolina ranked ninth in the State for overall hog harvest in 2005, an increase over all previous years surveyed (SCDNR Hog Harvest Report 2005). This harvest trend indicates an increasing population and a need for increasing the overall annual harvest. They are a popular game species, and the public interest would best be served by allowing this activity on the refuge. However, even with hunting, feral hogs are likely to always be present because they are prolific breeders.

Wild Turkey

Turkeys are non-migratory and therefore hunting only impacts the local population. Because the refuge turkey hunts are restricted to refuge tracts along the Great Pee Dee River, frequent flooding along with many other environmental circumstances often further impedes hunter success. Proposed turkey hunting on the refuge would be limited to a half-day hunt for four youths during the spring. Based on harvest data from six SCDNR youth turkey hunts, the overall harvest rates were less than 40 percent unless accompanied by a professional guide (personal communications with SCDNR biologist). These data indicate that the local turkey population has withstood hunting on surrounding private lands for several years without negative cumulative effects on turkeys. Therefore the refuge should not cumulatively adversely impact the population by providing a half-day hunt for 10 youth that could harvest a maximum of 10 turkeys.

Small Game

Squirrel, rabbit, raccoon, and opossum cannot be affected regionally by refuge hunting because of their limited home ranges. Only local effects will be discussed. Opossum and raccoon are hunted primarily at night. Raccoon are more sought after than opossum by the public. Hunting helps regulate opossum and raccoon populations; however, unless the popularity of this type of hunting increases, raccoon and opossum numbers will always be higher than desired. When these species become extremely overabundant, diseases such as distemper and rabies reduce the populations. However, waiting for disease outbreak to regulate their numbers can be a human health hazard. Cumulative adverse impacts to raccoon and opossum are unlikely considering they reproduce quickly, are difficult to hunt due to their nocturnal habits, and are not as popular for hunting as other game species.

Studies have been conducted within and outside of South Carolina to determine the effects of hunting on the population dynamics of small game. Results from studies have consistently shown that small game, such as rabbits and squirrels, are not affected by hunting, but rather are limited by food resources. Refuge staff consulted with biologists at the SCDNR in association with this assessment on the cumulative impacts of hunting squirrel, raccoons and opossum. Although overall State harvest data were unavailable for South Carolina for these species, the refuge hunt program is not expected to have any significant impact even on local populations of these species due to limited refuge access and frequent flood events. Under the proposed action, the refuge estimates a maximum additional 50 squirrels would be harvested. Gray squirrels are prolific breeders and their populations have never been threatened by hunting in South Carolina even prior to the passing of modern hunting regulations.

Non-hunted Wildlife

Non-hunted wildlife would include non-hunted migratory birds such as songbirds, wading birds, raptors, and woodpeckers; small mammals such as voles, moles, mice, shrews, and bats; reptiles and amphibians such as snakes, skinks, turtles, lizards, salamanders, frogs and toads; and invertebrates such as butterflies, moths, other insects and spiders. Except for migratory birds and some species of migratory bats, butterflies and moths, these species have very limited home ranges and hunting could not affect their populations regionally; thus, only local effects will be discussed.

Disturbance to non-hunted migratory birds could have regional, local, and flyway effects. Regional and flyway effects would not be applicable to species that do not migrate, such as most woodpeckers, and some songbirds, including cardinals, titmice, wrens, chickadees, etc. The cumulative effects of disturbance to non-hunted migratory birds under the proposed action are expected to be negligible due to the following: hunting season would not coincide with the nesting season; long-term impacts that could occur if reproduction was reduced by hunting are not relevant

for this reason; disturbance to the daily wintering activities, such as feeding and resting, of birds might occur; and disturbance to birds by hunters would probably be commensurate with that caused by non-consumptive users.

The cumulative effects of disturbance to non-hunted migratory birds under the proposed action are expected to be negligible due to the following: disturbance would be unlikely because small mammals, including bats, are inactive during winter when hunting season occurs and species are also nocturnal—both of these qualities make hunter interactions with small mammals very rare; hibernation or torpor by cold-blood reptiles and amphibians also limits their activity during the hunting season when temperatures are low; hunters would rarely encounter reptiles and amphibians during most of the hunting season; encounters with reptiles and amphibians in the early fall are few and should not have cumulative negative effects on reptile and amphibian populations; and invertebrates are also not active during cold weather and would have few interactions with hunters during the hunting season. The refuge has estimated current hunter density on peak days to be no more than one hunter per 1000 acres. During the vast majority of the hunting season, hunter density is much lower (1 hunter/3,000 acres). Refuge regulations further mitigate possible disturbance by hunters to non-hunted wildlife. Vehicles and all-terrain vehicles are prohibited on refuge roads and the harassment or taking of any wildlife other than the game species legal for the season is not permitted. Thus any disturbance would be negligible to very minor and is unlikely to be cumulative in effect.

Although ingestion of lead-shot by non-hunted wildlife could be a cumulative impact, it is not relevant to Waccamaw NWR because the use of lead shot would not be permitted on the refuge for any type of hunting.

Some species of bats, butterflies, and moths are migratory. Cumulative effects to these species at the “flyway” level should be negligible. These species are in torpor or have completely passed through South Carolina by peak hunting season in November-January. Some hunting occurs during September and October when these species are migrating; however, hunter interaction would be commensurate with that of non-consumptive users.

Endangered Species

Six federally listed threatened or endangered species are known to occur or potentially occur within the proposed boundary of the refuge. These include two species of birds, one species of fish, and three species of plants (listed in Chapter II of the CCP). Use of refuge lands by these threatened and endangered species typically occurs after all refuge hunting seasons, with the exception of turkey season. The bald eagle, which was recently de-listed, nests during late winter in South Carolina. If bald eagle nesting activity occurs on or near refuge lands, closed areas will be established to buffer the nesting area from any human disturbance and/or activity associated with a permitted public use. This would be the same with or without hunting. As with the potential for bald eagle nesting areas, if a wood stork rookery is established, a closed area will be established to buffer the area from any human activity. Because of seasonal use parameters listed above and the legal authority that refuges have to close areas to public access when necessary, there would be no significant cumulative effects under any alternative.

An Intra-Service Section 7 Evaluation Consultation was completed in 2003 for the Waccamaw NWR Recreational Hunt Plan (preferred alternative). Based on the current known locations of feeding, nesting, spawning, or physical locations of threatened or endangered species on or adjacent to refuge lands, it has been determined that the proposed action is not likely to adversely affect these species (Refer to 2003 Section 7 Evaluation for Recreational Hunt Plan on Waccamaw NWR). Another Intra-Service Section 7 Evaluation Consultation has been included in this CCP as Appendix

VI. Under the Effects Determination section, the evaluation finds that impacts on listed species from the objectives, strategies, programs, and projects proposed in this CCP, in their entirety, would either be “no effect” or “not likely to adversely affect.”

ANTICIPATED DIRECT AND INDIRECT IMPACTS OF PROPOSED ACTION ON REFUGE PROGRAMS, FACILITIES, AND CULTURAL RESOURCES

Wildlife-Dependent Recreation

As public use levels expand over time, unanticipated conflicts between competing user groups may occur. The refuge’s visitor use programs would be adjusted as needed to eliminate or minimize each problem and provide quality wildlife-dependent recreational opportunities. Experience has proven that time and space zoning (e.g., establishment of separate use areas, use periods, and restrictions on the number of users) is an effective tool in eliminating conflicts between user groups. Waccamaw NWR has focused more resources on establishing public use areas that are closed year-round to hunting than it has on hunting programs throughout the remaining 17,889 acres of refuge lands.

The level of recreation use and ground-based disturbance from visitors would be largely concentrated at trails and the refuge’s office and maintenance areas. This use should remain the same or increase as interest grows at the same rate with or without hunting. Access to more areas will remain a refuge priority; however, the lay of the land will preclude most areas from increased visitor access. However, the hunting season (except for the limited turkey hunt) is during the winter and not during most birds’ nesting periods. It is unlikely that bald eagles would establish nests near developed facilities or during the hunting season.

The opportunities for hunting would remain the same under the proposed action. High deer, feral hog, and raccoon numbers are recognized as a problem, causing crop damage, reducing some forest understory species, and reducing reforestation seedling survival. Hunting would be used to keep these populations, as well as other resident wildlife, in balance with the habitat’s carrying capacity, resulting in long-term positive impacts on wildlife habitat.

The refuge prohibits all land conveyance vehicle access for any public use on the refuge to minimize wildlife disturbance and habitat degradation. Some areas, such as waterfowl sanctuaries, would be closed seasonally to hunting to minimize disturbance to wintering waterfowl.

Refuge Facilities

The Service defines facilities as: “Real property that serves a particular function(s) such as buildings, roads, utilities, water control structures, raceways, etc.” Under the proposed action, those facilities most utilized by hunters are roads, parking lots, trails, and boat launching ramps. Because hunters are permitted to access the refuge by foot only, no additional maintenance or improvements of existing facilities would be required.

Cultural Resources

Hunting, regardless of method or species targeted, is a consumptive activity that does not pose any threat to historic properties on and/or near the refuge. In fact, hunting meets only one of the two criteria used to

identify an “undertaking” that triggers a Federal agency’s need to comply with Section 106 of the National Historic Preservation Act. These criteria, which are delineated in 36 CFR Part 800, state:

1. an undertaking is any project, activity, or program that can alter the character or use of an archaeological or historic site located within the “area of potential effect;” and
2. the project, activity, or program must also be either funded, sponsored, performed, licensed, or have received assistance from the agency.

Consultation with the South Carolina State Historic Preservation Office and federally recognized tribes is therefore not required.

Anticipated Impacts of Proposed Hunt on Refuge Environment and Community

The refuge expects no sizeable adverse impacts of the proposed action on the refuge environment, which consists of soils, vegetation, air quality, water quality and solitude. Hunting would benefit vegetation as it is used to keep many resident wildlife populations in balance with the habitat’s carrying capacity. The refuge would also control access to minimize habitat degradation.

The refuge expects impacts to air and water quality to be minimal and only due to boat emissions traveling to and from refuge lands. The effect of these refuge-related activities, as well as other management activities, on overall air and water quality in the region are anticipated to be relatively negligible, compared to the contributions of industrial centers, power plants, and non-refuge vehicle traffic. Existing State water quality criteria and use classifications are adequate to achieve desired on-refuge conditions; thus, implementation of the proposed action would not impact adjacent landowners or users beyond the constraints already implemented under existing State standards and laws.

Impacts associated with solitude are expected to be minimal given time and space zone management techniques, such as seasonal access and area closures, used to avoid conflicts among user groups.

The refuge would work closely with State, Federal, and private partners to minimize impacts to adjacent lands and their associated natural resources; however, no direct or indirect impacts are anticipated. The refuge hunts would result in a net gain of public hunting opportunities positively impacting the general public, nearby residents, and refuge visitors. The refuge expects increased visitation and tourism to bring additional revenues to local communities but not a significant increase in overall revenue in any area. Through these direct and indirect economic impacts, community support has increased significantly for refuge land acquisition and public use opportunity funding. For example, in the past year a \$35,000 donation was made by a national hunting/fishing equipment distributor to help fund and to be used as a match for additional grants to establish Waccamaw NWR’s first nature trail system. To date, this and other donations now total more than \$100,000.

Other Past, Present, Proposed, and Reasonably Foreseeable Hunts and Anticipated Impacts

Cumulative effects on the environment result from incremental effects of a proposed action when these are added to other past, present, and reasonably foreseeable future actions. While cumulative effects may result from individually minor actions, they may, viewed as a whole, become substantial over time. As proposed in this CCP, hunting has been designed so as to be sustainable through time, given relatively stable conditions. Changes in refuge conditions, such as sizeable increases in refuge acreage or public use, are likely to change the anticipated impacts of the CCP and could trigger a need for a new review and assessment process. CCPs are designed to allow for their amendment, if circumstances change substantially, prior to their expected 15-year lifetimes.

The past refuge hunting program has been very similar to the proposed action in season lengths, species hunted, and bag limits. Changes to the hunt program in the past decade have been made to open hunting on more land within the refuge. These lands were usually those that had been recently acquired. The refuge does not foresee any changes to the proposed action in the way of substantially increasing the intensity of hunting in the future.

Anticipated Impacts if Individual Hunts are Allowed to Accumulate

National wildlife refuges, including Waccamaw NWR, conduct hunting programs within the framework of State and Federal regulations. Waccamaw NWR is more restrictive than most State WMAs. By maintaining hunting regulations that are as, or more, restrictive than the State regulation on private lands and/or State WMAs, individual refuges ensure that a better diversity of management option exists upon which statewide and regional management implications can be better assessed. The proposed CCP, including its hunting objective, strategies, and provisions, has been reviewed and is supported by SCDNR. Additionally, South Carolina NWRs coordinate with SCDNR annually to maintain regulations and programs that are consistent with the State management program.

DIRECT AND INDIRECT EFFECTS OR IMPACTS

Direct effects are caused by an action and occur at the same time as the action. Indirect effects are caused by an action but are manifested later in time or further removed in distance, but still reasonably foreseeable.

The actions proposed for implementation under the proposed alternative include facility development (especially the new visitor center and trails); wildlife and population management; resource protection; public use; and administrative programs. These actions would result in both direct and indirect effects. Facility development, for example, would most likely lead to increased public use, a direct effect; and it, in turn, would lead to indirect effects such as increased littering, noise, and vehicular traffic.

SHORT-TERM USES VERSUS LONG-TERM PRODUCTIVITY

The habitat protection and management actions proposed under the proposed alternative are dedicated to maintaining the long-term productivity of refuge habitats. The benefits of this plan for long-term productivity far outweigh any impacts from short-term actions, such as the construction of observation towers and a visitor center, or creation of new trails. While these activities would cause short-term negative impacts, the educational values and associated public support gained from the improved visitor experience would produce long-term benefits for the refuge's entire ecosystem.

The key to protecting and ensuring the refuge's long-term productivity is to find the threshold where public uses do not degrade or interfere with the refuge's natural resources. The projects and programs proposed under the proposed alternative have been carefully conceived to achieve that threshold. Therefore, implementing the proposed alternative would lead to long-term benefits for wildlife protection and land conservation that far outweigh any short-term impacts.

V. Consultation and Coordination

OVERVIEW

This chapter summarizes the consultation and coordination that has occurred to date in identifying the issues, alternatives, and proposed alternative which are presented in this Draft CCP. It lists the meetings that have been held with the various agencies, organizations and individuals who were consulted in the preparation of the Draft CCP.

The following meetings, contacts, and presentations were undertaken by the Fish and Wildlife Service during the preparation of the Draft CCP.

The first step in developing the refuge's CCP was a Biological Review that took place in June 2003. The review team included eight Service biologists and managers and non-Service managers/biologists. Biological Review participants included:

Frank Bowers, FWS, RO, Chief, Division of Migratory Birds, Atlanta
Bob Noffsinger, FWS, Supervisory Wildlife Biologist, Manteo, NC
John Stanton, FWS, Fish and Wildlife Biologist, Manteo, NC
Dean Demarest, FWS, RO Non-game Migratory Bird Coordinator, Atlanta
Marshall "Craig" Sasser, Complex Wildlife Biologist, Cape Romain NWR, Awendaw, SC
Craig Watson, Atlantic Coast Joint Venture, Charleston, SC
Jamie Dozier, Wildlife Biologist, SCDNR, Georgetown, SC
Jan Tripp, Savannah Coastal Refuge Complex, GA
Bob Perry, Wildlife Biologist, SCDNR, Georgetown, SC
John Cely, Wildlife Biologist, SCDNR, Columbia, SC
Pam Robinson - The Nature Conservancy, Columbia, SC
Sam Stokes, Jr. - Wildlife Biologist, SCDNR, Florence, SC
William Conner - Clemson University, Georgetown, SC
Anne Kieser, USDA Forest Service, Francis Marion National Forest, McClellanville, SC

The review involved on-site evaluations to help the refuge meet its purpose and determine the role(s) this refuge could play regarding wildlife needs/objectives at various geographical scales (i.e., local, ecosystem, regional, and national). The approach was to take a holistic look at achieving refuge and landscape-level conservation needs while still giving priority to accomplishing the original purpose of the refuge.

A Visitor Services' Review was conducted in 2005 in preparation for the upcoming CCP. The three-member review team consisted of Service personnel from the Region – Visitor Services and Outreach, a representative of Cape Romain NWR, and a representative of Santee NWR. The review team met with refuge staff to discuss the visitor services' program. The staff explained what the visitor services' program is currently doing to provide recreational, educational, and interpretive opportunities on the refuge. The refuge manager and assistant refuge manager took the review team to all the different public use areas on the refuge. After the refuge tour and discussions with some of the staff and the director of the Sewee Center, the review team met to discuss the current status of the programs and to make recommendations. On the final day of the review, the team presented the recommendations to the staff and had an open discussion of the pros and cons of the various recommendations. Later the team prepared a report (USFWS 2005) with a number of recommendations for improving and expanding upon visitor services' facilities and operations.

The nucleus of the CCP planning team itself – composed of the refuge manager and a contractor with experience in preparing CCPs – met for the first time on February 1-2, 2006, for a tour of the refuge and an overview of its habitat and wildlife resources and public use programs, facilities, and opportunities. At this time, the planning team also conducted additional internal scoping and prepared a preliminary schedule and plans for public involvement.

Two open houses and public meetings were held on May 1-2, 2006. Since the refuge itself does not have meeting or conference facilities, the scoping meetings were held at the J.B. Beck Administrative and Education Center in Georgetown, and at the Coastal Carolina University Center for Marine and Wetland Studies in Conway. Approximately 15 members of the public attended the open house and scoping meeting on each day. Attendees were able to mingle at leisure with refuge staff, ask questions, provide comments, and look at exhibits and maps on hand. The public was able to express its concerns about the refuge and ideas and suggestions for its future management in writing on a comment form that was distributed to attendees and other interested parties. Written comments could either be submitted right at the meeting, mailed subsequently, or sent via email. A total of 82 comment forms and letters were received during scoping for the Waccamaw NWR Draft CCP/EA.

SECTION C. APPENDICES

I. Glossary

Adaptive Management:	Refers to a process in which policy decisions are implemented within a framework of scientifically driven experiments to test predictions and assumptions inherent in management plan. Analysis of results help managers determine whether current management should continue as is or whether it should be modified to achieve desired conditions.
Alluvial:	Sediment transported and deposited in a delta or riverbed by flowing water.
Alternative:	1. A reasonable way to fix the identified problem or satisfy the stated need (40 CFR 1500.2). 2. Alternatives are different sets of objectives and strategies or means of achieving refuge purposes and goals, helping fulfill the Refuge System mission, and resolving issues (Service Manual 602 FW 1.6B).
Anadromous:	Migratory fishes that spend most of their lives in the sea and migrate to fresh water to breed.
Biological Diversity:	The variety of life and its processes, including the variety of living organisms, the genetic differences among them, and the communities and ecosystems in which they occur (USFWS Manual 052 FW 1. 12B). The System's focus is on indigenous species, biotic communities, and ecological processes. Also referred to as Biodiversity.
Carrying Capacity:	The maximum population of a species able to be supported by a habitat or area.
Categorical Exclusion (CE, CX, CATEX, CATX):	A category of actions that do not individually or cumulatively have a significant effect on the human environment and have been found to have no such effect in procedures adopted by a Federal agency pursuant to the National Environmental Policy Act (40 CFR 1508.4).
CFR:	Code of Federal Regulations.
Compatible Use:	A proposed or existing wildlife-dependent recreational use or any other use of a national wildlife refuge that, based on sound professional judgment, will not materially interfere with or detract from the fulfillment of the National Wildlife Refuge System mission or the purpose(s) of the national wildlife refuge (50 CFR 25.12 (a)). A compatibility determination supports the selection of compatible uses and identifies stipulations or limits necessary to ensure compatibility.

Comprehensive Conservation Plan (CCP):	A document that describes the desired future conditions of a refuge or planning unit and provides long-range guidance and management direction to achieve the purposes of the refuge; helps fulfill the mission of the Refuge System; maintains and, where appropriate, restores the ecological integrity of each refuge and the Refuge System; helps achieve the goals of the National Wilderness Preservation System; and meets other mandates (Service Manual 602 FW 1.6 E).
Concern:	See Issue.
Cover Type:	The present vegetation of an area.
Cultural Resource Inventory:	A professionally conducted study designed to locate and evaluate evidence of cultural resources present within a defined geographic area. Inventories may involve various levels, including background literature search, comprehensive field examination to identify all exposed physical manifestations of cultural resources, or sample inventory to project site distribution and density over a larger area. Evaluation of identified cultural resources to determine eligibility for the National Register follows the criteria found in 36 CFR 60.4 (Service Manual 614 FW 1.7).
Cultural Resource Overview:	A comprehensive document prepared for a field office that discusses, among other things, its prehistory and cultural history, the nature and extent of known cultural resources, previous research, management objectives, resource management conflicts or issues, and a general statement on how program objectives should be met and conflicts resolved. An overview should reference or incorporate information from a field office background or literature search described in Section VIII of the Cultural Resource Management Handbook (Service Manual 614 FW 1.7).
Cultural Resources:	The remains of sites, structures, or objects used by people in the past.
Designated Wilderness Area:	An area designated by the United States Congress to be managed as part of the National Wilderness Preservation System (Draft Service Manual 610 FW 1.5).
Disturbance:	Significant alteration of habitat structure or composition. May be natural (e.g., fire) or human-caused events (e.g., aircraft overflight).
Ecosystem:	A dynamic and interrelating complex of plant and animal communities and their associated non-living environment.
Ecosystem Management:	Management of natural resources using system-wide concepts to ensure that all plants and animals in ecosystems are maintained at viable levels in native habitats and basic ecosystem processes are perpetuated indefinitely.

Endangered Species (Federal):	A plant or animal species listed under the Endangered Species Act that is in danger of extinction throughout all or a significant portion of its range.
Endangered Species (State):	A plant or animal species in danger of becoming extinct or extirpated in the State within the near future if factors contributing to its decline continue. Populations of these species are at critically low levels or their habitats have been degraded or depleted to a significant degree.
Environmental Assessment (EA):	A concise public document, prepared in compliance with the National Environmental Policy Act, that briefly discusses the purpose and need for an action, alternatives to such action, and provides sufficient evidence and analysis of impacts to determine whether to prepare an environmental impact statement or finding of no significant impact (40 CFR 1508.9).
Environmental Impact Statement (EIS):	A detailed written statement required by section 102(2)(C) of the National Environmental Policy Act, analyzing the environmental impacts of a proposed action, adverse effects of the project that cannot be avoided, alternative courses of action, short-term uses of the environment versus the maintenance and enhancement of long-term productivity, and any irreversible and irretrievable commitment of resources (40 CFR 1508.11).
Estuary:	The wide lower course of a river into which the tides flow. The area where the tide meets a river current.
Finding of No Significant Impact (FONSI):	A document prepared in compliance with the National Environmental Policy Act, supported by an environmental assessment, that briefly presents why a Federal action will have no significant effect on the human environment and for which an environmental impact statement, therefore, will not be prepared (40 CFR 1508.13).
Goal:	Descriptive, open-ended, and often broad statement of desired future conditions that conveys a purpose but does not define measurable units (Service Manual 620 FW 1.6J).
Habitat:	Suite of existing environmental conditions required by an organism for survival and reproduction. The place where an organism typically lives.
Habitat Restoration:	Management emphasis designed to move ecosystems to desired conditions and processes, and/or to healthy ecosystems.
Habitat Type:	See Vegetation Type.
Improvement Act:	The National Wildlife Refuge System Improvement Act of 1997.
Informed Consent:	The grudging willingness of opponents to “to along” with a course of action that they actually oppose (Bleiker).

Issue:	Any unsettled matter that requires a management decision, e.g., an initiative, opportunity, resource management problem, threat to the resources of the unit, conflict in uses, public concern, or other presence of an undesirable resource condition (Service Manual 602 FW 1.6K).
Management Alternative:	See Alternative.
Management Concern:	See Issue.
Management Opportunity:	See Issue.
Migration:	The seasonal movement from one area to another and back.
Mission Statement:	Succinct statement of the unit's purpose and reason for being.
Monitoring:	The process of collecting information to track changes of selected parameters over time.
National Environmental Policy Act of 1969 (NEPA):	Requires all agencies, including the Service, to examine the environmental impacts of their actions, incorporate environmental information, and use public participation in the planning and implementation of all actions. Federal agencies must integrate NEPA with other planning requirements, and prepare appropriate NEPA documents to facilitate better environmental decision-making (40 CFR 1500).
National Wildlife Refuge System Improvement Act of 1997 (Public Law 105-57):	Under the Refuge Improvement Act, the Fish and Wildlife Service is required to develop 15-year comprehensive conservation plans for all national wildlife refuges. The Act also describes the six public uses given priority status within the NWRS (i.e., hunting, fishing, wildlife observation, wildlife photography, and environmental education and interpretation).
National Wildlife Refuge System Mission:	The mission is to administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans.
National Wildlife Refuge System:	Various categories of areas administered by the Secretary of the Interior for the conservation of fish and wildlife, including species threatened with extinction; all lands, waters, and interests therein administered by the Secretary as wildlife refuges; areas for the protection and conservation of fish and wildlife that are threatened with extinction; wildlife ranges; games ranges; wildlife management areas; or waterfowl production areas.

National Wildlife Refuge:	A designated area of land, water, or an interest in land or water within the Refuge System.
Native Species:	Species that normally live and thrive in a particular ecosystem.
Noxious Weed:	A plant species designated by Federal or State law as generally possessing one or more of the following characteristics: aggressive or difficult to manage; parasitic; a carrier or host of serious insect or disease; or non-native, new, or not common to the United States, according to the Federal Noxious Weed Act (PL 93-639), a noxious weed is one that causes disease or had adverse effects on man or his environment and therefore is detrimental to the agriculture and commerce of the United States and to the public health.
Objective:	A concise statement of what we want to achieve, how much we want to achieve, when and where we want to achieve it, and who is responsible for the work. Objectives derive from goals and provide the basis for determining strategies, monitoring refuge accomplishments, and evaluating the success of strategies. Making objectives attainable, time-specific, and measurable (Service Manual 602 FW 1.6N).
Plant Association:	A classification of plant communities based on the similarity in dominants of all layers of vascular species in a climax community.
Plant Community:	An assemblage of plant species unique in its composition; occurs in particular locations under particular influences; a reflection or integration of the environmental influences on the site such as soils, temperature, elevation, solar radiation, slope, aspect, and rainfall; denotes a general kind of climax plant community.
Preferred Alternative:	This is the alternative determined [by the decision maker] to best achieve the refuge purpose, vision, and goals; contributes to the Refuge System mission, addresses the significant issues; and is consistent with principles of sound fish and wildlife management.
Prescribed Fire:	The application of fire to wildland fuels to achieve identified land use objectives (Service Manual 621 FW 1.7). May be from natural ignition or intentional ignition.
Priority Species:	Fish and wildlife species that the Washington Department of Fish and Wildlife believe require protective measures and/or management guidelines to ensure their perpetuation. Priority species include the following: (1) State-listed and candidate species; (2) species or groups of animals susceptible to significant population declines within a specific area or statewide by virtue of their inclination to aggregate (e.g., seabird colonies); and (3) species of recreation, commercial, and/or tribal importance.

Public Involvement Plan:	Broad long-term guidance for involving the public in the comprehensive planning process.
Public Involvement:	A process that offers impacted and interested individuals and organizations an opportunity to become informed about, and to express their opinions on Service actions and policies. In the process, these views are studied thoroughly and thoughtful consideration of public views is given in shaping decisions for refuge management.
Public:	Individuals, organizations, and groups; officials of Federal, State, and local government agencies; Indian tribes; and foreign nations. It may include anyone outside the core planning team. It includes those who may or may not have indicated an interest in service issues and those who do or do not realize that Service decisions may affect them.
Purposes of the Refuge:	“The purposes specified in or derived from the law, proclamation, executive order, agreement, public land order, donation document, or administrative memorandum establishing, authorizing, or expanding a refuge, refuge unit, or refuge sub-unit.” For refuges that encompass congressionally designated wilderness, the purposes of the Wilderness Act are additional purposes of the refuge (Service Manual 602 FW 106 S).
Recommended Wilderness:	Areas studied and found suitable for wilderness designation by both the Director and Secretary, and recommended for designation by the President to Congress. These areas await only legislative action by congress in order to become part of the Wilderness System. Such areas are also referred to as “pending in Congress” (Draft Service Manual 610 FW 1.5).
Record of Decision (ROD):	A concise public record of decision prepared by the Federal agency, pursuant to NEPA, that contains a statement of the decision, identification of all alternatives considered, identification of the environmentally preferable alternative, a statement as to whether all practical means to avoid or minimize environmental harm from the alternative selected have been adopted (and if not, why they were not), and a summary of monitoring and enforcement where applicable for any mitigation (40 CFR 1505.2).
Refuge Goal:	See Goal.
Refuge Purposes:	See Purposes of the Refuge.
Songbirds: (Also Passerines)	A category of birds that is medium to small, perching landbirds. Most are territorial singers and migratory.

Step-down Management Plan:	A plan that provides specific guidance on management subjects (e.g., habitat, public use, fire, safety) or groups of related subjects. It describes strategies and implementation schedules for meeting CCP goals and objectives (Service Manual 602 FW 1.6 U).
Strategy:	A specific action, tool, technique, or combination of actions, tools, and techniques used to meet unit objectives (Service Manual 602 FW 1.6 U).
Study Area:	The area reviewed in detail for wildlife, habitat, and public use potential. For purposes of this CCP/EA, the study area includes the lands within the currently approved refuge boundary and potential refuge expansion areas.
Threatened Species (Federal):	Species listed under the Endangered Species Act that are likely to become endangered within the foreseeable future throughout all or a significant portion of their range.
Threatened Species (State):	A plant or animal species likely to become endangered in the State within the near future if factors contributing to population decline or habitat degradation or loss continue.
Tiering:	The coverage of general matters in broader environmental impact statements with subsequent narrower statements of environmental analysis, incorporating by reference, the general discussions and concentrating on specific issues (40 CFR 1508.28).
U.S. Fish and Wildlife Service Mission:	The mission of the Fish and Wildlife Service is working with others to conserve, protect, and enhance fish and wildlife and their habitats for the continuing benefit of the American people.
Unit Objective:	See Objective.
Vegetation Type, Habitat Type, Forest Cover Type:	A land classification system based upon the concept of distinct plant associations.
Vision Statement:	A concise statement of what the planning unit should be, or what we hope to do, based primarily upon the Refuge System mission and specific refuge purposes and other mandates. We will tie the vision statement for the refuge to the mission of the Refuge System; the purpose(s) of the refuge; the maintenance or restoration of the ecological integrity of each refuge and the Refuge System; and other mandates (Service Manual 602 FW 1.6 Z).

**Wilderness Study
Areas:**

Lands and waters identified through inventory as meeting the definition of wilderness. A study area must meet the following criteria:

- Generally appears to have been affected primarily by the forces of nature, with the imprint of man's work substantially unnoticeable
- Has outstanding opportunities for solitude or a primitive and unconfined type of recreation
- Has at least 5,000 contiguous roadless acres or is sufficient in size as to make practicable its preservation and use in an unimpaired condition (Draft Service Manual 610 FW 1.5)

Wilderness:

See Designated Wilderness.

Wildfire:

A free-burning fire requiring a suppression response; all fire other than prescribed fire that occurs on wildlands (Service Manual 621 FW 1.7).

Wildland Fire:

Every wildland fire is either a wildfire or a prescribed fire (Service Manual 621 FW 1.3)

ACRONYMS AND ABBREVIATIONS

BCC	Birds of Conservation Concern
BRT	Biological Review Team
CCP	Comprehensive Conservation Plan
CFR	Code of Federal Regulations
cfs	cubic feet per second
DOI	Department of the Interior
DU	Ducks Unlimited
EA	Environmental Assessment
EE	Environmental Education
EIS	Environmental Impact Statement
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act
FR	Federal Register
FTE	Full-time equivalent
FWS	Fish and Wildlife Service (U.S.)
FY	Fiscal Year
GIS	Global Information System
NEPA	National Environmental Policy Act
NRHP	National Register of Historic Places
NWR	National Wildlife Refuge
NWRS	National Wildlife Refuge System
PFT	Permanent Full Time
PUNA	Public Use Natural Area
RM	Refuge Manual
RNA	Research Natural Area
ROD	Record of Decision
RONs	Refuge Operating Needs System
RRP	Refuge Roads Program
SCDNR	South Carolina Department of Natural Resources
Service	U.S. Fish and Wildlife Service (also, FWS and USFWS)
TFT	Temporary Full Time
USC	United States Code

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III. Relevant Legal Mandates and Executive Orders

STATUE	DESCRIPTION
Administrative Procedures Act (1946)	Outlines administrative procedures to be followed by Federal agencies with respect to identification of information to be made public; publication of material in the Federal Register; maintenance of records; attendance and notification requirements for specific meetings and hearings; issuance of licenses; and review of agency actions.
American Antiquities Act of 1906	Provides penalties for unauthorized collection, excavation, or destruction of historic or prehistoric ruins, monuments or objects of antiquity on lands owned or controlled by the United States. The Act authorizes the President to designate as national monuments objects or areas of historic or scientific interest on lands owned or controlled by the United States.
American Indian Religious Freedom Act of 1978	Protects the inherent right of Native Americans to believe, express, and exercise their traditional religions, including access to important sites, use and possession of sacred objects, and the freedom to worship through ceremonial and traditional rites.
Americans With Disabilities Act of 1990	Prevents discrimination of and make American society more accessible to people with disabilities. The Act requires reasonable accommodations to be made in employment, public services, public accommodations, and telecommunications for persons with disabilities.
Anadromous Fish Conservation Act of 1965, as amended	Authorizes the Secretaries of Interior and Commerce to enter into cooperative agreements with States and other non-Federal interests for conservation, development, and enhancement of anadromous fish and contribute up to 50 percent as the Federal share of the cost of carrying out such agreements. Reclamation construction programs for water resource projects needed solely for such fish are also authorized.
Archaeological Resources Protection Act of 1979, as amended.	Strengthens and expands the protective provisions of the Antiquities Act of 1906 regarding archaeological resources. It also revised the permitting process for archaeological research.
Architectural Barriers Act of 1968	Requires that buildings and facilities designed, constructed, or altered with Federal funds, or leased by a Federal agency, must comply with standards for physical accessibility.

STATUE	DESCRIPTION
Bald and Golden Eagle Protection Act of 1940, as amended	Prohibits the possession, sale or transport of any bald or golden eagle, alive or dead, or part, nest, or egg except as permitted by the Secretary of the Interior for scientific or exhibition purposes, or for the religious purposes of Indians.
Bankhead-Jones Farm Tenant Act of 1937	Directs the Secretary of Agriculture to develop a program of land conservation and utilization in order to correct maladjustments in land use and thus assist in such things as control of soil erosion, reforestation, conservation of natural resources and protection of fish and wildlife. Some early refuges and hatcheries were established under authority of this Act.
Cave Resources Protection Act of 1988	Established requirements for the management and protection of caves and their resources on Federal lands, including allowing the land managing agencies to withhold the location of caves from the public, and requiring permits for any removal or collecting activities in caves on Federal lands.
Clean Air Act of 1970	Regulates air emissions from area, stationary, and mobile sources. This Act and its amendments charge Federal land managers with direct responsibility to protect the "air quality and related values" of land under their control. These values include fish, wildlife, and their habitats.
Clean Water Act of 1974, as amended	Restores and maintains the chemical, physical, and biological integrity of the Nation's waters. Section 401 of the Act requires that federally permitted activities comply with the Clean Water Act standards, State water quality laws, and any other appropriate State laws. Section 404 charges the U.S. Army Corps of Engineers with regulating discharge of dredge or fill materials into waters of the United States, including wetlands.
Coastal Barrier Resources Act of 1982 (CBRA)	Identifies undeveloped coastal barriers along the Atlantic and Gulf coasts and included them in the John H. Chafee Coastal Barrier Resources System (CBRS). The objectives of the act are to minimize loss of human life, reduce wasteful Federal expenditures, and minimize the damage to natural resources by restricting most Federal expenditures that encourage development within the CBRS.
Coastal Barrier Improvement Act of 1990	Reauthorized the CBRA, expanded the CBRS to include undeveloped coastal barriers along the Great Lakes and in the Caribbean, and established "Otherwise Protected Areas (OPAs)." The Service is responsible for maintaining official maps, consulting with Federal agencies that propose spending Federal funds within the CBRS and OPAs, and making recommendations to Congress about proposed boundary revisions.

STATUE	DESCRIPTION
Coastal Wetlands Planning, Protection, and Restoration (1990)	Authorizes the Director of the Fish and Wildlife Service to participate in the development of a Louisiana coastal wetlands restoration program, participate in the development and oversight of a coastal wetlands conservation program, and lead in the implementation and administration of a National coastal wetlands grant program.
Coastal Zone Management Act of 1972, as amended	Established a voluntary national program within the Department of Commerce to encourage coastal States to develop and implement coastal zone management plans and requires that “any Federal activity within or outside of the coastal zone that affects any land or water use or natural resource of the coastal zone” shall be “consistent to the maximum extent practicable with the enforceable policies” of a State’s coastal zone management plan. The law includes an Enhancement Grants Program for protecting, restoring or enhancing existing coastal wetlands or creating new coastal wetlands. It also established the National Estuarine Reserve Research System, guidelines for estuarine research, and financial assistance for land acquisition.
Emergency Wetlands Resources Act of 1986	Authorized the purchase of wetlands from Land and Water Conservation Fund moneys, removing a prior prohibition on such acquisitions. The Act requires the Secretary to establish a National Wetlands Priority Conservation Plan, required the States to include wetlands in their Comprehensive Outdoor Recreation Plans, and transfers to the Migratory Bird Conservation Fund amounts equal to import duties on arms and ammunition. It also established entrance fees at national wildlife refuges.
Endangered Species Act of 1973, as amended	Provides for the conservation of threatened and endangered species of fish, wildlife, and plants by Federal action and by encouraging the establishment of State programs. It provides for the determination and listing of threatened and endangered species and the designation of critical habitats. Section 7 requires refuge managers to perform internal consultation before initiating projects that affect or may affect endangered species.
Environmental Education Act of 1990	Established the Office of Environmental Education within the Environmental Protection Agency to develop and administer a Federal environmental education program in consultation with other Federal natural resource management agencies, including the Fish and Wildlife Service.

STATUE	DESCRIPTION
Estuary Protection Act of 1968	Authorized the Secretary of the Interior, in cooperation with other Federal agencies and the States, to study and inventory estuaries of the United States, including land and water of the Great Lakes, and to determine whether such areas should be acquired for protection. The Secretary is also required to encourage State and local governments to consider the importance of estuaries in their planning activities relates to Federal natural resource grants. In approving any State grants for acquisition of estuaries, the Secretary was required to establish conditions to ensure the permanent protection of estuaries.
Estuaries and Clean Waters Act of 2000	Created a Federal interagency council that includes the Director of the Fish and Wildlife Service, the Secretary of the Army for Civil Works, the Secretary of Agriculture, the Administrator of the Environmental Protection Agency, and the Administrator for the National Oceanic and Atmospheric Administration. The Council is charged with developing a national estuary habitat restoration strategy and providing grants to entities to restore and protect estuary habitat to promote the strategy.
Food Security Act of 1985, as amended (Farm Bill)	Contains several provisions that contribute to wetland conservation. The Swampbuster provisions state that farmers who convert wetlands for the purpose of planting after enactment of the law are ineligible for most farmer program subsidies. It also established the Wetland Reserve Program to restore and protect wetlands through easements and restoration of the functions and values of wetlands on such easement areas.
Farmland Protection Policy Act of 1981, as amended	Minimizes the extent to which Federal programs contribute to the unnecessary conversion of farmland to nonagricultural uses. Federal programs include construction projects and the management of Federal lands.
Federal Advisory Committee Act (1972), as amended	Governs the establishment of and procedures for committees that provide advice to the Federal Government. Advisory committees may be established only if they will serve a necessary, non-duplicative function. Committees must be strictly advisory unless otherwise specified and meetings must be open to the public.
Federal Coal Leasing Amendment Act of 1976	Provides that nothing in the Mining Act, the Mineral Leasing Act, or the Mineral Leasing Act for Acquired Lands authorizes mining coal on refuges.

STATUE	DESCRIPTION
Federal-Aid Highways Act of 1968	Established requirements for approval of Federal highways through wildlife refuges and other designated areas to preserve the natural beauty of such areas. The Secretary of Transportation is directed to consult with the Secretary of the Interior and other Federal agencies before approving any program or project requiring the use of land under their jurisdiction.
Federal Noxious Weed Act of 1990, as amended	Authorized the Secretary of Agriculture to designate plants as noxious weeds and to cooperate with other Federal, State, and local agencies; farmers associations; and private individuals in measures to control, eradicate, prevent, or retard the spread of such weeds. The Act requires each Federal land-managing agency including the Fish and Wildlife Service to designate an office or person to coordinate a program to control such plants on the agency's land and implement cooperative agreements with the States, including integrated management systems to control undesirable plants.
Fish and Wildlife Act of 1956	Established a comprehensive national fish, shellfish, and wildlife resources policy with emphasis on the commercial fishing industry but also includes the inherent right of every citizen and resident to fish for pleasure, enjoyment, and betterment and to maintain and increase public opportunities for recreational use of fish and wildlife resources. Among other things, it authorizes the Secretary of the Interior to take such steps as may be required for the development, advancement, management, conservation and protection of fish and wildlife resources including, but not limited to, research, development of existing facilities, and acquisition by purchase or exchange of land and water or interests therein.
Fish and Wildlife Conservation Act of 1980, as amended	Requires the Service to monitor non-gamebird species, identify species of management concern, and implement conservation measures to preclude the need for listing under the Endangered Species Act.
Fish and Wildlife Coordination Act of 1958	Promotes equal consideration and coordination of wildlife conservation with other water resource development programs by requiring consultation with the Fish and Wildlife Service and the State fish and wildlife agencies where the "waters of a stream or other body of water are proposed or authorized, permitted or licensed to be impounded, diverted...or otherwise controlled or modified" by any agency under Federal permit or license.

STATUE	DESCRIPTION
Improvement Act of 1978	Improves the administration of fish and wildlife programs and amends several earlier laws, including the Refuge Recreation Act, the National Wildlife Refuge Administration Act, and the Fish and Wildlife Act of 1956. It authorizes the Secretary to accept gifts and bequests of real and personal property on behalf of the United States. It also authorizes the use of volunteers on Service projects and appropriations to carry out volunteer programs.
Fish and Wildlife Programs Improvement and National Wildlife Refuge System Centennial Act of 2000	Recognizes the vital importance of the Refuge System and the fact that the System would celebrate its centennial anniversary in the year 2003. Established the National Wildlife Refuge System Centennial Commission to prepare a plan to commemorate the 100 th anniversary of the Refuge System, coordinate activities to celebrate that event, and host a conference on the National Wildlife Refuge System. The commission is also responsible for developing a long-term plan to meet the priority operations; maintenance, and construction needs for the Refuge System, and improve public use programs and facilities.
Fishery (Magnuson) Conservation and Management Act of 1976	Established Regional Fishery Management Councils comprised of Federal and State officials, including the Fish and Wildlife Service. It provides for regulation of foreign fishing and vessel fishing permits.
Freedom of Information Act, 1966	Requires all Federal agencies to make available to the public for inspection and copying administrative staff manuals and staff instructions, official, published and unpublished policy statements, final orders deciding case adjudication, and other documents. Special exemptions have been reserved for nine categories of privileged material. The Act requires the party seeking the information to pay reasonable search and duplication costs.
Geothermal Steam Act of 1970, as amended	Authorizes and governs the lease of geothermal steam and related resources on public lands. Section 15c of the Act prohibits issuing geothermal leases on virtually all Service-administrative lands.
Lacey Act of 1900, as amended	Originally designed to help States protect their native game animals and to safeguard U.S. crop production from harmful foreign species. This Act prohibits interstate and international transport and commerce of fish, wildlife or plant taken in violation of domestic or foreign laws. It regulates the introduction to America of foreign species into new locations.

STATUE	DESCRIPTION
Land and Water Conservation Fund Act of 1948	Provides funding through receipts from the sale of surplus Federal land, appropriations from oil and gas receipts from the outer continental shelf, and other sources for land acquisition under several authorities. Appropriations from the fund may be used for matching grants to States for outdoor recreation projects and for land acquisition by various Federal agencies including the Fish and Wildlife Service.
Marine Mammal Protection Act of 1972, as amended	Established a Federal responsibility to conserve marine mammals with management vested in the Department of Interior for sea otter, walrus, polar bear, dugong, and manatee. The Department of Commerce is responsible for cetaceans and pinnipeds, other than the walrus. With certain specified exceptions, the Act establishes a moratorium on the taking and importation of marine mammals, as well as products taken from them.
Migratory Bird Conservation Act of 1929	Established a Migratory Bird Conservation Commission to approve areas recommended by the Secretary of the Interior for acquisition with Migratory Bird Conservation Funds. The role of the Commission was expanded by the North American Wetland Conservation Act to include approving wetlands acquisition, restoration, and enhancement proposals recommended by the North American Wetlands Conservation Council.
Migratory Bird Hunting and Conservation Stamp Act of 1934	Also commonly referred to as the "Duck Stamp Act," requires waterfowl hunters 16 years of age or older to possess a valid Federal hunting stamp. Receipts from the sale of the stamp are deposited into the Migratory Bird Conservation Fund for the acquisition of migratory bird refuges.
Migratory Bird Treaty Act of 1918, as amended	Implements various treaties and conventions between the U.S. and Canada, Japan, Mexico and the former Soviet Union for the protection of migratory birds. Except as allowed by special regulations, this Act makes it unlawful to pursue, hunt, kill, capture, possess, buy, sell, purchase, barter, export or import any migratory bird, part, nest, egg or product.
Mineral Leasing Act for Acquired Lands (1947), as amended	Authorizes and governs mineral leasing on acquired public lands.
Minerals Leasing Act of 1920, as amended	Authorizes and governs leasing of public lands for development of deposits of coal, oil, gas and other hydrocarbons, sulphur, phosphate, potassium, and sodium. Section 185 of this title contains provisions relating to granting rights-of-ways over Federal lands for pipelines.

STATUE	DESCRIPTION
Mining Act of 1872, as amended	Authorizes and governs prospecting and mining for the so-called “hardrock” minerals (such as gold and silver) on public lands.
National and Community Service Act of 1990	Authorizes several programs to engage citizens of the U.S. in full- and/or part-time projects designed to combat illiteracy and poverty, provide job skills, enhance educational skills, and fulfill environmental needs. Among other things, this law establishes the American Conservation and Youth Service Corps to engage young adults in approved human and natural resource projects, which will benefit the public or are carried out on Federal or Indian lands.
National Environmental Policy Act of 1969	Requires analysis, public comment, and reporting for environmental impacts of Federal actions. It stipulates the factors to be considered in environmental impact statements, and requires that Federal agencies employ an interdisciplinary approach in related decision-making and develop means to ensure that unqualified environmental values are given appropriate consideration, along with economic and technical considerations.
National Historic Preservation Act of 1966, as amended	Establishes a National Register of Historic Places and a program of matching grants for preservation of significant historical features. Federal agencies are directed to take into account the effects of their actions on items or sites listed or eligible for listing in the National Register.
National Trails System Act (1968), as amended	Established the National Trails System to protect the recreational, scenic and historic values of some important trails. National Recreation Trails may be established by the Secretaries of Interior or Agriculture on land wholly or partly within their jurisdiction, with the consent of the involved State(s), and other land managing agencies, if any. National Scenic and National Historic Trails may only be designated by an Act of Congress. Several National Trails cross units of the National Wildlife Refuge System.
National Wildlife Refuge System Administration Act of 1966	Prior to 1966, there was no single Federal Law that governed the administration of the various wildlife refuges that had been established. This Act defines the National Wildlife Refuge System and authorizes the Secretary of the Interior to permit any use of an area provided such use is compatible with the major purposes(s) for which the area was established.

STATUE	DESCRIPTION
National Wildlife Refuge System Improvement Act of 1997	Amends the National Wildlife Refuge System Administration Act of 1966. This Act defines the mission of the National Wildlife Refuge System, establishes the legitimacy and appropriateness of six priority wildlife-dependent public uses, establishes a formal process for determining compatible uses of Refuge System lands, identifies the Secretary of the Interior as responsible for managing and protecting the Refuge System, and requires the development of a comprehensive conservation plan for all refuges outside of Alaska.
Native American Graves Protection and Repatriation Act of 1990	Requires Federal agencies and museums to inventory, determine ownership of, and repatriate certain cultural items and human remains under their control or possession. The Act also addresses the repatriation of cultural items inadvertently discovered by construction activities on lands managed by the agency.
Neotropical Migratory Bird Conservation Act of 2000	Establishes a matching grants program to fund projects that promote the conservation of neotropical migratory birds in the United States, Latin America, and the Caribbean.
North American Wetlands Conservation Act of 1989	Provides funding and administrative direction for implementation of the North American Waterfowl Management Plan and the Tripartite Agreement on wetlands between Canada, U.S. and Mexico. North American Wetlands Conservation Council is created to recommend projects to be funded under the Act to the Migratory Bird Conservation Commission. Available funds may be expended for up to 50 percent of the United States share cost of wetlands conservation projects in Canada, Mexico, or the United States (or 100 percent of the cost of projects on Federal lands).
Refuge Recreation Act of 1962, as amended	This Act authorizes the Secretary of the Interior to administer refuges, hatcheries, and other conservation areas for recreational use, when such uses do not interfere with the area's primary purposes. It authorizes construction and maintenance of recreational facilities and the acquisition of land for incidental fish and wildlife-dependent recreational development or protection of natural resources. It also authorizes the charging fees for public uses.
Partnerships for Wildlife Act of 1992	Establishes a Wildlife Conservation and Appreciation Fund to receive appropriated funds and donations from the National Fish and Wildlife Foundation and other private sources to assist the State fish and game agencies in carrying out their responsibilities for conservation of non-game species. The funding formula is no more than 1/3 Federal funds, at least 1/3 Foundation funds, and at least 1/3 State funds.

STATUE	DESCRIPTION
Refuge Revenue Sharing Act of 1935, as amended	Provided for payments to counties in lieu of taxes from areas administered by the Fish and Wildlife Service. Counties are required to pass payments along to other units of local government within the county, which suffer losses in tax revenues due to the establishment of Service areas.
Rehabilitation Act of 1973	Requires nondiscrimination in the employment practices of Federal agencies of the executive branch and contractors. It also requires all federally assisted programs, services, and activities to be available to people with disabilities.
Rivers and Harbors Appropriations Act of 1899, as amended	Requires the authorization by the U.S. Army Corps of Engineers prior to any work in, on, over, or under a navigable water of the United States. The Fish and Wildlife Coordination Act provides authority for the Service to review and comment on the effects on fish and wildlife activities proposed to be undertaken or permitted by the Corps of Engineers. Service concerns include contaminated sediments associated with dredge or fill projects in navigable waters.
Sikes Act (1960), as amended	Provides for the cooperation by the Departments of Interior and Defense with State agencies in planning, development, and maintenance of fish and wildlife resources and outdoor recreation facilities on military reservations throughout the U.S. It requires the Secretary of each military department to use trained professionals to manage the wildlife and fishery resource under his jurisdiction, and requires Federal and State fish and wildlife agencies be given priority in management of fish and wildlife activities on military reservations.
Transfer of Certain Real Property for Wildlife Conservation Purposes Act of 1948	This Act provides that upon determination by the Administrator of the General Services Administration, real property no longer needed by a Federal agency can be transferred, without reimbursement, to the Secretary of the Interior if the land has particular value for migratory birds, or to a State agency for other wildlife conservation purposes.
Transportation Equity Act for the 21 st Century (1998)	Established the Refuge Roads Program, requires transportation planning that includes public involvement, and provides funding for approved public use roads and trails and associated parking lots, comfort stations, and bicycle/pedestrian facilities.
Uniform Relocation and Assistance and Real Property Acquisition Policies Act (1970), as amended	Provides for uniform and equitable treatment of persons who sell their homes, businesses, or farms to the Service. The Act requires that any purchase offer be no less than the fair market value of the property.

STATUE	DESCRIPTION
Water Resources Planning Act of 1965	Established Water Resources Council to be composed of Cabinet representatives, including the Secretary of the Interior. The Council reviews river basin plans with respect to agricultural, urban, energy, industrial, recreational, and fish and wildlife needs. The act also established a grant program to assist States in participating in the development of related comprehensive water and land use plans.
Wild and Scenic Rivers Act of 1968, as amended	Selects certain rivers of the nation possessing remarkable scenic, recreational, geologic, fish and wildlife, historic, cultural, or other similar values; preserves them in a free-flowing condition; and protects their local environments.
Wilderness Act of 1964, as amended	Directs the Secretary of the Interior to review every area of at least 5,000 contiguous roadless acres in size or roadless areas sufficient in size to make practicable their preservation and use in an unimpaired condition, or be a roadless island of any size, within the National Wildlife Refuge System, and to recommend suitability of each such area. The Act permits certain activities within designated Wilderness Areas that do not alter natural processes. Wilderness values are preserved through a “minimum tool” management approach, which requires refuge managers to use the least intrusive methods, equipment, and facilities necessary for administering the areas.
Youth Conservation Corps Act of 1970	Established a permanent Youth Conservation Corps (YCC) programs within the Department of Interior and Agriculture. Within the Service, YCC participants perform many tasks on refuges, fish hatcheries, and research stations.

EXECUTIVE ORDERS	DESCRIPTIONS
EO 11593, Protection and Enhancement of the Cultural Environment (1971)	States that if the Service proposes any development activities that may affect the archaeological or historic sites, the Service will consult with Federal and State Historic Preservation Officers to comply with Section 106 of the National Historic Preservation Act of 1966, as amended.
EO 11644, Use of Off-road Vehicles on Public Land (1972)	Established policies and procedures to ensure that the use of off-road vehicles on public lands will be controlled and directed so as to protect the resources of those lands, to promote the safety of all users of those lands, and to minimize conflicts among the various uses of those lands.
EO 11988, Floodplain Management (1977)	Prevents Federal agencies from contributing to the “adverse impacts associated with occupancy and modification of floodplains” and the “direct or indirect support of floodplain development.” In the course of fulfilling their respective authorities, Federal agencies “shall take action to reduce the risk of flood loss, to minimize the impact of floods on human safety, health and welfare, and to restore and preserve the natural and beneficial values served by floodplains.”
EO 11989 (1977), Amends Section 2 of EO 11644	Directs agencies to close areas negatively impacted by off-road vehicles.
EO 11990, Protection of Wetlands (1977)	Directs Federal agencies to provide leadership and to take action to minimize the destruction, loss of degradation of wetlands, and to preserve and enhance the natural and beneficial values of wetlands.
EO 12372, Intergovernmental Review of Federal Programs (1982)	Seeks to foster intergovernmental partnerships by requiring Federal agencies to use the State process to determine and address concerns of State and local elected officials with proposed Federal assistance and development programs.
EO 12898, Environmental Justice (1994)	Requires Federal agencies to identify and address disproportionately high and adverse effects of its programs, policies, and activities on minority and low-income populations.

EXECUTIVE ORDERS	DESCRIPTIONS
EO 12906, Coordinating Geographical Data Acquisition and Access (1994), Amended by EO 13286 (2003). Amendment of EO's & other actions in connection w/ transfer of certain functions to Secretary of DHS.	Recommended that the executive branch develop, in cooperation with State, local, and tribal governments, and the private sector, a coordinated National Spatial Data Infrastructure to support public and private sector applications of geospatial data. Of particular importance to CCP planning is the National Vegetation Classification System (NVCS), which is adopted, standard for vegetation mapping. Using NVCS facilitates the compilation of regional and national summaries, which in turn, can provide an ecosystem context for individual refuges.
EO 12962, Recreational Fisheries (1995)	Directs Federal agencies to improve the quantity, function, sustainable productivity, and distribution of U.S. aquatic resources for increased recreational fishing opportunities in cooperation with States and Tribes.
EO 13007, Native American Religious Practices (1996)	Provides for access to, and ceremonial use of, Indian sacred sites on Federal lands used by Indian religious practitioners and direction to avoid adversely affecting the physical integrity of such sites.
EO 13061, Federal Support of Community Efforts Along American Heritage Rivers (1997)	Established the American Heritage Rivers initiative for the purpose of natural resource and environmental protection, economic revitalization, and historic and cultural preservation. The Act directs Federal agencies to preserve, protect, and restore rivers and their associated resources important to our history, culture, and natural heritage.
EO 13084, Consultation and Coordination With Indian Tribal Governments (2000)	Provides a mechanism for establishing regular and meaningful consultation and collaboration with tribal officials in the development of Federal policies that have tribal implications.
EO 13112, Invasive Species (1999)	Directs Federal agencies to prevent the introduction of invasive species, detect and respond rapidly to and control populations of such species in a cost effective and environmentally sound manner, accurately monitor invasive species, provide for restoration of native species and habitat conditions, conduct research to prevent introductions and to control invasive species, and promote public education on invasive species and the means to address them. This EO replaces and rescinds EO 11987, Exotic Organisms (1977).

EXECUTIVE ORDERS	DESCRIPTIONS
EO 13186, Responsibilities of Federal Agencies to Protect Migratory Birds. (2001)	Instructs Federal agencies to conserve migratory birds by several means, including the incorporation of strategies and recommendations found in Partners in Flight Bird Conservation plans, the North American Waterfowl Plan, the North American Waterbird Conservation Plan, and the United States Shorebird Conservation Plan, into agency management plans and guidance documents.

IV. Public Involvement

SUMMARY OF PUBLIC SCOPING COMMENTS

FISH AND WILDLIFE POPULATION AND HABITAT MANAGEMENT

- Provide a complex of intensively and passively managed wood duck habitat.
- Maintain high-quality habitat for priority landbirds associated with mature forested wetlands.
- Provide high-quality breeding marshbird habitat.
- Provide secure nesting sites and ample foraging habitat for long-legged waders.
- Provide both northbound and southbound shorebird foraging sites.
- Provide secure nesting and roosting sites for bald eagles.
- Reduce deer herd density to improve herd health and improve habitat quality for other species.
- Encourage private landowners to provide additional moist-soil habitat and greentree reservoirs to complement the refuge habitat management programs.
- Invasive species control: keep canals and water delivery systems functional and protect native communities.
- A management plan is needed for the control of feral hogs.
- Perpetuate, restore, and research longleaf pine ecosystems.
- Maintain a healthy fishery in the waters associated with the refuge.
- Use prescribed fire as a land management tool.
- Keep the Waccamaw NWR as a sanctuary for protecting and managing threatened and endangered species.
- Make the recovery of the redbreast sunfish a high priority.

RESOURCE PROTECTION

- Regulate jet skis and other significant recreational/social issues affecting wildlife.
- Restrictions are needed on the type of boat traffic allowed. Boat wakes and noise are disruptive and damaging. I would like to see a ban on jet skis and perhaps a speed limit on boats over 20 feet.

-
- Do not allow activities in the refuge that are incompatible with its use, such as road building and residential and commercial development.
 - Continue to cooperate with the South Carolina Department of Transportation on the Highway 701 connector (road for evacuation route) and other new road construction-related issues that may affect the refuge.
 - We are concerned about the possible road that may be planned that would cut through the refuge. Please help us keep the refuge as it was intended, not an easy target for road building because of its remote location.
 - Keep the refuge clean and non-littered.
 - Drinking water quality safeguarded by the refuge.
 - Encroaching development is an important issue.

VISITOR SERVICES

- Establish an environmental education and interpretation center to provide ongoing programs for children and adults to learn about and appreciate the refuge's flora and fauna.
- Develop a portable exhibit to be used in the current refuge entryway for visitors stopping at the office after hours. The exhibit can also be used as a loaner for special events.
- Involve the SEWEE Association in the development of interpretive media concepts. Conduct a design workshop to develop conceptual drawings and narratives.
- Concentrate initial efforts to develop facilities and programs at the Yauhannah Bluff Visitor Center site. After annual funding is secured, expand programs to include the Causey Tract (with build up to include the International Paper lands as they are acquired) and the Haulover site.
- Increase wildlife observation opportunities by enhancing the trail system, adding interpretive panels and brochures.
- Collect recreation fees for quota hunts, and any additional activities that qualify to be in the recreation fee program.
- Place kiosks at 3 boat launches and develop a "welcome/waiting" shelter at the Yauhannah Lake landing.
- Expand youth hunts to possibly include deer, small game and/or waterfowl.
- As additional parcels of land (which are not island parcels) are acquired, consider establishing a hunt for persons with disabilities. The Yauhannah Tract may lend itself to this type of hunt program.
- Work with SCDNR and establish zones for various boat types and motor horse powers to help achieve a balance of allowed uses, to reduce user conflicts, to reduce and minimize conflicts and wildlife disturbance.

-
- Host annual youth fishing day during National Fishing Week or National Refuge Week.
 - Improve access for bank fishing on the refuge for anglers with disabilities.
 - Develop interpretive signs at Yauhannah Landing wildlife trail.
 - Construct an observation/photography blind at Causey Tract.
 - Establish and develop canoe trail route and post signs.
 - Establish an “Adopt a swallow-tailed kite” program.
 - Conduct environmental education programs for students visiting the refuge and visitor center. These are one-time field trips which are requested by teachers (not associated with Earth Stewards or the EIC programs).
 - Maintain the area's excellent hunting, fishing, and outdoor recreation.

REFUGE ADMINISTRATION

- Continue to foster partnerships. Develop marketing and communication strategies for fostering fund raising and potential partnerships.
- Continue land acquisition.
- Hire a park ranger/staff to manage the visitor services, visitor center, outreach, and volunteer program.
- Hire a park ranger that would be dedicated to public use programs.
- Develop a volunteer program to help with greeting and orienting the public and other routine office assignments, maintenance around the Yauhannah Bluff, conducting environmental education, and seeking grants.
- Partner with Coastal Carolina University and/or Horry County Technical College and develop an on-going internship program for students in environmental studies program.

V. Appropriate Use Determinations

FINDING OF APPROPRIATENESS OF A REFUGE USE

Refuge Name: Waccamaw National Wildlife Refuge

Use: Bicycling

This form is not required for wildlife-dependent recreational uses, take regulated by the State, or uses already described in a refuge CCP or step-down management plan approved after October 9, 1997.

Decision Criteria:	YES	NO
(a) Do we have jurisdiction over the use?	X	
(b) Does the use comply with applicable laws and regulations (Federal, State, tribal, and local)?	X	
(c) Is the use consistent with applicable executive orders and Department and Service policies?	X	
(d) Is the use consistent with public safety?	X	
(e) Is the use consistent with goals and objectives in an approved management plan or other document?	X	
(f) Has an earlier documented analysis not denied the use or is this the first time the use has been proposed?	X	
(g) Is the use manageable within available budget and staff?	X	
(h) Will this be manageable in the future within existing resources?	X	
(i) Does the use contribute to the public's understanding and appreciation of the refuge's natural or cultural resources, or is the use beneficial to the refuge's natural or cultural resources?	X	
(j) Can the use be accommodated without impairing existing wildlife-dependent recreational uses or reducing the potential to provide quality (see section 1.6D, 603 FW 1, for description), compatible, wildlife-dependent recreation into the future?	X	

Where we do not have jurisdiction over the use ["no" to (a)], there is no need to evaluate it further as we cannot control the use. Uses that are illegal, inconsistent with existing policy, or unsafe ["no" to (b), (c), or (d)] may not be found appropriate. If the answer is "no" to any of the other questions above, we will **generally** not allow the use.

If indicated, the refuge manager has consulted with State fish and wildlife agencies. Yes X No

When the refuge manager finds the use appropriate based on sound professional judgment, the refuge manager must justify the use in writing on an attached sheet and obtain the refuge supervisor's concurrence.

Based on an overall assessment of these factors, my summary conclusion is that the proposed use is:

Not Appropriate _____ Appropriate X

Refuge Manager: _____ Date: _____

If found to be **Not Appropriate**, the refuge supervisor does not need to sign concurrence if the use is a new use.
If an existing use is found **Not Appropriate** outside the CCP process, the refuge supervisor must sign concurrence.
If found to be **Appropriate**, the refuge supervisor must sign concurrence.

Refuge Supervisor: _____ Date: _____

A compatibility determination is required before the use may be allowed.

FINDING OF APPROPRIATENESS OF A REFUGE USE

Refuge Name: Waccamaw National Wildlife Refuge

Use: Commercial Services

This form is not required for wildlife-dependent recreational uses, take regulated by the State, or uses already described in a refuge CCP or step-down management plan approved after October 9, 1997.

Decision Criteria:	YES	NO
(a) Do we have jurisdiction over the use?	X	
(b) Does the use comply with applicable laws and regulations (Federal, State, tribal, and local)?	X	
(c) Is the use consistent with applicable executive orders and Department and Service policies?	X	
(d) Is the use consistent with public safety?	X	
(e) Is the use consistent with goals and objectives in an approved management plan or other document?	X	
(f) Has an earlier documented analysis not denied the use or is this the first time the use has been proposed?	X	
(g) Is the use manageable within available budget and staff?	X	
(h) Will this be manageable in the future within existing resources?	X	
(i) Does the use contribute to the public's understanding and appreciation of the refuge's natural or cultural resources, or is the use beneficial to the refuge's natural or cultural resources?	X	
(j) Can the use be accommodated without impairing existing wildlife-dependent recreational uses or reducing the potential to provide quality (see section 1.6D, 603 FW 1, for description), compatible, wildlife-dependent recreation into the future?	X	

Where we do not have jurisdiction over the use ["no" to (a)], there is no need to evaluate it further as we cannot control the use. Uses that are illegal, inconsistent with existing policy, or unsafe ["no" to (b), (c), or (d)] may not be found appropriate. If the answer is "no" to any of the other questions above, we will **generally** not allow the use.

If indicated, the refuge manager has consulted with State fish and wildlife agencies. Yes X No

When the refuge manager finds the use appropriate based on sound professional judgment, the refuge manager must justify the use in writing on an attached sheet and obtain the refuge supervisor's concurrence.

Based on an overall assessment of these factors, my summary conclusion is that the proposed use is:

Not Appropriate _____

Appropriate X

Refuge Manager: _____ Date: _____

If found to be **Not Appropriate**, the refuge supervisor does not need to sign concurrence if the use is a new use.
If an existing use is found **Not Appropriate** outside the CCP process, the refuge supervisor must sign concurrence.
If found to be **Appropriate**, the refuge supervisor must sign concurrence.

Refuge Supervisor: _____ Date: _____

A compatibility determination is required before the use may be allowed.

Refuge Name: Waccamaw National Wildlife Refuge

This form is not required for wildlife-dependent recreational uses, take regulated by the State, or uses already described in a refuge CCP or step-down management plan approved after October 9, 1997.

Where we do not have jurisdiction over the use ["no" to (a)], there is no need to evaluate it further as we cannot control the use. Uses that are illegal, inconsistent with existing policy, or unsafe ["no" to (b), (c), or (d)] may not be found appropriate. If the answer is "no" to any of the other questions above, we will **generally** not allow the use.

When the refuge manager finds the use appropriate based on sound professional judgment, the refuge manager must justify the use in writing on an attached sheet and obtain the refuge supervisor's concurrence.

Not Appropriate Appropriate X

If found to be **Not Appropriate**, the refuge supervisor does not need to sign concurrence if the use is a new use.
If an existing use is found **Not Appropriate** outside the CCP process, the refuge supervisor must sign concurrence.
If found to be **Appropriate**, the refuge supervisor must sign concurrence.

A compatibility determination is required before the use may be allowed.

FINDING OF APPROPRIATENESS OF A REFUGE USE

Refuge Name: Waccamaw National Wildlife Refuge

Use: Research

This form is not required for wildlife-dependent recreational uses, take regulated by the State, or uses already described in a refuge CCP or step-down management plan approved after October 9, 1997.

Decision Criteria:	YES	NO
(a) Do we have jurisdiction over the use?	X	
(b) Does the use comply with applicable laws and regulations (Federal, State, tribal, and local)?	X	
(c) Is the use consistent with applicable executive orders and Department and Service policies?	X	
(d) Is the use consistent with public safety?	X	
(e) Is the use consistent with goals and objectives in an approved management plan or other document?	X	
(f) Has an earlier documented analysis not denied the use or is this the first time the use has been proposed?	X	
(g) Is the use manageable within available budget and staff?	X	
(h) Will this be manageable in the future within existing resources?	X	
(i) Does the use contribute to the public's understanding and appreciation of the refuge's natural or cultural resources, or is the use beneficial to the refuge's natural or cultural resources?	X	
(j) Can the use be accommodated without impairing existing wildlife-dependent recreational uses or reducing the potential to provide quality (see section 1.6D, 603 FW 1, for description), compatible, wildlife-dependent recreation into the future?	X	

Where we do not have jurisdiction over the use ["no" to (a)], there is no need to evaluate it further as we cannot control the use. Uses that are illegal, inconsistent with existing policy, or unsafe ["no" to (b), (c), or (d)] may not be found appropriate. If the answer is "no" to any of the other questions above, we will **generally** not allow the use.

If indicated, the refuge manager has consulted with State fish and wildlife agencies. Yes X No

When the refuge manager finds the use appropriate based on sound professional judgment, the refuge manager must justify the use in writing on an attached sheet and obtain the refuge supervisor's concurrence.

Based on an overall assessment of these factors, my summary conclusion is that the proposed use is:

Not Appropriate

Appropriate X

Refuge Manager: _____

Date: _____

If found to be **Not Appropriate**, the refuge supervisor does not need to sign concurrence if the use is a new use.
If an existing use is found **Not Appropriate** outside the CCP process, the refuge supervisor must sign concurrence.
If found to be **Appropriate**, the refuge supervisor must sign concurrence.

Refuge Supervisor: _____

Date: _____

A compatibility determination is required before the use may be allowed.

Refuge Name: Waccamaw National Wildlife Refuge

This form is not required for wildlife-dependent recreational uses, take regulated by the State, or uses already described in a refuge CCP or step-down management plan approved after October 9, 1997.

Where we do not have jurisdiction over the use ["no" to (a)], there is no need to evaluate it further as we cannot control the use. Uses that are illegal, inconsistent with existing policy, or unsafe ["no" to (b), (c), or (d)] may not be found appropriate. If the answer is "no" to any of the other questions above, we will **generally** not allow the use.

When the refuge manager finds the use appropriate based on sound professional judgment, the refuge manager must justify the use in writing on an attached sheet and obtain the refuge supervisor's concurrence.

Not Appropriate _____ Appropriate X

If found to be **Not Appropriate**, the refuge supervisor does not need to sign concurrence if the use is a new use.
If an existing use is found **Not Appropriate** outside the CCP process, the refuge supervisor must sign concurrence.
If found to be **Appropriate**, the refuge supervisor must sign concurrence.

A compatibility determination is required before the use may be allowed.

FINDING OF APPROPRIATENESS OF A REFUGE USE

Refuge Name: Waccamaw National Wildlife Refuge

Use: Rights-of-way

This form is not required for wildlife-dependent recreational uses, take regulated by the State, or uses already described in a refuge CCP or step-down management plan approved after October 9, 1997.

Decision Criteria:	YES	NO
(a) Do we have jurisdiction over the use?	X	
(b) Does the use comply with applicable laws and regulations (Federal, State, tribal, and local)?	X	
(c) Is the use consistent with applicable executive orders and Department and Service policies?	X	
(d) Is the use consistent with public safety?	X	
(e) Is the use consistent with goals and objectives in an approved management plan or other document?	X	
(f) Has an earlier documented analysis not denied the use or is this the first time the use has been proposed?	X	
(g) Is the use manageable within available budget and staff?	X	
(h) Will this be manageable in the future within existing resources?	X	
(i) Does the use contribute to the public's understanding and appreciation of the refuge's natural or cultural resources, or is the use beneficial to the refuge's natural or cultural resources?	X	
(j) Can the use be accommodated without impairing existing wildlife-dependent recreational uses or reducing the potential to provide quality (see section 1.6D, 603 FW 1, for description), compatible, wildlife-dependent recreation into the future?	X	

Where we do not have jurisdiction over the use ["no" to (a)], there is no need to evaluate it further as we cannot control the use. Uses that are illegal, inconsistent with existing policy, or unsafe ["no" to (b), (c), or (d)] may not be found appropriate. If the answer is "no" to any of the other questions above, we will **generally** not allow the use.

If indicated, the refuge manager has consulted with State fish and wildlife agencies. Yes X No

When the refuge manager finds the use appropriate based on sound professional judgment, the refuge manager must justify the use in writing on an attached sheet and obtain the refuge supervisor's concurrence.

Based on an overall assessment of these factors, my summary conclusion is that the proposed use is:

Not Appropriate Appropriate X

Refuge Manager: _____ Date: _____

If found to be **Not Appropriate**, the refuge supervisor does not need to sign concurrence if the use is a new use.
If an existing use is found **Not Appropriate** outside the CCP process, the refuge supervisor must sign concurrence.
If found to be **Appropriate**, the refuge supervisor must sign concurrence.

Refuge Supervisor: _____ Date: _____

A compatibility determination is required before the use may be allowed.

Refuge Name: Waccamaw National Wildlife Refuge

This form is not required for wildlife-dependent recreational uses, take regulated by the State, or uses already described in a refuge CCP or step-down management plan approved after October 9, 1997.

Where we do not have jurisdiction over the use ["no" to (a)], there is no need to evaluate it further as we cannot control the use. Uses that are illegal, inconsistent with existing policy, or unsafe ["no" to (b), (c), or (d)] may not be found appropriate. If the answer is "no" to any of the other questions above, we will **generally** not allow the use.

When the refuge manager finds the use appropriate based on sound professional judgment, the refuge manager must justify the use in writing on an attached sheet and obtain the refuge supervisor's concurrence.

Not Appropriate Appropriate X

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If an existing use is found **Not Appropriate** outside the CCP process, the refuge supervisor must sign concurrence.
If found to be **Appropriate**, the refuge supervisor must sign concurrence.

A compatibility determination is required before the use may be allowed.

VI. Compatibility Determinations

Introduction:

The Fish and Wildlife Service reviewed several uses for compatibility during the comprehensive conservation plan (CCP) process for Waccamaw National Wildlife Refuge (Waccamaw NWR). Descriptions and anticipated impacts of each of these uses are addressed separately. However, the Uses through the Other Applicable Laws, Regulations, and Policies sections, the Literature Cited section, the Public Review and Comment section, and the Approval of Compatibility Determinations section apply to each use. If one of these uses is considered outside of the CCP for Waccamaw NWR, then those sections become part of that compatibility determination.

Uses:

Several uses were evaluated to determine their compatibility with the mission of the Refuge System and the purposes of the refuge: hunting, fishing, wildlife observation and photography, environmental education and interpretation, bicycling, commercial services, commercial fishing, research, camping, rights-of-way, and forest management – commercial timber harvest.

Refuge Name:

Waccamaw National Wildlife Refuge

Establishing and Acquisition Authorities:

Waccamaw NWR's approved acquisition boundary encompasses 54,572 acres and is located in portions of Marion, Horry and Georgetown Counties of South Carolina. Refuge land acquisition is under authority of the Migratory Bird Act of 1929 and the Emergency Wetland Resources Act of 1986 (100 Stat.3582-91). Funding for the refuge's land acquisition program comes from two primary sources: The Land and Water Conservation Fund and the Migratory Bird Conservation Fund.

Refuge Purposes:

The primary purposes for Waccamaw NWR are: (1) protect and manage diverse habitat components within an important coastal ecosystem for the benefit of threatened and endangered species, freshwater and anadromous fish, migratory birds, and forest wildlife, including a wide array of plants and animals associated with bottomland hardwood habitats; and (2) provide compatible wildlife-dependent recreational activities, including hunting, fishing, wildlife observation, wildlife photography, and environmental education and interpretation for the enjoyment of present and future generations (U.S. Fish and Wildlife Service, Waccamaw NWR FEIS April 1997).

National Wildlife Refuge System Mission:

As outlined in the 1997 National Wildlife Refuge System Improvement Act, the mission of the National Wildlife Refuge System is to administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans.

Other Applicable Laws, Regulations, and Policies:

National Wildlife Refuge System Administrative Act of 1966 (16 U.S.C.668dd-668ee)
National Environmental Policy Act of 1969
Refuge Recreation Act of 1962 as amended (16 U.S.C. 460k-460k-4)
Refuge Revenue Sharing Act of 1935
Federal Aid in Wildlife Restoration Act of 1937
Federal Aid in Sport Fish Restoration Act of 1950
Fish and Wildlife Act of 1956
Fish and Wildlife Improvement Act of 1978
Recreational Use of Conservation Areas Act of 1962, as amended.
Executive Order 12996, March 26, 1996 (Management and General Public Use of the National Wildlife Refuge System)
Executive Order 12898 (Environmental Justice Policy, 1994)
Land and Water Conservation Act as amended in 1976 (16 U.S.C. 4601-4-4601-11; 90 Stat. 1313)
Migratory Bird Hunting and Conservation Stamp Act of March 16, 1934 as amended (16 U.S.C. 718-718h)
Anadromous Fish Conservation Act of 1965
Antiquities Act of 1906 (34 Stat. 225)
National Historical Preservation Act of 1966 (16 U.S.C. 470, et seq.; 80 Stat. 915)
The National Environmental Policy Act of 1969, NEPA (42 U.S.C. 4321, et seq.; 83 Stat 852)
Endangered Species Act of 1973 (16 U.S.C. 1531 et seq.; 87 Stat 884)
North American Wetlands Conservation Act of 1989
Title 50 of the Code of Federal Regulations, parts 26-31
The USFWS Refuge Manual

Description of Use: *Hunting*

Under the approved Recreational Hunting Plan, hunting for white-tailed deer, feral hogs, wild turkey, gray squirrel, raccoon, waterfowl, and snipe will be allowed on Waccamaw NWR. Hunting for these species will occur in designated areas of the refuge and during specially designated times.

Big Game

White-tailed deer hunting will be allowed over the majority of the refuge lands in Units 1 and 3 with only the administrative areas with facilities dedicated exclusively to other public uses being closed to hunting. Deer hunts will be scheduled during the months of September through December and dates will vary between units. All deer hunts will be non-quota hunts. Archery, black powder rifles, and modern weapons will be permitted for use during deer hunts and designated seasons will be offered for each method of hunting.

Feral hog hunting will be allowed on any refuge tract where hogs are present. Feral hogs are a pest species on the refuge. The primary objective of hunting hogs is biological in nature, and will be to eliminate hogs, or at least maintain the population at numbers below destructive levels. Public recreation will be a secondary objective. Hog hunting will be in accordance with State regulations. Taking of feral hogs will be allowed incidentally during refuge deer hunts and during special hunts as designated and permitted by the refuge. There will be no size or bag limit on hogs and they will not be permitted to be taken from the refuge alive. Black powder weapons, bow and arrow, and modern weapons shot guns will be allowed during special hog hunts on the refuge.

Limited wild turkey hunting for public recreational purposes will be allowed on designated areas of the refuge. Turkey hunting will be restricted to adult/youth hunts only and all hunts will be in accordance with State regulations. More restrictive refuge-specific conditions may apply, such as season length, bag limit, and quota on number of permitted hunters. This is due to limited acreage of hunt able upland and forested wetlands. Turkey hunting involves covering large areas of land. This combined with the high public demand for the sport will severely limit numbers of hunters allowed in order to maintain a quality hunt.

Upland Game

Recreational gray squirrel hunting will be allowed on designated areas of the refuge. Squirrel hunting will be in accordance with State regulations except that more restrictive hunting methods and season lengths may apply to protect other resources.

Only gray squirrels will be permitted to be taken. No fox squirrel or flying squirrel shall be taken. Squirrel hunts will be closed during scheduled refuge deer hunts when the two seasons overlap.

Raccoon hunting will be allowed on designated areas of the refuge and seasons will vary depending on refuge units. Raccoons have an abundance of habitats and few natural predators on the refuge. In areas where raccoon populations become high, there is a greater potential incidence of disease (distemper and rabies) outbreaks, and the risk for spread of these diseases is increased. As a biological measure, hunting can maintain raccoon population numbers at healthier levels, while at the same time providing a valuable form of public recreation.

Waterfowl

Waterfowl hunting will be allowed only on designated areas of the refuge in Unit 1. The framework for all migratory bird hunting is set forth by the Atlantic Flyway Council. Each individual State sets its own seasons, lengths, bag limits, and special regulations within that framework. Waterfowl hunting on the refuge will be in accordance with State regulations and further restricted by refuge regulations.

Waterfowl hunting will be allowed on Saturdays only on designated areas within the refuge throughout the State season framework. Waterfowl hunting will be limited to morning hours, which concludes at 12 noon on the designated day open to waterfowl hunting. Currently, the refuge has 29 percent of the refuge open to waterfowl hunting and will open no more than 40 percent of the refuge to waterfowl hunting. These hunting restrictions will reduce disturbance to other wildlife and allow for waterfowl feeding and resting use of the areas. The hunting areas will be restricted to natural, unimpounded forested wetlands which are subject to seasonal flooding. All managed impoundments will remain as inviolate sanctuaries.

Navigable waters that bisect refuge lands are not regulated as part of the refuge; however, these waters do fall under State and Federal waterfowl hunting regulations, which will be actively enforced by refuge law enforcement.

Availability of Resources: Operation and maintenance funds to support hunting are taken from the refuge's annual budget, which is adequate to sustain the program at the current level. Costs to administer the hunt program will be primarily staff salaries. It is estimated that the following annual level of involvement by refuge staff will be required to adequately manage and monitor the additions to the hunt program over the long term:

Position and GS/WG Level	Involvement	FTE	Cost
Refuge Manager GS-12	Oversight, hunt plan developments/updates, coordination with the SCDNR	.10	9,260
Assistant Manager GS-11	Monitor, report, hunt brochure mailings, data collection, dual function law enforcement	.15	12,000
Law Enforcement Officer GS-9	Conduct law enforcement and compliance checks	.25	12,500
	Total Annual FTEs and Costs	.50	\$33,760

Anticipated Direct and Indirect Impacts of the Use on Wildlife Species: Anticipated impacts were identified and evaluated based on best professional judgment and published scientific papers. Many of the impacts associated with hunting are similar to those considered for other public use activities, such as wildlife viewing and photography, with the exception of direct mortality to game species, short-term changes in the distribution and abundance of game species, and unrestricted travel through the hunt area. Refuge hunting is a well monitored and regulated public use and this activity should not have a negative impact on overall refuge populations of the game species approved for hunting.

Migratory Birds

The Fish and Wildlife Service, working with partners, annually prescribes frameworks, or outer limits, for dates and times when hunting may occur and the number of birds that may be taken and possessed. These frameworks are necessary to allow State selections of season and limits for recreation and sustenance; aid Federal, State, and Tribal governments in the management of migratory game birds; and permit harvests at levels compatible with population status and habitat conditions. Because the Migratory Bird Treaty Act stipulates that all hunting seasons for migratory game birds are closed unless specifically opened by the Secretary of the Interior, the Service annually promulgates regulations (50 CFR Part 20) establishing the frameworks from which States may select season dates, bag limits, shooting hours, and other options for the each migratory bird hunting season. The frameworks are essentially permissive in that hunting of migratory birds would not be permitted without them. Thus, in effect, Federal annual regulations both allow and limit the hunting of migratory birds.

Migratory game birds are those bird species so designated in conventions between the United States and several foreign nations for the protection and management of these birds. Under the Migratory Bird Treaty Act (16 U.S.C. 703-712), the Secretary of the Interior is authorized to determine when "hunting, taking, capture, killing, possession, sale, purchase, shipment, transportation, carriage, or export of any ... bird, or any part, nest, or egg" of migratory game birds can take place, and to adopt regulations for this purpose.

These regulations are written after giving due regard to "the zones of temperature and to the distribution, abundance, economic value, breeding habits, and times and lines of migratory flight of such birds, and are updated annually (16 U.S.C. 704(a)). This responsibility has been delegated to the Fish and Wildlife Service as the lead Federal agency for managing and conserving migratory birds in the United States. Acknowledging regional differences in hunting conditions, the Service has administratively divided the nation into four flyways for the primary purpose of managing migratory game birds. Each flyway (Atlantic, Mississippi, Central, and Pacific) has a flyway council, a formal organization generally composed of one member from each State and Province in that flyway. Waccamaw NWR is within the Atlantic Flyway.

After Service establishment of final frameworks for hunting seasons, the States may select season dates, bag limits, and other regulatory options for the hunting seasons. States may always be more conservative in their selections than the Federal frameworks but never more liberal. Season dates and bag limits for national wildlife refuges open to hunting are never longer or larger than the State regulations. In fact, based upon the findings of an environmental assessment developed when a national wildlife refuge opens a new hunting activity, season dates and bag limits may be more restrictive than the State allows.

In 2006, Waccamaw NWR entered into a long-term lease agreement with SCDNR, which allowed the 7,661-acre Bucksport WMA to be combined with other fee title refuge lands. One primary condition of the lease agreement is that there is no net loss of hunting opportunities now that these lands are administered under the National Wildlife Refuge System. By adding this significant block of land, the refuge is now able to better manage important riverine habitats, as well as provide a more consistent set of regulations for the visiting public.

Equally as important as uniform management throughout the refuge acquisition boundary, by adding the Bucksport WMA to the refuge, it was able to create a contiguous 12,323-acre waterfowl sanctuary along the Waccamaw River. This area has now become an important resource for protecting wood duck populations in an area of the refuge where State or private sanctuaries do not exist.

Under the current refuge waterfowl hunting regulations, it is estimated that a maximum additional 100 wood ducks would be harvested each year on the refuge. This harvest impact represents a mere 0.001 percent of South Carolina's 4-year average harvest of 80,440 wood ducks (USFWS Waterfowl Harvest and Population Data July 2005). Waterfowl hunting will only be allowed until noon one day per week throughout the season.

Based on the Fish and Wildlife Service Harvest Report, snipe harvest estimates for South Carolina for 2004 and 2005 were 9,800 and 23,600, respectively. Hunter's total season harvest average for both seasons was 3.2/hunter in 2004 and 13.5/hunter in 2005. Total harvest of snipe for the Atlantic Flyway was 45,700 in 2004 and 50,200 in 2005. Although flyway harvest did not vary significantly between 2004 and 2005, seasonal harvest variations for South Carolina demonstrate how weather may be a significant factor in hunter success throughout the state. Snipe hunting will be restricted to tidal freshwater marsh habitats in Unit 3 that are owned by the refuge. Hunting will be further restricted to Wednesday and Saturdays only during the month of February and non toxic shot is required when hunting snipe.

Resident Big Game

Deer

Home range size in mammals often decreases as population density increases (Sanderson 1966). Bridges (1968) and Smith (1970) both observed a threefold increase in home-range size following a die-off in a Florida deer population. Adult bucks generally have larger home ranges than does and these ranges can vary in size due to many environmental factors. In Florida, minimum home ranges averaged 622.8 hectares (1,539 acres) for two mature bucks, and 153.0 hectares (606 acres) for two does, and 153.0 hectares (378 acres) for a buck fawn (Smith 1970). Deer hunting does not have regional population impacts due to restricted home ranges of white-tailed deer. Therefore, only local impacts are likely to occur from deer hunting on the refuge.

Deer herd health checks are conducted every 5 years on most national wildlife refuges by the Southeast Cooperative Wildlife Disease Study at the University of Georgia. In 2005, a herd health check was conducted on Waccamaw NWR. The herd health check report stated that “Although continuation of current herd density may result in declines in herd health or higher rates of disease-induced mortality, the data suggests that some level of covert mortality may be present. These losses will predominantly affect younger animals, 4-12 months of age, mainly during winter and early spring, and will be associated with parasitism by stomach worms (*Haemonchus contortus*) and lungworms (*Dictyocaulus viviparus*). Any significant increase in density likely would result in declines in population health from this density-dependent parasitism/malnutrition syndrome.” The 18,251 acres of refuge lands currently open to deer hunting have averaged less than 15 deer harvested per season.

Harvest and survey data confirm that decades of deer hunting on surrounding private lands (using bait and a longer season) have not had a local cumulative adverse effect on the deer population. The SCDNR estimates that 14,028,896 deer were harvested in South Carolina in 2005 (2005 SCDNR Deer Harvest Report).

Harvest records by each county indicate that Georgetown County harvested 3,464 deer in 2005. This total harvest also computes to 115.4 acres/deer or 5.5 deer/square mile. For Horry County, 4,113 deer were harvested in 2005, which also computes to 129.7 acres/deer or 4.9 deer/square mile (2005 SCDNR Deer Harvest Report). These harvest records fluctuate year-to-year and are down somewhat from a peak in 2002. Harvest rates on refuge lands have been significantly lower than private lands adjoining the refuge due to the allowance of baiting, longer seasons, and no restrictions of method of take on private lands.

Feral Hogs

Feral hogs are an extremely invasive introduced non-native species and are not considered a game species by the State of South Carolina. No bag limits are established for feral hogs. Hunting of feral hogs provides the refuge with another management tool in reducing this detrimental species, and at the same time, is widely enjoyed by local hunters. Cumulative effects to an exotic, invasive species should not be of concern because the refuge would like to extirpate this species on refuge lands. Hunting of hogs is not considered detrimental to the biological integrity of the refuge, and is not likely to create conflict with other public uses and is within the wildlife-dependent public uses to be given priority consideration. Since hogs are exotic, they are a priority species for refuge management only in terms of their negative impacts on refuge biota and need for eradication. Georgetown County, South Carolina, ranked ninth in the State for overall hog harvest in 2005, an increase over all previous years surveyed (2005 SCDNR Feral Hog Harvest Report). This harvest trend indicates an increasing

population and a need for increasing the overall annual harvest. They are a popular game species, and the public interest would best be served by allowing this activity on the refuge. However, even with hunting, feral hogs are likely to always be present because they are prolific breeders.

Wild Turkey

Turkeys are non-migratory and therefore hunting only impacts the local population. Because the refuge turkey hunts are restricted to refuge tracts along the Great Pee Dee River, frequent flooding along with many other environmental circumstances often further impedes hunter success. Proposed turkey hunting on the refuge would be limited to a half-day hunt for four youths during the spring. Based on harvest data from six SCDNR youth turkey hunts, the overall harvest rates were less than 40 percent unless accompanied by a professional guide (personal communications with SCDNR Biologist). It is estimated that harvest success on the refuge would be much lower than State-sponsored youth hunts due to habitat. Therefore, the refuge should not cumulatively adversely impact the population by providing a half-day hunt for 10 youths that could harvest a maximum of 10 turkeys.

Small Game

Squirrels, rabbit, raccoon, and opossum cannot be affected regionally by refuge hunting because of their limited home ranges. Only local effects will be discussed. Opossum and raccoon are hunted primarily at night. Raccoon are more sought after than opossum by the public.

Hunting helps regulate opossum and raccoon populations; however, unless the popularity of this type of hunting increases, raccoons and opossums numbers will always be higher than desired. When these species become extremely overabundant, diseases such as distemper and rabies reduce the populations. However, waiting for disease outbreak to regulate their numbers can be a human health hazard. Cumulative adverse impacts to raccoon and opossum are unlikely considering they reproduce quickly, are difficult to hunt due to their nocturnal habits, and are not as popular for hunting as other game species.

Studies have been conducted within and outside of South Carolina to determine the effects of hunting on the population dynamics of small game. Results from studies have consistently shown that small game, such as rabbits and squirrels, are not affected by hunting, but rather are limited by food resources. Although overall State harvest data were unavailable for South Carolina for these species, the refuge hunt program is not expected to have any significant impact even on local populations of the species due to limited refuge access and frequent flood events. Under the proposed action, the refuge estimates a maximum additional 50 squirrels would be harvested. Gray squirrels are prolific breeders and their populations have never been threatened by hunting in South Carolina even prior to the passing of hunting regulations as we know them today.

Non-hunted Wildlife

Non-hunted wildlife would include non-hunted migratory birds, such as songbirds, wading birds, raptors, and woodpeckers; small mammals, such as voles, moles, mice, shrews, and bats; reptiles and amphibians, such as snakes, skinks, turtles, lizards, salamanders, frogs and toads; and invertebrates, such as butterflies, moths, other insects, and spiders. Except for migratory birds and some species of migratory bats, butterflies and moths, these species have very limited home ranges and hunting could not affect their populations regionally; thus, only local effects will be discussed.

Disturbance to non-hunted migratory birds could have regional, local, and flyway effects. Regional and flyway effects would not be applicable to species that do not migrate, such as most woodpeckers and some songbirds, including cardinals, titmice, wrens, and chickadees. The cumulative effects of disturbance to non-hunted migratory birds under the proposed action are expected to be negligible for the following reasons. Hunting season would not coincide with the nesting season. Long-term future impacts that could occur if reproduction was reduced by hunting are not relevant for this reason. Disturbance to the daily wintering activities of birds might occur, such as feeding and resting. Disturbance to birds by hunters would probably be commensurate with that caused by non-consumptive users.

The cumulative effects of disturbance to small mammals as a result of hunting are expected to be negligible for the following reasons. Small mammals, including bats, are inactive during winter when hunting season occurs. These species are also nocturnal. Both of these qualities make hunter interactions with small mammals very rare. Hibernation or torpor by cold-blood reptiles and amphibians also limits their activity during the hunting season when temperatures are low. Hunters would rarely encounter reptiles and amphibians during most of the hunting season. Encounters with reptiles and amphibians in the early fall are few and should not have cumulative negative effects on reptile and amphibian populations. Invertebrates are also not active during cold weather and would have few interactions with hunters during the hunting season. The refuge has estimated current hunter density on peak days to be no more than 1 hunter per 1000 acres. During the vast majority of the hunting season, hunter density is much lower (1 hunter/3,000 acres). Refuge regulations further mitigate possible disturbance by hunters to non-hunted wildlife. Vehicles and all-terrain vehicles are prohibited on refuge roads and the harassment or taking of any wildlife other than the game species legal for the season is not permitted.

Although ingestion of lead shot by non-hunted wildlife could be a cumulative impact, it is not relevant to Waccamaw NWR because the use of lead shot would not be permitted on the refuge for any type of hunting.

Endangered Species

Six federally listed threatened and endangered species are known to occur or potentially occur within the proposed boundary of the refuge. These include two species of birds, one species of fish, and three species of plants. Use of refuge lands by these threatened and endangered species typically occurs after all refuge hunting seasons, with the exception of turkey season. The bald eagle, which was recently de-listed, nests during late winter in South Carolina. If bald eagle nesting activity occurs on or near refuge lands, closed areas would still be established to buffer the nesting area from any human disturbance and/or activity associated with a permitted public use. This would be the same with or without hunting. As with the potential for bald eagle nesting areas, if a wood stork rookery is established, a closed area would be established to buffer the area from any human activity. Based on the seasonal use parameters listed above and the legal authorities that refuges have to close areas to public access when necessary, adverse effects are expected to be negligible to both threatened and endangered species under the limited hunting and unlimited hunting alternatives.

An Intra-Service Section 7 Evaluation Consultation has been completed in 2007 for the Waccamaw NWR Recreational Hunt Plan (preferred alternative). Based on the current known locations of feeding, nesting, spawning, or physical locations of threatened or endangered species on or adjacent to refuge lands, it has been determined by the Service that hunting is not likely to adversely affect these species.

Determination (check one below):

	Use is not compatible
X	Use is compatible with the following stipulations*

*This use has been found compatible assuming adherence to the stipulations identified. All circumstances cannot be anticipated, and therefore, discretion must be left up to the refuge manager to manage the hunting program within the framework of the refuge goals and objectives.

Stipulations Necessary to Ensure Compatibility:

- Number of hunters, hunting days, and bag limits will be modified as needed to minimize any chance of over harvest of a particular species.
- Law enforcement patrols will be conducted to ensure compliance with hunt regulations.
- Any area on the refuge where reoccurring use for feeding or any nesting or other critical habitat for endangered species is determined to occur will be closed to hunting.
- All-terrain vehicles are prohibited throughout the refuge and are not a component of the refuge hunts.
- Primary access areas for public use facilities will be closed to hunting in order to provide year-round opportunities for other priority uses.
- Monitoring of wildlife populations and habitats will occur on a regular basis to assess health and viability of species that may be impacted by the hunt program.

Justification:

Hunting is a priority wildlife-dependent public use listed under the National Wildlife Refuge System Improvement Act of 1997. Development of hunting opportunities fulfills both the Refuge System mission and the purposes for which the refuge was established. Controlled, limited hunting is compatible with specific refuge goals and objectives, sound wildlife management, and in fostering the public's interest in Waccamaw NWR.

The removal of surplus deer and hogs prevents overpopulation, which can be detrimental to herd health and negatively impact the environment. Big game, waterfowl and upland game hunting has been identified as a priority wildlife-dependent activity under the National Wildlife Refuge System Improvement Act and has a traditional use on lands that are now part of Waccamaw NWR. Additionally, the interagency lease agreement between SCDNR and the Service, which added the Bucksport WMA to Waccamaw NWR, specifically stated as a requirement of the lease agreement that there be no "net loss" of public hunting opportunities under refuge management.

As a management objective, hunting provides the public with an opportunity to utilize a renewable resource. It will also provide an area for traditional public use in the Winyah Bay Focus Area, helping meet not only the objectives of the refuge, but also of the Winyah Bay Focus Area Joint Venture, a flagship project of the North American Waterfowl Management Plan.

Mandatory 15-Year Re-evaluation Date:

Description of Use: *Fishing*

Fishing has been identified as a priority wildlife-dependent activity under the National Wildlife Refuge System Improvement Act and is a traditional use on the refuge. Additionally, the Waccamaw NWR FEIS listed fishing as a priority public use in the conceptual management plan and Interim Compatibility Determination. This wildlife-dependent recreational use is supported by boating; however, almost all boating activities occur on State navigable waters over which the refuge has no control. Therefore, boating impacts associated with fishing will not be considered in this review.

Because of physical access issues, Waccamaw NWR has very few locations where shoreline fishing is feasible. Fishing is permitted throughout the 18,251 acres of refuge lands; however, there are only five locations that are accessible by a land conveyance. Fishing areas are currently limited to shoreline fishing along the Waccamaw and Great Pee Dee Rivers. If ponds, borrow pits, oxbow lakes, or other river access areas are acquired, these will also be open to the public for fishing. A common issue associated with bank fishing is litter.

Fishing is allowed in accordance with State regulations. Additionally, the refuge has implemented refuge-specific fishing regulations, which can be updated annually in Title 50, Code of Federal Regulations. The following items are a summary of refuge-specific fishing regulations:

- Fishing is allowed only during daylight hours.
- Bush hooks and trotlines are permitted to be fastened, anchored, and or secured to refuge lands as long as they are in compliance with State laws.
- Fisherman must attend their lines.

Availability of Resources: Operation and maintenance funds to support fishing are taken from the refuge's annual budget, which is adequate to sustain the program at the current level. Costs to administer the fishing program will be primarily staff salaries. It is estimated that the following annual level of involvement by refuge staff will be required to adequately manage and monitor the fishing program. This information will be used to evaluate and estimate costs as the program grows:

Position and GS/WG Level	Involvement	FTE	Cost
Refuge Manager (GS-12)	Oversight and coordination with partners to develop better fishing access facilities.	.05	4,630
Assistant Manager (GS-11)	Monitor, reports, dual function law enforcement.	.10	8,063
Law Enforcement Officer (GS-9)	Conduct law enforcement and compliance checks.	.10	5,000
	Total Annual FTEs and Costs	.25	\$17,693

Funding for the access improvements outlined in the CCP is not currently available. For example, the cost for a fishing pier at the Cox Ferry recreation Area is estimated to cost approximately \$125,000. Funding would also be needed for road and parking improvements, restrooms, bank fishing improvements, and freshwater fishing improvements. As fishing facilities are developed, an access fee system may be necessary to cover operational and maintenance costs of these facilities.

Anticipated Impacts of Use: Anticipated impacts of this use include litter and minor wildlife disturbance. Wildlife disturbance is generally limited to flushing individual or groups of feeding or resting wading birds, raptors, or waterfowl to other locations on the refuge or private property. It is anticipated that most of these wildlife disturbances will be attributable to boating on State navigable waters that bisect the refuge.

Boating has been shown to alter distribution, reduce use of particular habitats by waterfowl and other birds, alter feeding behavior, and cause premature departure from areas. Impacts of boating can occur even at low densities, given the ability of powerboats to cover extensive areas in a short amount of time, the noise they produce, and their speed (Sterling and Dzubin 1967, Bergman 1973, Speight 1973, Skagen 1980, Korschgen et al., 1985, Kahl 1991, Bauer et al., 1992, Dahlgren and Korschgen 1992). For refuge tracts in areas of Unit 3 where waterfowl sanctuaries may be established, seasonal closure and/or motorized boat access may be restricted in man-made canals which bisect each tract. If this step is taken, close coordination with State and Federal agencies will be maintained in order to meet all guidelines on barriers to navigation.

No significant impacts to air or water quality are expected. There will be little or no impacts to vegetation except where heavy shoreline fishing occurs. Over time, these impacts may be lessened by the development of piers or other permanently enhanced access structures. There are no long-term or cumulative impacts identified.

Determination (check one below):

	Use is not compatible
X	Use is compatible with the following stipulations

Stipulations Necessary to Ensure Compatibility: Fishing is allowed on the refuge in accordance with State regulations. In addition, the refuge has the listed sports fishing regulations, which are paraphrased.

- A refuge sports fishing permit is currently not required.
- Fishing is allowed only during daylight hours.
- Fisherman must attend their lines.
- Frequent patrols by refuge personnel must be continued to ensure compliance with refuge regulations and State law, including fishing license checks.
- Sensitive areas must be monitored and closed to public access as needed to protect fragile habitats and wildlife from disturbance during critical life-cycle periods (such as nesting).

Justification: Fishing is a priority wildlife-dependent use under the National Wildlife Refuge System Improvement Act. Fishing, as described, was determined to be compatible in view of the potential impacts that fishing and supporting activities (e.g., boating) can have on the Service's ability to achieve purposes and goals of the refuge, because: (1) fishing densities and use levels are relatively low during most days; (2) Most human disturbance impacts will occur on State navigable waters, which the refuge has little control over; and (3) sufficient opportunities are available for other priority wildlife-dependent recreation.

Mandatory 15-Year Re-evaluation Date:

Description of Uses: *Wildlife Observation and Photography*

Wildlife observation and photography are considered simultaneously in this compatibility determination. Wildlife observation and photography have been identified in the National Wildlife Refuge System Improvement Act of 1997 as priority wildlife-dependent recreational uses provided they are compatible with the purposes of the refuge. This compatibility determination applies only to personal wildlife photography. Commercial photography or videography, if allowed, would be covered under the Commercial Services compatibility determination and would require a special use permit by the refuge with specific restrictions.

Wildlife observation and photography may occur during daylight hours throughout all open areas of the refuge. Certain portions of the refuge are closed to protect wildlife and these areas will be posted with closed area signs. Wildlife viewing and photography improvements are being developed on the Cox Ferry Recreation Area and the Yauhannah Bluff Tract where a new environmental education center is being built and include boardwalks and hiking trails. These facilities will provide exposure to different refuge habitat types and diverse flora and fauna.

In addition, numerous refuge dikes and roads are open year-round or seasonally to provide different wetland or upland habitats for wildlife viewing. Although no photography blinds currently exist on the refuge, one wildlife observation platform is planned for Cox Ferry Recreation Area. Restrooms and other improvements are planned on the recreation area to support wildlife observation and photography.

Access for wildlife viewing and photography are limited to hiking, motorized and non-motorized boats, and bicycles on designated trails and roads. Certain areas may be closed to specific forms of transportation. The refuge may host special events where electric motorized vehicles, such as golf carts, will be allowed to provide additional access to handicapped or special needs visitors.

Refuge brochures and maps will provide the public with the locations of visitor facilities.

Availability of Resources: Many of the public use facilities that are in place or planned that would enhance opportunities for wildlife observation and photography also would enhance other uses such as hiking, biking, and environmental education. A specific FTE cost breakdown is not provided that is specific to these uses. Operation and maintenance funds to support wildlife viewing and photography are taken from the refuge's annual budget, which is adequate to sustain the program at the current level. Funds are needed annually to mow, grade, and maintain roads open to the public; replace gravel on the parking areas and other refuge roads; repair and replace boardwalks and trails; paint, repair, and replace signs; and develop and print brochures.

Funding is not currently available to fully support all the planned wildlife observation and photography improvements identified in the CCP. To support the program and make improvements, the South Eastern Wildlife and Environmental Association (SEWEE Association), in cooperation with other partners, has currently raised over \$95,300 to go towards the Cox ferry Recreation Area and is pursuing additional fund sources to cover additional facility enhancements. These funds will help offset construction costs; however, they will not cover annual maintenance or operational costs. Additional funding will be necessary to cover these costs as additional infrastructure is added.

Anticipate Impacts of Uses: This section is to critically and objectively evaluate the potential effects that wildlife observation and photography could have on the wildlife, habitat, and other public use activities based on available information and best professional judgment. Each activity has the potential to have impacts, but the focus is to minimize impacts to within acceptable limits. This is based on the impacts at the existing and projected level of use.

Short-term Impacts: Impacts associated with wildlife observation activities can be divided into two categories, based on whether the activity occurs within or outside of a vehicle. In general, activities that occur outside of vehicles tend to increase disturbance potential for most wildlife species (Klein 1993, Gabrielson and Smith 1995, Burger 1981, Pease et al., 2005).

Wildlife observation trails have a greater potential for disturbing wildlife species. Among wetland habitats, human disturbances can reduce time spent foraging and can cause water birds to avoid foraging habitats adjacent to trails and public viewing areas. Similarly, walking on wildlife observation trails tends to displace birds and can cause localized declines in the richness and abundance of wildlife species (Riffell et al., 1996). Bicycling and people walking causes more disturbances to waterfowl than motorized vehicles (Pease et al., 2005).

Wildlife photographers tend to have the largest disturbance impacts (Klein 1993, Morton 1995, Dobb 1998). While wildlife observers frequently stop on trails to view wildlife, wildlife photographers are much more likely to approach wildlife on foot (Klein 1993). Even slow approach by wildlife photographers tends to have behavioral consequences to wildlife (Klein 1993). Other impacts include the potential for some photographers to remain close to wildlife for extended periods of time (Dobb 1998), and the tendency of casual photographers with low power lenses to get much closer to their subject than other activities would require (Morton 1995).

Long-term Impacts: Considering the high level of use and variety of activities occurring at the refuge, appropriate solutions to minimize impacts need to be developed and monitored. Due to the limited access areas on the refuge, long-term impacts may be lessened significantly by the availability and a wildlife preference shift to remote resting and feeding areas. Public use currently is not at a level to cause this shift, but anticipated increases relative to the expansion of the population and growth of visitor opportunities could result in seasonal shifts in migratory bird use of the refuge's wetland habitats.

Determination (check one below):

	Use is not compatible
X	Use is compatible with the following stipulations

By design, wildlife observation and photography should have minimal wildlife and habitat impacts. However, as use increases, wildlife impacts are more likely to occur. Evaluation of the sites and programs will be conducted annually to assess if objectives are being met, if habitat impacts are minimized, and if wildlife populations are not being adversely affected. If evidence of unacceptable impacts begins to appear, it will be necessary to change the activity or the program, move the activity or program, or eliminate the program.

Stipulations Necessary to Ensure Compatibility:

- Establishing buffer zones that minimize disturbance around sensitive areas and establishing additional no-entry zones.
- Vegetation that effectively conceals visitors and provides cover for birds can help minimize impacts of people in busy areas like the Cox Ferry Recreation Area.
- Impacts from wildlife viewing and photography can be reduced by providing observation blinds.
- Re-routing, modifying, or eliminating activities which have demonstrated direct wildlife impacts should also be employed.
- Education is critical for making visitors aware that their actions can have negative impacts on birds.
- Establishing well-marked trails where human use is more predictable will lessen wildlife impacts.

Justification: Wildlife observation and photography are priority public uses of the National Wildlife Refuge System. Providing quality, appropriate, and compatible opportunities for these activities contributes toward fulfilling provisions of the National Wildlife Refuge System Improvement Act. Wildlife observation and photography would provide excellent forums for promoting increased awareness, understanding, and support of refuge resources and programs and of the Service. The stipulations outlined above should minimize potential impacts relative to wildlife/human interactions. At the current level of visitation, these wildlife-dependent uses would not conflict with the national policy to maintain the biological diversity, integrity, and environmental health of the refuge.

Mandatory 15-Year Re-evaluation Date:

Description of Uses: *Environmental Education and Interpretation*

Environmental education and interpretation consist primarily of a curriculum-based, youth program that targets the education and interpretation of the natural resources of the refuge. Activities include on-site staff-led or teacher-led environmental education programs; off-site teacher-led classroom programs; teacher workshops; and interpretation of wildlife, habitat, other natural features, and/or management activities occurring on the refuge.

These activities seek to increase the public's knowledge and understanding of wildlife and their habitats and to contribute to wildlife conservation and support of the refuge. Environmental education and interpretation have been identified in the National Wildlife Refuge System Improvement Act as priority public use activities, provided they are appropriate and compatible with the purposes for which the refuge was established.

Waccamaw NWR has partnered with the South Eastern Wildlife Environmental Education Association (SEWEE Association) in order to meet the current demands for environmental education programs on the refuge. The SEWEE Association has been successful in receiving several grants to help offset these program costs. One of the top priorities identified in the CCP is the construction of a new environmental education center on the Yauhannah Bluff Tract. Construction of the center has started and once built, this new facility will enhance the refuge's ability to reach more students throughout a larger area surrounding the refuge. Staffing, operational, and maintenance costs will become a limiting factor once this facility is opened. It is anticipated that the refuge will have to work very closely with the SEWEE Association to meet many of these needs.

The proposed interpretation program strives to increase awareness and understanding of the refuge's natural features, habitat diversity, wildlife, human history, and refuge management activities. The CCP calls for minor changes, such as adding new signs, revising brochures, and developing new interpretive panels and kiosks. The CCP also calls for more extensive improvements, such as developing the Cox Ferry Recreation Area which is already underway.

Availability of Resources: Annual refuge operation and maintenance funds support the Visitor Services' program and activities. The development of proposed facilities is contingent upon successfully locating a funding source. Costs for improvements identified in the CCP will typically come from the SEWEE Association, Fish and Wildlife Foundation, other grants or endowments, and refuge budget increases under the Refuge Operating Needs System (RONS). The SEWEE Association is currently supplementing the environmental education program and interpretive programs by \$10,000, which covers almost all of the costs of the environmental education program. As the program grows, many of the additional costs and staff needs will have to be met through the cooperation and assistance of the SEWEE Association.

Anticipated Impacts of Uses: Environmental education primarily occurs at the Yauhannah Tract, at the public boat ramp. As the new center comes on-line, these programs will shift more to Yauhannah Bluff. It is anticipated that the overall program will grow considerably at that time. The expansion of the program, as proposed, would increase disturbance on a new site; however, this site was acquired specifically for the construction of the new center. Impacts would be considered short-term and discrete due to the distance that this site is away from more sensitive wildlife habitats. Vegetation trampling, altering structure and species composition, and temporal wildlife impacts to species would be at a minimal level. This unavoidable impact associated with running the environmental education program is acceptable.

Impacts associated with interpretive activities generally occur at developed facilities, such as the visitor center, trails, boardwalks, or other improved facilities. Adding the new interpretive sites would have some wildlife or habitat impacts. The Cox Ferry Recreation Area will utilize an existing road system, which will be converted to trails, and a parking lot will be associated with this project. The planned observation tower for visitors at the Cox Ferry Recreation Area would be located adjacent to a main trail and most improvements (e.g., parking lots and a kiosk) would be located in a previously cleared and disturbed area. The tower and tower trail would be located near some wetlands, but the footprint of the tower and trail would be in uplands where impacts are minimal.

Determination (check one below):

	Use is not compatible
X	Use is compatible with the following stipulations

Stipulations Necessary to Ensure Compatibility: While anticipated impacts are anticipated to be minimal, stipulations are required to ensure that wildlife resources are adequately protected. The environmental education program activities will avoid sensitive sites and sensitive wildlife populations. A section on wildlife etiquette will be built into all curriculums. Environmental education programs and activities will be held at or near established facilities where impacts may be minimized. Evaluations of sites and programs should be conducted annually to assess if objectives are being met and to ensure that natural resources are not being adversely impacted.

Impacts associated with interpretive programs are also anticipated to be minimal. One overarching aspect of the interpretive program is to build understanding and appreciation for the refuge and its natural resources, many of which can not be physically accessed by refuge visitors. As use increases, wildlife disturbances are unavoidable, but through interpretive material (e.g., brochures, signs, and kiosk panels) proper wildlife etiquette will be stressed. Education is critical for making visitors aware that their actions can have negative impacts on wildlife. Interpretive activities and programs will be conducted at developed sites where impacts can be minimized. Wildlife impacts on the Cox Ferry Recreation Area will be carefully monitored. If impacts are detected, adaptive strategies will be developed, such as seasonal trail closures to lessen wildlife disturbance. Annual evaluations will be conducted to assess if objectives are being met and that the natural resources are not being adversely affected. The refuge will modify or eliminate any use that results in unacceptable impacts.

Justification: Environmental education and interpretation represent two priority wildlife-dependent recreational activities listed under the National Wildlife Refuge System Improvement Act. Environmental education and interpretation are used to encourage all citizens to act responsibly in protecting natural resources.

Environmental education and interpretation activities are tools the refuge can use to build understanding, appreciation, and support for the refuge and the National Wildlife Refuge System. Resources required to run the programs are minimal and are built into the refuge operation and maintenance budget. As long as stipulations to ensure compatibility are followed, the programs should remain compatible with the purposes of the refuge. At such time that the monitoring program identifies unacceptable wildlife impacts, the refuge will modify activities to minimize or eliminate the impacts.

Both programs allow for the public to become knowledgeable of the missions of the Service, the Refuge System, and the purposes of the refuge. The programs highlight the areas which are most in line with the refuge's management philosophy proposed under the CCP. Considering the minimal anticipated impacts through implementation of the environmental education and interpretation programs and the benefits that should arise through public education, participation, and involvement, the program is deemed compatible.

Mandatory 15-Year Re-evaluation Date

Description of Use: *Bicycling*

While not one of the six priority wildlife-dependent recreational uses listed in the National Wildlife Refuge System Improvement Act, bicycling is a mode of transportation currently used to facilitate wildlife observation and hunting. This compatibility determination provides additional guidance on its specific use. As proposed, bike riding would occur only on designated roads and trails, and would year-round.

Availability of Resources: Operation and maintenance funds to support wildlife viewing are taken from the refuge's annual budget, which is adequate to sustain the program at the current level. Funds are needed annually to mow, grade, and repair roads open to the public; replace gravel on the refuge roads; repair and replace boardwalks and trails; paint, repair, and replace signs; and develop and print brochures. Many of these direct and indirect costs are necessary for other public uses and so an FTE (position) cost breakdown specific to this use is not included in this compatibility determination. The refuge will seek outside funding, grants, and partnerships to fund the development of the refuge's trails, which will also serve as future bicycle paths. Trails dedicated to hiking only will be closed to bicycling.

Anticipate Impacts of Use: A critical and objective evaluation of the potential effects that bicycles could have on the wildlife, habitat, and other public use activities is based on available information and best professional judgment. Although bicycling has the potential to have impacts, the focus is to minimize impacts. This is based on the impacts at the existing and projected level of use.

Bicycling may be an appropriate form of transportation to view wildlife or to reach remote areas for hunting and has been approved in specific locations. However, bicycle riding takes several forms. For example, mountain biking, according to the International Mountain Bicycling Association (IMBA) is the sport of riding bicycles off paved roads. It requires endurance and bike handling skills and is performed on dirt roads, fire breaks, access roads, and public trails. According to the IMBA, the sport is broken down into several categories: cross country, downhill, street, dirt jumping, and free riding. Several aspects of mountain biking are more similar to trail running than to regular bicycling (Wikipedia 2005).

Although wildlife viewing may be an incidental aspect of the mountain biking activity, it is not considered the main purpose or intent. Mountain bikers may enjoy the outdoor setting found at the refuge, but the activity may conflict with other wildlife-dependent recreation activities, may disturb migratory birds, and is not specifically aimed at viewing wildlife. Therefore, mountain biking is not permitted.

Other forms of bike riding may be appropriate. The intent of some bike riders is wildlife viewing. Bicycle riders are not permitted to ride on refuge hiking trails. This activity disturbs other trail users and will be eliminated from hiking trails.

Short-term Impacts: Wildlife disturbance relative to bicycle riding has been poorly studied with most references using activities such as walking, hiking, and operating vehicles and their impacts on wildlife; therefore, bicycle impacts are inferred. In general, activities that occur outside of vehicles (including bicycling) tend to increase the disturbance potential for most wildlife species (Klein 1993, Gabrielson and Smith 1995, Burger 1981, Pease et al., 2005). Among wetland habitats, out of vehicle approaches can reduce time spent foraging and can cause water birds to avoid foraging habitats adjacent to the out of vehicle disturbance (Klein 1993). One possible reason for this result is that vehicle activity is usually brief; while out of vehicle activities, such as walking, require longer periods of time to cover the same distance. Similarly, walking on wildlife observation trails tends to displace birds and can cause localized declines in species richness and abundance (Riffell et al., 1996).

Wildlife may receive different cues from different modes of transportation, since wildlife do not flee as readily from cars, perhaps because the person is hidden in the vehicle and not perceived as a threat (Klein 1983). A 2005 study at Back Bay National Wildlife Refuge (Pease et al., 2005) compared five different human activities (i.e., motorized tram, slow moving truck, fast moving truck, bicyclist, and pedestrian) in relation to waterfowl disturbance. The study found that people walking and biking disturbed waterfowl more than vehicles.

Long-term Impacts: Considering the high level of use and variety of activities occurring at the refuge, appropriate solutions to minimize impacts need to be developed. Techniques to limit disturbance must first be evaluated, then implemented and monitored. This stems from the hypothesis that prolonged and extensive disturbance may cause migratory birds to abandon the wetlands most disturbed by humans and winter elsewhere. Current use may not be at a level to cause this shift, but anticipated increases relative to the expansion of the population and the growth of visitor opportunities could result in seasonal shifts in migratory bird use of the refuge wetland habitat. Bicycling would add to the level of disturbance, especially in wetland habitats, and strategies need to be implemented to limit wildlife impacts.

Determination (check one below):

	Use is not compatible
X	Use is compatible with the following stipulations

All forms of wildlife observation should have minimal wildlife and habitat impacts. However, bicycling can cause wildlife impacts in open wetland areas, can increase wildlife impacts, and can disrupt other individuals viewing wildlife. Bicycles will not be permitted on established hiking trails.

Stipulations Necessary to Ensure Compatibility:

- Establishing buffer zones that minimize disturbance around sensitive areas and establishing additional no entry zones.
- Vegetation that effectively conceals visitors and provides cover for birds can help minimize impacts of people.
- Impacts from wildlife viewing can be reduced by providing observation blinds.
- Techniques specific to bicycling will include: re-routing, modifying, or eliminating bicycle riding activities that have demonstrated direct wildlife impacts in open wetland habitats.
- Education is critical for making bicycle riders aware that their actions can have negative impacts on birds.
- Establishing well-marked bike trails where this use is allowed and contained.

Justification: Bicycling to observe wildlife facilitates priority public uses of the National Wildlife Refuge System. Providing opportunities for these activities contributes toward fulfilling provisions of the National Wildlife Refuge System Improvement Act. Wildlife observation from bicycles in areas where there are few impacts to wildlife would provide an appropriate mode of transportation for promoting increased awareness, understanding, and support of refuge resources and programs.

The stipulations outlined above should minimize potential impacts relative to wildlife/human interactions. At the current level of visitation, bicycling does not seem to conflict with the national policy to maintain the biological diversity, integrity, and environmental health of the refuge.

Mandatory 10-Year Re-evaluation Date:

Description of Use: *Commercial Services*

While not one of the six priority wildlife-dependent recreational uses named in the National Wildlife Refuge System Improvement Act, commercial services support wildlife viewing, interpretation, hunting, and fishing and they assist the refuge in providing quality wildlife-dependent recreational activities. The refuge would authorize commercial services through the issuance of special use permits. For the purpose of this document, a commercial provider is defined as a permittee who charges a client a fee for a program or service to generate a profit. This does not include individuals who perform these services for no fee, not-for-profit groups, schools, colleges, or other governmental agencies.

This activity would provide recreational and educational opportunities for the public who desire a quality wildlife-dependent experience, but who may lack the necessary equipment, skills, knowledge, ability, or resources to obtain it themselves. Commercial services on the refuge could include: motor vehicle tours; boat, canoe and kayak tours; filmmaking and professional photography; and guided sports fishing and hunting trips. Except for the fee charged to the customer by the commercial provider, the impacts associated with these activities would not be different than other activities already occurring on the refuge. The named activities covered by this compatibility determination are similar to the activities covered by the interpretation, wildlife observation, waterfowl hunting, and fishing compatibility determinations, but this compatibility determination would provide additional guidance specific to commercial services.

As proposed, some commercial services would be permitted in the open areas of the refuge under a special use permit. Interpretive training and further guidelines may be developed and required in the future. Currently, no administrative facilities for the providers of these commercial services are planned for the refuge.

Availability of Resources: The program costs to refuge operations would include, but not be limited to: development and review of policy and procedure, administration of annual permits (e.g., addressing inquiries, screening applicants, checking on insurance, and issuing permits), and enforcement and monitoring of permit holders. However, the size and scope of the program and number of permits issued would have to be balanced with the permit fee. Existing facilities, such as boat ramps and other infrastructure, could accommodate commercial services.

Anticipated Impacts of Use: To date, there are no commercial service programs on the refuge. It is anticipated that at some point in time a tour boat system may be necessary to access remote areas of the refuge where present access is only available by private boat. Commercial hunting guide services would not be permitted on refuge lands. Commercial trapping of turtles would not be permitted nor would traps fastened to woody vegetation on refuge lands be permitted.

Guided tour activities may conflict with other refuge visitors. For example, commercial tours would use the same areas as other visitors engaged in wildlife observation, kayaking, hunting, and angling. Unregulated, commercial operations could adversely affect the safety of other visitors and the quality of their experience, and could contribute to wildlife disturbance.

Determination (check one below):

	Use is not compatible
X	Use is compatible with the following stipulations

Stipulations Necessary to Make the Use Compatible: Commercial operators shall be permitted only in the areas open to the public. Seasonal or permanent closures in certain areas may be imposed on commercial operators if the level of use becomes excessive, conflicts occur with other users engaged in priority wildlife-dependent recreation, or wildlife impacts occur. In the future, interpretive training and other stipulations may be required of commercial operators to help the refuge achieve its outreach and educational objectives.

The fee for annual commercial use permits is \$250. These fees are anticipated to be increased as the cost for administering the program increases.

Commercial service providers would follow all refuge regulations along with additional special conditions stipulated in their permits. The following special conditions would be common to most commercial service providers:

- The permittee would provide proof of general liability insurance in the amount of \$300,000.
- The permittee would provide proof of a State charter license and/or Coast Guard Captain's license.
- The provider would supply the refuge with his/her fee schedule charged per client.
- The provider would supply the refuge with the number of trips provided per year (this would include the number of clients).
- A special use permit could be revoked for failure to comply with all conditions or for repeat violations of refuge regulations.
- Boat, canoe, and kayak tours would be permitted to use all designated launch sites. Tour routes would be approved in the permit. A concessionaire permit would be required for any tour operator accessing refuge lands.
- Fishing on State navigable waters that bisect the refuge is regulated by the South Carolina Department of Natural Resources. If refuge lakes are acquired or developed, fishing guide services would be permitted in accordance with refuge and State regulations. Commercial fishing guides may be limited to sustainable levels as determined by the refuge.
- Guide hunting trips would not be permitted in refuge hunt areas.
- Filmmaking and professional photography would be permitted on a case-by-case evaluation.

Justification: Commercial operations could support wildlife observation, interpretation, and fishing. Further, they could provide recreational and educational opportunities for the public who desire a quality wildlife-dependent experience, but who may lack the necessary equipment, skill, knowledge,

ability, or resource to obtain it themselves. Providing opportunities for these activities would contribute toward fulfilling provisions of the National Wildlife Refuge System Improvement Act. The stipulations outlined above should minimize potential impacts relative to wildlife/human interactions. At the current level of visitation, commercial operations would not conflict with the national policy to maintain the biological diversity, integrity, and environmental health of the refuge.

Mandatory 10-Year Re-evaluation Date:

Description of Use: *Commercial Fishing*

Commercial fishing from the creeks and rivers that bisect the refuge has been a historic use on the refuge well before its establishment. The commercial fishing activities that have historically occurred throughout the refuge include fishing with large gill nets, hoop nets, traps, trotlines, and set hooks, all of which require fastening fishing implements to woody vegetation that is part of the refuge. Species most often targeted include American shad, American eel, rough fish (bowfin, gar), and blue and flathead catfish. These activities are allowed under a South Carolina Department of Natural Resources commercial harvest permit and all State-approved commercial fishing methods will be allowed on refuge lands.

Availability of Resources: Law enforcement officers are required to ensure that commercial fisherman adhere to State and Federal laws which regulate commercial fishing in State waters. For instance, some water areas may be closed seasonally to commercial harvest. Special State regulations, such as bait, hook size, permit identification, and time of day for commercial activities, must be adhered to. Currently, refuge law enforcement routinely patrols areas where commercial fishing occurs in conjunction with other public uses and presently there are no significant additional costs to the refuge.

Anticipated Impacts of Use: Inherent impacts result from the operation of motorized boats in the aquatic environments, which include motor exhaust, disturbance to wildlife, turbidity of the water, and alteration of the river and creek bottoms. In addition, trotlines, traps, nets, and set hooks that have been abandoned or moved by storms continue to catch and kill many organisms. The level of recreational fishing from the shore and from boats is steadily increasing. At some point, direct competition will occur between the recreational and commercial fishing efforts.

Determination (check one below):

	Use is not compatible
X	Use is compatible with the following stipulations

Stipulations Necessary to Ensure Compatibility:

- Commercial fishing shall be permitted only in the areas open to the public.
- Seasonal or permanent closures in certain areas may be imposed on commercial fishing if the level of use becomes excessive, conflicts occur with other users engaged in priority wildlife-dependent recreation, or wildlife impacts occur.

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- A commercial freshwater fishing license must be in possession at all times.
 - All State freshwater and saltwater regulations must be strictly adhered to during all commercial fishing operations.
 - Set hooks are prohibited on Big Bull Creek.
 - All set hooks must display the owners name and address.

Justification: The refuge recognizes the family dependence on commercial fishing over the history of this local area. Many of the commercial fishing activities on the refuge occur in State waters and are sanctioned by the State. The refuge can only regulate fishing on isolated ponds, oxbow lakes, and standing water bodies that cannot be accessed by boat. Refuge regulations can, however, address specific commercial fishing practices that use vegetation or structures located on refuge lands to fasten fishing implements to trotlines, set hooks, nets, or traps. In order to allow a long tradition of family businesses and to not place undo hardship on these families and their businesses, the refuge has developed a policy that is fair and equitable to the commercial fishing industry.

Mandatory 10-Year Re-evaluation Date:

Description of Use: *Research*

Research is the planned, organized, and systematic gathering of data to discover or verify facts. In principle, research conducted on the refuge by universities, co-op units, non-profit organizations, and other research entities furthers refuge management and serves the purposes, vision, and goals of the refuge. The refuge hosts research from a variety of research institutions.

All research activities, whether conducted by governmental agencies, public research entities, universities, private research groups, or any other entity, shall be required to obtain special use permits from the refuge. All research activities will be overseen by the refuge manager.

Availability of Resources: Other than the administration of associated special use permits, no refuge resources are generally required for this use.

Anticipated Impacts of the Use: Generally, adverse impacts from research are minimal. Occasionally, slight or temporary wildlife or habitat disturbances may occur (e.g., minor trampling of vegetation may occur when researchers access monitoring plots). However, these impacts are not significant, nor are they permanent. Also, a small number of individual plants or animals might be collected for further scientific study, but these collections are anticipated to have minimal impact on the populations from which they came. All collections will adhere to the Service's specimen collection policy (U.S. Fish and Wildlife Service 2005 b). Projects that are fish and wildlife management-oriented, which will provide needed information to refuge operation and management, will receive priority consideration and will even be solicited.

Determination (check one below):

	Use is not compatible
X	Use is compatible with the following stipulations

Stipulations Necessary to Ensure Compatibility: All research conducted on the refuge must further the purposes of the refuge and the mission of the National Wildlife Refuge System. All research will adhere to established refuge policy on research and policy on collecting specimens (U.S. Fish and Wildlife Service 2005 b). To ensure that research activities are compatible, the refuge requires that a special use permit be obtained before any research activity may occur. Research proposals and/or research special use permit applications must be submitted in advance of the activity to allow for review by refuge staff to ensure minimal impacts to the resources, staff, and programs of the refuge. Each special use permit may contain conditions under which the research will be conducted.

Each special use permit holder will submit annual reports to update the refuge on research activities, progress, findings, and other information. Further, each special use permit holder will provide copies of findings, final reports, publications, and/or other documentation at the end of each project. The refuge will deny permits for research proposals that are determined to not serve the purposes of the refuge and the mission of the National Wildlife Refuge System. The refuge will also deny permits for research proposals that are determined to negatively impact resources or that materially interfere with or detract from the purposes of the refuge. All research activities are subject to the conditions of their permits.

Justification: Research activities provide important benefits to the refuge and to the natural resources supported by the refuge. Supporting management, research conducted on the refuge can lead to new discoveries, new facts, verified information, and increased knowledge and understanding of resource management, as well as track current trends in fish and wildlife habitat and populations to enable better management decisions. Research has the potential to further the purposes of the refuge and the mission of the National Wildlife Refuge System.

Mandatory 10-Year Re-evaluation Date:

Description of Use: *Camping*

Camping on beaches and islands along the creeks and rivers that bisect the refuge has been a historic use that dates back thousands of years. In more recent years, camping has occurred in conjunction with hunting and fishing activities including commercial fishing. Most often with modern camping use, selection of sites has been opportunistic and most often occurred without permission from private landowners who manage the land. The refuge has only permitted camping by special use permits for volunteers who pick up litter during annual river sweeps and then on a case-by-case basis as volunteer work has been necessary. As the refuge continues to grow, camping may be considered when it is necessary and beneficial for other permitted activities, such as hunting, fishing, canoeing, and kayaking.

Any decision to expand camping will take into account all environmental impacts and the availability of resources and other costs which might be required to support expansion of camping opportunities.

Availability of Resources: Presently, there are very few administrative costs to providing camping on a very limited basis as a support amenity for volunteers. Refuge law enforcement routinely patrols for illegal camping and the volunteers assist the refuge in litter clean up that is a result of years of irresponsible camping by illegal campers. The refuge manager and law enforcement officer coordinate the special use permits, monitor compliance, and ensure the conservation project is accomplished. The refuge's operating budget is adequate to sustain this program at the current level of use.

Anticipated Impacts of Use: The camping areas are selected based on conservation project needs and almost exclusively in remote areas away from areas of intensive bird use. All sites used for camping would be upland sites with no impacts to wetlands. Some minor soil compaction and vegetation trampling do occur associated with the use. Fires are restricted to an approved fire pit and fire wood must be brought to the site.

Determination (check one below):

	Use is not compatible
X	Use is compatible with the following stipulations

Stipulations Necessary to Ensure Compatibility: Applicants must obtain a special use permit from the refuge. This use must have a conservation basis supporting the missions of the Service and Refuge System, the purposes and goals of the refuge, and the six priority public uses of the Refuge System. A conservation project assisting the refuge must be a part of the requirements. A temporary, portable sanitary system must be brought in by the campers and in place to support the activity.

Justification: Many of the historic camp sites throughout the refuge are in remote locations which limits access, consequently lessening interest by the general public for volunteer conservation programs. Litter will always remain a problem on Waccamaw NWR and habitat degradation will increase unless annual litter sweeps occur. By allowing limited and very controlled camping on the refuge, refuge volunteers have increased to a level where the refuge can maintain litter levels at a sustainable level. Therefore, as long as the impacts are minimized and the refuge has adequate funds and staff to support this activity, it could continue.

Mandatory 10-year Re-evaluation Date:

Description of Use: *Rights-of-way*

In 1997, Waccamaw NWR was established and with this establishment, a 49,800-acre acquisition boundary was designated for future land acquisition purposes. In 2001, the acquisition boundary was expanded through a minor expansion to 54,475 acres. At the time of refuge establishment, there were two existing electrical transmission line rights-of-way and three existing sewer line rights-of-way in place within the acquisition boundary. In addition to these existing rights-of-way, one water line right-of-way was under construction within an existing electrical transmission line right-of-way, which bisected the first tract of land to be acquired by the refuge. The refuge completed an environmental action statement and determined that because the water line was being installed within an existing right-of-way, and that all wetland habitats would be restored immediately after installation, this right-of-way was consistent with a categorical exclusion.

In addition to existing public water and sewer utility rights-of-way, there were several county, State, or Federal road rights-of-way that bisected the acquisition boundary at the time of refuge establishment. The Fish and Wildlife Service addressed road replacement and/or upgrades and maintenance to existing roads in the Waccamaw NWR Final Environmental Impact Statement (U.S. Fish and Wildlife Service 1997). Within the Waccamaw NWR Final Environmental Impact Statement, an agreement between the South Carolina Department of Transportation and the Fish and Wildlife Service (Appendix V) was developed specifically addressing existing road projects and future allowances for rights-of-way associated with these specific road projects.

Availability of Resources: All of the existing rights-of-way that bisect lands owned or leased by the Fish and Wildlife Service as part of Waccamaw NWR are maintained and managed by the authorized party responsible for each particular right-of-way. With all but one right-of-way, the refuge still maintains ownership of the lands within the rights-of-way and refuge specific laws and regulations apply to all refuge visitors. The addition of any new rights-of-way will have to be addressed on a case-by-case basis.

Anticipated Impacts of the Use: Depending on location, size, frequency of disturbance, as well as function, design and purpose of each right-of-way, direct and/or indirect impacts to wildlife habitats can vary significantly. Large rights-of-way can fragment habitat by altering forest or plant structure as well as impact hydrology and wetland functions. Road rights-of-way can have numerous direct impacts, including creating physical barriers to seasonal migration of many species of wildlife. Electrical transmission lines can cause avian mortality through collisions, and/or electrical shock generally associated with nesting or roosting on electrical lines. Because all of the existing rights-of-way within the acquisition boundary pre-existed the refuge, many of these impacts are beyond the refuge's control unless a change in use or new construction occurs. At that time, the refuge will work with the company/agency responsible for the right-of-way to avoid and minimize potential impacts.

Determination (check one below):

	Use is not compatible
X	Use is compatible with the following stipulations

Stipulations Necessary to Ensure Compatibility: The maintenance and management of existing rights-of-way should be continued in a manner that will minimize direct and indirect impacts to refuge wildlife and habitats. Use of pesticides/herbicides and other vegetation management should be consistent with refuge policies and Service regulations. Pesticides will be applied only when a Pesticide Use Proposal has been approved for that chemical. Pesticide Use Proposals will be developed annually in accordance with current Service policy. During utility infrastructure repairs or replacement, close coordination must be maintained between the refuge and the responsible company/agency.

Justification: Because all of the existing rights-of-way within the acquisition boundary pre-existed the refuge, many of these impacts are beyond the refuge's control unless a change in use or new construction occurs. At that time, the refuge will work with the company/agency responsible for the right-of-way to avoid and minimize potential impacts. As more lands are acquired by the refuge, more rights-of-way may be acquired. The refuge will continue to coordinate with the company/agency responsible for management of the right-of-way to ensure that measures are in place to reduce impacts to wildlife and habitat.

Mandatory 10-Year Re-evaluation Date:

Description of Use: *Forest Management – Commercial Timber Harvest*

Waccamaw NWR currently has no commercial timber harvesting occurring on the refuge; however, recommendation to use timber harvesting as a habitat management tool is included in the refuge's comprehensive conservation plan. Many of the newly acquired refuge tracts were formerly owned by industrial timber companies and forest conditions at the time of acquisition are often managed for commercial timber production rather than species and age class diversity.

Timber harvesting will be used to help achieve several of the goals and objectives outlined in the comprehensive conservation plan. Included in these are restoration of forested wetland communities associated with the Waccamaw and Great Pee Dee Rivers, forest structure for migratory songbirds, creation of diversity in the greater landscape, and maintenance of ecological integrity. The strategies and techniques for each of these will be discussed in detail in the Habitat Management Plan, which will be developed as a step-down plan of the comprehensive conservation plan.

Periodically, timbered areas of the refuge will be assessed as to their ability to meet habitat requirements. When it is necessary to remove part or all of a stand of trees, a prospectus will be prepared and the sale offered to commercial harvesting operations. Two general methods of choosing the trees will be used. The first is to mark the individual trees that are to be removed. This method is most often used where the purpose of the harvest is to diversify age classes and create midstory forest structure.

The other method of choosing trees to be harvested is logger selection, which can be used when it is necessary to remove either the entire stand or the majority of it. With the logger selection method, the commercial operator is given the number of stems per acre that are to be left on the site, along with some size and form parameters. He is then allowed to select the trees that are cut as he works through the stand. The most beneficial use of this method is to reduce trees in areas where the shrub layer would provide habitat for the bird species which prefer early successional plant communities, or to replace commercial pine stands with native hardwoods generally associated with wetland habitats. Although this method reduces the amount of pre-harvest work by eliminating marking, it requires closer monitoring of the logging operation.

Commercial timber harvesting may also be used to protect the health of the forests and woodlands. In this scenario, pockets of trees infested with insects or disease would be removed to prevent the spread of these pathogens throughout the area.

Availability of Resources: In order to effectively use timber harvesting to achieve refuge goals and objectives, a member of the refuge staff needs to be knowledgeable in forest ecology. This staff person must also have an awareness of the capabilities and limitations of timber harvesting operations and be in a position to develop a forest management plan. Until such time that a forester can be added to the refuge staff, the services of a forester from another refuge would be utilized.

Anticipated Impacts of the Use: Harvesting operations can have a major impact on the shrub layer of forests. The equipment used in these endeavors crushes and breaks many of the plants as trees are felled and skidded to the loading docks. However, the understory quickly recovers. Within a year, much of the shrub layer has grown back. The removal of some of the stems opens up the understory and allows easier access by wildlife. Often times, the herbaceous layer responds positively to the removal of the overstory and portions of the shrub layer. This can create important foraging opportunities although they are short-lived.

Soil compaction and disruption of local drainage can also be an important negative side effect of logging operations. These can be mitigated by selecting proper sites for loading areas, varying skid trails, and avoiding operations during wet periods.

Noise level of the equipment and chainsaws will cause some minor disruption or displacement of wildlife.

Determination (Check one below):

	Use is not compatible
X	Use is compatible with the following stipulations

Stipulations Necessary to Ensure Compatibility: All commercial timber harvesting operations will be carried out under a special use permit. Conditions of the sale will be specified in the permit and will depend on the purpose of the harvest, the characteristics of the site, current policy, and safety of refuge employees and visitors.

While checking on harvest operations, refuge staff will be aware of present and forecasted weather conditions. If soil moisture reaches a point where excessive damage is being done to the site, operations will be shut down until conditions improve. Refuge staff will also check for damage to the residual stand and will make operators aware of any problems as soon as they are detected.

Justification: Forest management actions proposed in the comprehensive conservation plan are in accordance with Service guidelines for the protection, management, and enhancement of wildlife populations and habitats on the refuge. The timber harvest will also help meet goals of maintaining upland habitat diversity and will help maintain the ecological integrity of the refuge landscape.

Mandatory 10-Year Re-evaluation Date:

Literature Citations:

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Personal Communications:

Charles R. Ruth, Jr., Deer Project Supervisor/ Wildlife Section, South Carolina Department of Natural Resources, Columbia, S.C.

Public Review and Comment:

These compatibility determinations are being made available for public review and comment in conjunction with the public comment period for the Waccamaw National Wildlife Refuge Draft Comprehensive Conservation Plan and Environmental Assessment.

Signature: _____

Refuge Manager	Date
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Date _____

Review: _____

Regional Compatibility Coordinator	Date
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Date _____

Review: _____

Refuge Supervisor	Date
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Date _____

Concurrence: _____

Regional Chief
National Wildlife Refuge System
Southeast Region

Date

Date _____

VII. Intra-Service Section 7 Biological Evaluation

INTRA-SERVICE SECTION 7 BIOLOGICAL EVALUATION FORM

Originating Person: Marshall "Craig" Sasser
Telephone Number: (843) 527- 8069
E-Mail: Marshall_Sasser@fws.gov
Date: May 15, 2007

PROJECT NAME: WACCAMAW NATIONAL WILDLIFE REFUGE
COMPREHENSIVE CONSERVATION PLAN

I. Service Program:

- ☐ Ecological Services
- ☐ Federal Aid
- ☐ Clean Vessel Act
- ☐ Coastal Wetlands
- ☐ Endangered Species Section 6
- ☐ Partners for Fish and Wildlife
- ☐ Sport Fish Restoration
- ☐ Wildlife Restoration
- ☐ Fisheries
- ☒ Refuges/Wildlife

II. State/Agency: South Carolina Department of Natural Resources

III. Station Name: Waccamaw National Wildlife Refuge

IV. Description of Proposed Action

The proposed action consists of approving and then implementing a Comprehensive Conservation Plan (CCP) for Waccamaw National Wildlife Refuge in Georgetown, Horry and Marion Counties, South Carolina. The CCP provides overall management guidance on the refuge over a 15-year-period in the form of a vision and goals, objectives and strategies related to fish and wildlife management, habitat management, resource protection, visitor use, and refuge administration.

The aim of the CCP is to provide specific guidance in the pursuit of the purposes for which Waccamaw National Wildlife Refuge was established. Wildlife, fish, and their respective habitats are the first priority in refuge management. Public uses (wildlife-dependent recreation), in particular, hunting, fishing, wildlife observation, wildlife photography, and environmental education and interpretation, are permitted as long as these uses are compatible with, or do not impinge upon, the refuge's primary wildlife-related purposes.

V. Pertinent Species and Habitat:

A. Include species/habitat occurrence map: See Figure 5 of Draft CCP/EA.

Complete the following table:

SPECIES/CRITICAL HABITAT	STATUS ¹
Red-cockaded woodpecker (<i>Picoides borealis</i>) – nests within the refuge acquisition boundary in longleaf pine-dominated upland forests on Sandy Island.	E
Wood stork (<i>Mycteria americana</i>) – has been observed foraging and loafing on wetland habitats within the refuge acquisition boundary, but nesting has not been documented.	E
Shortnose sturgeon (<i>Acipenser brevirostrum</i>) – rivers and creeks within the refuge acquisition boundary represent important spawning habitat.	E
Pondberry (<i>Lindera melissifolia</i>) – inhabits seasonally flooded wetlands, sandy sinks, pond margins, and swampy depressions; not known to occur within refuge acquisition boundary, but potential habitat present on Sandy Island and elsewhere.	E
Canby's dropwort (<i>Oxypolis canbyi</i>) – inhabits a variety of coastal plain habitats including natural ponds dominated by pond cypress, grass-sedge dominated bays, wet pine savannahs, shallow pineland ponds, and cypress-pine swamps; unknown on refuge, but potential habitat present in sandy pinelands.	E
American chaffseed (<i>Schwalbea americana</i>) – pine flatwoods and savannahs with a history of frequent burning; unknown within the refuge acquisition boundary, but potential habitat is present on Sandy Island and other pineland areas.	E
Bald eagle (<i>Haliaeetus leucocephalus</i>) – coasts, rivers, and lakes, usually nesting in tall trees near bodies of water where it feeds.	De-listed

¹STATUS: E=endangered, T=threatened, PE=proposed endangered, PT=proposed threatened, CH=critical habitat, PCH=proposed critical habitat, C=candidate species, S/A=Similar Appearance

VI. Location (attach map): See next page for location map.

A. Ecoregion Number and Name: #33, Savannah/Santee/Pee Dee Rivers

B. County and State: Georgetown, Horry, and Marion Counties, South Carolina

C. Section, township, and range (or latitude and longitude):

33°36' North Latitude, 79°6' West Longitude (approximate center of refuge)

D. Distance (miles) and direction to nearest town(s):

Conway, 3 miles to north, Georgetown, 10 miles to southwest of refuge

E. Species/habitat occurrence within Waccamaw NWR acquisition boundary:

Red-cockaded woodpecker: habitat and species both occur

Wood stork: habitat and species (foraging/loafing, not nesting) both occur

Shortnose sturgeon: habitat and species both occur

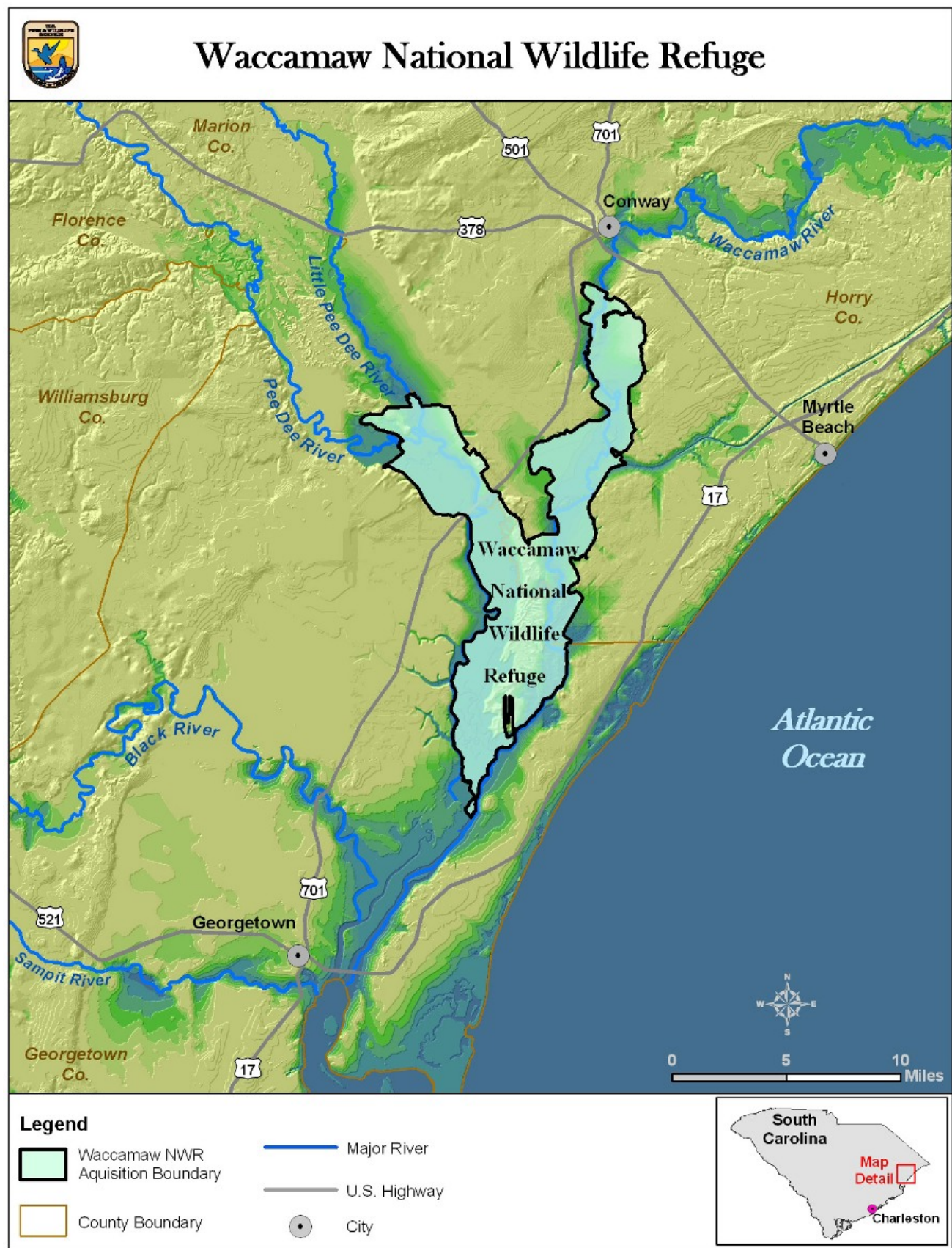
Pondberry: potential habitat present but species not known to occur

Canby's dropwort: potential habitat present but species not known to occur

American chaffseed: potential habitat present but species not known to occur

Bald eagle: habitat and species (foraging, not nesting) both occur

Figure 1. Location map of Waccamaw National Wildlife Refuge



VII. Determination of Effects:

A. Explanation of effects of the action on species and critical habitats in item V. B:

SPECIES/ CRITICAL HABITAT	IMPACTS TO SPECIES/CRITICAL HABITAT
Red-cockaded woodpecker – longleaf pine forests	Open structure of longleaf pine forests to be maintained by prescribed fire; impacts likely to be neutral to beneficial.
Wood stork – wetland areas	No impacts anticipated on existing refuge lands; proposed acquisition of additional areas would protect more habitat, and thus likely be beneficial.
Shortnose sturgeon – rivers and creeks	No impacts anticipated on existing refuge lands; proposed acquisition of additional areas would protect more watershed area, helping to maintain water quality and stream/river integrity.
Pondberry – seasonally flooded wetlands and pond margins; undocumented on refuge but potential habitat present	No impacts anticipated on existing refuge lands; proposed acquisition of additional areas would protect more potential habitat, which would represent a possible benefit.
Canby's dropwort – natural ponds dominated by pond cypress, grass-sedge dominated bays, wet pine savannahs, shallow pineland ponds, and cypress-pine swamps; undocumented on refuge but potential habitat present.	No impacts anticipated on existing refuge lands; proposed acquisition of additional areas would protect more potential habitat, which would represent a possible benefit.
American chaffseed – pine flatwoods and savannahs with a history of frequent burning; undocumented on refuge but potential habitat present	No impacts anticipated on existing refuge lands; proposed acquisition of additional areas would protect more potential habitat, which would represent a possible benefit.
Bald eagle – coasts, rivers, and lakes, usually nesting in tall trees near bodies of water where it feeds	Proposed habitat management would benefit the bald eagle by conserving nesting and roosting trees as well as forestland, shorelines, and water quality.

B. Explanation of actions to be implemented to reduce adverse effects:

SPECIES/ CRITICAL HABITAT	ACTIONS TO MITIGATE/MINIMIZE IMPACTS
Red-cockaded woodpecker – longleaf pine forests	Conduct prescribed burns away from nest sites or during non-nesting seasons.
Wood stork – wetland areas	No mitigation measures needed unless nesting is observed; if nesting observed, implement buffer zone around nesting area.
Shortnose sturgeon – rivers and creeks	No mitigation measures needed or proposed.
Pondberry – seasonally flooded wetlands and pond Margins; undocumented on refuge but potential habitat present	Conduct targeted survey periodically for this and other listed plant species prior to prescribed burns.
Canby's dropwort – natural ponds dominated by pond cypress, grass-sedge dominated bays, wet pine savannahs, shallow pineland ponds, and cypress-pine swamps; undocumented on refuge but potential habitat present	Conduct targeted survey periodically for this and other listed plant species prior to prescribed burns.
American chaffseed – pine flatwoods and savannahs with a history of frequent burning; undocumented on refuge but potential habitat present	Conduct targeted survey periodically for this and other listed plant species prior to prescribed burns.
Bald eagle – coasts, rivers, and lakes, usually nesting in tall trees near bodies of water where it feeds	Protect large trees (especially snags) near water bodies for potential nesting and roosting.

VIII. Effect Determination and Response Requested:

SPECIES/CRITICAL HABITAT	DETERMINATION ¹			REQUESTED
	NE	NA	AA	
Red-cockaded woodpecker – longleaf pine forests		X		Concurrence
Wood stork – wetland areas		X		Concurrence
Shortnose sturgeon – rivers and creeks	X			Concurrence
Pondberry – seasonally flooded wetlands, sandv sinks, and pond margins	X			Concurrence
Canby's dropwort – natural ponds dominated by pond cypress, grass-sedge dominated bays	X			Concurrence
American chaffseed – pine flatwoods and savannahs with a history of frequent burning	X			Concurrence
Bald eagle – coasts, rivers, and lakes, and adjacent trees and upland sites		X		Concurrence

¹DETERMINATION/ RESPONSE REQUESTED:

NE = no effect. This determination is appropriate when the proposed action will not directly, indirectly, or cumulatively impact, either positively or negatively, any listed, proposed, candidate species or designated/proposed critical habitat. Response Requested is optional but a "Concurrence" is recommended for a complete Administrative Record.

NA = not likely to adversely affect. This determination is appropriate when the proposed action is not likely to adversely impact any listed, proposed, candidate species or designated/proposed critical habitat or there may be beneficial effects to these resources. Response Requested is a "Concurrence".

AA = likely to adversely affect. This determination is appropriate when the proposed action is likely to adversely impact any listed, proposed, candidate species or designated/proposed critical habitat. Response Requested for listed species is "Formal Consultation". Response requested for proposed and candidate species is "Conference".

Signature (originating station)

Date

Title

IX. Reviewing Ecological Services Office Evaluation:

A. Concurrence _____ Nonconcurrence _____

B. Formal consultation required _____

C. Conference required _____

D. Informal conference required _____

E. Remarks (attach additional pages as needed):

Signature

Date

Title

Office

VIII. Wilderness Review

Wilderness Review Summary Waccamaw National Wildlife Refuge October 12, 2006

The South Carolina Lowcountry Refuge Complex Project Leader, Refuge Manager, and Refuge Complex Planner met at Waccamaw National Wildlife Refuge (NWR) on October 12, 2006, to inventory and study the refuge as part of the wilderness review. The review team included:

Donny Bowning, South Carolina Lowcountry Refuge Complex Project Leader
Craig Sasser, Waccamaw NWR Refuge Manager
Van Fischer, South Carolina Lowcountry Refuge Complex Planner

The wilderness review is a required component of the comprehensive conservation plan. The Wilderness Act defines a Wilderness Area as an area of undeveloped Federal land retaining its primeval character and influence, without permanent improvements or human habitation, and managed to preserve its natural conditions such that it:

- 1) generally appears to have been affected primarily by the forces of nature, with the imprint of man's work substantially unnoticeable;
- 2) has outstanding opportunities for solitude or primitive and unconfined type of recreation;
- 3) has at least 5,000 contiguous roadless acres or is of sufficient size to make practicable its preservation and use in an unimpaired condition;
- 4) does not substantially exhibit the effects of logging, farming, grazing, or other extensive development or alteration of the landscape, or its wilderness character could be restored through appropriate management, at the time of review;
- 5) is a roadless island; and
- 6) may contain ecological, geological, or other features of scientific, education, scenic, or historic value.

The wilderness review process is conducted in three phases: inventory, study, and recommendation. The inventory phase is a broad look at the planning area to identify lands and waters that meet the minimum criteria for wilderness and warrant further study for wilderness designation. These criteria include every area of at least 5,000 contiguous roadless acres or roadless areas sufficient in size to make practicable their preservation and use in an unimpaired condition; or be a roadless island of any size. Areas meeting these criteria are considered wilderness inventory areas. Wilderness inventory areas are then further evaluated for naturalness, opportunities for solitude or primitive and unconfined recreation, and special or supplemental values. Those areas that meet these criteria are identified as wilderness study areas (WSAs).

In the study phase, each WSA is evaluated, through careful analysis of alternative management options, to determine its suitability for wilderness designation. The analysis considers all values (e.g., ecological, recreational, cultural, economic, symbolic); resources (e.g., wildlife, water, vegetation,

minerals, soils); refuge uses; and refuge management activities within the WSA. It includes an evaluation of whether the WSA can be effectively managed to preserve its wilderness character.

The findings of the study determine whether a WSA, or portion of a WSA, will be recommended for designation as wilderness. Wilderness recommendations are forwarded or reported from the Director of the Fish and Wildlife Service through the Secretary of the Interior and the President to Congress in a wilderness study report.

Wilderness Review Findings

The wilderness review team identified two wilderness inventory units in Waccamaw NWR (Table 8). Both of these islands are located in the Pee Dee River.

Table 8. Lands evaluated as potential wilderness inventory units

Unit	Acreage
Richmond Island	40
Bull Island	4,600

Richmond Island meets the minimum criterion for a wilderness inventory area (a roadless island of any size), but could not be practicably managed as wilderness because of location and close proximity to a marina and heavy motor boating activity. This heavy public use, combined with the small size of the island, prevents opportunities for individuals to enjoy solitude or a primitive and unconfined recreational experience.

Bull Island (Figure 8) meets the minimum criterion for a wilderness inventory area (a roadless island of any size), and provides values and resources in keeping with wilderness character. Historically, Bull Island was intensively logged but the last logging operations took place close to 100 years ago. The island has recovered from past logging activity and now exhibits century-old bottomland hardwood forests and forested wetlands. The island is one of the most remote areas on the refuge and provides excellent opportunities for solitude or primitive and unconfined types of wildlife-dependent recreation. Setting aside Bull Island as wilderness is in keeping with the establishing purposes of Waccamaw NWR, and management will be able to effectively maintain its wilderness character.

The inventory and initial study phases of the wilderness review warrant inclusion of Bull Island as a wilderness study area in the comprehensive conservation plan. An objective and strategies will be developed as part of the comprehensive conservation plan to maintain the wilderness character and within ten years of CCP approval, the staff will prepare a wilderness study report on whether Bull Island should be recommended for formal designation as a unit of the National Wilderness Preservation System (NWPS).

Wilderness Management

The wilderness management policy and regulations allow motorized access and use of mechanized equipment for administrative purposes only if such uses are the minimum tool necessary to accomplish wilderness objectives. For the purpose of analysis in the comprehensive conservation plan/environmental assessment, managers should assume that authorization of such uses would be temporary and rare in a wilderness area. If such restrictions would significantly limit the Service's

ability to accomplish other resource management objectives, these impacts would be fully described and evaluated in the wilderness study report.

Congressionally Designated Wilderness

The National Wilderness Preservation System is a network of federally owned areas designated by Congress as wilderness and managed by one of four Federal agencies: the Service, Bureau of Land Management, National Park Service, or the Forest Service. More than 70 designated wilderness areas, totaling 20.7 million acres, are currently found on 63 national wildlife refuges. This represents approximately 22 percent of the National Wilderness Preservation System.

The Service administers wilderness areas within the Refuge System consistent with refuge purposes and in accordance with the Wilderness Act (16 U.S.C. 1131-1136), and the specific legislation designating a particular wilderness area. The purposes of the Wilderness Act are to: secure an enduring resource of wilderness; protect and preserve the wilderness character of areas within the National Wilderness Preservation System; and administer areas for the use and enjoyment of the American people in a way that will leave these areas unimpaired for future use and enjoyment as wilderness. Wilderness purposes are “within and supplemental” to refuge establishing purposes. They become additional purposes of the area within the refuge designated as wilderness.

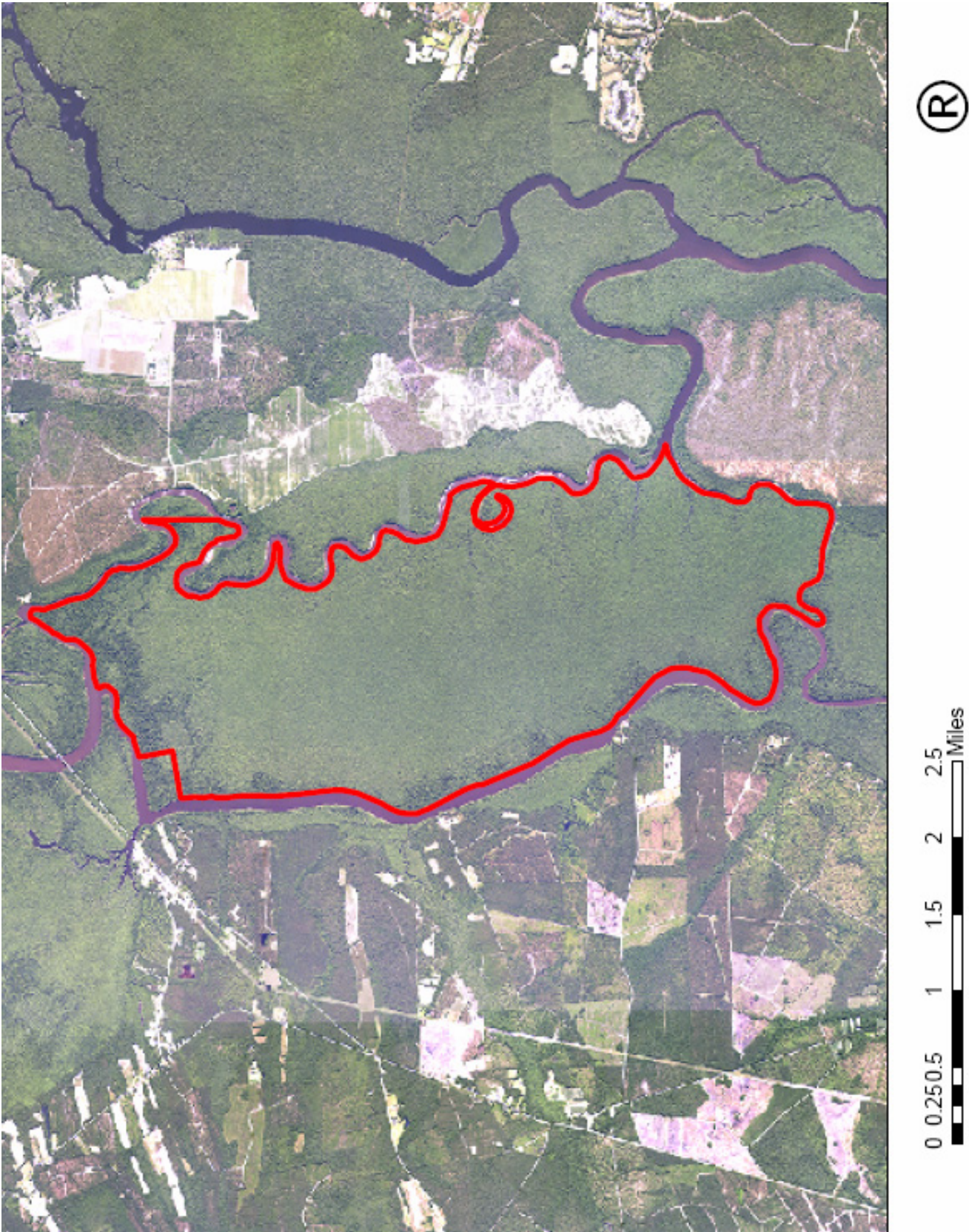
Preserving wilderness character is a primary criterion for judging the appropriateness of proposed refuge management activities and refuge uses, including public use and enjoyment in wilderness. Preserving wilderness character requires that we maintain both the tangible and intangible aspects of wilderness.

Section 4(c) of the Wilderness Act prohibits commercial enterprises and permanent roads within wilderness. Commercial services, such as outfitter and guide services, are permitted only when they are “necessary for activities which are proper for realizing the recreational or other wilderness purposes of the areas.” We may allow commercial services where they are necessary to accomplish the purposes of the refuge, including Wilderness Act purposes.

Section 4(c) of the Wilderness Act also lists a number of “generally prohibited uses” in wilderness: temporary roads, use of motor vehicles, use of motorized equipment or motorboats, landing of aircraft, other forms of mechanical transport, and structures or installations. We do not authorize generally prohibited uses in refuge wilderness except when the use is: allowed under the terms of the area-specific wilderness legislation and the Wilderness Act; the minimum requirement for administering the area as wilderness and necessary to accomplish the purposes of the refuge, including Wilderness Act purposes; or an emergency involving the health and safety of persons within the area.

The Service conducts and documents a “minimum requirement analysis” for all proposed refuge management activities whether or not the activity involves a generally prohibited use. The minimum requirement analysis clarifies the need for and impacts of a proposed action. The Service authorizes an activity only if it is demonstrated that the activity is necessary to meet the minimum requirement for administering the area as wilderness and necessary to accomplish the purposes of the refuge, including Wilderness Act purposes. The management alternative that has the least impact upon all of the area’s wilderness values and character, including intangible aspects of wilderness character, and accomplishes refuge purposes, including wilderness purposes, constitutes the minimum requirement. The Service does not use cost or convenience as the main factor in determining the minimum requirement or minimum tool. Furthermore, the Service will attempt to use primitive tools when possible.

Figure 8. Bull Island Wilderness Study Area on Waccamaw NWR



IX. Refuge Biota

Wildlife species likely found on Waccamaw National Wildlife Refuge (USFWS 1997)

BIRDS

Common Name	Scientific Name
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LOONS

Common Loon	<i>Gavia immer</i>
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GREBES

Pied-billed Grebe	<i>Podilymbus podiceps</i>
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PELICANS AND ALLIES

Double-crested Cormorant	<i>Phalacrocorax auritus</i>
Anhinga	<i>Anhinga anhinga</i>
Brown Pelican	<i>Pelecanus occidentalis</i>

HERONS, EGRETS AND ALLIES

American Bittern	<i>Botaurus lentiginosus</i>
Least Bittern	<i>Ixobrychus exilis</i>
Great Blue Heron	<i>Ardea herodias</i>
Great Egret	<i>Ardea alba</i>
Snowy Egret	<i>Egretta thula</i>
Little Blue Heron	<i>Egretta caerulea</i>
Tricolored Heron	<i>Egretta tricolor</i>
Cattle Egret	<i>Bubulcus ibis</i>
Green-backed Heron	<i>Butorides striatus</i>
Black-crowned Night-Heron	<i>Nycticorax nycticorax</i>
Yellow-crowned Night-Heron	<i>Nycticorax violaceus</i>

IBISES, SPOONBILL, STORK

Glossy Ibis	<i>Plegadis falcinellus</i>
White Ibis	<i>Eudocimus albus</i>
Wood Stork	<i>Mycteria americana</i>

WATERFOWL

Fulvous Whistling-Duck	<i>Dendrocygna bicolor</i>
Tundra Swan	<i>Cygnus columbianus</i>
Snow Goose	<i>Chen caerulescens</i>
Canada Goose	<i>Branta canadensis</i>
Wood Duck	<i>Aix sponsa</i>
Green-winged Teal	<i>Anas crecca</i>
American Black Duck	<i>Anas rubripes</i>
Mottled Duck	<i>Anas fulvigula</i>
Mallard	<i>Anas platyrhynchos</i>
Northern Pintail	<i>Anas acuta</i>
Blue-winged Teal	<i>Anas discors</i>
Northern Shoveler	<i>Anas clypeata</i>
Gadwall	<i>Anas strepera</i>
American Wigeon	<i>Anas americana</i>
Canvasback	<i>Aythya valisineria</i>
Redhead	<i>Aythya americana</i>
Ring-necked Duck	<i>Aythya collaris</i>
Greater Scaup	<i>Aythya marila</i>
Lesser Scaup	<i>Aythya affinis</i>
Common Goldeneye	<i>Bucephala clangula</i>
Bufflehead	<i>Bucephala albeola</i>
Hooded Merganser	<i>Lophodytes cucullatus</i>
Common Merganser	<i>Mergus merganser</i>
Red-breasted Merganser	<i>Mergus serrator</i>
Ruddy Duck	<i>Oxyura jamaicensis</i>

VULTURES, HAWKS AND ALLIES

Black Vulture	<i>Coragyps atratus</i>
Turkey Vulture	<i>Cathartes aura</i>
Osprey	<i>Pandion haliaetus</i>
American Swallow-tailed Kite	<i>Elanoides forficatus</i>
Mississippi Kite	<i>Ictinia mississippiensis</i>
Bald Eagle	<i>Haliaeetus leucocephalus</i>
Northern Harrier	<i>Circus cyaneus</i>
Sharp-shinned Hawk	<i>Accipiter striatus</i>
Cooper's Hawk	<i>Accipiter cooperii</i>
Red-shouldered Hawk	<i>Buteo lineatus</i>
Broad-winged Hawk	<i>Buteo platypterus</i>
Red-tailed Hawk	<i>Buteo jamaicensis</i>
American Kestrel	<i>Falco sparverius</i>
Merlin	<i>Falco columbarius</i>
Peregrine Falcon	<i>Falco peregrinus</i>

GALLINACEOUS BIRDS

Wild Turkey	<i>Meleagris gallopavo</i>
Northern Bobwhite	<i>Colinus virginianus</i>

RAILS, GALLINULES, COOTS AND CRANES

Clapper Rail	<i>Rallus longirostris</i>
Black Rail	<i>Laterallus jamaicensis</i>
King Rail	<i>Rallus elegans</i>
Virginia Rail	<i>Rallus limicola</i>
Sora	<i>Porzana carolina</i>
Purple Gallinule	<i>Porphyrio martinica</i>
Common Moorhen	<i>Gallinula chloropus</i>
American Coot	<i>Fulica americana</i>

SHOREBIRDS AND GULLS

Killdeer	<i>Charadrius vociferous</i>
Greater Yellowlegs	<i>Tringa melanoleuca</i>
Lesser Yellowlegs	<i>Tringa flavipes</i>
Spotted Sandpiper	<i>Actitis macularia</i>
Common Snipe	<i>Gallinago gallinago</i>
American Woodcock	<i>Scolopax minor</i>
Laughing Gull	<i>Larus atricilla</i>
Ring-billed Gull	<i>Larus delawarensis</i>
Herring Gull	<i>Larus argentatus</i>
Caspian Tern	<i>Sterna caspia</i>
Royal Tern	<i>Sterna maxima</i>
Sandwich Tern	<i>Sterna sandvicensis</i>
Forster's Tern	<i>Sterna forsteri</i>
Least Tern	<i>Sternula antillarum</i>

PIGEONS, DOVES

Rock Dove	<i>Columba livia</i>
Mourning Dove	<i>Zenaida macroura</i>
Common Ground-Dove	<i>Columbina passerina</i>

CUCKOOS

Yellow-billed Cuckoo	<i>Coccyzus americanus</i>
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OWLS

Barn Owl	<i>Tyto alba</i>
Eastern Screech-Owl	<i>Megascops asio</i>
Great Horned Owl	<i>Bubo virginianus</i>
Barred Owl	<i>Strix varia</i>

GOATSUCKERS

Common Nighthawk	<i>Chordeiles minor</i>
Chuck-will's-widow	<i>Caprimulgus carolinensis</i>
Whip-poor-will	<i>Caprimulgus vociferus</i>

SWIFTS, HUMMINGBIRDS

Chimney Swift	<i>Chaetura pelagica</i>
Ruby-throated Hummingbird	<i>Archilochus colubris</i>

KINGFISHERS

Belted Kingfisher	<i>Megaceryle alcyon</i>
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WOODPECKERS

Red-headed Woodpecker*	<i>Melanerpes erythrocephalus</i>
Red-bellied Woodpecker*	<i>Melanerpes carolinus</i>
Yellow-bellied Sapsucker	<i>Sphyrapicus varius</i>
Downy Woodpecker*	<i>Picoides pubescens</i>
Hairy Woodpecker*	<i>Picoides villosus</i>
Red-cockaded Woodpecker	<i>Picoides borealis</i>
Northern Flicker*	<i>Colaptes auratus</i>
Pileated Woodpecker*	<i>Dryocopus pileatus</i>

FLYCATCHERS

Eastern Wood-Pewee	<i>Contopus virens</i>
Acadian Flycatcher	<i>Empidonax virescens</i>
Eastern Phoebe	<i>Sayornis phoebe</i>
Great Crested Flycatcher	<i>Myiarchus crinitus</i>
Eastern Kingbird	<i>Tyrannus tyrannus</i>

MARTINS AND SWALLOWS

Purple Martin	<i>Progne subis</i>
Tree Swallow	<i>Tachycineta bicolor</i>
Northern Rough-winged Swallow	<i>Stelgidopteryx serripennis</i>
Barn Swallow	<i>Hirundo rustica</i>

JAYS AND CROWS

Blue Jay	<i>Cyanocitta cristata</i>
American Crow	<i>Corvus brachyrhynchos</i>
Fish Crow	<i>Corvus ossifragus</i>

CHICKADEES AND TITMICE

Carolina Chickadee	<i>Parus carolinensis</i>
Tufted Titmouse	<i>Parus bicolor</i>

NUTHATCHES

White-breasted Nuthatch	<i>Sitta carolinensis</i>
Brown-headed Nuthatch	<i>Sitta pusilla</i>

WRENS

Carolina Wren	<i>Thryothorus ludovicianus</i>
House Wren	<i>Troglodytes aedon</i>
Sedge Wren	<i>Cistothorus platensis</i>
Marsh Wren	<i>Cistothorus palustris</i>

KINGLETS AND GNATCATCHERS

Golden-crowned Kinglet	<i>Regulus satrapa</i>
Ruby-crowned Kinglet	<i>Regulus calendula</i>
Blue-gray Gnatcatcher	<i>Polioptila caerulea</i>

BLUEBIRDS, THRUSHES AND ROBIN

Eastern Bluebird	<i>Sialia sialis</i>
Veery	<i>Catharus fuscescens</i>
Swainson's Thrush	<i>Catharus ustulatus</i>
Hermit Thrush	<i>Catharus guttatus</i>
Wood Thrush	<i>Hylocichla mustelina</i>
American Robin	<i>Turdus migratorius</i>

THRASHERS

Gray Catbird	<i>Dumetella carolinensis</i>
Northern Mockingbird	<i>Mimus polyglottos</i>
Brown Thrasher	<i>Toxostoma rufum</i>

PIPITS

American Pipit	<i>Anthus rubescens</i>
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WAXWINGS

Cedar Waxwing	<i>Bombycilla cedrorum</i>
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STARLINGS

European Starling	<i>Sturnus vulgaris</i>
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SHRIKES

Loggerhead Shrike	<i>Lanius ludovicianus</i>
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VIREOS

White-eyed Vireo	<i>Vireo griseus</i>
Solitary Vireo	<i>Vireo solitarius</i>
Philadelphia Vireo	<i>Vireo philadelphicus</i>
Red-eyed Vireo	<i>Vireo olivaceus</i>

WARBLERS

Northern Parula	<i>Parula americana</i>
Black-throated Blue Warbler	<i>Dendroica caerulescens</i>
Black-throated Green Warbler	<i>Dendroica virens</i>
Yellow-rumped Warbler	<i>Dendroica coronata</i>
Black-throated Gray Warbler	<i>Dendroica nigrescens</i>
Yellow-throated Warbler	<i>Dendroica dominica</i>
Pine Warbler	<i>Dendroica pinus</i>
Prairie Warbler	<i>Dendroica discolor</i>
Palm Warbler	<i>Dendroica palmarum</i>
Black-and-white Warbler	<i>Mniotilta varia</i>
American Redstart	<i>Setophaga ruticilla</i>
Prothonotary Warbler	<i>Protonotaria citrea</i>
Swainson's Warbler	<i>Limnothlypis swainsonii</i>
Ovenbird	<i>Seiurus aurocapilla</i>
Northern Waterthrush	<i>Seiurus noveboracensis</i>
Kentucky Warbler	<i>Oporornis formosus</i>
Common Yellowthroat	<i>Geothlypis trichas</i>
Hooded Warbler	<i>Wilsonia citrine</i>
Yellow-breasted Chat	<i>Icteria virens</i>

TANAGERS

Summer Tanager	<i>Piranga rubra</i>
Scarlet Tanager	<i>Piranga olivacea</i>

NEW WORLD FINCHES

Northern Cardinal	<i>Cardinalis cardinalis</i>
Blue Grosbeak	<i>Passerina caerulea</i>
Indigo Bunting	<i>Passerina cyanea</i>

SPARROWS

Rufous-sided Towhee	<i>Pipilo erythrophthalmus</i>
Chipping Sparrow	<i>Spizella passerine</i>
Field Sparrow	<i>Spizella pusilla</i>
Henslow's Sparrow	<i>Ammodramus henslowii</i>
Vesper Sparrow	<i>Pooecetes gramineus</i>
Savannah Sparrow	<i>Passerculus sandwichensis</i>
Sharp-tailed Sparrow	<i>Ammodramus caudacutus</i>
Seaside Sparrow	<i>Ammodramus maritimus</i>
Song Sparrow	<i>Melospiza melodia</i>
Swamp Sparrow	<i>Melospiza georgiana</i>
White-throated Sparrow	<i>Zonotrichia albicollis</i>

BLACKBIRDS, GRACKLES, COWBIRDS AND ORIOLES

Bobolink	<i>Dolichonyx oryzivorus</i>
Red-winged Blackbird	<i>Agelaius phoeniceus</i>
Eastern Meadowlark	<i>Sturnella magna</i>
Rusty Blackbird	<i>Euphagus carolinus</i>
Boat-tailed Grackle	<i>Quiscalus major</i>
Common Grackle	<i>Quiscalus quiscula</i>
Brown-headed Cowbird	<i>Molothrus ater</i>
Orchard Oriole	<i>Icterus spurius</i>

OLD WORLD FINCHES

Purple Finch	<i>Carpodacus purpureus</i>
American Goldfinch	<i>Carduelis tristis</i>

WEAVER FINCHES

House Sparrow	<i>Passer domesticus</i>
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MAMMALS

Big Brown Bat	<i>Eptesicus fuscus</i>
Red Bat	<i>Lasiurus borealis</i>
Seminole Bat	<i>Lasiurus seminolus</i>
Hoary Bat	<i>Lasiurus cinereus</i>
Evening Bat	<i>Nycticeius humeralis</i>
Silver-haired Bat	<i>Lasionycteris noctivagans</i>
Eastern Pipistrel	<i>Pipistrellus subflavus</i>
Rafinesque's Big-eared Bat	<i>Plecotus rafinesquii</i>
Southeastern Myotis	<i>Myotis austroriparius</i>
Whitetail Deer	<i>Odocoileus virginianus</i>
Bobcat	<i>Lynx rufus</i>
Raccoon	<i>Procyon lotor</i>
Opossum	<i>Didelphis marsupialis</i>
Eastern Cottontail	<i>Sylvilagus floridanus</i>
Marsh Rabbit	<i>Sylvilagus palustris</i>
River Otter	<i>Lutra canadensis</i>
Mink	<i>Mustela vison</i>
Longtail Weasel	<i>Mustela frenata</i>
Beaver	<i>Castor canadensis</i>
Gray Fox	<i>Urocyon cinereoargenteus</i>
Southern Flying Squirrel	<i>Glaucomys volans</i>
Eastern Gray Squirrel	<i>Sciurus carolinensis</i>
Eastern Fox Squirrel	<i>Sciurus niger</i>
Golden Mouse	<i>Peromyscus nuttalli</i>
Eastern Woodrat	<i>Neotoma floridana</i>

Rice Rat	<i>Oryzomys palustris</i>
Hispid Cotton Rat	<i>Sigmodon hispidus</i>
Meadow Vole	<i>Microtus pennsylvanicus</i>
Pine Vole	<i>Pitymys pinetorum</i>
Norway Rat	<i>Rattus norvegicus</i>
Black Rat	<i>Rattus rattus</i>
Shorttail Shrew	<i>Blarina brevicauda</i>
Eastern Mole	<i>Scalopus aquaticus</i>
Black Bear	<i>Ursus americanus</i>

AMPHIBIANS AND REPTILES

American Alligator	<i>Alligator mississippiensis</i>
Common Snapping Turtle	<i>Chelydra serpentina serpentina</i>
Common Musk Turtle (Stinkpot)	<i>Sternotherus odoratus</i>
Striped Mud Turtle	<i>Kinosternon bauri</i>
Eastern Mud Turtle	<i>Kinosternon subrubrum</i>
Carolina Diamondback Terrapin	<i>Malaclemys terrapin centrata</i>
Spotted Turtle	<i>Clemmys guttata</i>
Eastern Chicken Turtle	<i>Deirochelys reticularia reticularia</i>
Florida Cooter	<i>Chrysemys floridana</i>
Yellowbelly Slider	<i>Trachemys scripta scripta</i>
Eastern Box Turtle	<i>Terrapene carolina carolina</i>
Gulf Coast Spiny Softshell	<i>Trionyx spiniferus asperus</i>
Green Anole	<i>Anolis carolinensis</i>
Southern Fence Lizard	<i>Sceloporus undulates undulatus</i>
Ground Skink	<i>Scincella lateralis</i>
Five-lined Skink	<i>Eumeces fasciatus</i>
Broadhead Skink	<i>Eumeces laticeps</i>
Southeastern Five-lined Skink	<i>Eumeces inexpectatus</i>
Six-lined Racerunner	<i>Cnemidophorus sexlineatus sexlineatus</i>
Eastern Glass Lizard	<i>Ophisaurus ventralis</i>
Eastern Slender Glass Lizard	<i>Ophisaurus attenuatus longicaudus</i>
Banded Water Snake	<i>Natrix fasciata fasciata</i>
Redbelly Water Snake	<i>Natrix erythrogaster erythrogaster</i>
Brown Water Snake	<i>Natrix taxispilota</i>
Glossy Crayfish Snake	<i>Regina rigida</i>
Carolina Black Swamp Snake	<i>Seminatrix pygaea paludis</i>
Eastern Garter Snake	<i>Thamnophis sirtalis sirtalis</i>
Eastern Ribbon Snake	<i>Thamnophis sauritus. sauritus</i>
Pine Wood Snake	<i>Rhadinaea flavilata</i>
Midland Brown Snake	<i>Storeria dekayi</i>
Florida Redbelly Snake	<i>Storeria occipitomaculata</i>
Rough Earth Snake	<i>Virginia striatula</i>
Eastern Earth Snake	<i>Virginia valeriae valeriae</i>
Southern Ringneck Snake	<i>Diadophis punctatus punctatus</i>
Southern Hognose Snake	<i>Heterodon simus</i>
Eastern Hognose Snake	<i>Heterodon platyrhinos</i>
Eastern Worm Snake	<i>Carphophis amoenus amoenus</i>
Northern Scarlett Snake	<i>Cemophora copei copei</i>

Rough Green Snake	<i>Opheodrys aestivus</i>
Rainbow Snake	<i>Farancia erythrogramma erythrogramma</i>
Eastern Mud Snake	<i>Farancia abacura abacura</i>
Southern Black Racer	<i>Coluber priapus priapus</i>
Eastern Coachwhip	<i>Masticophis flagellum flagellum</i>
Northern Pine Snake	<i>Pituophis melanoleucus</i>
Yellow Rat Snake	<i>Elaphe obsoleta quadrivittata</i>
Corn Snake	<i>Elaphe guttata guttata</i>
Eastern Kingsnake	<i>Lampropeltis getulus getulus</i>
Mole Kingsnake	<i>Lampropeltis calligaster rhombomaculata</i>
Scarlet Kingsnake	<i>Lampropeltis traingulum elapsoides</i>
Southeastern Crowned Snake	<i>Tantilla coronata</i>
Eastern Cottonmouth	<i>Agkistrodon piscivorus piscivorus</i>
Southern Copperhead	<i>Agkistrodon contortrix</i>
Eastern Coral Snake	<i>Micrurus fulvius fulvius</i>
Carolina Pygmy Rattlesnake	<i>Sistrurus miliarius miliarius</i>
Timber Rattlesnake	<i>Crotalus horridus</i>
Eastern Diamondback Rattlesnake	<i>Crotalus adamanteus</i>
Greater Siren	<i>Siren lacertina</i>
Eastern Lesser Siren	<i>Siren intermedia intermedia</i>
Broad-striped Dwarf Siren	<i>Pseudobranchius striatus striatus</i>
Two-toed Amphiuma	<i>Amphiuma means</i>
Dwarf Waterdog	<i>Necturus punctatus</i>
Broken-striped Newt	<i>Notophthalmus viridescens dorsalis</i>
Mole Salamander	<i>Ambystoma talpoideum</i>
Mabees Salamander	<i>Ambystoma mabeei</i>
Flatwoods Salamander	<i>Ambystoma cingulatum</i>
Eastern Tiger Salamander	<i>Ambystoma tigrinum</i>
Spotted Salamander	<i>Ambystoma maculatum</i>
Marbled Salamander	<i>Ambystoma opacum</i>
Southern Dusky Salamander	<i>Desmognathus auriculatus</i>
Eastern Mud Salamander	<i>Pseudotriton montanus montanus</i>
Many-lined Salamander	<i>Stereoecheilus marginatus</i>
South Carolina slimy Salamander	<i>Plethodon variolatus</i>
Southern Two-lined Salamander	<i>Eurycea cirrigera</i>
Three-lined Salamander	<i>Eurycea longicauda guttolineata</i>
Dwarf Salamander	<i>Eurycea quadridigitata</i>
Eastern Spadefoot	<i>Scaphiopus holbrookii holbrookii</i>
Eastern Narrowmouth Toad	<i>Gastrophryne carolinensis</i>
Southern Toad	<i>Bufo terrestris</i>
Oak Toad	<i>Bufo quercicus</i>
Green Treefrog	<i>Hyla cinerea</i>
Pine Woods Treefrog	<i>Hyla femoralis</i>
Barking Treefrog	<i>Hyla gratiosa</i>
Squirrel Treefrog	<i>Hyla squirella</i>
Gray Treefrog	<i>Hyla chrysoscelis</i>
Northern Spring Peeper	<i>Pseudacris crucifer crucifer</i>
Brimleys Chorus Frog	<i>Pseudacris brimleyi</i>
Southern Chorus Frog	<i>Pseudacris nigrita nigrita</i>
Little Grass Frog	<i>Pseudacris ocularis</i>
Ornate Chorus Frog	<i>Pseudacris ornata</i>

Southern Cricket Frog	<i>Acris gryllus gryllus</i>
Pig Frog	<i>Rana grylio</i>
River Frog	<i>Rana heckscheri</i>
Carpenter Frog	<i>Rana virgatipes</i>
Bronze Frog	<i>Rana clamitans clamitans</i>
Bull Frog	<i>Rana catesbeiana</i>
Southern Leopard Frog	<i>Rana utricularia</i>
Carolina Gopher Frog	<i>Rana capito capito</i>
Pickerel Frog	<i>Rana palustris</i>

FISHES

Alewife	<i>Alosa pseudoharengus</i>
American Eel	<i>Anguilla rostrata</i>
American Shad	<i>Alosa sapidissima</i>
Atlantic Sturgeon	<i>Acipenser oxyrinchus</i>
Banded Killfish	<i>Fundulus diaphanous</i>
Banded Pygmy Sunfish	<i>Elassoma zonatum</i>
Banded Sunfish	<i>Enneacanthus obesus</i>
Black Crappie	<i>Pomoxis nigromaculatus</i>
Blackbanded Sunfish	<i>Enneacanthus chaetodon</i>
Blueback Herring	<i>Alosa aestivalis</i>
Bluegill	<i>Lepomis macrochirus</i>
Bluespotted Sunfish	<i>Enneacanthus gloriosus</i>
Bowfin	<i>Amia calva</i>
Broadtail Madtom	<i>Noturus n. sp.</i>
Brook Silverside	<i>Labidesthes sicculus</i>
Brown Bullhead	<i>Ameiurus nebulosus</i>
Carp	<i>Cyprinus carpio</i>
Carolina Pygmy Sunfish	<i>Elassoma boehlkei</i>
Chain Pickerel	<i>Esox niger</i>
Channel Catfish	<i>Ictalurus punctatus</i>
Coastal Shiner	<i>Notropis petersoni</i>
Creek Chubsucker	<i>Erimyzon oblongus</i>
Dollar Sunfish	<i>Lepomis marginatus</i>
Dusky Shiner	<i>Notropis cummingsae</i>
Eastern Mosquitofish	<i>Gambusia holbrooki</i>
Eastern Mudminnow	<i>Umbra pygmaea</i>
Everglades Pygmy Sunfish	<i>Elassoma evergladei</i>
Flat Bullhead	<i>Ameiurus platycephalus</i>
Flathead Catfish	<i>Pylodictis olivaris</i>
Flier	<i>Centrarchus macropterus</i>
Freshwater Goby	<i>Gobionellus schufeldti</i>
Gizzard Shad	<i>Dorosoma cepedianum</i>
Golden Shiner	<i>Notemigonus crysoleucas</i>
Golden Topminnow	<i>Fundulus chrysotus</i>
Goldfish	<i>Carassius auratus</i>
Hickory Shad	<i>Alosa mediocris</i>
Hogchoker	<i>Trinectes maculatus</i>
Ironcolor Shiner	<i>Notropis chalybaeus</i>

Lake Chubsucker	<i>Erimyzon sucetta</i>
Largemouth Bass	<i>Micropterus salmoides</i>
Least Killifish	<i>Heterandria formosa</i>
Lined Topminnow	<i>Fundulus lineolatus</i>
Longnose Gar	<i>Lepisosteus osseus</i>
Margined Madtom	<i>Noturus insignis</i>
Mud Sunfish	<i>Acantharchus pomotis</i>
Pirate Perch	<i>Aphredoderus sayanus</i>
Pumpkinseed	<i>Lepomis gibbosus</i>
Rainwater Killifish	<i>Lucania parva</i>
Red Drum	<i>Sciaenops ocellatus</i>
Redbreast Sunfish	<i>Lepomis auritus</i>
Redear Sunfish	<i>Lepomis microlophus</i>
Redfin Pickerel	<i>Esox americanus americanus</i>
Sawcheek Darter	<i>Etheostoma serriferum</i>
Shortnose Sturgeon	<i>Acipenser brevirostrum</i>
Silvery Minnow	<i>Hybognathus nuchalis</i>
Snail Bullhead	<i>Ameiurus brunneus</i>
Southern Flounder	<i>Paralichthys lethostigma</i>
Spottail Shiner	<i>Notropis hudsonius</i>
Spotted Sucker	<i>Minytrema melanops</i>
Spotted Sunfish	<i>Lepomis punctatus</i>
Striped Bass	<i>Morone saxatilis</i>
Striped Mullet	<i>Mugil cephalus</i>
Summer Flounder	<i>Paralichthys dentatus</i>
Swamp Darter	<i>Etheostoma fusiforme fusiforme</i>
Swamp Darter	<i>Etheostoma fusiforme barratti</i>
Swampfish	<i>Chologaster cornuta</i>
Tadpole Madtom	<i>Noturus gyrinus</i>
Taillight Shiner	<i>Notropis maculatus</i>
Tarpon	<i>Megalops atlanticus</i>
Tessellated Darter	<i>Etheostoma olmstedii</i>
Threadfin Shad	<i>Dorosoma petenense</i>
V-lip Redhorse	<i>Moxostoma papillosum</i>
Warmouth	<i>Lepomis gulosus</i>
White Catfish	<i>Ameiurus catus</i>
White Perch	<i>Morone americana</i>
Yellow Bullhead	<i>Ameiurus natalis</i>
Yellow Perch	<i>Perca flavescens</i>

X. Budget Requests

Budget requests will be included in the final CCP.

XI. List of Preparers

Karen Bashears, Executive Director, South Eastern Wildlife and Environmental Education Association (SEWEE) – *Participant in Alternatives, Goals, and Objectives Workshop*

Cooper Chavis, U.S. Fish and Wildlife Service, South Carolina Lowcountry Refuge Complex – *Participant in Alternatives, Goals, and Objectives Workshop*

Jamie Dozier, South Carolina Department of Natural Resources – *Participant in Alternatives, Goals, and Objectives Workshop*

Van Fischer, Natural Resource Planner, U.S. Fish and Wildlife Service, South Carolina Lowcountry Refuge Complex – *Project guidance and management*

Tim Kallgren, GIS Analyst, Mangi Environmental Group/Waccamaw National Wildlife Refuge – *GIS analysis, map production, and ground truthing*

Leon Kolankiewicz, Project Manager/Planner/Biologist, Mangi Environmental Group – *Project manager and primary CCP editor; facilitated alternatives, goals, and objectives workshop*

Eveline Martin, Environmental Analyst/Biologist, Mangi Environmental Group – *Facilitated scoping Meetings; drafted CCP chapters 1-4*

Kay McCutcheon, U.S. Fish and Wildlife Service, Santee National Wildlife Refuge – *Participant in Alternatives, Goals, and Objectives Workshop*

Ray Pattera, U.S. Fish and Wildlife Service, Cape Romain National Wildlife Refuge – *Participant in Alternatives, Goals, and Objectives Workshop*

Craig Sasser, Refuge Manager, U.S. Fish and Wildlife Service, Waccamaw National Wildlife Refuge – *Overall project guidance and input; CCP editor*