DRAFT COMPREHENSIVE CONSERVATION PLAN AND ENVIRONMENTAL ASSESSMENT

SANTEE NATIONAL WILDLIFE REFUGE

Clarendon County, South Carolina

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

Southeast Region
Atlanta, Georgia

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SECTION A. DRAFT COMPREHENSIVE CONSERVATION PLAN

I. Background

INTRODUCTION

This Draft Comprehensive Conservation Plan and Environmental Assessment (Draft CCP/EA) for Santee National Wildlife Refuge (Santee 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 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 (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, which 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 (Improvement Act) 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 CCPs for all refuges. These CCPs, which are completed with full public involvement, help guide the future management of refuges by establishing natural resources and recreation/education programs. Consistent with the Improvement Act, approved plans will serve as the guidelines for refuge management for the next 15 years. The Improvement 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 (i.e., 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 species 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 Improvement Act stipulates that CCPs are to be prepared in consultation with adjoining federal, state, and private landowners and that the Service develops and implements a process to ensure an opportunity for active public involvement in the preparation and revision (every 15 years) of the CCPs.

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

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 Santee NWR and other partners, such as the South Carolina Public Service Authority, South Carolina Department of Natural Resources, and private landowners.

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 Improvement Act. 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 Improvement 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, refuge role 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 the following:

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, working 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. The four international and national bird initiatives include the North American Waterfowl Management Plan, Partners in Flight, U.S. Shorebird Conservation Plan, and North American Waterbird Conservation Plan.

North American Waterfowl Management Plan. The North American Waterfowl Management Plan is an international action plan to conserve migratory birds throughout the continent. The plan's goal is to return waterfowl populations to their 1970s' levels by conserving wetland and upland habitat. Canada and the United States signed the plan in 1986 in reaction to critically low numbers of waterfowl. Mexico joined in 1994, making it a truly continental effort. The plan 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. Plan projects are international in scope, but implemented at regional levels. These projects contribute 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 Southeastern Coastal Plain (Bird Conservation Region 27) 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 for 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.

North 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 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 Improvement Act, 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 sustainment of fish and wildlife species in the State of South Carolina.

The South Carolina Department of Natural Resources (SCDNR) developed a “Vision for the Future” in 1994, when various state conservations agencies were merged. This vision guides management actions of the SCDNR. The basic framework follows.

Mission of the SCDNR:
Our mission is to serve as the principal advocate for and steward of South Carolina’s natural resources.

Vision of the SCDNR:
Our vision for South Carolina is an enhanced quality of life for present and future generations through improved understanding, wise use, and safe enjoyment of healthy, diverse, sustainable and accessible natural resources.

Our vision for the SCDNR is to be a trusted and respected leader in natural resource protection and management, by consistently making wise and balanced decisions for the benefit of the state’s natural resources and its people.

Core Values of the SCDNR:
Our actions will be guided at all times by the following shared internal values:

- Teamwork - We will accomplish our mission and achieve our vision through goal-focused, cooperative efforts that rely on effective internal and external communication and partnering.
- Integrity - We will lead by example, ensuring that our standards are high, and our actions are fair, accountable, and above reproach.
- Dedication - We will maintain a steadfast commitment to the state’s natural resources and our agency’s mission.
- Excellence - We will always do our best, and continuously strive to improve our processes, activities, policies, operations, and products.
- Service - We will provide quality service that meets the needs and exceeds the expectations of the public and our own employees.

Guiding Principles of the SCDNR:
In carrying out our mission, we will continuously strive to:

- Enhance public and private partnerships and open communications necessary to cooperatively protect and manage the state's natural resources;
- Ensure that agency decisions and actions regarding the state's natural resources are based on a balance of scientific knowledge, strong conservation ethics, objectivity, fairness, and the needs and interests of the public;
- Ensure the safety and well-being of the public in their use and enjoyment of the state's natural resources;
- Ensure the continuation and effective management of hunting, fishing, boating, and other natural resources-related activities;
- Evaluate and improve agency functions and procedures to ensure efficiency, effectiveness, and accountability, emphasizing quality service to all customers, internal and external; and
- Foster an organizational culture that emphasizes effective leadership at all levels; a diverse, well-trained, and professional workforce; and an enjoyable and fulfilling work environment.

Strategy of the SCDNR:
To more effectively accomplish our mission and attain our vision, the DNR will work diligently toward achieving the following overarching goals and objectives during the next five years:

1. Enhance the effectiveness of the agency in addressing natural resource issues.
    a. Broaden strategies to address the impacts of population growth, habitat loss, environmental alterations, overuse and other challenges faced in protecting, enhancing and managing diverse natural resources;
    b. More effectively develop, coordinate, and integrate resource-specific conservation and management plans, research, and policies within the agency; and
    c. Expand sound application of science for natural resource management and decision-making.
2. Improve the general operations of the agency.
    a. Develop and implement department-wide operational plans that clearly connect all agency activities to specific goals and annual accountability reports;
    b. Fully develop the agency's regional hub system;
    c. Continue to develop and maintain modern, well-integrated information systems and technology throughout the agency;
    d. Enhance and maintain effective communications throughout all levels of the agency;
    e. Maximize efficiency of internal operations and business procedures; and
    f. Aggressively pursue increases in revenue, state and federal funding, and identify new funding sources to support accomplishment of our mission.
3. Create an agency environment that supports a dedicated, professional workforce.
    a. Implement comprehensive workforce planning that is consistent with agency priorities;
    b. Expand consistent, agency-wide employee training, retention, and compensation efforts;
    c. Implement initiatives that improve employee morale and teamwork, instill a sense of pride in the agency, and emphasize the importance of its mission.
4. Enhance public trust and confidence in the agency.
    a. Foster more effective communications, outreach, and partnering with the public and state legislature;
    b. Develop strategies that address divergent public opinion and expectations concerning issues related to accessibility, use, and protection of natural resources; and

c. Optimize our customer service through regular monitoring of constituent needs, public opinion, and agency performance; and
d. Enhance natural resource education to provide the public with knowledge necessary in making informed natural resource decisions.

The state'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.

II. Refuge Overview

INTRODUCTION

Santee NWR was established in 1942, and is in Clarendon County, South Carolina (Figure 1). The 15,000-acre refuge lies within the Atlantic Coastal Plain and consists of mixed hardwoods, mixed pine hardwoods, pine plantations, marsh, croplands, old fields, ponds, impoundments, and open water. This tremendous diversity of habitats supports many kinds of wildlife.

A myriad of wildlife species inhabit the varied landscape of Santee NWR (Figures 2, 3, 4, and 5). During the winter months, the bald eagle and occasionally the peregrine falcon can be seen. From November through February, migrating waterfowl, such as mallards, pintails, teal, and wood ducks, along with Canada geese, are a major attraction. Throughout the year, red-tailed and red-shouldered hawks can be viewed soaring overhead, as can a variety of songbirds in the trees, and wild turkey.

Birds are not the only residents of Santee NWR. The forest provides a home for white-tailed deer and other woodland creatures, such as raccoons, squirrels, and bobcats. The ponds and marshes provide a home for alligators, plus a number of other reptiles and amphibians.

To support a large variety of wildlife species, intensive habitat management is a must. The habitat management programs at Santee NWR range from the very basic to complex. One of the basic programs is the wood duck nest box program, where nesting boxes are provided in areas that are lacking in available tree cavities, thus “adding to” the natural habitat. The water and marsh management program is more complex (Figures 6, 7, 8 and 9). Water levels are adjusted to provide maximum benefits for wildlife. In the impoundments and marshes different levels are used to help some types of vegetation to grow while controlling unwanted “pest plants.” Periodically flooded woodlands containing nut-producing hardwoods are food-rich and very beneficial to waterfowl.

The management of forest and croplands is also critical. Refuge staff and contracted private farmers plant corn, wheat, millet, nutgrass, or other small grain crops. These crops attract many species of wildlife and provide an excellent source of high-energy foods for wintering waterfowl. Refuge forests are maintained with management techniques, ranging from prescribed burning to selective thinning. Habitat management is a complicated process but well worth the effort since it provides an abundant amount of food, cover, and shelter for a wide range of animals.

Santee NWR also contains areas of cultural and local significance. The 420-acre Dingle Pond unit consists primarily of a Carolina Bay and is a designated public use natural area. A historic site on the refuge that is listed on the National Register of Historic Places is the Santee Indian Mound/Fort Watson area. The mound itself is more than 3,000 years old and artifacts of the Santee NWR have been dated to 3,500 years ago. During the Revolutionary War, the British kept a garrison of about 100 soldiers at the mound. This gave them strategic control over the Santee River and a major road connecting Charleston to Camden. The garrison was eventually captured by American revolutionary forces under General Francis Marion.

Figure 1. Santee National Wildlife Refuge Location Map

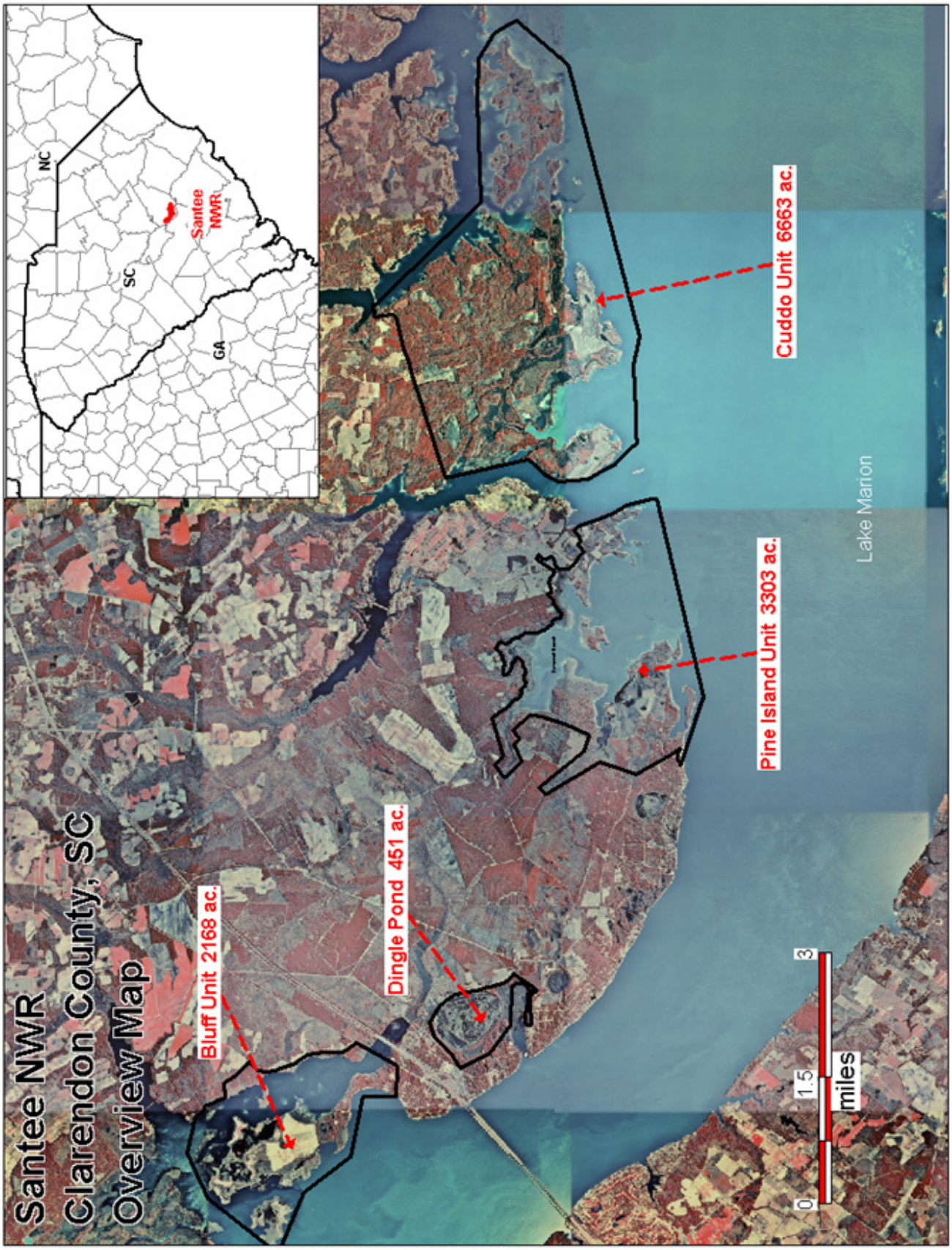


Figure 2. Bluff Unit Forestland

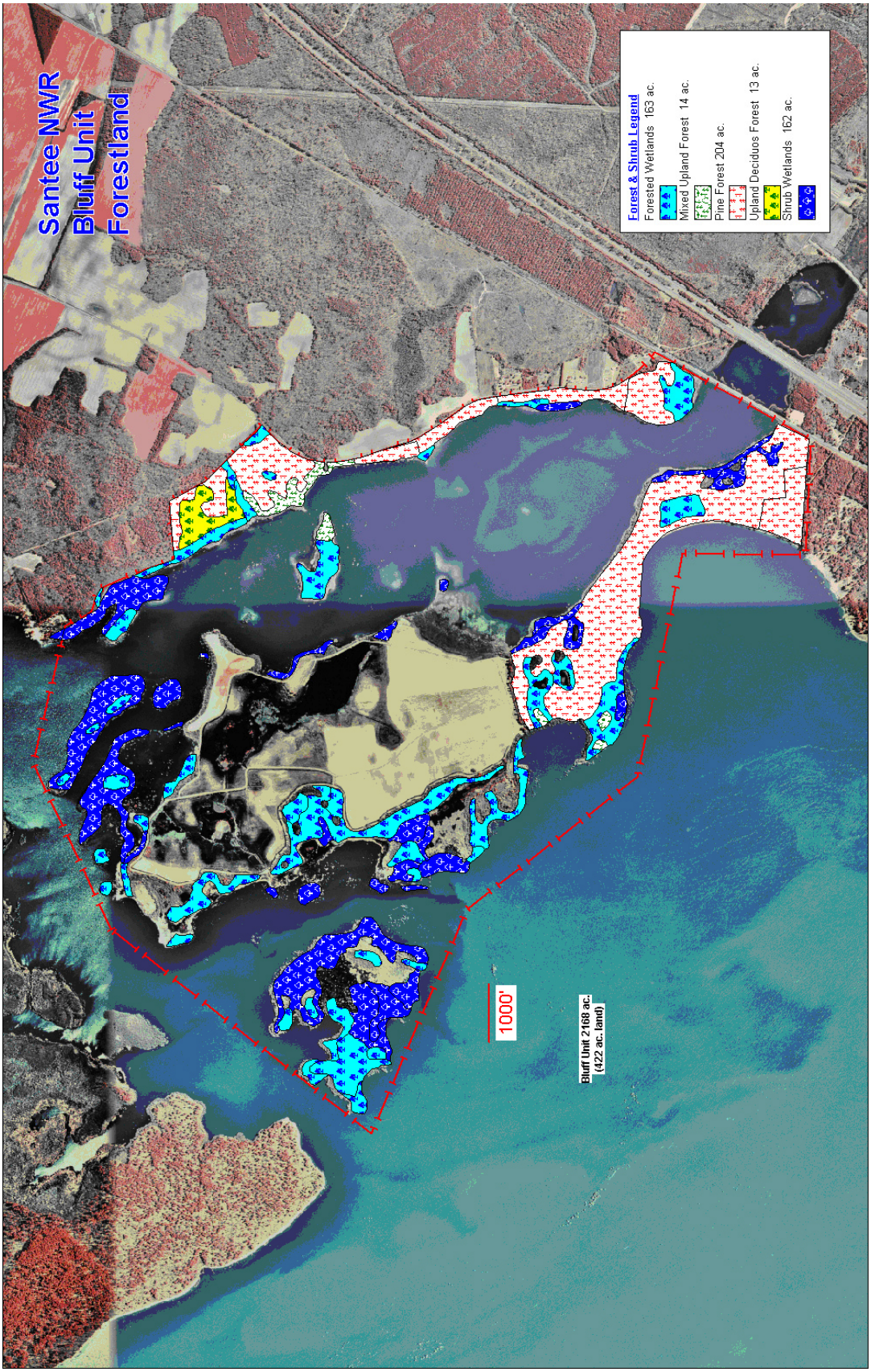


Figure 3. Bluff Unit Impounds

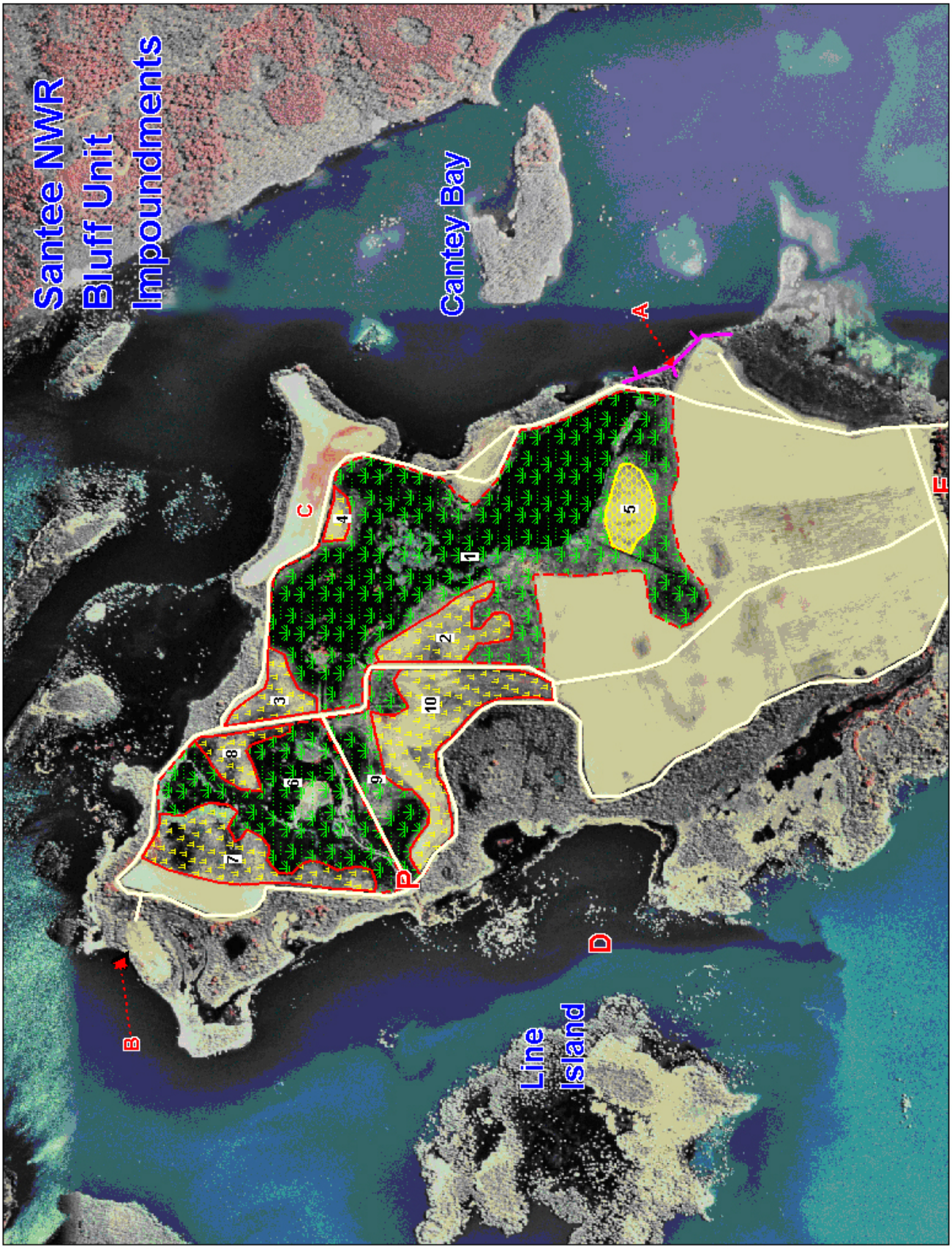


Figure 4. Cuddo Unit Forestland

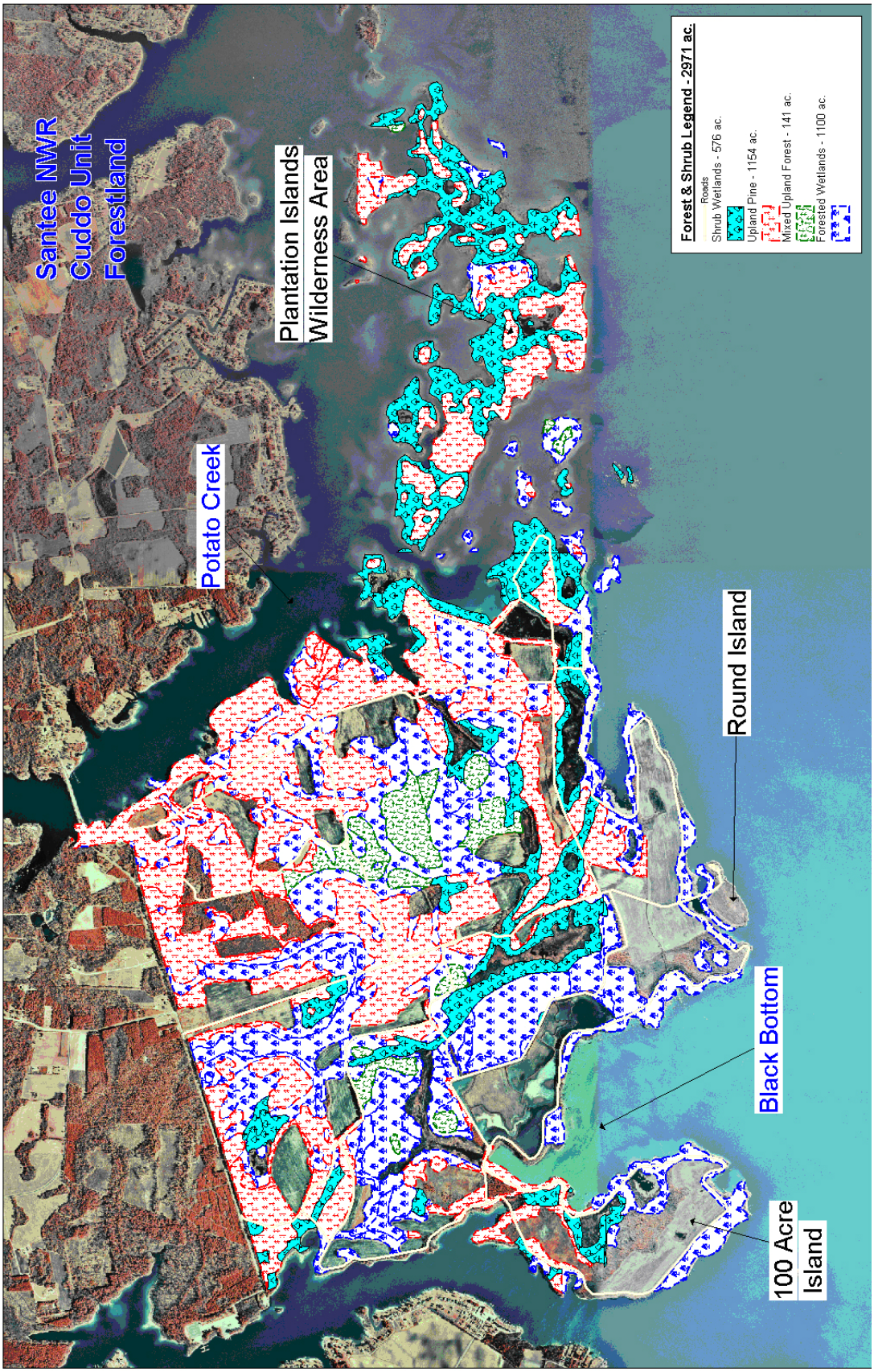


Figure 5. Cuddo Unit Impounds

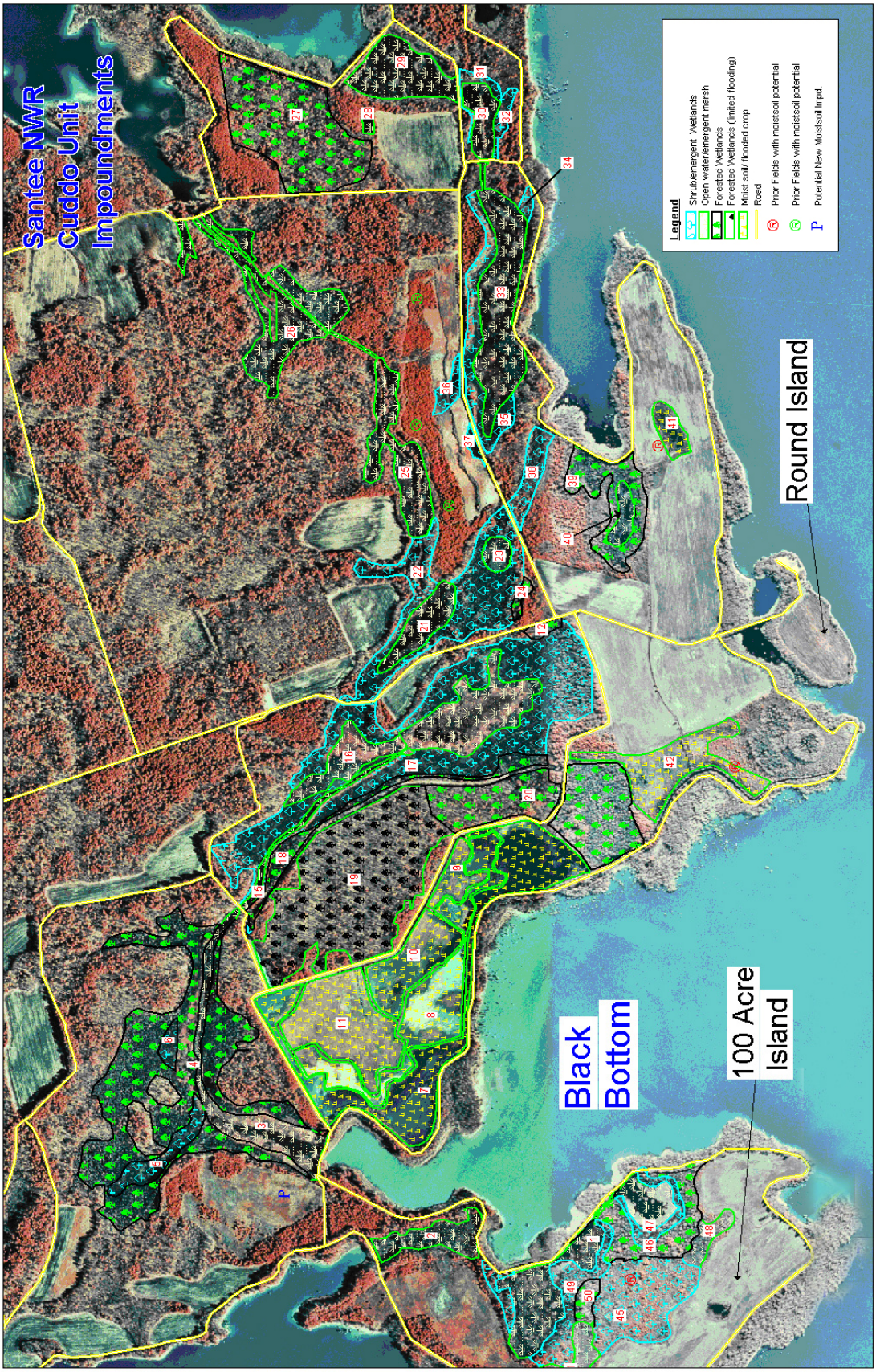


Figure 6. Dingle Pond Forestland

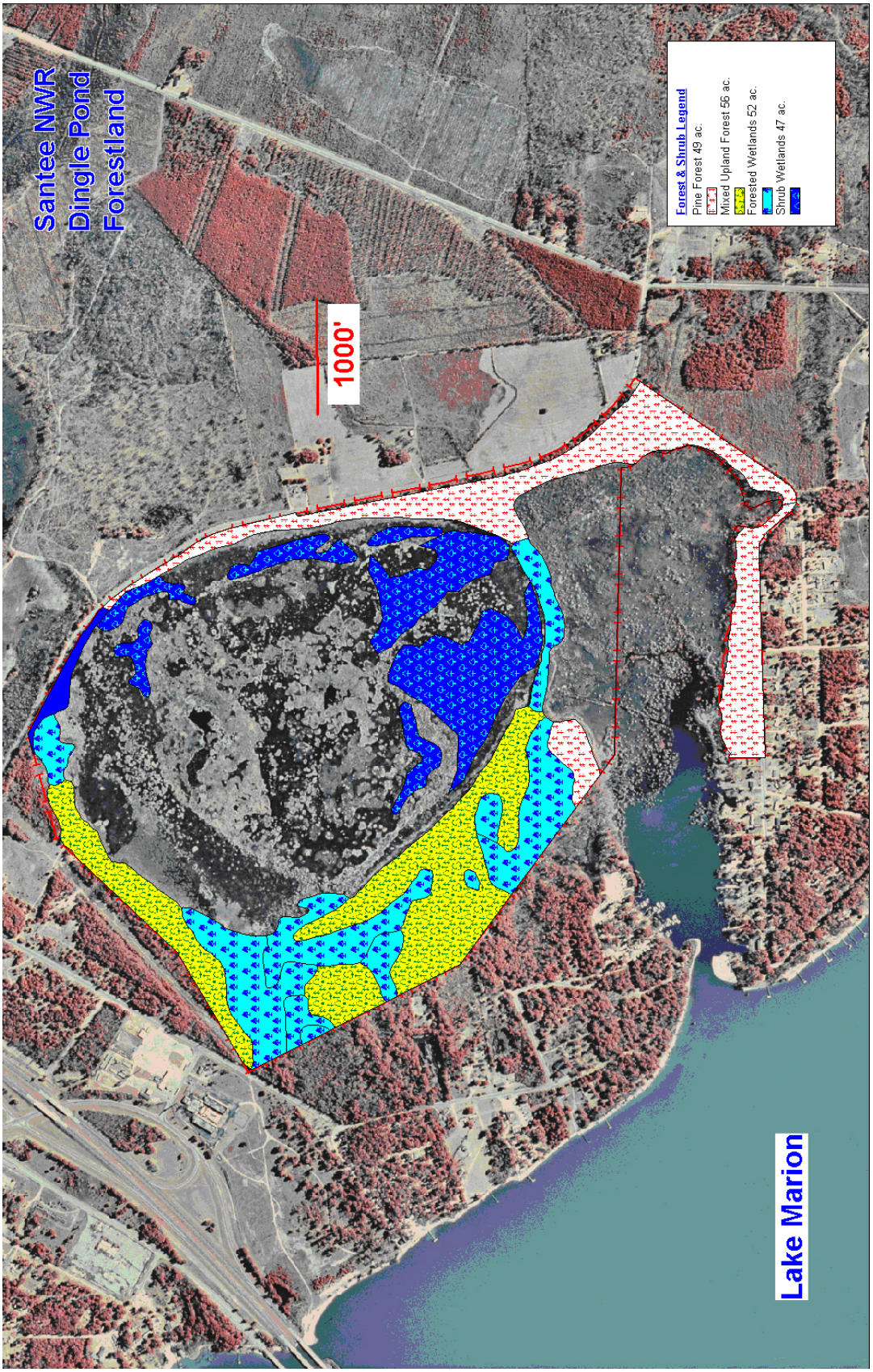


Figure 7. Dingle Pond Habitats

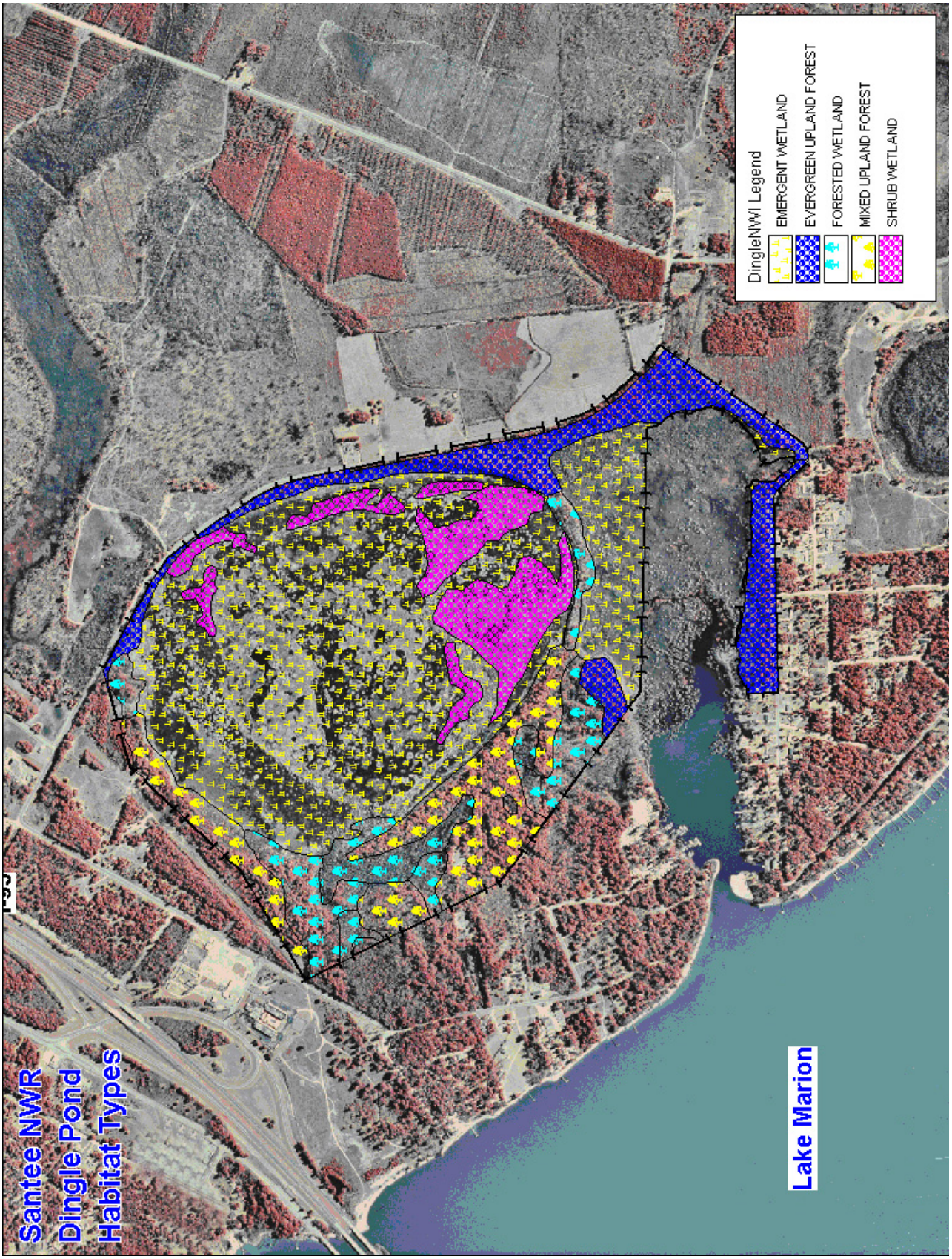


Figure 8. Pine Island Unit Forestland

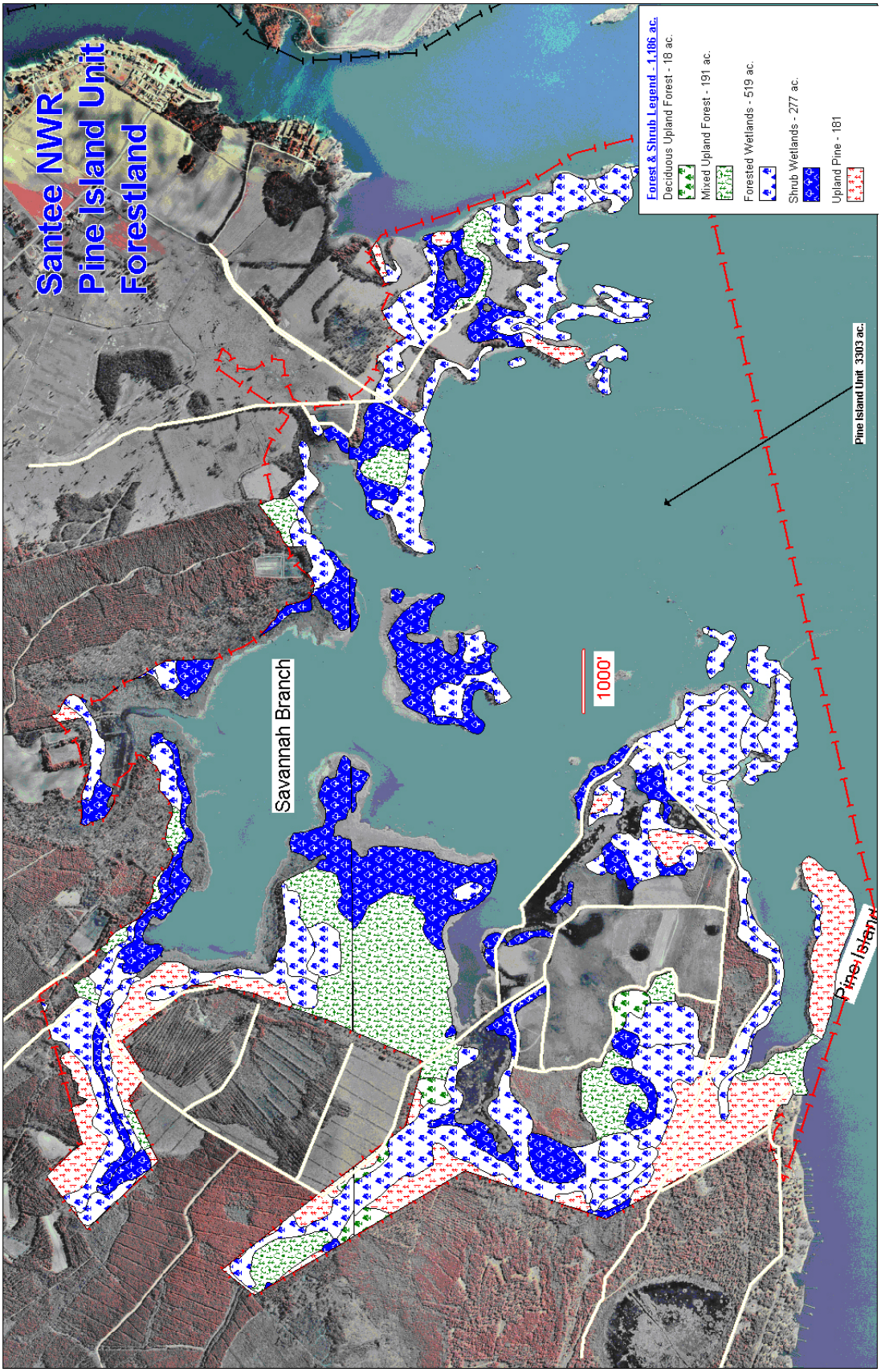
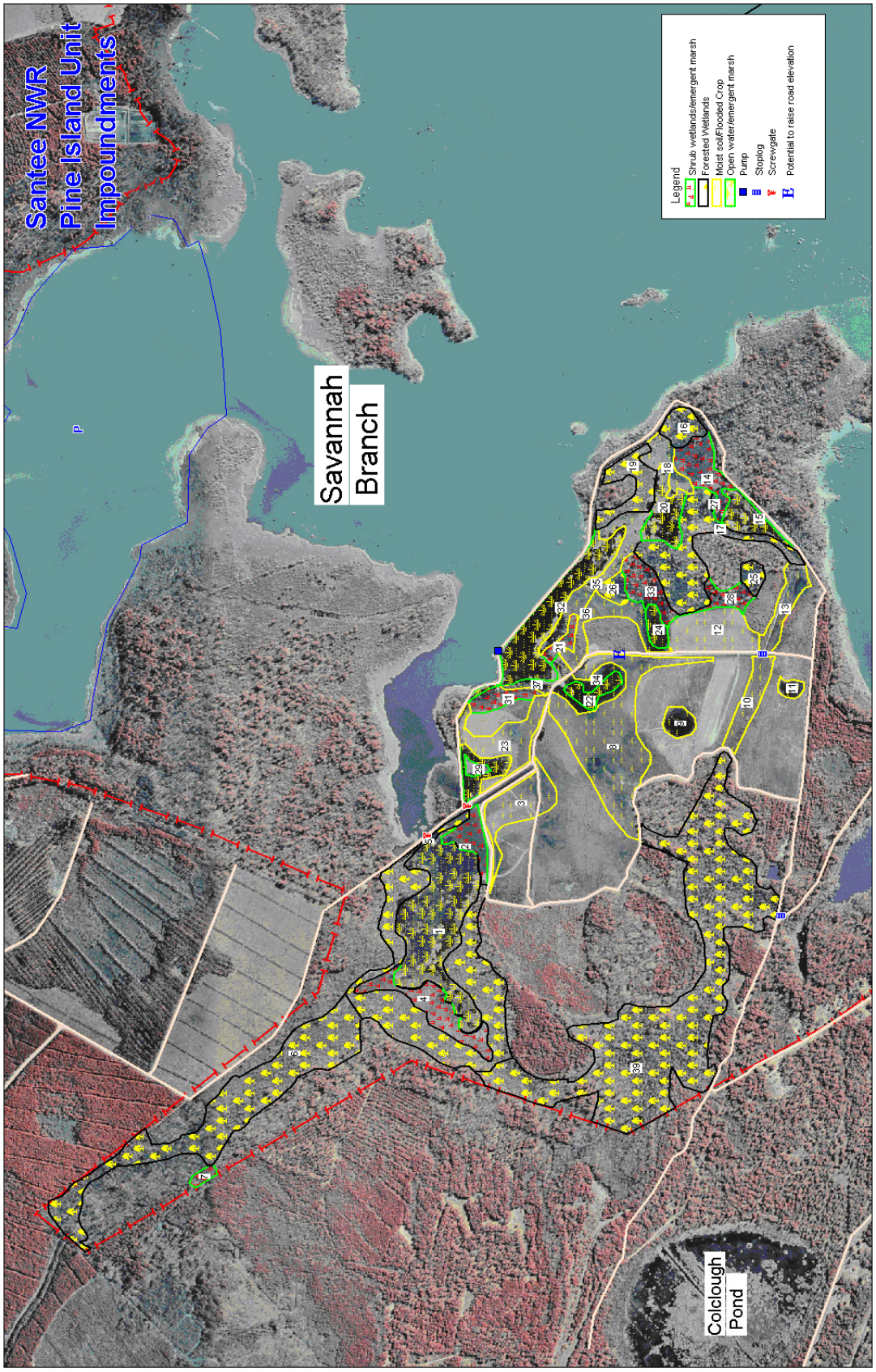


Figure 9. Pine Island Unit Impounds



REFUGE HISTORY AND PURPOSE

Santee NWR is in Clarendon County in the upper coastal plain region of South Carolina. The refuge was established on January 1, 1942, primarily to alleviate the loss of natural waterfowl and other wildlife habitat caused by the construction of hydro-electric power and navigational projects on the Santee and Cooper Rivers. Total refuge acreage is 15,095. Except for approximately 4,400 acres of fee title land, the refuge is superimposed on lands and waters of the 110,000-acre Lake Marion Reservoir, which is administered by the South Carolina Public Service Authority (SCPSA).

A new 50-year lease agreement between the Service and the SCPSA became effective in 1975. This lease completely altered the water boundary and changed much of the land boundary from the original lease. Provisions in the new lease permitted the posting of mutually agreed upon boundaries, which would become official refuge boundaries after the lines were surveyed. Both land and water boundary surveys were completed in 1985 and finalized approved maps were received from SCPSA in 1986.

Recognizing the high migratory bird benefits and recreational opportunities served by the lands and waters of Santee NWR, the Service administratively designated Santee NWR in 1941, under the Migratory Bird Conservation Act and the Refuge Recreation Act, thus outlining the primary purposes of these lands and waters:

> ”... for use as an inviolate sanctuary, or for any other management purpose, for migratory birds.”
> 16 U.S.C. 715d (Migratory Bird Conservation Act)
>
> “…to conserve and protect migratory birds…and other species of wildlife that are listed…as endangered species or threatened species and to restore or develop adequate wildlife habitat.”
> 16 U.S.C. 715i (Migratory Bird Conservation Act)
>
> “... suitable for (1) incidental fish and wildlife-oriented recreational development, (2) the protection of natural resources, (3) the conservation of endangered species or threatened species ...” 16 U.S.C. 460k-1 “... the Secretary ... may accept and use ... real ... property. Such acceptance may be accomplished under the terms and conditions of restrictive covenants imposed by donors ...” 16 U.S.C. 460k-2 (Refuge Recreation Act (16 U.S.C. 460k-460k-4), as amended).

SPECIAL DESIGNATIONS

- Audubon Designated Important Bird Area
- Refuge Designated Waterfowl Sanctuary
- Santee Indian Mound/Fort Watson is listed on the National Register of Historic Places

ECOSYSTEM CONTEXT

An ecosystem is a geographic area including all the living organisms (e.g., people, plants, animals, and microorganisms), their physical surroundings (e.g., 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 (e.g., a single stand of aspen) or large (e.g., an entire watershed, including hundreds of forest stands across many different ownerships).

The Service has adopted an ecosystem approach to conservation. We realize that we are not going to achieve conservation within the boundaries of a national wildlife refuge; that we are not going to restore aquatic resources within a national fish hatchery; and that listing an endangered species is not going to conserve the ecosystem. All of these are interconnected. If we disturb or manage one, all of the others will be affected. 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.

Comprising one of the 53 ecosystems around the country, the Service's Savannah-Santee-Pee Dee Ecosystem (SSPD Ecosystem) includes the entire State of South Carolina, as well as the northeastern portion of Georgia, and the southwestern portion of North Carolina. The SSPD Ecosystem encompasses approximately 52,500 square miles and is divided into four main physiographic provinces, including the Blue Ridge Mountains, Piedmont, Carolina Sandhills, and Coastal Plain provinces. Two major types of river systems traverse these provinces. Alluvial rivers originate in the mountains and piedmont and include the Great Pee Dee, Savannah, Congaree, Wateree, Catawba, and Santee. Blackwater rivers originate in the coastal plain and include the Cooper, Ashley, Edisto, Salkahatchie, Combahee, Ashepoo, New, Four Holes, Little Pee Dee, Wacammaw, Black, and Lumber. The SSPD Ecosystem includes several important areas with protective designations, including 14 national wildlife refuges, 6 national forests, 4 national fish hatcheries, 2 national estuarine research reserves, and more than 50 state parks.

A considerable acreage of tidal freshwater swamp and marsh are associated with the major river systems. In addition, the SSPD Ecosystem contains numerous palustrine wetlands that are isolated or contiguous with freshwater stream and river systems. The river basins drain into an extensive estuarine network of saltwater marsh with tidal creeks, inlets, and sounds intermixed with barrier, sea, and marsh islands. The estuarine system provides tremendous nursery grounds for commercially important fish and shellfish and fuels the base of the marine food chain.

The SSPD Ecosystem supports large populations of wading birds, shorebirds, waterfowl, game and non-game mammals, reptiles, amphibians, and anadromous fish. The habitats within the SSPD Ecosystem fall within the Atlantic Flyway. Forage, refuge, cover, and staging areas for a variety of migrating waterfowl, neotropical migratory birds, raptors, and shorebirds are provided. The several species of flora and fauna listed as federally threatened or endangered in the SSPD Ecosystem are indicative of the development pressures and habitat losses incurred. Approximately 37 animal and 31 plant species are listed as federally threatened or endangered within the SSPD Ecosystem. Numerous species of plants and animals are candidates for listing. Several federally protected species depend on the SSPD Ecosystem for some portion of their life cycle (e.g., eastern cougar, West Indian manatee, red wolf, five species of whales, Carolina northern flying squirrel, Virginia big-eared bat, Indiana bat, wood stork, piping plover, red-cockaded woodpecker, Bachman's warbler, eastern indigo snake, loggerhead and other sea turtles, shortnose sturgeon, Carolina heelsplitter, and many plant species).

The greatest problem facing the SSPD Ecosystem is the loss of habitat through direct destruction and fragmentation, as well as through impacts from human activities. The predominant stresses for the SSPD Ecosystem are: population growth, tourism, agriculture, silviculture, shipping ports, water channelization, urbanization, aquifer depletion, fire suppression, exotic species, non-point source pollution, and point source pollution. The actions of the SSPD Ecosystem Team are guided by two categories: trust resources and management issues. The trust resources include: migratory birds, anadromous fish, endangered species, and marine mammals. The management issues focus on: habitat protection and management, habitat restoration, contaminants, regulatory compliance, law enforcement, and biodiversity.

To address these threats, the management issues, and the needs of the trust resources, the SSPD Ecosystem Team pursues a mix of objectives under the following seven goals.

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 and endangered species 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.
6. To protect, enhance, and manage interjurisdictional and diadromous fish populations 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 an 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 implementing 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 (e.g., terrestrial and marine) organized within 5 ecoregions, as well as 13 ecobasins, which characterize the freshwater aquatic habitats of the state.

Eight categories of conservation strategies or conservation action areas 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 conservation action area, 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 nongovernmental. 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 conservation action areas 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 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, over 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 the state's 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, or soon would 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 SSPD 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 exotic wildlife and fish also flourish in this southern coastal climate. Animals like feral hogs have caused extensive habitat damage and alterations.

PHYSICAL RESOURCES

CLIMATE

South Carolina has a humid subtropical climate. Average annual precipitation is about 49 inches per year with the coast receiving 48 to 50 inches, while the area of the Blue Ridge Mountains receives up to 80 inches per year (Table 1). Average January temperatures range from 50 degrees near the coast to 38 degrees in the mountains; July temperatures average 81 near the coast and 71 in the mountains. The growing season ranges from 200 to 290 growing days. During the winter months, the state is typically under a continental air mass that is cold and dry, while during summer, the Bermuda high pressure cell in the Atlantic drives much of the weather. Heat and humidity prevail when clockwise circulation around the Bermuda high brings a southerly flow of air from the Gulf of Mexico, a pattern that becomes rather stable as the mountains in the northwestern part of the state block any cool fronts which might arrive from the north.

Table 1. Monthly temperature and precipitation data for 2004			
Month	**Temperature**		**Precipitation (Inches)**
	High	**Low**	
January	78	19	3.28
February	76	25	7.50
March	84	28	0.79
April	92	31	1.94
May	96	42	5.38
June	98	64	8.79
July	100	67	4.73
August	98	53	7.81
September	92	54	5.72
October	88	37	2.07
November	85	29	2.42
December	80	19	2.03
TOTAL			52.46

GEOLOGY AND TOPOGRAPHY

The Santee Limestone underlies a large portion of the South Carolina Coastal Plain Region but is exposed at the surface only along the Santee River valley and its surrounding counties. The most spectacular example of Karst topography (the term given to landscapes which are sculpted primarily by groundwater activity) is located in Santee State Park along the western shore of Lake Marion. The park contains sinkholes, caves, disappearing streams, solution valleys, and sinkhole lakes. Park naturalists conduct tours of the caves during times when visits will not bother the native bat population. Rock samples, many of which contain fossils, may be found outside of the park boundaries on both sides of Lake Marion. The limestone itself is composed of a mixture of limey sands, lime muds, and shell-hash layers. Accumulations of oyster beds, from the shallow continental shelf located here 40 million years ago, are found in several places within the major sinkhole area of Santee State Park.

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:

- 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

The 110,600-acre Lake Marion was created from 1939-42 as a hydroelectric project by the SCPSA, and is commonly known as "Santee Cooper." (All references to “Santee Cooper” in this Draft CCP/EA refer to this hydroelectric project.) Being in the lower portion of the Santee River basin, it is one of the largest drainages on the east coast. Lake Marion and its companion reservoir, Lake Moultrie, are collectively called the Santee–Cooper Lake System. The Santee River begins at the confluence of the Congaree and Wateree Rivers, approximately 11 miles upriver from the lake. Most of the water coming into the lake is from upstream “blackwater” drainage (Tufford and Mckellar 1999) and from seasonal precipitation patterns.

There is an average annual rainfall of 43 inches, which mostly occurs in June, July, August, and September. With the creation of Lake Marion, the extensive flood-plain and bottomland forest that existed along the Santee River were drowned. The lake is more shallow (average 7 feet) in the upper stream (i.e., Santee Swamp) areas and deepens (average 16 feet) at the lower dam area of the lake. The lake becomes wider and deeper below the I-95 Highway, having more lacusturine characteristics.

Santee Cooper manages the water levels in Lake Marion. Lake levels are typically high in summer to provide for hydro-power and recreation, and low in winter to provide flood storage. These seasonal levels are contrary to what is needed for good water management at the Santee NWR.

The preferred hydrological management of managed impoundments during the summer would be to have lower, drawn-down conditions to encourage moist-soil vegetation and also tree growth and productivity in greentree reservoirs. Gravity drainage from the impoundments is slow or non-existent when the lake levels are high during the summer months. Under these conditions, pumping must be used to maintain lower water levels in the impoundments. Pumping costs and maintenance can be high where permeable dikes allow water to seep back into the impoundments from the lake.

During the fall and winter, low lake levels are typical and may inhibit pumping when the water is needed. Under these conditions, the existing pump for the Bluff Unit often cannot provide water for late summer/early fall flooding of the units. If the elevation of the pump’s intake pipe is above the lake level (often at such times) no water is available for pumping. Permeability of soils and dikes also inhibit water retention, particularly at the Bluff Unit. However, lack of maintenance of the dike and water control systems on the Cuddo, Pine Island, and Dingle Pond units will require the refuge to conduct a comprehensive wetland management plan to upgrade and repair these systems.

AIR QUALITY

Clarendon 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 were no exceedances of NAAQS for these parameters. Clarendon County Air Quality Index in 2003 was considered very good and one of the best overall in the State of South Carolina (Scorecard 2005).

WATER QUALITY AND QUANITY

Limestone, found in the coastal plain of South Carolina, is exposed in the Santee area near Lake Marion, allowing the formation of features characteristic of Karst topography. This porous limestone is the aquifer for much of the lower part of the state. Because of the rapid flow of groundwater through the Karst system around Santee, the aquifer is highly susceptible to contamination. Quality groundwater supplies for home use and farm irrigation could easily be lost if proper conservation measures are not taken. Loss of water quality would also have a significant impact on the entire Santee community, including Santee NWR and Santee State Park. As recreation and tourism become an even greater economic resource to this region, a readily available source of groundwater is a critical requirement. The public must become aware of the special properties of limestone rock aquifers and protect such areas from pollution. Measures must be taken so that hazardous waste is not placed in a location that could affect major underground water supplies.

BIOLOGICAL RESOURCES

The coastal plain is the largest ecoregion in South Carolina. Land elevation in this ecoregion begins at 270 to 300 feet at the inland boundary with the sandhills and reaches nearly to sea level at the coastal zone boundary. From a land use standpoint, the coastal plain consists of two significantly different landscapes. An inner belt is predominantly composed of cropland, with forests limited to small patches and hardwood “stringers” along creeks. An outer belt, sometimes called the “flatwoods” is primarily pine-dominated forest. Bisecting both belts are major floodplains, which are largely forested.

Seven major habitat types are defined for the coastal plain, of which six are either unique to the region or reach their greatest extent there. The predominant habitat types are: (1) grassland and early successional habitats, (2) pine woodland, and (3) river bottoms. Although the remaining types are less extensive, they provide habitat diversity that is important to a number of species, especially wetland species.

Grasslands or early successional fields include those with cover provided by grasses and/or weeds and with few, if any, trees. These sites also include managed open areas, such as meadows, pastures, golf courses, or expansive lawns with or without damp depressions. These fields occur throughout the region; more extensively in the inner “agriculture belt.” Pine woodlands include all pine-dominated forests throughout the ecoregion. They include tracts that occupy a variety of soil moisture characteristics except floodplains. The canopy is dominated by one or several species of pine, generally loblolly (*Pinus taeda*), or longleaf (*Pinus palustris*), depending on elevation, soil type and silvicultural history. Dense shrub thickets of hollies (*Ilex* sps.) and wax myrtle (*Morella cerifera*) may be found throughout stands. Finally, the river bottoms of the coastal plain include a variety of hardwood and hardwood-pine communities occupying the floodplains of small streams and infrequently flooded flats in association with streams or rivers. These flats are often characterized by the presence of American beech (*Fagus grandifolia*) and occur in scattered locations on sheltered sites with moist soils, particularly on north-facing river bluffs and on slopes of drains and creeks.

At Santee NWR, forest cover comprises approximately 2,320 acres with 1,230 acres of mixed hardwood forest and 1,090 acres of pine forest. The forest lands are divided between four management units, namely Bluff, Cuddo, Pine Island, and Dingle Pond. The Bluff unit totals 130 acres of forest with 60 acres of mixed hardwoods and 70 acres of pine. The Cuddo unit contains approximately 1,580 acres of forest lands comprised of 880 acres of mixed hardwoods and 700 acres of pine. The Pine Island unit contains 510 acres of forest with 230 acres of hardwoods and 280 acres of pine. Dingle Pond totals 100 acres with 60 acres of hardwoods and 40 acres of pine.

Natural pine stands are predominantly loblolly while plantation areas are primarily slash pine. Some longleaf and shortleaf pine is scattered throughout the four units. Most of the pine stands were previously farmed and were either planted with slash pine or regenerated naturally.

Mixed hardwood stands are primarily composed of sweet gum, willow oak, black gum, white oak, maple, water oak, post oak, Southern red oak, swamp chestnut oak, hickory and blackjack oak. Generally, hardwood stands are situated in and along coves. Most of the hardwood forests were heavily harvested prior to the creation of Lake Marion.

HABITAT

Grassland, Early Successional, and Cropland Habitats

Grasslands include early successional fields, with cover provided by grasses and/or weeds, and few, if any, trees. Also, managed open areas such as meadows, pastures, croplands, golf courses, or expansive lawns with or without damp depressions are included. Grassland occurs throughout the coastal plain region; but more extensively in the inner “agriculture belt.”

Pine Woodland

Pine woodland includes all pine-dominated forests throughout the region, including those occupying a variety of soil moisture characteristics except floodplains. The canopy is dominated by one or several species of pine, generally loblolly (*Pinus taeda*), or longleaf (*Pinus palustris*), depending on elevation, soil type, and silvicultural history. Dense shrub thickets of hollies (*Ilex* sps.) and wax myrtle (*Morella cerifera*) may be evident. Higher elevation pine woodlands have abundant grasses and herbs, particularly when burning is frequent.

Sandhill Pine Woodland

Sandhill pine woodland is a complex of xeric pine and pine-hardwood forest types adapted to sandy soils. They occur principally in the Sandhills but also on fluvial sand ridges in the Coastal Plain. Absent frequent fire, a canopy of longleaf pine and a subcanopy of turkey oak prevail interspersed with scrub oak species and scrub/shrub cover. Frequent burning leads to development of longleaf pine-wiregrass communities.

Upland Forest

Upland forests are dominated by hardwoods, primarily with oaks and hickories, and typically on fire suppressed upland slopes near river floodplains or between rivers and tributaries. Vegetation composition is similar to oak-hickory forest in the Piedmont, where it is a major vegetation type. Upland forest is rare in the Coastal Plain. It intergrades with river slopes and is lumped with this type for species treatments (see below). Representative canopy trees are: white oak (*Quercus alba*), black oak (*Quercus velutina*), post oak (*Quercus stellata*), mockernut hickory (*Carya tomentosa*), pignut hickory (*Carya glabra*), loblolly pine (*Pinus taeda*), flowering dogwood (*Cornus florida*), and black gum (*Nyssa sylvatica*).

Ponds and Depressions

Ponds and depressions are a variety of permanently and semi-permanently flooded isolated freshwater wetlands, with open or closed canopy forest cover, including depression meadows, pond cypress ponds, swamp tupelo ponds, pocosins, limestone sinks, and pond pine woodlands. Landforms include natural and artificial ponds dominated by cypress and/or swamp tupelo, limestone sinks, and Carolina Bays. They occur extensively throughout the region, and more in the outer "Atlantic Coast Flatwoods" belt.

River Bottoms

River bottoms are hardwood-dominated woodlands with moist soils that are usually associated with major river floodplains and creeks. They may contain small creeks or pools and may be seasonally flooded. Characteristic trees include: sweetgum (*Liquidambar styraciflua*), loblolly pine (*Pinus taeda*), water oak (*Quercus nigra*), willow oak (*Quercus phellos*), laurel oak (*Quercus laurifolia*), cherrybark oak (*Quercus pagoda*) and American holly (*Ilex opaca*). In the southern coastal counties on drier sites, spruce pine (*Pinus glabra*) may be an associate. The cypress-tupelo swamp subtype occurs on lower elevation sites as seasonally flooded swamps. It is usually transected by tannic-acid rivers and creeks and contains oxbow lakes and pools. Dominant trees are bald cypress (*Taxodium distichium*), water tupelo (*Nyssa aquatica*), swamp gum (*Nyssa biflora*), Carolina ash (*Fraxinus caroliniana*), water elm (*Planera aquatica*), and red maple (*Acer rubrum*).

River Slopes and Stream Bottoms

River slopes and stream bottoms consist of a variety of hardwood and hardwood-pine communities, occupying the floodplains of small streams and infrequently flooded flats in association with streams or rivers. Several mixed mesophytic subtypes, characterized by the presence of American beech, occur in scattered locations on sheltered sites with moist soils, particularly on north-facing river bluffs and on slopes of drains and creeks. The calcareous cliff and marl forest subtype occurs on circum-neutral soils derived from limestone or unconsolidated calcareous substrates, such as marl.

WILDLIFE

Mammals

The variety of habitats at Santee NWR provide 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 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

Many species of amphibians and reptiles are likely to occur within and adjacent to the refuge acquisition area. 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

Lake Marion supports a wide diversity of freshwater fish. Several species of fish are associated with the refuge acquisition area, including fresh water, anadromous (fish that move up the rivers from the sea to spawn), and estuarine-dependent fish (USFWS 1997). Anadromous fish known to occur include the striped bass, American shad, hickory shad, blueback herring, Atlantic sturgeon, and shortnose sturgeon. 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, redfin 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 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. Baldcypress-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 area.

<u>Neotropical Migratory Birds</u>
The mosaic of wetland habitats on the refuge, along with a specialized flora composition associated with each component, provide habitat for breeding neotropical migratory birds. This wetland and upland habitat diversity is important to several high-priority species, such as painted buntings, indigo buntings, and Swainson's and prothonotary warblers. Additionally, the habitat mosaic represented within Santee NWR serves as an important migration stop for transient neotropical migratory species, as well as feeding, foraging, and nesting habitat for other temperate migratory and resident species.

<u>Waterfowl</u>
South Carolina's coastal plain wetlands 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.

Santee NWR provides year-round, as well as nesting and brood rearing habitat for wood ducks. There is an abundance of wood ducks at the refuge and the wood duck banding program provides one of the best long-term records for wood ducks in the southeast.

Marsh and Wading Birds

All of the priority marshbirds that are found in the refuge acquisition area 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 Santee NWR is supported in managed wetland impoundments, where management techniques can provide tall emergent habitat for marshbirds along with providing for waterfowl.

Nesting long-legged wading birds have plenty of available habitats, 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 on the refuge include the killdeer, greater and lesser yellowlegs, spotted sandpiper, common snipe, and American woodcock.

CULTURAL RESOURCES

Santee NWR used to be an important location for Native American culture and became strategically important during the Revolutionary War. Built on the Santee Indian Mound overlooking the Santee River, British Fort Watson controlled movement through this important transportation route. Its siege and eventual capture by Francis Marion and his men highlights an interesting chapter of the American Revolution.

The Santee Indian Mound is a well-preserved example of flat-topped Native American ceremonial mounds that were once located throughout the southeastern United States. This particular mound was a gathering place, serving much of the central Coastal Plain of South Carolina. It served as a platform on which a temple could be built. The temple was constructed of upright posts through which small sticks were woven and then plastered with mud. The roof was thatched with straw. The mound probably served as a central distribution point for food and other supplies as well. These mounds have sometimes been mistakenly identified as burial mounds, but their shape and function were very different from those of burial mounds.

Temple mounds first appeared in the Mississippi River Valley about 1000 A.D., and shortly thereafter became commonplace in the southeastern United States. Archaeologists theorize that the Santee Indian Mound was built sometime between 1200 and 1400 A.D., because it occurs along the easternmost extension of the region inhabited by the mound building culture. The spread of the mound culture coincided with the spread of large scale agriculture and trade among the Native American population.

It is highly probable that the Santee Indian Mound site was once a part of the Province of Cofitachiqui, a Native American cultural region with its center near present-day Camden. Cofitachiqui was visited between 1540 and 1542 by the Spanish explorer Hernando de Soto who wrote that the people he found around the mound site were generally healthy and taller than Europeans. The Province of Cofitachiqui was ruled at that time by a female priestess, a situation which was not

uncommon in that culture. Nobody really knows why the mound builders died out over the next hundred years, but diseases introduced by Europeans, which are known to have killed thousands of Native Americans, may have played a significant role.

During the Revolutionary War, General Francis Marion became a hero because of the unconventional tactics he used to win battles. One of the most famous stories about his exploits is the capture of Fort Watson, formerly the Santee Indian Mound, within what is now the Santee NWR. The British had established a fort on the mound by building a high wall around it, and this fort guarded one of the main roads from Charles Towne to Camden. They kept the fort closely guarded, and kept the bluff surrounding Fort Watson bare of trees. Marion and his brigade of southern patriots had recently been joined by General Light Horse Harry Lee and his Continental troops. After trying and failing to penetrate the wall by force, Lee requested a cannon from General Nathanael Greene, the commander of the Southern army in Camden. The cannon was Immediately dispatched, but Greene's troops lost their way and wandered around for days before finally returning to Camden without delivering the cannon.

Prior to the battle, the water for Fort Watson had been taken from a nearby oxbow lake. When Marion and his troops arrived, their first objective was to cut off the British water supply. But while Marion and Lee were waiting for the cannon, they noticed that the British were digging a well at the base of the Indian mound. In the meantime, however, an epidemic of smallpox had broken out in Marion's camp, and many of the militiamen began to desert. Marion, realizing that they could not take the fort by storm, considered abandoning the siege. But Major Hezekiah Maham, a Continental officer, suggested building a tower higher than the fort. Immediately, Marion sent his horsemen to scour the neighboring plantations for axes so they could chop down pine saplings. Maham's tower was erected during the night. At daybreak on April 15, 1781, the best riflemen climbed into the crow's nest to fire on the British as they went to their well for water. The British immediately raised the white flag signifying surrender. Once again Francis Marion's ragged guerrilla troops had defeated the British in a clever, fox like manner. This episode added even more credence to Francis Marion's legendary nickname of "The Swamp Fox." His men, known for their ability to hide themselves in trees, make plates out of bark, and live for days on nothing but sweet potatoes and water, were greatly admired.

SOCIOECONOMIC ENVIRONMENT

In 1790, South Carolina's total resident population numbered 249,073 people. According to data collected in 2003, the U.S. Census Bureau estimated the population of South Carolina to be 4,147,152 people, a 3.4 percent increase from 2000. South Carolina saw a 15.1 percent population increase from 1990 to 2000. The average population density in this state is 133.2 people per square mile (U.S. Census Bureau 2005).

Of the over 19 million acres of land in the state, seven percent (over 1.3 million acres) is publicly owned, while 93 percent (17,912,789 acres) is privately owned. The vast majority of the state is characterized as non-federal rural lands (non-federal referring to all lands in private, municipal, state or tribal ownership). Land use on non-federal lands in the state, which total 18,115,500 acres, is primarily forestland. South Carolina saw a twenty percent increase in developed lands between 1992 and 1997 (USDA 2000) and continues to see similar rates of conversion in land use.

As of 2002, there were approximately 4.85 million acres in agricultural production in South Carolina (USDA 2003). In 1982, there were approximately 5.5 million acres in agricultural production, which amounts to a 12 percent drop in twenty years. The average farm in South Carolina was approximately 197 acres in size in 2002; up two percent from an average of 193 acres in 1997 (USDA 2003). The

market value of agricultural products sold in 2003 totaled over $1.6 billion with top outputs in poultry, tobacco, and greenhouse/nursery production. Counties in South Carolina with the highest agricultural yields in 2002 were Lexington, Kershaw, York, Dillon and Orangeburg (USDA 2003).

South Carolina is rich in non-fuel raw minerals with a total of over $506 million produced in 1997 (US Department of the Interior 1998). The most common minerals produced in South Carolina are: cement, clays, gemstones, peat, sand, gravel, and crushed stone. In 1997, South Carolina was the top producer of vermiculite, ranked fourth in masonry cement, sixth in common clays, third in kaolin, and fifth in crude mica. Portland cement and crushed stone were estimated at $193 and $155 million, respectively, for 1997.

According to results of the USDA Forest Service Inventory Analysis (FIA) published in 2000, 12.3 million acres of land in South Carolina is forested (Conner and Sheffield 2000). Non-industrial private owners, including individual and corporate timberland owners not associated with the forest product industry, own 74 percent of these lands. Timberland ownership under corporate control has increased in recent years to 19 percent or 2.0 million acres. The percentage of forests managed by the forest products industry has decreased 14 percent, from 2.3 million to 2.0 million acres over the FIA study period. Public land ownership increased to 1.2 million acres. Total softwood production increased 14 percent to 9.2 billion cubic feet, while hardwood production increased just over 4 percent to 10.2 billion cubic feet.

FISHING

In 2001, 812,000 state residents and nonresidents, 16 years old and older, fished in South Carolina. Of this total, 571,000 anglers (70 percent) were state residents and 241,000 anglers (30 percent) were nonresidents. Anglers fished a total of 10.7 million days in South Carolina— an average of 13 days per angler. State residents fished 9.8 million days, 91 percent of all fishing days within South Carolina compared to nonresidents who fished 910,000 days—9 percent of all fishing days in the state.

Anglers, 16 years old and older, spent $559 million on fishing expenses in South Carolina in 2001. Trip-related expenditures, including food and lodging, transportation, and other expenses, totaled $318 million—57 percent of all their fishing expenditures. They spent $127 million on food and lodging and $64 million on transportation. Other trip expenses, such as equipment rental, bait, and cooking fuel, totaled $127 million. Each angler spent an average of $400 on trip-related costs during 2001. Anglers spent $228 million on equipment in South Carolina in 2001, 41 percent of all fishing expenditures. Fishing equipment (e.g., rods, reels, and line) totaled $79 million—35 percent of the equipment total. Auxiliary equipment expenditures (e.g., tents and special fishing clothes) and special equipment expenditures (e.g., boats and pickups) amounted to $148 million, 65 percent of the equipment total. Special and auxiliary equipment items are items that were purchased for fishing, but could be used in activities other than fishing. The purchase of other items, such as magazines, membership dues, licenses, permits, stamps, and land leasing and ownership, amounted to $13 million—2 percent of all fishing expenditures.

HUNTING

In 2001, there were 265,000 residents and nonresidents 16 years old and older who hunted in South Carolina. Resident hunters numbered 221,000 accounting for 83 percent of the hunters in South Carolina. There were 44,000 nonresidents who hunted in South Carolina—17 percent of the state's hunters. Residents and nonresidents hunted 4.7 million days in 2001, an average of 18 days per hunter. Residents hunted on 4.4 million days in South Carolina, or 94 percent of all hunting days, while nonresidents spent 307 thousand days hunting in South Carolina, 6 percent of all hunting days.

Hunters 16 years old and older spent $305 million in South Carolina in 2001. Trip related expenses, such as food and lodging, transportation, and other trip costs, totaled $96 million, 31 percent of their total expenditures. They spent nearly $36 million on food and lodging and $42 million on transportation. Other expenses, such as equipment rental, totaled $18 million for the year. The average trip-related expenditure per hunter was $361. Hunters spent $158 million on equipment—52 percent of all hunting expenditures. Hunting equipment (e.g., guns and ammunition) totaled $108 million and comprised 68 percent of all equipment costs. Hunters spent $50 million on auxiliary equipment (e.g., tents and special hunting clothes) and special equipment (e.g., boats and pickups), accounting for 32 percent of total equipment expenditures for hunting. Special and auxiliary equipment items are items that were purchased for hunting but could be used in activities other than hunting. The purchase of other items, such as magazines, membership dues, licenses, permits, and land leasing and ownership, costs hunters $52 million—17 percent of all hunting expenditures.

WILDLIFE WATCHING ACTIVITIES

In 2001, 1.2 million U.S. residents, 16 years old and older, fed, observed, or photographed wildlife in South Carolina. Approximately 88 percent—1 million of the wildlife watchers—enjoyed their activities close to home and are called "residential" participants. Those persons who enjoyed wildlife at least 1 mile from home are called "nonresidential" participants. People participating in nonresidential activities in South Carolina in 2001 numbered 331,000—28 percent of all wildlife watchers in South Carolina. Of the 331,000, 204,000 were state residents and 128,000 were nonresidents.

South Carolinians, 16 years old and older, who enjoyed nonresidential wildlife watching within their state totaled 204,000. Of this group, 195,000 participants observed wildlife, 100,000 participants photographed wildlife, and 87,000 participants fed wildlife. Since some individuals engaged in more than one of the three nonresidential activities during the year, the sum of wildlife observers, feeders, and photographers exceeds the total number of nonresidential participants.

Bird watching attracted many wildlife enthusiasts in South Carolina. In 2001, 742,000 people observed birds around the home and on trips. The majority, 78 percent (582,000), observed wild birds around the home while 39 percent (291,000) took trips away from home to watch birds.

Participants, 16 years old and older, spent $256 million on wildlife-watching activities in South Carolina in 2001. Trip related expenditures, including food and lodging ($56 million); transportation ($25 million); and other trip expenses, such as equipment rental ($8 million), amounted to $89 million. This summation comprised 35 percent of all wildlife watching expenditures by participants. The average trip-related expenditure for nonresidential participants was $269 per person in 2001.

Wildlife-watching participants spent $149 million on equipment—58 percent of all their expenditures. Specifically, wildlife watching equipment (e.g., binoculars and special clothing) totaled $113 million, 76 percent of the equipment total. Auxiliary equipment expenditures (e.g., tents and backpacking equipment) and special equipment expenditures (campers and trucks) amounted to $36 million—24 percent of all equipment costs. Special and auxiliary equipment items are items that were purchased for wildlife-watching recreation but could be used in activities other than wildlife-watching activities. Other items purchased by wildlife watching participants, such as magazines, membership dues, and contributions; land leasing and ownership; and plantings totaled $18 million—7 percent of all wildlife-watching expenditures.

Further information regarding fishing, hunting, and wildlife watching activities can be found in the following survey: *U.S. Department of the Interior, Fish and Wildlife Service and U.S. Department of Commerce, U.S. Census Bureau. 2001 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation.*

REFUGE ADMINISTRATION AND MANAGEMENT

LAND PROTECTION AND CONSERVATION

The increasing human population in the Clarendon County 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 lake 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 grassy fields and timber plantations, and traditional lifestyles within local communities (e.g., farming). These factors are affecting land use all around the refuge boundaries.

VISITOR SERVICES

Visitor use facilities on Santee NWR include:

- 3,500+ square foot visitor center/office with interpretive panels and exhibits
- one improved hiking/nature trail on the Bluff Unit (0.9 miles) with 600 linear feet of boardwalk and one viewing platform/observation tower
- one dirt and gravel auto tour route 7 1/2 miles in length on the Cuddo Unit
- one unimproved hiking trail (ca. 3/4-mile) on the Dingle Pond Unit
- two unimproved hiking trails (total length 3 1/2 miles) on the Cuddo Unit
- four miles of dirt and gravel roads on the Pine Island Unit suitable for hiking and/or bicycle riding

In addition, the refuge is home to the Santee Indian Mound, the only such site in South Carolina open to the public. An interpretive sign and refuge literature, along with stairs leading up to an observation deck, are available to visitors to this site. The Indian Mound was also used as an outpost by the British during the Revolutionary War. Its capture by Francis Marion's troops in April 1781 was an important turning point for the war in South Carolina.

The refuge staff leads special presentations, programs and environmental education activities for schools, civic organizations, and other special groups as requested when personnel are available.

Potential for increasing visitation and outreach efforts is high (see enclosed suggestions for improvements to the primary visitor contact area – the Bluff Unit and the Visitor Center/Office complex - submitted by Cheryl Simpson, former Chief of Visitor Services in the Service's Regional Office. With the transfer of a park ranger (public use) in January 2002, efforts began to improve visitor services and accomplish as many of these recommendations as possible. Progress is slowly being made to bring visitor services and facilities up to Service standards.

Annual visitation for the refuge averages 160,000 visits per year (Table 2), with the majority of the non-consumptive visits recorded for activities related to wildlife observation and the use of refuge trails and the auto tour route on the Cuddo Unit. Fishing tops the list of consumptive activities, with hunting programs comprising less than three percent of the total.

Table 2. Three-year summary of primary public uses - Santee NWR

Visitor Use Category	Number of Visits			
	FY 2002	FY 2003	FY 2004	Average
Total Number of Visits	**160,000**	**163,500**	**164,700**	**162,733**
Talks/Tours	735	2,185	2,375	1,765
Visitor Center/Contact Stations	21,800	29175	30,600	27,192
Foot Trails	13,500	16,300	16,700	15,500
Boat/Canoe	42,000	50,400	51,300	47,900
Auto	26,000	33,400	35,000	31,466
Teachers (Workshops, etc.)	0	0	0	0
Students Taught (on-site)	700	675	765	713
Students Taught (off-site)	450	530	230	403
Non Staff Conducted (students-on andoff site)	200	745	200	382
Hunting (Migratory Birds – Mourning Dove)	1,300	575	600	825
Hunting (Upland Game – Squirrel)	150	300	325	258
Hunting (Big Game – Deer)	2,600	2,000	2,400	2,333
Fishing (Freshwater)	40,000	52,300	54,200	48,833
Recreational Boating	9,000	7,250	5,000	7,083
Other (picnicking, camping, jogging, etc.)	700	500	600	600
Group Presentations	200	630	415	415
Exhibits	500	70,625	60,000	43,708
News Releases	8	15	12	12
Radio/TV Spots		4	0	1
Special Events		10	8	9

Outreach and Environmental Education

A total of 1,418 participants were reached by sixteen outreach/environmental education events conducted on-site during FY 2004. Groups and activities varied from the 1,000 adults and children who enjoyed two days of Revolutionary War history and wildlife exhibits for the "Victory at Fort Watson" celebration held in October 2003, to the 35 individuals on hand for a bird walk, scavenger hunt, "natural" bird sculptures, and other activities celebrating Migratory Bird Day in May 2004.

Off-site outreach efforts in FY 2004 included exhibits and demonstrations set up at numerous events (e.g., Palmetto Sportsmans Class, Southeastern Wildlife Exposition, and National Tourism Day at the South Carolina Welcome Center) along with special programs presented to retiree groups, civic groups, and schools. Refuge staff also assisted with Orangeburg Fish Hatchery's annual fishing day that attracted 350-400 individuals. An estimated 70,000+ persons attended and/or viewed these events.

Santee NWR is host to one of the most popular Audubon Christmas Bird Counts in the Carolinas. With recorded observations of 296 species, it is easy to understand why the refuge is considered one of the best inland birding areas in the state. The 2003 count was conducted on December 27, 2003, with thirty-seven participants logging 380 miles in 92 hours. Sightings of interest included grasshopper sparrow, red-breasted nuthatch, peregrine falcon, LeConte's sparrow, and seventeen bald eagles.

Hunting and Fishing

It is difficult to estimate the number of visits made for recreational fishing each year. The public is allowed to fish in refuge waters included within the boundaries of Lake Marion and from several impoundments located within the interior of refuge units. All water areas of the refuge are open to public fishing. An estimated 45,000 to 50,000 visits are made annually to fish these waters.

Hunting activities allowed on the refuge include:

- Raccoon and Opossum Hunt (10 days)
- Mourning Dove Hunt (13 days)
- Primitive Weapons Hunt for Deer (Pine Island Unit) (6 days)
- Archery Hunt for Deer (Cuddo Unit) (6 days)
- Primitive Weapons Hunt for Deer (Cuddo Unit) (6 days)

Refuge Volunteers

Ninety-one volunteers contributed a total of 4,364 hours of work during Fiscal Year 2004. The number and variety of individuals interested in helping Santee NWR conduct management and public use programs is indeed impressive. The potential for growing the volunteer program here is substantial. Existing volunteers are energetic and are especially interested in improving the refuge's public image and exposure. Volunteer activities range from assistance with special events to maintenance of equipment, buildings, roads, and facilities.

Friends of Santee National Wildlife Refuge

On January 17, 2002, the refuge hosted an organizational meeting to gauge local interest in establishing a refuge support group. After hearing pertinent details, the group of twenty individuals gathered for this meeting decided to pursue organizing and officially establishing the Friends of Santee National Wildlife Refuge. Their charter and articles of incorporation were approved in May 2002.

In October 2004, the group signed a Cooperating Association Agreement with Santee NWR. Since its establishment, the group has been primarily involved in activities to improve visitor use facilities and promote the refuge to local and regional audiences. However, a number of the members of this group are active in refuge management activities (i.e., wood duck and winter waterfowl banding, wood duck box maintenance, casual wildlife surveys, and office assistance). Accomplishments include the highly successful annual "Victory at Fort Watson" events; partnering with Santee Cooper Public Service Authority for purchase and erection of mounted binoculars on the visitor center deck; encouraging the South Carolina Department of Transportation to erect three new signs directing visitors from I-95 to the visitor center, and seven new signs directing visitors from the visitor center to the Cuddo Unit; and allocation of a grant from the National Fish and Wildlife Foundation to establish a visitor contact station at the Cuddo Unit entrance and make other improvements to the wildlife drive.

PERSONNEL, OPERATIONS, AND MAINTENANCE

Most of the refuge uplands are owned in fee title, with the exception the water boundary of Lake Marion and the Dingle Pond Unit, which is leased from Santee Cooper. Maintaining a partnership with Santee Cooper is important to the refuge. Acquiring additional lands or leases in the future would benefit Santee NWR. The refuge extends for 18 miles along the northern shore of Lake Marion. It protects 15,095 acres in four distinct separate units. Unique natural and cultural resources found on the refuge include a Carolina Bay and the Santee Indian Mound (used as both a ceremonial and burial mound). British troops erected Fort Watson atop the mound during the Revolutionary War only to have it taken by Francis Marion's colonial troops in April 1781. The refuge is located in the largely rural/agricultural part of Clarendon County where land interest and value are quickly increasing as the area becomes a resort area.

The size and complexity of the refuge are depicted in the infrastructure required to support the refuge. The refuge has an inventory of over 33 miles of maintained roads, 4 miles of trails, and 6 miles of dikes; a 7-mile auto wildlife drive; 6 buildings; 2 boat ramps; unimproved parking lots; and 6 pumps. There are 13 pieces of heavy equipment; 9 motor vehicles, including 5 tractors, 3 bulldozers, 1 backhoe, 1 tracked-excavator, 1 dump truck, 1 tractor trailer, and 1 rollback transport truck. There are 3 all-terrain vehicles; 3 boats; and 15 farm implements, such as disc, plows, planters, and rotary cutters needed to manage refuge habitat and facilities.

The refuge currently has 8 permanent staff members: one staff member is being transferred (refuge officer) to the Refuge Complex headquarters and another position is targeted for abolishment (office assistant) under Service's regional work force plan. The remaining 5 positions are directed toward the administration, biological, public use, and maintenance programs. Figure 10 outlines the current staffing chart. Historically, the refuge supported as many as 16 seasonal and permanent staff members. There are 6 regular volunteers who annually contribute 2,500 hours to the refuge. Another 90 volunteers only work occasionally and can contribute an additional 2,200 hours. All staff members have office space in the refuge visitor center except for the equipment operators, who use the maintenance shop office, and the refuge officer, whose office is located at Waccamaw NWR. The refuge uses the District Fire Management and Wildland Urban Interface staff members who are headquartered at the Savannah NWR Complex. The district fire management staff serves refuges at both the Lowcountry and Savannah NWR Complexes. All units of the refuge are currently open to public access with a 7-mile auto wildlife drive located at the Cuddo Unit. Annual visitation to the refuge averages 130,000 to 160,000 visits per year, with the majority of the non-consumptive visits recorded for activities related to wildlife observation and the use of refuge trails, and the auto tour

route on the Cuddo Unit. Fishing tops the list of consumptive activities, with hunting programs comprising less than three percent of the total. Special use permits govern research and other access into these refuges.

Primary refuge facilities and equipment are located on the Bluff Unit. The refuge shop consists of a 3-bay enclosed equipment/vehicle shop and one attached open bay; a wood working shop; a fire cache; a small equipment storage shed; a chemical storage shed with one open (i.e., outside) equipment bay attached; a fuel depot; a grain bin; and a fenced compound. There is an additional open equipment storage shed, and a 1-bay metal storage building on the western Bluff unit. There is one fenced compound storage area on the Pine Island Unit.

There are 31 water control structures that facilitate water management and 6 permanent, diesel-operated pumping stations. The control system services 18 managed impounded wetlands on the refuge.

This Draft CCP/EA recommends converting one park ranger position to one biological technician within five years of CCP approval, restoring one full-time law enforcement officer and one administrative assistant, and adding an additional biological technician and one temporary forester (Figure 11).

Figure 10. Current organization chart for Santee NWR

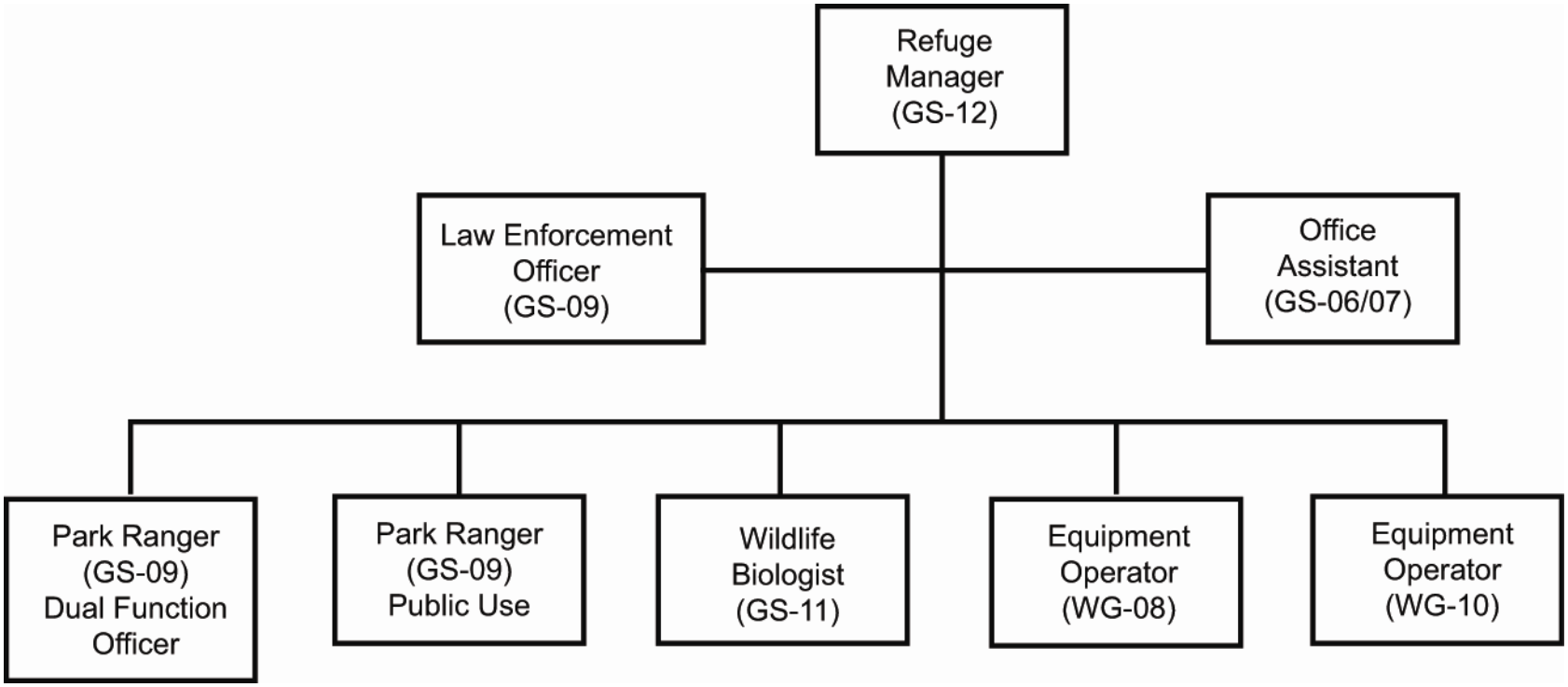
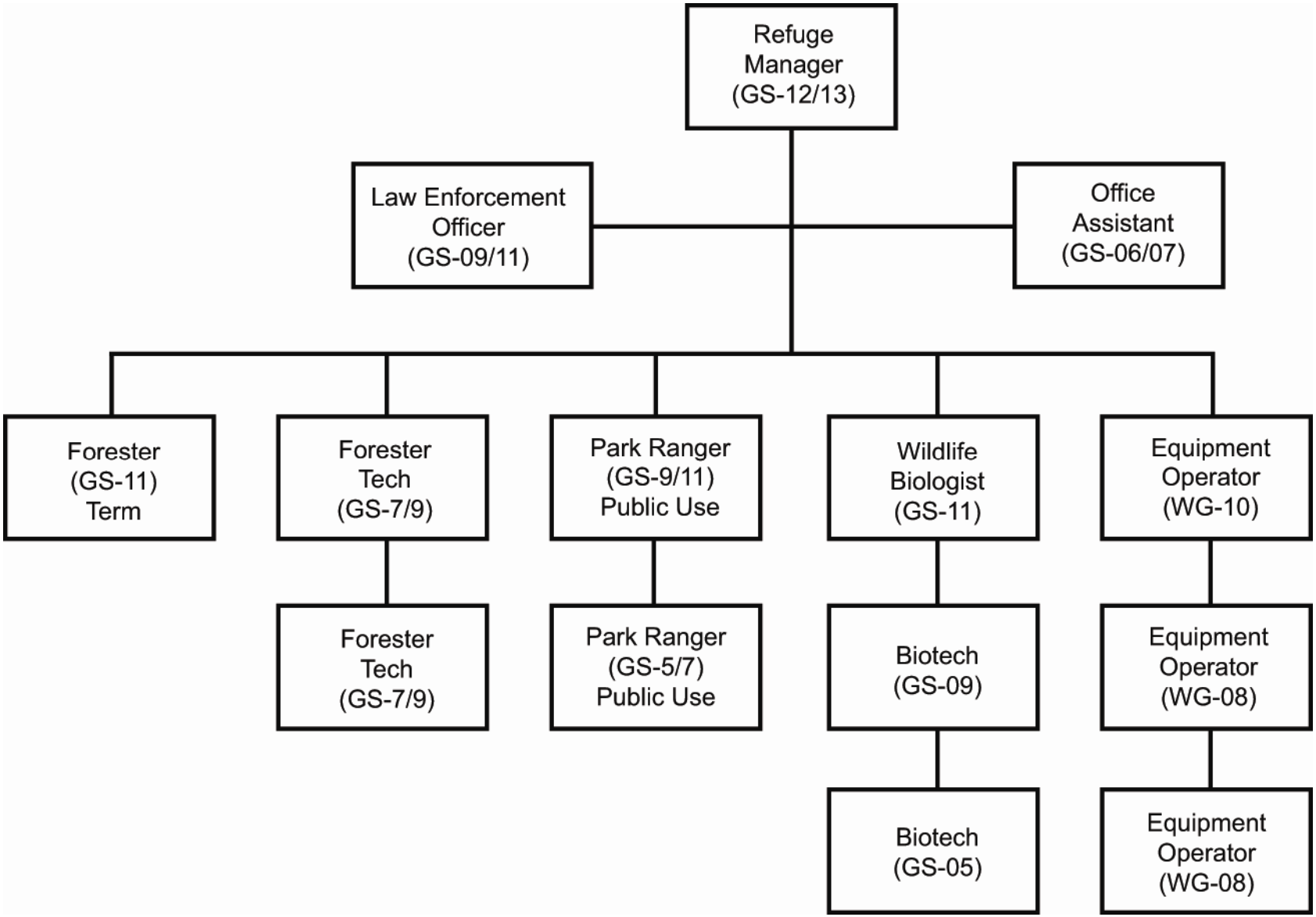


Figure 11. Proposed organizational chart for Santee NWR



III. Plan Development

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 public scoping meetings, planning team meetings, 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 identified 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 MANAGEMENT

- Ensure wintering needs (e.g., forage and sanctuary) of migratory Southern James Bay Canada Geese, with emphasis on high-caloric foods, green browse, improved agricultural crops, and reduction of impact of deer/resident geese on available foods. This is to include a partnership with the SCDNR to conduct a study of both migratory and resident geese to assist the state in determining the impact of hunting on migratory geese and determine if an expanded hunt on resident geese is feasible.
- Encourage and promote management and monitoring activities to increase wood duck productivity.
- Evaluate ways to increase wintering waterfowl numbers.

HABITAT MANAGEMENT

- Ensure up-to-date maintenance, rehabilitation, and replacement of the refuge's water management and water delivery capabilities to meet migratory bird objectives (focus on waterfowl, waterbirds, and marsh birds) and to include a comprehensive understanding of the ecology of wetlands and enhanced health of the wetland vegetative communities for all migratory birds. Monitor the impact of captive-reared mallards on food resources produced for migratory waterfowl.
- Continue perpetuation of early successional grassland, scrub/shrub communities on the abandoned agricultural fields, including emphasis on adapted management linked to ongoing (i.e., off-site) and former old-field research studies. To include an evaluation of the number and size of fields and determine the feasibility for reforestation of some fields in native, desirable forest communities (e.g., carbon sequestration programs) if possible.
- Improve forest management to enhance under-story and mid-story vegetation densities for several key groups of non-game birds (need an updated Forest Management Plan). Partnership with the SCDNR to establish breeding bird surveys on the refuge; obtain technical assistance through an existing Memorandum of Understanding, and on recommendations for management of key species as identified in the CWCS and the South Atlantic Migratory Bird Initiative.

- Control exotics and invasive non-desirable plant communities on upland and wetland sites. Develop partnerships with Santee-Cooper and other agencies for the control of exotic species.
- Work with Santee-Cooper and State to explore possibility of encouraging native submerged aquatic plants into main reservoir backwaters and coves associated with the refuge and controlling grass carp impacts to native species. Work with SCDNR and others to establish desirable, native wetland plant communities for enhanced migratory bird management.
- Update the existing Forest Management Plan. A critical need exists for a forester to update the plan and provide direction for forest resource management, including harvesting and mechanical thinning.
- Continue present work to evaluate the Wetland Management Plan on all units and develop an updated, formal plan to include reconstruction and repair of dikes on the Cuddo Unit, to replace and install additional water pumps to maintain adequate water flow capabilities on all refuge units, and to evaluate the dike systems and water control structure locations on all units for enhanced water management capability.
- Update the 2001 Fire Management Plan. The plan was well-prepared; however, it needs to be updated to include current resource management objectives. The Biological Review Team was concerned with the direction towards managing mixed hardwoods through mostly dormant season burns. However, there was a split opinion on the frequency, season, and use of fire in the mixed hardwood community. The present burn plan needs to have targeted resource conservation objectives that are linked to state and national plans, such as, the Comprehensive Wildlife Strategy, Atlantic Coast Joint Venture, and SAMBI, such that the resulting forest treatments will be providing habitat to identified key migratory bird species. The practice of burning and/or mechanical manipulation needs to be clearly addressed relative to habitat types, safe fuel reduction, migratory birds, and other native species.

RESOURCE PROTECTION

- Pursue acquisition of additional property around Dingle Pond and other units to provide a clearly defined boundary and buffer from increasing local land development. Include working with SCDNR and Santee-Cooper to promote environmental stewardship efforts and an understanding of how future landscape changes (i.e., development) will impact adjacent refuge habitats. Encourage Santee-Cooper to look at the potential of buffers zones that could be created by reestablishing former refuge boundary lines. For example, a request has been made to Santee-Cooper to reestablish the former water boundary line at the Dingle Pond, Polly-Cantey Bay area. Additional buffers have also been requested along the Bluff Unit and Cantey Bay area.
- Develop an understanding of local demographic changes with respect to how increased human population growth will impact user demand and also impact refuge programs and resources.
- Restore the hydrology of Dingle Pond so that it actually functions like a Carolina bay.

VISITOR SERVICES

- Develop a regional coalition of “outreach” partnerships that could link nearby conservation areas and programs, assist with educational and interpretive programs, and enhance local/regional awareness of the refuge. Include a coordinated effort to determine the feasibility of developing a birding festival at Santee NWR that would bring together local and regional partners.
- Determine the condition of existing public use trails and other facilities; determine needed maintenance and improvements for safe, compatible, and appropriate uses.
- Maintain quality hunting and fishing opportunities.
- Maintain quality wildlife observation and wildlife photography opportunities.

REFUGE ADMINISTRATION

- Develop the refuge volunteer program to include volunteers to assist with the biological program, including bird monitoring, water quality monitoring, and/or other activities that volunteers could do, depending on their levels of expertise.

Wilderness Review

Refuge planning policy requires a wilderness review as part of the comprehensive conservation planning process. The Wilderness Act of 1964 defines a wilderness area as an area of federal land that retains its primeval character and influence, without permanent improvements or human habitation, and is managed so as to preserve its natural conditions and which:

- 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 primitive and unconfined type of recreation;
- has at least 5,000 contiguous roadless acres or is of sufficient size to make practicable its preservation and use in an unimpaired condition;
- 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; and
- may contain ecological, geological, or other features of scientific, education, scenic, or historic value.

SUMMARY OF REFUGE WILDERNESS REVIEW

A proposal for wilderness designation of 163 acres of island habitat at Santee NWR was finalized on March 25, 1975, and submitted for congressional approval. No official action was taken by Congress at the time to include the islands as part of the National Wilderness Preservation System. In 1993, and again in 1999, official requests from Congress for information regarding the Santee NWR wilderness proposal were made, thus indicating that the proposal was still viable for consideration. However, no official legislative action has yet been taken by Congress.

The proposed Santee NWR Wilderness Area consists of 13 islands in Lake Marion. These islands comprise 163 acres and are split between two of the four refuge management units. The Cuddo Unit includes the Plantation Islands, and the Pine Island Unit includes Pine Island. The islands range in size from the 22-acre Pine Island to less than one acre in the Plantation Islands.

Historically, the timber in the area was actively harvested and agricultural land was actively farmed prior to the creation of Lake Marion when the hydroelectric dam was built. Natural regeneration had restored much of the wilderness character of the islands in 1975, and presently the islands exhibit even greater wilderness character because of nearly 70 years of forest growth. The islands contain a mix of pine and hardwood forests.

The Wilderness Act specifies that proposed wilderness areas are to be managed as wilderness pending congressional approval. The proposed Santee NWR Wilderness Area has been managed as wilderness since 1975, and will continue to be treated as wildness in perpetuity.

The Service analyzed other refuge lands within the planning area and found no additional areas that meet the eligibility criteria for a Wilderness Study Area as defined by the Wilderness Act.

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 Improvement Act 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 CCP for managing the refuge over the next 15 years. This proposed management direction contains the goals, objectives, and strategies that will be used to achieve the refuge vision.

Three alternatives for managing the refuge were considered:

ALTERNATIVE A – CONTINUE CURRENT MANAGEMENT (NO ACTION)
ALTERNATIVE B – TARGETED HABITAT MANAGEMENT PRIMARILY FOR WATERFOWL
ALTERNATIVE C – WILDLFE AND HABITAT DIVERSITY (PROPOSED)

Each of these alternatives is described in the EA. The Service chose Alternative C as the proposed management direction.

Implementing the proposed alternative would result in a greater amount of effort to manage the refuge to increase overall wildlife and habitat diversity. Waterfowl would remain a focus of management. However, wetland habitat manipulations would also consider the needs of multiple species, such as marsh and wading birds. Management of upland forests and fields for neotropical migratory birds would be more actively managed, and landscape level consideration of habitat management would include a diversity of open fields, upland and wetland forests, and additional managed wetlands. Multiple species consideration would include species and habitats identified by the South Atlantic Migratory Bird Initiative and the CWCS.

The proposed alternative would expand monitoring efforts to provide additional, active efforts to monitor migratory neotropical and breeding songbirds, and other resident species. Monitoring efforts would be increased with the assistance of additional staff, trained volunteers, and academic research. Greater effort would be made to recruit academic researchers to the refuge to study and monitor resources.

Wildlife-dependent uses of the refuge would continue. Hunting and fishing would continue to be allowed. However, hunting would be managed with a greater focus to achieve biological needs of the refuge, such as deer population management. Education and interpretation would be the same as Alternative A but with additional education and outreach efforts aimed at the importance of landscape and diversity. A much broader effort would be made with outreach to nearby developing urban communities and a growing human population.

The refuge would be staffed at current levels plus the addition of biological technicians to carry out the increased habitat management and monitoring needs. Greater emphasis would be placed on recruiting and training volunteers. Refuge biological programs would actively seek funding and researchers to study primarily management-oriented research needs. Refuge staff would place greater emphasis on developing and maintaining active partnerships, including seeking grants to assist the refuge in reaching primary objectives.

VISION

Through a motivated, experienced, and well-trained staff and volunteers and with active participation of partners, Santee NWR will strive to maintain its unique ecological landscape features. Through team development, the refuge will strive to be a model of excellence in natural resource management and celebrate achievements with the public and our partners. The management of wildlife and habitat on the refuge will be an adaptive, science-based, comprehensive endeavor that links biological needs with resource management. The refuge will actively seek partnerships to further conservation stewardship and protection of natural resources. We will actively seek research to support the informational needs of the refuge, being able to adapt and being responsive to change. We will seek and develop appropriate and compatible public use opportunities and enhance awareness and appreciation of the refuge and the National Wildlife Refuge System. The refuge will work in partnership with the State, local agencies, non-governmental organizations and others to coordinate and enhance resource management, visitor services, and protection. Neighboring communities will support and understand the refuge and appreciate how it enhances the quality of their lives. Through outreach and public participation, the community will share in the values of the National Wildlife Refuge System to ensure a fish and wildlife heritage for all Americans.

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 Improvement Act, the mission of the Refuge System, and the purposes and vision of Santee NWR. The Service intends to accomplish these goals, objectives, and strategies within 15 years following approval of the Final CCP.

WILDLIFE AND HABITAT MANAGEMENT

Goal 1. Threatened and Endangered Species
Conserve, protect, and enhance populations of rare, threatened, and endangered species of plants and animals at existing or increased levels on the refuge and conserve, protect, manage, and restore native South Carolina coastal plain habitats occurring on the refuge to contribute to recovery goals.

Objective 1.1. Provide and protect foraging habitat to support wood stork recovery efforts.

Discussion: Wood storks are federally listed as an endangered species (USFWS 1997). Wood storks are listed as rare on the most recent refuge bird list; however, they have been observed more frequently utilizing the refuge wetlands. The highest number recorded on the refuge was 41 birds (B. Good, personal observation 1999), but they typically feed in small groups consisting of 10 birds or less. However, in 2007, over 100 were observed in Monkey Bay (contiguous to Cantey Bay) in one feeding group (M. Epstein, personal observation). Typically attracted to shallow ponds, the refuge can provide habitat with seasonally fluctuating wetlands, where they generally are observed feeding along with other wading and diving birds. To date, no wood stork nesting activities have been recorded on the refuge or elsewhere in Clarendon County (E. Daly, personal communication). Some storks may be adapting to residing year-round as evidenced by winter sightings of storks on the refuge and numerous verbal reports of wood storks being sighted approximately 12 miles northwest of the refuge at a commercial crawfish farm.

Strategies:

- Provide ample foraging habitat on the refuge with preferred water depths and quality habitat.
- Coordinate with local birding groups and individuals to census off refuge wood storks on a year-round basis to determine if additional habitat requirements are needed.
- Reevaluate the status of the wood stork on the refuge and make necessary changes to the bird list.

Objective 1.2. Annually maintain, monitor, and protect a minimum of two bald eagle nesting sites and appropriate roosting areas.

Discussion: The bald eagle (*Haliaeetus leucocephalus*) is present year-round on the refuge with the majority of observations occurring during migration periods. There are two bald eagle nests on the Pine Island and Cuddo units. The bald eagle was officially taken off the endangered species list in June 2007, but it will remain in a protected status under the Bald and Golden Eagle Protection Act and the Migratory Bird treaty Act. The refuge staff continues to provide secure nesting and roosting sites; however, immediately off the refuge boundary there has been at least one recent incident where an eagle was shot. Management of eagles on the refuge include occasional nest checking from the ground, conducting midwinter bald eagle surveys, and obtaining aerial nesting results from the SCDNR as they become available.

Bald eagle habitat encompasses not only nesting substrate, but also foraging areas, perch trees, and areas devoid of disturbance. The impoundments and marshes on the refuge, along with the Santee-Cooper lake system both on and adjacent to the refuge provide ample foraging habitat. While these areas are not specifically managed for eagle foraging, activities aimed at maintaining populations of migratory waterfowl provide abundant prey for the eagles. Fishery resources in the refuge and lake system also provide an important food source.

Strategies:

- Monitor existing eagle nest sites and conduct a nest tree site characterization to determine if other suitable sites exist on the refuge. Sites will be recorded using GPS and mapped using GIS analysis. This information will be shared with other agencies and the fire management team for management and protection of the sites.
- Nesting trees will be protected during prescribed fires and proper smoke management will be employed when eaglets are present. Reduction of vegetation under the nest tree immediately prior to the ignition of a prescribed fire can prevent harm to nest trees.
- Coordinate with state and federal law enforcement agencies for the protection of eagles on or near the refuge.
- Send any dead eagles found on or adjacent to the refuge to the National Eagle Repository per Service policy for the collection, storage, and distribution of dead bald eagles and their parts, or to a cooperative wildlife disease unit for determination of cause of death.
- Evaluate forest habitats to identify and protect suitable bald eagle nest trees to provide additional and future nest sites.

Goal 2: Migratory Birds
Maintain and actively manage refuge wetlands and uplands primarily to contribute to migratory bird priorities of the refuge and South Carolina coastal plain physiographic area, while providing consistency with state, regional, and national goals.

Objective 2.1. Waterfowl
Upon CCP approval, maintain a minimum of 685 acres of managed wetlands, including 55 acres of planted corn (or other quality grain crop); 350 acres of moist-soil/submerged aquatic vegetation; and 400 acres in managed greentree reservoirs to support a minimum wintering population of approximately 15,000 ducks (Bernie Good, personal observation) from November through February (120 days).

Discussion: Currently, Santee NWR provides wintering habitat to support peak numbers of approximately 15,000 -18,000 ducks in recent years (Bernie Good and Larry Woodward, personal observation). This figure includes waterfowl utilizing wetland habitats in both optimum and poor management conditions (approximately 50 percent of the refuge's wetland habitats are in relatively poor management condition). However, Santee NWR is committed to upgrading the wetland management program. Plans for wetland management improvements have been implemented over the past few years and additional improvements are presently underway.

Objective 2.2. Waterfowl
Upon CCP approval, annually evaluate and increase the acreage of wetland habitats in good to excellent condition to accommodate any increases in wintering waterfowl populations. This would include maintaining 685 acres in good condition while improving 700 acres in relatively poor management condition.

Objective 2.3. Waterfowl
Within two years of CCP approval, conduct a GIS analysis of refuge wetlands to evaluate current and potential wetland management opportunities based on hydric soil overlays.

Discussion: The Santee Cooper focus area, at one time, was nationally known as a mecca for wintering waterfowl, consisting primarily of mallards (personal observation, Larry Woodward). The establishment of the Santee NWR was instrumental in attracting these waterfowl to this focus area. Historically, peak waterfowl numbers using refuge managed wetlands and lake margins were over 170,000 ducks in the late 1970s. However, there have been significant changes in the size of the Santee NWR since establishment in 1941. When established, the refuge consisted of around 125,000 acres, which included most of the open, deep water habitat of Lakes Marion and Moultrie. In an agreement with Santee-Cooper, the refuge size was reduced to 70,000 acres because managers did not feel they could effectively manage the large open water habitats. The refuge boundary was further reduced to 15,000 acres in 1975. Additionally, there have been significant declines in overall waterfowl habitat suitability within the Santee Lakes drainage system that once supported vast natural wetlands prior to the creation of the lakes, which may have adversely affected wintering waterfowl in the region (B. Baker, personnel communication).

Waterfowl numbers remained on an upward trend until 1978, which suggest some of the most important waterfowl areas still remain within the existing boundary. The most dramatic declines in waterfowl numbers began throughout the 1980s and continued in the 1990s. Waterfowl habitat conditions within public water portions of Lake Marion have undergone many changes since the 1980s due to management objectives of the Santee-Cooper (e.g., grass carp, exotic aquatic vegetation, herbicides, and water level management). The most obvious examples of habitat change that could have adversely influenced waterfowl within the lake portion of the refuge is the loss of massive button bush (*Cephalanthus occidentalis*) flats and the invasion of large cut grass (*Zizaniopsis miliacea*) fields occupying the most valuable waterfowl use areas (Harold Furze, personal communication). Many variables attributed to the decline in wintering waterfowl numbers in the Santee Cooper Focus Area. Continental waterfowl numbers and duck hunting opportunities also started declining in the mid 1980s across the country (Division of Migratory Bird Management 2003). Factors such as short stopping in northern latitudes have added to declines at Santee NWR. As duck numbers started declining on the refuge, there was an apparent decrease in management operations for ducks in the 1990s. Some changes that affected refuge operations included a reduction in staff and a change in management direction. Since 2000, with a renewed focus on migratory waterfowl, wintering numbers have consistently increased every year, peaking at approximately 18,000 birds counted during recent winters (Larry Woodward, personal observation). During the 2006-2007 state mid-winter waterfowl survey, Santee NWR ranked the second most important public area in South Carolina for non-coastal ducks (SCDNR Midwinter Waterfowl Survey 2006-007). However, a recent review of waterfowl counts showed high annual and monthly variation in duck numbers on the refuge.

The future of waterfowl populations on Santee NWR is one of the highest priorities and greatest challenges for Santee NWR, which is linked directly to the purpose and establishment of the refuge. Managed habitats differ in their ability to provide food and cover and can depend on many environmental variables that influence vegetative production and quality (Stader and Stinson 2005). Variability in annual environmental conditions can influence habitat productivity (e.g., drought, flooding, stress, insects, and depredation) causing a decrease in food production. Providing a wetland complex with diversity among habitats is important and enhances the refuge's ability to provide optimum wintering habitats. Primary habitats at Santee NWR include agriculture, moist soil/submerged aquatic vegetation, and greentree reservoir.

Migratory waterfowl feeding ecology is a complex of interactions of their nutritional demands, habitat availability and quality, and waterfowl behavior (Heitmeyer 1985). How waterfowl use wetlands is further influenced by various external factors such as, landscape development and levels of disturbance. Feeding habits reflect the energy demands from low temperatures, dispersal over wintering habitats, preparing for reproduction (pair bonding and egg production), and molting from "winter" plumage to breeding plumage. Waterfowl breeding success has been linked to the quality of wintering areas and the condition of the birds when they return to the breeding ground. Therefore, waterfowl that reach a high nutritional plain on the wintering grounds have better chances of returning and nesting.

Agricultural crops have become especially important to waterfowl as a quick energy source to increase their lipid stores during migration. Agricultural crops or grains that have a high caloric value are also known as "hotfoods." Wintering waterfowl are attracted to and use agricultural crops as an easily obtainable energy source; however, natural vegetation and invertebrates are required to supplement their protein and nutritional requirements. Waterfowl diets will change during the winter from hotfoods (lipid stores during energy demanding activities like dispersal and migration) to the need for natural foods (e.g., native vegetation and invertebrates for protein and nutrition) to supplement their needs for egg and feather production. The switch in diet will reflect the seasonal shift in waterfowl activities (e.g., wintering to molting and breeding). The seasonal shift in diets also corresponds to seasonal changes in water depth, wetland conditions, warmer temperatures, and increased availability and production of invertebrates and other natural foods.

Reinecke and Kaminski (2007) estimated the carrying capacity of various foraging habitats for the Lower Mississippi Valley Joint Venture Working Group. This carrying capacity was based on duck energy days (DED), which equates to the average number of ducks that can obtain daily energy requirements from one acre of habitat for one day. Based on the most accurate data available, they estimated that most-soil plants provided 1,868 DED/acre, bottomland hardwoods (with approximately 40 percent red oak) provided 156 DED/acre, and one bushel of planted, un-harvested corn provided 357.4 DEDs.

Refuge staff calculated that corn production is approximately 50 bushels per acre (bu/acre). Therefore, the refuge can provide 17,870 DED/acre (50 bu/acre x 357.4 DED). With a minimum of 55 acres of corn, this can be extrapolated to 982,850 DEDs for the refuge (50bu/acre x 55 acres x 357.4 DED). Based on these calculations, the present agricultural program at the refuge can support 8,190 ducks per day over a 120-day period. With approximately 350 acres of moist-soil and submerged aquatic plants, it is estimated that an additional 5,448 ducks per day could be supported over a 120-day period. With about 400 acres of greentree reservoir, the refuge can support an additional 520 ducks per day over a 120-day period. Based on the best available research (Reinecke and Kaminski 2007), the refuge can currently support an estimated 14,158 ducks per day over a 120-day period. All total, the refuge can provide 1,698,960 DEDs over the 120-day period (14,158 x 120).

The waterfowl migration pattern at Santee NWR begins in early November and peaks in mid-winter. Thus, actual waterfowl numbers are generally much lower than the potential peak of approximately 18,000 ducks for most of the 120-day period. Based on 164 surveys between 2000 and 2006, the average monthly duck numbers for the Bluff, Pine Island and Cuddo units were 1,000 in November, 2,427 in December, 3,166 in January, and 2,690 in February (Note: these are average numbers of ducks over a 7-year period and are not peak numbers). Based on these averages, there are 275,537 DEDs actually used during the 120-day period from November through February. Therefore, the refuge currently provides a surplus of available food resources that is approximately six times greater than the amount currently required for waterfowl wintering at the refuge.

Waterfowl surveys conducted between 2000 and 2006 were used because these surveys represent a time when many improvements began at Santee NWR, and the number of surveys was sufficient to characterize waterfowl use on the refuge. There was considerable variation in monthly counts from year-to-year, which is typical of migratory duck counts. Waterfowl numbers generally peak in January, but peaks did occur in December and February in some years.

Corn or small grains produced on the refuge do not benefit from typical private landowner protection methods, such as electric fences and pesticide use that keep depredation to a minimum. As such, corn or small grain crops on the refuge are affected by insects and animals such as deer and turkey. However, the effects of this depredation are at a low level and do not adversely affect food availability for waterfowl.

With increased focus on waterfowl management in recent years, the refuge has been very successful planting a Round-Up ready variety of corn in floodable impoundments on the Bluff and Cuddo units. Additionally, the refuge has been successful in production of beneficial moist-soil plants within the flooded corn fields, providing an added food source for waterfowl. Evaluating the potential of expanding the floodable acreage planted in agriculture crops (e.g., primarily corn) on all units should be a high priority.

One of the most important factors influencing how ducks use the Santee NWR is how the landscape and land use are changing around the Santee NWR. Historically, lands and waters surrounding the refuge were considered remote, rural, and largely agricultural. Since 2000, there has been a dramatic increase in construction of “duck hunting ponds” and consistent, possibly growing hunting pressure in public portions of Lake Marion. Creation of “flooded agricultural” crops and expanded release of “captive-reared” mallards for hunting on adjacent and nearby private lands may be a significant influence on waterfowl use on and around the refuge (Division of Migratory Bird Management 2003). In previous years, more than 17,000 mallards have been released within close proximity to the refuge, with well over 60,000 mallards released statewide. Free-flight, captive-reared mallards are presently using the refuge in greater numbers and this use will be monitored.

The full effect that the increasing numbers of privately owned cultivated duck ponds (e.g. duck farms) surrounding the refuge will have on waterfowl use of the refuge is presently unknown. Duck farming and the subsequent rise in non-migratory duck numbers have greatly increased the importance of Santee NWR as a regional waterfowl sanctuary. Priorities include maintaining site fidelity and maintaining migration imprinting of migratory waterfowl using Santee NWR. However, these efforts may be greatly impacted by future landscape changes and private lands’ management surrounding the refuge. Rapid urban development and increasing property values will further reduce land available to waterfowl and will likely increase the importance of the refuge.

Strategies:

- Maintain or improve wetland units by utilizing adaptive management practices to improve habitat conditions and provide for a healthy wintering waterfowl population.
- Evaluate the need for providing additional protection and management to improved and expanded sanctuary areas (e.g., Pine Island Savannah Branch; Bluff Unit Line Island; and Cuddo Unit Plantation Islands no-motor zone).
- Monitor wintering waterfowl populations by conducting bi-monthly ground waterfowl surveys (Oct. – Mar.) for all managed wetland complexes on the refuge.

- Continue post-season waterfowl banding operations to assist SCDNR with specific state objectives, as a refuge outreach program, and to monitor a dramatic increase in captive-reared mallards using the refuge.
- Investigate feasibility of creating additional moist soil/agriculture impoundments and agricultural fields on Cuddo Unit (Q1-10) and Bluff Unit (fields 9, 12, and 13) based on soil surveys and water management options.
- Develop a feasibility plan for increasing crop acreage to accommodate any increase in wintering waterfowl numbers beyond the excess food capacity currently available.
- Monitor effects of captive-reared mallards on refuge resources. Encourage research on the impact of captive-reared mallards to migratory waterfowl use on the refuge and banding programs.
- Develop monitoring programs to evaluate the effects on potential increases of refuge recreational uses on migratory waterfowl.

Objective 2.4. Southern James Bay Canada Geese
Continue to work with primary partners, including the SCDNR, USGS, and others, to formally investigate the ecology, home range, and migration pathways of migratory Canada geese using the refuge.

Objective 2.5. Southern James Bay Canada Geese
Throughout the life of the CCP, annually maintain current agricultural practices (i.e., 55 acres of corn and 65 acres of green browse) to provide high-quality food sources for approximately 1,200 migratory Canada geese.

Objective 2.6. Southern James Bay Canada Geese
Throughout the life of the CCP, annually evaluate and expand current agricultural practices and protection on the refuge to enhance and accommodate any increases in wintering migratory Canada geese.

Discussion: Southern James Bay Canada geese are a sub-population of Canada Geese that have historically wintered at Santee NWR. These Canada geese nests along the southwestern shore of James Bay in Ontario and on Akimiski Island in James Bay, a portion of the Northwest Territories. Banding reports also suggest geese from the northeastern Hudson Bay area may be using the Santee NWR. Spring surveys on the breeding grounds indicate the breeding population has fluctuated on the breeding grounds with no evident trend. On Akimiski Island, banding data suggest pre-migration mortality in young geese may be high and that nesting habitats might be adversely impacted by expanding populations of snow geese (USFWS 2007).

Wintering as many as 39,000 Canada geese between 1960 and 1970, the population sharply declined by the late 1980s, probably due to short stopping in northern states. Since the late 1980s, the wintering migratory geese numbers have averaged 1,000 to 1,200 birds annually. Located at the southern range of the Southern James Bay Canada goose migration, the Santee NWR maintains the highest wintering population in South Carolina, and management for this species remains a high priority for the refuge.

Current acres planted on the Bluff Unit, approximately 55 acres of corn and 65 acres of winter wheat, are rotated among upland fields. This effort has been an annual minimum target to support the current wintering population of 1,000 to 1,200 geese along with other wintering waterfowl. Additionally, in 2006, approximately 40 acres of winter wheat were planted on the Cuddo Unit. An additional effort was made to clear openings between fields and Lake Marion to enhance habitat

conditions for goose use. Force account farming on the Cuddo Unit should be supplemented by encouraging cooperative farming that will benefit Canada geese as well as other migratory birds. Agricultural acres should be gradually increased to accommodate any possible population increases.

Strategies:

- Monitor wintering goose populations by conducting bi-monthly surveys (Oct. – Mar.).
- Provide adequate habitat, inviolate sanctuary, and maintain site fidelity for wintering migratory populations.
- Maintain grassy fields adjacent to lake and pond margins wherever possible.
- Maintain current agricultural practices by rotating corn and wheat (or other suitable green winter graze). Increase planted acres to provide an adequate food source for an expanding wintering goose population.
- Work with partners to conduct research and monitor migratory goose populations wintering on Santee NWR, as well as observe interactions of migratory and resident Canada geese. Assist the SCDNR in better understanding the distribution and conservation needs of the migratory geese in relation to potential expanded hunting off refuge in Clarendon County for resident geese.
- Conduct research to better understand the migratory pathways of refuge geese, including the relationship of the breeding grounds to the primary wintering/staging areas, using satellite telemetry, isotope analysis, and genetic analysis.

Objective 2.7. Wood Ducks
Throughout the life of the CCP, the refuge should put forth efforts to meet or exceed the annual quota for banding pre-season wood ducks.

Discussion: Santee NWR is one of the most, if not the most, successful wood duck banding sites with the highest annual quota and birds banded in the United States. More than 22,000 wood ducks have been banded at Santee NWR, utilizing a very successful rocket net program. However, the proliferation of a captive-reared mallard release program on wetlands surrounding the refuge appears to have significantly impacted the wood duck banding program.

Strategies:

- Continue to maintain Santee NWR wood duck banding program as one of the most successful in the country.
- Provide adequate control methods for an increasing population of captive-reared mallards using the refuge.
- Monitor the captive-reared mallard program on and around the refuge to evaluate the impacts on the pre-season wood duck banding program.
- Manage water levels and control vegetation at band sites to attract wood ducks to these areas.
- Investigate the possibility of creating another suitable wood duck banding site on the refuge that will provide enough birds to meet banding quotas.
- Use the banding program as a valuable public outreach tool to demonstrate the value of the Refuge System.

Objective 2.8. Wood Ducks
Within five years of CCP approval, initiate an artificial wood duck nest box program based on the results of an evaluation of box placement and location. This is to supplement wood duck production achieved from natural nesting cavities and to optimize production based on adaptive management of available artificial nest locations and available brood habitat.

Objective 2.9. Wood Ducks
Biological staff will record wood duck box production data annually and evaluate the program using long-term data, and determine which boxes and/or locations contribute little towards the wood duck production program.

Objective 2.10. Wood Ducks
Within two years of CCP approval, evaluate the condition of all nest boxes and make appropriate repairs to boxes, predator guards, and support poles.

Objective 2.11. Wood Ducks
Within three years of CCP approval, complete a Wood Duck Box Nesting Management Plan that is designed to outline the nest box program, box location, and monitoring and maintenance actions.

Discussion: The refuge has one of the most productive and intensively managed artificial wood duck box programs in the Atlantic Flyway. Santee NWR has had a wood duck program since 1969, with many fluctuations in the number of boxes, box placement, types of boxes, frequency of box checks, and box maintenance protocols. The highest number of boxes was 321 in 1984; however, this number was reduced in 1985, when it was obvious that a large percentage of boxes had not been serviced in several years. Approximately two-thirds of the boxes had deteriorated beyond repair due to staff time constraints, as well as the fact that over half of them had to be checked by boat, which compounded the situation.

Presently, the refuge maintains 140 cypress boxes of which approximately one-third are at least 15 years or older. These boxes have been maintained in a relatively good condition over the last 10 years. The boxes require periodic replacing of cypress tops, sides, and bottoms, as well as hinges, latches, supporting poles, and predator shields as needed. Since 1985, one volunteer has checked and cleaned all refuge boxes from March to July of each year, recording data and cleaning out the boxes after each use or attempted use. Predation and dump nesting are the biggest problems. Nest box location and density can influence dump nesting (Semel et al., 1988) and the refuge's long-term data will be evaluated to provide recommendations on number and location of boxes based on the best information available. A literature search and additional information will have to be gathered to better understand and implement means to reduce predation by other birds and mammals.

Nest production checks are conducted based on the estimated chick hatching dates or incubation period. An average of 2,042 ducklings per year was produced over the 5-year period of 2002 through 2006. This translates into an average of 16 hatchlings each year per box for each of the 140 boxes being maintained (Lauren Billodeaux, unpublished data). It should be noted that reproduction successes in the individual boxes varied from year-to-year with results ranging from no production to two or more successful nests produced in the same box during the nesting period.

Strategies:

- Develop Wood Duck Box Nesting Management step-down plan.
- Update and evaluate wood duck production data annually by November or December to determine the proper number and location of nest boxes that should be maintained or relocated.
- Locate boxes based on sound biological data and in areas easily accessible for high-quality maintenance. Nest box maintenance should be completed annually in January and February.
- Maintain quality habitat adjacent to nesting boxes with special emphasis on not disturbing necessary tree and shrub cover. Quality wood duck habitat is generally considered to be 75 percent cover and 25 percent water.

Objective 2.12. Wading Birds
Within one year of plan CCP approval, map and post all known refuge wading bird rookeries and monitor species composition and nest numbers in existing and new refuge rookeries.

Objective 2.13. Wading Birds
Within two years of CCP approval, develop a program to monitor wading bird use of refuge managed and unmanaged wetlands, and use adaptive management where appropriate to enhance wading bird use.

Discussion: The refuge provides a complex of managed and natural habitats throughout the year that attracts thirteen different types of wading birds (see Santee NWR Bird List). Key wading bird species that inhabit the refuge and are of special conservation interest (SAMBI 2005, SCDNR CWCS 2005) in the South Atlantic Coastal Plain include: yellow-crowned night heron, black-crowned night heron, tricolored heron, little blue heron, white ibis and wood stork. Additional wading birds, such as great blue heron, great egret, glossy ibis, snowy egret and green heron, are also present. Rookery sites for the great blue heron appear to be expanding on the refuge. Green heron also nest along canals; however, the refuge is not presently monitoring wading bird nesting. Additional data will be needed to determine if wading bird use can be enhanced through wetland management, protection and enhancement of rookery sites, and lower disturbances to wading birds by the visiting public. An Anhinga rookery has been observed within the Polly-Cantey Bay of the Dingle Pond Unit (Mark Percell, personal communication). Anhinga nests in other wetlands on the refuge along with osprey and great blue herons.

Wading birds, such as the great egret and great blue heron are commonly observed year-round feeding on the refuge. Wading bird use of wetlands managed for waterfowl can be high due to seasonally fluctuating water depths, which concentrate prey (e.g., small fish, amphibians, and invertebrates) in small pools. Gradual lowering of water depths from winter into spring for waterfowl will also enhance prey availability for many waterbird species (Epstein et al., 1989). Generally, on private lands near refuge boundaries, waterfowl ponds are drained quickly at the end of the waterfowl hunting season. Therefore, the refuge wetland management program is meeting the needs of multiple species under the present waterfowl management program. Wading birds are also commonly seen feeding in small pools during summer the as they naturally become drier.

Strategies:

- Locate and monitor all rookeries on the refuge. Ensure that all wading bird and diving bird rookeries are protected and clearly posted to prevent disturbance and public intrusion during the nesting season.
- Determine if additional water level management from March through September at selected sites (e.g., main banding pond on the Bluff Unit, Pump Pond on the Pine Island Unit, and the Cattle Guard wetlands on the Cuddo Unit) can enhance wading bird use.
- Selectively identify sites that could be enhanced for rookeries through habitat manipulation or establishment of suitable nest tress, such as willow marshes.
- Minimize disturbance from any public uses.

Objective 2.14. Neotropical and Migratory Songbirds
Within one year of CCP approval, identify the key species of migratory and breeding songbirds using the refuge that are identified in South Atlantic Migratory Bird Initiative (SAMBI) and the CWCS to determine the species of special management concern for Santee NWR.

Objective 2.15. Neotropical and Migratory Songbirds
Within five years of CCP approval, develop a volunteer bird monitoring program (e.g., breeding bird survey) to document species composition and habitat use patterns of select neotropical and migratory songbirds to identify critical habitat components and the influence of management practices.

Objective 2.16. Neotropical and Migratory Songbirds
Within three years of CCP approval, expand existing monitoring programs to better understand the seasonal use patterns of key neotropical and migratory songbirds during the non-breeding period.

Objective 2.17. Neotropical and Migratory Songbirds
Within three years of CCP approval, identify critical habitat components of migratory and breeding songbirds and provide recommendations on how to better manage for key (i.e., state and regional) species of concern.

Discussion: Santee NWR supports a great diversity of habitats, making this refuge one of the top birding areas in South Carolina. Large stands of mature upland and lowland hardwoods are intermixed by mixed pine/hardwoods, scrub/shrub, grassland, and wetland habitats. The habitat diversity attracts many species utilizing the refuge during all seasons of the year and many are listed by SAMBI as birds of special concern because of recent declines in populations. High-priority species include black-throated green warbler (*Dendroica virens*), Cerulean warbler (*Dendroica virens*), loggerhead shrike (*Lanius ludovicianus*), Henslow's sparrow (*Ammodramus henslowii*), and painted bunting (*Passirina ciris*). The refuge will support SAMBI in the furtherance of its goals to "provide a secure future for songbird, waterfowl, shorebird, and other vulnerable bird populations via an integrated federal, state and private lands approach to protect, restore, and manage avian coastal plain habitats from southeastern Virginia to Florida." SAMBI emphasizes year-round management of wetlands to include moist-soil, fresh and bottomland forested wetlands, and other important habitats for waterfowl, rails, shorebirds, long-legged waders, sparrows, and wrens. Other priority birds are mallards, pintails, wood ducks, painted buntings, Henslow's sparrow, American woodcock, yellow rail, snipe, short-eared owl, northern bobwhite, grasshopper sparrow, barn owl, loggerhead shrike, sedge wren, and LeConte's sparrow, king and sora rails, least bittern, purple gallinule, wood stork, little blue heron, tricolored heron, black-crowned night heron, yellow-crowned night heron and white ibis. Foraging wood storks and nesting bald eagles occur on and near the refuge.

Strategies:

- Expand the newly established breeding bird survey to identify key species relative to breeding occurrence, abundance, and habitat utilization.
- Increase knowledge of species status by conducting annual surveys and collecting baseline data.
- Identify key songbird species utilizing the refuge and determine priority habitats needed to support these species.
- Using GIS technology, evaluate upland habitats and provide recommendations on the expansion or reconfiguration of old field and forest habitats to enhance suitability for key species.
- Maintain 500 to 900 acres of open field habitat, rotating between grasslands and pioneer shrubs, through mechanical strip mowing and/or controlled burning in accordance with the 1988 Cropland and Non-forested Upland Plan (Bond 1988).
- Update the 1988 Cropland and Non-forested Uplands Plan.
- Update the existing Forest Management Plan to facilitate biologically sound forest habitat management and enhancement practices for breeding, feeding, and wintering habitat for migratory birds.
- Manage mature forest stands with prescribed fire or mechanical thinning to increase the understory and midstory component to accommodate key species identified from region and state plans.
- Acquire mechanical equipment capable of thinning and removing young tree species (4- to10-inch dbh) to return older scrub/shrub habitat to year one grassland condition.
- Work with the fire management program to ensure fire applications are meeting the needed resource goals and objectives.

Goal 3. Herpetological Species
Within five years of the plan write an abbreviated summary listing for any known amphibian or reptile and/or habitats that warrants an additional measure of protection on the refuge.

Objective 3.1.
Within ten years of CCP approval, conduct a formal inventory of reptiles and amphibians.

Discussion:
More than 89 species of reptiles and amphibians are likely to occur on the refuge (Fish and Wildlife Service 1983). As with many refuges, little is known concerning the amphibian and reptile community. What is known is that the diversity of habitat on the refuge supports a wide variety of amphibians and reptiles. This habitat diversity includes mixed hardwoods, mixed pine/hardwoods, pine plantations, marsh, croplands, old fields, ponds, wetland impoundments, and open waters. The list of 35 amphibian species and 54 reptile species is based on information from a variety of sources described by the Service (1983; Amphibians and Reptiles of the Santee NWR).

Although all units of the refuge would benefit from a herpetological study, the Dingle Pond unit should be one of the first to be studied as it is a Carolina Bay and has special geological features. Also the land adjacent to the Dingle Pond unit is being developed at a rapid pace, which may have long-term implications for dispersal and recruitment of herpetological species. The Carolina Bay was designed to be a semi-closed system with natural variations of water by way of a man-made water control structure with leaky stop logs. This stop-log structure has been maintained for many years, and it appears to have worked efficiently. Over the last three years, water has been held artificially high, often to the paved road edge, due to lack of resources to maintain the structure. Beavers compound

the problem by frequently clogging the structure. An inventory of herpetological species would be recommended to characterize species composition of this Carolina Bay ecosystem.

Strategies:

- Encourage community characterization studies for amphibians and reptiles and determine their management priority status.
- Encourage research that would assist in documenting ecological features relative to habitat and species.
- Develop a monitoring program to record herpetological observations on the refuge.
- Purchase and maintain suitable books, field guides, and other technical information for the refuge library.
- Seek funding sources for a detailed herpetological study on all units of the refuge.
- Increase signage and interpretation for the American alligator consistent with conservation needs and public safety.

Goal 4: Wildlife and Habitat Diversity
Protect, manage, and enhance the natural diversity of fish, wildlife, and habitats and the important landscapes of the refuge's coastal plain habitats to ensure that fish and wildlife populations remain naturally self-sustaining.

Discussion: The intrinsic landscape at the refuge is very diverse and ecologically supports many native and migratory species of plants and animals that are both aquatic and upland in nature. The diversity of habitats includes: freshwater marshes and swamps, flooded cypress, open water lake, moist-soil, farm fields, grassland/scrub fields, bottomland hardwoods, pinelands, mixed hardwood/pine, and hardwoods. Maintaining the natural integrity and biodiversity of the refuge includes having a professional staff with the knowledge and background of the ecology to manage these systems (e.g., fire and wetland ecology, fisheries, forest, and wetland management). As adjacent landscapes and habitats become more stressed from increased fragmentation and development, the refuge would become more important to species that are displaced, as a sanctuary area from disturbance, and simply as an area that could support native habitats and fish and wildlife populations. The refuge is presently working with local communities and developers, building a support base to enhance public awareness as to the purpose of the refuge, management needs/issues, exotic species, fish and wildlife, and the added value of having a national wildlife refuge in their community.

Objective 4.1. Managed Wetlands
Within one year of CCP approval, organize a formal wetlands review team to include local, state, and national expert wetland biologists to meet, evaluate, and provide specific recommendations on the Santee NWR wetlands management program.

Objective 4.2. Managed Wetlands
Annually maintain wetland infrastructure (if feasible) and protect the 1,400 acres of managed wetlands to include moist soil, permanent, greentree, and agricultural impoundments.

Objective 4.3. Managed Wetlands
Within one year of CCP approval, develop a formal wetlands monitoring program that integrates vegetative and migratory bird responses to the water level management program on the 1,400 acres of managed wetlands on Santee NWR.

Objective 4.4. Managed Wetlands
Within two years of CCP approval, evaluate agricultural crop rotation on managed wetlands and develop an adaptive management plan for moist-soil and agricultural applications.

Objective 4.5. Managed Wetlands
Within three years of CCP approval, evaluate refuge landscape potential and soil suitability for potential expansion of a managed wetland and agricultural applications for migratory waterfowl.

Objective 4.6. Managed Wetlands
Within four years of CCP approval, evaluate all wetland infrastructures (e.g., dikes, water control structures, ditches, and pumping stations) and provide recommendations for restoration of a functional, managed wetland complex.

Objective 4.7. Managed Wetlands
Within one year of CCP approval, develop a standardized riser size design for all water control structures to be installed in refuge impoundments, as replacement or installation is necessary.

Discussion: The refuge needs the ability to fully control water within and among the impoundments. Improved water control structures would enhance management by providing the means to stop, manage, or allow water flow within and among impoundments based on the stated goals of the impoundment. Over time, different sized riser structures were used, which has become troublesome for biologists trying to replace boards among structures with different sizes. Therefore, a standard size-riser width will be used to replace old structures and to add new ones.

***Strategies*:**

- Develop a standard water control structure design and flashboard riser sizes for all water control structures to be installed in refuge impoundments. Use an inside width of 47 3/8 inches for large structures and develop a standard width for the smaller structures.
- Install water control structures that would allow total control over water management and that would maximize the capability to correctly manage wetland habitats. Continue to evaluate new water control structures to determine the best ones for the refuge.
- Use and maintain dikes and appropriate water control structures to conduct water management options as necessary to achieve desired wetland community types.

Objective 4.8. Managed Wetlands
Within five years of CCP approval, restore open water/emergent wetlands on three units including;150 acres on Cuddo; 60 acres on the Pine Island; and 30 acres on the Bluff. Restoration activities will consist of herbicide, mechanical, and prescribed fire treatments.

Objective 4.9. Managed Welands
Within four years of CCP approval, develop a strategic management and monitoring plan for the Dingle Pond Unit to guide the future of this valuable unit.

Discussion: Management of wetlands is critical to the mission and purposes of Santee NWR. In 2003, a wildlife and habitat management review was conducted for the refuge that provided abundant information and recommendations on biological resource management. Proper water control and delivery systems are a basic need for wetland management (Stader and Stinson 2005). For Santee NWR, a focus on site-specific restoration and cleaning of approximately 1,000 feet of canals to improve water movement is

needed. In cooperation with partners (e.g., Santee-Cooper, Ducks Unlimited), the refuge will restore proper water management on all refuge units. The Dingle Pond Unit consists of a 228-acre Carolina Bay dominated by emergent wetlands, but also includes forested wetland habitats.

The dike and ditch systems on some managed wetlands are below operational condition. The 90-acre Timber Island Fields waterfowl impoundment complex on the Cuddo Unit will require a complete dike restoration, including the removal of trees and the rebuilding of the dike and ditch systems so the impoundments can be managed independently. This may require strategically restoring or moving interior dikes to improve water management. Greentree reservoirs on both the Cuddo and Pine Island units need selective thinning of non-target trees to encourage desirable mast-producing trees. Additional pumping stations will be evaluated for both the Bluff and Cuddo units to correctly facilitate the flooding of high-quality waterfowl impoundments. A formal wetlands habitat management plan will need to be developed to properly facilitate ecologically sound application of seasonally manipulated moist-soil and greentree reservoir impoundments. The present wetland management system does not fully allow independent management of wetland impoundments on some units. A dedicated maintenance program will have to be implemented to keep water control structures and ditches operational.

Presently, approximately 175 acres of floodable, impounded fields are available to plant corn or other agricultural crops on the Cuddo, Bluff, and Pine Island units. The refuge proposes to evaluate the wetlands management program to increase the number of acres for moist-soil and/or agricultural crops to accommodate any increases in numbers of wintering migratory ducks and geese.
Waterfowl management (i.e., featured species approach) provides habitat and resources for multiple species, including key migratory birds, reptiles, and amphibians (Fredrickson and Taylor 1982). Although waterfowl is the focus species of management on refuge wetlands, the diversity among refuge wetlands is beneficial to a suite target wildlife species. Wetlands that have moist-soil and bottomland hardwood forests will be managed under “best management practices” to include proper ecological application of wetland and bottomland forest management practices (Fredrickson, King, and Kaminski 1999). Most wetlands are in critical need of restoration, including ditch cleaning, dike clearing and reconstruction, and chemical/mechanical/fire prescriptions. Wetland impoundment creation and management will include impact considerations on all priority species (e.g., waterfowl, pied-billed grebes, American and least bitterns, rails, sandhill cranes, and a large variety of neotropical songbirds) utilizing Santee NWR. However, the primary focus of managed wetlands is for waterfowl use.

***Strategies*:**

- Implement a formal wetlands monitoring program to facilitate best management practices and ecologically sound strategies.
- Evaluate and implement wetland restoration (i.e., reconstruction) activities on all management units. These activities will include mechanical, chemical, and fire prescriptions that will focus on water level manipulation, encourage desirable plant growth, and discourage invasive plants.
- Identify and treat selected areas of wetlands for exotic and nuisance vegetation; degrading prime waterfowl areas is a priority. Work with Santee-Cooper, Ducks Unlimited, and other partners on cooperative efforts.
- Monitor wildlife use (i.e., migratory birds other than waterfowl) within wetland units during spring, summer, and early fall seasons to better understand their needs.
- Determine the need and potential for creating or expanding impounded wetlands on each unit, using soil surveys and GIS technology to delineate the hydric soil distribution.
- Investigate strategies to rotate greentree reservoir flooding schedules to allow a prescribed alternation of drying once every three years during the dormant season.

- Seek partnerships with Ducks Unlimited, Santee-Cooper, SCDNR, and with other groups to assist in wetlands management plan development, funding, and implementation.
- Work with partners to evaluate the wetlands management program to provide recommendations for water control structures and pumps needed for independent management.
- Annually collect soil samples to determine soil fertility in selected managed fields to adequately maintain optimum growing conditions for desired native vegetation and agricultural crops.

Objective 4.10. Grassland, Scrub/Shrub

Discussion: Grassland habitat makes up about 18 percent of the refuge. This habitat is composed of a grassland/scrub/shrub cover types. The lack of fire or other disturbance, such as agricultural operations, over the refuge uplands has contributed to the encroachment of woody vegetation. This habitat type is dispersed throughout the refuge, occupying abandoned agricultural fields. Historically, up to 800 acres of these fields were farmed as part of a cooperative farming program, which ceased to exist in 2000 due to a lack of interest by farmers, deer depredation, and restrictions on pesticides. These areas are critical for many priority species, including Henslow's sparrow; eastern kingbird; eastern meadowlark; loggerhead shrike; painted bunting; northern bobwhite; American woodcock; and black, yellow and sora rails found in fields bordering wetlands. Recommended prescribed fire rotations in grassland fields should be planned at 3 to 4 year intervals. Fields in succession after 3 to 4 years may require special equipment (e.g., dozer and roller-chopping) for maintaining early successional growth. The biological review clearly defines the importance of grassland/scrub/shrub habitats on Santee NWR as being a critical factor for maintaining populations of priority grassland bird species. Larger fields are found to be the most productive and should contain a feathered or gradual edge along forest borders. The importance of these habitats will increase as the surrounding privately owned landscape continues to develop thus reducing these habitat types (Biological Review, Santee NWR, USFWS 2004, 88 pp.).

Objective 4.11. Grassland, Scrub/Shrub
Continue to manage approximately 1,200 acres of grassland and scrub/shrub habitats on the refuge, utilizing mechanical equipment and prescribed burning to maintain communities in early succession warm season grasses with mixed scrub/shrub vegetation.

Objective 4.12. Grassland, Scrub/Shrub
Evaluate the configuration of size and location of existing fields to determine if some smaller fields can be combined into larger fields.

Objective 4.13. Grassland, Scrub/Shrub
Develop habitat monitoring to enhance grassland field management based on timing of manipulation (i.e., fire and/or mechanical).

***Strategies*:**

- Monitor vegetation response caused by the effects of fire and mechanical disturbance within these communities. Maintain habitats in a 3-year rotation.
- Integrate existing bird monitoring programs to include grassland habitats.
- Acquire mechanical equipment capable of thinning and removing young tree species (4- to10-inch dbh) to return older scrub/shrub habitat to year one grassland condition.
- Work closely with the fire management staff from nearby refuges to conduct prescribed burns.

- Develop partnerships with the SCDNR for recommendations on management.
- Evaluate the grassland community cover on the refuge and provide recommendations on field size and location. Determine if restoring additional old farm fields will assist in meeting the needs of key species compared to having old farm fields revert to mature forest.
- Determine the advantages of introducing soft-edged ecotones for transitional communities between forest and field types.

Goal 5. Forest Management

Discussion: A Forest Management Plan was produced for Santee NWR in 1975. This now outdated plan does not meet present-day landscape goals and objectives or the habitat types of the refuge. The primary objectives of this plan were to manage forest habitats in an even-aged management system "on the premise of growing, harvesting, and reproducing timber" which "safeguards a sustained yield of forest products with the additional feature of providing wildlife with a diversified habitat." This document does contain some relevant information and is an invaluable historical document for the refuge.

Forest habitat types on Santee NWR are dominated primarily by a mature hardwood component with mixed pines and bottomland hardwood forested wetlands. A forest habitat and cover type analysis is needed to determine site density and to provide recommendations for thinning and forest management. Most of these mature stands consist of a closed canopy that limits: (1) growth of understory and midstory vegetation and primary habitat conditions; and (2) bird abundance and diversity. The remaining forest habitats are mostly composed of pioneer tree species that have succeeded from farm fields that were abandoned approximately 15 to 20 years ago. A forest habitat evaluation and management plan will provide recommendations for: the need to replant these old fields with native forest species (e.g., using Go Zero program); thinning treatments and harvest rates; allowing vegetation to improve naturally with age; and for reclaiming these fields in a grass/scrub management program. A more aggressive management approach (fire and/or mechanical) will be needed to manage forests for key, priority species. A determination on forest management treatments through an updated forest management plan is recommended to emphasize improving hardwood stands and/or pine.

The diversity of refuge forest habitat types benefits a wide variety of wildlife including migratory birds and resident wildlife such as non-migratory birds, mammals, reptiles, and amphibians. More than 2,300 acres of forest habitat exist on the four units of the refuge, with nearly 70 percent of the total forested area on the Cuddo Unit. The natural pine stands are predominantly loblolly, with some longleaf and shortleaf pine throughout the four units. Some small plantations of slash pine have been planted on the refuge; however, they have never received management considerations beyond the planting stage. The mixed hardwood stands are comprised primarily of sweet gum, willow oak, black gum, white oak, red maple, water oak, post oak, southern red oak, swamp chestnut oak, hickory, and blackjack oak, with a mixture of small understory trees, shrubs, and vines. Some mature trees, both pines and hardwoods, are over 100 years old; however, the majority of trees are less than 60 years in age.

Upland forest on the refuge has received very little management attention. Staff hours and equipment needed to properly thin timber and curtail unwanted pioneer growth species of pines and hardwood never materialized leaving the forest to natural succession. The 1975 Forest Plan was never implemented and was goal-oriented towards timber harvest and not forest and wildlife diversity. In 1989, Hurricane Hugo caused major damage to the forest, snapping off an estimated 50 percent of mature trees at the 40-foot level. It also damaged smaller trees, causing huge piles of debris that remained over a 15-year-period following the hurricane.

The present forest on the Cuddo Unit has recovered and is nearing a sub-climax forest type with some crown closure dominated by large pines and oaks. However, there are still many distinct openings and areas of pioneer growth that consist mostly of sweet gums and mature wax myrtles. Mechanical treatments of dense scrub areas may improve some herbaceous plant growth favorable to migratory birds and other species of wildlife. A plan to maintain areas previously farmed as grassy, grass/shrub, or scrub/shrub fields by alternate strip mowing to favor migratory songbirds was limited due to funding and staffing constraints (Bond 1983).

Additional forest types include greentree reservoirs, pine woodlands, pure gum stands, and cypress bogs, of which most are also in need of management recommendations. An updated forest management plan will provided needed recommendations on thinning, controlled burns, and/or mechanical treatments to meet primary resource objectives.

Objective 5.1. Forest Management
Focus forest management (i.e., prescribed fire and/or mechanical manipulation) on improving midstory and understory vegetation by opening forest canopy by 30 to 40 percent to provide improved habitat conditions for many key bird species.

Objective 5.2. Forest Management
Within five years of CCP approval, conduct an upland habitat cover type analysis to coincide with and include other refuge vegetative community typing.

Objective 5.3. Forest Management
Within seven years of CCP approval, evaluate all forest and upland habitats to develop an integrated landscape habitat management plan.

Objective 5.4. Forest Management
Within seven years of CCP approval, manage stands of pioneer tree species that have overtaken abandoned agriculture fields on the Cuddo Unit and determine the need to restore/convert these fields either to grass/shrub or allow them to remain forested for habitat dispersion and songbird use.

***Strategies*:**

- Update the Forest Management Plan to reflect current and future forest management needs. The updated plan will determine the optimal ratio of hardwood to pine forests.
- Evaluate forest habitats and other landscape features for integrated migratory bird and other wildlife management objectives, including the priorities identified in SAMBI (2005) and the SCDNR CWCS (2005).
- Work closely with the District fire management staff to implement a consistent prescribed fire management program for the refuge.
- Monitor the effects of fire on forest habitats and bird species.

Objective 5.5. Prescribed Fire
Continue to conduct annual prescribed burns in 400 to 1,000 acres of upland and wetland habitats based on resource, habitat and fuel management objectives with highest priority to grassland fields, scrub/shrub, and wetland units.

Discussion: A Fire Management Plan was developed in 2001 to help enhance and maintain vegetative communities that are dependent upon or positively influenced by fire. The plan would benefit wildlife, promote nutrient cycling, and reduce an unnatural buildup of fuels that could otherwise

create hazardous, high-intensity, catastrophic wildfires. Prescribed fire is the most efficient means to maintain a desirable vegetation response in early successional habitats that include grassland fields, scrub/shrub, and wetland units. Prescribed fire also plays key and cost-effective roles in restoring critical habitats that have declined in productivity. These areas will be identified and efforts directed toward achieving these goals. Burning will also be prescribed in forest habitats to open a pre-determined amount of canopy layer to encourage development of understory and midstory vegetation, providing snags for birds as nesting and foraging sites. All burning operations would be coordinated to meet specific resource objectives and to control nuisance and exotic vegetation.

The use of prescribed burns is largely a misunderstood management practice by the general public and an increased emphasis should be placed on interpreting this important management tool. Prescribed fire and wildlife information is presently placed in some of our public information boxes in coordination with the state and county fire management teams.

Strategies:

- Update Fire Management Plan to include new Service polices on risk assessment and smoke management.
- Monitor effects of vegetation responses to burning within these communities.
- Update Fire Management Plan to include and emphasize resource management needs.
- Work closely with the Fire District Management staff to conduct prescribed burns on refuge lands.
- Reintroduce fire into forest habitats that have not seen prescribed burning for more than 20 years, while, at the same time, maintaining the old-growth hardwood component of these forests.
- Prescribed fire could be useful in both altering vegetative structure and encouraging native plants, while discouraging exotic plants.
- Increase emphasis on including additional interpretation as part of the public use program, such as working with neighboring homeowners' associations and developers to include language in their by-laws to increase awareness of the refuge's fire management program.
- Continue to maintain a system of fire breaks to protect the forest from potential wildfires.

Objective 5.6. Prescribed Fire
Continue to suppress all unwanted wildfires occurring on the refuge to protect refuge resources and facilities and to provide for health and safety of staff and visitors.

Discussion: Three members of the refuge staff are red-carded and are available for initial attack on wildfires occurring on refuge property. Heavy equipment, a type 6 engine, and tools are maintained in good condition for wildfire operations. Service fire crews from within the Fire District will be dispatched if additional resources are needed. Refuge staff will command operations until relieved by additional Service resources. The South Carolina Forestry Commission and local fire departments are available to assist refuge staff if needed.

Strategies:

- Continue to work with Fire District Management staff for coordination of fire management and wildlife.
- Develop strong partnerships with local fire teams to assist refuge and district staff on wildfires.
- Utilize prescribed fire and mechanical operations to reduce fuel buildup (e.g., leaf litter, pine straw, limbs, and other dead vegetation) in large continuous acreages to minimize catastrophic wildfires.
- Maintain existing fire breaks, both within the refuge boundary and the wildland urban interface by mowing and disking in order to reduce fuel buidup.

Objective 5.7. Wildland Urban Interface (WUI)
Maintain adequate safety buffers between refuge and private lands.

Discussion: WUI firebreaks are cleared firelines strategically placed to reduce the risk of wildfires that may occur on refuge property from spreading to neighboring properties. These breaks can also reduce the potential for wildfires spreading from adjoining property onto refuge property. With the surrounding landscape adjacent to the refuge continuing to develop with single and multiple family structures, the creation and management of WUI firebreaks are critical.

In 2004, the Fire District contracted with a private contractor to create 10 miles (or comparable clearing) of WUI fire lines. A 32-foot wide fireline was created along the western boundary of the Dingle Pond Unit, as well as a 16-foot wide fireline along the northern end of the Bluff Unit off of Nelson Ferry Road, connecting this road and Cantey Bay. The remainder of clearing occurred just north of the shop on the Bluff Unit between Fort Watson Road and Cantey Bay. This area consisted of clearing approximately seven acres of dense underbrush and small trees. Fuel was removed from this stand to reduce the fire and smoke hazard of the area. All of these areas were picked due to their close proximity to Interstate 95, as well as populated areas and crowded campgrounds.

Strategies:

- Continue to identify development projects near refuge property to evaluate current and future WUI projects in order to mitigate threats from wildfire. Meet with developers and landowners whenever possible, educating them about the WUI project and any concerns they might have about the refuge.
- Maintain all WUI projects adequately to reduce the potential threat of wildfire.
- Work with local and state fire programs to inform them of the WUI project, as well as the location of these firebreaks.

Goal 6: Exotic, Invasive, and Nuisance Species
Control and eliminate, where feasible, exotic, invasive, and nuisance species on the refuge to maintain and enhance the biological integrity of the refuge's native South Carolina coastal plain habitats.

Discussion: The occurrence and spread of exotic, invasive, and nuisance plant and animal species have been identified by Service staff and intergovernmental partners as one of the priority management issues facing Santee NWR (Biological Review, Santee NWR, USFWS 2004). Exotic species have invaded all refuge wetland and upland habitats, as well as disturbed sites. Invasive species can have negative impacts on natural plant diversity and on wildlife habitat. Invasive species can also have negative economic and public health and safety impacts. No comprehensive survey of exotic plants has been conducted on the refuge. Most efforts are

focused on reduction of invasive seed sources throughout the refuge, and on Chinese tallow control for 256 acres of floodable bottomland hardwoods on the Cuddo Unit. The refuge has received limited resources for invasive plant control for these projects.

Objective 6.1. Exotic Plants
Within three years of CCP approval, identify all exotic plant species and produce appropriate mapping, using GIS technology to track infestations.

Discussion: Exotic plant control would be enhanced by partnering with other agencies (e.g., Santee-Cooper and SCDNR) to seek funding for matching grants in order to purchase chemicals and the services of contractors to conduct exotic plant control and surveys, and by continuing to seek funding or partnerships for additional support in GIS mapping and control efforts.

Strategies:

- Complete an exotic plant database, including a GIS component, of all refuge units. This database should identify the number of exotic/invasive plant species present on the refuge and the coverage and stocking level for each species.
- Each year refuge lands should be surveyed to identify any infestations of exotic plants and to determine the coverage and stocking level for all exotic plant species, including the re-sprouting of any previously treated areas. This would assess the effectiveness of control efforts and re-direct ongoing control efforts as needed.

Objective 6.2. Exotic Plants
Within five years of CCP approval, eliminate and/or control, to a high degree, all known infestations of Chinese tallow trees on the refuge.

Discussion: The levels of infestation and biology of certain exotic plant species make it difficult to eliminate these species from the refuge unless very aggressive programs are set in place. The exotic species identified would be considered eliminated when all known new plants and all re-growth from previous infestations could be killed each year. It is anticipated that this level of control could be attained within five years after plan approval. The key to elimination of these exotic species is annual surveys and control efforts.

Objective 6.3. Exotic Plants
Within the 15-year life of the CCP, eliminate and or control 80 percent of all invasive plant species with particular emphasis on preventing any new infestations of Chinese tallow trees and any new state and/or federal identified Class 1 exotic species.

Discussion: Exotic plants occur on an estimated 560 acres of the refuge land and present a major management concern as they quickly outgrow and/or compete with desirable native vegetation. Among the “Top Six Biological Priorities” listed for Santee NWR (USFWS 2003) is the recommendation to control invasive and non-desirable plant communities on upland and wetland sites. Exotic plants known to exist on the refuge include: Chinese tallow, autumn olive, Chinaberry, wisteria, and privet. Of particular concern is Chinese tallow, which has invaded wetlands on the Cuddo Unit and has the potential to destroy 256 acres of bottomland hardwood stands utilized by migratory waterfowl. Progress has been made in control of Chinese tallow within the bottomland hardwood division on the Cuddo Unit, using funding from the Service’s Invasive Strike Team and limited refuge resources. Other funding proposals for invasive plant control are pending. Control

methods for exotic plant removal have included the hand pulling of seedlings, stump cut chemical treatment, and foliage spraying. Controlled burning has been avoided in areas with high concentrations of exotics to avoid soil disturbance favorable to exotic plant propagation.

Strategies:

- Seek additional funding to contract for exotic plant control.
- Continue routine spraying of invasive plants on outer edges of identified concentrations for containment purposes.
- Work closely with the Service's Invasive Strike Team for funding and technical support.
- Maintain a minimum of two staff members with a South Carolina Pesticide Applicator's License.
- Attend South Carolina EPPC meetings to gain knowledge on invasive plant management and possible funding sources.
- Closely monitor all controlled burn sites and areas where mechanical disturbances have occurred for new infestations of invasive plants.

Objective 6.4. Exotic Animals

Discussion: Invasive animals can also cause negative natural resource impacts through direct mortality to native wildlife and by competition with native wildlife for food resources. Two invasive animal species are known to occur on the refuge: feral dogs and feral house cats. However, feral hogs are an invasive species presently found in areas north of the refuge boundary (Hickery Top WMA, H. Fures, personal communication). Feral hogs are expected to invade the refuge in the next few years. Hogs cause extensive habitat damage and the Service believes that they also negatively impact wildlife by direct mortality and through competition for food. They cause economic damage through vehicle collisions and through destruction of landscaped areas and road shoulders by rooting. The number of feral dogs and house cats occurring on the refuge is small and is usually associated with nearby residential areas. However, it is assumed that some feral dogs and house cats occurring on the refuge are released by the public.

The infestation of invasive plants and feral hogs may increase on the refuge with increasing human population and urban expansion. The refuge is presently working with potential developers to help educate new landowners on the adverse impacts of exotic species. Without control efforts, the level of hog infestation is anticipated to continue, resulting in even greater impacts to refuge habitats and wildlife populations.

Objective 6.5. Feral hogs
Upon CCP approval and annually thereafter, continue to monitor and aggressively remove feral hogs from refuge lands.

Strategy:

- Consider all known sources of removal of feral hogs to help prevent infestation of this species on refuge lands.

Objective 6.6. Captive-reared Mallards
Upon CCP approval and annually thereafter, continue to monitor and aggressively remove all known captive-reared mallards from refuge lands.

Discussion: Captive-reared mallards began occurring in significant numbers on Santee NWR in 2001. These mallards were not in conflict with the pre-season wood duck banding program until the spring of 2005. Although in relatively small numbers in 2005 and 2006, captive-reared mallards began congregating at the bait site until overwhelmed by wood ducks in July. In 2006, a neighboring landowner constructed an 80-acre waterfowl impoundment and 1,500 captive-reared mallards were released in August 2006. In 2007, 1,500 captive-reared mallards were released within 600 feet of the refuge, with at least another 17,000 released in the local area. Landowners and organizations involved in the Mallard Restoration and Research Program (SCWFA 2007) release 60,000 captive-reared mallards annually in an effort to restore wintering mallard populations in South Carolina; this does not take into account privately purchased birds released on private property. It is unknown what impact these birds are having on natural and agricultural waterfowl foods produced within refuge boundaries.

In 2007, the ability of refuge staff to attract wood ducks to the band site was significantly compromised by an abundance of captive-reared mallards congregating at the banding site. As many as 250 of these captive-reared non-migratory mallards were flying in daily and consuming all bait used to attract wood ducks. Typically, approximately 100 wood ducks were visiting the band site during the first weeks of June. In 2007, no more than 15 wood ducks were seen at the site before measures were taken to remove the captive-reared mallards. Captive-reared mallards have been observed aggressively chasing wood ducks from the band site. Over 300 captive-reared mallards were observed using the banding site in July 2007.

In consultation with the Service's Law Enforcement Division, the refuge was informed that properly marked captive-reared mallards are not protected and can be transported from refuge property (50 CFR 21.13). Refuge employees made four attempts to rocket-net and remove the captive-reared mallards from the banding site. All captured mallards (150) were inspected for proper markings (i.e., toe clipped). All captured under the net were identified as captive-reared birds and were relocated to a site off refuge.

Captive-reared mallards also impact refuge operations during winter months when migratory waterfowl are arriving in peak numbers. Captive-reared mallards have steadily increased within refuge boundaries every year since 2000. The only accurate way population monitoring can occur is during post-season banding efforts that begin in February of each year. Both in 2002 and 2003, 15 percent of the mallards captured were local, captive-reared birds, while in 2006 and 2007, captive-reared mallards increased to 30 percent and 47 percent, respectively. This dramatic increase in captive-reared mallards using refuge impoundments is due to increased mallard release sites within close proximity of the refuge.

The staff is concerned that increased captive-reared mallard use of the refuge can severely impact the its ability to maintain migratory waterfowl in optimum condition, with respect to competition for a limited food source during stressful conditions (e.g., energy demands of egg production, courting, molting, and severe winter weather). The other impacts that remain unknown for South Carolina are the interbreeding with wild migratory birds (i.e., genetic dilution) and the consequence of disease from captive-reared mallards (USFWS 2003).

Known costs from the loss of grain (i.e., bait) and labor (i.e., personnel time) associated with captive-reared mallards affecting wood duck banding operations exceeded $3,000 in 2007.

Strategy:

- Consider all available sources of removal of captive-reared mallards to help prevent infestation of this species on refuge lands.

Objective 6.7. Feral House Cats and Dogs
Upon CCP approval, minimize the threat to native wildlife, especially migratory birds, by controlling feral cats and dogs.

Strategy:

- Develop outreach programs aimed at nearby residential areas to assist in educating the general public on the damage that feral animals cause on wildlife. Work with new developers in increasing awareness and appreciation of the Refuge System and the value of these lands in their community. Assist developers by working with new homeowners' associations in developing by-laws to help homeowners understand the importance of conservation buffers and control of exotic species.

RESOURCE PROTECTION

Goal 7: Land Acquisition
Acquire or obtain management authority for the coastal plain natural resources found within the existing refuge acquisition boundary.

Discussion: The refuge will continue to acquire parcels of land from willing sellers within the acquisition boundary as funding allows.

Objective 7.1. Land Acquisition
Within one year of CCP approval, determine and verify the official refuge acquisition boundary based on the original refuge configuration and establishment.

Strategy:

- Coordinate with the Service's Realty Division to evaluate the historical changes in the refuge boundary since establishment and determine the correct acquisition boundary based on the original refuge size.

Objective 7.2. Land Acquisition
Throughout the life of the CCP, work with the State of South Carolina, Clarendon County, Santee-Cooper and other partners to complete acquisition of recognized inholdings within the refuge boundary.

Strategies:

- Determine critically important inholdings within the refuge's approved acquisition boundary and develop multi-partner efforts to protect these lands in perpetuity.
- Work with existing private landowners, conservation organizations, and local or state agencies to acquire these lands as funding is available.
- Prioritize and purchase key inholdings.
- Increase and actively seek partnership opportunities that will provide strategic habitats and buffer zones for the refuge through long-term lease agreements, fee title, and conservation easements.

Objective 7.3. Land Acquisition
Work with Santee-Cooper to obtain management authority or fee title ownership to the properties strategically identified to serve the purpose of the refuge, such as lands/leases contiguous to Cantey Bay, the Polly-Cantey Bay Cove, Dingle Pond, Pine Island, and the Cuddo Unit.

Discussion: Much of the original leased lands and waters previously managed as part of the refuge were returned to Santee-Cooper for various reasons. Many of these original leased areas could be easily added back into various refuge management units with specific habitat management and protection objectives. The refuge continues to seek additional purchases and/or leases of Santee-Cooper lands on Cantey Bay in order to attempt to strategically create needed buffers and provide protection for existing refuge lease areas.

Strategy:

- Actively pursue land leases or purchases from Santee-Cooper.

Objective 7.4. Land Acquisition
Evaluate the existing refuge management boundary to reflect current agreements with Santee-Cooper and adjacent private lands.

Discussion: As part of the refuge, the Service currently manages four units that make up the refuge. These units are separated by lands and waters that are outside of the refuge's management boundary but may be within the approved acquisition boundary. The nature of this objective is to recognize parcels of land that may be strategic to the future management of the refuge.

Strategies:

- Work with Santee-Cooper to discuss proactive ways to protect the intrinsic values of the refuge and lake resources for the future.
- Incorporate the knowledge of proposed and pre-proposed commercial and/or urban development of the landscape surrounding the refuge, and the understanding of what impacts this might have on refuge resources.
- Work with developers to protect the refuge lands, waters, and natural resources, with the understanding that this would maintain and add value to any development that may occur around the refuge in the future.
- Work with Santee-Cooper to create a buffer zone around the refuge and/or perhaps restore some of the historic boundaries that would assist in this endeavor.

Goal 8: Cultural Resources
Maintain and preserve in perpetuity the archaeological and historical resources of the refuge that exemplify the natural and cultural history of the South Carolina, dating from the archaic period to the present.

Discussion: With the enactment of the Antiquities Act of 1906, the Federal Government recognized the importance of cultural resources to the national identity and sought to protect archaeological sites and historic structures on those lands owned, managed, or controlled by the United States. Federal agencies have a responsibility to (1) consider the impacts to cultural resources during the agency's management activities and seek to avoid or mitigate adverse impacts; and (2) protect cultural resources from looting and vandalism using a combination of informed management, law enforcement efforts, and public education.

The Santee Indian Mound/Fort Watson site, located near the refuge visitor center, is historically significant due to its documented history of use by the Santee Indians over 3,000 years ago as both a ceremonial and burial site. The site has added cultural importance because of its use by the British as an outpost during the Revolutionary War and its subsequent capture by American colonial troops led by General Francis Marion in 1781. As such, it receives a high level of attention from both casual refuge visitors and those with a keen interest in either Native American culture and/or American Revolutionary War history. Limited interpretation of the site has been accomplished with an interpretive sign and a two-page brochure. Refuge staff and volunteers routinely incorporate the important cultural aspects of this site into standard wildlife interpretive programs. The objectives and strategies below outline the Service's plan to achieve its mandated historic preservation responsibilities and to improve interpretation of this culturally significant site.

Objective 8.1. Cultural Resources
Within six years of CCP approval, the refuge will integrate cultural resource preservation into refuge programs, operations, and management plans to protect cultural resources in perpetuity.

Strategies:

- Beginning immediately, prior to any non-emergency, ground-disturbing activity, the refuge will complete a Request for Cultural Review Compliance form and forward it to the Regional Archaeologist for review. Refuge staff will conduct grounds and facilities maintenance in known areas with cultural resources in a manner that will not disturb those resources. Tree stumps will be left in the ground so the root mass and any associated cultural resources in the immediate area will not be disturbed.
- Beginning immediately, the refuge will evaluate the effects of fire management activities on cultural resources in the vicinity of those activities and agree to use strategies that will not disturb cultural resources. A section on fire's impacts on cultural resources and an Unanticipated Site Discovery Plan will be incorporated in the Fire Management Plan within 6 years of CCP approval. As the refuge prepares annual burn plans, this cultural resource protocol will be included. Heavy equipment will not be used in areas with identified cultural resources. If new cultural resources are discovered during fire management activities, then the use of heavy equipment will be stopped at that location.
- When step-down plans (e.g., fire management, road maintenance, safety, and emergency response) are written or rewritten for all refuge programs, a section addressing cultural resource management will be included.

Objective 8.2. Cultural Resources
Within five years of CCP approval, the refuge will develop and implement law enforcement procedures to protect the Santee Indian Mound/Ft. Watson site and to diminish site destruction due to looting and vandalism, resulting in less than three violations detected per year for destruction or looting of the site.

Strategies:

- Immediately implement a regular system of patrolling and monitoring of the site by law enforcement personnel and other refuge staff.
- Law enforcement officers will participate in cultural resource protection training at annual law enforcement refresher courses.

Objective 8.3. Cultural Resources
Within the 15-year life of the CCP, one interpretive display and program and/or special event will be developed to educate visitors about the significance of the Santee Indian Mound, focusing attention on the protection of cultural resources. Additionally, one to two brochures and/or tear sheets will convey similar interpretation of the site.

***Strategies*:**

- With the assistance of the Regional Archaeologist, develop partnerships with local and state historic societies, universities, and volunteers to assist with the location and validation of available historical information on the site.
- Utilizing validated information, develop interpretive and outreach programs, signs, and literature that incorporate an environmental stewardship message while conveying the importance of the site to our cultural history.
- Redesign existing signage at the site to prominently display regulations prohibiting searching for and/or removal of objects of antiquity as included in the Antiquities Act of 1906 alongside existing panel interpreting use of the site by the Santee Indians and later as the site of an important Revolutionary War battle.
- Develop outreach strategies utilizing periodic news releases, interpretive programs (i.e., archaeologists and Native American and Revolutionary War subject matter experts), and special events to emphasize the importance of protecting cultural and natural resources.

Goal 9: Wilderness
Preserve the wilderness character within the existing proposed Santee NWR wilderness area.

Discussion: A proposal for wilderness designation of 163 acres of island habitat at Santee NWR was finalized on March 25, 1975, and submitted for congressional approval. No official action was taken by Congress at the time to include the islands as part of the National Wilderness Preservation System. In 1993, and again in 1999, official requests from Congress for information regarding the Santee NWR wilderness proposal were made, thus indicating that the proposal was still viable for consideration. However, no official legislative action has yet been taken by Congress.

The proposed Santee Wilderness Area consists of 13 islands in Lake Marion in Clarendon County, South Carolina. These islands comprise 163 acres and are split between two of the four refuge management units. The Cuddo Unit includes the Plantation Islands and the Pine Island Unit includes Pine Island. The islands range in size from the 22-acre Pine Island to less than one acre in the Plantation Islands.

Historically, the timber in the area was actively harvested and agricultural land was actively farmed prior to the creation of Lake Marion, when the hydroelectric dam was built. Natural regeneration had restored much of the wilderness character of the islands in 1975, and presently the islands exhibit even greater wilderness character because of nearly 70 years of forest growth. The islands contain a mix of pine and hardwood forests.

The Wilderness Act specifies that proposed wilderness areas are to be managed as wilderness pending congressional approval. The proposed Santee NWR wilderness area has been managed as Wilderness since 1975, and will continue to be treated as Wilderness in perpetuity.

Objective 9.1. Wilderness
Within the 15-year life of the CCP, the refuge shall continue to pursue the special designation of the Plantation Islands as a Wilderness Area in order to preserve the unique wilderness character of this area.

Strategies:

- Maintain an open dialog regarding the Plantation Islands' proposal status as Wilderness with the wilderness system contacts in both the Service's Regional and Washington offices.
- Develop a Wilderness Management Step-down Plan.
- Incorporate wilderness themes into refuge interpretation and education materials.
- Develop a Plantation Islands' Wilderness fact sheet and newspaper article template.

Goal 10. Welcome and Orient Visitors
Visitors will feel welcome and find accurate, timely, and appropriate orientation materials and information on visitor facilities, programs, and management activities.

Discussion: The refuge's 15,095 acres are contained within four distinct units stretching for eighteen miles along the northern shore of the 110,000-acre Lake Marion, which was created in the 1940s as part of a hydro-electric dam project. Each of these units offers a variety of outdoor recreation activities for refuge visitors and the visitor center located on the Bluff Unit includes several natural history exhibits and information panels.

Two of the four units (e.g., Bluff and Dingle Pond) are within one mile of Interstate 95 (I-95). However, the other two units (e.g., Pine Island and Cuddo) are located 5+ and 8+ miles from I-95 and as much as 15 miles from the refuge visitor center.

Objective 10.1. Welcome and Orient Visitors
Within four years of CCP approval, sampling of adult refuge visitors will indicate that at least 70 percent were able to easily find the refuge visitor center and/or all refuge units. Additionally, at least 70 percent will report that they found appropriate and sufficient information to guide themselves to refuge facilities as determined by regular sampling.

Discussion: Adequate directional signs from Interstate 95 and primary highways to the visitor center on the Bluff Unit and to the Cuddo Unit are in place. Appropriately placed directional signs are needed to guide visitors to the Dingle Pond and Pine Island units. Directional signs are also needed at several decision points to assist visitors in easily finding and accessing hiking trails, wildlife observation areas, exit points, and other visitor use facilities on all four units.

Strategies:

- Coordinate with the South Carolina Department of Transportation to produce and erect additional directional signs at the intersection of the I-95 exit road and Road 400, directing visitors to both the Dingle Pond and Pine Island units.
- Purchase and erect directional signs providing additional guidance at appropriate decision points along the 1-mile and 5-mile routes to Dingle Pond and Pine Island units, respectively, to include both arrows and approximate distances to each location.
- Purchase and erect directional signs within each of the four refuge units at appropriate decision points for hiking trails, wildlife observation areas, exit points, and other visitor use facilities.

Objective 10.2. Welcome and Orient Visitors
Within two years of CCP approval, the landowner of the access road to the Pine Island Unit will report no more than five instances annually of non-compliance to private property postings clearly identifiable to refuge visitors.

Discussion: Visitors must utilize a sand and dirt road that is in private ownership to gain access to the Pine Island Unit of the refuge. The current landowner has expressed concern about visitors unwittingly trespassing on his property because they may not understand that the access road is on private property. He has experienced problems with unauthorized off-road vehicle entry onto his property. However, this type of trespass is likely associated with local residents rather than refuge visitors. The aim of the signage would be to make it clear that the access road is on private land.

***Strategies*:**

- Work with landowner to develop appropriate signage.
- The signage will inform refuge visitors that they will be crossing private property for a distance of 1-1/2 miles before entering the Pine Island Unit.
- Erect signage at the point where Road 400 ends and a private dirt road begins.

Objective 10.3. Welcome and Orient Visitors
Within the 15-year life of the CCP, regulatory signs; visitor information and interpretive materials, including brochures and electronic media; interpretive and information panels; kiosks; and exhibits will be updated to comply with Service standards. All text will be written interpretively; illustrations and text on panels will highlight refuge resources and management goals and activities. Placement and dissemination of these materials will be sufficient to meet visitors' needs, as attested to by a 75 percent satisfaction rate from sampled adult visitors.

Discussion: The refuge visitor center located on the Bluff Unit includes a visitor reception and exhibit area of approximately 1,000 square feet, which houses exhibits designed and installed in 1981. Renovations to the entire visitor center, including the staff's offices, exhibit area, conference room, and outside decking were scheduled for completion in late 2007. These renovations included improvements to the flooring, wall covering, and lighting systems, as well as replacement of heating and air conditioning units and upgrading of restroom facilities to meet ADA standards. Additional upgrades are needed to provide interpretive exhibits and panels that adequately highlight featured species and habitat; and convey appropriate conservation messages and refuge management goals.

Three panels with interpretive messages about "wetlands," "managing water for wildlife," and "wildlife you may see" are also displayed on the outside wall of the visitor center on the deck/porch area. Visitor contact stations on all four refuge units were upgraded in 2006 and 2007 to provide an introduction to Santee NWR, along with information on permitted/prohibited activities in a format that meets Service standards. Exhibit panels at each of these contact stations include a unit map with roads, hiking trails, and other visitor use facilities highlighted, along with a "full refuge" map to delineate the unit's proximity to other units. Several visitor use facility contact points (e.g., trailheads and observation points) need both standard permitted/prohibited activities signs, and additional interpretive panels and signs are needed on various hiking/nature trails to provide information and orient visitors to refuge wildlife, habitat, management goals, and cultural assets.

***Strategies*:**

- Update Refuge Sign Plan.
- Provide a person, either staff or volunteer, at the visitor center reception booth to provide the public with any needed information.
- Develop numbered stops along the Cuddo Wildlife Drive and nature trails that will be linked to brochure maps and interpretive information.
- Work with the Service's Regional Office staff to assume responsibility for and improve/expand the refuge's existing website, with updated texts and photographs. Assume responsibility for maintenance and future development of website.
- Update existing and develop new interpretive materials, including brochures, interpretive panels, kiosks, and exhibits, that highlight refuge resources. Expand wildlife diversity messages to include threatened and endangered species, migratory birds, and habitat management. Panels will be written and illustrated interpretively.
- Incorporate interactive technology when updating visitor center exhibits so that visitors are more fully engaged, creating a better understanding and appreciation for the refuge's diverse habitats and wildlife.
- Work with the Service and/or contractors to produce a 10- to 20-minute video highlighting the refuge's habitat and wildlife diversity; important management programs; cultural significance; and visitor use activities, such as wildlife observation.
- Install kiosks at parking/trailhead areas (on all four refuge units) that convey trail length and conditions, estimated strolling time, and permitted and prohibited activities.
- Develop wayside panels that interpret refuge wildlife, focusing on endangered species, waterfowl, water birds, neotropical migratory birds, and associated management activities, such as prescribed burns.

Objective 10.4. Welcome and Orient Visitors
Within two years of CCP approval, develop a random sampling protocol, targeting adult visitors to the refuge, and ascertain whether the majority of those targeted felt welcomed by the staff, enjoyed their visit, and could identify that they were on a national wildlife refuge.

Strategies:

- Develop basic visitor satisfaction survey and protocol for randomly selecting adults who may have a reasonable expectation to visit the Santee Lakes area or who live in reasonable proximity to refuge visitor use facilities.
- Coordinate with local tourism agencies, chambers of commerce, and other organizations to disseminate visitor satisfaction surveys to their adult clients.
- Develop schedule for collection of surveys, and compilation and analysis of survey data.

Goal 11. Hunting
Hunters will enjoy quality hunting experiences that lead to support for refuge management.

Discussion: As identified in the Improvement Act, hunting is one of the six priority wildlife-dependent recreation uses. Hunting must be appropriate and compatible with the refuge's purposes. To ensure a quality wildlife-dependent recreational experience, while achieving a wildlife first mandate, the number of individuals participating in the activity and conflicts among users may be limited by (1) establishing special regulations; (2) zoning and separating different uses; (3) permitting uses at certain times of the year; and (4) establishing quotas. Other situations exist where future refuge closures or restrictions

may be warranted. Examples of these situations include, but are not limited to, protection of endangered species, establishment of sanctuary areas for waterfowl, closure of a hunt due to population declines, and safety of other visitors.

Objective 11.1. Hunting
Provide safe, quality recreational deer hunting opportunities that help refuge management maintain a healthy deer herd by preventing overpopulation and associated habitat and/or agricultural crop degradation.

Discussion: Hunting is a necessary deer population management tool for the refuge. Ongoing habitat loss surrounding the refuge due to development pushes deer and other wildlife onto refuge lands. Refuge habitat available to deer and other species is limited, and management of deer population levels is critical to meeting other refuge goals. Traditional predators of deer, such as wolves, no longer occur in the area, and hunting must be used to fill that void. Hunting provides several benefits not only for the refuge but also for the deer population. Overpopulation degrades the health of the entire refuge deer population due to severe stresses, such as increased competition for food, increased incidence of disease, and increased levels of harmful parasites. High population numbers will cause habitat degradation (i.e., deer consume most available food sources and understory vegetation) that directly affects the well-being of literally hundreds of other species, including migratory birds, resident birds, various mammals, and reptiles. Over-browsing will also adversely impact the refuge's agricultural crop program for migratory bird management. Deer hunting was established on the refuge in the 1960s when the refuge determined that hunting was needed to maintain appropriate deer levels. The fact that population management needs can be achieved by allowing public hunts is an excellent example of how hunters can be provided excellent hunting opportunities while the refuge accomplishes critical management needs at a minimal cost to the public.

Strategies:

- Maintain current levels of deer hunting opportunity on the refuge.
- Make an assessment of current hunting programs to assure the programs provide both quality hunting opportunities and meet management needs, incorporate changes needed to improve appropriate aspects of the program.
- Seek partnerships with SCDNR and other conservation groups to help determine optimal population levels for deer on the refuge.
- Update Hunt Plan as necessary.

Objective 11.2. Youth Hunt
Provide a special refuge deer hunt for young hunters (youths) that is a safe, controlled, quality, and educational deer hunting experience on the Bluff Unit of Santee NWR.

Discussion: This refuge special deer hunt is for youths that are at least 10 years and no more than 17 years of age. The special deer hunt, occurring on the Bluff Unit, not only provides an excellent hunting opportunity, but more importantly, provides a means for the refuge to biologically manage an overpopulated deer herd, which causes agricultural crop depredation. Youths are drawn by a lottery type drawing that allows them to participate in this hunt.

The white-tailed deer herd on the Bluff Unit increased in population until serious depredation impacts were observed on native and agricultural vegetation. Approximately 80 percent of the agricultural crops planted for migratory waterfowl were destroyed due to deer depredation in 2000 and 2001. A

draw hunt was implemented in 2002, and succeeded in controlling this heard. In 2003, the refuge introduced the opportunity to allow only youth hunters to be eligible for this special hunt. This hunt was successful in not only controlling deer numbers and crop depredation, but also provided an outstanding recreational opportunity and memorable experience for youths. Refuge staff pre-position ladder stands capable of holding two adults in safe and productive locations. Hunters randomly draw for stands and are taken to and picked up from hunting locations. The positive feedback from youth, as well as adults, confirms the success of this recreational opportunity.

Strategies:

- Continue to provide and expand if possible, quality hunting opportunities for youth hunters and their adult companions.
- Continue to seek assistance from outside sources to support and volunteer during these hunts.
- Explore possibility of holding a special youth turkey hunt and deer hunts on other units of Santee NWR.

Objective 11.3. Hunting Opportunities
Santee NWR will continue to support and provide quality hunting opportunities, while at the same time use these opportunities to manage specific biological resource objectives.

Discussion: Hunting opportunities on Santee NWR have been available for more than 40 years. The refuge will continue to provide quality hunting opportunities within the existing hunt program, but should evaluate harvest results and hunter participation to set future hunting objectives. A decline in refuge resources will also need to be addressed when considering all aspects of the hunting programs, including length of hunts, times of day for hunts, regulations pertaining to each hunt, and expenditures of resources needed to provide quality hunts (e.g., farming, administration, law enforcement, closures to non-hunters, staffing, biological objectives, and monitoring).

Strategies:

- Continue to provide safe and quality hunting opportunities for participants.
- Continue to seek assistance from outside sources as volunteers to provide support during these hunts.
- Explore possibility of opening a special youth turkey hunt on Santee NWR.
- Hire a fulltime law enforcement officer at Santee NWR, or minimally, an additional fulltime law enforcement officer for the Complex. Provide a dual-function officer on Santee NWR to provide the additional support needed.
- Continue to collect data from hunts to analyze and document harvest and hunter data.
- Consider other types of hunts that meet special needs, such as a hunting program for the mobility impaired or for women only, which will assist the refuge in meeting biological objectives.

Objective 11.4. Hunting Opportunities
During designated hunting periods on refuge units, minimize disturbance to non-targeted species, provide for safety of non-hunting public, and ensure that alternative sites and/or activities are available to provide quality wildlife-dependent experiences for all refuge visitors.

Discussion: During the periods that hunting for white-tailed deer is permitted on the Cuddo and Pine Island units, and when the Bluff Unit is open for quota youth deer hunts, the non-hunting public could be subjected to hazardous conditions if its access is not restricted. The potential for injuries or fatalities from accidental weapons discharge, vehicle collisions, or vehicle/pedestrian encounters is markedly increased during open hunt periods. Additionally, hunters are subject to the same hazardous conditions as the non-hunting public. Annually published hunting regulations provide every means possible to ensure a quality hunting experience and to minimize the potential for accidents and other incidents for both the hunting and non-hunting public. A safe hunt is indicated when no hunting-related safety incidents occur. Non-hunted species should be monitored by refuge staff to assure that migratory bird behavior patterns (e.g., foraging, roosting, and resting) remain consistent with non-hunt periods and that flight and movement patterns are not due to disturbance or stress by hunt programs.

Strategies:

- Continue to maintain the Bluff Unit as a non-hunting unit except for youth or other special deer hunts and maintain the Dingle Pond Unit as a non-hunting unit entirely.
- Continue to require hunters to obtain a no-charge hunt permit that provides applicable safety and regulatory requirements, increases national wildlife refuge awareness, and requires hunter signature to attest that each has read and understands refuge regulations that govern hunting on the refuge.
- Continue to require personal, daily check-in and check-out at designated hunter check stations.
- Continue to require completion of hunter safety education for hunters under age 16.
- Continue prohibitions listed in annually published regulations against the transporting of loaded firearms; hunting in close proximity to roads, buildings, and hunter check stations; possessing of alcoholic beverages; using dogs (except for mourning dove and raccoon/opossum hunts), and man-driving and stalk hunting. These regulations also restrict vehicular travel and require the wearing of 500 square inches of solid fluorescent orange visible from 360 degrees during firearm seasons.
- Continue to close refuge units to general public access during designated deer hunts and determine the need for additional closure for other hunts as needed for safety reasons.

Goal 12. Fishing
Members of the fishing public will enjoy their fishing experiences, display ethical behavior, and support refuge management.

Discussion: The public is allowed to fish in refuge waters included within the boundaries of Lake Marion and from several impoundments located within the interior of refuge units. Except in seasonally designated waterfowl areas, all water areas of the refuge are open to public fishing. An estimated 45,000 to 50,000 visits are made annually to fish these waters.

Objective 12.1. Fishing
Provide quality sport fishing opportunities to the public as determined when 75 percent of sampled adult fishing visitors indicate satisfaction with their experience. The level of fishing activities will be compatible with wildlife and resource objectives.

Discussion: Currently, the Bluff Unit along the Lake Marion shoreline draws 75,000 to 80,000 visitors annually for fishing and wildlife observation. The majority of fishing occurs from motorized boats on Lake Marion. There are no improved facilities for shoreline or bank fishing; however, the old State Highway 301, adjacent to the refuge, serves as public access for fishing, viewing, and other opportunities.

Strategies:

- Within one year of CCP approval, educate anglers about refuge regulations governing sport fishing by developing and publishing a refuge fishing brochure in compliance with Service standards that will also serve as a free, self-issuing fishing permit.
- Within five years of CCP approval, write a Fisheries Management Plan and Fishing Plan.
- Within six years of CCP approval, educate anglers and all visitors about fishery resources, water quality, and other issues, using printed or electronic media, news releases, signs, exhibit kiosks, or via interpretive programs and environmental education activities.
- Improve maps and information available to the public; evaluate signage and the use and placement of education kiosks. Evaluate parking and access to the interior levees for fishing.

Objective 12.2. Fishing
Within five years of CCP approval, decrease the amount of littering from fisherman and other visitors on all areas open for sport fishing that are adjacent to or within land units (especially in the Scotts Lake area - along Ft. Watson Road between the Visitor Center and the Santee Indian Mound). Within ten years of CCP approval, decrease littering in those areas by 75 percent.

Discussion: Currently, Scotts Lake (Ft. Watson Road) is open for sport fishing 24 hours a day as long as individuals are actively fishing. However, the refuge is not staffed at night, which contributes to the constant littering and other law enforcement problems. The improper disposal of monofilament fishing line and other plastic products creates hazards for numerous wildlife species. Littering along roadsides in South Carolina in general, and Clarendon County, specifically, is a major problem.

***Strategies*:**

- Within one year of CCP approval, conduct a volunteer "beach sweep" in the Scotts Lake area to clean up the littered shoreline. Ensure press coverage and prepare news releases, including before and after photographs to focus attention on the littering problem, and potential impacts to refuge programs.
- Within one year of CCP approval, develop an outreach plan targeted at fishermen and other refuge visitors to educate them about the threats to wildlife and loss of aesthetic appeal from littering. Encourage them to "leave no trace" and help keep the refuge and other natural areas free of litter.
- If the two aforementioned strategies do not produce the targeted 50 percent reduction in litter within five years of CCP approval, close the area to fishing and post signs stating why area was closed.
- Within five years of CCP approval, coordinate with SCDNR and other partners (e.g., Bass Pro and monofilament fishing line manufacturers) to initiate a monofilament recycling program on the refuge and designate at least one recycling bin on each refuge unit for this purpose.
- Within two years of CCP approval, require permits for night fishing access in the Scotts Lake area and provide walk-in only access from a point east of Ft. Watson.

Objective 12.3. Fishing
Within the 15-year life of the CCP, provide staff support for one on-site and one off-site special event, focusing on fisheries resources and management.

Discussion: Although Santee NWR encompasses a wealth of wetland and open water habitat, there is no suitable area for conducting fishing rodeos or similar events aimed at engaging youth, seniors, or special needs clients in sport fishing activities to promote an awareness of fish species and their habitat and management needs. Much of the water habitats do not lend themselves to the "put and take" stocking necessary to make these events both successful and enjoyable for participants.

Strategies:

- Continue to partner wth Orangeburg National Fish Hatchery (e.g., annual Youth Fishing event) and other facilities within the state; seek to locate and improve an area that meets desired criterion for hosting of fishing rodeo type events (i.e., with water area small enough to feasibly stock catchable sized fish species and shorelines areas that can be safely accessed by youth and other clients).
- Consider timely stocking of fish and with assistance from refuge partners (e.g., Friends of Santee NWR, sport fishing organizations, and corporations) host fishing events targeted to special groups (e.g., youth, seniors, and special needs).
- Develop interpretive and environmental education activities with fisheries and fishing related themes (e.g., casting contests and fish prints) at all refuge sponsored special events.

Goal 13: Wildlife Observation and Photography
Wildlife observers and photographers of all abilities will enjoy and value the diversity of refuge wildlife and will support efforts to maintain high-quality wildlife habitat.

Discussion: Wildlife observers and photographers of all abilities will enjoy and value the diversity of refuge wildlife and will support efforts to maintain high-quality wildlife habitat. Visitor use facilities are available on all four refuge units, enhancing opportunities for wildlife observation and photography. Facilities on the Bluff Unit include two hiking trails with one elevated observation platform (a second non-elevated platform is scheduled for construction), numerous unimproved observation points along Lake Marion, and approximately four miles of sand dirt roads open to foot and/or bicycle traffic on a seasonal basis.

The Dingle Pond Unit currently only has a one-mile woods road that is available for foot traffic. Access is presently limited to a small driveway off Dingle Pond Road that stops at a locked gate (visitors must back into the public roadway to exit). On the Pine Island Unit, visitors may park in a designated parking area and walk or bicycle approximately 3 -1/2 miles of established roads and dikes on a seasonal basis. During the spring and early summer, large alligators often sun themselves on these dikes, which create some apprehension for refuge visitors. The Cuddo Unit is the largest of the four units and also is the only site allowing access by motorized vehicles (a 7-1/2 mile wildlife drive). In addition, this unit has two hiking trails totaling nearly 3 -1/2 miles and an additional 7-1/2 miles of woods roads open to foot and bicycle traffic on a seasonal basis. There are several observation points along and adjacent to the wildlife drive.

Objective 13.1. Wildlife Observation and Photography
Within ten years of CCP approval, improve existing facilities and add new ones to provide for the safety of refuge visitors. Enhance opportunities for wildlife observation and wildlife photography, as indicated by a 70 percent satisfaction rate among sampled adult visitors.

Discussion: Many of our visitors have an ingrained fear of wildlife they do not understand. A high percentage of adults >30 years old have been taught that "all snakes are bad" and the refuge receives numerous requests for assistance with "alligator" problems. Interpretive programs providing accurate information and dispelling myths, along with controlled exposure to non-venomous snakes, are excellent tools for dispelling many of these ingrained fears. Visitors to the Pine Island Unit must utilize existing roads and a dike system by foot or bicycle for wildlife observation and wildlife photography opportunities. During the early spring months, it is not uncommon for these visitors to encounter medium and large alligators sunning on dikes and roads near water. Adequately maintained (i.e., mowed) pathways and interpretive/information panels detailing safe behavior around alligators will provide an appropriate level of security for refuge visitors.

Strategies:

- Develop and install interpretive panels, highlighting wildlife species that are sometimes deemed dangerous or unappealing to refuge visitors. Incorporate these interpretive messages into refuge programs and environmental education activities. Provide annual programs during special events to educate visitors on snakes, alligators, insects, bats, etc., with a goal to develop an understanding of and appreciation for these creatures and arm them with tools to minimize unpleasant encounters between people and wildlife.
- Develop quarterly schedule for mowing, herbicide application, and/or clearing of walking trails, woods roads, and dikes on the Pine Island, Dingle Pond, and Bluff units.
- Develop quarterly schedule for mowing, herbicide application, and/or clearing of roadsides and wildlife observation vistas along the Cuddo Unit wildlife drive to reduce vegetation that limits observation opportunities.
- Replace existing one-level observation platform on the Wrights Bluff nature trail with a two-level tower that includes an accessible lower level, ensuring that the new design is non-intrusive to minimize disturbance to waterfowl. Install at least one spotting scope and develop a grit pile near enough to the observation tower to increase the chance of observing fall and winter birds. Include interpretive panels, focusing on migratory bird species and management.
- Construct at least one accessible photography blind with screening that provides photographers and other visitors with good opportunities for viewing and photographing waterfowl species in their natural habitat. Consider limiting access and develop and disseminate procedures for reserving the photography blind, if appropriate.
- Rehabilitate and stabilize surface of an existing one-mile sand dirt road on the Dingle Pond Unit that currently serves as a hiking trail. Provide trail marking and install boardwalk sections in seasonally wet areas. Construct a short spur off of the existing trail to lead visitors to a two tiered observation tower that overlooks either Dingle Pond (a Carolina Bay) or hardwood swamp along Polly-Cantey Bay. Interpretive signs and/or wayside exhibits will be erected at appropriate locations and a small parking area will be provided with space adequate to accommodate 3-5 vehicles, and allow for safe entry and exit onto public roadways. Continue to nurture refuge relationships with adjacent residential developments to encourage participation in the development of safe and compatible public use facilities.
- Assess potential to manage moist-soil areas near visitor use roads and/or observation points to increase opportunities for observing shorebirds, waterfowl, and wading birds during non-sensitive times or areas.

Objective 13.2. Wildlife Observation and Photography
Within five years of CCP approval, improve the refuge's recognition as one of South Carolina's premier birding and wildlife observation areas, such that 70 percent of sampled adult visitors to the Santee Lakes Focus area know about the refuge and are aware of available wildlife observation activities and visitor use facilities supporting these activities.

Discussion: Santee NWR has long been considered the best inland bird watching destination in South Carolina. Birding enthusiasts flock to the area in search of the brilliantly colored painted bunting in early spring and eagerly anticipate the arrival of a plethora of migratory waterfowl in the fall and winter. Yet, many of the local residents and visitors from outside of the state remain unaware of the refuge's presence and its important contribution to the conservation of neotropical migratory birds and waterfowl populations.

Strategies:

- Develop outreach plan targeted to birdwatchers and other wildlife observation enthusiasts, focusing on seasonal abundance and migration trends, places to observe birds, and tips for ethical wildlife watching. Utilize press releases, refuge web site, and other electronic media (e.g., birding list serves), as well as birding journals, and promotions with local chambers of commerce and tourism bureaus to reach this audience.
- Continue to coordinate with refuge partners (e.g., Carolina Bird Club; South Carolina Audubon Society; Congaree National Park; Santee State Park; local, county, and state tourism bureaus; volunteers; and natural area support groups) to host an annual birding and nature festival headquartered in the area of Santee NWR.

Objective 13.3. Wildlife Observation and Photography
Within five years of CCP approval, develop additional facilities and/or activities to increase overall refuge visitation by 10 percent and visits from clients within a 50-mile radius of the refuge visitor center by 15 percent, as determined by random sampling of adult visitors.

Discussion: As is the case with many national wildlife refuges, Santee NWR suffers from a lack of notoriety and name recognition from potential visitors and local residents. Many visitors mistake the refuge for a national or state park and a substantial percentage are unaware of available visitor use opportunities. Fifteen percent of Clarendon County residents are over 65 and 24 percent of all residents declare some sort of disability (U.S. Census Bureau Quick Facts based on 2006 population estimates - URL - http://quickfacts.census.gov).

With approximately 9,000 of the refuge's 15,095 acres comprised of “wet” habitats, one of the most effective means of wildlife observation is via non-motorized watercraft. Such conveyances are generally quiet and unobtrusive, giving users enhanced opportunities to see and observe wildlife in natural settings for longer periods, and most often with low levels of disturbance to wildlife.

Strategies:

- Develop and provide programs and/or activities (e.g., naturalist led bird and nature walks) to local residents that provide easier accessibility for seniors and mobility impaired visitors. Examples include conveying participants by wagons or trailers, allowing electric carts (e.g., golf carts) for special birding events, and providing audiovisual presentations highlighting significant refuge wildlife resources and management.
- Establish and maintain a minimum of three non-motorized boat trails on the refuge.

Objective 13.4. Wildlife Observation and Photography
Within ten years of CCP approval, assess the demand for use of the refuge by various user groups and evaluate the public access program to meet increasing user demands.

Strategies:

- Research available information on similar activities on other national wildlife refuges to assist with assessment of suitability of activities.
- Where appropriate, initiate compatibility determination procedures to assure appropriateness of activities.
- Ensure minimal wildlife disturbance from proposed activities by using restrictions on seasonal access, maintaining sanctuary areas, developing guidelines to ensure the welfare of wildlife, and maintaining the goal of "wildlife first" on the refuge.

Goal 14: Environmental Education and Interpretation
Provide quality, appropriate, and compatible wildlife-dependent environmental education opportunities to promote understanding and awareness of the refuge, its natural resources, and its human influences on ecosystems.

Discussion: Santee NWR does not currently offer a structured environmental education program that includes written curriculum and periodically scheduled teacher workshops. However, trained refuge staff members provide interpretive tours and programs, utilizing environmental education techniques and activities in response to requests from area teachers. These school field trips (in keeping with South Carolina Department of Education policy) are designed to meet specific written goals and objectives of the state's approved curricula. Approximately twenty such school field trips are hosted each year. Because of the presence of the Santee Indian Mound/Ft. Watson site near the refuge visitor center, the refuge receives many requests for programs and tours related to this site. The staff makes every effort to emphasize the importance of the refuge to natural resource conservation as a means to redirect some of its focus toward wildlife/refuge resources by providing hands-on, activity-based programs.

Objective 14.1. Environmental Education and Interpretation
Within one year of CCP approval, provide naturalist-led interpretive tours/field trips to 25 school groups annually.

Discussion: The first step towards either maintaining or increasing the level of activity for staff- or volunteer-led tours and/or field trips is an assessment of our abilities to provide quality environmental education activities to requesting school groups.

Strategies:

- Research and document recent history of field trip requests to determine average annual number of requests, size of groups, and staff's ability to meet needs without unduly impacting other visitor use or management programs.
- Based on research, establish plan for limiting requests to be accommodated on a weekly or monthly basis (as needed).
- Seek and train volunteers so they can lead field trips and/or assist with larger groups.

- Develop activity kits, trunks, or other tools that teachers can utilize in their classrooms or in the field to convey global and refuge-specific conservation messages. Utilize South Carolina grade-based curriculum guides to guide content and partner with universities, 4-H programs, corporate partners, etc., to assist with development, production, and/or procurement of kit materials and supplies.
- Establish system for loan of existing videos and other materials available from Service production and publication libraries to interested schools as orientation and support for field trips. Available videos focus on such topics as wetlands, neotropical birds, waterfowl migration, endangered species, shorebirds, watersheds, wildlife habitats, and natural resource careers.
- Seek partnership opportunities with Clemson University (e.g., Camp Bob Cooper's 4-H camp), the South Carolina Waterfowl Association's Camp Woodie, and others for incorporating the Service, Refuge System, and Santee NWR's conservation messages into their programs.
- Develop core messages to be used in all refuge programs and environmental education activities that emphasize "wildlife first" and focus on importance of this refuge and the Refuge System for the protection and conservation of natural resources. As appropriate, link important cultural and historic values to related wildlife conservation values.

Objective 14.2. Environmental Education and Interpretation
Within the 15-year life of the CCP, develop a minimum of four curriculum-based environmental education programs that focus on one or more topics related to wildlife conservation and the Refuge System's role in that arena.

Discussion: Curriculum contents will be developed to meet State of South Carolina curriculum standards. Topics to be considered include: freshwater marshes and the importance of wetlands, habitat management and wildlife diversity, prescribed burning as a management tool, role of water management in attracting and providing habitat for waterfowl, planting supplemental crops for wildlife, using regulated harvest activities to manage wildlife populations, careers in resource conservation, and role of the ordinary citizen in wildlife conservation (including focus on climate change). A teacher's guide will be developed so that educators can utilize the guide in their classrooms to support related curriculums. They will also be designed to encourage teachers to use the refuge as an outdoor classroom.

Strategies:

- Develop teacher's guide to Santee NWR that provides an introduction to the refuge and the Service, focuses on the diversity of habitats and wildlife found on the refuge, management programs, and history of the area. The guide will include activities and reproducible materials to illustrate and enhance students' understanding of the ecological concepts presented within the guide.
- Conduct a minimum of two educator workshops annually to demonstrate activities and techniques for developing and using environmental education to support related curriculums as a means to create and encourage environmental stewardship. Utilize existing environmental education tools, such as Project Wild, Project Learning Tree, and The Wonder of Wetlands, and develop site-specific activities and materials as appropriate.
- Develop refuge-specific messages, with associated classroom materials and/or environmental education activity guidance, to be used by volunteers and educators during refuge field trips or in classroom settings. Focus will be on wetlands habitat and associated species, habitat and species diversity, and opportunities for citizens to make a difference on environmental issues (e.g., recycling, water conservation, and strategies for reducing impacts of climate change).

- Partner with the South Carolina Waterfowl Association (e.g., Camp Woodie), South Carolina Ducks, or other partners to develop a wood duck activity kit that could be used for instruction in the classroom or to supplement field environmental education activities.
- Support nature discovery and children's programs that link children to natural areas and wildlife and encourage educational programs that connect children to the natural world and its intricate relationships.

Objective 14.3. Environmental Education and Interpretation
Within 15 years of CCP approval, at least 25 percent of students in grades 4-6 in targeted school districts will participate in curriculum-based environmental education programs that focus on the importance of habitat diversity.

Discussion: Targeted districts include Clarendon District 1, which includes Summerton, South Carolina schools, Clarendon District 2, which includes Manning, South Carolina schools, and Orangeburg District 3, which includes Elloree, Holly Hill, and Vance, South Carolina schools. These districts, within travel distances of 30 miles or less of the refuge, better facilitate field trips by students and off-site classroom visits by refuge staff and volunteers.

Strategies:

- Coordinate with Clarendon and Orangeburg Counties' school districts to identify specific grade level(s) targeted for environmental education activities (recommended grades 4-6).
- Update and disseminate the existing "Guide to Services and Materials Available to Educators at Santee National Wildlife Refuge."
- Develop presentation for school district curriculum coordinators and/or targeted educators to encourage refuge field trips, classroom activities utilizing curriculum based environmental education programs, and stewardship projects to convey desired conservation messages.
- Coordinate with area Boy and Girl Scout leaders for possible field trips, merit badge activities related to wildlife conservation, and possible stewardship projects on the refuge.
- Identify designated outdoor classroom area(s) for use by educators to conduct environmental education activities in support of related class curricula.
- Recruit, train, and utilize non-public use staff, interns, and volunteers to conduct and/or assist with environmental education programs. Within four years of CCP approval, recruit and train five volunteers for these programs.
- Seek grant opportunities for funding per diem and/or lodging costs for student interns to assist with environmental education and interpretive programs. Use existing travel trailer and research other available, no-cost lodging for interns.
- Coordinate with South Carolina Lowcountry NWR Complex visitor services' staff and staff of its support group (e.g., SEWEE Association) for assistance with environmental education program requests beyond the capability of refuge staff and volunteers.
- Request funding and volunteer assistance from the Friends of Santee National Wildlife Refuge as needed to support environmental education programs (e.g., student materials, activity supplies, materials for teacher kits, and assistance with school transportation costs for needy schools).

Goal 15. Interpretation
Visitors of all abilities will enjoy their visits and increase their knowledge, understanding, and support for the refuge and the Refuge System.

Discussion: The primary themes now interpreted on the refuge include the diversity of habitat and wildlife species found on the refuge, with focus on wetlands, waterfowl and endangered species, management actions supporting this diversity, and the role of national wildlife refuges and the Service in wildlife conservation. Although most tactile interpretation takes place within the visitor center, small contact stations are located at numerous visitor use areas on all four refuge units. The visitor center is wheelchair accessible but most other visitor use areas are minimally acceptable from an accessibility standpoint.

Objective 15.1. Interpretation
Within six years of CCP approval, at least 75 percent of adult visitors regularly sampled at the visitor center will be able to identify that they are visiting a national wildlife refuge where wildlife comes first.

Strategies:

- Interpretive panels at all visitor use areas will include Service, Refuge System, and refuge-specific messages such as migratory waterfowl and neotropical birds, threatened and endangered species, habitat diversity and management, and wetlands conservation.
- Utilize "tag lines" and other media to market and identify the Refuge System on the products sold in the retail sales area.
- Coordinate with the Friends of Santee National Wildlife Refuge to develop sales items that include the refuge name and feature prominent native wildlife species.
- Refuge staff and volunteers staffing the visitor center and/or encountering visitors in the field will emphasize ethical wildlife observation/photography methods and encourage visitors to observe wildlife from afar without interfering with the animal's activities.
- Exhibit panels and literature will clearly state permitted/prohibited activities and include language that states the primary purpose of the refuge, which is to provide sanctuary and habitat needs for wildlife; visitor use activities are only allowed when they do not conflict with wildlife interests.

Objective 15.2. Interpretation
Within the 15-year life of the CCP, provide an average of at least one interpretive program per month.

Discussion: Refuge staff and volunteers provide an average of 6 to 10 interpretive programs annually. Current offerings range from naturalist-led bird walks, programs on the Santee Indians, the American Revolution, reptiles and amphibians, wildflower walks, public waterfowl banding events, and butterfly walks, to back roads tours of various units by wagon, foot, or bicycle.

Strategies:

- Continue to host special events in conjunction with existing Refuge System and other established celebrations or commemorations (e.g., National Wildlife Refuge Week, Earth Day, and International Migratory Bird Day).
- Develop new programs for additional focus events (e.g., Wetlands Month, Public Lands Day, Hunting and Fishing Day celebrations, and Santee Birding and Nature Festival).
- Develop interpretive programs for ranger-led canoe and/or kayak field trips on refuge units as appropriate.
- Seek partners and use volunteers to host "speakers' bureau" with subject matter experts on such topics as alligators, pollinators, wetlands plants, and Native American culture.
- Increase demonstration type and hands-on interpretive programs, such as waterfowl and migratory bird banding.

- Partner with Santee State Park, University of South Carolina Department of Archaeology, State Historic Preservation Officer, and Regional Archaeologist to develop joint or stand-alone interpretive programs and/or guided tours of the Santee Indian Mound/Ft. Watson site for National Archaeology Month celebrations held annually in October.
- Coordinate with volunteers, community partners and/or the South Carolina Wildlife Federation to establish a native plants, wildflower, and butterfly garden at the refuge visitor center. Through interpretive signs and an accompanying guide, the area could become an outdoor classroom and serve as a demonstration area for “Backyard Wildlife Management" to encourage environmental stewardship.

Objective 15.3. Interpretation
Within three years of CCP approval, a minimum of one refuge hiking trail will be classified as an interpretive trail.

Discussion: None of the refuge's existing hiking trails is interpreted. Exhibit panels at trailheads describe the refuge habitat and wildlife and provide guidance and suggestions for successfully observing wildlife.

Strategies:

- Develop or purchase standard interpretive signs for erection at appropriate locations along the Wrights Bluff Nature Trail, with focus on identification and/or description of major habitat components, endangered species, waterfowl and related management, and wood duck box management.
- Install interpretive signs at both the Cantey Bay observation platform and the observation tower overlooking croplands, Lake Marion, and the banding pond. Focus for these panels will be on waterfowl, shorebirds, water birds, alligators and other reptiles, croplands management, water management, and refuge banding efforts.

Goal 16. Recreation
All public use activities will be appropriate and compatible and visitors will support priority public use activities that minimize wildlife and habitat disturbance.

Discussion: The Improvement Act identifies six specific priority wildlife-dependent recreation uses. They are hunting, fishing, wildlife observation, wildlife photography, and environmental education and interpretation. Fundamental to the provisions of these uses are viable and diverse fish and wildlife populations and the habitats upon which they depend. These priority uses, along with all other uses, must be appropriate and compatible with the refuge purposes and the mission of the Refuge System.

To ensure a quality wildlife-dependent recreational experience, while achieving a wildlife first mandate, the number of refuge uses are limited and certain actions are taken to limit conflicts between users by: (1) zoning activities; (2) designating trails, dikes roads, structures, and sites for specific recreation activities; (3) establishing closed areas to provide wildlife sanctuaries; (4) establishing special regulations; (5) minimizing conflicts with other management or visitor programs; and (6) controlling or prohibiting certain recreational activities that disturb wildlife. Some current uses may be affected with the implementation of this CCP.

Although jogging activity on the refuge has not been documented to any extent, this activity does not meet the definition of a wildlife-dependent recreation activity and would be eliminated as an approved activity. Bicycle riding on refuge walking trails has never been permitted because of safety concern for other trail users. Bicycle riding would be restricted to roads designated on refuge maps. In general, activities that adversely affect fish and wildlife or their habitats will have to be evaluated to determine if they are appropriate and compatible with the purpose of the refuge and the Refuge System. Determinations will be based on field monitoring and published literature (e.g., Klein 1993; Gabrielson and Smith 1995; Morton 1995; Dobb 1998; Riffell et al., 1996; Burger 1981; Pease et al., 2005).

Other uses will be studied and adaptive strategies developed to deal with activities that cause wildlife disturbance, such as activities or vehicles that generate loud noises and disturb wildlife. The area of greatest concern is along the Cuddo Wildlife Drive and some boating, where the potential for visitors versus wildlife conflicts is greatest. Strategies that may be implemented to reduce the potential for wildlife disturbance include: designation of seasonal access areas to provide sanctuary for sensitive threatened and endangered species and waterfowl, developing new signs which stress proper wildlife viewing etiquette, and establishing vegetative screens. These and other adaptive strategies may be used at other locations if wildlife conflicts arise.

Objective 16.1. Recreation
Over the 15-year life of the CCP, information will be provided at the refuge visitor center, visitor contact areas, and via the refuge website and through printed materials (e.g., brochures) relating to appropriate and compatible recreational activities that will assist visitors in understanding the refuge boundary and the fact that their behavior can reduce wildlife disturbance.

Strategies:

- Wildlife viewing etiquette messages will be incorporated into brochures, exhibits, and electronic media.
- All refuge brochures, signs, and exhibits will be updated to assure that the public is aware of potential wildlife disturbances and clearly understands permitted and prohibited activities for all refuge units.

Objective 16.2. Recreation
Upon CCP approval, assess and mitigate any adverse impacts on the 7 1/2-mile Cuddo Unit Wildlife Drive's trust resources (e.g., namely waterfowl and alligators) by visitors using the drive.

Discussion: The Cuddo Unit Wildlife Drive is open for public access 7 days per week except for the periods when the Cuddo Unit is open for deer hunting. Hours of access are from 7 a.m. until 7 p.m., from April 1 through September 30, and 8 a.m. until 5 p.m., October 1 through March 31, each year. Access to the wildlife drive is controlled by an automatic gate.

Strategies:

- Develop procedures for staff and/or visitor reporting and documenting of instances of wildlife disturbance (e.g., noting that wood ducks flush when vehicles pass by without soon returning to the site and instances of individuals throwing articles at alligators). Analyze findings to determine seasonal occurrences or patterns of problems.

- As necessary, close that section of the wildlife drive past Otter Trail, routing traffic down Otter Trail to a point where visitors can access the north and south loops of the hiking trail, turning left and continuing to the intersection of Woods Road, making another left turn to take visitors back to the main (Center) road of the wildlife drive. This closure, whether seasonal or permanent, would provide additional measures to prevent disturbance to wildlife.
- Continue to prohibit vehicular access to the west side of the Cuddo Unit year-round, with access only allowed via foot or bicycle. And, continue to prohibit public access of any type on the west side of this unit from November 1 through March 31, to minimize disturbance to wintering waterfowl.
- Consider closing the wildlife drive to all public access on Mondays and Tuesdays, year-round (except during special hunts or other public use events) to provide wildlife with a respite from disturbance.

Objective 16.3. Recreation
Upon CCP approval, provide measures to monitor and mitigate wildlife disturbance and/or wildlife/visitor conflicts on all refuge units.

Discussion: All four refuge units host sensitive threatened and endangered species (e.g., wood storks) and are home to bald eagles, wintering waterfowl and wood ducks, as well as alligators. Although the four units stretch for 18 miles along the shore of Lake Marion, each unit is actually a small refuge area separated by privately owned properties. All indications support increased development of the North Santee area in the vicinity of refuge units. As such, all four units are vulnerable to unauthorized access and incompatible activities, with these activities likely increasing in the future.

Strategies:

- Continue to prohibit vehicular access to Pine Island, Dingle Pond, and Bluff units.
- Limit bicycle access to the Pine Island Unit and designated areas on the Bluff Unit, with seasonal limits on access for both areas (prohibited during the period November 1 through March 1). Consider a reconfiguration of public access on the Pine Island Unit to limit disturbance to wintering waterfowl.
- Limit access on the Dingle Pond Unit to foot traffic on a designated hiking trail.
- Before opening other access onto these areas (namely canoe and/or kayak trails), assess potential for wildlife disturbance and mitigate using closed areas and/or seasonal closure of these trails. Where necessary, expand the waterfowl sanctuary zones, such as Bluff Unit Line Island Savannah Branch and Cuddo Unit Plantation Islands. A “no-motor” zone around the Plantation Islands would add an additional safety measure for individuals using the canoe or kayak trails.
- Develop outreach strategies and coordinate with local realtors, developers, and/or homeowner associations to educate and encourage them to employ practices to enhance the habitat value of their property during and after home construction. Consider developing posters for local distribution that identifies the refuge boundary and enhances awareness and understanding of the refuge.
- Coordinate with partners mentioned in the preceding strategy to seek funding, volunteers and other assistance to enable the refuge to improve existing pubic use facilities and add new facilities to meet increased outdoor recreation demands.

Objective 16.4. Recreation
Within four years of CCP approval, develop a comprehensive Visitor Services' Plan and associated plans (e.g., fishing, outreach, and hunting) that include visitor services' goals, objectives, and strategies required to meet current and future demands, while adhering to the Refuge System mission of "wildlife first."

Discussion: A visitor services' review of Santee NWR was conducted in May 2005, with the final report filed in April 2006. This review was conducted by a team from the Service's Regional Office, along with field experts in visitor services' management who spent several days meeting with refuge staff and visited all four refuge units to view ongoing visitor facilities, while receiving information from refuge staff on visitor uses provided, anticipated demands, and associated issues. The review team made a number of recommendations for improving the refuge's visitor services' program, including a primary recommendation to develop a Visitor Services' Plan.

Strategies:

- Immediately upon CCP approval, develop a short-term Visitor Services' Plan that includes important conservation messages, means for delivering those messages, analysis of demands/visitor uses to determine appropriate delivery methods, procedures for prioritizing visitor service activities, and outlining methods for increasing use of volunteers to accomplish visitor service priorities.
- Develop a comprehensive Visitor Services' step-down plan that will encompass priorities and plans for the six priority public uses of the Refuge System (e.g., hunting, fishing, wildlife observation, wildlife photography, and environmental education and interpretation) and measures to determine appropriateness of non-priority public uses, such as bicycling or activities that adversely disturb wildlife.

Goal 17. Friends Group
The Friends of Santee Refuge will be an advocate for the refuge, supporting all refuge goals and objectives and providing financial and in-kind support of refuge programs.

Discussion: The Friends of Santee Refuge, established in 2002, has been incorporated as a 501 (C) 3 federal non-profit group. It has executed a Memorandum of Agreement with the refuge. The group's stated purposes are to support and promote programs and activities of the Santee NWR. Currently, the group has approximately seven active members and an inactive membership that does not regularly participate in friends or refuge activities and programs.

One of the major efforts of the Friends group has been the coordination of six annual "Victory at Fort Watson" celebrations that bring an average of 450 visitors to the refuge for a combination of wildlife-related events and activities, and programs and activities commemorating the Revolutionary War in South Carolina, including colonial life demonstrations. Another very successful function of the Friends group has been its "behind-the-scenes" advocacy for the refuge and the community. Friends' members manage a very small retail sales unit in the visitor center.

The refuge's volunteer program will also be addressed under this goal. Descriptive information on the volunteer program is included under objectives related to volunteers.

Objective 17.1. Friends Group
Within five years of CCP approval, assist the Friends group in growing from 7 members to greater than 100 members.

Strategies:

- Continue existing policy of recognizing the benefits derived by the refuge from Friends of Santee Refuge in appropriate news releases, interpretive program announcements, and any other appropriate media.
- Develop presentations for use by Friends members and staff aimed at community groups and organizations to assist with recruiting efforts.
- Utilize special events such as the planned birding and nature festival to promote the merits of the Friends group and to recruit members.
- Provide links from the refuge web site to the Friends group website.
- On at least an annual basis, provide media releases promoting the Friends group, with particular emphasis on accomplishments and significant contributions to refuge programs.
- Coordinate with local realtors, developers, and landowners to encourage their clients to join the Friends group and actively participate in its activities.

Objective 17.2. Friends Group
Over the 15-year life of the CCP, the refuge will continue to maintain a close working relationship with the Friends of Santee Refuge, assisting in promoting the growth in membership and financial revenues, providing input on refuge needs, and working to maintain proper focusing of the group's activities in support of the refuge and in habitat and wildlife activities and contributions**.**

Strategies:

- Encourage attendance by the refuge manager and/or the park ranger at all member and board meetings.
- Provide quarterly updates to the board regarding ongoing refuge management activities and projects, with particular emphasis on those needing involvement from volunteers and Friends members.
- Limit the "Victory at Ft. Watson" commemorative event to one day with activities and programs originating from the Santee Indian Mound/Ft. Watson site only.
- Request significant volunteer and coordination efforts from the Friends group for planned birding and nature festival.
- Coordinate with Friends board to stock items in the retail sales area that promote wildlife related visitor experiences (e.g., species guide books, wildlife species postcards and note cards, refuge pins, Blue Goose passport, refuge T-shirt, tote bag, and caps featuring wildlife) and decrease emphasis on historically related sales items.
- Update refuge volunteer/visitor center host orientation training and present on a semi-annual basis. Recruit Friends members to serve as visitor center hosts.
- Invite Friends members to either planned educator workshops or develop specific orientation/training for them. Offer on a semi-annual basis. Recruit Friends members to assist with interpretive and environmental education programs.

Objective 17.3. Volunteer Program
Within the 15-year life of the CCP, increase number of active volunteers by 20 percent over 2007 numbers. Secure volunteers for at least 75 percent of needed volunteer positions or identified tasks.

Description: Approximately ninety volunteers have signed agreements with the refuge; the level of volunteer activity ranges from those who only assist on one or two special projects annually to those who contribute on a weekly or daily basis.

Strategies:

- Publicize volunteer program and refuge volunteer needs via every available avenue (e.g., media releases, community presentations, refuge and friends website, contacts and partnerships with local chambers of commerce, and educational institutions) to recruit for needed volunteers.
- Use existing volunteer responsibility designations to create formal volunteer position descriptions for the major areas of responsibility (e.g., visitor center duties, building and facilities maintenance, public use facility duties, interpretive and environmental education, and administrative support)
- Plan and conduct a minimum of two annual "Volunteer Work Days" with one of those also dedicated to recognition of volunteers with an awards ceremony. Recommend that Friends group provide financial assistance for awards and ceremony.
- Post Santee NWR volunteer applications and skills assessment survey on the refuge and Friends group websites.
- Establish recreational vehicle site with associated infrastructure to accommodate a work/camper program.

Objective 17.4. Volunteer Program
Within five years of CCP approval, surveys will indicate that 90 percent of volunteers are highly satisfied with their volunteer experiences.

Strategies:

- Conduct volunteer orientation for all volunteers and an annual refresher for active volunteers.
- Develop and disseminate a volunteer handbook specific to Santee NWR.
- From submitted volunteer applications and skills surveys, determine training needs for volunteers. Utilize local and area resources, on-the-job training, teacher workshops, and courses offered by the Service's National Conservation Training Center (NCTC) in West Virginia to provide training needs. Seek available scholarships to NCTC or request assistance from the Friends group to fund training as needed.
- Develop procedures for survey volunteers on a semi-annual basis to ascertain their levels of satisfaction with their volunteer experiences. Conduct exit interviews of all volunteers that leave the program. Assess ongoing volunteer program to make needed adjustments if indicated on volunteer surveys.
- Seek opportunities for non-traditional rewards for volunteers (e.g., guided tours of other refuges within the state or complex).
- Increase efforts to recognize and reward volunteers; seek regional and national recognition of outstanding volunteer contributions.
- Designate active volunteer to serve as station volunteer coordinator to assist with recruitment, orientation, project assignments, volunteer recognition, and supervision. Provide needed orientation and/or training.
- Hire a volunteer coordinator for the South Carolina Lowcountry NWR Complex to coordinate volunteer programs for ACE Basin, Cape Romain, Santee, and Waccamaw NWRs.

Goal 18. Law Enforcement
The refuge will have sufficient law enforcement staff to protect the visiting public, refuge facilities, and wildlife resources and all officers will have adequate training and equipment to perform their duties.

Discussion: The refuge encompasses four separate units that stretch for eighteen miles along the northern shore of Lake Marion, a 110,000-acre lake extremely popular for sport fishing and waterfowl hunting. Each of the four units is separated by miles of private property inhabited by both permanent and part-time residents. Public use pressure on refuge holdings from outside sources is heavy. When wintering waterfowl are present on the refuge, our areas truly serve as havens for these species, since waterfowl hunting is permitted during designated seasons in most areas surrounding the refuge. The potential for all sorts of illegal activities occurring in the Scotts Lake/Santee Indian Mound area is significant. These activities range from littering and illegal campfires to removal of artifacts, along with drug trafficking and almost anything else in between.

Currently, one collateral duty law enforcement officer and one fulltime law enforcement officer for the South Carolina Lowcountry NWR Complex are the only staff resources available to conduct law enforcement activities.

Objective 18.1. Law Enforcement
Within the 15-year life of the CCP, sufficient resources will be provided to ensure that refuge buildings, visitor use facilities, and trust resources are not harmed and refuge visitors are not injured or killed.

Strategies:

- Develop or update existing Law Enforcement step-down plan.
- Provide up-to-date training and equipment for collateral duty and fulltime duty officers (Complex staff).
- Develop Memoranda of Understanding with state and/or county law enforcement agencies and the SCDNR to facilitate cooperation and assistance for law enforcement activities.
- Collateral duty law enforcement officer will coordinate with complex officer and available SCDNR officers to respond to reported or detected violations.
- Schedules and procedures for periodic and random law enforcement patrols will be established and will include protocol for designating emergency contacts to ensure safety of refuge law enforcement personnel.
- Hire an additional fulltime law enforcement officer for the complex with a documented goal that a minimum of 50 percent of his time is devoted to Santee NWR.
- Develop procedures for adequately informing refuge visitors of hazardous conditions or areas.
- Collateral duty officer and complex law enforcement officer will coordinate with Santee NWR visitor services' program manager to develop outreach strategies that will assist in attaining compliance with refuge regulations as needed (e.g., littering).

Objective 18.2 Law Enforcement
Provide a safe and enriching environment for the visiting public engaged in authorized activities on Santee NWR. Allow staff to work in a safe and efficient manner without interference from any un-authorized activity. Protect all resources and property entrusted to the Federal Government by its citizens. Enforce all federal, state, or local laws within the boundaries of Santee NWR, and enforce any federal laws adjacent to the refuge that have the potential to impact the refuge's stated objectives.

Discussion: Santee NWR plays a critical role in protecting the resources found in the Santee Cooper Focus Area. Residential development adjacent to and within close proximity of the refuge is growing rapidly and is expected to grow even faster in the near future. The growth in the residential population, as well as vacationers, will greatly impact the refuge. While these impacts will not all be negative, the refuge's ability to manage them will be challenged. Approximately 9,000 acres of open lake water is located within the boundaries of Santee NWR and with the exception of the waterfowl season, is rarely patrolled by refuge officers. This lake is an extremely popular and heavy traffic area for pleasure boaters, personal watercraft, fishermen, and hunters. At present, one dual-function officer is onsite to manage these impacts that will grow exponentially in the near future. One fulltime officer is available to initiate or assist in law enforcement activities on Santee NWR, but this officer is also responsible for similar activities on three other refuges, all located more than 80 miles away.

***Strategies*:**

- Create a fulltime law enforcement officer position at Santee NWR, or minimally, a fulltime law enforcement officer within the complex. Locate another dual-function officer at Santee NWR to provide the additional support needed.
- Provide Santee NWR with an adequate law enforcement budget for permanently stationed law enforcement officers at the refuge (both fulltime and dual-function). This budget would be used to provide needed law enforcement equipment and overtime pay.
- Create and implement strategies to discourage unauthorized activities on all units and to manage a significant increase in visitor use.
- Provide an avenue to educate visitors and neighbors on refuge regulations and activities both authorized and unauthorized.
- Identify illegal activities and resolve these issues before they become more complex.

Goal 19. Refuge Management
Provide sufficient resources to implement a comprehensive refuge management program to protect and mange the natural and cultural values of the refuge's inland South Carolina coastal plain and Santee lakes system.

Objective 19.1. Refuge Management
Within five years of CCP approval, site and develop an administrative office facility and expanded visitor center.

Discussion: The refuge's offices are clustered at the visitor center and at the maintenance compound. Offices in the visitor center include the management, administration, biological, public use, and law enforcement programs and no space allocation for the Friends of Santee NWR. The maintenance compound includes an office in the shop building for law enforcement and storage of law enforcement and fire equipment. The shop compound also houses chemicals and fuels and serves as a general warehouse facility, with equipment storage garage and gas pumps. A small travel-all trailer is housed within the compound that is used by interns, students, and visiting staff.

The existing combination office/visitor center is deemed insufficient to handle the support structure of a cooperating association, volunteers, and annual visitors, while also supporting the refuge's daily operational and administrative functions. The small conference room in the visitor center is used as an occasional meeting room for state and Service staff, training, fire briefings, and refuge visitors.

The existing visitor center has served the program well within the limits of historic public uses and administrative needs. The building should be expanded to accommodate the needs of a growing public use program and a separate or adjoining administrative office facility should be built to accommodate the refuge's administrative functions. These plans should include any engineering services to upgrade the refuge's utility systems, including water, sewer, telephone, fax, and computer services.

The refuge headquarters, visitor center, and shop compound are dependent upon a well and septic system that are part of the original structure. The refuge has two septic systems for its offices, one at the visitor center and another at the maintenance compound. The present utilities for telephone, fax, and computer communications need to be updated. Over the years, the refuge has utilized nearly all of the available communication capacity. An upgrade of the system is needed to keep up with the information and communication demands of today and for security purposes.

Objective 19.2. Refuge Management
Within seven years of CCP approval, construct a dormitory facility and recreational vehicle pad facilities within the refuge headquarters compound for use by researchers, interns, students, volunteers, and temporary firefighters. This would replace the existing Bluff Shed storage facility.

Discussion: A major asset to a refuge for research and fire management support is a crew quarters and dormitory facility, which can be used by the refuge to house fire management teams, researchers, and volunteers. The undisturbed landscape and migratory bird management potential make the refuge a highly desirable location for research. The availability of a dormitory facility for researchers offsets research costs considerably when compared to the cost of having to rent motel rooms and/or apartments. This type of facility offers researchers, students, and volunteers on-site housing during their courses of study. This is a valuable asset to provide in-kind support to attract needed researchers to conduct projects on the refuge.

Beyond researchers, interns and volunteers can provide an essential component of the public use program for visitors on the refuge. This can include support of the visitor center operations, assist with interpretive and educational programs, and disseminate information. Interns are provided a small stipend, but free housing in a dormitory facility or providing recreational vehicle pads are key components to making this program successful. Located about one mile west of the refuge's headquarters on the Bluff Unit, the Bluff Shed is approximately fifty years old and has been used for various purposes over the years. It historically was the site of Santee-Cooper mosquito control operations. The shed has been used for refuge materials and equipment storage over the years. The refuge is seeking a groundwater and soil contaminates survey to ensure the site is safe for human use and occupation. The long-term solution to the need for housing interns, volunteers, researchers, and temporary firefighters is to construct a dormitory within this compound. This facility would have to be connected to the support systems (e.g., water, electric, telephone, and septic) of the refuge headquarters. An additional feature would be the construction of recreational vehicle hookups and concrete pads. Some interns and volunteers would take advantage of the recreational vehicle pad option, especially those who are retired.

Objective 19.3. Refuge Management
Within four years of CCP approval, determine the feasibility of the refuge taking ownership and responsibility for all, or a portion, of the Fort Watson Road.

Discussion: The state-owned Fort Watson Road is the only access for staff and visitors to reach refuge headquarters and the Bluff Unit. The asphalt-covered road terminates as a cull de sac at the Indian Mound and Fort Watson and does not provide a throughway across the refuge. The road is in fair condition and can have numerous potholes and overhanging branches; it is not fully maintained by the South Carolina Department of Transportation (DOT). The road presents a management issue for the refuge from individuals accessing the area after hours, including special law enforcement issues such as drug dealing and use. The roadway is now showing signs of cracking and will have to be resurfaced to enable visitors to have a safe route to travel. The refuge wishes to take position and ownership of the road due to the special management problems (e.g., law enforcement and refuge access) and proper maintenance issues. Planning and completion of this effort may be a joint project and coordination between the Service, Federal Highway Administration, Clarendon County, South Carolina DOT, and the Friends of Santee NWR.

***Strategy*:**

- Coordinate with Clarendon County, the South Carolina DOT, and/or legislative delegates to transfer ownership of portions of Fort Watson Road that fall within the existing Santee NWR boundary to the Service for the purpose of controlling access to the refuge.

Objective 19.4. Refuge Management
Within the 15-year life of the CCP, provide a full complement of 13 permanent staff to protect and manage the natural and cultural resources of the refuge, while providing opportunities for appropriate and compatible public use.

Discussion: To serve the purposes of the refuge and to accomplish the outlined goals and objectives of the CCP, additional staff and volunteers would be required. Along with additional staff, additional support equipment and facilities would be needed (e.g., office space, computers, and vehicles). See the staffing charts for each of the refuge program areas [i.e., Refuge Management (one staff); Office Administration (one staff); Biological Program (three staff); Law Enforcement Program (one staff); Public Use Program (two staff); Fire Program (two staff); and Maintenance Program (three staff)]. The refuge would emphasize recruiting and retaining staff and supporting applicable training and certification programs for maintaining primary job functions. Spanning several refuge programs (including management, biology, law enforcement, public use, maintenance, and fire), one desired skill set for refuge staff (probably in the biological staffing) would involve geographic information systems (GIS) and global positioning systems (GPS).

Objective 19.5. Refuge Management
Throughout the 15-year life of the CCP, maintain an effective network of signs, meeting the Refuge System's standards to notify the public of refuge boundaries, public use areas, and closed areas by annually re-posting, replacing, and/or maintaining 20 percent of the refuge signs.

Discussion: Santee NWR maintains signs in accordance with Service standards. In addition, highway signs are administered in accordance with the Uniform Code of Traffic Standards. The network of signs informs the public of refuge boundaries, speed limits, closed areas, public facilities, sensitive wildlife areas, and rules and regulations designed to protect the public and the natural resources.

Goal 20. Intergovernmental Coordination
Foster a strong and effective working relationship with existing partners and new partners for the purposes of accomplishing refuge management goals and protecting the natural and cultural resources of the refuge's habitats.

Discussion: Government is required to reinvent itself based on the economic conditions, shifting national priorities, national defense, and recovery from natural disasters. The public has an expectation that more of the Service's goals can be accomplished through partnerships and that government must become more efficient. The Director of the Service has stated that we must emphasize working cooperatively with others, develop a more integrated approach to problem-solving, and share resources to get the job done. We must make choices and find efficiencies in both resource and business management practices. This focus strengthens the refuge's current intergovernmental coordination efforts. Numerous federal, state, and local agencies could be considered partners of the refuge. However, more could be done to inform and educate the partners of the value of the refuge and the refuge's goals. In the same vein, the Service helps other agencies with issues, such as fire management, nuisance wildlife, exotic plant control, and specific wildlife conservation issues. Much of this coordination could be accomplished by regular meetings and by developing personal relationships with individuals within other agencies.

Objective 20.1. Intergovernmental Coordination
Improve refuge coordination with Santee-Cooper in order to make refuge goals and objectives an important component in the planning and implementation of Santee-Cooper Focus Area's environmental and land management efforts.

Discussion: Since much of the refuge is an overlay of the lands and waters of Santee-Cooper Focus Area, the most important relationship for the refuge is a positive interactive relationship with this agency. This relationship also includes the various departments within Santee-Cooper. As Santee-Cooper adapts to new land management goals, growing urban communities around the Santee Lake system and FERC re-licensing responsibilities, new and evolving relationships are critical to maintain good partnerships. Santee-Cooper needs to understand the role of the refuge and hopefully come to place a high value on the resources it protects. In addition, it should come to understand that it plays an integral role as a refuge partner in the protection and management of the resources.

***Strategies*:**

- Brief Santee-Cooper director and senior staff annually on current and future refuge plans.
- Meet regularly with Santee-Cooper environmental staff to better communicate on research, monitoring activities, potential new development projects, and opportunities to improve habitat.
- Continue to respond appropriately to Santee-Cooper requests for technical support in dealing with wildlife issues or partnership efforts
- Invite Santee-Cooper staff to periodic demonstrations and viewings of actual refuge operations. Include social events where appropriate.
- Develop coordination meetings so staff can meet regularly to discuss issues, problems, and partnership opportunities.

Objective 20.2. Intergovernmental Coordination
Continue effective refuge coordination with SCDNR as it applies to programs of mutual interest, including public use activities, research, law enforcement, wildlife, and habitat management.

***Strategies*:**

- Continue to have an annual meeting with the regional state coordinators to ensure consistency between programs and agencies and provide an open-door policy for visits from SCDNR staff.
- Invite new SCDNR staff to visit the refuge for an orientation.
- Invite SCDNR staff to social events where appropriate.
- Participate in appropriate special events sponsored by the SCDNR.
- Enhance opportunities to partner on projects

Objective 20.3. Intergovernmental Coordination
To further goals and objectives in programs of mutual interest, continue to work with local governmental partners, such as county and city governments (e.g., environmental programs, Parks and Recreation, County Commissioners, Sheriff's Department, and County Tourist Development Councils).

***Strategies*:**

- Continue to seek input and encourage these entities to be involved and informed of refuge activities and plans.
- Maintain mutual aid agreements in the event of emergencies or disasters.
- Work with local partners to support the development of environmental and educational programs.

Objective 20.4. Intergovernmental Coordination
Continue to work with non-governmental partners, such as Ducks Unlimited, Delta Waterfowl Association, South Carolina Ducks, Audubon Society, The Conservation Fund, South Carolina Wildlife Federation, The Nature Conservancy, South Carolina Waterfowl Association, and other conservation groups to discover areas of mutual interest.

***Strategy*:**

- Maintain a dialogue with these groups to keep them informed of refuge activities and seek opportunities for grants or other funding.

Objective 20.5. Intergovernmental Coordination
Seek new partnerships, some of which may not be the conventional partners of the refuge, such as groups interested in cultural and historical resources.

***Strategies*:**

- Identify and maintain a list of problems, issues, and opportunities with which the refuge could use partnership involvement.
- Take advantage of networking to seek partners.
- Augment and articulate the relationships between natural and cultural resources.

Objective 20.6. Intergovernmental Coordination
Continue to develop cooperative farming operations to support refuge migratory bird management efforts with an emphasis on conservation practices.

Discussion: Agricultural crops play an important role in migratory bird management, as they provide a source of high energy carbohydrates needed during periods of cold weather. Typically, the refuge supplies "hot food" crops that are either rotated with moist-soil units or produced on the higher elevations to ensure that Southern James Bay Canada Geese have a readily available food source. Santee NWR cropland operation could potentially occupy 1,100 acres (including approximately 200 acres of floodable fields and 900 acres un-impounded) among the Bluff, Pine Island, and Cuddo units. The number of acres of crops may vary depending on the degree of cooperative farming and funding. Some crop fields that are planted for the refuge can be flooded for waterfowl utilization. Of the total agricultural lands available, 205 acres were farmed using force account in 2007. Historically, a much broader agricultural program existed with a greater work force and emphasis on farming. In 2006, the refuge began exploring cooperative farming agreements and updated the Compatibility Determination. In the agreement, the refuge identifies its portion of the crops left to better suit migratory bird, waterfowl, and goose management objectives. This sets the stage for the refuge to make substantial contributions to the South Carolina and flyway migratory bird objectives. The refuge farming program will continue to work to address habitat issues that affect migratory bird populations, in keeping with refuge goals and establishing purposes.

Goal 21. Climate Change
Provide opportunities to study climate change effects by encouraging associated research on the refuge.

Objective 21.1. Climate Change
Within five years of CCP approval, develop partnerships with other wildlife management agencies to share climate change issues and possible solutions to those issues.

Objective 21.2. Climate Change
Throughout the 15-year life of the CCP, train all refuge staff and volunteers to look for and document any notable change in wildlife and/or wildlife habitat due to climate change.

Discussion: South Carolina is home to an incredible diversity of wildlife species, including 313 birds, 96 mammals, 120 fish, 72 reptiles, and 66 amphibians. Rising temperatures and sea level in the state will likely change the makeup of entire ecosystems, forcing wildlife to shift their ranges or adapt. At the rate temperatures are projected to increase, South Carolina's forests are not expected to be able to adapt fast enough and could change dramatically within 30 to 80 years.

No one can be certain exactly how climate change would affect refuge plants and animals; however there is little doubt that the effects would be quite noticeable when comparing biological notations over a span of 30 to 80 years. At best, wildlife and plant species would adapt to the changed environment, but in a worse case situation, the refuge could lose many species of plants and animals. Perhaps the first to adapt or be eradicated from the refuge would be reptiles, amphibians, and fish. Since there are no-clear cut answers to the total effects of climate change, perhaps it would be best to prepare for the worst and hope for the best.

Strategies:

- Continue to monitor refuge plants and animals.
- Keep up-to-date on local and national issues involving climate change.
- Keep long-term recorded data in the permanent refuge files.

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.

To accomplish the purpose, vision, goals, and objectives contained in this Draft CCP/EA for Santee NWR, this section identifies projects, funding and personnel needs, volunteers, partnership opportunities, step-down management plans, 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.

FISH AND WILDLIFE POPULATION MANAGEMENT

(1) Migratory Bird Migration Corridors with Partnerships, Land Acquisition, and Easements

Description: Strategically adapt the proposed refuge acquisition boundary expansion to allow for future acquisition needs as they relate to migratory bird migration corridors, primary habitat types, and wetland protection. This priority is addressed in the migratory bird objective.

HABITAT MANAGEMENT

(2) Develop and Implement a Comprehensive Wetland Management and Restoration Plan

Description: Develop and implement a comprehensive wetland management and restoration plan for the refuge to include primary recommendations identified in the wildlife and habitat management review and restoration of the Timber Island Field impoundment complex and greentree reservoir water management system. This priority is addressed in the wildlife and diversity objectives.

(3) Develop a Comprehensive Forest Management Plan by Hiring a Temporary Forester

Description: Develop a comprehensive upland forest management plan for the refuge to include recommendations for forest and field management for migratory birds. This priority is to include the resource application of fire and mechanical management and is addressed in the Wildlife and Diversity objectives. Priorities are to coincide with hiring a temporary forester.

RESOURCE PROTECTION

(4) Develop a Working Landscape Acquisition and Protection Plan through Partnerships with Governmental and Non-Governmental Agencies and Private Landowners

Description: Work with Santee-Cooper, State of South Carolina, Clarendon County, conservation groups, and private landowners to obtain easements, leases, management authority, or fee title ownership to the properties strategically identified to serve the purpose of the refuge, such as lands/leases contiguous to Cantey Bay, Polly-Cantey Bay Cove, Dingle Pond, Pine Island, and Cuddo units. This priority is addressed in the Resource Protection objectives.

VISITOR SERVICES

(5) Update Existing and Develop New Interpretive Materials, including Brochures, Visitor Center Displays, and Interpretive Panels, Kiosks, and Exhibits that Highlight Refuge Resources

Description: Expand wildlife diversity messages to include threatened and endangered species, migratory birds, and habitat management. Panels will be written and illustrated interpretively, rather than "information presenting." Incorporate interactive technology when updating visitor center exhibits so that visitors are more fully engaged, creating a better understanding of and appreciation for the refuge's diverse habitats and wildlife. Create a children's activity area utilizing hands-on activities (e.g., "build a bird," and wildlife etching) to include development and production of new exhibit panels, redesign of refuge literature, and production of children's activity elements.

(6) Develop Hands-on and Demonstration Type Interpretive Programs and Expand Existing Programs that Allow Children and Adults to Become Intimately Involved with Wildlife and Their Habitats

Description: Expand upon existing "public" waterfowl and migratory bird banding offerings and partner with SCDNR, South Carolina Waterfowl Association, South Carolina Audubon Society, and others to develop new programs. Continue to cooperate with Women in the Outdoors. Look at activities similar to the annual hunting and fishing day activities (e.g., kayaking, casting demonstrations, and fish preparation and cooking) sponsored by the South Carolina Wildlife Federation, SCDNR, and other partners.

(7) Develop Signage and Outreach Strategy to Emphasize Importance of Protecting both Cultural and Natural Resources on the Refuge

Description: Through partnerships with local and state historic societies, universities, and volunteers, secure and validate historical information on the Santee Indian Mound site and develop interpretive and outreach programs, signs, and literature. Develop interpretive kiosk with two to three panels, depicting Santee Indian Mound history and Native American culture along with the historical significance of the battle to capture Ft. Watson (located atop the mound) from the British during the Revolutionary War.

REFUGE ADMINISTRATION

(8) Expand the Refuge's Visitor Center and Office Complex

Description: Expand the recently rehabilitated visitors center to include office space for refuge staffing. The staff office spacing is presently shared by the Office Administrator, Biologist, and 2 Park Rangers. This priority is addressed in the Facilities Objective of the Refuge Administration Goal.

(9) Hire Two Full-time Biological Technicians to complete the Biological Staffing

Description: Secure funding for and hire a GS-7 and a GS-5 full-time biological technicians positions to assist with the biological and habitat management program. These positions will also help with refuge habitat management and fire management programs. This priority is addressed in the Staffing Objective.

(10) Hire Administrative Officer

Description: 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 3. Summary of projects

PROJECT NUMBER	PROJECT TITLE	FIRST YEAR COST	RECURRING ANNUAL COST	STAFF (FTE'S)
1	**Migratory Bird Migration Corridors with Partnerships, Land Acquisition and Easements**	250,000		1.5
2	**Develop and Implement a Comprehensive Wetland Management and Restoration Plan**	$30,000 (Develop) $750,000 (Implement)		1.5
3	**Develop a Comprehensive Forest Management Plan by Hiring a Temporary Forester**	$80,000	74,000 (4-year term)	1
4	**Develop a Working Landscape Acquisition and Protection Plan through Partnerships**	$5,000		1

PROJECT NUMBER	PROJECT TITLE	FIRST YEAR COST	RECURRING ANNUAL COST	STAFF (FTE'S)
5	**Update existing and develop new interpretive materials, including brochures; Visitor Center displays and interpretive panels, kiosks, and exhibits**	$75,000		1.5
6	**Develop hands-on and demonstration type interpretive programs and expand existing programs that allow children and adults to become intimately involved with wildlife and their habitats.**	25,000		1
7	**Develop signage and outreach strategy to emphasize importance of protecting both cultural and natural resources on the refuge.**	30,000		1
8	**Expand the Refuge's Visitor Center and Office Complex**	300,000		1.5
9	**Hire Two Full-time Biological Technicians to complete the Biological Staffing**	$150,000	115,000	1
10	**Hire Administrative Officer**	65,000	65,000	1

PARTNERSHIP/ VOLUNTEERS OPPORTUNITIES

A key element of this Draft CCP/EA 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 partnerships with local chapters of Delta Waterfowl, South Carolina Ducks, Ducks Unlimited, South Carolina Waterfowl Association, Chamber of Commerce, Clarendon County, Town of Santee, Santee State Park, and Refuge friends group. At regional and state levels, partnerships may be established or enhanced with organizations such as: The Conservation Fund, Audubon Society, South Carolina Wildlife Federation, Santee-Cooper, South Carolina Department of Natural Resources, National Park Service, U.S. Geological Survey, or other interested state and federal agencies.

STEP-DOWN MANAGEMENT PLANS

A comprehensive conservation plan is a strategic plan that guides the 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 4) are also developed in accordance with NEPA, which requires the identification and evaluation of alternatives and public review and involvement prior to their implementation.

Table 4. Step-down management plans related to the goals and objectives of the CCP

Step-down Plan	Completion/Revision Date
Cultural Resources Management Plan	2017
Visitor Services' Plan	2013
Hunting Plan	1975
Fishing Plan	1986
Law Enforcement Plan	1988
Safety Plan	1984/2006
Aircraft Pre-Accident/Hazard	1992
Habitat Management Plan	2017
Forestry Management Plan	1975/2015
Hurricane Plan	2007 (revise annually)
Fire Management Plan	2001/2013
Cropland Management Plan	1988
Wetland Management Plan	1988/2017
Fishery Management Plan	1986
Sign Plan	1979
Wildlife Inventory Plan	1988
Wood Duck Box Nesting	1984

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 CCP.

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 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 final 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

The Fish and Wildlife Service (Service) prepared this Environmental Assessment (EA) for Santee National Wildlife Refuge (NWR) in compliance with the National Environmental Policy Act (NEPA) and the National Wildlife Refuge System Improvement Act of 1997 (Improvement Act). The Improvement Act requires the development of comprehensive conservation plans (CCPs) for all refuges. Following a public review and comment period on the Draft CCP, a final decision will be made by the Service that will guide Santee NWR management actions and decisions over the next 15 years, provide understanding about the refuge and management activities, and incorporate information and suggestions from the public and refuge partners.

The Draft CCP proposes a management direction, which is described in detail through a set of goals, objectives, and strategies. The Draft CCP addresses current management issues, provides long-term management direction and guidance for the refuge, and satisfies the legislative mandates of the Improvement Act. While the CCP provides general management direction, subsequent step-down plans will provide more detailed management actions.

The EA determines and evaluates a range of reasonable management alternatives. The intent is to support informed decision-making regarding future management of the refuge. Each alternative presented in this EA was generated with the potential to be fully developed into a Final CCP. The predicted biological, physical, social, and economical impacts of implementing each alternative are analyzed in this EA. This analysis assists the Service in determining if the alternatives represent no significant impacts, thus requiring the preparation of a Finding of No Significant Impact (FONSI), or if the alternatives represent significant impacts, thus requiring more detailed analysis through an Environmental Impact Statement (EIS) and a Record of Decision (ROD). Following public review and comment, the Service will select an alternative to be fully developed for this refuge.

This CCP is needed to address current management issues, to provide long-term management direction for the refuge, and to satisfy the legislative mandates of the Improvement Act, which requires the preparation of a CCP for all national wildlife refuges.

PURPOSE AND NEED FOR ACTION

The purpose of the CCP and EA is to establish and implement management direction for Santee 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 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 C as the proposed management action. In the opinion of the Service and the planning team, Alternative C 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 Improvement Act requires that all national wildlife refuges have a CCP in place within 15 years.

DECISION FRAMEWORK

Based on the assessment described in this EA, the Service will select an alternative to implement the CCP for Santee NWR. The Final CCP will include a 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

Santee NWR was established in 1942, and is in Clarendon County, South Carolina. The 15,000-acre refuge lies within the Atlantic Coastal Plain and consists of mixed hardwoods, mixed pine/hardwoods, pine plantations, marsh, croplands, old fields, ponds, impoundments, and open water. This tremendous diversity of habitats supports many kinds of wildlife.

A myriad of wildlife species inhabit the varied landscape of Santee NWR. During the winter months, the bald eagle, and occasionally the peregrine falcon, can be seen. From November through February, migrating waterfowl, such as mallards, pintails, teal, wood ducks, and Canada geese, are a major attraction. Throughout the year, red-tailed and red-shouldered hawks can be viewed soaring overhead, as can a variety of songbirds in the trees, and wild turkey.

Birds are not the only residents of Santee NWR. The forest provides a home for white-tailed deer and other woodland creatures, such as raccoons, squirrels, and bobcats. The ponds and marshes provide a home for alligators, plus a number of other reptiles and amphibians.

To support a large variety of wildlife species, intensive habitat management is a must. The habitat management programs at Santee NWR range from very basic to complex. One of the basic programs is the wood duck nest box program, where nesting boxes are provided in areas that are lacking in available tree cavities, thus "adding to" the natural habitat. The water and marsh management program is more complex. Water levels are adjusted to provide maximum benefits for wildlife. In the impoundments and marshes, different levels are used to help some types of vegetation to grow while controlling unwanted "pest plants". Periodically flooded woodlands containing nut-producing hardwoods are food-rich and very beneficial to waterfowl.

The management of forests and croplands are also critical. Refuge staff and contracted private farmers plant corn, wheat, millet, and small grain crops. These crops attract many species of wildlife and provide an excellent source of high-energy foods for wintering waterfowl. Refuge forests are maintained with management techniques ranging from prescribed burning to selective thinning. Habitat management is a complicated process but well worth the effort since it provides an abundant amount of food, cover, and shelter for a wide-range of animals.

Santee NWR also contains areas of cultural and local significance. The 420-acre Dingle Pond unit consists primarily of a Carolina Bay and is a designated Public Use Natural Area. A historic site on the refuge that is listed on the National Register of Historic Places is the Santee Indian Mound/Fort Watson area. The mound itself is over 3,000 years old and artifacts have been dated to 3,500 years ago. During the Revolutionary War, the British kept a garrison of about 100 soldiers at the mound. This gave them strategic control over the Santee River and a major road connecting Charleston to Camden. The garrison was eventually captured by American revolutionary forces under General Francis Marion.

This EA 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 in compliance with the Improvement Act and Part 602 of the Fish and Wildlife Service Manual (National Wildlife Refuge System Planning). The actions described within this Draft CCP also meet the requirements of NEPA. The refuge staff achieved compliance with NEPA through the involvement of the public and the incorporation of this EA, with a description of the alternatives considered and an analysis of the environmental consequences of the alternatives. When fully implemented, the CCP will strive to achieve the vision and purposes of Santee NWR.

The CCP's overriding consideration is 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.

COMPATIBILITY

The Improvement Act, which amended the National Wildlife Refuge System Administration Act of 1966, 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 Refuge System, as listed in the Improvement Act. 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 NEPA recommendations, public involvement has been a crucial factor throughout the development of the Draft CCP for Santee 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 Santee 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.

A public scoping meeting was conducted on February 21, 2007, at the Summerton Cultural Arts Center in Summerton, South Carolina. Meeting notices were published in the local newspapers; meeting notices were posted at the refuge and at the Arts Center; and invitations were mailed to approximately 35 different groups and individuals. A total of 22 members of the public attended the meeting and contributed a diverse array of comments.

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 our planning process, and have developed plans that attempt to balance the competing opinions regarding important issues.

A complete summary of these issues and concerns is provided in Appendix D.

II. Affected Environment

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

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 Ecosystem Team; the goals of the Refuge System; and the mission on the Service. Alternatives are formulated to address the significant issues, concerns, and problems identified by the Service and the public during public scoping.

The three 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 (Table 5). 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 administration.

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 three 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 three alternatives are summarized below. A comparison of each alternative follows the general description.

ALTERNATIVE A: (NO-ACTION) CONTINUE CURRENT MANAGEMENT

This alternative represents no change from current management of the refuge and provides a baseline. Management emphasis would continue to focus on maintaining existing managed wetlands for wintering waterfowl. Primary management activities include managing wetland impoundments, basic species monitoring, wood duck banding, and planting corn for waterfowl. Alternative A represents the anticipated conditions of the refuge for the next 15 years assuming current funding, staffing, policies, programs, and activities continue. The other two alternatives are compared to this alternative in order to evaluate differences in future conditions compared to baseline management.

This alternative reflects actions that include managing habitat for resident and wintering waterfowl, nesting bald eagles, maintaining upland and wetland forests, repairing wetland impoundment control structures, and providing opportunities for wildlife-dependent recreation. Species monitoring would be limited due to staffing constraints, volunteer assistance, and limited research interest. Habitat management actions are intended to benefit waterfowl; however, there is limited active management of other species and habitats.

Management coordination would occur between the refuge and the state. Coordination would be limited because of staffing constraints and remain focused on waterfowl management, hunting, and fishing. Hunting and fishing are allowed on the refuge provided that state regulations are followed. Wildlife-dependent uses are allowed on the refuge with all areas opened to the public with some areas only seasonally opened.

The refuge would remain staffed at current levels with periodic interns. Researchers would be accommodated when projects benefit the refuge.

ALTERNATIVE B: TARGETED HABITAT MANAGEMENT PRIMARILY FOR WATERFOWL

This alternative expands on Alternative A with a greater amount of active habitat management on the refuge. The focus of this alternative is to enhance and expand suitable habitat under species-specific management, targeted to attract greater numbers of wintering waterfowl and breeding areas for resident wood ducks. The acreage of managed wetlands and agricultural fields would be increased to accommodate larger waterfowl numbers. Some open fields and scrub/shrub areas on the refuge would be converted to wetlands or crops. Management of habitats for neotropical migratory and breeding songbirds would be greater than under Alternative A, but limited to maintaining existing areas suitable for these migratory species. There would be increased efforts to control invasive exotic plants.

This alternative proposes to increase monitoring efforts to focus primarily on waterfowl with less effort to address other species. Under Alternative A, monitoring is focused almost entirely on waterfowl but does include other species as funding and time permit. This alternative would provide extensive waterfowl monitoring with little additional effort for monitoring other species. Monitoring efforts would only occur based on available staffing, additional volunteers, and academic research.

Wildlife-dependent uses of the refuge would continue. Hunting and fishing would continue to be allowed and environmental education and interpretation enhanced. Interpretive signage would be increased or added to existing nature trails. There would be restricted access to some areas of the refuge that have waterfowl and threatened or endangered species sensitive to disturbance. Interpretation efforts would focus mostly on the primary objective of waterfowl management.

The refuge would be staffed at current levels plus the addition of one biological technician to carry out the increased habitat management and monitoring needs. Researchers would be accommodated when projects benefit the refuge and focus mostly towards waterfowl habitat and management.

ALTERNATIVE C: WILDLFE AND HABITAT DIVERSITY (PROPOSED ACTION)

This alternative expands on Alternative A with a greater amount of effort to manage the refuge to increase overall wildlife and habitat diversity. Although waterfowl would remain a focus of management, wetland habitat manipulations would also consider the needs of multiple species, such as marsh and wading birds. Management of upland forests and fields for neotropical migratory birds would be more actively managed than under Alternative B. Landscape level consideration of habitat management would include a diversity of open fields, upland and wetland forests, and additional managed wetlands. Multiple species consideration would include species and habitats identified by the South Atlantic Migratory Bird Initiative and the state's Strategic Conservation Plan.

This alternative would expand the monitoring efforts of Alternative A to provide additional, active efforts to monitor migratory neotropical and breeding songbirds, and other resident species. Monitoring efforts would be increased with the assistance of additional staff, trained volunteers, and academic research. Greater effort would be made to recruit academic researchers to the refuge to study and monitor refuge resources.

Wildlife-dependent uses of the refuge would continue. Hunting and fishing would continue to be allowed. However, hunting would be managed with a greater focus to achieve biological needs of the refuge, such as deer population management. Education and interpretation would be the same as Alternative A, but with additional education and outreach efforts aimed at the importance of landscape and diversity. A much broader effort would be made with outreach to nearby developing urban communities and a growing human population.

The refuge would be staffed at current levels plus the addition of two biological technicians to carry out the increased habitat management and monitoring needs. Greater emphasis would be placed on recruiting and training volunteers. Refuge biological programs would actively seek funding and researchers to study primarily management-oriented research needs. Refuge staff would place greater emphasis on developing and maintaining active partnerships, including seeking grants to assist the refuge in reaching primary objectives.

FEATURES COMMON TO ALL ALTERNATIVES

Although the alternatives differ in many ways, there are similarities among them as well. Common features are described in the alternatives and not repeated here to reduce length and redundancy of the individual alternative descriptions. Several elements of refuge management are common to all of the alternatives. All management activities that could impact natural resources, including subsurface mineral reservations, utility lines and easements, soil, water, air, contaminants, and archaeological and historical resources, would be managed to comply with all applicable laws, regulations, and policies. Each alternative is subject to all applicable future permit requirements. Individual projects may require additional consultation with the Service's Regional Archaeologist and the State of Florida's Historic Preservation Office. Additional consultation, surveys, and clearances may be required where project development would be conducted on the refuge or when activities would affect properties eligible for the National Register of Historic Places.

COMPARISON OF THE ALTERNATIVES BY ISSUE

Table 5. Comparison of alternatives by management issues for Santee NWR

Issues	Alternative A (Current Management – No Action Alternative)	Alternative B Targeted Habitat primarily for Waterfowl	Alternative C Wildlife and Habitat Diversity (Proposed Alternative)
Bald Eagle	Conduct annual nest survey of 2 nesting pairs. Protect nest sites during prescribed fire.	Expand Alternative A. Increase nesting from 2 to 3 nesting pairs. Conduct intensive forest management to increase eagle use. Conduct annual nest survey. Protect nest sites during prescribed fire.	Expand Alternative A. Maintain and monitor 2 nesting pairs. Actively manage forests to create and conserve future potential eagle nest tree stands. Conduct annual nest survey. Protect nest sites during prescribed fire. Focus management primarily for neotropical migratory birds.
Wood Stork	No specific management other than recording use of impoundments by storks.	Conduct wetland surveys. Manage wetlands to increase prey base. Manage 2 to 3 target impoundments for wood stork foraging by augmenting freshwater prey and using pumps to regulate water levels and prey availability.	Manage impoundments for multiple species, including wood storks under a featured species approach for migratory ducks. Conduct wetland surveys, monitoring, and adaptive management.

Issues	Alternative A (Current Management – No Action Alternative)	Alternative B Targeted Habitat primarily for Waterfowl	Alternative C Wildlife and Habitat Diversity (Proposed Alternative)
Waterfowl	Manage approximately 685 existing acres of impounded wetlands actively with a waterfowl management focus for wintering ducks. No set target duck numbers. Conduct routine surveys. Designate waterfowl sanctuary areas.	Increase Alternative A. Manage approximately 685 acres of impounded wetlands based on hydric soil determination, with a waterfowl management focus to potentially support historical levels of over 100,000 wintering migratory ducks. Conduct routine winter and monthly surveys. Maintain sanctuary status.	Increase Alternative A. Manage a minimum of 685 acres of impounded wetlands for waterfowl under a featured species approach with migratory ducks and geese as the featured species of management. Conduct appropriate winter surveys and wetlands monitoring for adaptive management. Maintain and expand sanctuary status as needed to restore and protect habitats for migratory ducks and geese. Incrementally increase the number of acres managed to accommodate annual increases in wintering waterfowl populations.

Issues	Alternative A (Current Management – No Action Alternative)	Alternative B Targeted Habitat primarily for Waterfowl	Alternative C Wildlife and Habitat Diversity (Proposed Alternative)
Southern James Bay Canada geese	Manage approximately 132 acres of cropland to provide corn and winter browse for approximately 1,000 wintering geese. Provide a ratio of approximately 50:50 of corn/green browse. Continue conducting seasonal surveys.	Increase Alternative A. Manage minimum of 60 acres of corn and 60 acres of green browse for wintering geese, and increase these acres to potentially support historical levels of over 30,000 migratory geese. Conduct annual winter surveys.	Increase Alternative A. Manage a minimum of 60 acres of corn and 60 acres of green browse for wintering geese on the Bluff and Cuddo units. Expand the agricultural program to include the Pine Island unit. Work with state and local concerns to restore winter geese populations to historic conditions. Conduct annual winter surveys. Control resident Canada geese numbers. Work with SCDNR to study migratory geese restoration efforts. Incrementally increase the number of acres managed to accommodate annual increases in wintering waterfowl populations.
Wading Birds	Management for wading birds is secondary to the featured waterfowl and geese restoration efforts. Protect all wading bird rookeries.	Increase Alternative A. Refocus management efforts to manage 350 acres of impoundments for wading birds in the non-winter months. Monitor impoundment use by wading birds. Protect all wading bird rookeries.	Expand Alternative A. Maintain 350 acres of impounded wetlands to focus on wading birds in the non-winter months, enhancing feeding and prey base conditions. Conduct surveys and monitoring for adaptive, multi-species management program. Coordinate with national and regional wading bird management plans. Integrate waterfowl and wading bird management. Enhance protection and encourage rookery growth.

Issues	Alternative A (Current Management – No Action Alternative)	Alternative B Targeted Habitat primarily for Waterfowl	Alternative C Wildlife and Habitat Diversity (Proposed Alternative)
Wood ducks	Maintain and replace existing 143 wood duck boxes when possible. Band wood ducks for Atlantic Flyway goals. No specific habitat management for wood ducks.	Increase the number of wood duck boxes to 160 to provide more nesting opportunity. Ensure boxes are ready for peak summer nesting period. Monitor boxes during peak nesting period. Increase the amount of wood duck brood habitat in all units. Continue to band wood ducks for Atlantic Flyway goals.	Evaluate and adaptively adjust the number of wood duck boxes based on biological data to provide greater nesting productivity and fewer dump nests. Ensure boxes are ready for peak summer nesting period. Monitor boxes during peak nesting period. Increase the amount of wood duck brood habitat, specifically in the Dingle Pond unit. Continue to band wood ducks for Atlantic Flyway and local environmental education goals. Wood duck nest box and monitoring efforts would be dependent on staff and volunteer positions on the refuge.
Neotropical and Migratory Songbirds	No specific active management.	Maintain approximately 2,000 acres of existing upland areas for neotropical migratory birds. Maintain existing mix of forest, grassland, and scrub/shrub.	Focus approximately 5,000 acres of existing forest, shrub, and grassland fields for neotropical and migratory songbirds with key species identified in SAMBI and the state Comprehensive Wildlife Conservation Strategy. Coordinate with SCDNR partners to determine habitat priorities and initiate research/monitoring to determine/adapt the best mix of forests, grasslands, and scrub/shrub and habitat enhancements.

Issues	Alternative A (Current Management – No Action Alternative)	Alternative B Targeted Habitat primarily for Waterfowl	Alternative C Wildlife and Habitat Diversity (Proposed Alternative)
Managed Wetlands	Continue to manage impoundments and green tree wetlands under existing water management regime.	Evaluate all managed wetlands, moist-soil, and greentree areas and maximize the acres managed based on soil surveys. Provide recommendations for new wetland control structures and maintenance of dikes. Focus primarily on waterfowl.	Expand Alternative B to include a formal management and monitoring program for all wetland sites, providing alternating manipulations consistent with the ecology and enhanced productivity of the wetlands. Evaluate all dike and ditching systems for appropriate water management and delivery, providing a means to manage units independently under a featured species approach, with migratory waterfowl being the focus species group. Develop partnerships for funding and maintenance programs.
Forests	No active forest management. Forest management plan outdated.	Update and implement forest management plan. Maximize managed wetland acres based on soil surveys.	Update and implement forest management plan. Focus management on improving mid-story and under-story of existing forest areas for several key groups of non-game birds. Employ adaptive habitat management.
Grassland, scrub/shrub	Mow grassy fields to prevent forest tree growth.	Mow and prescribe burn limited fields to prevent tree growth. Convert most abandoned fields and scrub areas into additional wetland impoundments or agricultural fields to target migratory waterfowl and other non-game bird species.	Mow, roller chop, and prescribe burn target fields to maintain early successional warm season grass communities. Consider expanding grassy field habitats based on habitat evaluation and focus species needs.

Issues	Alternative A (Current Management – No Action Alternative)	Alternative B Targeted Habitat primarily for Waterfowl	Alternative C Wildlife and Habitat Diversity (Proposed Alternative)
Prescribed fire	Prescribed burns conducted at random intervals primarily based on fuel loads and wildfire potential. Burns conducted during dormant season.	Prescribe burn upland and wetland habitats based on fuel loads and fire personnel availability.	Conduct prescribed burns in upland and wetland habitats based on resource requirements and habitat management needs. Coordinate burning to enhance or control preferred habitats, forest canopy cover, and vegetation control, such as the control of undesirable and exotic species. Update fire management plan to include and emphasize resource management needs.
Control of Exotic Plants	Intermittently treat canals, dikes, open fields and forest as time permits.	Refocus management of exotic plants to managed wetlands serving waterfowl species. Conduct surveys, develop database, control on 20% of refuge, and eliminate target exotic plants in managed wetlands.	Refocus management of exotic plants to address entire refuge. Conduct surveys, develop database, control undesirable and exotics on 50% of refuge, and eliminate 100% of target exotic invasive plants on the refuge.
Herpetological Species (e.g., frogs, toads, snakes, and lizards)	No active management.	Expand Alternative A. Increase target herpetological species and initiate monitoring programs.	Expand Alternative A. Increase species numbers and diversity through habitat enhancement, management, and protection. Develop a monitoring and inventory program for selected refuge habitats to determine baseline populations and monitor population dynamics.

Issues	Alternative A (Current Management – No Action Alternative)	Alternative B Targeted Habitat primarily for Waterfowl	Alternative C Wildlife and Habitat Diversity (Proposed Alternative)
Determine a valid acquisition boundary based on the original refuge configuration and establishment.	Take no action at this time.	Use the existing acquisition boundary.	Coordinate with the RO to evaluate the historical changes in the refuge boundary since establishment and determine the correct acquisition boundary based on the original refuge size.
Acquire inholdings and critical acres on all units of the refuge.	No active acquisitions.	Expand Alternative A. Purchase from willing sellers as funding is available. Prioritize acquisition key inholdings. Increase partnership opportunities.	Expand Alternative A. Purchase from willing sellers as funding is available. Prioritize acquisition key inholdings. Increase and actively seek partnership opportunities that will provide strategic habitats and buffer zones for the refuge through long-term lease agreements, fee title, and conservation easements.
Santee Cooper Lease Agreement	Use existing lease agreements without consideration of expansion opportunities.	Use existing lease agreements and the 4 amendments. Seek ratification of the 5th amendment of the agreement.	Expand Alternative B to seek additional purchases of Santee-Cooper leases on Cantey Bay and expand refuge boundaries strategically to create needed buffers and provide protection to existing refuge lease areas.

Issues	Alternative A (Current Management – No Action Alternative)	Alternative B Targeted Habitat primarily for Waterfowl	Alternative C Wildlife and Habitat Diversity (Proposed Alternative)
Santee Indian Mound/Fort Watson	Protect mound from destruction caused by artifact hunters.	Same as Alternative A.	Expand Alternative A to include gated system with limited access to the mound and fort area. Develop partnerships to assist with design and funding of a gate on Fort Watson Road and public interpretive displays. Redesign existing signage at site to more prominently focus on protection of cultural resources.
Protection	Respond as issues arise. Occasional law enforcement patrols.	Same as Alternative A.	Expand Alternative A to develop a protection program including regular patrol and LE enforcement oversight.
Providing Information to the Public	Provide information at Visitor Center through volunteers, exhibits, and movie. Provide refuge brochures and maps.	Expand Alternative A. Provide information at three refuge kiosk. Provide information at Visitor Center through volunteers, exhibits, and movie. Provide refuge brochures and maps. Expand Visitor Center.	Expand Alternative A. Provide information at additional refuge kiosks. Use additional refuge signs (for direction, information, and interpretation). Provide information at Visitor Center through volunteers, exhibits, and movie. Provide refuge brochures and maps. Develop enhanced partnerships with landowners, other agencies, NGOs, volunteer programs, and through a Friends Group that will support the primary purpose of the refuge. Seek and develop new programs for outreach.

Issues	Alternative A (Current Management – No Action Alternative)	Alternative B Targeted Habitat primarily for Waterfowl	Alternative C Wildlife and Habitat Diversity (Proposed Alternative)
Youth hunt	Conduct a single youth hunt each year to introduce and educate children about safe hunting practices.	Same as Alternative A.	Expand Alternative A to evaluate additional youth hunting opportunities, based on staffing abilities to conduct and operate managed hunts.
Hunting Opportunities	Conduct deer and upland game hunts based on state seasons.	Same as Alternative A plus prohibit alcoholic beverages during public hunts.	Same as Alternative A to determine the level and methods of hunting as a tool based on biological and resource management goals and public use opportunities. Evaluate compatibility of other hunt opportunities (i.e., special accessible deer hunt, youth and/or adult turkey hunting, etc.). Prohibit alcoholic beverages during public hunts.
Freshwater Fishing Opportunities	Sport fishing is allowed in refuge impoundments and canals on all refuge units during times the refuge is open to the public. The public may fish along Fort Watson Road (between the visitor center and the Santee Indian Mound) day and night.	Modify Alternative A to limit fishing along Fort Watson Road to daytime fishing only.	Modify Alternative A to limit fishing to daytime fishing only along Fort Watson Road. Develop a free, self issuing fishing permitting system and guidelines that will assist augmenting the awareness and appreciation of refuge rules, goals and objectives.

Issues	Alternative A (Current Management – No Action Alternative)	Alternative B Targeted Habitat primarily for Waterfowl	Alternative C Wildlife and Habitat Diversity (Proposed Alternative)
Wildlife Viewing and Photography Opportunities	Facilities include Visitor Center, Santee Indian Mound, Cuddo Wildlife Drive (7.8 miles), four hiking-only trails (5 miles), and two hiking/biking trails (11.4 miles).	Decrease Alternative A. Maintain existing trails but eliminate wildlife viewing and photography in habitats with species sensitive to disturbance.	Expand Alternative A. Facilities include Visitor Center, Santee Indian Mound, Cuddo Wildlife Drive (7.8 miles), four hiking-only trails (5 miles), and two hiking/biking trails (11.4 miles). Seasonal access only to sensitive threatened and endangered species and migratory bird management areas. Enhance opportunities for public access and enjoyment of photography on the refuge by developing special programs that also protect sensitive habitats and species from disturbance. Segregate hunting and non-hunting activities. Develop recreational concessions as deemed appropriate and compatible with refuge public use demand.

Issues	Alternative A (Current Management – No Action Alternative)	Alternative B Targeted Habitat primarily for Waterfowl	Alternative C Wildlife and Habitat Diversity (Proposed Alternative)
Environmental Education Opportunities	Historically, the refuge responded to requests for environmental education programs. Conduct one annual college program. Occasional teacher workshops.	Expand Alternative A. Focus educational messages on migratory waterfowl. Develop an environmental education program, providing opportunities to surrounding counties. Grades 4-8 could annually participate in programs of the refuge. Recruit and train 5-10 volunteers to assist teachers with these programs. Develop curriculum-based environmental education programs based on habitats serving migratory waterfowl. Conduct at least two workshops per year. Develop brochures on climate change.	Expand Alternative B. Coordinate with local school(s) to target specific grade levels (recommended grades 4-6); encourage field trips and classroom activities, utilizing curriculum-based environmental education programs, hands-on activities, and stewardship projects in the classroom and on-site (at the refuge). Develop four curriculum-based activities/programs focusing on refuge habitat, management, and trust resources. Conduct at least two workshops per year. Develop brochures on climate change.
Visitor Center Visitation	Opened in 1984, consists of 2,600 square feet. Serves >60,000 annual visitors.	Focus visitor display on migratory waterfowl and public recreation. Develop a vicarious experience for refuge visitors to enhance understanding of the purpose of the refuge. Increase visitation by renovating the visitor center and upgrading the displays. Develop movies, interpretive presentations, and exhibits, including interactive exhibits.	Expand Alternative B. Expand wildlife diversity messages to include threatened and endangered species, all migratory birds, and habitat management. Expand visitor center to 5,200 square feet and parking to 40 spaces to accommodate increased visitation. Annually host, in partnership with others, one to two festivals, focusing on migratory birds, threatened and endangered species, and wildlife diversity. Update exhibits to include new interactive technology.

Issues	Alternative A (Current Management – No Action Alternative)	Alternative B Targeted Habitat primarily for Waterfowl	Alternative C Wildlife and Habitat Diversity (Proposed Alternative)
Interpretive Programs	Annually conduct ~10 interpretive programs, including 5 guided bird walks.	Expand Alternative A. Refocus interpretive programs to migratory waterfowl. Most interpretive programs would occur at the visitor center. Focus birding tours on waterfowl. Incorporate climate change issues into programs.	Expand Alternative A. Regularly scheduled (monthly) programs are offered to the public that include refuge tours, wildlife monitoring, guided walks, guest speakers, and other programs, focusing on wetlands, waterfowl, neotropical birds, cultural resources (as related to wildlife messages), and programs encouraging environmental stewardship. Incorporate climate change issues into programs.
Interpretive Trails	No interpretive signs along trails. Kiosk provides information.	Add interpretive signs and displays.	Develop partnerships and add interpretive facilities, signs, displays, nature trails, and outdoor opportunities for the public.
Santee Birding Festival	No Action	Same as Alternative A	Work with partners to develop a comprehensive birding and arts festival that will engage the environmental and local community.
Local Residents	Occasional programs provided on request to local organizations. Partner for one local festival.	Same as Alternative A.	Expand Alternative A. Increase outreach to local residents such that 50% sampled would recognize the location and importance of the refuge.

Issues	Alternative A (Current Management – No Action Alternative)	Alternative B Targeted Habitat primarily for Waterfowl	Alternative C Wildlife and Habitat Diversity (Proposed Alternative)
Volunteers	Approximately 15 active volunteers and 90 total volunteers. Average 4,500 annual hours of volunteer service. Conduct volunteer orientation, an annual refresher, and informal on-the-job training.	Expand Alternative A. Increase the number of volunteers to serve the visitor center, monitor impacts, and conduct surveys. Focus messages on targeted habitat management. Conduct volunteer orientation, an annual refresher, and informal on-the-job training. Increase training for volunteers. Survey volunteers to determine satisfaction levels. Increase satisfaction such that over 75% of volunteers are highly satisfied.	Expand Alternative A. Increase number of active volunteers. Fill at least 75% of needed volunteer positions. Focus messages on wildlife diversity. Conduct volunteer orientation, an annual refresher, and informal on-the-job training. Increase training for volunteers. Survey volunteers to determine satisfaction levels. Increase satisfaction such that over 75% of volunteers are highly satisfied.
Friends of Santee NWR	Continue to work with the Friends Group on mostly a historical interpretation of the refuge with wildlife programs reflected in refuge staff efforts.	Continue to influence the Friends Group to have a primary focus of “Wildlife First” and to provide support to the refuge on all aspects, including natural and cultural history.	Expand Alternative B to assist the Friends Group in growing from 7 members to over a 100 members within 5 years of plan approval. Work with developers and local communities to promote the Friends Group and encourage a trusting relationship between them and the refuge staff.

Issues	Alternative A (Current Management – No Action Alternative)	Alternative B Targeted Habitat primarily for Waterfowl	Alternative C Wildlife and Habitat Diversity (Proposed Alternative)
Control of Trash and Litter	Use volunteers and staff to clean worst areas. Close some areas to use due to trash. Control of trash and litter is minimally effective.	Use volunteers and staff to clean worst areas. Close some areas to use due to trash. Control of trash and litter is minimally effective.	Expand Alternative A. Decrease trash on refuge by 50% within 5 years and 75% within 10 years from current levels. Use volunteers and staff to clean worst areas. Close some areas to use due to trash. Use the public outreach to educate the public on litter problems on the refuge.
Administrative Facilities and Signs	Visitor contact and services are provided at the refuge office/visitor center and the temporary administrative trailer. Attempt is made to maintain boundary signs. Maintain visitor services signs.	Offices located at visitor center and administrative trailer. Upgrade water, sewer, phone/fax, and computer utilities. Locate a facility for researchers, interns, and volunteers adjacent to the shop area, at the Bluff Storage area, or on the Pine Island compound area. Annually re-post or maintain boundary and visitor services signs on 20% of the refuge. Provide concerted effort to repost refuge water boundaries. Erect information signs (already on hand) at boat ramps and landings adjacent to refuge units that provide a detailed map of refuge along with importation regulatory information (hours/seasons of access, permitted and prohibited activities, etc.).	Same as Alternative B.

Issues	Alternative A (Current Management – No Action Alternative)	Alternative B Targeted Habitat primarily for Waterfowl	Alternative C Wildlife and Habitat Diversity (Proposed Alternative)
Staff	Existing 7 full-time and occasional term/temporary staff.	Same as Alternative A plus addition of 3 biological technicians.	Modify Alternative A to include staffing appropriate to the level and need for fully functional farming, fire, law enforcement, biological, public use, and refuge and administration: 10-11 total staff.
Relationship with South Carolina Department of Natural Resources and Santee-Cooper	Good coordination efforts are in place.	Expand Alternative A. Increase coordination with an emphasis on targeted waterfowl habitat management.	Expand Alternative A. Increase coordination efforts on programs of mutual interest for wildlife and habitat diversity. Encourage coordination meetings of the primary partners of SCDNR and SC, and encourage the development of a Santee Lakes Working Group to enhance partnerships for ecological programs and resource management to include multiple agencies and the Santee Lakes Focus Area.
Climate Change	No Action.	Solicit research related to potential climate change effects on wetlands managed for waterfowl.	Develop a climate change research needs plan that solicits research projects from universities and other agencies. Structure research projects to help track environmental changes related to global climate change.

ALTERNATIVES CONSIDERED BUT ELIMINATED FROM FURTHER ANALYSIS

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

Managing the refuge solely to attract and retain historic waterfowl levels was rejected. This approach to management was raised during public scoping, but the planning team determined that it was not an appropriate approach. This approach would convert all open fields and scrub/shrub areas into managed wetlands or corn fields. This would provide the maximum number of managed waterfowl habitat acres possible. The main problem with this alternative is the negative effects it would have on neotropical migratory birds, resident birds, and other species.

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 three 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 U.S. 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 warning. In relation to comprehensive planning for national wildlife refuges, carbon sequestration constitutes the primary climate-related impact to be considered in planning. The U.S. 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 CCP 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

As indicated in Appendix C, Relevant Legal Mandates and Executive Orders, the Service must comply with a number of federal laws, administrative orders, and policies in the development and implementation of its management actions and programs. Among these mandates are the Endangered Species Act of 1973, the Migratory Bird Treaty Act of 1918, and compliance with Executive Orders 11990 (Protection of Wetlands) and 11988 (Floodplain Management). The implementation of any of the three alternatives described in this EA would not lead to a violation of these or other mandates.

All management activities that could affect the refuge's natural resources (e.g., 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 Santee National Wildlife Refuge 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 Clarendon County 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 discusses the environmental consequences of adopting each refuge management alternative. Table 6 summarizes and addresses the likely outcomes for the specific issues, and is organized by broad issue categories.

ALTERNATIVE A - (NO-ACTION) CONTINUE CURRENT MANAGEMENT

Implementation of Alternative A is anticipated to result in net positive environmental benefits.

The management activities outlined under Alternative A are anticipated to have net neutral to positive impacts on soils.

The management activities outlined under Alternative A would help to improve air quality. Minor, short-term negative air quality impacts could be experienced during controlled burns or wildfires. However, these impacts are offset by the positive impacts of the resultant higher quality native habitats.

The management activities outlined under Alternative A are anticipated to have net positive impacts to hydrology and water quality. Minor restoration activities of impounded wetlands and interior freshwater wetlands are anticipated to positively impact hydrology and water quality.

The management activities outlined under Alternative A are anticipated to have net positive impacts to biological resources. Habitat management activities would result in high-quality habitats supporting native wildlife and wildlife diversity.

ALTERNATIVE B – TARGETED HABITAT MANAGEMENT PRIMARILY FOR WATERFOWL

Implementation of Alternative B is anticipated to result in net positive environmental benefits.

The management activities outlined under Alternative B are anticipated to have net positive impacts on soils. Restoring forest areas, managing habitats, and restoring impounded wetlands would positively impact soils and soil formation processes.

The management activities outlined under Alternative B would help to improve air quality. Minor, short-term negative air quality impacts could be experienced during controlled burns or wildfires. However, these impacts are offset by the positive impacts of the resultant higher quality native habitats.

The management activities outlined under Alternative B are anticipated to have net positive impacts to hydrology and water quality. Restoration activities of impounded wetlands and interior freshwater wetlands are anticipated to positively impact hydrology and water quality. Positive hydrology and water quality impacts would result from the acquisition, protection, and management of additional lands.

The management activities outlined under Alternative B are anticipated to have net positive impacts to biological resources. Habitat management activities would result in high-quality habitats supporting increased numbers of migratory birds and native wildlife and wildlife diversity.

ALTERNATIVE C – WILDLFE AND HABITAT DIVERSITY (PROPOSED ALTERNATIVE)

Implementation of Alternative C is anticipated to result in net positive environmental benefits.

The management activities outlined under Alternative C are anticipated to have net positive impacts on soils. Restoring forest areas, managing habitats, and restoring impounded wetlands would positively impact soils and soil formation processes.

The management activities outlined under Alternative C would help to improve air quality. Minor, short-term negative air quality impacts could be experienced during controlled burns or wildfires. However, these impacts are offset by the positive impacts of the resultant higher quality native habitats.

The management activities outlined under Alternative C are anticipated to have net positive impacts to hydrology and water quality. Restoration activities of impounded wetlands and interior freshwater wetlands are anticipated to positively impact hydrology and water quality. Positive hydrology and water quality impacts would result from the acquisition, protection, and management of additional lands.

The management activities outlined under Alternative C are anticipated to have net positive impacts to biological resources. Habitat management activities would result in high-quality habitats supporting native wildlife and wildlife diversity.

COMPARISON OF EFFECTS FROM IMPLEMENTING ALTERNATIVES

While the three alternatives share similarities, the differences result in varying types and levels of impacts. None of the proposed management activities would lead to a violation of federal, state, or local laws imposed for the protection of the environment. Alternative A does not propose any change in the present management direction. As such, Alternative A serves as the baseline for comparing the other alternatives. Without funding and staffing to support needed programs and to provide protection for the resources, Alternative A provides the least support for long-term productivity and

sustainability of the refuge. Alternative C provides the most benefits to the refuge, the natural resources supported by the refuge, and the local community, supporting long-term productivity and sustainability of the refuge.

Adaptive management is a key component of each alternative. As such, the actions outlined would not establish a precedent for future actions with significant effects nor represent a decision in principle about future considerations. Refuge management activities are constantly adapted as new research, data, and information become available.

See Table 7 for a comparison of the environmental consequences related to the categories of wildlife and habitat management, resource protection, visitor services, and refuge administration.

UNAVOIDABLE IMPACTS AND MITIGATION MEASURES

Under Alternative A—the no action alternative—there are numerous unavoidable 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 plants and nuisance animals; and a probable continued decline in biodiversity. Over time, if these issues are not addressed, they will continue to impact refuge resources. There would also be adverse impacts on public uses, mostly in terms of 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 would be similar to those of Alternative A, though probably less severe in scope and intensity. Alternative B aims to restore and enhance habitat primarily for waterfowl throughout the refuge. A portion of these efforts would include an intensified program to monitor and control invasive plant species that infest aquatic and upland habitats. Overall, the unavoidable adverse impacts associated with Alternative B would be less than would exist under Alternative A.

Alternative C, the proposed alternative, also has some unavoidable impacts. Generally, these impacts are expected to be minor and/or short-term in duration. However, the refuge will attempt to minimize these impacts whenever possible. As with the other two alternatives, other impacts that 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 will 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, FARMING AND FOREST MANAGEMENT

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

Table 6. Summary of environmental effects by alternative

Issues	Alternative A (Current Management – No Action Alternative)	Alternative B Targeted Habitat primarily for Waterfowl	Alternative C Wildlife & Habitat Diversity (Proposed Alternative)
Bald Eagle	Neutral to Negative. No change in eagle habitat to support stable to decreased populations.	Neutral to Positive. Limited change in eagle habitat to support stable to increased populations.	Positive. Emphasis on forest management to improve eagle nesting habitat to support increased bald eagle population.
Wood Stork	Neutral. No change in wood stork foraging habitat.	Positive. Increased management to provide additional foraging areas to support increased wood stork numbers.	Same as Alternative B.
Waterfowl	Neutral to negative. No change in available waterfowl habitat to allow for increased waterfowl numbers.	Positive. Increase in food sources and habitats to support increased waterfowl numbers.	Same as Alternative B.
Southern James Bay Canada geese	Neutral to negative. No change in available habitat for geese to allow for increased numbers.	Positive. Increase in food and green browse would support increased numbers of geese.	Same as Alternative B.
Wading Birds	Neutral to Positive. No change in wading bird habitat to support stable to increasing populations.	Neutral to Positive. Increased information to support stable to increased wading bird populations.	Positive. Increased management to support stable to increased wading bird populations.
Wood ducks	Neutral to negative. Wood duck boxes remain at current level. No specific habitat management to provide resources needed to support a larger wood duck population.	Positive. Increased number of wood duck boxes and increased brood habitat would support larger wood duck population.	Same as Alternative B.

Issues	Alternative A (Current Management – No Action Alternative)	Alternative B Targeted Habitat primarily for Waterfowl	Alternative C Wildlife & Habitat Diversity (Proposed Alternative)
Neotropical and Migratory Songbirds	Neutral to negative. No active management.	Negative. Decreased neotropical migratory bird habitat to support decreased populations.	Positive. Increased neotropical migratory bird management and habitat quality to support increased populations. Increased information.
Managed Wetlands	Neutral. Continue to manage wetlands under continuous water management regime.	Neutral to positive. Increased information would allow for more management control if additional water control structures installed.	Positive. Increased information and a formal management plan would allow management to target multiple species.
Forests	Neutral to negative. Current forest management plan is outdated.	Neutral to negative. Manage existing forests with updated plan, but no reforestation since scrub/shrub would transition to waterfowl habitat.	Positive. Update forest management plan and focus management efforts on improving mid-story and under-story vegetation.
Grassland, scrub/shrub	Neutral. Maintain existing fields.	Neutral to negative. Maintain existing fields with some transitioned to waterfowl habitat.	Neutral to positive. Increased information as to which fields are most utilized by various species. Potential to increase acreage of fields.
Prescribed fire	Neutral to negative. Burns conducted based on fuel loads and not biological reasons.	Neutral to positive. Burns conducted mainly to support waterfowl habitat. Biological basis for burns.	Positive. Burns conducted for biological reasons and to support waterfowl and upland species.
Control of Exotic Plants	Negative. No specific exotic plant control efforts are in place.	Positive. Increased management. Decreased exotic plants in habitats serving waterfowl.	Positive. Increased management. Decreased levels of exotic plants, with the elimination of target exotic plants.

Issues	Alternative A (Current Management – No Action Alternative)	Alternative B Targeted Habitat primarily for Waterfowl	Alternative C Wildlife & Habitat Diversity (Proposed Alternative)
Herpetological Species (e.g., frogs, toads, snakes, and lizards)	Neutral to Negative. No active management.	Neutral to Positive. Increased information.	Neutral to Positive. Increased habitat management to support herpetological populations. Increased information.
Determine a valid acquisition boundary based on the original refuge configuration and establishment.	Neutral to negative. Inaccurate boundary hampers refuge management.	Same as Alternative A.	Neutral to positive. Determining accurate boundary could improve refuge management.
Acquire inholdings and critical acres on all units of the refuge.	Neutral to negative. No active acquisition efforts.	Neutral to positive. Prioritize target parcels and purchase from willing sellers if funds available.	Neutral to positive. Prioritize target parcels and purchase from willing sellers. Actively seek land acquisition funds and partnerships.
Santee Cooper Lease Agreement	Neutral. No change in existing lease.	Neutral to positive. Ratify pending amendments.	Positive. Seek modifications that allow for increased buffers around refuge.
Santee Indian Mound/Fort Watson	Neutral. Continue to protect site from destruction.	Same as Alternative A.	Positive. Increase security at the site and develop partnerships to provide better interpretation.
Protection	Neutral to negative. Available law enforcement officer patrols periodically.	Same as Alternative A.	Neutral to positive. Schedule regular law enforcement patrols and increase protection infrastructure.
Providing Information to the Public	Neutral. No change to existing program.	Positive. Increased number of kiosks and increased information.	Same as Alternative B.

Issues	Alternative A (Current Management – No Action Alternative)	Alternative B Targeted Habitat primarily for Waterfowl	Alternative C Wildlife & Habitat Diversity (Proposed Alternative)
Youth hunt	Neutral. No change to existing program.	Same as Alternative A.	Same as Alternative A.
Hunting Opportunities	Neutral. No change to exiting deer and upland game and hunting.	Same as Alternative A.	Neutral to positive. Alter hunting program to achieve biological resource needs. No increase in hunt days.
Freshwater Fishing Opportunities	Neutral. No changes to fishing opportunity.	Negative. Discontinue night fishing. Only daytime fishing allowed.	Neutral to positive. Implement a permitting system to track fishing activity. Provide daytime and periodic nighttime fishing.
Wildlife Viewing and Photography Opportunities	Neutral. Stable opportunities and facilities for wildlife viewing and photography.	Neutral to Negative. Stable facilities. Seasonally decreased wildlife viewing and photography opportunities.	Positive. Increased wildlife viewing and photography opportunities and facilities.
Environmental Education Opportunities	Neutral. Limited program.	Positive. Increased environmental education programs and participation.	Same as Alternative B.
Visitor Center Visitation	Neutral to negative. Expect increase in visitation due to anticipated population growth in area. No change in visitor center programs.	Neutral to positive. Expect increase in visitation due to anticipated population growth in area. Enhanced interpretation materials at visitor center.	Positive. Expect increase in visitation due to anticipated population growth in area. Provide additional interpretive programs that will increase visitor satisfaction.
Interpretive Programs	Negative. Stable interpretive programs, but increased visitation.	Neutral to Positive. Stable to increasing interpretive programs.	Positive. Expanded interpretive programs.

Issues	Alternative A (Current Management – No Action Alternative)	Alternative B Targeted Habitat primarily for Waterfowl	Alternative C Wildlife & Habitat Diversity (Proposed Alternative)
Interpretive Trails	Neutral. Stable interpretive trails.	Neutral to positive. Increased number of interpretive maps, brochures, and signs.	Positive. Increased number of trails and interpretive maps, brochures, and signs.
Santee Birding Festival	Neutral. No action.	Same as Alternative A.	Positive. Birding festival would provide an excellent outreach opportunity.
Local Residents	Neutral to Negative. Minimal management and outreach.	Same as Alternative A.	Positive. Increased management and outreach. Increased awareness and understanding.
Volunteers	Neutral. Stable volunteer work force.	Positive. Expanded volunteer work force.	Same as Alternative B.
Friends of Santee NWR	Negative. Friends group not focused on wildlife and habitat.	Positive. Increased membership. Increased support of refuge management and operations.	Same as Alternative B.
Recreational Concessions	Neutral. No concessions.	Same as Alternative A.	Neutral to positive. Develop concessions that are compatible if demand exists.
Control of Trash and Litter	Neutral to negative. No change in efforts.	Neutral to positive. Eliminate alcoholic beverages and glass containers. Otherwise no change.	Positive. Actively address litter problems at worst areas. Increase visitor education about litter.

Issues	Alternative A (Current Management – No Action Alternative)	Alternative B Targeted Habitat primarily for Waterfowl	Alternative C Wildlife & Habitat Diversity (Proposed Alternative)
Administrative Facilities and signs	Neutral. No changes.	Positive. Upgrade facility to provide better utility services. Increase maintenance of refuge information and boundary signs.	Same as Alternative B.
Staff	Neutral. No change in the levels of biological support and wildlife and habitat protection.	Positive. Increased staff in biological programs. Enhanced information and habitat management.	Positive. Increased staff in all refuge programs. Enhanced information and habitat management.
Relationship with South Carolina Department of Natural Resources and Santee-Cooper	Neutral. No change.	Positive. Increased coordination.	Same as Alternative B.
Climate Change	Neutral. No climate change actions.	Positive. Encourage research on the refuge that contributes to overall knowledge of climate change effects.	Same as Alternative B.

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 will include informational signs that request trail users to remain on the trails, in order to avoid causing potential erosion problems.

Forest management activities (e.g., 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 practice in modern fire suppression and management to minimize impacts to soils and subsequent erosion and sedimentation.

Farming activities require the preparation of soil for planting various crops and ground cover. The best available farming techniques are utilized to minimize loss of topsoil and siltation. Fields are never left in a bare soil state for longer than is necessary to produce a crop. Pesticide and fertilizer use is the absolute minimum required and monitored to ensure compliance with all applicable regulations.

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 will be planned to avoid unacceptable levels of impact.

The known and anticipated levels of disturbance from the proposed alternative are not considered to be of concern. Nevertheless, the refuge will 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 will 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 will be discontinued, restricted, or rerouted to other less sensitive areas.

Forest management activities, such as thinning and prescribed fire, will 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. Bald eagle nest areas are always avoided and burns occur when eagles are not active on the nests.

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. Location of new trails would be such that minimal or no removal of native vegetation would occur. Any unavoidable clearing of vegetation would be mitigated by planting a greater amount of vegetation in various restoration sites throughout the refuge. There would be a net gain of vegetative cover and no loss of carbon sequestration at the refuge.

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 will 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 (e.g., thinning and prescribed fire) would also temporarily disturb vegetation, including trees, understory plants, and ground cover (e.g., saplings, shrubs, forbs, grasses). These effects, which would also be localized and temporary, will be minimized by proper marking of areas and diligent monitoring. Pine dominated forests require periodic fire in order to remain healthy and provide the greatest habitat benefits to wildlife. While fire has the immediate effect of disturbing vegetation, the beneficial results far outweigh the initial disturbance.

USER GROUP CONFLICTS

As public use increases, unanticipated conflicts between different user groups could occur. If this should happen, the refuge will adjust its programs, as needed, to eliminate or minimize any public use issues. The refuge will 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. Positive impacts that would be expected include higher property values, less intrusion of invasive exotic plants, and increased opportunities for viewing more diverse wildlife.

However, some negative impacts that may occur include a higher frequency of trespass onto adjacent private lands, and noise associated with increased traffic. To minimize these potential impacts, the refuge will 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 will 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; 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 nonfederal) 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 Santee NWR.

ANTICIPATED IMPACTS ON WILDLIFE SPECIES

Migratory Birds

Santee NWR does not allow hunting of any migratory birds or waterfowl. The refuge is a designated waterfowl sanctuary. The refuge contributes to beneficial cumulative effects related to migratory waterfowl.

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 Santee 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 viviparous*). Any significant increase in density likely would result in declines in population health from this density-dependent parasitism/malnutrition syndrome." Of the 15,000 acres of refuge lands, the Cuddo and Pine Island units are currently open to limited deer hunting, which have had an average of 115 deer harvested per season since 2002.

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 South Carolina DNR estimates that 244,045 deer were harvested in South Carolina in 2005 (SCDNR 2005 Deer Harvest Report). Harvest records by each county indicate that Clarendon County harvested 4,534 deer in 2005. This total harvest also computes to 65.8 acres per deer or 9.7 deer per-square-mile. These harvest records fluctuate year-to-year and were down 8.8 percent from 2004. 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 on 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 their need for eradication. Clarendon County, South Carolina, ranked twelfth in the state for overall hog harvest in 2005, and increased from fourteenth the previous year (SCDNR 2005 Deer 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 the youth hunt, there are few turkeys taken each year. 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, Raccoon, Opossum)

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, 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. 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 thee 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 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, such as feeding and resting, of birds might occur. 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 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. Refuge regulations further mitigate possible disturbance by hunters to non-hunted wildlife. Vehicles and ATVs 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 Santee NWR because the use of lead shot is not 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

The wood stork and the bald eagle are known to occur or potentially occur within the boundary of the refuge. Although the bald eagle is no longer listed, there is the potential that it could nest on the refuge. If bald eagle nesting activity occurs on, or nearby 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. 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 not be any appreciable cumulative effects under any of the alternatives.

An Intra-Service Section 7 Evaluation Consultation (Appendix G) was completed in 2007 for Santee NWR 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 actions are not likely to adversely affect these species. Under the Effects Determination section, the evaluation finds that impacts on listed species from the objectives, strategies, programs, and projects proposed in this CCP 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. Santee 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 15,000 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 offices, visitor center, 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 but 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 period. 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.

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 will 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 vehicle and 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 associated natural resources; however, no indirect or direct 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.

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. A CCP is designed to be amended, if circumstances change substantially, prior to the expected 15-year lifetime.

Anticipated Impacts if Individual Hunts are Allowed to Accumulate

National wildlife refuges, including Santee NWR, conduct hunting programs within the framework of state and federal regulations. Santee NWR is more restrictive on hunting than the state on most state lands. By maintaining hunting regulations that are as restrictive, or more restrictive, than the state regulation ensures that a better diversity of management options exist upon which statewide and regional management implications can be assessed. The Draft CCP, including its hunting objective, strategies, and provisions, has been reviewed and is supported by SCDNR. Additionally, all national wildlife refuges in South Carolina 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; 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 kiosks, 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 plans 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 Santee NWR Draft CCP/EA was written with the participation and assistance of refuge and Service staff and the SCDNR.

In March 2005, a refuge biological review was completed. A team of biologists conducted a comprehensive biological review for the refuge to help guide CCP development. Participants in the biological review were drawn primarily from the refuge, the Service, and the SCDNR.

Also in 2005, refuge and Service personnel met to conduct a visitor services' review. The information and recommendations in the reports of the biological and visitor service reviews provided a valuable starting point for the development of this Draft CCP/EA. Subsequently, the refuge hosted a public scoping meeting on May 22, 2007, and began an outreach campaign through various media to collect ideas and concerns from all stakeholders. Please see Chapter III of the Draft CCP for more information on public scoping and overall consultation and coordination in plan development.

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Appendix A. 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, it's 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 offices 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 U.S. Fish and Wildlife Service is required to develop 15-year Comprehensive Conservation Plans for all National Wildlife Refuges outside Alaska. The Act also describes the six public uses given priority status within the NWRS (i.e., hunting, fishing, wildlife observation, photography, 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 System.
Native Species:	Species that normally live and thrive in a particular ecosystem.
Notice of Intent (NOI):	A notice that an environmental impact statement will be prepared and considered (40 CFR 1508.22). Published in the Federal Register.
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 Untied 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 are 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/EIS 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 U.S. 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 and undergoing evaluation for recommendation for inclusion in the Wilderness System. 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
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
Service	U.S. Fish and Wildlife Service (also, FWS)
TFT	Temporary Full Time
USC	United States Code
USFWS	U.S. Fish and Wildlife Service

Appendix B. References and Literature Citations

Dupree, A. Hunter. 1957. Science in the Federal Government: A History of Policies and Activities to 1940. Harvard University Press, Cambridge, Massachusetts. 460 pp.

Gabrielson, Ira N. 1943. Wildlife Conservation. The Macmillan Company, New York, New York. 250 pp.

Laycock, George. 1965. The Sign of the Flying Goose: A Guide to the National Wildlife Refuges. The Natural History Press, Garden City, New York. 299 pp.

New Employee Handbook. U.S. Fish and Wildlife Service.

United States Department of Agriculture. 2000. Summary Report: 1997 National Resources Inventory (revised December 2000), Natural Resources Conservation Service, Washington, DC, and Statistical Laboratory, Iowa State University. Ames, Iowa. 89 pp.

United States Department of Agriculture. 2003. National Agricultural Statistics Service. 2002 Census of agriculture, state profile: South Carolina. Accessed online on March 14, 2005 at http://www.nass.usda.gov/census/census02/profiles/sc/cp99045.PDF.

Conner, R.C. and R.M. Sheffield. 2000. South Carolina's forest resources -- 2000 update. U.S. Forest Service Southern Research Station, Resource Bulletin SRS–65.

U.S. Department of the Interior, Fish and Wildlife Service and U.S. Department of Commerce, U.S. Census Bureau. *2001 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation.*

SCDNR. 2006. South Carolina Department of Natural Resources. Comprehensive Wildlife Conservation Strategy. Accessed 8-20-06 on the World Wide Web at: http://www.dnr.sc.gov/cwcs/.

SCDNR. 2006. South Carolina Department of Natural Resources. 2005 Deer Harvest Report.

USDA, 1997. United States Department of Agriculture, Natural Resources Conservation Service. National Resources Inventory.

Scorecard, 2005. Criteria Air Pollutant Report: Clarendon County, SC. Accessed 5-17-07 on the World Wide Web at: http://www.scorecard.org/env-releases/cap/county.tcl?fips_county_code=45027#exposures_pollutants .

USFWS. 1997. U.S. Fish and Wildlife Service. April 1997. Final Environmental Impact Statement: Proposed Establishment of Waccamaw National Wildlife Refuge – Georgetown, Horry, and Marion Counties South Carolina. Southeast Region. Atlanta, Georgia.

Bridges, R.J. 1968. Individual white-tailed deer movement and related behavior during the winter and spring in northwestern Florida. M.S. Thesis. Univ. of Georgia, Athens.86pp.

Sanderson, G.C. 1966. The study of mammal movement – a review. *Journal of Wildlife Management*. 30(1):215-235.

Smith, F.H., Jr. 1970. Daily and seasonal variation in movements of white-tailed deer on Elgin Air Force Base, Florida. M.S. Thesis. Univ. of Georgia, Athens. 58pp.

Appendix C. 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 Unites 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	Intended to prevent 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 Secretary of the Interior and Commerce to enter into cooperative agreements with states and other non-Federal interest 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.	This act 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.
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.

STATUE	DESCRIPTION
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, preservation 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 “sir quality and related values” of land under their control. These values include fish, wildlife, and their habitats.
Clean Water Act of 1974, as amended	This Act and its amendments have as its objective the restoration and maintenance of 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.
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.

STATUE	DESCRIPTION
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	This Act 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 endangered and threatened 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	This act 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.
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.

STATUE	DESCRIPTION
Estuaries and Clean Waters Act of 2000	This law creates 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)	The Act 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	The purpose of this law is to minimize 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, nonduplicative function. Committees must be strictly advisory unless otherwise specified and meetings must be open to the public.
Federal Coal Leasing Amendment Act of 1976	Provided that nothing in the Mining Act, the Mineral Leasing Act, or the Mineral Leasing Act for Acquired Lands authorized mining coal on refuges.
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	The Secretary of Agriculture was given the authority 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.

STATUE	DESCRIPTION
Fish and Wildlife Act of 1956	Establishes 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.
Improvement Act of 1978	This act was passed to improve 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 will celebrate its centennial anniversary in the year 2003. Established the National Wildlife Refuge System Centennial Commission to prepare a plan to commemorate the 100th anniversary of the 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 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.

STATUE	DESCRIPTION
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 15 c 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.
Land and Water Conservation Fund Act of 1948	This act 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	The 1972 Marine Mammal Protection Act 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.

STATUE	DESCRIPTION
Migratory Bird Treaty Act of 1918, as amended	This Act 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.
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	It 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.

STATUE	DESCRIPTION
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.
National Wildlife Refuge System Improvement Act of 1997	This Act 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 System lands, identifies the Secretary of the Interior as responsible for managing and protecting the 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 oriented recreational development or protection of natural resources. It also authorizes the charging fees for public uses.

STATUE	DESCRIPTION
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 that 1/3 Federal funds, at least 1/3 Foundation funds, and at least 1/3 State funds.
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 Department of the 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 21st 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.

STATUE	DESCRIPTION
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.
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	This act 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	The Wilderness Act of 1964 directs the Secretary of the Interior to review every roadless area of 5,000 acres or more and every roadless island regardless of 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)	The purpose of this Executive Order is to prevent 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)	Federal agencies are directed to provide leadership and 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 NVCT facilitates the compilation of regional and national summaries, which in turn, can provide an ecosystem context for individual refuges.
EO 12962, Recreational Fisheries (1995)	Federal agencies are directed 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)	Federal agencies are directed 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.

Appendix D. Public Involvement

SUMMARY OF PUBLIC SCOPING COMMENTS

A public scoping meeting was conducted on February 21, 2007, at the Summerton Cultural Arts Center in Summerton, South Carolina. Meeting notices were published in the local newspapers; meeting notices were posted at the refuge and at the Arts Center; and invitations were mailed to approximately 35 individuals and groups. A total of 22 members of the public attended the meeting.

ISSUES IDENTIFIED

Internal:

- Ensure up-to-date maintenance, rehabilitation, and replacement of the refuge's water management and water delivery capabilities to meet migratory bird objectives (focus on waterfowl, waterbirds, and marsh birds) and to include a comprehensive understanding of the ecology of wetlands and enhanced health of the wetland vegetative communities for all migratory birds. Monitor the impact captive-reared mallards on food resources produced for migratory waterfowl.
- Ensure wintering needs (forage and sanctuary) of migratory Southern James Bay Canada Geese with emphasis on high caloric foods, green browse, improved agricultural crops, and reduction of impact of deer/resident geese on available foods. This is to include a partnership with the SCDNR to conduct a study of both migratory and resident geese to assist the state in determining the impact of hunting on migratory geese and determine if an expanded hunt on
- Continue perpetuation of early successional grassland, shrub/scrub communities on the abandoned agricultural fields - - including emphasis on adapted management linked to ongoing (off-site) and former old-field research studies. To include an evaluation of the number of size of fields and determine the feasibility for reforestation of some fields in native, desirable forest communities (e.g., carbon sequestration programs) if possible.
- Improved forest management to improve understory and mid-story vegetation densities for several key groups of non-game birds (need an updated Forest Management Plan). To include a partnership with the SCDNR to establish breeding bird surveys on the refuge, technical assistance through an existing MOU, and on recommendations for management of key species as identified in the SC Comprehensive Wildlife Strategy and the South Atlantic Migratory Bird Initiative.
- Control exotics, invasive and non-desirable plant communities on upland and wetland sites. To include developing partnerships with Santee-Cooper and other agencies or partnerships for funding and control of exotic species.
- Work with Santee-Cooper and State to explore possibility of encouraging native submerged aquatic plants into main reservoir backwaters and coves associated with the Refuge and controlling grass carp impacts to native species. To include working with the SCDNR and others on the potential of establishing desirable, native wetland plant communities for enhanced migratory bird management.
- Encourage and promote management and monitoring activities to increase wood duck productivity.
- Acquisition of additional property around Dingle Pond and other units to provide a clearly defined boundary and buffer from increasing local land development. To include working with SCDNR and Santee-Cooper to promote environmental stewardship efforts and an understanding how future landscape changes (development) will impact adjacent refuge

habitats. Encourage Santee-Cooper to look at the potential of buffers zones that could be created by reestablishing former refuge boundary lines. For example, a request has been made to Santee-Cooper to reestablish the former water boundary line at the Dingle Pond, Polly-Cantey Bay area. Additional buffers have also been requested along the Bluff Unit and Cantey Bay area.

- A critical need has been identified for a forester to update the existing Forest Management Plan. This would provide direction for forest resource management with potential for harvest and mechanical thinning for habitat management.
- Continue present work to evaluate the wetland management plan on all units and develop an updated, formal wetland management plan to include reconstruction and repair of dikes on the Cuddo Unit, replace and install additional water pumps to maintain adequate water flow capabilities on all refuge units, and evaluate the diking systems and water control structure locations on all units for enhanced water management capability.
- The 2001 Fire Management Plan was well done; however, the fire management plan needs to be updated to include current resource management objectives. The Biological Review Team was concerned with the direction towards managing mixed hardwoods though mostly dormant season burns. However, there was a split opinion on the frequency, season, and use of fire in the mixed hardwood community. The present burn plan needs to have targeted resource conservation objectives that are linked to State and national plans, such as, the SC Comprehensive Wildlife Strategy, Atlantic Coast Joint Venture and SAMBI such that the resulting forest treatments will be providing habitat to identified key migratory bird species. The practice of burning and/or mechanical manipulation needs to be clearly addressed relative to habitat types, for safe fuel reduction, migratory birds and other native species.
- Develop the refuge volunteer program to include volunteers to assist with the biological program including bird monitoring, water quality monitoring and/or other activities that volunteers could do depending on their level of expertise.
- Develop a regional coalition of “outreach” partnerships that could link nearby conservation areas and programs together, to help with educational and interpretive programs, and enhance local/regional awareness of the refuge. To include a coordinated effort to determine the feasibility of developing a birding festival at Santee NWR that would bring together local and regional partners.
- Develop an understanding of local demographic changes with respect to how increased human population growth will impact user demand and impacts to refuge programs and resources.
- Make a determination of the condition of existing public use trails and other facilities and determine needed maintenance and improvements for safe, compatible, and appropriate uses.

State:

- Habitat loss, fragmentation and/or alteration
- Human disturbance of critical bird nesting areas
- Chemical contamination of species from pesticides and other sources
- Non-native invasive species – both plant and animal
- Prescribed fire to maintain fire-dependent habitats
- Water quality
- Air quality
- Conversion of land uses from rural to urban due to increasing population
- Potential for increase in the decline of vertebrate species
- Increase baseline biological inventories with emphasis on natural history, distribution and status of native species

- Increase commitment by natural resource agencies, conservations organizations and academia toward establishing effective conservations strategies
- Funding and budgets for natural resource conservation
- Create public-private partnerships and educational outreach programs for broad-scale conservation efforts
- Quality hunting and fishing opportunities

Public

- Waterfowl management efforts should be based on carrying capacity of refuge lands
- Refuge should evaluate ways to increase wintering waterfowl numbers
- General concern with declining waterfowl numbers
- Increase communication with the public via a website that provides information on what is being done and what the refuge wants to do.
- Identify refuge needs that could be better accomplished with volunteers (e.g., planting corn, maintaining dikes)
- Refuge should create a “wish list” of needs and let refuge partners know about it
- General concerns about continued funding for refuge activities given the considerable budget cuts and staff reductions
- Concern that workforce planning will further reduce refuge staff
- Consider possible user fees for affluent bird watchers
- Increase education about duck stamps (e.g., fund much more than ducks)
- Maintain close coordination with Santee/Cooper for lake management
- Concerns about pollution effects that will arise with increased development
- Private landowners are attracting waterfowl away from the refuge resulting in a loss of “public” birds
- What is the waterfowl carrying capacity of the refuge?
- Refuge should consider determining a habitat index
- Refuge should consider increasing the amount of flooded wetlands/impoundments
- Refuge should increase acreage of flooded agricultural lands
- Better control of water levels in impoundments is needed
- The hydrology of Dingle Pond should be restored so that it actually functions like a Carolina bay
- General concern that future development surrounding the refuge will result in further declines in waterfowl numbers
- There should be no hunting on the refuge
- There should be some increased hunting opportunities on the refuge

Appendix E. Appropriate Use Determinations

Santee National Wildlife Refuge Appropriate Use Determinations

An appropriate use determination is the initial decision process a refuge manager follows when first considering whether or not to allow a proposed use on a refuge. The refuge manager must find that a use is appropriate before undertaking a compatibility review of the use. This process clarifies and expands on the compatibility determination process, by describing when refuge managers should deny a proposed use without determining compatibility. If we find that a proposed use is not appropriate, we will not allow the use and will not prepare a compatibility determination.

Except for the uses noted below, the refuge manager must decide if a new or existing use is an appropriate refuge use. If an existing use is not appropriate, the refuge manager will eliminate or modify the use as expeditiously as practicable. If a new use is not appropriate, the refuge manager will deny the use without determining compatibility. Uses that have been administratively determined to be appropriate are:

- Six wildlife-dependent recreational uses - As defined by the National Wildlife Refuge System Improvement Act of 1997 (Improvement Act), the six wildlife-dependent recreational uses (hunting, fishing, wildlife observation, wildlife photography, and environmental education and interpretation) are determined to be appropriate. However, the refuge manager must still determine if these uses are compatible.
- Take of fish and wildlife under State regulations - States have regulations concerning take of wildlife that includes hunting, fishing, and trapping. We consider take of wildlife under such regulations appropriate. However, the refuge manager must determine if the activity is compatible before allowing it on a refuge.

Statutory Authorities for this policy:

National Wildlife Refuge System Administration Act of 1966, as amended by the National Wildlife Refuge System Improvement Act of 1997, 16 U.S.C. 668dd-668ee (Administration Act). This law provides the authority for establishing policies and regulations governing refuge uses, including the authority to prohibit certain harmful activities. The Administration Act does not authorize any particular use, but rather authorizes the Secretary of the Interior to allow uses only when they are compatible and "under such regulations as he may prescribe." This law specifically identifies certain public uses that, when compatible, are legitimate and appropriate uses within the Refuge System. The law states ". . . it is the policy of the United States that . . .compatible wildlife-dependent recreation is a legitimate and appropriate general public use of the System . . .compatible wildlife-dependent recreational uses are the priority general public uses of the System and shall receive priority consideration in refuge planning and management; and . . . when the Secretary determines that a proposed wildlife-dependent recreational use is a compatible use within a refuge, that activity should be facilitated . . . the Secretary shall . . . ensure that priority general public uses of the System receive enhanced consideration over other general public uses in planning and management within the System . . . ." The law also states "in administering the System, the Secretary is authorized to take the following actions: . . . issue regulations to carry out this Act." This policy implements the standards set in the Administration Act by providing enhanced consideration of priority general public uses and ensuring other public uses do not interfere with our ability to provide quality, wildlife-dependent recreational uses.

Refuge Recreation Act of 1962, 16 U.S.C. 460k (Recreation Act). This law authorizes the Secretary of the Interior to ". . . administer such areas [of the System] or parts thereof for public recreation when in his judgment public recreation can be an appropriate incidental or secondary use." While the Recreation Act authorizes us to allow public recreation in areas of the Refuge System when the use is an "appropriate incidental or secondary use," the Improvement Act provides the Refuge System mission and includes specific directives and a clear hierarchy of public uses on the Refuge System.

Other Statutes that Establish Refuges, including the Alaska National Interest Lands Conservation Act of 1980 (ANILCA) (16 U.S.C. 410hh - 410hh-5, 460 mm - 460mm-4, 539-539e, and 3101 - 3233; 43 U.S.C. 1631 et seq.).

Executive Orders. We must comply with Executive Order (E.O.) 11644 when allowing use of off-highway vehicles on refuges. This order requires that we: designate areas as open or closed to off-highway vehicles in order to protect refuge resources, promote safety, and minimize conflict among the various refuge users; monitor the effects of these uses once they are allowed; and amend or rescind any area designation as necessary based on the information gathered. Furthermore, E.O. 11989 requires us to close areas to off highway vehicles when we determine that the use causes or will cause considerable adverse effects on the soil, vegetation, wildlife, habitat, or cultural or historic resources. Statutes, such as ANILCA, take precedence over executive orders.

Definitions:

Appropriate Use
A proposed or existing use on a refuge that meets at least one of the following four conditions.

1) The use is a wildlife-dependent recreational use as identified in the Improvement Act.
2) The use contributes to fulfilling the refuge purpose(s), the Refuge System mission, or goals or objectives described in a refuge management plan approved after October 9, 1997, the date the Improvement Act was signed into law.
3) The use involves the take of fish and wildlife under State regulations.
4) The use has been found to be appropriate as specified in section 1.11.

*Native American***.** American Indians in the conterminous United States and Alaska Natives (including Aleuts, Eskimos, and Indians) who are members of federally recognized tribes.

Priority General Public Use. A compatible wildlife-dependent recreational use of a refuge involving hunting, fishing, wildlife observation, wildlife photography, and environmental education and interpretation.

Quality. The criteria used to determine a quality recreational experience include:

- Promotes safety of participants, other visitors, and facilities.
- Promotes compliance with applicable laws and regulations and responsible behavior.
- Minimizes or eliminates conflicts with fish and wildlife population or habitat goals or objectives in a plan approved after 1997.
- Minimizes or eliminates conflicts with other compatible wildlife-dependent recreation.
- Minimizes conflicts with neighboring landowners.
- Promotes accessibility and availability to a broad spectrum of the American people.
- Promotes resource stewardship and conservation.

- Promotes public understanding and increases public appreciation of America's natural resources and our role in managing and protecting these resources.
- Provides reliable/reasonable opportunities to experience wildlife.
- Uses facilities that are accessible and blend into the natural setting.
- Uses visitor satisfaction to help define and evaluate programs.

Wildlife-Dependent Recreational Use. As defined by the Improvement Act, a use of a refuge involving hunting, fishing, wildlife observation, wildlife photography, and environmental education and interpretation.

FINDING OF APPROPRIATENESS OF A REFUGE USE

Refuge Name: Santee National Wildlife Refuge

Use: Cooperative Farming

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: Santee National Wildlife Refuge

Use: Upland Game Hunting

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: Santee National Wildlife Refuge

Use: Fishing/Boating

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: Santee National Wildlife Refuge

Use: Wildlife Observation and Photography

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: Santee National Wildlife Refuge

Use: Environmental Education and Interpretation

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: Santee 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: Santee National Wildlife Refuge

Use: Exotic and Nuisance Wildlife Control

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: Santee 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.

FINDING OF APPROPRIATENESS OF A REFUGE USE

Refuge Name: Santee National Wildlife Refuge

Use: Forest Management – Commercial Timber Harvest

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.

Appendix F. Compatibility Determinations

Santee National Wildlife Refuge Compatibility Determinations

Introduction:

The Fish and Wildlife Service reviewed several uses for compatibility during the comprehensive conservation planning process for Santee National Wildlife Refuge. 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 Comprehensive Conservation Plan for Santee National Wildlife Refuge, 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: upland game hunting, fishing/boating, wildlife observation and photography, environmental education and interpretation, bicycling, research, exotic and nuisance wildlife control, forest management – cooperative timber harvest, and cooperative farming.

Refuge Name:
Santee National Wildlife Refuge

Establishing and Acquisition Authorities:
Migratory Bird Conservation Act
Refuge Recreation Act

Refuge Purposes:

Recognizing the high migratory bird benefits served by the lands and waters of the refuge, the Service administratively designated Santee National Wildlife Refuge in 1941, under the Migratory Bird Conservation Act and the Refuge Recreation Act. This designation outlined several primary purposes which guide management for these lands and waters:

- Refuge Establishment: May 5, 1941, State, Congressional District: South Carolina, 6th District

- Purpose: ”... for use as an inviolate sanctuary, or for any other management purpose, for migratory birds.” 16 U.S.C. 715d (Migratory Bird Conservation Act)

- Purpose: “…to conserve and protect migratory birds…and other species of wildlife that are listed…as endangered species or threatened species and to restore or develop adequate wildlife habitat.” 16 U.S.C. 715i (Migratory Bird Conservation Act)

- Purpose: “... suitable for (1) incidental fish and wildlife-oriented recreational development, (2) the protection of natural resources, (3) the conservation of endangered species or threatened species ...” 16 U.S.C. 460k-1 “... the Secretary ... may accept and use ... real ... property. Such acceptance may be accomplished under the terms and conditions of restrictive covenants imposed by donors ...” 16 U.S.C. 460k-2 (Refuge Recreation Act (16 U.S.C. 460k-460k-4), as amended).

The refuge's primary purpose applies to all lands and waters managed by the refuge, regardless of when they were added to the refuge. Since the refuge has management agreements with the Santee Cooper Public Authority, lands and waters under those management agreements are also subject to the conditions of those agreements.

National Wildlife Refuge System Mission:

The mission of the 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.*

Other Applicable Laws, Regulations, and Policies:

Antiquities Act of 1906 (34 Stat. 225)
Migratory Bird Treaty Act of 1918 (15 U.S.C. 703-711; 40 Stat. 755)
Migratory Bird Conservation Act of 1929 (16 U.S.C. 715r; 45 Stat. 1222)
Migratory Bird Hunting Stamp Act of 1934 (16 U.S.C. 718-178h; 48 Stat. 451)
Criminal Code Provisions of 1940 (18 U.S.C. 41)
Bald and Golden Eagle Protection Act (16 U.S.C. 668-668d; 54 Stat. 250)
Refuge Trespass Act of June 25, 1948 (18 U.S.C. 41; 62 Stat. 686)
Fish and Wildlife Act of 1956 (16 U.S.C. 742a-742j; 70 Stat.1119)
Refuge Recreation Act of 1962 (16 U.S.C. 460k-460k-4; 76 Stat. 653)
Wilderness Act (16 U.S.C. 1131; 78 Stat. 890)
Land and Water Conservation Fund Act of 1965
National Historic Preservation Act of 1966, as amended (16 U.S.C. 470, et seq.; 80 Stat. 915)
National Wildlife Refuge System Administration Act of 1966 (16 U.S.C. 668dd, 668ee; 80 Stat. 927)
National Environmental Policy Act of 1969, NEPA (42 U.S.C. 4321, et seq; 83 Stat. 852)
Use of Off-Road Vehicles on Public Lands (Executive Order 11644, as amended by Executive Order 10989)
Endangered Species Act of 1973 (16 U.S.C. 1531 et seq; 87 Stat. 884)
Refuge Revenue Sharing Act of 1935, as amended in 1978 (16 U.S.C. 715s; 92 Stat. 1319)
National Wildlife Refuge Regulations for the Most Recent Fiscal Year (50 CFR Subchapter C; 43 CFR 3101.3-3)
Emergency Wetlands Resources Act of 1986 (S.B. 740)
North American Wetlands Conservation Act of 1990
Food Security Act (Farm Bill) of 1990 as amended (HR 2100)
The Property Clause of The U.S. Constitution Article IV 3, Clause 2
The Commerce Clause of The U.S. Constitution Article 1, Section 8
The National Wildlife Refuge System Improvement Act of 1997 (Public Law 105-57, USC668dd)
Executive Order 12996, Management and General Public Use of the National Wildlife Refuge System. March 25, 1996
Title 50, Code of Federal Regulations, Parts 25-33

Archaeological Resources Protection Act of 1979
Native American Graves Protection and Repatriation Act of 1990

Description of Use:
Upland Game Hunting

Hunting has been identified as a priority wildlife-dependent activity under the National Wildlife Refuge System Improvement Act of 1997. With the implementation of the CCP, the Service will continue (e.g., develop needed regulations and publish the appropriate *Federal Register* notice) to open specified units of the refuge to upland hunting for deer, migratory birds, and raccoons, and will allow the harvest of feral hogs (exotic species) as an incidental take during scheduled hunts. This will provide additional opportunities for a priority recreational activity and will help to reduce the feral hog population on the refuge. Implementing the upland game hunting program will follow the existing refuge hunt plan, including posting appropriate notice in the *Federal Register*; and establishing regulations in Title 50, Code of Federal Regulations.

Upland hunting for white-tailed deer is presently allowed in designated areas of the Cuddo and Pine Island units of the refuge. A special youth hunt is conducted on the Bluff Unit with a quota for the number of hunters and harvest. Additional special hunts will be considered for turkey on the Cuddo Unit and deer/hog on the Bluff Unit. The refuge will continue to allow upland hunts for raccoon and doves on the Cuddo Unit. The remainder of the refuge will remain closed to upland hunting to minimize conflicts with other priority uses, except that special hunts for hogs (exotic species) will be considered if necessary.

Availability of Resources: A schedule has been established for administering the existing program that includes one week of deer hunting with primitive weapons on the Pine Island Unit and one week each of deer hunting with archery and primitive weapons on the Cuddo Unit. The Bluff Unit presently has three days of hunting for youths, ages 11-17, with three additional days set aside for other special use deer hunts. Additionally, the Cuddo Unit is open to 12 days of hunting for mourning doves, raccoons, and opossums. Funds are needed annually to mow, grade, and repair roads and parking areas open to hunter access; to maintain signs; and to print hunting regulations and permits. Management of the program has a biological, administrative, maintenance, and law enforcement component. Partnering with the State will help provide the needed components. Details for administering an expanded program have not been determined. The proposed additional special hunts for turkey, deer, and hogs will not pose a significant administration need and will only be conducted if resources are available.

Anticipated Impacts of Use: Anticipated impacts were identified and evaluated based on best professional judgment and published scientific papers. Many of the impacts associated with upland hunting are similar to those considered for other public use activities, such as wildlife viewing and wildlife 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. Direct mortality can impact isolated, resident game species populations by reducing breeding populations to a point where the isolated population can no longer be sustained. This can result in localized extirpation of isolated populations.

The hunt would be conducted prior to migratory waterfowl arrival; therefore, minimal disturbance to migratory waterfowl is anticipated. Use of lead shot is allowed for deer and feral hogs, but considering the separation between the upland hunt and wetland habitat, the ingestion of lead shot by migratory birds should be minimal. The walk-in hunters would use existing fire breaks and roads for access. No soil compaction or vegetation disturbance is expected. Parking would occur in temporary sites already designated along existing fire lines and roads.

The refuge does not have an active hog removal program where the permittees trap and remove feral hogs from the refuge. The primary intent of feral hog hunts would be to increase pressure on this exotic species and assist in the population control of this unwanted species. Upland hunting for feral hogs would help remove the hogs in this area and would assist the refuge in the control of this species.

Determination (check one below):

	Use is Not Compatible
X	Use is Compatible, with the Listed Stipulations

Stipulations Necessary to Ensure Compatibility: Several stipulations will be necessary to ensure compatibility of this use. Additional stipulations may be added, as the program is developed. Known stipulations are listed.

- The hunt will be conducted in accordance with State regulations and seasons.
- The methods of hunting to be considered include primitive weapons, archery, .22 caliber rimfire rifles, and shotguns.
- Hunting will be allowed only in the designated units.
- Quota hunt permits will be issued for special hunts.
- Hunting will be conducted based on the goals and objectives outlined in the CCP.
- Check stations will be used to collect hunt data and to monitor the quality of the hunt.
- Vehicle access and parking will be limited and confined to designated areas and unimproved roads.
- Liberal bag limits or extended seasons may be established for feral hogs as part of a wider effort to eliminate this non-native species.
- Hunting will be allowed based on existing refuge rules and regulations.

Upland hunting would have little impact on other visitor activities. There are four units within the refuge. While one unit is open to hunting, the other units will be open for general visitor access. General public access is limited to hunters in units open to hunting for safety reasons.

Justification: Hunting is a priority wildlife-dependent use under the National Wildlife Refuge System Improvement Act. Upland hunting, as described, was determined to be compatible, in view of the potential impacts that hunting can have on the Service's ability to achieve purposes and goals of the refuge, because: (1) hunter densities and use levels will be relatively low during days the refuge is open to hunting; (2) sufficient restrictions have been established to ensure that an adequate amount of high-quality habitat would be available to accommodate the needs of deer and other wildlife using the refuge; and (3) sufficient opportunities are available for other priority wildlife-dependent recreation during the upland hunt season.

Mandatory 15-Year Re-evaluation Date:

Description of Use:
Fishing/Boating
Fishing has been identified as a priority wildlife-dependent activity under the National Wildlife Refuge System Improvement Act and is a traditional use at the refuge. This wildlife-dependent recreational use is supported by boating; therefore, boating impacts which are associated with fishing are also considered in this review.

Fishing is permitted on the refuge. Designated areas are closed seasonally as sanctuary areas from fishing activities to protect migratory waterfowl. Fishing areas include the open waters of Lake Marion, shoreline of the Bluff Unit, and inland ponds and channels.

Fishing is allowed in accordance with State regulations. Additionally, the refuge has implemented refuge-specific fishing regulations which can be update annually in Title 50 Code of Federal Regulations. The listed items are a summary of refuge-specific fishing regulations.

- Fishing is allowed only during daylight hours.
- Night fishing from boats is allowed in the open waters of Lake Marion, except designated areas that are seasonally closed as a waterfowl sanctuary.
- Airboats, personal watercraft, or hovercraft are not allowed.

Inland and shoreline fishing is available, but the fishing opportunities in the open waters of Lake Marion is by far the largest component of the fishing program. Because of the associated wildlife and habitat impacts of boats, regulations have been developed to reduce impacts from boats.

With the advent of jet boats, personal water craft, and use of airboats, many boats can now operate at fast speeds in shallow water. With these developments, fishing boats now present the potential to disturb foraging and loafing water birds in shallow water habitats. Outboard-powered boats also have the potential to cause impacts to wildlife and the submerged aquatic plants. Non-motorized boats (e.g., canoe and kayak) may have less impacts but could be disruptive seasonally in winter waterfowl use areas or in rookery or roosting areas. In recent times, these impacts have been increasing along with the number of anglers and boaters utilizing the open waters of the refuge. Over the last 20 years the number of sports fishermen has increased and annual fishing visits are made by approximately 50,000 visitors. The combination of increased anglers and boat designs has increased impacts in the open waters of the refuge, impacting the quality of the fishing experience. The requirement to obtain and possess a fishing permit, which is self issuing and free, is an adaptive strategy to augment public awareness of the refuge, refuge rules, and boundaries. This strategy may also help reduce wildlife disturbance and minimize problems associated with submerged aquatic plants.

Fishing by boat represents the largest percentage of fisherman, but bank fishing opportunities are available from Fort Watson Road and from numerous other locations where anglers fish from the bank or fish by wading in the water. Several freshwater borrow pits and drainage ditches provide limited freshwater fishing opportunities. A common issue associated with bank fishing is litter.

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. Funds are needed annually to mow, grade, and repair roads, parking lots, and boat ramps open to fishing or boating; replace gravel on roads leading to boat ramps; paint, repair, and replace fencing and signs; and develop and print brochures. Two rangers (one duel function law enforcement officer), one full-time law enforcement officer, and two maintenance workers spend up to two months a year managing the fishing program. These salaries come out of the refuge's operating budget, which is adequate to sustain the existing program.

Funding for the improvements outlined in the CCP is not currently available. For example, the cost to post the water boundary is estimated at $60,000; however, we are seeking assistance from Santee Cooper Public Service Authority for installation of boundary poles to reduce cost. Replacing and posting the water boundary signs is highly important. If the water boundary zones were expanded, additional funding would be necessary. Funding would also be needed for road and parking improvements, restrooms, bank fishing improvements, litter control, and freshwater fishing improvements. A fee for use is not recommended within the CCP.

Anticipated Impacts of Use: Anticipated impacts were identified and evaluated based on best professional judgment and published scientific papers. Over-fishing has been known to cause ecological extinction of certain fish species and precedes all other human disturbance (Jackson et al 2001). In recent history, over-fishing in some areas has led to the decline of certain species. However, the lake system that surrounds the refuge was created primarily for hydroelectric power generation, with fishing a secondary resource available to the public. The fishery resource of the lake has changed significantly with time, habitat, and fish populations. The refuge open water fishing opportunity is a small portion of the 110,600-acre lake. Primary game fish are largemouth bass, black Crappie, chain pickerel, channel catfish, flathead catfish, blue catfish, freshwater striped bass (*striped white and hybrid bass)*, bream, and shellcracker. Santee Cooper Public Service Authority began introducing triploid (sterile) grass carp to the Santee Cooper Lakes in 1989, in an effort to control and manage the exotic invasive hydrilla infestations. Today, the State monitors fish populations and has set seasons, slot and size limits, and total bag limits for most sports fish, making the likelihood of over-fishing depleting fish stocks minimal. The areas of the refuge closed to boating and fishing also serve to recharge local waters. Collectively, the State fishing regulations and the seasonally closed waterfowl sanctuary areas should minimize the likelihood of fish stocks declining on the refuge and minimize migratory bird impacts from boating.

Wildlife responds differently to boats based on their size, speed, the amount of noise they make, and how close the crafts get to wildlife. Boats increase the access of visitors to areas not open to most other visitors, thus having a greater potential to cause wildlife disturbance if not managed properly. The speed and manner in which a boat approaches wildlife can influence wildlife responses. Rapid movement directly toward wildlife frightens them, while movement away from or at an oblique angel to the animal is less disturbing (Knight and Cole 1995). Dahlgren and Korschgen (1992) categorized human activities in order of decreasing disturbance to waterfowl:

1. rapid over water movement and loud noise (e.g., power-boating, water skiing, and aircraft),
2. over water movement with little noise (e.g., sailing, wind surfing, rowing, and canoeing),
3. little over water movement or noise (e.g., wading and swimming), and
4. activities along shorelines (e.g., fishing, birdwatching, hiking, and traffic).

Hume (1976 as cited by Dahlgren and Korschgen 1992) observed a similar differential response of waterfowl to human activities. Common goldeneyes often flew when people on the shore approached within 100 or 200 meters, but settled elsewhere on the water. A single sailing dingy was sufficient to cause more than 60 common goldeneyes to take flight and for most to leave the vicinity within a few minutes. Remaining birds then flew up each time the boat approached to within 300 to 400 meters and generally left the area within an hour. The appearance of a powerboat caused instantaneous flight by most birds. If the boat traversed the length of the reservoir, all remaining birds left within minutes. Hume reported that waterfowl abundance decreased over time as a result of the increased frequency of boating.

In Germany, Bauer et al. (1992) concluded that boating pressure on wintering waterfowl had reached such a high level that it was necessary to establish larger sanctuaries and stop water sports and angling from October to March. Likewise, on numerous occasions Thornburg (1973) observed boaters causing mass flights of diving ducks on the Mississippi River. He believed that increased boating could pose a serious threat to the continued use of the area by great numbers of migratory waterfowl. Thornburg (1973) concluded that eventually restrictions on boating activity may be necessary and that establishing a sanctuary should be considered.

Rodgers and Schwikert (2002) compared flushing distance of three species of birds in response to a slow versus fast approach using the same outboard-powered boat. A fast approach resulted in significantly larger flush distances for brown pelicans, anhingas, and great egrets. They concluded that water bird staging areas along migratory corridors and frequently used foraging sites of resident birds merit protection from human activity. In another study, Rodgers and Smith (1997) recommended that the establishment of 150-meter buffer zones around colonial bird rookeries would help minimize disturbance. Increasing the predictability of boating patterns to help wildlife habituate to non-threatening human disturbance can also be accomplished by establishing well marked routes of travel.

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). Refuge rules regarding boating and boat use, including seasonally closed areas and prohibiting the use of air-thrust boats, hover-craft, airboats, and personal watercraft, will assist in lowering disturbance to birds. Additionally, a designated canoe and kayak trail will have interpretive opportunities for visitors to increase awareness of waterbirds. Consideration for seasonal use of certain areas will also reduce impacts. Creation of seasonally no-motor zones in sensitive wintering waterfowl staging areas or rookeries will also reduce impacts from boating and serve as a safety measure for non-motorized boats.

Under Service policy, fishing tournaments cannot originate within the refuge, but, because the quality of fishing is better within the refuge, tournament fishermen originating from a tournament outside the refuge often travel into refuge waters. Tournaments have become big businesses and can substantially increase the level of fishing activity in the refuge. This can have negative impacts on other sports fisherman, wildlife, and habitat.

Determination (check one below):

	Use is Not Compatible
X	Use is Compatible, with the Listed Stipulations

Stipulations Necessary to Ensure Compatibility: Fishing is allowed on the refuge in accordance with State regulations. In addition, the refuge has the following sports fishing regulations, which are paraphrased.

- A free refuge sports fishing permit is required.
- Fishing is allowed only during daylight hours from refuge shorelines.
- Night fishing from boats is allowed with possession of a free sports fishing permit in the open waters of the refuge (i.e., Lake Marion).

- Fishing and boat/canoe/kayak launching is not permitted except in designated boat launch areas and as seasonally specified as open for general public access.
- Airboats, personal watercraft, or hovercraft are not allowed.
- All areas open to boating are open to fishing. All State and Federal fishing regulations apply.

Boating impacts wildlife due to noise and speed, as well as from increased access to more parts of the lake. Boat wakes can cause erosion of shoreline and may be a safety issue for canoe and kayak operations. There are areas on the refuge, including Black Bottom at Cuddo, Savannah Branch at Pine Island, and Cantey Bay, that are seasonally closed to all entry, including for fishing, from November 1 to March 1 due to the areas serving as waterfowl sanctuaries. Additional zones may be expanded to other shallow water habitats of the refuge if necessary to serve the primary refuge purpose for waterfowl. Reducing disturbance from powerboats would also benefit other shallow water foraging and loafing birds. Water boundaries were previously marked and the refuge is seeking funds to repair or replace damaged markers. Closed areas buffers are depicted on refuge tear sheet maps and will be updated for the fishing regulation brochures. Monitoring will help the Service to determine the effectiveness of refuge management actions in maintaining migratory birds, endangered species, and other wildlife populations on the refuge.

The refuge has little control over fishing tournaments which originate off the refuge. However, the staff will work with the organizers of these events to educate them to the impacts boating can have on wildlife and brief them on refuge regulations.

It is anticipated that the existing and proposed rules will be adequate to sustain migratory bird and endangered species populations and adequate stocks of fish, and provide for a quality fishing experience which has little impact on other visitors. If wildlife populations suffer as a result of fishing or boating activities, the quality of fishing declines, or other wildlife impacts occur, additional buffer zones may be established and/or additional motor boat restrictions may be implemented. The refuge will modify or eliminate any use with unacceptable impacts.

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) sufficient restrictions have been established to ensure the protection of migratory birds and that an adequate amount of high-quality feeding and resting habitat would be available to accommodate the needs of waterfowl, migratory birds, and other resident birds using the refuge; 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 wildlife observation and photography. Commercial 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. Posted with closed area signs, certain portions of the refuge are closed to protect wildlife, such as during the migratory, wintering waterfowl season. Wildlife viewing and photography improvements have been made at the Wrights Bluff nature trail and additional opportunities are being developed on the other units of the refuge, such as the Cuddo Wildlife Drive, along hiking trails, Dingle Pond, and at other locations to 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 a diversity of wetland or upland habitats for wildlife viewing. Although no photography blinds currently exist on the refuge, wildlife viewing blinds are being considered. In addition to hiking trails, a canoe/kayak trail on the Cuddo and Pine Island Units will enhance existing wildlife observation and photography within upland and wetland habitats.

Approved forms of access for wildlife viewing and photography include driving legal motor vehicles, hiking, and motorized and non-motorized boats. Certain areas may be closed to specific forms of transportation. Motor boat restriction zones are in place in several locations to provide protection for migratory birds and to improve the quality of fishing opportunities. Bicycles are not allowed on hiking trails and will be allowed only on designated routes.

Refuge brochures and maps will provide the public with the locations of visitor facilities. Additional informational displays and maps are located at refuge boat ramps, public boat ramps, refuge kiosks, and visitor contact stations.

Availability of Resources: 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 repair roads open to the public; replace gravel on the Wildlife Drive and other public roads; repair, and replace boardwalks and trails; paint, repair, and replace signs; and develop and print brochures. Up to two equipment operators, two rangers, two law enforcement officers, and the refuge manager can be involved in managing this program.

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 refuge in cooperation with other partners, will have to pursue additional funding opportunities as they become available. Other refuge staff, volunteers, and the Friends of Santee National Wildlife Refuge Association also support these uses.

Anticipate Impacts of Uses: This purpose of 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 levels 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 and pullouts along the Cuddo Wildlife Drive have a greater potential for disturbing wildlife species. 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 walking requires a longer period of time to cover the same distance. 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 cause more disturbances to waterfowl than 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 their vehicles to view wildlife, wildlife photographers are much more likely to leave their vehicles and 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).

Boating impacts on wildlife can be classified based on the form of boating activity (Korschgen and Dahlgren 1992; Knight and Cole 1995) the season of use (Burger 1995) and species tolerance to the activity (Jahn and Hunt 1964). For example, motorboat activity likely has more disturbances on wildlife than non-motorized boat travel because motorboats produce a combination of movement and noise ((Knight and Cole 1995). Even canoes can cause disturbance based on the ability to access shallower areas of the marsh (Speight 1973). However, compared to motorboats, personal water craft (jet skis), and airboats, canoe travel appears to have the least disturbance (Jahn and Hunt 1964).

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. For example, during the fall migration and over-wintering season, wildlife observation, photography, environmental education, interpretation, and waterfowl hunting are all occurring simultaneously and are at the highest levels of the year. Techniques to limit disturbance must be evaluated, 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 public use may not be 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 Listed Stipulations

Stipulations Necessary to Ensure Compatibility: 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 determine 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, relocate the activity or program, or eliminate the program.

Stipulations that may be employed include those listed.

- 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 Cuddo Wildlife Drive.
- Impacts from wildlife viewing and photography can be reduced by providing observation blinds.
- The establishment of stay in your vehicle zones could further reduce disturbance on the Wildlife Drive.
- 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 in areas where members of the public are generally allowed help fulfill 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 youth and adult 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.

The CCP identifies an expansion of the environmental education program to a curriculum-based program that focuses on habitat diversity, wildlife, and children. Over time, the program would grow to provide a diverse range of on-site staff-led education programs. The programs will explore various habitats of the refuge (i.e., lake system, wetlands, bottomlands, pinelands, hardwood uplands, and Carolina Bays), leading to a better understanding of the value of these habitats to fish and wildlife resources, the human influence on the ecosystem, and the importance of these resources to society. The refuge has a visitor center facility to support a moderate-sized program and can develop curricula that allow students to explore and experience these habitats firsthand.

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 plan also calls for more extensive improvements, such as expanding the visitor center for exhibits, displays, staffing, and developing interpretive trails (e.g., canoe trail and Dingle Pond trail enhancements); making improvements at the Wrights Bluff observation deck; developing more interpretive wildlife viewing areas; and consideration of a guided golf-cart type tour.

Proposed changes in the environmental education and interpretive program are planned for areas currently open to the public. Current interpretive sites include the Visitor Center, Santee Indian Mound and Ft. Watson, Wrights Bluff Nature Trail, Cuddo Wildlife Drive, Cuddo Nature Trail, Pine Island Nature Trail, Dingle Pond Nature Trail, Santee NWR Canoe and Kayak Trail. The refuge utilizes the visitor center as the focal point for education programs. Supervised activities will encourage the exploration of the environment, but efforts will be made to return any collected item to the habitat from which it came in an unharmed condition.

Availability of Resources: Annual refuge operation and maintenance funds support the Visitor Service 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 Friends of the Santee National Wildlife Refuge, Fish and Wildlife Foundation, other grants or endowments, and refuge budget increases under the Refuge Operating Needs System (RONS). The Santee friends group is supportive of the refuge public use program, providing volunteers and supplementing refuge programs and facilities. Refuge staff, such as interpretive rangers and volunteers, provides the staffing for these uses.

Anticipated Impacts of Uses: Environmental education primarily occurs at the Santee Visitor Center and surrounding areas. The expansion of the program, as proposed, would increase disturbance in several new sites, however, impacts would be considered short-term and discreet due to the low anticipated frequency of use and ability to move sites to a new area if the habitat showed signs of impacts. 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, Wildlife Drive, canoe/kayak trail, or other improved facilities. Adding the new interpretive sites will have some wildlife or habitat impacts. The canoe/kayak trail expands use sites on the Cuddo and Pine Island units and only minimal clearing will be required for parking

and launch areas. The existing boat launch and earthen parking area will be minimally enhanced at Pine Island. The preferred route for the Dingle Pond trail enhancements uses the existing trail and fire break, and about two tenths of an acre of clearing would be required for a parking lot. Initial plans include working with neighborhood partners to develop public access points on the south boundary of Dingle Pond (e.g., parking lots and a kiosk). These visitor contact areas would originate just off the refuge. The trail would pass by some wetlands, but the footprint of the trail will be in uplands where impacts are minimal. Additional expansions would include raised boardwalks through forested wetlands for environmental interpretation.

Determination (check one below):

	Use is Not Compatible
X	Use is Compatible, with the Listed Stipulations

Stipulations Necessary to Ensure Compatibility: While anticipated impacts are expected 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. Program activities will be modified to avoid observed or predicted impacts. Built into all curriculums will be a section on wildlife etiquette. 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 determine if objectives are being met and 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. 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 Cuddo Wildlife Drive will be carefully monitored. If impacts are detected, adaptive strategies will be developed, such as re-routing traffic and public activity during sensitive times, or establishment of “stay in your vehicle” zones, to lessen wildlife disturbance. Annual evaluations will be conducted to assess if objectives are being met and that 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. They 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 with cost built into the refuge operation and maintenance budget. Identified improvements will not be developed until adequate staff and budget are available to develop and operate them. 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 that unacceptable wildlife impacts are occurring, the refuge will modify the activity to minimize or eliminate the impacts.

Both programs allow the education of the public on the missions of the Service and Refuge System, and the purposes of the refuge. They highlight the areas which are most closely aligned 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 Administration Act, bicycling is a mode of transportation currently used to facilitate wildlife observation. Bike riding is also included in the Compatibility Determination (CD) for Wildlife Observation and Photography. This CD provides additional guidance on this specific use. As proposed, bike riding would occur only on designated roads and trails. This use occurs all year.

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 Wildlife Drive and other public roads; repair and replace boardwalks and trails; paint, repair, and replace signs; and develop and print brochures. The refuge will seek outside funding, grants, and partnerships to fund the development of bicycle paths.

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 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, joggers, and all-terrain vehicle riders 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, along with other similar sport activities, such as jogging, is not permitted.

Other forms of bike riding may be appropriate. The intent of some bike riders is wildlife viewing and several bicycle trails are planned in the CCP. Bicycle riders are not permitted to ride on refuge hiking trails. This activity disturbs other trail users and will be eliminated from hiking trails or other areas where a conflict may occur.

Short-term Impacts: Wildlife disturbance relative to bicycle riding has been poorly studied with most references using other activities, such as walking, hiking, and operating vehicles and their impacts on wildlife; therefore, bicycle impacts are inferred (unless noted). As noted in the Wildlife Observation and Photography CD, 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 (including bicycling) tend to increase the disturbance potential for most wildlife species (Klein 1993; Gabrielson and Smith 1995; Burger 1981; Pease et al. 2005). Out of vehicle activities along wildlife observation trails and pullouts along the Cuddo Wildlife Drive have the greatest potential for disturbing wildlife species. 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).

A study conducted at Back Bay National Wildlife Refuge indicated that jogging and bike riding in an open habitat, such as marshes where the activity is highly visible to wading birds, shorebirds, and waterfowl, is disruptive. As a result, marsh birds in open areas flee from joggers and bike riders (Laskowski 1999). 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 NWR (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. For example, during the fall migration and the over-wintering season wildlife observation, photography, environmental education, and interpretation are all occurring simultaneously and are at the highest levels of the year. Refuge hunts are planned before the primary migratory waterfowl use period. Techniques to limit disturbance must be evaluated, and 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 urban expansion, human population growth, and increased visitor opportunities could result in seasonal shifts in migratory bird use of the refuge wetland habitats. 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 Listed Stipulations

Stipulations Necessary to Ensure Compatibility: All forms of wildlife observation should have minimal wildlife and habitat impacts. However, bicycling can cause wildlife impacts near wetland areas, can increase wildlife impacts, and can disrupt other individuals viewing wildlife. Bicycles will not be permitted on established hiking trails. Bicycling on the Cuddo Wildlife Drive has not reached a level where disturbance is occurring to wildlife or other individuals participating in wildlife observation. However, as use of the Cuddo Wildlife Drive or other trails increase, bicycling could become a greater disruption to wildlife or other visitors. As soon as bike paths are developed, bicycling will be limited to

these sites. Evaluation of bike riding on bike paths and other roads open to biking will be conducted annually to assess if objectives are being met, if habitat impacts are within a tolerable range, and if wildlife populations are being adversely affected. If evidence of unacceptable impacts begins to appear, it may be necessary to change the activity or the program, relocate the activity or program, or eliminate the program.

Stipulations that might be employed include:

- 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.
- The establishment of stay in your vehicle zones could further reduce disturbance on the Wildlife Drive or provide seasonal-only access to sensitive areas.
- Techniques specific to bicycling will include: re-routing, modifying, or eliminating bicycle riding activities which have demonstrated direct wildlife impacts near 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 help fulfill 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 and promote 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:
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 facilitates the purposes, vision, and goals of the refuge. The refuge hosts research from a variety of research institutions, including the U.S. Geological Survey and Santee-Cooper Public Authority. 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 biologist and approved by the refuge manager. Refuge approved research will prioritize studies that are fish and wildlife management-oriented studies that provide information that serves the refuge or the National Wildlife Refuge System.

Availability of Resources: The refuge presently has a small trailer on-site to support temporary housing for researchers and students. As funding becomes available, the CCP proposes the addition of an updated dorm facility and recreational vehicle pads on the refuge. The refuge maintains a small and growing geographic information system database and a library of pertinent biological texts, published scientific and biological papers, reports, and reprints. 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 (Director's Order 109, dated March 28, 2005). 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 Listed 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 (Directors Order Number 109). 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 the refuge updating 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 the 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:
Exotic and Nuisance Wildlife Control

Exotic animals (e.g., feral hogs) are one of the most destructive exotic animals invading refuge habitats. Similarly, nuisance animals (e.g., beaver) can also be destructive to real assets and habitats. They are present in nearly all refuge habitats. Coyotes are also found on all units of the refuge. With impacts not clearly known at this time, population control measures will be considered if adverse impacts are determined as a result.

Feral hogs cause considerable damage and impacts to native wildlife and habitats. Feral hogs are known to occur in some refuge units and on adjacent lands. Trapping and hunting are means used to control feral hogs and trapping is used for beaver and coyote control. For assistance in control of these species, trappers and their helpers will be issued access under special use permits. Trappers and hunters will be permitted to remove feral hogs from the refuge through the use of live traps and existing public hunts.

The CCP outlines the importance of the removal of feral hogs from the refuge, monitoring the feral hog population after this time, and adjusting the target take accordingly to limit impacts to native wildlife and habitats. Additionally, trappers will be used to assist in the reduction of nuisance wildlife, such as beavers and coyotes.

Availability of Resources:
The current level of refuge funding is adequate to support the feral hog removal program as it is proposed in the refuge's CCP. Funding at the current level is adequate to administer a feral hog removal or nuisance wildlife program. Management staff administers permits and checks for permit compliance. Law enforcement officers monitor permit compliance and compliance with applicable laws and regulations.

Anticipated Impacts of Use:
Minor, short-term, and discreet increased disturbance to native wildlife may be caused by trapping activities. Native wildlife, such as raccoons, opossums, and wild turkey, may occasionally feed on corn used for bait at trap sites. The potential for disturbance to the visiting public does exist. However, most trapping activities will take place in areas closed to the public or at night to limit disturbance. Additionally, all measures will be taken to ensure that the activity does not present a safety hazard to the general public or other wildlife.

Determination (check one below):

	Use is Not Compatible
X	Use is Compatible, with the Listed Stipulations

Stipulations Necessary to Ensure Compatibility:
Feral hog removal permits will be issued and renewed annually subject to successful performance during the permit period and on a prescribed need.

Agent trappers will furnish all labor, equipment, and supplies required to accomplish the effective capture and removal of hogs, coyotes, or beaver from the refuge.

Possession of firearms is prohibited except during legal public hunts.

All captured hogs will become the property of the trapper and will be disposed of in accordance with local, state, and federal laws.

Period of use, time of entry, route of travel, and techniques used are subject to approval by the refuge manager.

All trapping and capture activities (e.g., locations and time) will be restricted to areas and times designated and approved by the refuge manager.

Individuals with wildlife violations, felony violations, trespass violations, a pattern of repeated misdemeanor violations, and other similar violations will not be permitted to conduct trapping under this program.

Agent trappers will be required to submit reports outlining the number of hogs or beaver captured and the number of traps operated each month.

Agent trappers must provide the refuge with detailed personal information for each helper trapper and must provide detailed information on all vehicles to be used in the removal program.

Justification: Feral hog removal and the resulting reduction of the refuge feral hog population help reduce habitat disturbance, competition between feral hogs and native wildlife for food resources, native wildlife mortality, safety hazards due to hog and car collisions, and asset destruction caused by rooting activities. Without this feral hog removal program, an unrealistic amount of refuge staff time would be required to reduce the feral hog population.

Mandatory 10-Year Re-evaluation Date:

Description of Use:
Forest Management – Commercial Timber Harvest

A Refuge Forest Management Plan was produced for the Santee NWR in 1975. This plan is now 32 years old. It does not presently meet the landscape goals and objectives for habitat types of Santee NWR or those developed in the CCP. Under the refuge's CCP, timber harvesting will be used in forest and woodland stands where the trees are merchantable to assist in stand reduction that enhance conditions for migratory bird and wildlife habitat.

Timber harvesting will be used to help achieve several of the goals and objectives outlined in the CCP. These goals include maintaining nesting substrate for the bald eagle (*Haliaeetus leucocephalus*), the improvement of habitat for key priority species identified by SAMBI or SCDNR Strategic Plan, the creation of diversity in the landscape, and the maintenance of biological integrity. The strategies and techniques for these will be discussed in detail in development of a Habitat Management Plan (HMP) and/or an updated Forest Management Plan, as a step-down plan of the CCP.

Periodically, timbered areas of the refuge will be assessed to determine 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 usually used where the purpose of the harvest is to create a range of stand densities throughout the forest. In this case a relatively small portion of the stand is removed and is most

applicable where the objective is to create forest openings, enhanced understory, or where more diversity in the forest is desired. 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 likely use of this method is to reduce trees in areas where the shrub layer would provide habitat for migratory song birds. Although this method reduces the amount of pre-harvest work by eliminating marking, it requires closer monitoring of the logging operation. Either method will provide needed disturbance to the forest floor and enhance forest regeneration and succession. Mechanical disturbance is more desirable in the mixed hardwood where fire could damage hardwood species.

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, personnel on the refuge's staff need to be knowledgeable in forest ecology. They must also have an awareness of the capabilities and limitations of timber harvesting operations. At the present time, such staffing is available. The CCP provides for staffing at both the technical and professional level to meet this requirement in the future.

Anticipated Impacts of the Use: Harvesting operations can have a major impact on 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 layers have grown fewer with closed canopy conditions and the disturbance will have positive impacts to enhance understory regeneration. The removal of some of the stems opens up the canopy and allows sunlight penetration to the forest floor. The herbaceous layer responds positively to the removal of the overstory and enhances portions of the shrub layer and mid-story layer. This can create important breeding and foraging opportunities for migratory song birds and enhance overall wildlife habitat conditions.

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 Listed 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. The permit should also address any specific requirements to restore road and other assets damaged as a result of the permittee's activities.

While checking on harvest operations, refuge staff will be aware of present and forecasted weather conditions. Should soil moisture reach 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: The forest management actions proposed in the CCP are in accordance with Service guidelines for the protection, management, and enhancement of wildlife populations and habitats on the refuge. The habitat for migratory birds will require periodic manipulation if goals are to be met. The timber harvest will also help meet goals of maintaining upland habitat diversity and will help maintain the biological integrity of the refuge landscape.

Mandatory 10 Year Re-evaluation Date:

Description of Use:
Cooperative Farming

Permit cooperative farming activities on Santee NWR for the purpose of providing food for wintering waterfowl and a wide variety of resident and migratory wildlife. This activity would constitute a commercial use of the refuge as a Cooperative Farming Agreement that typically consists of an 80/20 percent shared crop. The normal 80/20 percent (or higher) is based on the cooperative farmer harvesting 80 percent of the crop for labor, equipment costs, fuel, fertilizer, and land preparation, with the refuge deriving the remaining 20 percent of the crop as a fee for use of the refuge land. This standard will be evaluated to consider existing fallow field conditions on the refuge. This proposed use (cooperative farming) would be considered on all units within Santee NWR. The amount of cooperative farming will be the minimal amount needed based on waterfowl and habitat objectives that were established for the Santee NWR and as recommended by a recent refuge biological review. The cropland allocation on each unit will be reviewed periodically to determine the success of the program and to ensure the use is meeting refuge goals and objectives. Additional habitat will also be provided through native moist-soil management and flooded forested wetlands.

Availability of Resources:
Presently, ample previously farmed fallow land is available on the Santee NWR to support cooperative farming. The majority of previously farmed fallow land receives minimal maintenance and management by way of a mowing/fire regimen. Without the preferred management, fallow farm fields will succeed to undesirable, rank stands of young pine, sweet gum, or other monotypic vegetative cover types. Historically, these fields were cooperatively farmed as part of the refuge program.

Cost estimates to administer a cooperative farming program would vary greatly, depending on the size of program and the situations afforded to the refuge at the time of the actual farming agreement being drafted. Actual costs to the refuge would be mainly for staff wages to administer the program, fees for yearly soil sampling, and costs for fuel to cover site visits. Estimated cost for staffing would be between .10 and .25 of a full-time equivalent position at the GS-7 level, with some additional staffing cost for supervisory oversight. At present, base funding is available to cover staff costs.

Anticipated Impacts of the Use:
The proposed use is not expected to have any significant impact upon refuge resources providing that: 1) this activity is strictly monitored by refuge personnel; and 2) the cooperative farmer follows all directives in the Cooperative Farming Agreement. Some impacts on refuge resources can be

expected as land will need to be disturbed to facilitate the farmers activities and some minor disturbances to wildlife can be expected due to this activity. The cropland management agreement and plan outlines compliance with Service pesticide use policies and as stipulated in the Refuge Manual. Minimal impacts are expected as only pre-approved pesticides may be used on the refuge.

Determination (check one below):

	Use is Not Compatible
X	Use is Compatible, with the Listed Stipulations

Stipulations Necessary to Ensure Compatibility:

- The farmer will only plant suitable wildlife foods and cover crops, such as corn, winter wheat, millet, or other pre-approved wildlife food and cover crop, with the refuge share being determined at time of harvest.
- Farming activities will be conducted March through October to avoid conflict with migratory bird management.
- Refuge soils will be maintained at proper PH levels by the farmer as determined by yearly soil analysis.
- The farmer will follow all directives in the Cooperative Farming Agreement, paying particular attention regarding the application of pesticides.
- Farmer will not cause any unreasonable disturbance to refuge wildlife.
- Each Cooperative Farming Agreement will be reviewed annually and all activities will be evaluated to determine the success of the program as it relates to assisting the refuge to meet stated refuge goals and objectives for wildlife habitat and management.

Justification:
In 1941, Congress established the Santee NWR with the primary purpose "... for use as an inviolate sanctuary, or for any other management purpose, for migratory birds.." and with a focus on waterfowl management. Santee NW R is comprised of fee title and leased land for which agricultural crop production is considered essential for carrying out the intended purposes, including recent recommendations provided by the refuge biological review. Contract or force account farming would not require compatibility determinations as there would be no commercial production over and above that needed to support migratory and wintering waterfowl and migratory birds. However, existing and projected refuge funding and staffing levels necessitate the use of cooperative farming agreements to achieve these foraging objectives. A Cooperative Farming Agreement will be established for this use, which requires farmers to minimize impacts and greatly reduce applications of pesticides and artificial fertilizers. Further, only minimal acreage will be farmed to coincide with existing waterfowl population and habitat needs. Also, it would create landscape diversity by creating small interspersion fields favorable to resident wildlife.

This use is deemed compatible under the stipulated requirements. Since the proposed use will further refuge establishment purposes, this compatibility determination is necessary only to ensure that these uses are compatible with higher priority wildlife and habitat purposes established by Congress, and the mission of the Refuge System. No additional justification for this use is necessary or appropriate.

Mandatory 10-Year Re-evaluation Date:

Literature Cited:

Arctander, P., J. Fjeldsa, and A. Jensen. 1984. Sejlads med lufpudebade, jagt og andre forstyrrelser af jugle of sealer ved Saltholm jaj-september 1984. Milljoministeriet, Fredningsstyrelsen, Denmark.

Bauer, H. G., H. Stark, and P. Grenzel. 1992. Disturbance Factors and their Effects on Water Birds Wintering in the Western Parts of Lake Constance. Der Ornithologische Beobachter 89:81-91.

Bergman, R. D. 1973. Use of Southern Boreal Lakes by Post Breeding Canvasbacks and Redheads. Journal of Wildlife Management. 37:160-170.

Burger, J. 1995. Beach Recreation and Nesting Birds. Pages 281-295 in T.L. Knight and K. J. Gutzwiller, ed. Wildlife and Receptionists: Coexistence Through Management and Research. Island Press, Washington, D.C. 372pp.

Burger, J. 1981. The Effects of Human Activity on Birds at a Coastal Bay. Biological Conservation. 21:231-241.

Cronan, J.M. 1957. Food and Feeding Habits of the Scaups in Connecticut Waters. Auk 74(4):459-468.

Dahlgren, R. B. and C.E. Korschgen. 1992. Human disturbance of waterfowl: and annotated bibliography. Resource Publication 188. U.S. Fish and Wildlife Service. Washington D.C. 62 pp.

Dobb, E. 1998. Reality Check: The Debate behind the Lens. Audubon: Jan.-Feb.

Fox, A.D. and Madsen. 1997. Behavioral and Distributional Effects of Hunting Disturbance on Waterbirds in Europe: Implications for Refuge Design. Journal of Applied Ecology 34: 1-13.

Gabrielson, G. W. and E. N. Smith. 1995. Physiological Responses of Wildlife to Disturbance. Pages 95-107 in R. L. Knight and K. J. Gutzwiller, ed. Wildlife and Recreation: Coexistence through Management and Research. Island Press. Washington, D.C. 372 pp.

Hume, R.A. 1976. Reaction of Goldeneyes to Boating. British Birds 69:178-179.

Jackson, Jeremy B. C., Kirby, Michael, Berger, Wolfgang, H., Bjorndal, A. 2001. Historical Overfishing and the Recent Collapse of Coastal Ecosystems. Science, Volume 293: pp. 629-638.

Jahn, L. R, and R. A. Hunt. 1964. Duck and Coot Ecology and Management in Wisconsin. Wisconsin Conservation Department. Tech. Bull. No. 33. 211 pp.

Kahl, R. 1991. Boating Disturbance of Canvasbacks during Migration at Lake Poygan, Wisconsin. Wildlife Society Bulletin19: pp. 242-248.

Klein, M. L. 1993. Waterbird Behavior Responses to Human Disturbances. Wildlife Society Bulletin 21: pp. 31-39.

Knight, R. L. and D. N. Cole. 1995. Wildlife Response to Recreationist. Pages 71-79 in R.L. Knight and K. J. Gutzwiller, ed. Wildlife and Recreation: Coexistence thorough Management and Research. Island Press. Washington, D.C. 372 pp.

Korschgen, C.E. and R. B. Dahlgren. 1992. Human Disturbance of Waterfowl: Causes, Effects and Management. U.S. Fish and Wildlife Service Leaflet 13.2.15. 7 pp.

Korschgen, C.E. L.S. George, and W.L. Green. 1985. Disturbance of Diving Ducks by Boaters on a Migrational Staging Area. Wildlife Society Bulletin 13: pp. 290-296.

Laskowski, H., T. Leger, J. Gallegos, and F. James. 1993. Behavior Response of Greater Yellowlegs, Snowy Egrets and Mallards to Human Disturbance at Back Bay National Wildlife Refuge. Unpub. Repot #51510-01-92. U.S. Fish and Wildlife Service, Washington, D.C. 25pp.

Madsen, J. 1995. Impacts of Disturbance on Migratory Waterfowl. Ibis 137: S67-S74.

Madsen, J., E. Bogebjerg, J.B. Kristensen, J. Frikke, and J.P. Hounisen. 1992. Forsogsreservat Ulvshale-Nyord: Baggrundsundersogelser efteraret. 1985 til foraret 1989. Danmarks Miljoundersogelser Fagilig Rapport. 47:1-57.

Morton J.M. 1995. Management of Human Disturbance and its Effects on Waterfowl. Pages F59-F86 in W. R. Whitman, T. Strange, L. Widjeskog, R. Whittemore, P. Kehoe, and L. Roberts (eds). Waterfowl Habitat Restoration, Enhancement and Management in the Atlantic Flyway. Third Ed. Environmental Management Committee, Atlantic Flyway Council Technical Section, and Delaware Division of Fish and Wildlife. Dover, DE. 1114 pp.

Morton, J.M., A.C. Fowler and R.L. Kirkpatrick. 1989a. Time and Energy Budget of American Black Ducks in Winter. Journal of Wildlife Management 53: 401-410.

Morton, J.M., R.L. Kirkpatrick, M.R. Vaughan, and D.F. Stauffer 1989b. Habitat Use and Movements of American Black Ducks in Winter. Journal of Wildlife Mangement 53: 390-400.

Paulus, S.L. 1984. Activity Budgets of Nonbreeding Gadwalls in Louisiana. Journal of Wildlife Management 48: 371-380.

Pease, M. L., R.K. Rose, and M.J. Butler. 2005. Effects of Human Disturbances on the Behavior of Wintering Ducks. Wildlife Society Bulletin 33(1): 103-112.

Reichholf. J. 1973. Begrundung einer okologischen Strategie der Jagd auf Enten. Anzeiger Ornitholghishes Gessellschafte Bayern. 12: 237-247.

Riffell, S. K., J. Gutzwiller, and S. H. Anderson. 1996. Does repeated human intrusion cause cumulative declines in avian richness and abundance? Ecological Applications 6(2): 492-505.

Rodgers, J. A. Jr., and H. T. Smith. 1997. Buffer Zone Disturbances to Protect Foraging and Loafing Waterbirds from Human Disturbances in Florida. Wildlife Society Bulletin 25(1): 139-145.

Rodgers, J. A. Jr., and S. T. Schwikert, 2002. Buffer-zone Distances to Protect Foraging and Loafing Waterbirds from Disturbance by Personal Watercraft and Outboard-powered Boats. Conservation Biology 16 No.1 Pages 216-224.

Skagen, S.K. 1980. Behavioral Response of Wintering Bald Eagles to Human Activity on the Skagit River, Washington. Pages 231-241 in R.L. Knight, G.T. Allen, M.V. Stalmaster, and C.W. Servhenn, eds. Proc. Wash. Bald Eagle Symposium, The Nature Conservancy. Seattle, WA.

Speight, M. C. D. 1973. Outdoor Recreation and its Ecological Effects: A Bibliography and Review. University College London, England. Discussion Papers in Conservation 4. 35 pp.

Sterling, T. and A. Dzubin. 1967. Canada Goose Molt Migrations to the Northwest Territories. Trans. N. Am. Res. Conf. 32:367-369.

Stevenson, Phillip W. and Sulak, Kenneth. 2001. Egress of Adult Sport Fish from an Estuarine Reserve within Merritt Island National Wildlife Refuge, Florida. Marine Estuary Sci. Conso. pp. 77-89.

Thompson, D. 1973. Feeding Ecology of Diving Ducks on Keokuk Pool, Mississippi River, Journal of Wildlife Management 37: 367-381.

Thornburg, D.D. 1973. Diving Ducks Movement on Keokuk Pool, Mississippi River, Journal of Wildlife Management 37: 382-389.

Wikipedia. 2005. Mountain Biking. <http://en.wikipedia.org/wiki/Mountain.biking>.

Wolder, M. 1993. Disturbance of Wintering Northern Pintail at Sacramento National Wildlife Refuge, California. M.S. Thesis, Humbolt State University. Arcata 62 pp.

Public Review and Comment: Following the initial gathering of information, a Notice of Intent to prepare a CCP for the refuge was published in the *Federal Register* on January 3, 2007. The Service also placed ads in local newspapers, posted information on the refuge's web site regarding upcoming meetings and how to submit comments, posted meeting information in the local community (e.g., at local shops, at the refuge's Visitor Center, and at local libraries), and sent out flyers announcing the public meetings. A public scoping meeting was conducted on February 21, 2007, with approximately 25 people attending.

Approval of Compatibility Determinations

The signature of approval is for all compatibility determinations considered within the Comprehensive Conservation Plan for Santee National Wildlife Refuge. If one of the descriptive uses is considered for compatibility outside of the Comprehensive Conservation Plan, the approval signature becomes part of that determination.

Refuge Manager: _____
(Signature/Date)

Regional Compatibility Coordinator: _____
(Signature/Date)

Refuge Supervisor: _____
(Signature/Date)

Regional Chief, National Wildlife Refuge System, Southeast Region: _____
(Signature/Date)

Appendix G. Intra-Service Section 7 Biological Evaluation

Originating Person: Marc Epstein
Telephone Number: (803) 478- 2217
E-Mail: marc_epstein@fws.gov
Date: September 5, 2007

PROJECT NAME: **SANTEE 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
_X_Refuges/Wildlife

II. State/Agency: South Carolina/U.S. Fish and Wildlife Service

III. Station Name: Santee National Wildlife Refuge

IV. Description of Proposed Action

The proposed action consists of approving and then implementing a Comprehensive Conservation Plan (CCP) for Santee National Wildlife Refuge in Clarendon County, South Carolina. The CCP provides overall management guidance on the refuge over a 15 year period in the form of a vision, 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 Santee 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:

B. Complete the following table:

SPECIES/CRITICAL HABITAT	STATUS[1]
Wood stork (*Mycteria americana*) – have been observed foraging and loafing on wetland habitats within the refuge acquisition boundary, but nesting has not been documented.	E

[1]STATUS: 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

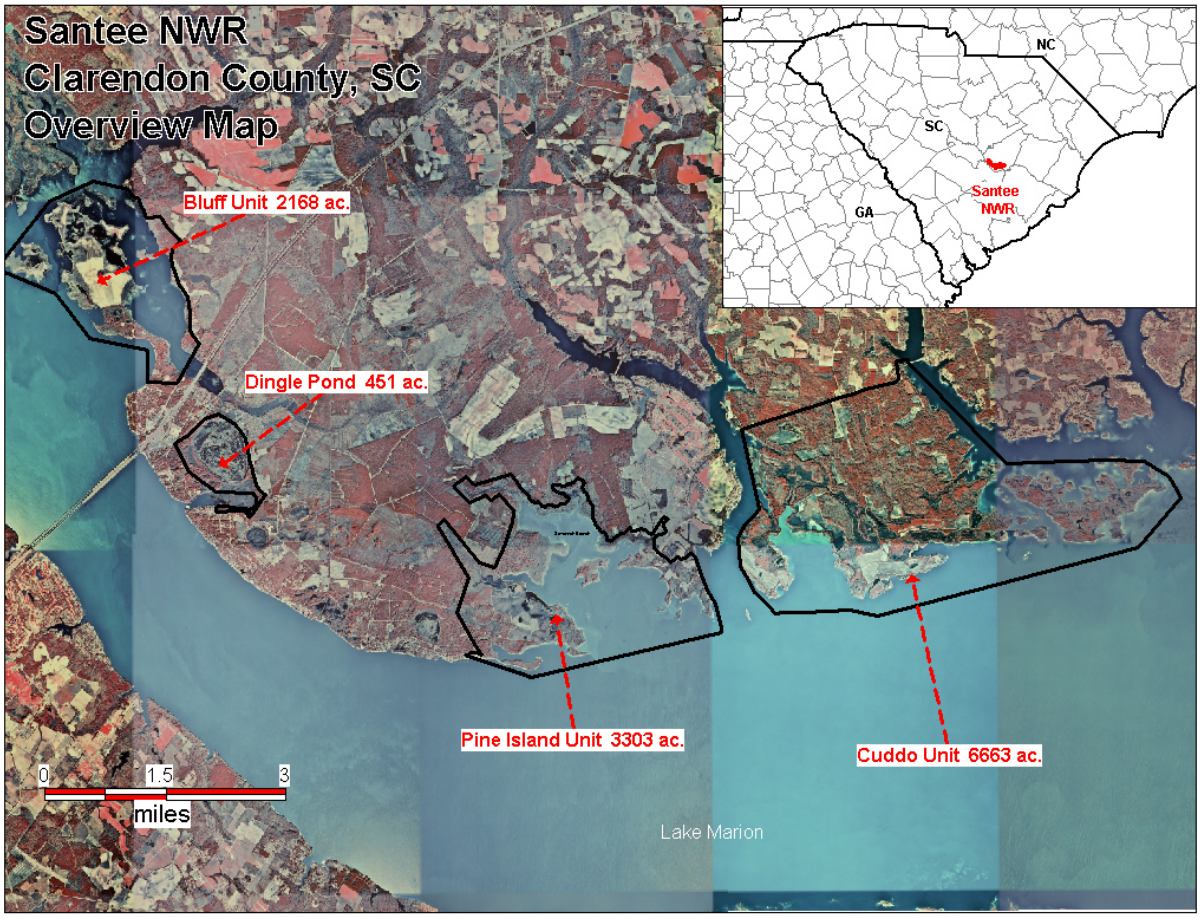
B. County and State: Clarendon County, South Carolina

C. Section, township, and range (or latitude and longitude):
33°36' North Latitude, 79°6' West Longitude (approx. center of refuge)

D. Distance (miles) and direction to nearest town(s):
Santee, 10 miles to south, Summerton, 5 miles to north of refuge

E. Species/habitat occurrence within Waccamaw NWR acquisition boundary:
Wood stork: habitat and species (foraging/loafing, not nesting) both occur
Bald eagle: habitat and species (foraging, nesting) both occur

Location Map of Santee 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
Wood stork – wetland areas	No impacts anticipated on existing refuge lands; proposed acquisition of additional areas would protect more habitats and thus likely be beneficial.

B. Explanation of actions to be implemented to reduce adverse effects:

SPECIES/ CRITICAL HABITAT	ACTIONS TO MITIGATE/MINIMIZE IMPACTS
Wood stork – wetland areas	No mitigation measures needed unless nesting is observed; if nesting is observed, implement buffer zone around nesting area.

VIII. Effect Determination and Response Requested:

SPECIES/CRITICAL HABITAT	DETERMINATION[1]			REQUESTED
	NE	NA	AA	
Wood stork – wetland areas		X		Concurrence

[1]DETERMINATION/ 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**

Appendix H. Wilderness Review

The Wilderness Act of 1964 defines a wilderness area as an area of federal land that retains its primeval character and influence, without permanent improvements or human inhabitation, and is managed so as to preserve its natural conditions and which:

1. generally appears to have been influenced 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 types 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 unimpeded condition; or is a roadless island, regardless of size;

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; and

5. may contain ecological, geological, or other features of scientific, educational, scenic, or historic value.

The lands within Santee National Wildlife Refuge were reviewed for their suitability in meeting the criteria for wilderness, as defined by the Wilderness Act of 1964.

A proposal for wilderness designation of 163 acres of island habitat at Santee NWR was finalized on March 25, 1975, and submitted for congressional approval. No official action was taken by Congress at the time to include the islands as part of the National Wilderness Preservation System. In 1993 and again in 1999, official requests from Congress for information regarding the Santee wilderness proposal were made, thus indicating that the proposal was still viable for consideration. However, no official legislative action has yet been taken by Congress.

The proposed Santee Wilderness Area consists of 13 islands located in Lake Marion in Clarendon County, South Carolina. These islands comprise 163 acres and are split between two of the four refuge management units. The Cuddo Unit includes the Plantation Islands and the Pine Island Unit includes Pine Island. The islands range in size from the 22-acre Pine Island to less than one acre in the Plantation Islands.

Historically, the timber in the area was actively harvested and agricultural land was actively farmed prior to the creation of Lake Marion when the hydroelectric dam was built. Natural regeneration had restored much of the wilderness character of the islands in 1975 and presently the islands exhibit even greater wilderness character because of nearly 70 years of forest growth. The islands contain a mix of pine and hardwood forests.

The Wilderness Act specifies that proposed wilderness areas are to be managed as wilderness pending congressional approval. The proposed Santee Wilderness Area has been managed as wilderness since 1975 and will continue to be treated as wilderness in perpetuity.

The Service analyzed other refuge lands within the planning area and found no additional areas that meet the eligibility criteria for a Wilderness Study Area as defined by the Wilderness Act.

Appendix I. Refuge Biota

BIRDS

The Santee NWR, established in 1941 as a refuge for migratory waterfowl, lies in the upper coastal plains of central South Carolina in Clarendon County, approximately seven miles south of Summerton on Highway 301.

The refuge is comprised of 15,095 acres of mixed hardwoods, mixed pine/hardwoods, pine plantations, marsh, croplands, old fields, ponds, impoundments, and open waters located in four separate management units along Lake Marion, a hydroelectric reservoir. This diversity of habitats on Santee NWR supports a wide variety of birds.

This list of 293 species is based on records and observations by refuge personnel, state biologists, and visiting birders and on a literature search of appropriate publications. Persons having information regarding species not listed are urged to contact the Refuge Manager.

Since most birds are migratory, species use of the refuge is indicated by the following codes:

P = Permanent Resident
W = Winter Visitor
S = Summer Resident
T = Transient
A = Accidental

LOONS	
___ Common Loon	T
___ Red-throated Loon	T
GREBES	
___ Red-necked Grebe	T
___ Horned Grebe	W
___ Eared Grebe	A
___ Pied-billed Grebe	P
PELICANS, CORMORANTS, DARTERS	
___ American White Pelican	A
___ Double-crested Cormorant	P
___ Anhinga	P

HERONS, BITTERNS, STORKS

___ Great Blue Heron	P
___ Green Heron	S
___ Little Blue Heron	P
___ Cattle Egret	S
___ Great Egret	P
___ Snowy Egret	P
___ Tricolored Heron	P
___ Black-crowned Night-Heron	P
___ Yellow-crowned Night-Heron	S
___ Least Bittern	S
___ American Bittern	W
___ Wood Stork	A

IBISES

___ Glossy Ibis	S
___ White Ibis	P

WATERFOWL

___ Tundra Swan	W
___ Canada Goose	W
___ Barnacle Goose	A
___ Greater White-fronted Goose	W
___ Snow Goose	W
___ Fulvous Whistling-Duck	A
___ Mallard	P
___ American Black Duck	W
___ Gadwall	W
___ Northern Pintail	W
___ Green-winged Teal	P
___ Blue-winged Teal	P
___ Cinnamon Teal	A
___ Eurasian Wigeon	A
___ American Wigeon	W
___ Northern Shoveler	W
___ Wood Duck	P
___ Redhead	W
___ Ring-necked Duck	W
___ Canvasback	W
___ Greater Scaup	W
___ Lesser Scaup	W
___ Common Goldeneye	W
___ Bufflehead	W
___ White-winged Scoter	A
___ Ruddy Duck	W
___ Hooded Merganser	W
___ Common Merganser	W
___ Red-breasted Merganser	W

VULTURES

___ Turkey Vulture	P
___ Black Vulture	P

HAWKS

___ American Swallow-tailed Kite	A
___ Mississippi Kite	S
___ Sharp-shinned Hawk	W
___ Cooper's Hawk	P
___ Red-tailed Hawk	P
___ Red-shouldered Hawk	P
___ Broad-winged Hawk	S
___ Rough-legged Hawk	A
___ Golden Eagle	W
___ Bald Eagle	P
___ Northern Harrier	W

OSPREYS, FALCONS

___ Osprey	P
___ Peregrine Falcon	T
___ Merlin	T
___ American Kestrel	W

QUAIL, TURKEY, CRANES

___ Northern	P
___ Wild Turkey	P
___ Sandhill Crane	A

RAILS, AVOCETS

___ King Rail	P
___ Virginia Rail	W
___ Sora	W
___ Yellow Rail	T
___ Black Rail	T
___ Purple Gallinule	S
___ Common Moorhen	P
___ American Coot	W
___ American Avocet	A

PLOVERS

___ Semipalmated Plover	T
___ Wilson's Plover	T
___ Killdeer	P
___ Piping Plover	T
___ American Golden Plover	T
___ Black-bellied Plover	T

SANDPIPERS

__ Marbled Godwit	T
___ Whimbrel	T
___ Upland Sandpiper	T
___ Greater Yellowlegs	W
___ Lesser Yellowlegs	T
___ Solitary Sandpiper	T
___ Willet	T
___ Spotted Sandpiper	W
___ Ruddy Turnstone	T
___ Wilson's Phalarope	T
___ American Woodcock	P
___ Common Snipe	W
___ Short-billed Dowitcher	T
___ Long-billed Dowitcher	T
___ Red Knot	T
___ Sanderling	T
___ Semipalmated Sandpiper	T
___ Western Sandpiper	T
___ Least Sandpiper	T
___ White-rumped Sandpiper	T
___ Baird's Sandpiper	T
___ Pectoral Sandpiper	T
___ Dunlin	T
___ Stilt Sandpiper	T
___ Buff-breasted Sandpiper	T
___ Ruff	A

GULLS, TERNS, SKIMMERS

___ Herring Gull	P
___ Ring-billed Gull	P
___ Laughing Gull	T
___ Franklin's Gull	A
___ Bonaparte's Gull	W
___ Forster's Tern	W
___ Common Tern	W
___ Little Tern	S
___ Royal Tern	T
___ Caspian Tern	T
___ Black Tern	T
___ Black Skimmer	A

PIGEONS, DOVES, CUCKOOS

___ Rock Dove	P
___ Mourning Dove	P
___ Common Ground-Dove	A
___ Yellow-billed Cuckoo	S
___ Black-billed Cuckoo	T

OWLS

___ Barn Owl	P
___ Eastern Screech-Owl	P
___ Great Horned Owl	P
___ Barred Owl	P
___ Long-eared Owl	W
___ Short-eared Owl	W
___ Northern Saw-whet Owl	T

GOATSUCKERS

___ Chuck-will's widow	S
___ Whip-poor-will	T
___ Common Nighthawk	S

SWIFTS, HUMMINGBIRDS, KINGFISHERS

___ Chimney Swift	S
___ Ruby-throated Hummingbird	S
___ Belted Kingfisher	P

WOODPECKERS

___ Northern Flicker	P
___ Pileated Woodpecker	P
___ Red-bellied Woodpecker	P
___ Red-headed Woodpecker	P
___ Yellow-bellied Sapsucker	W
___ Hairy Woodpecker	P
___ Downy Woodpecker	P
___ Red-cockaded Woodpecker	P

FLYCATCHERS

___ Eastern Kingbird	S
___ Gray Kingbird	A
___ Western Kingbird	T
___ Scissor-tailed Flycatcher	A
___ Great Crested Flycatcher	S
___ Eastern Phoebe	W
___ Yellow-bellied Flycatcher	T
___ Acadian Flycatcher	S
___ Willow Flycatcher	T
___ Alder Flycatcher	T
___ Least Flycatcher	T
___ Eastern Wood-Pewee	S
___ Olive-sided Flycatcher	T

LARKS, SWALLOWS

___ Horned Lark	W
___ Tree Swallow	T
___ Bank Swallow	T
___ Northern Rough-winged Swallow	S
___ Barn Swallow	S
___ Cliff Swallow	T
___ Purple Martin	S

JAYS, CROWS

___ Blue Jay	P
___ American Crow	P
___ Fish Crow	P

TITMICE, NUTHATCHES, CREEPERS

___ Carolina Chickadee	P
___ Tufted Titmouse	P
___ White-breasted Nuthatch	P
___ Red-breasted Nuthatch	W
___ Brown-headed Nuthatch	P
___ Brown Creeper	W

WRENS

___ House Wren	W
___ Winter Wren	W
___ Bewick's Wren	A
___ Carolina Wren	P
___ Marsh Wren	W
___ Sedge Wren	W

MIMIC THRUSHES, THRUSHES

___ Northern Mockingbird	P
___ Gray Catbird	P
___ Brown Thrasher	P
___ American Robin	P
___ Wood Thrush	S
___ Hermit Thrush	W
___ Swainson's Thrush	T
___ Gray-cheeked Thrush	T
___ Veery	T
___ Eastern Bluebird	P

KINGLETS

___ Blue-gray Gnatcatcher	P
___ Golden-crowned Kinglet	W
___ Ruby-crowned Kinglet	W

PIPITS

___ American Pipit	W
___ Sprague's Pipit	A

WAXWINGS, SHRIKES, STARLINGS

___ Cedar Waxwing	W
___ Loggerhead Shrike	P
___ European Starling	P

VIREOS

___ White-eyed Vireo	S
___ Yellow-throated Vireo	S
___ Solitary Vireo	W
___ Red-eyed Vireo	S
___ Philadelphia Vireo	T
___ Warbling Vireo	T

WOOD WARBLERS

___ Black-and-white Warbler	P
___ Prothonotary Warbler	S
___ Swainson's Warbler	S
___ Worm-eating Warbler	T
___ Golden-winged Warbler	T
___ Blue-winged Warbler	T
___ Tennessee Warbler	T
___ Orange-crowned Warbler	W
___ Nashville Warbler	T
___ Northern Parula	S
___ Yellow Warbler	T
___ Magnolia Warbler	T
___ Cape May Warbler	T
___ Black-throated Blue Warbler	T
___ Yellow-rumped Warbler	W
___ Black-throated Green Warbler	T
___ Cerulean Warbler	T
___ Blackburnian Warbler	T
___ Yellow-throated Warbler	P
___ Chestnut-sided Warbler	T
___ Bay-breasted Warbler	T
___ Blackpoll Warbler	T
___ Pine Warbler	P
___ Kirtland's Warbler	T
___ Prairie Warbler	S
___ Palm Warbler	W
___ Ovenbird	T
___ Northern Waterthrush	T
___ Louisiana Waterthrush	S
___ Kentucky Warbler	S
___ Connecticut Warbler	T
___ Mourning Warbler	T
___ Common Yellowthroat	P
___ Yellow-breasted Chat	S
___ Hooded Warbler	S
___ Wilson's Warbler	T
___ Canada Warbler	T
___ Slate-throated Redstart	S

WEAVER FINCHES, BLACKBIRDS

___ House Sparrow	P
___ Bobolink	T
___ Eastern Meadowlark	P
___ Western Meadowlark	A
___ Yellow-headed Blackbird	A
___ Red-winged Blackbird	P
___ Orchard Oriole	S
___ Northern Oriole	W
___ Rusty Blackbird	W
___ Brewer's Blackbird	A
___ Boat-tailed Grackle	A
___ Common Grackle	P
___ Brown-headed Cowbird	P

TANAGERS

___ Western Tanager	T
___ Scarlet Tanager	T
___ Summer Tanager	S

FINCHES

___ Northern Cardinal	P
___ Rose-breasted Grosbeak	T
___ Blue Grosbeak	S
___ Indigo Bunting	S
___ Painted Bunting	S
___ Dickcissel	T
___ Evening Grosbeak	W
___ Purple Finch	W
___ House Finch	T
___ Pine Siskin	W
___ American Goldfinch	W
___ Rufous-sided Towhee	P
___ Savannah Sparrow	W
___ Grasshopper Sparrow	W
___ Henslow's Sparrow	A
___ Le Conte's Sparrow	W
___ Vesper Sparrow	W
___ Lark Sparrow	T
___ Bachman's Sparrow	P
___ Dark-eyed Junco	W
___ Chipping Sparrow	P
___ Clay-colored Sparrow	A
___ Field Sparrow	P
___ White-crowned Sparrow	W
___ White-throated Sparrow	W
___ Fox Sparrow	W
___ Lincoln's Sparrow	A
___ Swamp Sparrow	W
___ Song Sparrow	W

MAMMALS

Common Name	Scientific Name
Beaver	*Castor canadensis*
Big brown bat	*Eptesicus fuscus*
Black bear	*Ursus americanus*
Black rat	*Rattus rattus*
Bobcat	*Lynx rufus*
Brazilian free-tailed bat	*Tadarida brasiliensis*
Cotton mouse	*Peromyscus gossypinus*
Eastern cottontail	*Sylvilagus floridanus*
Eastern fox squirrel	*Sciurus niger*
Eastern gray squirrel	*Sciurus carolinensis*
Eastern harvest mouse	*Reithrodontomys humulis*
Eastern mole	*Scalopus aquaticus*
Eastern mole	*Scalopus aquaticus*
Eastern pipistrel	*Pipistrellus subfiavus*
Eastern woodrat	*Neotoma floridana*
Evening bat	*Nycticeius humeralis*
Golden mouse	*Peromyscus nuttalli*
Gray fox	*Urocyon cinereoargenteus*
Hispid cotton rat	*Sigmodon hispidus*
Hispid cotton rat	*Sigmodon hispidus*
Hoary bat	*Lasiurus cinereus*
House mouse	*Mus musculus*
Least shrew	*Cryptotis parva*
Little brown myotis	*Myotis lucifugus*
Long-tailed weasel	*Mustela frenata*
Marsh rabbit	*Sylvilagus palustris*
Marsh rice rat	*Oryzomys palustris*
Meadow vole	*Microtus pennsylanicus*
Mink	*Mustela vison*
Muskrat	*Ondatra zibethicus*
Northern yellow bat	*Lasiurus intermedius*

Common Name	Scientific Name
Norway rat	*Rattus norvegicus*
Oldfield mouse	*Peromyscus polionotus*
Opossum	*Didelphis marsupalis*
Pine Vole	*Pitymys pinetorum*
Raccoon	*Procyon lotor*
Rafinesque's big-eared bat	*Plecotus rafinesquii*
Red bat	*Lasiurus borealis*
Rice rat	*Oryzomys palustris*
River otter	*Lutra Canadensis*
Seminole bat	*Lasiurus Seminolus*
Short-tailed shrew	*Blarina brevicauda*
Silver-haired bat	*Lasionycteris noctivagans*
Southeastern myotis	*Myotis austroriparius*
Southeastern shrew	*Sorex longirostris*
Southern flying squirrel	*Glaucomys volans*
Star-nosed mole	*Condylura cristata*
Whitetail deer	*Odocoileus virginianus*
Red fox	*Vulpes vulpes*
Striped skunk	*Mephitis mephitis*

AMPHIBIANS

Common Name	Scientific Name
Lesser Siren	*Siren intermedia*
Greater Siren	*Siren lacertian*
Eastern Newt	*Notophthalmus viridescens*
Two-toed Amphiuma	*Amphiuma means*
Maybee's Salamander	*Ambystoma mabeei*
Spotted Salamander	*Ambystoma maculatum*
Marbled Salamander	*Ambystoma opacum*
Mole Salamander	*Ambystoma talpoideum*
Southern Dusky Salamander	*Desmognathus auriculatus*
Dwarf Salamander	*Eurycea quadridigitata*

Common Name	Scientific Name
Slimy Slamander	*Plethodon glutinosus*
Many-lined Salamander	*Stereochilus marginatus*
Eastern Spadefoot Toad	*Scaphiopus holbrooki*
Oak Toad	*Bufo quercicus*
Southern Toad	*Bufo terrestris*
Fowler's Toad	*Bufo woodhousei*
Northern Cricket Frog	*Acris crepitans*
Southern Cricket Frog	*Acris gryllus*
Gray Treefrog	*Hyla chrysoscelis*
Green Treefrog	*Hyla cinerea*
Spring Peeper	*Hyla crucifer*
Pine Woods Treefrog	*Hyla femoralis*
Barking Treefrog	*Hyla gratiosa*
Squirrel Treefrog	*Hyla squirella*
Little Grass Frog	*Limnaoedus ocularis*
Brimley's Chorus Frog	*Pseudacris brimleyi*
Southern Chorus Frog	*Pseudacris nigrita*
Ornate Chorus Frog	*Pseudacris ornate*
Crawfish Frog	*Rana areolata*
Bullfrog	*Rana catesbeiana*
Green Frog	*Rana clamitans*
Pig Frog	*Rana grylio*
Southern Leopard Frog	*Rana sphenocephala*
Carpenter Frog	*Rana virgatipes*
Eastern Narrowmouth Toad	*Gastrophryne carolinensis*

REPTILES

Common Name	Scientific Name
American Alligator	*Alligator mississippiensis*
Snapping Turtle	*Chelydra serpentine*
Eastern Mud Turtle	*Kinosternon subrubrum*
Eastern Musk Turtle	*Sternotherus odoratus*

Common Name	Scientific Name
River Cooter	*Chrysemys concinna*
Florida Cooter	*Chrysemys floridana*
Yellowbelly Slider	*Chrysemys scripta*
Spotted Turtle	*Clemmys guttata*
Chicken Turtle	*Deirochelys reticularia*
Eastern Box Turtle	*Terrapene Carolina*
Spiny Softshell	*Trionyx spiniferus*
Carolina Anole	*Anole carolinensis*
Eastern Fence Lizard	*Sceloporus undulates*
Five-lined Skink	*Eumeces fasciatus*
Ground Skink	*Scincella lateralis*
Six-lined Racerunner	*Cnemidophorus sexlineatus*
Slender Glass Lizard	*Ophisaurus attenuatus*
Eastern Glass Liazrd	*Ophisaurus ventralis*

FISH

Common Name	Scientific Name
Alewife	*Alosa pseudoharengus*
American eel	*Anguilla rostrata*
American shad	*Alosa sapidissima*
Atlantic sturgeon	*Acipenser oxyrhynchus*
Banded killfish	*Fundulus diaphanous*
Banded pygmy sunfish	*Elassoma zonatum*
Banded sunfish	*Enneacanthus obesus*
Black crappie	*Pomoxis nigromaculatus*
Blackbanded sunfish	*Enneacanthtus chaetodon*
Blueback herring	*Alosa aestivalis*
Bluegill	*Lepomis macrochirus*
Bluespotted sunfish	*Enneacanthus gloriosus*
Bowfin	*Amia calva*
Broadtail madtom	*Noturus n sp.*
Brook silverside	*Labidethes sicculus*

Common Name	Scientific Name
Brown bullhead	*Ameiurus nebulosus*
Carp	*Cyprinus carpio*
Carolina pigmy sunfish	*Elassoma boehlkei*
Chain pickeral	*Esox niger*
Channel catfish	*Ictalurus punctatus*
Coastal shiner	*Notropis petersoni*
Creek chubsucker	*Erimyzon oblongus*
Dollar sunfish	*Lepomis marginatus*
Dusky shiner	*Notropis cummingsae*
Easterrn mosquitofish	*Gambusia holbrooki*
Eastern mudminnow	*Umbra pygmaea*
Everglades pygmy sunfish	*Elassoma evergladei*
Flat bullhead	*Ameiurus platycephalus*
Flathead catfish	*Pylodictis olivaris*
Flier	*Centrarchus macropterus*
Freshwater goby	*Gobionellus schufeldti*
Gizzard shad	*Dorosoma cepedianum*
Golden shiner	*Notemigonus crysoleucas*
Golden topminnow	*Fundulus chrysotus*
Goldfish	*Carassius auratus*
Hickory shad	*Alosa mediocris*
Hogchoker	*Trinectes maculatus*
Ironcolor shiner	*Notropis chalybaeus*
Lake chubsucker	*Erimyzon sucetta*
Largemouth bass	*Micropterus salmoides*
Least killifish	*Heterandria formosa*
Lined topminnow	*Fundulus lineolatus*
Longnose gar	*Lepisosteus osseus*
Margined madtom	*Noturus insignis*
Mud sunfish	*Acantharchus pomotis*
Pirate perch	*Aphredoderus sayanus*
Pumpkinseed	*Lepomis gibbosus*

Common Name	Scientific Name
Rainwater killifish	*Lucania parva*
Red drum	*Sciaenops ocellatus*
Redbreast sunfish	*Lepomis auritus*
Redear sunfish	*Lepomis microlophus*
Redfin pickerel	*Esox americanus americanus*
Sawcheek darter	*Etheostoma serriferum*
Shortnose sturgeon	*Acipenser brevirostrum*
Silvery minnow	*Hybognathus nuchalis*
Snail bullhead	*Ameiurus brunneus*
Southern flounder	*Paralichthys lethostigma*
Spottail shiner	*Notropis hudsonius*
Spotted sucker	*Minytrema melanops*
Spotted sunfish	*Lepomis punctatus*
Striped bass	*Morone saxatilis*
Striped mullet	*Mugil cephalus*
Summer flounder	*Paralichthys dentatus*
Swamp darter	*Etheostoma fusiforme fusiforme*
Swamp darter	*Etheostoma fusiforme barratti*
Swampfish	*Chologaster cornuta*
Tadpole madtom	*Noturus gyrinus*
Taillight shiner	*Notropis maculates*
Tarpon	*Megalops atlanticus*
Tessellated darter	*Etheostoma olmstedi*
Threadfin shad	*Dorosoma petenense*
V-lip redhorse	*Moxostoma papillosum*
Warmouth	*Lepomis gulosus*
White catfish	*Ameiurus catus*
White perch	*Morone Americana*
Yellow bullhead	*Ameiurus natalis*
Yellow perch	*Perca flavescens*

PLANTS

Common Name	Scientific Name
Tag alder	*Alnus serrulata*
Alligator-weed	*Alternanthera philoxeroides*
Water hemp	*Amaranthus cannabinus*
False indigo	*Amorpha fruticosa*
Asiatic dayflower	*Aneilema keisak*
Giant reed	*Arundo donax*
Asters	*Aster spp.*
Mosquito-fern	*Azolla caroliniana*
Sea myrtle	*Baccharis halimifolia*
Baggar's-ticks	*Bidens spp.*
Water-shield	*Brasenia schreberi*
Sedges	*Carex spp.*
Ironwood	*Carpinus caroliniana*
Partridge pea	*Cassia fasciculate*
Button-bush	*Cephalanthus occidentalis*
Lamb's quarters	*Chenopodium album*
Water hemlock	*Cicuta maculate*
Wood reed	*Cinna arundinacea*
Sawgrass	*Cladium jamaicense*
Leather-flower	*Clematis crispa*
Sweet pepperbush	*Clethra alnifolia*
Dodder	*Cuscuta sp.*
Sedges	*Cyperus spp.*
No common name	*Dichromena colorata*
Millet	*Echinochloa crusgalli*
Spikerushes	*Eleocharis spp.*
Wildrye	*Elymus virginicus*
Dog-fennel	*Eupatorium capillifolium*
Water-weed	*Egeria densa*
Water-weeds	*Elodea spp.*
Plume grass	*Erianthus giganteus*

Common Name	Scientific Name
Marsh eryngo	*Eryngium aquaticum*
Water locust	*Gleditsia aquatica*
Halberd-leaved marsh mallow	*Hibiscus militaris*
Rose mallow	*Hibiscus mosheutos*
Pennywort	*Hydrocotyle rannunculoides*
Pennyworts	*Hydrocotyle spp*.
Spider-lily	*Hymenocallis crassifolia*
Jewel-weed	*Impatiens capensis*
Blue flag	*Iris virginica*
Soft rush	*Juncus effuses*
Duckweeds	*Lemna spp.*
No common name	*Lilaeopsis chinesis*
Frog's-bit	*Limnobium spongia*
Sweet gum	*Liquidambar styraciflua*
Cardinal-flower	*Lobelia cardenalis*
Water-primroses	*Ludigia spp.*
Loosestrife	*Lythrum lineare*
Climbing hempweed	*Mikania scandens*
Wax myrtle	*Myrica cerifera*
Parrots-feather	*Myriophyllum sp.*
Yellow pond-lily	*Nuphar luteum*
White water-lily	*Nymphaea odorata*
Tupelo gum	*Nussa aquatic*
Black gum	*Nussa sylvatic*
Golden-club	*Orontium acquaticum*
Royal fern	*Osmunda regalis*
Panic grasses	*Panicum spp.*
No common name	*Paspalm distichum*
Arrow-arum	*Peltandra virginica*
Reed	*Phragmites communis*
Marsh fleabanes	*Pluchea spp.*
Smartweeds	*Polygonium spp.*

Common Name	Scientific Name
Pickerel-weed	*Pontedaria cordata*
Pondweeds	*Potomogeton spp.*
Mock-bishopweed	*Ptilimnium capillaceum*
Beakrush	*Rhynchospora sp.*
Swamp rose	*Rosa palustris*
Swamp dock	*Rumex verticillatus*
No common name	*Sacciolephis striata*
Arrowheads	*Sagittaria spp.*
Swamp willow	*Salix caroliniana*
Elderberry	*Sambucus canadensis*
Common threesquare	*Scirpus americanus*
Bulrush	*Scirpus cyperinus*
Olynei's threesquare	*Scirpus olynei*
Salt marsh bulrush	*Scirpus robustus*
Soft-stem bulrush	*Scirpus validus*
Skullcap	*Scutellaria sp.*
Butterweed	*Senecio sp.*
Foxtail grass	*Setaria magna*
Water parsnip	*Sium suave*
Seaside goldenrod	*Solidago sempervirens*
Giant cordgrass	*Spartina cynosuroides*
Duckweek	*Spirodela polyrrhiza*
Bald cypress	*Taxodium distichum*
Gamma grass	*Tripsacum dactyloides*
Narrow-leaved cattail	*Typha angustifolia*
Southern cattail	*Typha domingensis*
Blue cattail	*Typha glauca*
Broadleaf cattail	*Typha latifolia*
No common name	*Uniola latifolia*
No common name	*Uniola laxa*
Bladderwort	*Utricularia sp.*
No common name	*Verbesiana occidentailis*

Common Name	Scientific Name
Ironweed	*Vernonia sp.*
No common name	*Viburnum dentatum*
Wild rice	*Zizania acquatica*
Giant cutgrass	*Zizaniopsis miliacea*
Water tupelo	*Nyssa aquatic*
Red maple	*Acer rubrum*
River birch	*Betula nigra*
Black willow	*Salix nigra*
Swamp cottonwood	*Populus heterophylla*
Swamp tupelo	*Nyssa acquatica*
No common name	*Biflora*
American elm	*Ulmus Americana*
Laurel oak	*Quercus laurifolia*
Overcup oak	*Quercus lyrata*
Willow oak	*Quercus phellos*
Water oak	*Quercus nigra*
Swamp chestnut oak	*Quercus michauxii*
Pond cypress	*Taxodium ascendens*
Sycamore	*Platanus occidentalis*
Red mulberry	*Morus rubra*
Ironwood	*Carpinus caroliniana*
Water ash	*Fraxinus caroliniana*
American holly	*Ilex opaca*
Tag alder	*Alnus serrulata*
Green ash	*Fraxinus Pennsylvania*
Swamp ash	*Farxinus Carolina*
Bitter pecan	*Carya cordiformis*
Black gum	*Nyssa sylvatica*
Sweet bay	*Magnolia virginiana*
Cabbage palm	*Sabal palmetto*
Water hickory	*Carya aquatic*
Loblolly pine	*Pinus taeda*

Common Name	Scientific Name
Longleaf pine	*Pinus palustris*
Persimmon	*Diospyros virginiana*
Atlantic white cedar	*Chamaecyparis thyoides*
Tulip poplar	*Liriodendron tulipifera*
Bluestern palmetto	*Sabal minor*
Red bay	*Persea borbonia*
Southern red cedar	*Juniperus silicicola*
Titi	*Cyrilla racemiflora*
Pepper-vine	*Ampelopsis aborea*
Lizard’s tail	*Saururus cernuus*

Appendix J. Budget Requests

REFUGE OPERATING NEEDS SYSTEM (RONS)

Station Rank	Project Number	Project Title	Cost
4	00004	Visitor Center staffing at Santee NWR to meet minimum requirements	$59.5K
2	99001	Maintenance and habitat management to meet minimum requirements	$122K
3	00002	Public Use (declining capabilities)	$49K
1	00001	Wildlife protection and management (declining capabilities)	$65K
1	98002	Improve moist soil management capabilities	$180K
7	99002	Provide optimal habitat for the Eastern painted bunting	$160K
8	01009	Reintroduce Endangered Red-Cockaded Woodpecker	$193K
6	00003	Restore vital habitat management and protection capabilities (declining capabilities)	$49K
2	98003	Restore water level management to existing managed wetlands	$220K
10	98008	Restore use of prescribed fire	$200K
11	02001	Create new interpretive exhibits in visitor center	$179K
12	01005	Conduct extensive studies of Dingle Pond unit	$254K
13	98002	Underground storage tank monitoring	$25K
14	99003	Evaluate health of populations of key forest land birds	$150K

Station Rank	Project Number	Project Title	Cost
5	01004	Restore hardwood habitat in managed wetlands	$60K
9	00005	Prepare CCP	$120K
3	02003	Provide supplemental winter forage for St. James Bay colony of Canada geese and migratory waterfowl	$55K
4	03001	Invasive plant species eradication/management	$65K

MAINTENANCE MANAGEMENT SYSTEM NEEDS

Appendix K. List of Preparers

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