Ernest F. Hollings Ace Basin National Wildlife Refuge

Comprehensive Conservation Plan

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

September 2009

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COMPREHENSIVE CONSERVATION PLAN

ERNEST F. HOLLINGS ACE BASIN NATIONAL WILDLIFE REFUGE

Beaufort, Charleston, Colleton, and Hampton Counties, South Carolina

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

Southeast Region
Atlanta, Georgia

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I. Background

INTRODUCTION

The U.S. Fish and Wildlife Service (Service) developed this Comprehensive Conservation Plan (CCP) for Ernest F. Hollings ACE Basin National Wildlife Refuge (ACE Basin NWR) to guide the refuge's management actions and direction over the next 15 years. Fish and wildlife conservation will receive first priority in refuge management, while 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. The Draft Comprehensive Conservation Plan and Environmental Assessment (Draft CCP/EA) described the Service's proposed plan, as well as the other alternatives considered and their effects on the environment. The Draft CCP/EA was made available to state and federal government agencies, conservation partners, and the general public for review and comment. All comments were considered in the development of this final CCP. Substantive comments and the Service responses are provided in Appendix IV, Public Involvement.

PURPOSE AND NEED FOR THE PLAN

The purpose of the CCP is to identify the role that ACE Basin NWR will play in support of the mission of the National Wildlife Refuge System, and to provide long-term guidance to the refuge's management programs and activities for the next 15 years.

Specifically, the CCP will:

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

U.S. FISH AND WILDLIFE SERVICE

The U.S. Fish and Wildlife Service traces its roots to 1871 through the establishment of the Commission of Fisheries primarily involved with research and fish culture. The once-independent commission was renamed the Bureau of Fisheries and placed under the Department of Commerce and Labor in 1903.

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

The Department of Commerce, Bureau of Fisheries, was combined with the Department of Agriculture, Bureau of Biological Survey, on June 30, 1940, and transferred to the Department of the Interior as the Fish and Wildlife Service. The name was changed to the Bureau of Sport Fisheries and Wildlife in 1956 and finally to the Fish and Wildlife Service in 1974.

The Service, working with others, is responsible for conserving, protecting, and enhancing fish and wildlife and their habitats for the continuing benefit of the American people through federal programs relating to migratory birds, endangered species, interjurisdictional fish and marine mammals, and inland sport fisheries (142 DM 1.1).

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

NATIONAL WILDLIFE REFUGE SYSTEM

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

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

The National Wildlife Refuge System Improvement Act (Improvement Act) of 1997 established, for the first time, a clear legislative mission of wildlife conservation for the National Wildlife Refuge System (Refuge System). Actions were initiated in 1997 to comply with the direction of this new legislation, including an effort to complete comprehensive conservation plans for all refuges. These plans, which are completed with full public involvement, help guide the future management of refuges by establishing natural resources and recreation/education programs. Consistent with 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 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;
- 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
- retain the authority of refuge managers to determine compatible public uses.

The following are just a few examples of the Service's 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 overhunting, competition with cattle, and natural disasters decimated the once-abundant herds. The drought conditions of the Dust Bowl during the 1930s severely depleted breeding populations of ducks and geese. Refuges established during the Great Depression focused on protecting waterfowl production areas such as the 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 had begun to focus on establishing refuges for endangered species.

Approximately 38 million people visited national wildlife refuges in 2002, most to observe wildlife in their natural habitats. As the number of visitors grows, economic benefits to local communities similarly increase. 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, providing more than $2.2 million to 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 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 2003).

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 comprehensive conservation plans be prepared in consultation with adjoining federal, state, and private landowners. Further, it states that the Service should develop and implement a process to ensure opportunities for active public involvement in the preparation and revision (every 15 years) of the plans.

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

LEGAL AND POLICY CONTEXT

Legal Mandates, Administrative and Policy Guidelines, and Other Special Considerations

Administration of national wildlife refuges is guided by the mission and goals of the 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. A selected number of legal treaties and laws relevant to the administration of the Refuge System and management of ACE Basin NWR is summarized in Appendix C.

Treaties, laws, administrative guidelines, and policy guidelines assist the refuge manager in making decisions pertaining to natural, historical, and cultural resources; research and recreation on refuge lands; and provide a framework for cooperation between ACE Basin NWR and other partners, such as the South Carolina Department of Natural Resources, Ducks Unlimited, The Nature Conservancy, The Lowcountry Open Land Trust, Nemours Wildlife Foundation, and private landowners.

Lands within the 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. These uses are 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 the 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 within an ecosystem, applicable laws, and best available science, as well as 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 refuges 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 CCP.

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

North American Bird Conservation Initiative. Started in 1999, the North American Bird Conservation Initiative 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, Waterbird Conservation for the Americas, and the U.S. Shorebird 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 physiographic area (Bird Conservation Region 27) represents a scientifically based land bird conservation planning effort that ensures long-term maintenance of healthy populations of native land birds, primarily nongame land birds. Nongame land birds have been vastly underrepresented in conservation efforts, and many are exhibiting significant declines. This plan is voluntary and nonregulatory, 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.

Northern American Waterbird Conservation Plan. The North American Waterbird Conservation 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 identify 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 cumulatively 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.

In South Carolina, the Service partners with the South Carolina Department of Natural Resources (SCDNR). The SCDNR developed a "Vision for the Future" when various state conservation agencies were merged in 1994. This "Vision" document guides the management actions of the SCDNR. The basic framework is as follows:

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

Vision of the SCDNR: The 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. The vision for the SCDNR is to be a trusted and respected leader in natural resources 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: The SCDNR's 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 its mission, the SCDNR 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.

Strategies of the SCDNR: To more effectively accomplish its mission and attain its vision, the SCDNR will work diligently toward achieving the following overarching goals and objectives during the next 5 years:

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

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

The SCDNR's participation and contribution throughout the planning process for this CCP has provided 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 the integration of common mission objectives where appropriate.

II. Refuge Overview

INTRODUCTION

ACE Basin NWR is located within the 350,000-acre Ashepoo–Combahee–Edisto (ACE) Basin Project. The ACE Basin Project is widely recognized as a unique and critical environment marked by a wide diversity of wildlife and plants and represents the largest estuarine resource in South Carolina. The refuge is composed of two units, together comprising approximately 11,815 acres. The Edisto Unit consists of 7,203 acres and is located approximately 20 miles southwest of the city of Charleston, South Carolina in Charleston County (Figure 1). The Combahee Unit consists of 4,612 acres in Beaufort, Colleton, and Hampton Counties and is located approximately 20-25 miles northwest of the city of Beaufort, South Carolina (Figure 2).

The refuge's two units are drained by two significant river systems: the Combahee–Salkahatchie, which flows through the Combahee Unit; and the South Edisto, which flows adjacent to the Edisto Unit. Many broad, low-gradient interior drains are present as either extension of tidal streams and rivers or flooded bays and swales. Within this diverse drainage system, the refuge contains exceptionally diverse wildlife habitat including high-quality forested wetlands, forested uplands, brackish natural marshes, freshwater natural marshes, managed marshes or wetland management units, marsh islands, and pristine estuarine rivers.

REFUGE HISTORY AND PURPOSE

ACE Basin NWR was established on September 20, 1990. The refuge was renamed the Ernest F. Hollings ACE Basin National Wildlife Refuge on May 16, 2005, in honor of South Carolina's retired U.S. Senator Ernest F. Hollings. The refuge is a partner in the ACE Basin Task Force, a coalition consisting of the U.S. Fish and Wildlife Service, the South Carolina Department of Natural Resources, Ducks Unlimited, The Nature Conservancy, The Low Country Open Land Trust, Mead Westvaco, and private landowners of the ACE Basin system. The refuge's two separate units (Edisto Unit and Combahee Unit) are further broken down into subunits, with the Edisto Unit containing the Barrelville, Grove and Jehossee subunits, and the Combahee Unit containing the Bonny Hall, Combahee Fields, and Yemassee subunits. The refuge has been separated into nine management units or compartments that range in size from 350 to 3,355 acres. The compartment boundaries are established along geographic features that can be easily identified on the ground (i.e., rivers, roads, trails, etc.).

Recognizing the importance of the ACE Basin system for wetland and habitat protection, migratory bird benefits and conservation opportunities served by the lands and waters of the refuge, the Service administratively designated ACE Basin NWR in 1990 under the Emergency Wetlands Resources Act of 1986, the Fish and Wildlife Act of 1956, and the Migratory Bird Act, thus outlining the primary purposes of these lands and waters:

> "...the conservation of the wetlands of the Nation in order to maintain the public benefits they provide and to help fulfill international obligations contained in various migratory bird treaties and conventions..." 16 U.S.C. 3901(b) (Emergency Wetlands Resources Act of 1986).

Figure 1. Combahee Unit map

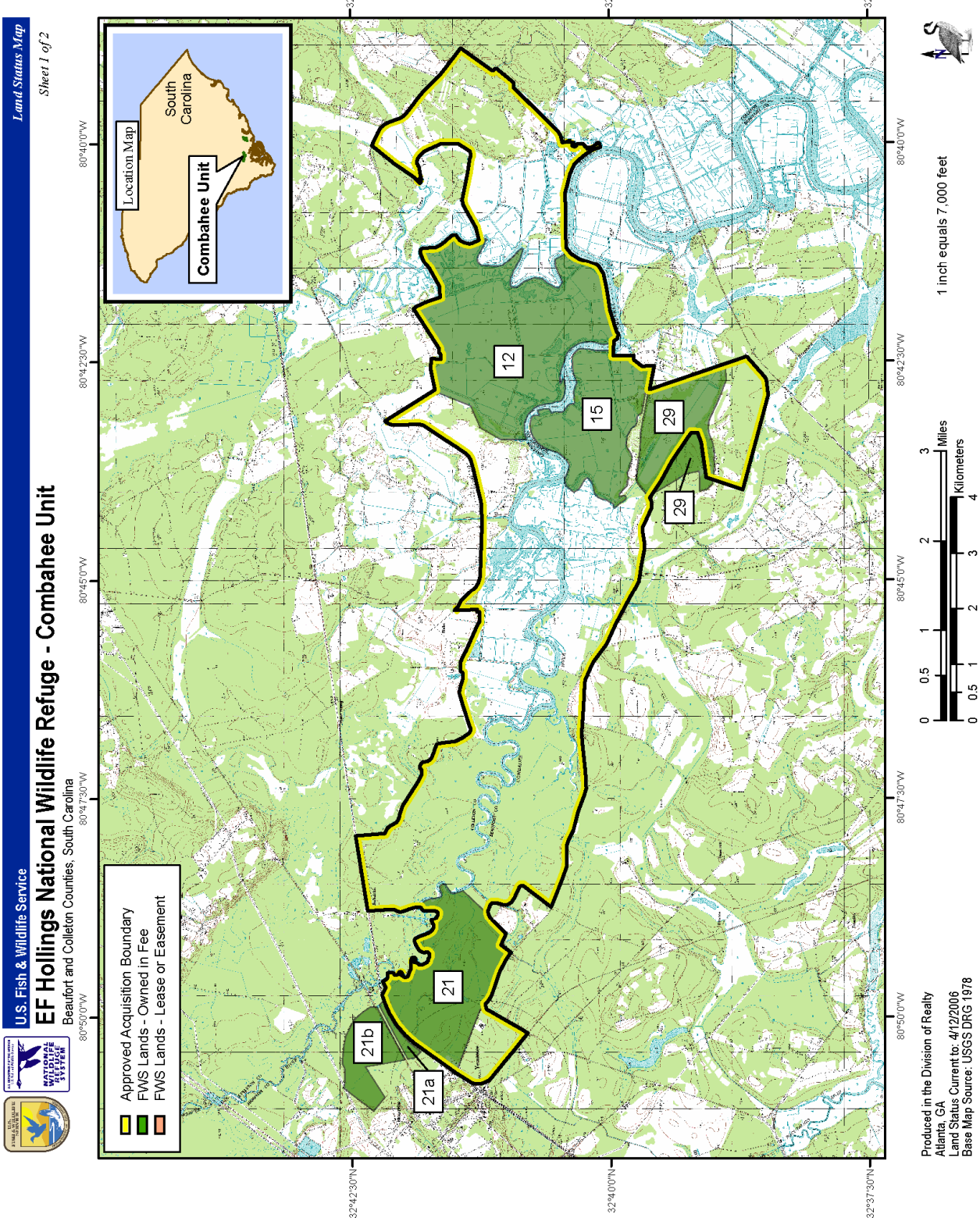
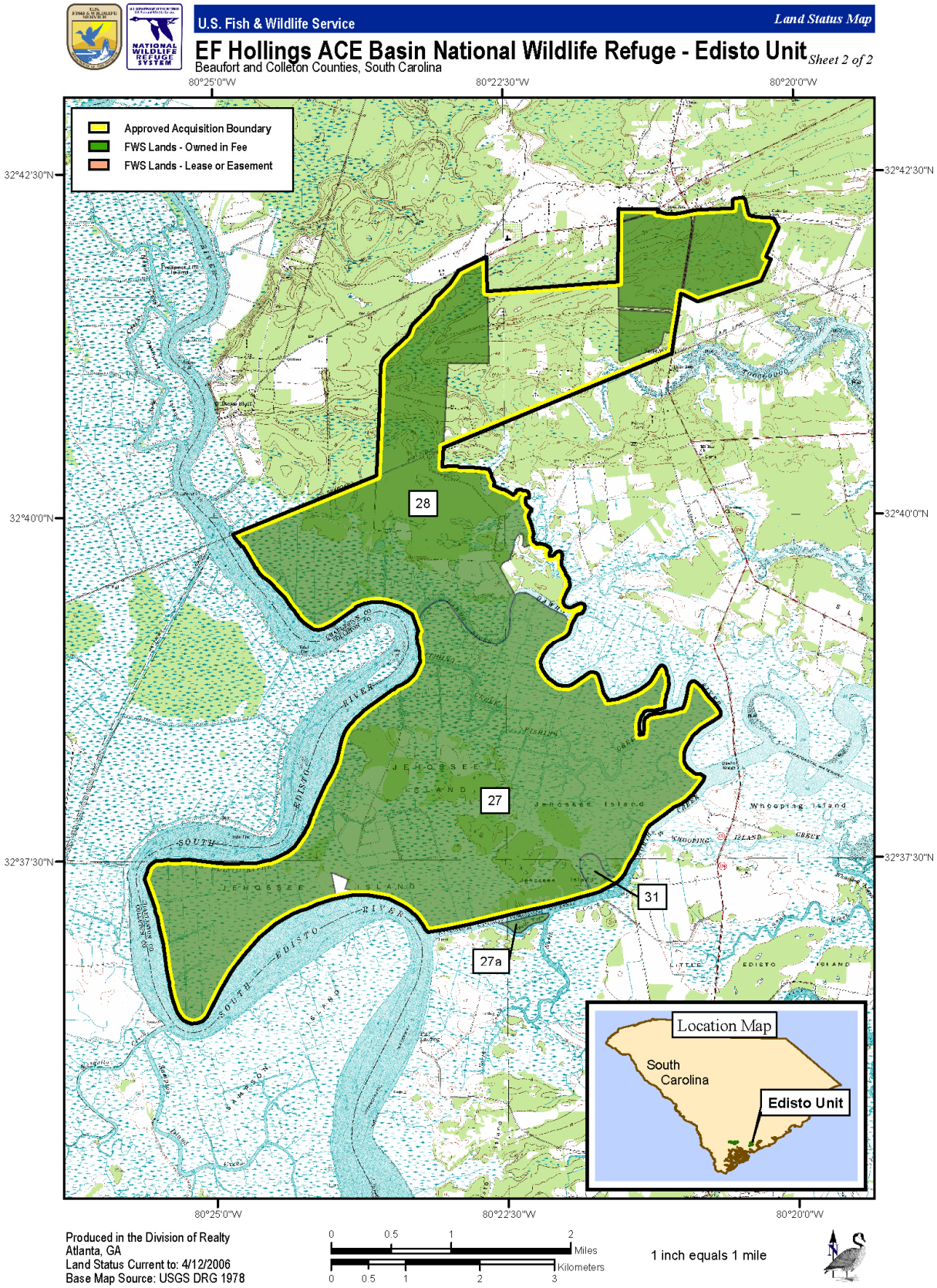


Figure 2. Edisto Unit map



"... for the development, advancement, management, conservation, and protection of fish and wildlife resources ..." 16 U.S.C. 742f(a)(4) "... for the benefit of the United States Fish and Wildlife Service, in performing its activities and services. Such acceptance may be subject to the terms of any restrictive or affirmative covenant, or condition of servitude ..." 16 U.S.C. 742f(b)(1) (Fish and Wildlife Act of 1956).

"... 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).

The natural character and diverse habitats of the ACE Basin system have been protected by historical good fortune. From about 1750 to 1850, much of the basin was owned by a few people who managed their wetlands primarily to grow rice. After the rice culture declined in the late 1800s, wealthy sportsmen purchased many of the tidewater plantations as hunting retreats. The new owners successfully managed the former rice fields and adjacent upland estates for a wide range of wildlife.

Presently, the area has enormous natural value precisely because private landowners have tended it so wisely. Undeveloped, the area has not been polluted; the habitat remains diverse and extremely productive. Particularly significant are the wetlands. These include 91,000 acres of fresh, brackish, and saltwater tidal marshes. Included are about 26,000 acres of managed impoundments and more than 55,000 acres of forested wetlands.

So important to waterfowl are these wetland areas that the North American Waterfowl Management Plan identified the ACE Basin system as one of two "flagship" projects within the Atlantic Coast Joint Venture. A task force consisting of the U.S. Fish and Wildlife Service, the South Carolina Department of Natural Resources, Ducks Unlimited, The Nature Conservancy, and private landowners in the basin was established to coordinate efforts and identify the best options for accomplishing the overall goal of protection of the area. The task force identified several options for accomplishing this, one of which was that the establishment of a national wildlife refuge would be necessary for the success of the joint venture project.

The refuge acquisition boundary currently includes approximately 18,000 acres. ACE Basin NWR was established in accordance with the Emergency Wetlands Resources Act of 1986 (100 Stat. 3582-91) for "…the conservation of the wetlands of the Nation in order to maintain the public benefits they provide and to help fulfill international obligations contained in various migratory bird treaties and conventions…" 16 U.S.C. 3901 (b) (Emergency Wetlands Resources Act of 1986). The primary purpose of the refuge is to conserve a nationally significant wildlife ecosystem that will provide a complex of habitats for wintering waterfowl, endangered species, other migratory and resident birds, mammals, reptiles, amphibians, and plants.

SPECIAL DESIGNATIONS

ACE Basin NWR is designated as an Important Bird Area by the National Audubon Society. The ACE Basin system is the largest undeveloped estuary in South Carolina. The Edisto River is the longest free-flowing blackwater river on the east coast of North America.

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 components are interconnected and managing any one component affects the others in that ecosystem. Ecosystems can be small (i.e., a single stand of aspen) or large (i.e., an entire watershed including hundreds of forest stands across many different ownerships).

The Service adopted an ecosystem approach to conservation because it cannot look at a single animal, species, or piece of land in isolation from all that surrounds it. All of the components are interconnected. If one is disturbed or managed, 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—Blue Ridge Mountains, Piedmont, Carolina Sandhills, and Coastal Plain. 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 Rivers. Blackwater rivers originate in the coastal plain and include the Cooper, Ashley, Edisto, Salkahatchie, Combahee, Ashepoo, New, Four Holes, Little Pee Dee, Waccamaw, Black, and Lumber Rivers. 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 is 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 fuels the base of the marine food chain and provides tremendous nursery grounds for commercially important fish and shellfish.

The SSPD Ecosystem supports large populations of wading birds, shorebirds, waterfowl, game and nongame mammals, reptiles, amphibians, and anadromous fish. The habitats within the SSPD Ecosystem fall within the Atlantic migratory bird 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 that are federally listed as threatened or endangered in the SSPD Ecosystem are indicative of the development pressures and habitat loss incurred. Approximately 37 species of animals and 31 species of plants are federally listed as threatened or endangered within the SSPD Ecosystem. Numerous species of plants and animals are candidates for listing but are not currently receiving federal protection. Several federally protected species depend on the SSPD Ecosystem for some portion of their life cycle, such as the eastern cougar, West Indian manatee, red wolf, 5 species of whales, Virginia big-eared bat, Indiana bat, bald eagle, peregrine falcon, 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 biggest problem facing the SSPD Ecosystem is the loss of habitat through direct destruction and fragmentation, or from other 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, invasive species, nonpoint 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, threatened and 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:

- To protect, restore, and enhance the biodiversity of aquatic resources, wetlands, and their associated habitats on a landscape scale.
- To recover and enhance threatened and endangered species and species of special concern and the habitats upon which they depend.
- To protect, enhance, and manage migratory bird populations and the habitats upon which they depend.
- To manage national wildlife refuges and national fish hatcheries to serve as models of effective conservation of natural resources.
- To increase and enhance public awareness, support, and participation in carrying out the Service's mission through cooperative outreach efforts.
- To protect, enhance, and manage interjurisdictional and diadromous fish populations and the habitats upon which they depend.
- To perpetuate healthy native plant and animal communities threatened by invasive native and nonnative plants and animals.

REGIONAL CONSERVATION PLANS AND INITIATIVES

The ACE Basin Project, of which the refuge is a part, was initiated in 1988 when Ducks Unlimited, Inc., The Nature Conservancy, the U.S. Fish and Wildlife Service, the South Carolina Department of Natural Resources, and a number of private landowners came together and formed the ACE Basin Task Force. "ACE" stands for the three major rivers in the basin—the Ashepoo, Combahee, and Edisto. The 358,000-acre ACE Basin is one of the largest undeveloped estuarine-wetland ecosystems remaining along the U.S. Atlantic Coast. Currently, approximately 190,000 acres of the basin had been brought under various forms of conservation management.

The mission of the ACE Basin Project is to maintain the natural character of the basin by promoting wise resource management on private lands and protecting strategic tracts by conservation agencies. A major goal of the protection efforts is to ensure that traditional uses such as farming, forestry, recreational and commercial fishing, and hunting will continue in the area.

PHYSICAL RESOURCES

CLIMATE

The refuge is characterized by generally pleasant weather. The southerly latitude, proximity of the ocean, and sea level elevation are the determining climatic factors which produce warm, humid summers and relatively mild temperate winters. The average maximum/minimum temperatures are

60º/40º Fahrenheit (F) for January and 89º/73º F for July. Nearly 240 frost-free days are reported annually. Roughly 15 percent of the area's rainfall is associated with tropical storms. The coastal area of South Carolina is a moderately high-risk zone with respect to hurricane occurrences and destruction. Rainfall averages about 50 inches per year.

GEOLOGY AND TOPOGRAPHY

The refuge is part of the Atlantic Coastal Plain physiographic province and consists of low-lying broad sand ridges and terraces which are relic Pleistocene coastal deposits. The seaward edges of these sand ridges and terraces are buried by coastal marshes which are from the middle to late Holocene (less than 5,000 years old). The major river valleys are composed of broad floodplains containing oxbow lakes, meander scroll or point bar deposits, natural levees, and sand dunes. During the Wisconsin glacial event of the late Pleistocene, these rivers flowed into an ocean 100 to 200 meters below its present level. A rising sea level during the late Wisconsin and early Holocene (15,000 to 10,000 years ago) resulted in the formation of the various river valley dune sheets and caused a shift from wide, sandy, braided river beds to the present-day narrow, meandering channels.

SOILS

The refuge contains basically five major soil associations. These include the Coosaw–Williman and Torhunta–Osier–Pickney associates, which are dominantly loamy soils; the Bladen–Argent–Wahee association, which is dominantly loamy soil having a clayey subsoil; and the Pungo–Levy and Bohicket–Capers–Hansboro associations, which are dominantly mucky and clayey soils that are flooded. Soil characteristics are closely associated with natural drainage characteristics. Generally, these soils are saturated or seasonally wet except on slight ridges where drainage is good. Most are acid to strongly acid. The tidal marsh soils consist of a sediment layer deposited over an older sand layer. The sediments contain a thin, dark brown, layer and a black, lower layer rich in reduced compounds (sulfides of iron and other metals) resulting from anaerobic decomposition of organic matter.

The pH of the sediments in this anaerobic layer is generally neutral. However, if the sediments are subjected to drying and consequent aeration, as occurs during impoundment construction or management, the pH can be lowered to 2.0 as the sulfides are oxidized to form sulfates, including sulfuric acid. The resulting soil, known as cat clay, can inhibit plant growth and impoundment utilization for many years.

HYDROLOGY

The refuge is drained by two significant river systems: the Combahee–Salkahatchie and the South Edisto. Many broad, low-gradient interior drains are present as either extensions of tidal streams and rivers or flooded bays and swales. The major rivers' combined average freshwater flow of approximately 2,500 cubic feet per second empties into St. Helena Sound, a drowned river valley/bar-built estuary. St. Helena Sound is relatively deep (15-30 ft.) except on large banks and flats and has a mean tidal amplitude of 6.1 feet at the mount to 7.2 feet at the ocean reaches. Salinities range from sea strength at the mouth to freshwater in the upper reaches.

The refuge's mean tidal amplitude ranges from around 2 feet on the upper reaches of the Combahee to 5 feet on the lower area along the South Edisto. Salinities range from freshwater in the upper reaches to 6-7 ppt. on the lower reaches, with seasonal deviations dependent on precipitation.

AIR QUALITY

Charleston, Colleton, Beaufort, and Hampton Counties generally have good air quality and are 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 (Scorecard 2005).

WATER QUALITY AND QUANITY

Water quality standards in the basin are designated as Class SA by the South Carolina Department of Health and Environmental Control. Class SA waters are suitable for the harvest of shellfish and other fishery resources, swimming and other water-body contact sports, and high-quality uses. The South Edisto River is classified as SAA, the highest possible rating given to water bodies in South Carolina.

BIOLOGICAL RESOURCES

The ACE Basin system is one of the largest undeveloped estuaries on the east coast. Formed by the convergence of three free-flowing rivers—the Ashepoo, Combahee and Edisto—the basin includes nine marsh and barrier islands, upland pine forests, bottomland hardwoods, and freshwater marshes.

With its meandering blackwater rivers, dense cypress swamps and teeming estuary, the ACE Basin system supports migratory waterfowl, wood storks, southern bald eagles, loggerhead turtles, alligators, bobcats, and minks. During the early 1980s, the ACE Basin was a critical landscape in the recovery of the then-endangered southern bald eagle.

Botany Bay Island, located in the ACE Basin system, is the yearly nesting site for approximately 50 to 100 sea turtles. The nests are screened to protect them from raccoon predation and produce from 3,000 to 10,000 sea turtle hatchlings annually.

HABITAT

The major vegetative communities on ACE Basin NWR include freshwater and brackish natural marshes, managed marshes (impoundments), forested wetlands, and upland forests. These habitats, although diverse in composition, are interrelated components of a dynamic system through which organisms and materials constantly move. The general characteristics of each community are described below.

Managed Marshes or Wetland Management Units - 2,726 acres
These habitat types are referred to as wetland management units on habitat maps. Management of naturally occurring plant communities within these impoundments provides cover and food resources required to meet the behavior and nutritional needs of waterfowl, as well as a broad spectrum of other wildlife species. In freshwater impoundments managed by spring and summer drawdown, waterfowl food plants include panic grasses, smartweeds, flat sedges, and wild millets. In freshwater impoundments managed as semipermanently flooded marshes, food plants and cover include watershield, white waterlily, pondweeds, and giant cutgrass. Important waterfowl food plants encouraged in brackish impoundments include wigeongrass, saltwater bulrush, and dwarf spikerush.

Forested Wetlands - 2,768 acres
The refuge contains forested wetlands that occur primarily on old natural levees, floodplain terraces, and flats that are relics from inland rice fields. Mixed pine/hardwood (1,270 acres) and bottomland hardwood (1,498 acres) are the principal forest types represented. Within mixed pine/hardwoods, the

hardwood component may exhibit dominance on certain sites which may be considered as pine/hardwood stands. These forests are temporarily inundated or saturated with flooding occurring periodically for up to one month of the growing season (Wharton et al. 1982). Another minor but ecologically important additional forest wetland type occurring in the bottomlands is the cypress/tupelo swamp forests. This forest type occupies deep sloughs, margins of oxbows and wet flats, and is flooded for the major portion of the year. These occur primarily in the upper portion of the floodplains of the Combahee Unit. Forested wetlands are extremely important for supporting healthy populations of many vulnerable neotropical migratory land birds. These species include Swainson's and prothonotary warblers, as well as possibly the swallow-tailed kite.

a) *Mixed Pine/Hardwood Type (PH)* - This forest type, including Live Oak-Maritime, occurs on higher flats and is composed of tree species that tolerate limited periods of moderately high soil saturation and flooding (Wharton et al. 1982).

   Dominant tree species include loblolly pine, swamp chestnut oak, cherrybark oak, laurel oak, and swamp red oak. Codominants species are represented by live oak, willow oak, water oak, white oak, overcup oak, sweetgum, blackgum, and pignut hickory. A diverse associated shrub layer is composed of horse sugar, wax myrtle, switch cane, sweet pepperbush, American holly, fetterbush, persimmon, huckleberry, dwarf palmetto, gallberry, and blueberry. Vines present include greenbriar, catbrier, cross vine, and Virginia creeper. The ground layer is comprised of cinnamon fern, royal fern, marsh fern, nut rush sedge, partridge berry, panic grasses, and rushes interspersed throughout the forest.

b) *Bottomland Hardwood Type (BH)* - While including a number of species found in the pine/hardwood type, bottomland hardwood forests occur on lower flats and are dominated by species tolerant of slightly longer periods of soil saturation and flooding (Wharton et. al 1982). Dominant tree species include overcup oak, swamp chestnut oak, water oak and red maple. Although loblolly pine is present, spruce pine is the principal codominant pine species found on these wetter sites. Other codominants are water hickory, pignut hickory, American hornbeam, and green ash. Shrubs and vines include switch cane, wax myrtle, fetterbush, dwarf palmetto, catbrier, sawbrier, poison ivy, and Virginia creeper. The ground layer is less dense than that of the pine/hardwood type and consists of a variety of herbs, grasses, and sedges including netted chain fern, partridge berry, nut rush sedge, beak rush, sedges, plume grass, and panic grass. The Bald Cypress/Water Tupelo Swamp community occurs in the wettest parts of floodplains that have standing water for most of the year. As a result, few herbs are present and bald cypress and water tupelo dominate the canopy. This forest type is commonly found along the Combahee River.

Forested Uplands - 1,156 acres

Forested Uplands include the following forest types: natural pine (loblolly, longleaf and pond pine), pine plantations, and upland hardwood. The natural pine type occurs on old fields that were left to succeed into pine forests and are maintained by the regular influence of fire. On well-drained sites, a mixture of loblolly and longleaf pines occur. On wetter sites, pond pines integrate into the stand. Longleaf pine, also maintained by a regular fire regime, is found on dry flatwood sites. The upland hardwood type occurs at sporadic localities adjacent to pine/hardwood sites.

a) *Natural Pine (P)* - This type occurs on somewhat poorly drained soils of broad, flat, low areas and knolls. Dominant canopy species are loblolly pine, longleaf pine, and pond pine. Loblolly is the dominant pine species on all pine sites with the exception of Stand 3 in Compartment 3 (Grove north) where longleaf dominates. The midstory is dominated by sweetgum, with mockernut hickory, swamp red oak, laurel oak, and switch cane also occurring. Shrub species

include wax myrtle, sparkleberry, and persimmon. Yellow jessamine, greenbriar, and blackberry are the principal vines. The ground layer is composed of begger's ticks, sedges, broom straw, goldenrod, and plume grass.

b) *Pine Plantations (PL)* - The pine plantations are located in the transitional zone between forested wetlands and upland pine. Loblolly is the single tree species. Past logging and agricultural practices, combined with present-day forestry management, has resulted in monotype loblolly pine plantations being established on the Barrelville, Bonny Hall, and Yemassee South Tracts. These plantations were established prior to refuge acquisition.

c) *Upland Hardwood (UH)* - This forest type occurs on slopes with moderately to poorly drained soils and frequently in small bands adjacent to pine/hardwood and bottomland hardwood sites. Dominant tree species include water oak, white oak, post oak, Southern red oak, sweetgum, American beech, and Southern magnolia. Wax myrtle is the principal shrub.

Fields and Openings - 224 acres

Forest openings play a vital role in providing diversity for nesting, resting, and feeding requirements for many wildlife species. Refuge fields are maintained as permanent openings through planting (agricultural or cover crop) and periodic mowing or burning. Forest openings are upland areas that are permanently or temporary maintained in the grass or early successional stage. Forest regeneration areas provide temporary openings which are generally useful for 3 to 8 years depending on species and regeneration method used. Permanent openings include food strips, permanent firebreaks, road rights-of-way, utility rights-of-way, and loading areas created during timber harvest operations. Rights-of-way and refuge roads traverse forested areas on the refuge, breaking up blocks of homogenous habitat to provide edge. A combination of clearings and openings helps to provide diversity to the variety of habitats necessary to meet multiple management objectives.

ACE Basin NWR inherited a large acreage of old fields in early successional stages. Most of this habitat is located on the Grove Unit. Original plans were to reforest these sites, but the refuge recognized the importance of these habitats for painted buntings, Henslow's sparrows, and other grass/shrub mosaic or early successional wildlife species. In addition, these sites could also be important for supporting local American woodcock populations. Old pasture sites, especially where they grade to moist sites, could provide good wintering woodcock habitat. Woodcocks are presently declining throughout the Atlantic and Mississippi Flyways. This is thought to be due primarily to loss of early successional habitats.

WILDLIFE - THREATENED AND ENDANGERED SPECIES

Several threatened or endangered species are found on ACE Basin NWR. The wood stork is becoming increasingly abundant within the ACE Basin project, partly due to the maintenance of water levels in wetland units at optimum wood stork foraging depths. Several rookeries have become established in close proximity to the refuge, and management is hoping to establish rookeries on refuge lands.

Nearly 50 percent of South Carolina's nesting bald eagle population occurs in the Ace Basin project area. Thirty active nesting territories were documented in 2005. Three nests are currently known on the refuge; two are located on Jehossee Island and the other one is near the Grove Plantation House where timber management activity is restricted. An additional nest is located immediately adjacent to the refuge on private land. Bald eagles were removed from threatened species status in 2008, but are still a species of concern protected by several state and federal laws. Several whooping cranes from an experimental flock have repeatedly overwintered on the refuge's rice fields and other wetland areas in the ACE Basin project area since 2004.

The South Edisto and Combahee Rivers provide habitat for the endangered shortnose sturgeon. Neither of these riparian areas would normally be affected by timber management activities. Occasionally, a West Indian manatee is reported in the river systems adjacent to the refuge.

Endangered plants or animals that have not been confirmed in the area but could be present include the red-cockaded woodpecker, flatwoods salamander, Canby's dropwort, American chaffseed and pondberry. Currently, no active clusters of red-cockaded woodpeckers are documented within the refuge. The ACE Basin project contains suitable habitat for this species, but the refuge proper has very little potentially suitable habitat. Other listed species with historic ranges that include the refuge are: red wolf, eastern cougar, Bachman's warbler, ivory-billed woodpecker, and eastern indigo snake.

ACE Basin NWR provides habitat for a broad array of wildlife species which includes listed or candidate species and species of concern to conservation partner organizations. Habitat needs, protection, and management actions designated to enhance suitable habitat conditions for these species must be considered, to the extent practical, in all management activities.

WATERFOWL

The refuge's impoundments are heavily utilized by wintering ducks such as mallards, pintail, green-winged teal, blue-winged teal, wigeon, wood duck, black duck, gadwall, and ring-necked ducks. Mottled ducks and wood ducks also utilize these impoundments for nesting and brooding. The bottomland hardwoods of the river systems are also used extensively by wood ducks and mallards when these areas are seasonally flooded.

WADING BIRDS AND SHOREBIRDS

The refuge's managed wetland units provide extensive foraging areas for wading birds, including wood storks and various species of herons, egrets, ibis, and bitterns. Seventeen rookeries currently are located adjacent to the refuge in the ACE Basin system and provide nesting habitat for 10 species of wading birds. Refuge impoundments provide resting and feeding habitat for a variety of shorebird species including sandpipers, plovers, yellowlegs, dowitchers, and dunlins. In recent years, the black-necked stilt has been increasing in the refuge's managed wetlands and has been observed to successfully nest on impoundment berms.

Table 1 lists the species of wading birds, shorebirds, waterfowl, and other birds that use the impoundments of the ACE Basin.

LANDBIRDS

Forested uplands are an important habitat type for birds, with many species associated with this habitat type also using forested wetlands and open habitats. The principal bird group of upland forests includes both resident and migratory songbirds (e.g., warblers, vireos, nuthatches, and tanagers) that occupy tree canopies, as well as the ground story where they glean insects, seeds, and fruit.

The pine warbler is abundant and perhaps the most characteristic breeding species of the forest canopy whereas the Bachman's sparrow is characteristic of the grass-shrub forest floor. Other common ground-dwelling species include the Carolina wren, hermit thrush, American robin, and gray catbird. The northern bobwhite quail, an important game bird also characteristic of the forest understory, feeds on various seeds, fruits, and invertebrates (Sandifer et al. 1980). A number of hawks and owls feed, nest, and roost in upland forest.

Table 1. Bird species utilizing impoundments in the ACE Basin

Pied-billed grebe	Redhead
Horned grebe	Canvasback
Great blue heron	Fulvous Whistling duck
Louisiana heron	Canada Goose
Green heron	Black-necked stilt
Little blue heron	Bonaparte's gull
Yellow-crowned night heron	Herring gull
Black-crowned night heron	Ring-billed gull
Double-crested cormorant	Laughing gull
Brown pelican	Forester's tern
Great egret	Least tern
Snowy egret	Gull-billed tern
Least bittern	Common tern
White ibis	Royal tern
Glossy ibis	Black tern
Osprey	Semipalmated plover
Hooded merganser	Dunlin
Red-breasted merganser	Black skimmer
Mottled duck	Bald eagle
Green-winged teal	Wood Stork
Blue-winged teal	American coot
Baldpate	Clapper rail
Scaup	Virginia rail
Bufflehead	Sora rail
Mallard	Common gallinule
Black duck	Western sandpiper
Gadwall	Spotted sandpiper
Pintail	Least sandpiper
Shoveler	Semipalmated sandpiper
Ringed-necked duck	Willet
Ruddy duck	Greater yellowlegs
Wood duck	Lesser yellowlegs
Black-bellied plover	Ruddy turnstone
Dowitcher	American avocet

The Eastern screech owl, which nests in tree cavities and feeds on small birds, mice, and insects, is perhaps the most characteristic of this habitat type (Sandifer et al. 1980).

Dominant woodpecker species include the red-bellied woodpecker, downy woodpecker, pileated woodpecker, and northern flicker.

The Chuck-will's-widow and common nighthawk are nocturnal birds that rest on limbs or on the ground during the day and feed exclusively on insects while on the wing. Another species employing specialized feeding habits is the ruby-throated hummingbird, which feeds primarily on the nectar of flowering woodland plants.

Forested wetlands, characterized by a high variability of wet and dry sites and associated trees, shrubs, and ground cover vegetation, are among the most productive habitats for bird species diversity. Two distinctive birds of forested wetlands, the Mississippi kite and the American swallow-tailed kite, feed almost exclusively in flight on large insects, but will also take snakes and frogs as food.

The red-eyed vireo, prothonotary warbler, Swainson's warbler, magnolis warbler, blue-gray gnatcatcher, Kentucky warbler, and hooded warbler are among the neotropical migratory birds that nest in forested wetlands. Other songbirds that are typically permanent residents of forested wetlands include the Carolina wren, northern cardinal, and Rufous-sided towhee. The red-winged blackbird and common grackle also use forested wetlands as roost sites (Sandifer et al. 1980). The eastern wild turkey, American woodcock, and wood duck are important game birds that similarly depend on forested wetlands.

Many species of neotropical migratory songbirds are experiencing long-term declines as a result of widespread habitat loss and fragmentation. Bottomland hardwood forests and riparian woodlands have been identified as a top habitat conservation priority throughout the southeast (Hunter et al. 1993). Conservation and management of these critical bottomland forests on the refuge will enhance the breeding, wintering, and transitional habitats for many species of migratory and resident songbirds.

The breeding landbird requiring the most management attention at ACE Basin NWR is the painted bunting. Although the painted bunting is already listed as a Species of Continental Conservation Interest, the eastern subspecies is among the highest ranking taxa in the southeast in need of conservation attention. Some sizable populations presently occur in the Coastal Plain and extend to the Fall Line. This species is declining within the South Atlantic Coastal Plain, not unlike most other species associated with early successional habitats. ACE Basin NWR may represent an important location for supporting the eastern painted bunting in the outer Coastal Plain habitat. Painted buntings seem to be most closely associated with woodland edges and scrub/shrub with access to grassy areas. The painted bunting is a priority bird species for Bird Conservation Region (BCR) 27, which is the southeastern coastal plain. With regard to action level/code priority, it is listed as needing immediate management to reverse significant population decline.

As of 2008, the refuge's bird checklist included 291 total species of birds found with varying degrees of regularity. Fifty-five of this total are considered accidentals, meaning they have been reported only once or twice. A total of 96 species are known to nest on the refuge.

MAMMALS

The ACE Basin system is home to most mammalian species common to South Carolina. Large populations of white-tailed deer are found in the area along with bobcat, gray fox, raccoon, river otter, opossum, beaver, cottontail and marsh rabbit, gray and fox squirrel, and an assortment of small rodents. Coyotes and armadillos have recently appeared. Many of these species utilize both upland and wetland habitats.

The Rafinques big-eared bat and other forested wetland-dependent bats could possibly be located within the ACE Basin system. Surveys for the Rafinques big-eared bat and other bats should be conducted to determine their population status and the potential effects of fires on bats that may roost in Spanish moss and pine needles.

REPTILES AND AMPHIBIANS

The combination of a warm climate and interspersion of upland and aquatic habitat types provides excellent conditions for a variety of reptiles and amphibians (Table 2).

Table 2. Some reptiles and amphibians in the ACE Basin

Crocodilians	Toads and Frogs
American alligator	Eastern spadefoot toad
Turtles	Southern toad
Snapping turtles	Southern cricket frog
Stinkpot	Spring peeper
Eastern mud turtle	Green treefrog
Eastern box turtle	Squirrel treefrog
Chicken turtle	Southern chorus frog
Carolina diamondback terrapin	Bullfrog
Yellow-bellied turtle	Pigfrog
Florida cooter	Bronze frog
Florida softshell	Southern leopard frog
Lizards	Snakes
Green anole	Brown water snake
Six-lined racerunner	Banded water snake
Ground skink	Eastern garter snake
Southeastern five-lined skink	Eastern ribbon snake
Broad-headed skink	Corn snake
Eastern glass lizard	Mud snake

Salamanders	**Snakes (Cont'd)**
Dwarf waterdog	Eastern hognose snake
Greater sirens	Yellow rat snake
Two-toed amphiuma	Southern hognose snake
Mabee's salamander	Eastern kingsnake
Mole salamander	Southern black racer
Spotted salamander	Scarlet snake
Southern dusky salamander	Eastern coachwhip
Slimy salamander	Southeastern crowned snake
Eastern mud salamander	Rough green snake
Southern two-lined salamander	Scarlet kingsnake
Dwarf salamander	Southern copperhead
	Eastern cottonmouth
	Eastern diamondback rattlesnake
	Rainbow snake

FISH

The ACE Basin estuarine system, within which the refuge is located, is extremely valuable as habitat and as a spawning and nursery ground for most of the commercial and recreational fish species common to the South Atlantic Coast. Six species of anadromous fish utilize the tri-river system as transients while passing from the marine environment to riverine ecosystems during their spawning migrations. These anadromous fish are the American shad, hickory shad, blueblack herring, striped bass, Atlantic sturgeon, and the endangered shortnose sturgeon. Other important freshwater fish species include the largemouth bass, crappie, catfish, gar, and bream.

The ACE Basin marsh/estuarine system also provides valuable habitat and spawning and nursery habitat for many species of saltwater fish, including the spotted sea trout, channel bass (redfish), flounder, drum, bluefish, Spanish mackerel, and king whiting. Fish common in the subtidal areas include mullet, menhaden, and bay anchovy, as well as young-of-the-year star drum, Atlantic croaker, spot, silver perch, juvenile weakfish, flounder, hogchokers, tongue fish, catfish, and hake.

As an indicator of the productivity of this estuary/forested wetland ecosytem, the commercial fishery harvest from this area is over 2.74 million pounds annually, or about 21 percent of the state's total volume of fish and shellfish. The dockside value of this harvest is nearly $2,730,000. Recreational fishing in the ACE Basin system is also a popular activity.

NUISANCE WILDLIFE

Feral pigs, coyote, and beaver are the most prevalent nuisance wildlife species within the ACE Basin, with feral pigs contributing the most destructive impacts on native wildlife habitat. Feral pigs compete with native wildlife for hard and soft mast, consume the eggs and chicks of ground-nesting birds, destroy native vegetation, and consume native reptiles and amphibians. The effects of coyotes on many native species and habitats have yet to be determined, but imperiled species, such as fox squirrels, may experience population declines resulting from coyote predation. The rapidly expanding beaver population has the potential to radically change wetlands and ecotonal landscapes.

CULTURAL RESOURCES

From the early 1700s to the mid-1800s, much of the ACE Basin was home to several large plantations owned by a small number of individuals who managed their wetlands primarily to grow rice. After the rice culture declined in the late 1800s, wealthy sportsmen purchased the plantations for hunting retreats. The new owners successfully managed the former rice fields and adjacent upland estates for a wide range of wildlife. The enormous natural values found on the refuge today are largely due to the wise resource management practices of these past private landowners.

Largely undeveloped and unpolluted, these diverse habitats remain diverse and extremely productive. Much of the historical values of the ACE Basin system have been protected and preserved. The refuge office, a former rice plantation house built in 1828, is one of only three antebellum mansions that survived the Civil War in the ACE Basin area. Former owners ensured that it would be preserved by including it on the National Register of Historic Places.

The area now known as the Grove Plantation was originally a land grant to Robert Fenwick in 1694. It has had many owners through the years, unlike most plantations which belonged to the same family for numerous generations. From 1695 until 1825, the property changed hands nine times. In 1825, George Washington Morris purchased the land and named it Grove Plantation.

George Washington Morris, son of Ann Barnett Elliott and Col. Lewis Morris, was born in 1796 and married Maria Evans Whaley from Edisto. His parents owned large tracts of land, including a plantation directly across the river from what is now known as Grove Plantation. He built the Grove House about 1828. It is built in the late-Federal-period plantation style of architecture and has the unusual feature of polygonal rooms and projecting symmetrical polygonal bays. George Washington Morris died on August 22, 1834, leaving his wife, a son, and three daughters. After his death, his wife, Maria, kept control of the Grove, and later purchased a schooner, with which she transported freight for her neighbors. By 1837, she had not only paid off her husband’s debts, but she also had the house plastered. In 1839, she installed a threshing machine and by 1841, she employed a housekeeper and a governess in addition to her overseer.

G. W. Morris' son, George Jr., was not a good business manager, and from the time his mother passed the management of the plantation to him until the time of his death, he built up huge debts. After his death, the plantation was sold to John Berkely Grimball in 1857.

John Grimball was married to Margaret Ann (Meta) Morris, G. W. Morris' niece, and owned the adjacent plantation, Pinebury. He combined Pinebury and the Grove into one large property and the family moved into the Grove House early in 1858. During the War Between the States, John, Meta and the five younger children went to Spartanburg. The five oldest boys were fighting in the war and John Grimball made numerous trips to check on the plantation. Both Pinebury and the Grove were sites of military activity and

the Grove House was at one time occupied by Confederate troops. By 1866, Meta had to sell clothes and ornaments just to get food. Since the Grove was considered abandoned, it was confiscated. On January 24, 1866, J. Berkeley Grimball made application to the Bureau of Refugees, Freedmen, and Abandoned Lands for restoration of his property. Because he took the amnesty oath of loyalty to the United States, he was able to regain ownership of the Grove and Pinebury. After the war, John Grimball was unable to make his mortgage payments on the Grove. Therefore the land reverted back to G. W. Morris' heirs, Josephine M. Porter and Sabina Ann Morris in 1870.

After that, the property changed hands numerous times until it was purchased in early 1929 by the president of Brooks Brothers, Owen Winston. Winston restored the house and is probably the owner who had the outbuildings constructed.

Thompson Brown purchased the plantation in late 1930. The Brown family used the Grove as a winter vacation residence and for hunting waterfowl and deer. The plantation was also a place where Mr. Brown's daughter recuperated from polio. Between 1934 and 1951, the Browns planted pecan, persimmon, cedar, palmetto, magnolia, and azaleas around the house. In 1947, the South Carolina Power Company ran power lines to the house.

R. Carter Henry purchased the Grove in 1964. Henry provided an extensive renovation on the house. He changed the stairwell in the foyer to an open design and also put the duck tiles around the fireplace in the conference room. In addition, he did extensive renovations to the outbuildings.

Mr. Henry sold the Grove to A. Leigh Baier in the early 1970s. During the Baier family's ownership, numerous rice field trunks (water control structures) were rebuilt or replaced and many of the dikes around the rice fields were repaired. Mr. Baier later sold the Grove to Margaret B. Hendricks, who owned the plantation until The Nature Conservancy purchased it in 1991.

The Service purchased the Grove in 1992 and designated it as the ACE Basin National Wildlife Refuge. Another extensive renovation was done on the house in 1996 and 1997. Today, the house serves as the headquarters for ACE Basin NWR.

Archaeological sites recorded on the refuge occur primarily within the Edisto Unit and Jehossee Island and include rice plantations (the Grove, Brisbane's, Pineberry and Aiken's Plantation). An archaeological and historical investigation of Jehossee Island was conducted in 2002. A total of 16 archaeological sites were identified based on the survey conducted. Of these 16 sites, 13 were located on Jehossee proper; one in the waters between Jehossee and the island to the north, and two on the northern island where yet another plantation—called the Brisbane Plantation—was situated. The island itself has been assessed for eligibility both as a rural historic landscape and also as a historic district. A description and location of these sites are found in the publication entitled, *Archaeological and Historical Investigations of Jehossee Island, Charleston County, South Carolina* (Trinkley et al. 2002). These areas will be provided full protection as provided by the Archaeological Resources Protection Act.

SOCIOECONOMIC ENVIRONMENT

The population of the ACE Basin is centered near the three incorporated municipalities of Walterboro, Cottageville, and Edisto Beach. Presently, Walterboro is the only urban area in Colleton County with public water and sewer facilities that can support an increase in the population (Colleton County Land Use Planning Task Force 1997). In 1990, educational attainment was low in the ACE Basin and 24 percent of residents in the five incorporated areas lived in poverty. Low educational attainment represents a potentially significant economic barrier for the region. The average income per job was

only $19,497 in 1996 for Colleton County (U.S. Department of Commerce 1998), with a racial gap in the earnings (U.S. Census Bureau 1990). However, it is misleading to assume that these average figures are representative of the whole region. The urban areas, and especially the pocket resort and high-end residential communities, have higher relative wealth and educational backgrounds than is apparent from the county or subdivision averages.

Nearly 27 percent of Colleton County residents travel to work outside the county, compared to approximately 7 percent and 2 percent of the residents in Charleston and Beaufort Counties, respectively (U.S. Census Bureau 1990). This difference highlights the need for more opportunities in the Colleton area. It also highlights the potential for Colleton to become a bedroom community to more prosperous areas and the increased threat of the subdivision of natural areas into residential developments. Land use planning in the ACE Basin system will be an important tool to guide development in a way that does not compromise the benefits and values of the area's natural resources. If the economic resources of the neighboring areas are used to support sustainable economic development of the natural resources within the ACE Basin system, then the resulting economic benefits can be returned to the ACE Basin area.

The primary industry-related activities in the ACE Basin include light manufacturing, the service sector, forestry, and agriculture. Three key strategies were established by the ACE Basin Economic Task Force to encourage economic growth while preserving the natural characteristics of the basin: (1) create a framework for responsible growth; (2) enhance awareness, understanding, and appreciation of the basin; and (3) promote environmentally compatible business development. In particular, natural resource-based industries such as agriculture, forestry, seafood, and local crafts have played a key role in the ACE Basin's heritage, and recommendations were established for exploring new ways to make these industries develop higher value-added products and operate in a more sustainable fashion. New and increased nature-based tourism development is highly desirable and environmentally compatible, thereby allowing the area to capitalize on and protect the region's character and natural assets (ACE Basin Economic Forum 1996).

The ACE Basin has a long tradition of hunting beginning with Native Americans and continuing to present-day hunters. The primary wildlife hunted in the ACE Basin study area were white-tailed deer; wild turkey; bobwhite quail; mourning dove; eastern gray squirrel; rabbit; terrestrial furbearers such as raccoon, gray fox, and opossum; waterfowl; and American alligator. The white-tailed deer is the most popular game species sought by hunters in South Carolina. The trends in deer harvest for Colleton County have remained relatively stable since 1988. Harvest reports obtained from private and public lands in the state represent the minimum number harvested, largely because reporting harvested animals is not required and many harvested deer are unreported.

The other big game species sought by hunters in the ACE Basin is the wild turkey. In the coastal plains of South Carolina, hunting for turkey occurs during the spring months. The hunting is restricted to gobblers only, but bag limits are liberal with two birds per day or five per season. No special permits are required to hunt turkey in South Carolina, and the mandatory turkey tags are issued free to individuals with a license and big-game permit. The turkey harvest in Colleton County has increased steadily since 1989.

One of the most striking changes that has occurred with hunting in the ACE Basin study area and other parts of South Carolina has been the transition from small game, such as squirrels and rabbits, to big game hunting for white-tailed deer and wild turkey. Squirrel hunting was once the most popular hunting activity in South Carolina, but today squirrels are among the most underutilized game animals. Rabbit

hunting has also declined in popularity. The switch from small game to deer and turkey has increased the demand for available hunting land. A score of hunting clubs that are tightly managed have been formed in the ACE Basin area and are a popular means of gaining access to private land.

Waterfowl hunting has been a long-standing tradition in coastal South Carolina and the ACE Basin study area. The impoundments of the ACE Basin offer ideal wintering habitat for waterfowl. Private lands are not available to most hunters, but the state-managed wildlife management areas (WMAs), such as Bear Island WMA and Donnelley WMA, provide hunting opportunities through the statewide lottery. In Colleton County, the waterfowl harvest has been variable, with the greatest estimated harvest occurring in 1995. The major species of interest to hunters statewide are wood duck, mallard, and green-winged teal. Reports from band returns and surveys indicate that the primary species harvested in Colleton County, over a 10-year period, were green-winged and blue-winged teals, wood ducks, wigeons, and mallards. At the Bear Island WMA, the primary harvested species in 1996-97 were shoveler, green-winged and blue-winged teal, and wigeon, while at Donnelley WMA, green-winged teal and wood duck constituted greater than 70 percent of the total harvest.

Management of wildlife is not only a state and federal activity, but is also undertaken by private landowners, hunt clubs, and timber companies. Management for hunting emphasizes habitat maintenance, in particular the creation of edge habitat, and the enhancement of hunting opportunities for game species. Hunter-based conservation organizations have been instrumental in educating landowners and sportsmen and in promoting sound management practices (Beasley et al. 1996). A major factor in the future of hunting is the public's attitude. As the rural face of the landscape surrounding the ACE Basin changes due to burgeoning population growth, fewer individuals are viewing hunting as an acceptable tradition. The future of hunting in the ACE Basin study area will depend on strict enforcement of laws and regulations along with increased educational efforts that focus on hunter ethics, safety, and game management.

Commercial fisheries are important to the economic and social fabric of the ACE Basin. In particular, Bennett’s Point and Edisto Beach are primary centers for shrimp and shellfish harvesting. Fishery products landed in the ACE Basin are consumed locally, as well as transported to larger regional markets. In addition to the direct economic impacts of the fisheries, fishing communities also serve as focal points for other residents not directly supported by the fisheries.

Blue crabs, shrimp, and oysters/clams are the three main fisheries in the ACE Basin. In addition, there are smaller fisheries for shad, sturgeon, horseshoe crabs, and flathead catfish. Revenue from commercial fisheries during 1996 was estimated to be almost 25 million dollars in South Carolina. The total commercial landings for Colleton County, which largely encompasses the ACE Basin, have an estimated value between $750,000 and $1,500,000 per year. More than 90 percent of this is attributable to the shrimping industry. To date, no mechanism exists to accurately evaluate the number of individuals active in the fishery industry of the ACE Basin system.

The shrimping industry is the most important commercial fishery in the ACE Basin. Shrimping is of particular economic importance to a number of small coastal communities, including Bennett's Point, Edisto Beach, and larger towns such as Beaufort. The fishing community not only contributes to those directly involved in the fishery but also indirectly to the local tourism-based economy. In addition to the commercial shrimp trawl fishery, a number of commercial companies farm-raise shrimp in impoundments and ponds in South Carolina, with a few companies in the ACE Basin area (Hopkins 1991). Aquaculture landings range from 8 to 19 percent of the total harvest.

Recreational fishing in freshwater and saltwater is an activity that attracts people without regard to race, sex, or income level and can often influence the economy of an area (Hammond and Cupka 1977; Smith and Moore 1981). A variety of fishing opportunities exist in the ACE Basin study area, in habitats that range from black water streams and swamps to intertidal marshes, creeks, and the ocean surf (Beasley et al. 1996).

The marine and freshwater recreational fishery resources of the ACE Basin have become very important to the economics and aesthetics of the area. Most of the fishing activity is centered in the Edisto, Ashepoo, and Combahee Rivers, but other small streams in the watershed do provide for similar opportunities, especially for bank anglers. Most recreational fishing is from small boats, but bank anglers utilize the areas around landings and bridges. Because of the remoteness of the area, travel upstream in the rivers is often difficult due to obstruction by fallen trees. In general, boating anglers undertake fishing for specific fish species, while bank anglers simply catch what they can and keep most everything. Fishing licenses are required to fish from a boat, but bank fishing does not require a license.

The estuarine waters in the ACE Basin study area are considered to be among the best inshore saltwater fishing locations in the state. Inshore anglers may fish in the surf along the beaches of the barrier islands as well as from bridges, piers, and boats throughout the many rivers and tidal creeks in the ACE Basin and St. Helena Sound. Shore-based fishermen catch a variety of species in the marine waters of the ACE Basin, including spot, Atlantic croaker, bluefish, summer and southern flounders, spotted seatrout, red drum, black drum, pinfish, southern and gulf kingfish, and sheepshead. White and brown shrimp are the species most sought by recreational shrimpers, as well as several different types of small sharks and rays. The blue crab is the only recreationally caught crab. Though generally not targeted, silver perch are also frequently caught.

High levels of exploitation by fishermen, coupled with the loss of productive habitat due to coastal development and pollution, have a major impact on estuarine recreational finfish stocks. For some species such as red drum, a gradual reduction in the recreational harvest has been implemented by measures such as size limits and bag limits. Assessments are regularly done to determine if such measures result in reduced mortality of highly sought recreational species throughout the region.

The recreational freshwater fisheries in the ACE Basin study area were valued at almost $2 million annually (Allen and Thomason 1993; Thomason et al. 1993). From free-flowing streams to the tidally influenced sections of freshwater rivers and creeks, anglers target flathead catfish, largemouth bass, striped bass, redbreast sunfish, and black crappie. In addition, several species of sunfish and catfish are often caught, but not directly targeted.

The majority of freshwater angling is done from small- to medium-sized boats (3.0-4.6 meters or 10-17 feet). Freshwater anglers are required to have a South Carolina fishing license to fish in public waters. The following issues are currently influencing the management of freshwater fisheries in the ACE Basin: (1) logging, (2) urban and industrial development, (3) introduction of foreign fish and plant species, (4) water withdrawal and flows, (5) alterations to wetland habitat, (6) increases in nonpoint source pollution, and (7) instream integrity. The future looks bright for the ACE Basin's freshwater fishery resources. Educational efforts to inform citizens of the importance of natural resource protection are increasing. Because of governmental efforts that encourage best management practices and monitor industrial pollution, water quality is not deteriorating drastically. Wetlands are being conserved at an increased rate so that habitats vital for fish production will remain an integral part of the ACE Basin landscape.

In 1990, 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 (more than 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 nonfederal rural lands ("nonfederal" referring to all lands in private, municipal, state, or tribal ownership). Land use on nonfederal lands in the state, which total 18,115,500 acres, is primarily forestland. South Carolina saw a 20 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, approximately 4.85 million acres were in agricultural production in South Carolina (U.S. Department of Agriculture [USDA] 2003). In 1982, about 5.5 million acres were in agricultural production, which amounts to a 12 percent drop in 20 years. The average farm in South Carolina was approximately 197 acres in size in 2002, up 2 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 (U.S. 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 was estimated at $193 and $155 million respectively for 1997.

According to the results of the USDA Forest Service's Forest 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 (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, or 91 percent of all fishing days within South Carolina compared to nonresidents who fished 910,000 days or 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, or 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, or 41 percent of all fishing expenditures. Fishing equipment (e.g., rods, reels, and line) totaled $79 million, or 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, or 65 percent of the equipment total. Special and auxiliary equipment 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, or 2 percent of all fishing expenditures.

HUNTING

In 2001, 265,000 residents and nonresidents, 16 years old and older, hunted in South Carolina. Of this total, 221,000 were resident hunters, accounting for 83 percent of the hunters in South Carolina. The other 44,000 were nonresidents, or 17 percent of the state's hunters. Residents and nonresidents hunted 4.7 million days in 2001, for 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 307,000 days hunting in South Carolina, or 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, or 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, or 52 percent of all hunting expenditures. Hunting equipment (guns and ammunition) totaled $108 million and comprised 68 percent of all equipment costs. Hunters spent $50 million on auxiliary equipment (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 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, cost hunters $52 million, or 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 or 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 or more from home are called "nonresidential" participants. People participating in nonresidential activities in South Carolina in 2001 numbered 331,000, or 28 percent of all wildlife watchers in South Carolina. Of that number, 204,000 were state residents and 127,000 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 observed wildlife, 100,000 photographed wildlife, and 87,000 fed wildlife. Because some individuals engaged in more than one of the three nonresidential activities during the year, the sum of the 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 or 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, or 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 (e.g., campers and trucks) amounted to $36 million, or 24 percent of all equipment costs. Special and auxiliary equipment are items that were purchased for wildlife-watching recreation but could be used in activities other than wildlife-watching. Other items purchased by wildlife-watching participants, such as magazines, membership dues and contributions, land leasing and ownership, and plantings, totaled $18 million, or 7 percent of all wildlife-watching expenditures.

Further information regarding fishing, hunting, and wildlife-watching activities can be found in the following publication: 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.* Washington, DC.

REFUGE ADMINISTRATION AND MANAGEMENT

LAND PROTECTION AND CONSERVATION

ACE Basin NWR is currently comprised of 11,815 acres of fee title land ownership and has an acquisition boundary exceeding 18,000 acres. Refuge lands are part of a cooperative partnership among members of the ACE Basin Task Force to protect and conserve the resources, allowing traditional land uses of the relatively pristine 358,000-acre Ashepoo–Edisto–Combahee River Basin, known as the ACE Basin Project. The partnership includes private landowners, corporate lands, non-governmental organization protected properties, and state and federal lands. Currently, approximately 190,000 acres of the targeted 350,000 acres of land are under protective ownership or easement.

The increasing human population in the coastal South Carolina Lowcountry area, including the ACE Basin Project Area (portions of Charleston, Colleton, Beaufort, Dorchester, Orangeburg, Bamberg, and Hampton Counties) 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 Atlantic seaboard (Edisto Beach) and major rivers. Additional demands will likely occur for housing, government services, and infrastructure features such as recreational areas, and additional 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 suitable habitats, open space such as grassy fields and timber plantations, and traditional lifestyles within local communities. These demands affect land use all around the refuge boundaries.

VISITOR SERVICES

The refuge is divided into two units. The Edisto Unit consists of the Grove Plantation and Jehossee Island. The Combahee Unit is made up of the Bonnie Hall tract, the Combahee Fields tract and the Upper Combahee Unit. It is 45 miles from the Edisto Unit to the Upper Combahee Unit.

Many visitors are coming to see the Grove Plantation and not a wildlife refuge. The Grove Plantation area of ACE Basin NWR is unique because not only is it a wildlife refuge, it is one of the few remaining historically significant plantations open to the public. It is estimated that 90 percent of the visitors to the refuge are coming to the Grove and 60 percent of those are coming to see the house.

The Grove Plantation house itself is on the historical register along with the "viewscape" around the house. This means that any changes to the view, such as directional signs, require consultation with the Regional Archaeologist.

The hunt program is the largest public use program on the refuge with around 1,400 participants per year. Fishing is also a popular on the refuge, with fishing opportunities available along most of the impoundment perimeter canals, various ponds and impoundments, and river shorelines.

The refuge hosts a variety of environmental education and interpretation programs for grade schools and college students.

Many good hiking trails and wildlife observation areas are on the Edisto Unit and on parts of the Combahee Unit.

The refuge is currently providing the appropriate level of visitor services (e.g., hunting, fishing, wildlife observation, wildlife photography, and off-site programs) relative to the staff size and positions. There is a lot of opportunity for expanding the on- and off-site environmental education at the refuge.

Jehossee Island has extensive cultural resources and is closed to the public.

PERSONNEL, OPERATIONS, AND MAINTENANCE

The refuge headquarters office is located near the town of Hollywood, South Carolina, a small community with a population of approximately 4,600 people. The refuge units occur in four different counties that include Charleston, Colleton, Beaufort, and Hampton. Refuge lands border Toogoodoo Creek, Dawho River, Edisto River and the Combahee River and encompass a geographic area that is approximately 25 miles in length. The refuge staff currently includes six funded positions and one fire-funded position.

The refuge's mechanized equipment includes numerous trucks, farm tractors, all-terrain vehicles, excavators, bulldozer, skid-steer equipment and fire engine.

The SEWEE Association supports the refuge as a friends group, primarily on environmental education- and interpretation-related activities.

Volunteers provide assistance with various refuge management and public use programs that include a hunting program for hunters with disabilities, bird surveys, nest box maintenance, and gardening. The refuge is currently developing two work-camper sites to expand volunteer administration and maintenance support.

III. Plan Development

PUBLIC INVOLVEMENT AND THE PLANNING PROCESS

The process of developing this CCP began in March 2004, with a biological review completed by a team of 14 biologists representing the refuge, the Service, the South Carolina Department of Natural Resources, Nemours Wildlife Foundation, and Ducks Unlimited. The team conducted a review of the refuge's existing biological programs and developed a set of recommendations for future desired conditions. Also in 2004, a comprehensive visitor services review was conducted to evaluate the refuge's public use and environmental education and interpretation programs. This review involved a team of four public use specialists from the Service's Southeast Regional Office and two other national wildlife refuges. The recommendations of both the biological review team and visitor services review team helped determine the alternatives, goals, objectives, and strategies that were included in this CCP. The members of the biological review team and visitor services review team are identified in Chapter V.

The CCP planning team for ACE Basin NWR consisted of five staff members from the Service and one representative from the South Carolina Department of Natural Resources. This team was the primary decision-making team for the CCP. The key tasks of this group involved defining the vision for the refuge; identifying, reviewing, and filtering the issues; defining the goals; outlining the alternatives; and drafting the CCP. The CCP planning team members consisted of the following:

- Mark Purcell, Refuge Manager, ACE Basin NWR
- Van Fischer, Natural Resource Planner, South Carolina Lowcountry Refuge Complex
- Melissa Pope, Office Assistant, ACE Basin NWR
- Larry Hartis, Wildlife Biologist, ACE Basin NWR
- Bryan Woodward, Park Ranger, ACE Basin NWR
- Sam Chappelear, Wildlife Coordinator, South Carolina Department of Natural Resources

The planning team reviewed the recommendations of the biological review and visitor services review teams and conducted a comprehensive review of the refuge's overall natural resource management and public use programs. It also conducted additional internal scoping and prepared a preliminary schedule, a mailing list, and plans for public involvement. A notice of intent to prepare a CCP for the refuge was published in the *Federal Register* on January 3, 2007.

The planning team held a public scoping meeting on July 25, 2007, at the Meggett Town Hall in Meggett, South Carolina. Public notices advertising the meeting in advance were posted at the refuge office and published in local newspapers, and invitations were mailed to approximately 65 individuals and groups on the refuge's mailing list. Three citizens attended the public scoping meeting. Although the attendance was low, many useful comments were received. The comments from this public scoping meeting are summarized in Appendix D, Public Involvement.

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; public recreation; and management of threatened and endangered species. Additionally, the planning team considered federal and state mandates and applicable local ordinances, regulations, and plans. The team also directed the process of obtaining public input through the public scoping meeting, open planning team meetings, comment packets,

and personal contacts. All public and advisory team comments were considered. However, some issues that are important to the public are beyond the scope of the Service's authority and cannot be addressed within this planning process. The team did consider all issues that were raised throughout the planning process, and has developed a plan that attempts to balance the competing opinions regarding important issues. The team identified those issues that, in its best professional judgment, are most significant to the refuge. The significant issues are summarized below.

WILDLIFE AND 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 (with the focus on waterfowl, waterbirds, and marsh birds). In order to address these objectives, appropriate management actions will require a comprehensive understanding of the ecology of wetlands and enhanced health of the wetland vegetative communities for all migratory birds. Maintenance of peat composition dikes and wooden rice trunk-style water control structures requires atypical maintenance needs that can conflict with the refuge's existing Service Asset Maintenance Management System (SAMMS)-based maintenance cycles.

Control of invasive exotic and nondesirable plant communities on upland and wetland sites and associated funding needs will require cooperative partnerships with the South Carolina Department of Natural Resources, U.S. Geological Survey, U.S. Department of Agriculture, and other agencies.

The refuge staff will aggressively pursue timber management options to restore industrial-type timber lands to natural states.

Expand endangered and threatened species recovery efforts on the refuge that include habitat management for whooping cranes.

Consider seasonal closure zones within wetland management units during peak wintering waterfowl use periods.

Expand pre- and post-season waterfowl banding operations and summer mourning dove banding in concert with the South Carolina Department of Natural Resources.

Implement appropriate and approved control measures targeting both plant and animal invasive species.

Continue to utilize prescribed burning to maintain fire-dependent habitats.

Expand baseline biological inventories with an emphasis on natural history, distribution, and status of native species.

Conduct plant surveys of the refuge with an emphasis on rare native plants.

RESOURCE PROTECTION

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 (including prescribed fire smoke management).

Reinvigorate efforts to acquire lands within the approved refuge acquisition boundary utilizing partners such as the ACE Basin Task Force, The Nature Conservancy, Ducks Unlimited, and Charleston County (Greenbelt).

Seek to eliminate easements and out parcels on the refuge by mutual agreements and willing buyer/seller opportunities.

Develop an effective cultural resources protection plan that considers permanently restricting public access to Jehossee Island.

Stabilize the bank/shoreline of Jehossee Island (south end) along the Edisto River.

Restore or stabilize the house on Jehossee Island so that it does not collapse.

VISITOR SERVICES

Expand the refuge's volunteer program to include volunteer assistance with biological programs such as bird monitoring, water quality monitoring, and other resource-related activities.

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, especially pertaining to youth.

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. Develop additional passive recreational uses on the refuge including the development of a canoe/kayak launch on the Toogoodoo River in concert with Charleston County "Greenbelt Conservation Funds."

REFUGE ADMINISTRATION

Achieve a full complement of staffing at the refuge.

Seek long-term funding mechanisms and partnerships to adequately operate and maintain the historic Grove House Office and Jehossee Island caretaker's house.

Increase the commitment of natural resource agencies, conservation organizations, and academia to establish effective conservation strategies.

Create public and private partnerships and educational outreach programs for broad-scale conservation efforts.

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 inhabitation, and is managed so as to preserve its natural conditions and which:

- generally appears to have been influenced primarily by the forces of nature, with the imprint of man's work substantially unnoticeable;

- has outstanding opportunities for solitude or primitive and unconfined types of recreation;

- 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;

- 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, educational, scenic, or historic value.

The lands within ACE Basin NWR were reviewed for their suitability in meeting the criteria for wilderness, as defined by the Wilderness Act of 1964. None of the refuge lands were found to meet these criteria. Therefore, the suitability of refuge lands for wilderness designation is not further analyzed in this CCP.

IV. Management Direction

INTRODUCTION

The Service manages fish and wildlife habitats while 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 and these are: hunting, fishing, wildlife observation, wildlife photography, and environmental education and interpretation.

Described below is the comprehensive conservation plan for managing the refuge over the next 15 years. This 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, Current Management (No Action); Alternative B, Protection of Trust Resources and State-listed Species; and Alternative C, Wildlife and Habitat Diversity (Preferred Alternative). Each of these alternatives were described in the Environmental Assessment, which was Section B of the Draft CCP. The Service has chosen Alternative C as the preferred management direction.

Implementing the preferred alternative will result in a greater amount of effort to manage the refuge to increase its overall wildlife and habitat diversity, and will be consistent with the founding principles of the refuge as follows:

- **Ecosystem Management:** Assist in protection and enhancement of the 350,000-acre ACE Basin area, an ecosystem of national significance.
- **Migratory Bird Management:** Manage for migratory birds with emphasis on providing optimum habitat for wintering waterfowl; providing nesting and brooding habitat for wood ducks and mottled ducks; and providing habitat for neotropical migratory birds.
- **Endangered Species:** Conserve, protect, and manage refuge habitats for threatened and endangered species of wildlife.
- **Native Wildlife:** Manage the refuge for native wildlife species and their habitats.
- **Wildlife-dependent Recreation and Environmental Education and Interpretation:** Provide opportunities for compatible public environmental education and interpretation and recreational opportunities associated with wildlife and their habitats.
- **Archaeological/Historical Site Protection:** Provide protection to known archaeological and historical sites throughout the refuge from theft, vandalism, and inadvertent damages from refuge operations.

Waterfowl will remain a focus of refuge management. However, wetland habitat manipulations will also consider the needs of multiple species, such as marsh and wading birds. Management of upland forests and fields for neotropical migratory birds will be more actively managed. Landscape-level considerations for habitat management will include a diversity of open fields, upland and wetland forests, and additional managed wetlands. Multi-species considerations will include target species and habitats identified by the South Atlantic Migratory Bird Initiative and the state's Strategic Conservation Plan.

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

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

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

VISION

The vision of the refuge is as follows:

Established in 1990, the Ernest F. Hollings ACE Basin National Wildlife Refuge provides resources for migratory birds, endangered species, and compatible public uses. Through motivated, experienced, and well-trained staff and volunteers and active partners, the refuge will strive to maintain the unique ecological landscape features and be an active partner to achieve the goals and objectives of the ACE Basin Project, a 350,000-acre estuary/ecosystem conservation partnership between state, federal, corporate, private landowners, and non-governmental organizations. Through team development, the refuge will strive to be a model of excellence in natural resource management and celebrate our 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 to expand partnerships that advance conservation stewardship and protection of natural resources. We will actively pursue research supporting the informational needs of the refuge while 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 National Wildlife Refuge System. Through outreach and public participation, the neighboring communities within the ACE Basin area will share our values for the National Wildlife Refuge System and a fish and wildlife heritage for all Americans.

GOALS, OBJECTIVES, AND STRATEGIES

The goals, objectives, and strategies presented below are the Service's responses to the issues, concerns, and needs expressed by the planning team, the refuge staff and partners, and the public and are presented in an 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 ACE Basin NWR. The Service intends to accomplish these goals, objectives, and strategies within the next 15 years.

Goal 1: THREATENED, ENDANGERED, AND IMPERILED 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 1A: Wood Stork (*Mycteria americana*) – Provide and protect foraging habitat to support wood stork recovery efforts. Encourage colonial nesting of wood storks on the refuge.

Discussion: Wood storks are federally listed as an endangered species (U.S. Fish and Wildlife Service 1997). Wood stork nesting has been observed within the ACE Basin Project Area, although not within the refuge acquisition boundary. Large numbers (several hundred) of wood storks are regularly foraging in refuge impoundments, especially those on Jehossee Island, and roosting in the trees adjacent to refuge impoundments. The refuge has attempted to encourage colonial nesting of wood storks within an impoundment known as Goose Pond on the Grove unit of the refuge by the installation of artificial nesting platforms; however, no rookeries currently exist on refuge lands. The contiguous mature blocks of wetland ecosystems provide suitable habitat for wood storks to nest, forage, and roost. Wood storks have been observed foraging and loafing on refuge lands and throughout the refuge acquisition boundary.

Strategies:

- Locate potential nesting sites for wood storks each year and determine if special measures are needed to reduce disturbance
- By 2010, determine potential sites for establishing new nesting sites for wood storks and follow guidelines established by SCDNR.
- Manage impoundments for multiple species, including wood storks under a featured species approach for migratory ducks. Conduct wetland surveys, monitoring, and adaptive management.
- Work with PFW program to assist with wood stork pond management

Objective 1B: Red-cockaded Woodpecker (*Picoides borealis*) – Provide and protect nesting and foraging habitat to support red-cockaded woodpecker (RCW) recovery efforts.

Discussion: There are no active RCW clusters on refuge lands and they are not known to currently exist within refuge acquisition boundary or the ACE Basin Project Area. However, as recently as the early 1970s active clusters existed on the Cheeha–Combahee Plantation (personal correspondence with Lew Crouch, Manager, Cheeha–Combahee Plantation) and thousands of suitable acres of habitat exists throughout the ACE Basin Project Area as the result of private plantation quail management objectives.

Strategies:

- Identify potential RCW nesting and foraging habitat on the refuge and conduct mechanical thinning operations and introduce growing season prescribed fire to 30-60+ year-age class pine forests.

- Coordinate with the Charleston Ecological Services Office, the ACE Basin Task Force and land owners the ACE Basin Project Area to encourage participation in the Safe Harbor program.
- Assist ACE Basin Project Area landowners with the accomplishment of RCW baseline surveys.

Objective 1C: Flatwoods Salamander (*Ambystoma cinquiculata*) – Provide and protect foraging and breeding habitat to support flatwoods salamander recovery efforts.

Discussion: Little research and survey effort has been directed towards this species and accordingly limited information is known about flatwoods salamander populations in the southern coastal plain of South Carolina. These salamanders prefer pine forest habitat subjected to growing season fires, most importantly to maintain ephemeral, isolated wetlands in a non-woody state where the larvae mature in March and April before migrating as adults to the adjacent pine forest uplands. Of critical importance is that the wetlands utilized by this species be isolated and ephemeral in nature to prohibit the existence of predatory fishes from foraging upon larval and adult salamanders.

Strategies:

- Conduct fall breeding season surveys and spring larvae surveys in suitable habitat.
- Conduct growing season prescribed fires in suitable pine forest habitat.
- Where possible, install ditch blocks to prevent predatory fishes access to naturally isolated wetlands.

Objective 1D: Canby's Dropwort (*Oxypolis canbyi*) – Identify, protect, and manage for optimal habitat conditions.

Discussion: Canby's dropwort occurs within the coastal plain of the southeastern United States primarily in depression wetlands. Although not known to occur in the refuge acquisition boundary, potential habitat is present on the Grove and Barrelville Units and in other pineland areas. South Carolina harbors the largest concentrations of this species and it can be found in the nearby Crosby Oxypolis Heritage preserve in Colleton County.

Strategies:

- Conduct surveys for this species within and adjacent to depression wetlands in pineland forest habitat.
- Conduct growing season prescribed fires in suitable pine forest habitat.

Objective 1E: Pondberry (*Lindera melissifolia*) – Identify, protect, and manage for optimal habitat conditions.

Discussion: Pondberry occurs within the coastal plain of the southeastern United States primarily in depression wetlands in pine flatwoods and along the margins of pond cypress-swamp gum swamp forests, open bogs, and sandy sinks. In South Carolina, it is known to occur in Beaufort County. Although not known to occur in the refuge acquisition boundary, potential habitat is present on several units of the refuge in and adjacent to pine forests.

Strategy:

- Conduct surveys for this plant when flowering in the spring and in late summer when fruits (drupes) mature and are most apparent (red).

Objective 1F: American chaffseed (*Schwalbea americana*) – Identify, protect, and manage for optimal habitat conditions.

Discussion: American chaffseed primarily occurs within the southeastern coastal plain and in South Carolina occurs in pine flatwoods and savannas, ecotonal areas between peaty wetlands and xeric sandy soils, and within open grassy areas. American chaffseed is a highly fire-dependent plant, especially growing season burns. Although it is not known to occur in the refuge acquisition boundary, potential habitat is present on several units of the refuge in and adjacent to pine forests.

Strategies:

- Conduct surveys for this species in pineland forest habitat.
- Conduct growing season prescribed fires in suitable pine forest habitat.

Objective 1G: Bachman's Warbler (*Vermivora bachmanii*) – Identify, protect, and manage for optimal habitat conditions.

Discussion: The Bachman's warbler is considered extinct by many, if not possibly the rarest North American songbird. Historically, it was very local in moist deciduous woodlands similar to the habitat of hooded warblers. In South Carolina, it was last reported in Charleston County (Ion Swamp) and historically reported along Parkers Ferry Road near the refuge's Grove Unit.

Strategy:

- Conduct spring breeding bird surveys in suitable habitat.

Goal 2: MIGRATORY BIRDS

Objective 2A: Waterfowl – Ensure the perpetuation of a healthy wetland system, improve the infrastructure of refuge impoundments, and optimize their management to provide the habitat, sanctuary, and life-history needs of wintering waterfowl in order to help achieve population and habitat objectives of the North American Waterfowl Management Plan, Atlantic Flyway Species Management Plans, the Atlantic Coast Joint Venture-South Atlantic Migratory Bird Initiative's waterfowl habitat objectives, and refuge waterfowl objectives. Concurrently, use a multiple species management approach to provide habitat for migrating shorebirds, marsh birds, and wading birds.

Discussion: The South Carolina coast has long been a key area for wintering waterfowl and has a rich waterfowl tradition. In recent years, the total numbers of dabbling ducks observed in South Carolina in the Mid-Winter Inventory have declined. During this time, the flyway population trends for some duck species have been more stable. The decline in the number of mallards observed during the MWI in South Carolina has been especially noticeable. The reasons for this decline in South Carolina and other south Atlantic Flyway wintering states are not well understood and are receiving attention at the flyway level. While we try to understand the reasons behind the declines and until we

can take the correct measures to reverse the trend, it is important that good and abundant winter waterfowl habitat is provided to maintain a waterfowl habitat base in South Carolina, especially in traditional wintering areas such as ACE Basin.

The Atlantic Coast Joint Venture Waterfowl Technical Committee is presently working to develop wintering waterfowl habitat goals, specific to the Atlantic Flyway, based on the overall North American waterfowl population numbers. These habitat goals will be apportioned to the state Level. It is intended that these state goals will then be stepped down further, to specific South Carolina waterfowl areas through the waterfowl technical committee of the South Atlantic Migratory Bird Initiative (SAMBI). Other habitat needs, which can be addressed in managed impoundments, will also be identified through other national and regional plans for shorebirds, marsh birds, and wading birds. The refuge's Biological Review Team does not think it is wise to wait until these plans are developed for the ACE Basin to have short-term and long-term wintering waterfowl goals. Therefore, the team recommends that, for the short-term (1-5 years), ACE Basin NWR maintain habitat conditions needed to support the peak winter population numbers presently being experienced.

Beyond these short-term needs, we anticipate that the migratory bird plans being developed and stepped down will result in recommendations for providing additional habitat in the ACE Basin area for waterfowl, shorebirds, and wading birds. Options for providing additional habitat include improving habitat quality and/or providing additional acres. Because we anticipate additional habitat needs, the team developed the following interim long-term goal. An interim long-term goal will allow the refuge to begin planning for and working towards anticipated long-term habitat needs, while they await the presently unscheduled Atlantic Coast Joint Venture step-down of national and regional plans to the state and eventually refuge level. The short-term winter waterfowl population goal (1-5 years) recommended by the review team is that ACE Basin NWR should support a peak winter population of 15,000 to 20,000 ducks. The present level of food and cover has supported an average peak waterfowl population of approximately 14,000 ducks over the period of record. To support this short-term goal will require, at a minimum, the present level of winter waterfowl food and cover being provided. Based on infrastructure problems, equipment needs, and manpower needs identified during the review, the refuge will require funding for some immediate needs in order to maintain their recent levels of habitat production over the short term (details of these are given later).

To estimate an interim long-term winter population goal for ACE basin NWR, the review team began by looking at the breeding population goals of the North American Waterfowl Management Plan (NAWMP). These breeding population goals are based on the numbers of breeding waterfowl that occurred in the 1970s. The NAWMP set breeding population goals for duck species where adequate information was available at the time; this did not include black ducks and wood ducks. The combined NAWMP breeding population goals for all dabblers, that have a species goal set, is 29,600,000 ducks.

A goal of the NAWMP is to achieve the numbers and distribution of waterfowl that occurred during the 1970s. Since the intent of the NAWMP is to achieve both the target numbers and distribution, South Carolina should plan to be able to winter their proportion of the waterfowl population goals. While we await the step-down of the NAWMP goals to regional and state levels, we can obtain a rough estimate for the South Carolina proportion. This will give us a ballpark figure for the number of dabbling ducks to accommodate in South Carolina and will serve as a reference point for the team to develop an interim long-tern goal. We are using dabbling ducks for this estimate, since the ACE Basin primarily winters dabbling ducks. Assuming long-term progress in attaining NAWMP breeding population and distribution goals, we will expect increased numbers of wintering waterfowl in the ACE Basin area and on ACE Basin NWR in particular. For an interim long-term (6-20 years) goal, the

team recommends that ACE Basin should consistently provide adequate habitat for the maximum annual peak number of ducks observed over their present period of record. This is a peak of approximately 38,000 ducks.

This interim long-term goal does not seem to be excessive considering our rough estimate of almost 1,000,000 dabbling ducks as South Carolina's wintering proportion of the NAWMP population goals. This interim long-term population goal can be adjusted as more precise step-down population goals from national and regional plans become available.

Strategies:

- Over the next 5 years, ACE Basin NWR should provide habitat to support a peak winter duck population of 15,000 to 20,000.
- Maintain, at a minimum, the present level of food and cover which has supported an average peak waterfowl population of approximately 14,000 ducks over the period of record.
- Conduct a GIS analysis of refuge wetlands to evaluate current and potential wetland management opportunities based on hydric soil overlays.
- Monitor wintering waterfowl populations by conducting bimonthly ground waterfowl surveys (October–March) for all managed wetland complexes on the refuge.
- Combahee Unit–Combahee Fields – Purchase and install 5 new water control structures (estimated cost is $50,000 total for aluminum risers).
- Grove Unit – Replace rice trunk ($60,000); maintain ditches and quarter drains ($150,000).
- Jehossee Island – Build approximately 750 feet ($350,000) of internal dike and purchase and install a new rice trunk ($100,000) and a new flash board riser ($15,000) to independently manage a 25-acre subunit (J8).
- Bonny Hall – Replace rice trunk ($60,000) in B6 (and install two flashboard risers in potential colonial bird rookery ponds ($20,000).
- Acquire access barge (capable of transporting a track hoe) ($75,000).
- Construct barge landing facilities on Grove Plantation and Jehossee Island ($150,000).
- Construct equipment Storage Shed on Jehossee Island ($75,000).
- Expand existing staff by hiring an equipment operator ($50,000).
- Over the next 6-20 years, ACE Basin NWR should provide habitat to support a peak winter duck population of 38,000.
- Independent water drawdown and flooding. This means a reliable water source and the ability to deliver water when required to each impoundment, directly to the impoundment, without the need to lower or raise any other impoundment to allow this. For drawdown capabilities, this means the ability to draw each impoundment down, regardless of the water level being maintained in other impoundments and without having to affect or change the other impoundments' water level. This will require new structures and new dikes to produce feeder canals to some of the impoundments.
- A complete system of water level gauges and the manpower costs needed to routinely check water levels and adjust water levels when needed, as indicated by prescriptions in the annual water management plans.
- The ability to set back vegetation succession in each unit, when needed, through water level management, mechanical disturbance, fire or other means and an estimate of the cost per acre by impoundment to accomplish this.
- The manpower to monitor vegetation after germination to ensure if a predominance of the desired species has been achieved and to readjust the plan if this has not occurred (i.e., additional disturbance or control of invasive/exotic plants; the manpower to monitor vegetation after maturity, typically late summer/early fall to estimate the percent occurrence of the plant

species present and the percentage of desirable and undesirable plants). This should include a per-acre-cost estimate for the monitoring.
- Estimate costs of adequate waterfowl surveys needed to document any obvious responses to the vegetation conditions present in the impoundments.
- Identify all existing infrastructure and make a long-term maintenance schedule (i.e., estimate the expected life of existing structures).
- Make a schedule for dike mowing, invasive plant control, and routine dike and ditch maintenance. The schedule should include estimated maintenance costs.

Objective 2B: Wood Ducks – Provide wood duck wintering habitat and quality wood duck nesting and brood habitat.

Discussion: The Atlantic Flyway and Region 4 of the Service encourage and promote management activities to increase wood duck productivity on Service lands. Wood ducks are common winter residents at ACE Basin NWR. In addition to providing wintering habitat, a goal of the refuge should be to maintain quality wood duck nesting and brood habitat. Research studies have documented a lack of suitable natural cavities in the southeast. Wood duck nest boxes can make a positive contribution to the well being of this species, if they are properly constructed, located and erected, predator proofed, and maintained.

Strategies:

- Provide a minimum of 35 nest boxes to supplement natural cavities. When box use rates are greater than 60 percent, additional boxes should be put out.
- Wood duck boxes should be checked and monitored for use, at least twice a year (right before spring nesting period and after peak spring/summer nesting, probably July).
- If feasible, check boxes every 35-40 days during peak nesting periods (March, April, May).
- Review regional guidelines for data recording, or utilize other standardized date recording sheets.
- Remove boxes in poor condition and ensure all boxes have predator guards.
- If use of present boxes exceeds 60 percent, add up to 10 percent more wood duck boxes if personnel, including volunteers, are available to clean and monitor boxes. (See regional wood duck guidance for more details).
- Relocate individual boxes (when old boxes need replacing) such that one box is not visible from the next. A distance of 100+ yards between boxes is recommended.
- To provide good brood habitat, maintain dense scrub/shrub vegetation and encourage dense stands of emergent or floating vegetation (50-70 percent vegetated; 30-50 percent open water) in portions of the managed impoundments where this is practical.
- Achieve the Atlantic Flyway/Region 4 banding goals for wood ducks.
- The refuge should continue its wood duck banding operations and assistance to SCDNR for any post-season banding needs.

Objective 2C: Shorebirds – Provide for both northbound and (especially) southbound shorebird foraging sites.

Discussion: Where opportunities exist, managing shorebird habitat should be focused during both northbound and southbound movement periods. For areas dedicated to shorebird habitat management in managed wetlands, consideration for flooding and gradual drawdown should be undertaken between late March and late May and again from late July to early October. Providing habitat during autumn southbound migration may be the most important due to the fact that few

managers are willing to sacrifice high-quality moist soil waterfowl habitat during this critical time. However, as pointed out during the biological review, moist soil management involving dwarf spike rush may be timed perfectly in providing southbound shorebird habitat.

Strategies:

- Identify potential sites among moist-soil managed wetlands where water can be drawn down during late March to late May and late July to early October, rotating among sites as needed to ensure available waterfowl habitat.
- Contribute to International Shorebird Survey by implementing counts in coordination with the South Atlantic Migratory Bird Initiative.

Objective 2D: Wading Birds – Provide for both secure nesting sites and ample foraging habitat.

Discussion: Generally speaking, nesting long-legged wading birds have plenty of habitat available, but the issue of how much disturbance these nesting birds can tolerate is key to protecting these species. Also, as development and disturbance continues to escalate in coastal South Carolina, ACE Basin NWR (and other public lands within ACE Basin) will become increasingly important in providing secure nesting areas for these species. If the refuge staff finds nesting areas at remote sites (from the standpoint of public use), it may be worth the effort to occasionally monitor the site for potential disturbance problems and make entry adjustments accordingly. In other situations where colonies form and there is public use nearby, it may not be necessary to be too concerned. The main issue is change in public use around established colony sites.

The biological review team recommends the following guidelines developed by Tom Murphy, SCDNR, to establish new potential nesting areas at the “fishing pond” on the Bonny Hall Unit, another site at Bonny Hall field proper, and a third site at Combahee Fields.

One important aspect of managing for long-legged wading birds is providing post-breeding foraging habitat in late summer and early fall, which may include dispersing endangered wood storks. Such habitat conditions would involve providing habitat conditions similar to that provided for shorebirds by drawing down water in impoundments.

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

Strategies:

- Locate nesting sites for colonial waterbird species each year and determine if special measures are needed to reduce disturbance.
- Determine potential sites for establishing new nesting sites for long-legged wading birds and follow guidelines established by SCDNR.
- Determine use of managed wetlands and flooded agriculture during post-breeding periods by long-legged waders, concurrently with southbound shorebird surveys.

Objective 2E: Land Birds – Provide forest habitat conditions conducive to supporting both priority pine and hardwood associated species by 2010. Provide for habitat and improved survival of transient landbirds.

Discussion: ACE Basin NWR provides habitat for a variety of forest, scrub/shrub, and grassland bird species. The breeding landbird requiring the most management attention at ACE Basin NWR is the painted bunting. Although the painted bunting is already a species of Continental Conservation Interest, the eastern subspecies (possibly a separate species) is among the highest ranking taxa in the southeast in need of conservation attention. The eastern painted bunting is restricted to the Coastal Plain of extreme southeast North Carolina, South Carolina, Georgia, and northeast Florida, while most birds winter in south Florida (formerly more common, now decidedly uncommon), Cuba, and the Bahamas. Although most large breeding populations are on sea islands or otherwise within 50 miles of the Atlantic coast, some sizeable populations do occur in the inner Coastal Plain to the Fall line with the Piedmont, most of which are closely associated with major rivers, such as the Altamaha, Savannah, and ACE Basin–Cooper. This species is declining within the South Atlantic Coastal Plain, not unlike most other species associated with successional habitats.

ACE Basin NWR may represent an important location for supporting eastern painted buntings in the outer Coastal Plain habitat. Painted buntings seem to be most closely associated with woodland edges and scrub/shrub with access to grassy areas. Grassy areas are especially important for foraging young (i.e., "bugging"). ACE Basin should be able to contribute to reversing population trends with increasing habitat being made available and supporting high annual reproductive success. Regarding the latter, painted buntings, like many edge species, may be particularly vulnerable to high nest depredation and parasitism associated with areas with substantial open land, but like many edge-associated species may be able to persist despite these problems. High reproductive success should be measured as an average of 4 young per successful nest, as suggested in the South Atlantic Coastal Plain Bird Conservation Plan.

A combination of existing forests, narrow forested corridors, and early successional habitats should provide ample habitat for most migratory landbirds. Bobolinks will take advantage of grassy fields. Beyond habitat availability, the most important issue involving migratory landbirds is the proliferation of communication towers that may result in significant mortality on inclement nights when nocturnal migratory birds are attracted to slow blinking beacon lights on towers over 199 feet high. Refer to the Service's guidelines on how to reduce mortality associated with communication towers when such towers are being planned adjacent to or on the boundaries of the refuge.

Strategies:

- Grass >50 percent, mow in early March, preferably, or hold off till end of September-early October.
- Consider prescribed burning when wax myrtle is 2-3 meters in height. The desired condition should be 25-50 percent coverage in a mosaic with 50-75 percent is grassy condition. Emphasis on regular dormant season burning (3-6 years) or growing season (3-6 years) mixed in bush-hogging and preferably disking (3-6 year disturbance intervals).
- Open pine or hardwood forest with <50 percent canopy cover and opening-tree falls. Old-growth maritime forest is excellent painted bunting habitat (low densities but probably very high nest success based on other scrub/shrub nesting birds). No need to manage this habitat, since tree falls provide scrub/shrub habitat for painted buntings.
- By 2010, all forest edges should be feathered by cutting into the existing woods to maximize potential use by eastern painted buntings and other scrub/shrub species.

- By 2010, arrest succession as necessary (i.e., do not allow development of pole stands) of the existing 300-500 acres of scrub/shrub.
- By 2015, specifically for eastern painted buntings, ensure that dense patches of tall grasses are adjacent to nesting habitat to support post-breeding "bugging" habitat.
- By 2010, initiate a study on the interaction between landscape context surrounding the refuge, occupied habitat conditions both on and off refuge, and factors influencing reproductive output for eastern painted buntings, assessing the variety of management options now employed, perhaps in association with Santee NWR.
- By 2010, establish roadside point counts along forest and field edges across the refuge to track habitat use by all priority scrub/shrub species.
- Implement Service communication tower guidelines when appropriate.
- By 2010, if and when volunteers are available, consider implementing migration surveys.

Objective 2F: Marsh Birds – Provide for both secure nesting sites and ample foraging habitat.

Discussion: All of the priority marshbirds that are found at ACE Basin NWR require tall emergent vegetation as part of their habitat. All are breeding species, except American bittern and yellow rail. Breeding populations of pied-billed grebes and American coots are considered of regional conservation interest, even though wintering populations are considered secure. Of the marshbirds of conservation interest, king, yellow, and black rails are of highest concern, followed by least bitterns and purple gallinules. Among songbirds, priority species are resident seaside sparrows and wintering saltmarsh and Nelson's sharp-tailed sparrows.

Nearly 4,000 acres are identified as natural marsh on the refuge, with over 3,000 acres on the Jehossee Unit. In addition, nearly 3,000 acres are managed wetlands. The natural marsh is subject to tides and structure can be managed through prescribed burning to keep shrub encroachment to a minimum. The managed wetlands are primarily managed by manipulating water levels and with mechanical disking.

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

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

The king rail, by being the highest priority marshbird, may serve as an umbrella species for the other priority marshbirds. King rails may be the most habitat-specialized of the species nesting in tall emergent vegetation. Their nests are constructed near the soil, usually where standing water depths are about 10 inches. Higher water levels have the potential to flood out the species and little or no

standing water potentially exposes nests to greater depredation pressure from raccoons, etc. These conditions should support nesting least bitterns as well, with nests usually placed higher in the vegetation making this species more tolerant of deeper flooding.

Density estimates for breeding pairs of king rails are extremely variable and more work is needed here to allow us to establish specific population and habitat objectives. However, from the data that does exist, it appears realistic that to support 1 pair at least 5 acres of tall emergent vegetation is required. Other estimates suggest 20 acres may be necessary to support a pair, but there is no information to determine the relative quality of habitat or the accuracy of these estimates. Assuming that a minimum of 5 acres and a maximum of 20 acres is necessary to support at least one pair and all the marshland acres are in suitable condition for king rails (see below), then using an average of 10 acres/pair, about 300 pairs of king rails could be supported at ACE Basin NWR. At the low end of habitat area, close to 100 percent should be in tall emergent vegetation with water on the surface but no more than 10 inches in depth, preferably with some topographic variation within the patch.

Such small patches may suffer from elevated depredation pressure, so more emphasis should be given to maintaining suitable marshland in larger patches wherever possible. In these larger patches it is desirable to manage to maintain some proportion of open water and short emergent vegetation. The team suggests maintaining 40-70 percent of a marsh unit in tall emergent vegetation, with the remainder in open water (which may include some lotus and lily pads), with submerged aquatic vegetation favorable to waterfowl. Such conditions should also be favored by breeding pied-billed grebes, purple gallinules, and American coots, as well as with wood duck brooding habitat and other (wintering) waterfowl habitat requirements.

The habitat requirements for the black rail are similar to the breeding habitat for king rail in the need to have some relatively high ground, except for black rail this is required throughout the year. The need to fully understand the effects of prescribed fire on black and yellow rails are particularly important as certain practices (ringing and/or multiple aerial ignitions) are known to result in high mortality; as these small rails are unable to escape flames and smoke.

The refuge staff should initiate the marshbird survey conducted in the early 1990s by the SCDNR that included Bear Island WMA to establish baseline data and monitor use of managed sites targeting breeding rails, bitterns, grebes, gallinules, and coots.

Strategies:

- By 2010, provide high-quality breeding marshbird habitat.
- By 2010, focus specific attention to promoting tall emergent vegetation in a way that would support sizeable breeding king rail (between 200-400 pairs) and least bittern populations spread across all four units.
- Of the larger patches of marsh, promote 40-70 percent in tall emergent vegetation, with the remaining 30-60 percent in open water, floating vegetation, and submergent aquatic vegetation in support of breeding purple gallinules, pied-billed grebes, and American coots, as well as brooding wood duck and wintering waterfowl.
- By 2010, evaluate use of natural marsh by priority marshbirds, especially black and yellow rails, as well as seaside and “sharp-tailed” sparrows, especially in response to prescribed burning.

- By 2010, initiate marshbird call-back survey points and contribute to ongoing secretive marshbird survey data presently coordinated by Courtney Conway, BRD-University of Arizona.
- By 2010, initiate specific study of managed wetlands and determine use by especially king rail, but other priority marshbirds as well.

Objective 2G: Bald Eagle (*Haliaeetus leucocephalus*) – Over the 15-year lifespan of the CCP, monitor nesting bald eagle populations and continue to support bald eagle foraging and nesting habitat on the refuge.

Discussion: The number of occupied breeding areas for bald eagles in South Carolina was at a low of 13 in 1977 when studies began, and has increased to 181 in 2003 and fledging 224 young (Murphy, SCDNR personal correspondence, 2003). The bald eagle is primarily associated with coasts, rivers, and lakes, usually nesting near bodies of water where it feeds (U. S. Fish and Wildlife Service 1992b). Bald eagles are present year-round on the refuge with the majority of observations occurring during migration periods. There are three active bald eagle nests on the refuge in the Grove Unit and Jehossee Island. The bald eagle was officially removed from 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. Management activities for bald eagles on the refuge include occasional nest surveys from the ground and midwinter bald eagle surveys, in coordination with aerial nest surveys results from the SCDNR as they become available.

Bald eagle habitat encompasses not only nesting structure, but also foraging areas, perch trees, and undisturbed areas. The impoundments and marshes on the refuge, along with the Edisto River and Combahee River marsh/ricefield complexes, both on and adjacent to the refuge, provide ample foraging habitat. While these areas are not specifically managed for eagle foraging, management activities aimed at maintaining populations of migratory waterfowl also provide abundant prey for the eagles. Fishery resources in the refuge and river system also provide an important food source.

Strategies:

- Provide for secure nesting and roosting sites for bald eagles by implementing the Southeast Regional Bald Eagle Management Guidelines around known nest sites.
- Monitor existing eagle nest sites and conduct a nest tree site characterization to determine 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 for protecting 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 3: NATIVE WILDLIFE SPECIES

Objective 3A: Game Animals – Maintain a well-balanced and healthy deer herd in order to prevent overpopulation and habitat destruction and provide recreational opportunity. Keep raccoon population density at moderate levels.

Discussion: White-tailed Deer. Many of the refuge's mixed pine/hardwood and hardwood stands are deficient in understory vegetation and need treatment to improve the amount of deer browse available. Attention to oak composition is important to ensure adequate hard mast. Forest management should include efforts to ensure that 30 to 60 percent of the canopy composition is in oaks or other hard mast-producing species. Inherited loblolly plantations (such as the stands on the Barrellville Tract) should be converted to mixed pine/hardwood stands with less than 25 percent of the stems composed of loblolly pine. Special emphasis is needed on ensuring that oak will be a significant component of future stands. This may require the underplanting of hardwoods prior to thinning of the pine if no advance oak/hardwood regeneration is found to be present.

Overall, the deer herd on the refuge appears to be in satisfactory condition. Herd health surveys were conducted in 1992, 1998, and 2004. Surveys indicate some need for increased harvest. The refuge's either-sex deer hunts were begun when the refuge was established in 1992. Quality deer management was begun in 1994; bucks are not taken with less than three points on a side. As habitat conditions improve from planned understory improvement, herd numbers will increase. Deer harvest should be increased as needed. To increase hunter participation, the deer hunts should be scheduled, where possible, to avoid overlap with existing local archery and primitive weapons state hunts. The deer management program should continue to measure herd health conditions and density through abomasal parasite (AP) counts every 4 to 6 years. Special attention should be given to the deer herd on Jehossee Island where overpopulation could become a problem since public access is limited and no hunts have been conducted there. Control of the deer herd is necessary to make sure that the present and increased levels of understory vegetation are perpetuated. Herd health may also become a problem with overpopulation. An AP count on Jehossee Island should be a high priority. Table 3 provides deer harvest data for 1998-2003 for the remaining portions of the refuge where hunts are conducted.

Table 3. ACE Basin NWR deer harvest for fiscal years 1998-2003

Type of Hunt	Year						Average
	1998	1999	2000	2001	2002	2003	
Archery	4	12	13	18	5	6	10
Muzzle	11	24	5	29	27	14	18
Mobility Impaired	11	2	11	10	4	14	9
Totals	26	38	29	57	36	34	37

Strategies:

- Continue to use the services of the Southeastern Disease Study Group to do deer herd health checks on a 4- to 6-year interval or when signs of disease or poor health trigger need for immediate sampling.
- Increase days of deer hunting, if needed, to maintain healthy herd and reduce over-browsing in forested areas.
- To increase hunter participation, schedule deer hunts, where possible, to avoid overlap with existing local archery and primitive weapons state hunts.

Discussion: Turkey, Quail, Dove. These species are present in appropriate refuge habitats. Current State of South Carolina regulations allow for a spring gobbler season of approximately 5 weeks' duration. The refuge currently has no scheduled hunts for dove, turkey, or quail. The refuge's habitat management programs (primarily fire), and other objectives and strategies within this CCP, should be successful at creating and maintaining sufficient habitats for these species.

Discussion: Raccoons. Raccoons are common throughout the refuge, especially in the bottomland habitats. These small omnivores are very prolific in the absence of larger predators and often quickly become too numerous in areas where no control methods are utilized. The refuge currently has no scheduled hunts for raccoons, squirrels, and other small furbearers, but these hunts may be recommended in the future. If implemented, the season(s) should be sufficient to result in harvests that keep the populations from expanding beyond moderate levels.

Strategies:

- Consider implementing raccoon hunting.
- Consider implementing a special raccoon hunt that allows use of dogs at night.
- Consider implementing gray squirrel hunting.
- The refuge staff should support State Resident Game surveys by completing the survey sheets and submitting them on schedule.

Objective 3B: Nongame Animals – Maintain healthy and viable populations of nongame animals on the refuge.

Discussion: The opportunity exists to manage for both open pine forest associated and mature hardwood associated nongame species at ACE Basin NWR. The landscape context suggests that a focus primarily on improving forest habitat conditions should be emphasized without much concern that surrounding land use may lead to elevated nest depredation and parasitism pressures. The number one priority for ACE Basin NWR with respect to forested habitats is to implement the existing forest management plan. An opportunity exists to convert existing pine plantations on the refuge to more appropriate forest habitat conditions. This, in turn, may lead to providing better support for accomplishing other objectives in improving forest structure for forest songbirds in pine/hardwood mix and bottomland hardwoods. For the longleaf and appropriate loblolly pine-dominated habitat at ACE Basin NWR, basal area would need to be reduced by about 50 percent in most stands and more aggressive prescribed burning would be necessary to promote a grassy-herbaceous dominated ground cover. This habitat condition should support the Bachman's sparrow, brown-headed nuthatches, and in wetter areas, wintering Henslow's sparrows.

For the mixed pine/hardwood and higher site bottomland hardwood, we should expect at least modest support for priority forest species such as the wood thrush, worm-eating warbler, Kentucky warbler, and Swainson's warbler, as well as many other bird, mammal, reptile and amphibian species. These conditions would include thinning canopy to about 60 percent cover allowing understory vegetation layer to increase and then through group selection-sized openings, increase denser patches of understory vegetation. Supporting canebrake conditions would be part of this management, which in addition to nongame songbirds, should provide important diurnal habitat conditions for both nesting and foraging American woodcock. The emphasis of the fire management plan is to reduce advanced rough and duff layers that have accumulated for decades. This is in the short-term an appropriate strategy, but ultimately growing season fires will be required to fully restore appropriate habitat conditions.

Strategy:

- Complete SCDNR nongame surveys and report within requested timeframes.

Objective 3C: Native Fishes – During the life of this CCP, work with partners to document the native warmwater fish species present on the refuge, the habitats used by them, and their health and current population sizes.

Discussion: Warmwater fish generally are those that are able to survive water temperatures above 80° F and are generally more tolerant of poor water quality (low dissolved oxygen, high sedimentation). Typically, these are species that inhabit ponds, lakes, and slow-moving shallow rivers and canals. On the refuge, warmwater fish include largemouth bass, sunfish, bowfin, gar, and catfish. Warmwater fish are a part of the aquatic community and a prey-base for other wildlife such as birds and otters. Many of these fish species are also targeted by anglers.

Strategy:

- Partner with the National Estuarine Research Reserve (NERR), SCDNR, the Service's Bears Bluff National Fish Hatchery, and the Nemours Wildlife Foundation to conduct surveys and population assessments of fish species within the refuge acquisition boundary.

Objective 3D: Reptiles and Amphibians – Restore isolated wetlands within 5 years of the date of this CCP to improve breeding areas of amphibians. Also within 5 years of the date of this CCP, determine presence/absence of amphibian and reptile species on refuge.

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

Strategies:

- Conduct baseline amphibian/reptiles surveys using various methods (e.g., pitfall traps, cover boards, vocalization surveys, etc.) for major refuge habitat types.
- By 2010, determine status of diamond-backed terrapin in natural marshes.

Goal 4: EXOTIC, INVASIVE, AND NUISANCE SPECIES

Objective 4A: Control of Nuisance Plants – Control and eliminate, where feasible, exotic, invasive, and nuisance plant species on the refuge to maintain and enhance the biological integrity of the refuge's native South Carolina coastal plain habitats.

Within 3 years of the date of this CCP, identify all exotic plant species and produce appropriate mapping using GIS technology to track infestations.

Discussion: The occurrence and spread of exotic, invasive, and nuisance plant species have been identified by Service staff and intergovernmental partners as one of the priority management issues facing the ACE Basin NWR (Biological Review, Ernest F. Hollings ACE Basin NWR, U.S. Fish and Wildlife Service 2006). Exotic species have invaded all refuge wetland and upland habitats, as well as disturbed sites. Invasive species can have negative impacts to natural plant diversity and to 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. Control efforts by the refuge have been limited by staff and funding. Most efforts are focused on reduction of invasive seed sources throughout the refuge, and on Chinese tallowtree and Phragmites control. The refuge has received limited funding for invasive plant control for these projects.

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 re-surveyed to identify new 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, in order to assess the effectiveness of control efforts and to re-direct ongoing control efforts as needed.
- Seek additional funding for contracted exotic plant control
- Continue routine spraying of invasive plants on outer edges of identified concentrations of invasive plants for containment purposes.
- Work closely with the Region's Invasive Strike Team for funding and technical support.
- Maintain a minimum of one staff member with a South Carolina Pesticide Applicators License.
- Attend South Carolina Exotic Pest Plant Council meetings to gain knowledge on invasive plant management and additional funding sources.
- Closely monitor all controlled burn sites and areas where mechanical disturbances has occurred for new infestations of invasive plants.

Objective 4B: Control of Feral Hogs – Control populations of feral swine to protect wildlife and habitat on the refuge.

Discussion: Feral hogs continue to be a problem throughout the ACE Basin. The control of feral swine populations is critical to the health of native species, bottomland hardwood forest habitats, and overall management objectives of the refuge. This species destroys native vegetation and competes heavily with numerous wildlife species. Swine also depredate the nests of ground-nesting birds, many species of reptiles and amphibians, and young birds and mammals. In addition, they can cause considerable damage to dikes and roads.

Total elimination of swine populations, barring a disease epidemic, is virtually impossible. Management efforts must be focused on long-term intensive control utilizing multiple methods. Currently, hunters are allowed to harvest as many hogs as they wish during the regularly scheduled deer hunts.

Strategies:

- Utilize a variety of control methods aimed at reducing existing swine populations and preventing expansion of swine numbers on the refuge.
- Maintain current levels of hunting pressure. Consider expansion of public swine-only hunts when possible.
- Continue as much as possible the practice of incidental takes of hogs by Service personnel during performance of routine duties.
- Explore the possibility of issuing special use permits for one or more local parties willing to trap swine on the refuge. Contractors would provide all materials and expenses in exchange for all the captured swine. A provision of the permit would be that none of the captured swine would be released or sold alive at any location.

Objective 4C: Control of Feral and Free-roaming Animals – Within 5 years of the date of this CCP, coordinate with partners to minimize adverse impacts of feral and free-roaming animals to native wildlife and habitats.

Discussion: Feral and free-roaming animals are domesticated animals that have become wild and unsecured pets and livestock, including cats, dogs, goats, horses, cows, and poultry. These animals may have a negative impact on refuge wildlife and habitats through predation, grazing, trampling, disease spread, and unwanted cross-breeding.

Strategies:

- Coordinate with partners to control feral and free-roaming animals to minimize adverse impacts to wildlife and habitat.
- Utilize existing county animal control agents for coordinated removal of feral and free-roaming animals.

Goal 5: WILDLIFE AND HABITAT DIVERSITY

Objective 5A: Moist Soil Units – During the life of this CCP, increase the productivity of moist-soil units by at least 25 percent to provide native wetland vegetation as forage for wintering waterfowl.

Discussion: "Moist soil management" refers to all wetland management units on the refuge where water levels from tidal river water are managed for freshwater production of moist-soil plants as the primary objective. Typically, this involves maintaining water levels to create a moist-soil type condition conducive to the production of beneficial seed-producing plants throughout the spring germinating period and summer growing season. Undesirable invasives during the summer growing season include sesbania, if disturbed and dry early in the season, and southern wild rice, if maintained too wet anytime during the growing season. The plant growth in this geographic area is usually so dense that mechanical manipulation or prescribed burning is needed to encourage accessibility to waterfowl and to scarify the seedbed for next year's seed germination. Each unit is then flooded to make seeds or invertebrates available to foraging wildlife, usually waterfowl, during the fall and winter. Depending on water levels, other bird species which may benefit include seed-eating neotropical fall migratory birds, wintering sparrows, rails, and raptors. Finally, the cycle will

begin again with spring drawdown and germination. Although moist-soil units require more active management than flooded crop impoundments, they provide higher nutritional value forage to waterfowl. The refuge contains 1,750 acres of moist-soil units.

Strategies:

- Conduct vegetation transects during September 1-November 1 for each year for moist-soil units. Record dominant plant species and percent occurrence for each plant species in 1 m2 plots.
- Evaluate the potential for the creation of additional impoundments to support wildlife and habitat diversity.
- Evaluate and record the timing and effectiveness of managements activities (e.g., disking, mowing, and burning) to determine which methods produce the desired outcome.
- Determine timing for setting back succession/improving amounts and diversity of desirable wetland plants beneficial to waterfowl.
- Develop maintenance plan and schedule to maintain approximately 30 linear miles of wetland management unit dikes and the approximate 35 water control structures and associated canals and ditches that provide water delivery for the wetland management units.

Objective 5B: Greentree Reservoirs – Manage for healthy productive greentree reservoirs; these are especially important for wood ducks and potentially for nesting wading birds.

Discussion: Greentree reservoirs (GTRs) are bottomland hardwood forests that have been impounded with levees and are temporarily flooded during fall and winter to provide food and habitat for wintering waterfowl (Rudolph and Hunter 1964). Research has suggested that this practice can negatively impact bottomland hardwood stands, leading to decreases in mast production (Francis 1983), tree vigor and growth (King 1995), and regeneration (Young et al. 1995). There is also evidence that artificial flooding regimes applied to GTRs can shift tree species composition towards more flood tolerant species (Karr et al. 1990; King 1995). Problems associated with these sites can often be tied to inundation that extends into the growing season (Wigley and Filer 1989), reducing soil aeration, killing less water-tolerant tree species, and increasing overstory mortality (King and Allen 1996). If managed properly, GTRs can provide a valuable habitat, including feeding and resting areas for waterfowl. The refuge contains two GTRs totaling 95 acres (50 acres and 45 acres in size, respectively).

Strategies:

- All the GTRs should not have the same water levels in a given year.
- Each unit should occasionally be left unflooded or with a very low water level.
- The dry cycle should also be staggered among units so that they are not all “alike.”
- In all GTRs, all surface water should be drawn off before the growing season (“bud break” or “leaf break”). The exception to this would be small flooded patches of a few acres near water control structures that provide good habitat for wood ducks and wading birds.

Objective 5C: Brackish Impoundments – Ensure that adequate food and cover for waterfowl are provided for each wintering season. A secondary, but very important objective is to provide for other bird groups (e.g., shorebirds, rails, and wading birds).

Discussion: Edisto Unit – Jehossee Island. The management priority for Jehossee Island should be to produce habitat for a diversity of avian species, with waterfowl serving as the management emphasis. The unit contains 255 acres of managed brackish impoundments (Table 4 and Figure 3).

Table 4. Jehossee Island wetland management units (WMUs) with acreages

Unit	Tract	WMU	Major Wetland Type	Acres
Edisto	Jehossee	J1	Emergent wetlands/submerged aquatic vegetation (SAV)	80
Edisto	Jehossee	J2	Emergent wetlands/SAV	150
Edisto	Jehossee	J8	Emergent wetlands/SAV	25
Total				255

The primary wintering waterfowl habitat is the managed impoundments. All 255 acres of managed brackish marsh occurs within three managed impoundments. These are the only units on the refuge that lend themselves to brackish management. The target salinities for management are 5-15 ppt. The soils beneath the managed impoundments are mineral soils; loam, silty clay loam, and loamy fine sand. These soils are suitable for both SAV and moist-soil management. Vegetation management should be targeted for either SAV, primarily wigeon grass, or moist-soil vegetation, primarily dwarf spike rush and saltmarsh bulrush.

Developing tract J8 into a separately managed 25-acre unit impoundment would greatly increase management flexibility and thus allow more optimum management for waterfowl while accommodating management needs for shorebirds, rails, and wading birds.

Strategies:

- Jehossee Island – Build approximately 750 feet ($350,000) of internal dike and purchase and install a new rice trunk ($100,000) and a new flash board riser ($15,000) to independently manage a 25-acre subunit (J8).
- Hire a maintenance/equipment operator dedicated to perform necessary management and maintenance actions on the 4,500-acre Jehossee Island.
- Construct a pole shed on Jehossee Island to protect equipment from the harsh salt air environment.
- Obtain a barge and construct a barge docking/landing facility on the Grove Unit (Dawhoo River) and on Jehossee Island to enable the safe transport and loading/unloading of heavy equipment and material between the mainland and the island.

Objective 5D: Natural Marsh – Maintain natural marsh as important fish nursery habitat and as habitat for secretive marsh birds, wading birds and sparrows.

Discussion: Nearly 4,000 acres are identified as natural marsh on the refuge, with over 3,000 acres on the Jehossee Unit. The natural marsh is subject to tides and structure can be managed through prescribed burning to keep shrub encroachment to a minimum. During the last several decades, overall loss of freshwater emergent wetlands has been underway as development pressures increase, especially away from immediate coastlines. The king rail, in particular, is thought to have declined dramatically from inland areas and is now considered to be a species in potentially deep conservation trouble away from coastal areas. The least bittern likely has never been common in the

Figure 3. Jehossee Island wetland management units

inner Coastal Plain, but is likely also suffering from freshwater wetland losses in recent decades. The purple gallinule is close to the northern edge of its distribution at ACE Basin, but is also a species that may be in decline locally, if not regionally. All these factors considered together suggest that ACE Basin NWR is well positioned to support healthy habitat for these and other marshbird species, when in the surrounding areas such habitat is now likely very scattered and in decline. Fire is the primary management tool for these wetlands. Although these marshes are not as high priority as the managed impoundments, they still need burning, especially in the high marsh to keep out shrub encroachment. Fire management capabilities are driven by the availability of crews and the right conditions (i.e., cured vegetation). One trigger that should push burning to a high-priority level is shrub encroachment (e.g., hightide bush (*Baccharis halminifolia*) shading out the *Spartina bakeri* marshes).

Strategies:

- Implement long rotation of prescribed fire to limit shrub encroachment.
- Partner with the Nemours Wildlife Foundation to complete research comparing species distribution and abundance within natural marsh areas and impounded emergent vegetation units (rice fields).

Objective 5E: Upland Forest–Forested Uplands (1,156 acres) – Provide forest habitat conditions conducive to supporting both priority pine and hardwood associated species by 2010.

Discussion: Forested uplands include the following forest types: natural pine (e.g., loblolly, longleaf and pond pine), pine plantations, and upland hardwood. The natural pine type occurs on old fields that have been left to succeed into pine forests and are maintained by the regular influence of fire. On well-drained sites, a mixture of loblolly and longleaf pines occurs. On wetter sites, pond pine integrates within the stand. Longleaf pine, also maintained by a regular fire regime, is found on dry flatwoods. The upland hardwood type occurs in sporadic localities adjacent to pine/hardwood sites.

Upland Hardwood (UH) – This type occurs in small bands adjacent to pine/hardwood and bottomland hardwood sites on slopes with moderately poorly drained soils. Dominant tree species include: water oak, white oak, post oak, Southern red oak, sweetgum, American beech, and Southern magnolia. Wax myrtle is the principal shrub.

Strategies:

- For the 1,270 acres of mixed pine/hardwood stands, if decision is made to move these towards open mature pine stands, then very aggressive management will be required as above. If decision is to favor hardwood conditions, then lighter thinning and patch openings will be required, with longer fire return intervals, by 2010. A lot of this would be better as pine/hardwood mix, but some should be longleaf. Need soil work site-by-site again through development of forest plan. If pine is focus, then open canopy, prescribe burn 3- 5-year cycle to minimize loblolly favor longleaf. If a move towards pine/hardwood mix, allow natural regeneration of hardwoods (will need to fight off loblolly seedlings).
- When forest management decisions are made, establish point counts in stands that will be subjected to management in the near-term as well as stands that will not be managed in the near-term to track bird responses by 2015.
- Evaluate forest habitat work with respect to amphibian and reptiles. Fire issues—dormant versus growing. Favor growing season eventually, but dormant season burning may be necessary to reduce fuel load.

Objective 5F: Upland Pine Forest – Provide forest habitat conditions conducive to supporting priority pine species by 2010.

Discussion: This type occurs on somewhat poorly drained soils of broad, flat, low areas and knolls. Dominant canopy species are loblolly pine, longleaf pine, and pond pine. Loblolly is the dominant pine species on all pine sites with the exception of Stand 3 in Compartment 3 (Grove north) where longleaf dominates. The midstory is dominated by sweetgum with mockernut hickory, swamp red oak, laurel oak, and switch cane also occurring. Shrub species include: wax myrtle, sparkleberry, and persimmon. Yellow jessamine, greenbriar, and blackberry are the principal vines.

Pine Plantations (PL) – The pine plantations are located on transition zones between forest wetlands and upland pine. Loblolly pine is the single tree species. Past logging and agricultural practices combined with present day forestry management have resulted in monotype loblolly pine plantations being establishment on the Barrelville, Bonny Hall, and Yemassee South Tracts. These plantations were established prior to refuge acquisition.

Strategies:

- Treat as much of the loblolly plantation pine (~300 aces on Barrellville, 358 acres elsewhere on refuge) as considered feasible.
- Maintain existing acres with fire and restore other areas by gradually removing loblolly and replacing with longleaf saplings. A minimum of 20 acres identified as longleaf pine stands and 175 acres identified as mixed longleaf/loblolly pine requires heavy thinning and the eventual return (by 2010) of growing season burning.

Objective 5G: Bottomland Hardwoods – Provide forest habitat conditions conducive to supporting water-tolerant priority hardwood species by 2015.

Discussion: While including a number of species found in the pine/hardwood type, bottomland hardwood forest occur on lower flats and are dominated by species tolerant of slightly longer periods of soil saturation and flooding (Wharton et al. 1982). Dominant tree species include overcup oak, swamp chestnut oak, water oak, and red maple. Although loblolly pine is present, spruce pine is the principal codominant pine species found on these wetter sites. Other codominants are: water hickory, pignut hickory, American hornbeam, and green ash. Shrubs and vines include switch cane, wax myrtle, fetterbush, dwarf palmetto, catbrier, sawbrier, poison ivy, and Virginia creeper. The ground layer is less dense than that of the pine/hardwood type and consists of a variety of herbs, grasses, and sedges, including netted chain fern, partridge berry, nut rush sedge, beak rush, sedges, plume grass, and panic grass. The Bald Cypress-Water Tupelo Swamp community occurs in the wettest parts of floodplains that have standing water for most of the year. As a result, few herbs occur. Along with bald cypress, water tupelo dominates the canopy. It is commonly found along the Combahee River.

Strategy:

- Of the about 1,498 acres of (mostly) bottomland hardwoods and upland hardwoods that are infrequently flooded (at least during the breeding season), establish management triggers and future desired conditions (which also address requirements for other priority wildlife, such as bats). By 2010, conduct light thinning and patch openings where there is very rare incidence of fire.

Objective 5H: Grasslands/Old Fields/Right-of-Ways–Fields and Openings (224 acres) – Within 5 years of the date of this CCP, work with partners to maintain grasslands and early successional scrub/shrub habitats on rights-of-way and in old fields within the refuge boundary.

Discussion: Grasslands and rights-of-way are characterized as grassy, weedy areas with some low shrubs. They are man-made habitats created by frequent plowing and/or mowing, which prevents larger woody plant species from taking hold. These habitats host insects as well as small reptiles and mammals. Several smaller bird species may forage in grassy areas and feed on insects, fruit, and seed. Currently, refuge grasslands are mowed, burned, and mechanically/herbicidally treated for invasive exotic plants. Grassland areas can be further enhanced for forage by migratory birds.

Forest openings play a vital role in providing diversity for nesting, resting, and feeding requirements for many wildlife species. Refuge fields are maintained as permanent openings through planting (agricultural or cover crop) and periodic mowing or burning. Forest openings are upland areas that are permanently or temporary maintained in the early grass or successional stage. Forest regeneration areas provide temporary openings which are useful from 3 to 8 years depending on species and regeneration methods used. Permanent openings include food strips, permanent firebreaks, road rights-of-way, utility rights-of-way, and loading areas created during timber harvest operations. Rights-of-way and refuge roads traverse forested areas on the refuge, breaking up blocks of homogenous habitat to provide edge. A combination of clearings and openings help to provide the variety of habitats necessary to meet multiple management objectives.

ACE Basin NWR inherited large acreage of old fields in early successional condition. Most of this habitat is located on the Grove Unit. Original plans were to reforest these sites, but the refuge recognized the importance of these sites for painted buntings and Henslow's sparrows, among other grass/shrub mosaic or early successional species. In addition, these sites could also be important for supporting local American woodcock populations. Old pasture sites, especially where they grade to moist sites, could provide good wintering woodcock habitat. Woodcocks are presently declining throughout the Atlantic and Mississippi Flyways. This is thought to be due primarily to loss of early successional habitat.

Projections for future landscape composition within the Greater ACE Basin Ecosystem suggest that few relatively large and persistent early successional type habitats will be maintained. The emphasis on managing this habitat on the refuge should be to encourage optimum conditions for species of concern that prefer this successional stage.

Strategies:

- Schedule prescribed fire, mowing, and disking to provide optimal response of native vegetation.
- Seed with native plants.
- Establish a cooperative agreement with South Carolina Electric and Gas to restore the power line easements on the refuge to native grasses.
- Eliminate the spreading of nonnative grass seeds as ground cover following dirt work on the refuge.
- Limit mowing to fall, spring, and/or as needed to prepare for prescribed burning.
- Currently maintain old field areas in early successional growth with both shrubby vegetation and grassland.

Objective 5l: Prescribed Fire – Continue to conduct annual prescribed burns in approximately 1,750 to 2,000 acres of upland and wetland habitats based on resource, habitat and fuel management objectives, with highest priority to wetland management units, grasslands, and scrub/shrub and pine forests.

Discussion: A refuge fire management plan was developed (revised "Fire Management Plan 2008") to help enhance and maintain vegetative communities that are dependent upon or positively influenced by fire, for the benefit of wildlife, to promote nutrient cycling, and to 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 will also play a key and cost effective role 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 under-story and mid-story vegetation and provide snags for birds as nesting and foraging sites. Coordinate all burning operations to meet specific resource objective 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 can be placed on interpreting this important management tool. Prescribed fire and wildfire information is presently placed in some of our public information boxes in coordination with the state and county fire management teams.

Strategies:

- Continue to update present Fire Management Plan to include new Service polices on risk assessment and smoke management.
- Monitor effects of vegetative response to burning within these communities.
- Continue to update Fire Management Plan to include and emphasize resource management needs.
- Work closely with the District fire management staff to conduct prescribed burns on refuge lands.
- Introduce fire into forest habitats that have not seen prescribed burning for over 20 years while, at the same time, maintain 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 fire management program.
- Continue to maintain a system of fire breaks and Wildland Urban Interface (WUI) breaks to protect refuge and neighboring forests from potential wildfires.
- Institute growing season burns within historic longleaf pine and other appropriate age class pine forest to change forest structure for the benefit of ground nesting birds and recovery efforts associated with endangered red-cockaded woodpeckers.

RESOURCE PROTECTION

Goal 6: ACQUISITION BOUNDARY

Objective 6A: Land Acquisition – Actively seek to acquire from willing sellers all lands within the refuge acquisition boundary. This would be accomplished by fee title ownership at fair market price or by management agreements.

Discussion: The existing refuge acquisition boundary incorporates approximately 18,000 acres within the ACE Basin Project Area. A high priority should be placed on acquiring the McCloud tract that lies between the Barrelville Unit and the Grove Unit. This area is within the present acquisition boundary and will fill the gap that presently exists between the two parcels.

Strategies:

- Acquire strategic bottomland hardwoods within the refuge acquisition boundary along the Edisto River, Dawhoo River, Combahee River, and Toogoodoo Creek to connect river wildlife corridors.
- Work with The Nature Conservancy (TNC), the Charleston County Greenbelt Program, Ducks Unlimited, and other partners to acquire strategic tracts along the Edisto River, Dawhoo River, Combahee River, and Toogoodoo Creek.
- Add key wetland corridors to the refuge acquisition boundary through a minor expansion.
- Identify areas where highest priority corridors for migratory birds and large mammals should be added to the current acquisition boundary.

Goal 7: CONSERVATION FOCUS AREAS AND EASEMENTS

Objective 7A: ACE Basin Task Force – The summarized objective of the ACE Basin Task Force is to facilitate the protection and conservation of the 350,000-acre ACE Basin Project Area, by seeking protective ownership or easement from willing landowners, while maintaining traditional uses of the lands.

Discussion: The ACE Basin Task Force was created in 1988 as a joint effort between federal and state governments, private landholders, and conservation groups (e.g., Ducks Unlimited, The Nature Conservancy, Lowcountry Open Land Trust) to conserve and protect the land in the watershed of the Ashepoo, Combahee, and Edisto Rivers. This joint effort has become an international model for other areas to protect valuable ecosystems from development. The ACE Basin Project Area incorporates the largest undeveloped estuary in the State of South Carolina and accordingly, supports or harbors a myriad of fish, wildlife, and plant species.

Strategies:

- Maintain ACE Basin Task Force committee seat.
- Actively support, according to MOU, all ACE Basin Partners in conservation efforts.
- Seek the purchase of property from willing sellers within the refuge acquisition boundary.

Goal 8: CULTURAL RESOURCES

Objective 8A: Archaeological and Historical Resources – Maintain and preserve in perpetuity the archaeological and historical resources of the refuge, exemplifying the natural and cultural history of 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 vandalizing, using a combination of informed management, law enforcement efforts, and public education. ACE Basin NWR follows standard National Historic Preservation Act Section 106 procedures to protect the public's interest in preserving the cultural and historic legacy that may potentially occur on the refuge. Whenever construction work is undertaken that involves any excavation with heavy earthmoving equipment, such as tractors, graders and bulldozers, the refuge contacts the Regional Archaeologist, who digs several test pits in the area to see if any significant archaeological resources exist in the area.

The 1828 Grove Plantation House (Refuge Headquarters) is one of only three antebellum homes still in existence in the ACE Basin, and the plantation itself was occupied by both Confederate and Union troops in the Civil War. The plantation also has other archaeological and historical resources dating back to Native American occupation prior to settlement of the land. Jehossee Island was one of the most productive rice plantations in the area, was owned by Governor Aiken, and still has the remains of some buildings and mills, as well as several cisterns and a cemetery. Bonny Hall and Combahee Fields were also plantations where rice was grown.

Limited interpretation of the Grove Plantation House has been accomplished with an in-house brochure. The refuge staff routinely shares the history of the plantation and the house and explains how the old rice fields (and their technology) are still used today to manage for waterfowl and shorebirds. The strategies below outline the Service's plan to achieve its mandated historic preservation responsibilities and to improve interpretation of this culturally significant site. No interpretation is done for Jehossee Island, Bonny Hall, or Combahee Fields.

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 sites to our cultural history.
- Develop signage to prominently display regulations prohibiting searching for and/or removal of objects of antiquity as included in the Antiquities Act of 1906.
- Develop outreach strategies utilizing periodic news releases, interpretive programs (i.e., archaeologists, Native American, Revolutionary, and Civil War subject matter experts), and special events to emphasize the importance of protecting cultural and natural resources.

VISITOR SERVICES

Goal 9: VISITOR ORIENTATION

Objective 9A: Providing Information to the Public – Ensure that visitors are able to easily find the refuge visitor center and/or all refuge units, as well as providing appropriate and sufficient information to guide visitors to areas of interest to them. Provide information on refuge programs, wildlife in the area, historical information, etc.

Discussion: Currently, there are directional signs leading people to the Grove Plantation (Edisto Unit) from Highway 17, whether traveling north or south. Also, there are various brochures (i.e., Grove Plantation in-house publication, bird list, hunting and fishing regulations, trail map, refuge brochure, and the ACE Basin Project brochure published by the SCDNR) and a refuge-specific video that visitors can watch. Also, several kiosks have been installed and are awaiting panel installation to be complete.

Strategies:

- Upgrade signage as needed.
- Update brochures.
- Update trail map for Grove.
- Create formal brochure for Grove Plantation.
- Create brochures and trail maps for the Bonny Hall area of the refuge.

Goal 10: HUNTING AND FISHING

Objective 10A: Waterfowl, Small Game, Wild Turkey, White-tailed Deer, and Feral Hog Hunting – Continue to provide safe, quality recreational waterfowl, white-tailed deer, and feral hog hunting opportunities. Waterfowl hunting in the refuge's open marshes is consistent with the founding principle of the refuge to maintain traditional uses of the area. White-tailed deer and feral hog hunting help refuge management maintain a healthy refuge deer herd by preventing overpopulation and associated habitat and/or agricultural crop degradation, as well as helping to control invasive feral hogs and associated damage done by them. Large populations of small game animals, especially gray squirrels and raccoons, could provide the public a recreational opportunity on the refuge and reduce competition for nesting sites and mast with fox squirrels (for which no hunting season is allowed). Various units within the refuge harbor strong populations of wild turkey that could provide recreational hunting opportunities to user groups that have minimal access to hunt units such as youth and physically impaired persons.

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. 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 (e.g., 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. 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.

A 2-day "mobility impaired hunt" for hunters with disabilities is currently held on the refuge each year. This hunt is limited to people who are either permanently confined to a wheelchair or who need permanent use of mobility aids to walk, such as artificial limbs, etc.)

While there are no scheduled hog hunts, hunters are allowed to kill feral hogs during the scheduled deer hunts on the refuge. These feral hogs are an invasive species and do severe damage to the landscape.

Strategies:

- Continue to evaluate deer population for disease issues.
- As needed, provide USGS researchers with feral hog blood samples for disease coordination.
- Institute cooperative state/refuge hunt regulation and enforcement meetings on an annual basis.
- Estimate the refuge's deer population.
- All deer harvest information is collected at hunter check stations.
- Close the deer hunt areas to all other users during hunt days.
- Adjust hunting as adverse impacts are experienced by deer, other wildlife, and/or habitats.
- Monitor population status and trends.
- When opportune, implement small game and wild turkey hunts, especially for youth.
- Continue to assess the disturbance effects of waterfowl hunting adjacent to refuge impoundments and adjust setback zones accordingly.

Objective 10B: Freshwater Fishing Opportunities – Optimize the fishery resources of the refuge in accordance with the refuge's primary goals and objectives.

Discussion: Fishing for largemouth bass, bream, crappie, and catfish occurs on the refuge. Bank fishing is a popular activity on the refuge impoundments, canals, and river access locations. Boat access to the Edisto and Combahee Rivers is limited to the use of state boat ramps outside of refuge boundaries.

Strategies:

- In consultation with county, state, and federal partners, revise and update the refuge's Fishery Management Plan to provide a quality fishing experience.
- Periodically monitor fishing impacts on migratory birds, waterfowl, and threatened/endangered species.
- Develop canoe-kayak launch on the Toogoodoo Creek/Barrelville property.
- Continue to estimate the number of visits and hours spent at the refuge for the purpose of recreational fishing.
- Monitor fish populations by standard sampling techniques, keeping records of public use activity and conducting creel census when possible.
- Maintain signs directing the public to open fishing areas.
- Investigate the possibility of improving fishing access for anglers with disabilities.
- Keep brochure of maps and fishing regulations available to the public up-to-date.
- Continue to use the refuge news release program to inform the public of fishing events (e.g., Youth Fishing Day), refuge policies, and special events.
- Continue to provide and maintain fishing access areas around impoundments.
- Continue to patrol fishing areas to ensure compliance with fishing regulations.
- Enhance and develop the Bonny Hall Pecan Grove fishing ponds to encourage local residents' use of the refuge.

Goal 11: WILDLIFE OBSERVATION AND PHOTOGRAPHY

Objective 11A: Wildlife Viewing and Photography Opportunities – During the course of this CCP, work to increase wildlife photography and observation opportunities by adding additional photo blinds and evaluate potential for additional birding trails.

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 the Grove Unit, which enhances opportunities for wildlife observation and photography. Facilities on the Edisto Unit include two hiking trails with two elevated observation platforms (Goose Pond and Perimeter Pond, respectively), numerous unimproved observation points along refuge impoundments and river vistas, and approximately 25 miles of dirt roads and ricefield dikes open to foot and/or bicycle traffic on a seasonal basis.

Strategies:

- Maintain and enhance the observation sites to attract wildlife.
- Develop Toogoodoo Creek/Barrelville canoe-kayak launch with observation points from the abandoned railroad right-of-way.

Goal 12: ENVIRONMENTAL EDUCATION AND INTERPRETATION

Objective 12A: Visitor Contact Station – Provide a visitor contact station that instructs and informs the public of the refuge's mission and objectives, both globally and locally, while utilizing the antebellum period culture as a method of instruction.

Discussion: Currently, the refuge visitor contact station consists of a room with information and pamphlets and the ability to watch a short video on the ACE Basin Refuge and Project area. Staffing levels challenge making this contact station available to the public at all hours the refuge is open for access. Adjacent to the Administrative Office is a period architecture structure known as the Kitchen House. This structure is adequately sized and in fair repair that with the addition of appropriate displays and exhibits would provide an excellent self-serve visitor contact station.

Strategy:

- Within the 15-year life of this CCP, seek funding sources and convert the Kitchen House into a visitor contact station.

Objective 12B: Interpretive Programs and Environmental Education Opportunities – Over the 15-year life of this CCP, continue to expand the environmental education and interpretation program.

Discussion: Environmental education is a cost-effective way of educating the public about the role and importance of the refuge in the landscape. The refuge currently conducts, in concert with the SEWEE Association, an Earth Stewards program for local fifth graders. This program involves both classroom and field ecology study, which the students and schools find most rewarding. The earlier the children are instructed on natural systems and mankind's impacts upon those systems, the more likely the next generation will support the Service's conservation goals and missions. Additionally, the refuge partners with the SCDNR and NERR facility to provide environmental education and interpretive programs to the public of all ages.

Strategies:

- Develop onsite and offsite curriculum-based educational programs with messages focused on the role and importance of the refuge in the landscape
- Hire a full-time environmental education/outreach park ranger.
- Develop and conduct outdoor classroom activities.

- Manage the refuge website from the refuge to improve information provided therein.
- Disseminate refuge brochures and environmental education and interpretation materials.
- Train staff, volunteers, and teachers to conduct onsite and offsite educational and interpretive programs.
- Develop lesson plans and train local teachers to use the refuge as an outdoor classroom.

Objective 12C: Interpretive Trails – Within 5 years of the date of this CCP, add 2 hiking trails (1 each on the Edisto and Combahee Units).

Discussion: While the visiting public is encouraged to hike on the existing refuge roads and ricefield dikes, dedicated hiking trails for environmental interpretation are lacking. Due to the geographic distance between the Edisto and Combahee Units (approximately 20 miles), efforts should be made to provide interpretive trails on each unit.

Strategies:

- Within 5 years of the date of this CCP, develop a network of interpretive trails that originates at the Bonny Hall Pecan Grove parking lot.
- Within 5 years of the date of this CCP, develop a network of interpretive trails that extend and complement the existing Alexander Pond trail on the Grove subunit of the Edisto Unit.
- Construct interpretive signs and kiosks including a sign with an audible component on the Grove subunit.

Goal 13: OUTREACH

Objective 13A: Local Residents – Actively seek and maintain a positive connection between the refuge and local residents.

Discussion: Due to the remoteness of the refuge units and the rural character of the landscape, the existing neighboring human populations are rather small. While the refuge maintains an extremely positive and productive relationship with large-acre landowners that are part of the ACE Basin Project Area, smaller tract residents have not yet been reached. In order to maintain support for the refuge and for the refuge to support local communities, outreach opportunities need to be developed to bring local residents into understanding of the Service's mission.

Strategies:

- Expand upon the Earth Stewards program with local elementary schools to include the children's parents and family members in like programs.
- Continue support between the refuge's fire program and local rural fire departments.
- Host fishing days and other special events that are appropriate for the region.

Goal 14: FRIENDS GROUP AND VOLUNTEERS

Objective 14A: Volunteers – A sufficient number of skilled and trained volunteers will be available to support the refuge in meeting its mission and purposes.

Discussion: ACE Basin NWR volunteers currently contribute approximately 1,200 hours in general maintenance, assistance with refuge programs, administrative work, and biological data collection.

Strategies:

- Construct recreational vehicle hookup sites with cement pads.
- Actively recruit resident volunteers and interns.
- Develop a volunteer program that consists of resident and local volunteers and interns.

Objective 14B: SEWEE Association – Over the 15-year life of this CCP, continue to maintain a close working relationship with the SEWEE Association, assisting in promoting the growth in membership and financial revenues, providing input on refuge needs, and working to align interests.

Discussion: The SEWEE Association is an advocate for the refuge, supporting refuge goals and objectives, and providing financial and volunteer staff support for refuge programs.

Strategies:

- Actively recruit additional members for the SEWEE Association.
- Maintain positive working relationship with the SEWEE Association through meeting attendance and refuge support of the Association's programs.

Goal 15: LITTER CONTROL

Objective 15A: Control of Trash and Litter – Provide refuge wildlife and visitors with a litter-free environment.

Discussion: Trash and litter are unsightly and cause problems for wildlife. Plastic bags can be ingested by larger species, causing suffocation or fatal intestinal blockage. Bottles can cause entrapment of small animals and invertebrates. Plastic six-pack rings and other plastic strapping materials can cause entanglement in birds and other wildlife. Most visitors will unfavorably rate their experience if they experience high levels of trash and litter.

Strategies:

- Increase the number of clean-ups through coordination with area service groups and schools.
- Ensure that refuge is included in area clean-up projects.
- Increase public awareness on the problems associated with trash.
- Increase law enforcement surveillance.

REFUGE ADMINISTRATION

Goal 16: REFUGE MANAGEMENT

Objective 16A: Administrative Facilities and Signs – Maintain adequate administrative support facilities and signage on all refuge units to orient visitors concisely and accurately.

Discussion: The refuge's administrative functions are primarily provided out of the offices within the Grove Plantation House on the Edisto Unit. This antebellum period structure provides ample work space for staff and serves as the visitor contact station and a draw for tourists. A negative of the facility is its age and construction design, circa 1828, and the fact that all repair work has to be accomplished in accordance with National Register-listed historic properties. Refuge signs require

periodic maintenance and interpretive design is being incorporated into existing information panels and kiosks. Additional trail directional and regulatory signs need to be put in place on all units of the refuge to better orient visitors.

Strategies:

- Develop long-term management plan for Grove Plantation House, with the assistance of the Regional Office (Engineering and Facilities Division and Regional Archaeologist).
- Deferred maintenance priorities and percentages will reflect a wildlife and habitat diversity management focus.
- SAMMS work orders will reflect and support the management priorities of the refuge.

Objective 16B: Staff – Within the 15-year life of this CCP, provide a full complement of 12 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 will be required. Along with additional staff, additional support equipment and facilities will be needed (e.g., office space, computers, and vehicles). The refuge will emphasize recruiting and retaining staff, 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) will involve geographic information systems (GIS) and global positioning systems (GPS).

Strategies:

- Hire a park ranger, GS-7/9, to carry out public use and interpretation programs.
- Hire a wildlife refuge specialist, GS-7/9/11, to support the refuge's biological programs and function as a deputy refuge manager.
- Hire a tractor operator, WG-6, to mow grass and fields.
- Hire a forester, GS-9/11, to deal with forestry issues, such as timber harvest and thinning operations.
- Hire a law enforcement park ranger, GS-5/7/9, to help with public use and visitor safety issues.
- Hire a maintenance worker, WG-5, to assist with maintenance of equipment and facilities.

Objective 16C: Law Enforcement – The refuge will have sufficient law enforcement staff to protect the visiting public and the refuge's facilities and wildlife resources. All officers will have adequate training and equipment to perform their duties.

Discussion: Refuge law enforcement is currently provided by two dual-function officers for all property protection, visitor services, and administration of the refuge's hunting and fishing programs. Due to the increasing workload of these officers, a full-time law enforcement officer will be added to the staff as soon as funding becomes available within the 15-year life of this CCP.

Strategies:

- Develop or update existing Law Enforcement step-down plan.
- Provide up-to-date training and equipment for collateral duty and full-time duty officers (Complex staff).
- Develop memorandums of understanding with state and/or county law enforcement agencies and 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 protocols for designating emergency contacts to ensure safety of refuge law enforcement personnel.
- Hire an additional full-time law enforcement officer.
- Develop procedures for adequately informing refuge visitors of hazardous conditions or areas.
- Collateral duty officer and complex law enforcement officer will coordinate with station visitor services program manager to develop outreach strategies to assist with attaining compliance with refuge regulations as needed (i.e., littering).

Goal 17: INTERGOVERNMENTAL COORDINATION

Objective 17A: Relationship with South Carolina Department of Natural Resources – Continue effective refuge coordination with the SCDNR as it applies to programs of mutual interest, including public use activities, research, law enforcement, wildlife, and habitat management.

Discussion: The relationship between the refuge's most valued partner, the SCDNR, which shares the primary goals and objectives with the Service and which also often shares funding sources, enables the high level of natural resource protection and management that exists in the Ace Basin Project Area. The SCDNR staff participates in the review and makes recommendations at all stages in the development and implementation of management plans on the refuge. The SCDNR's staff members are recognized in the highest regard as experts in the disciplines pertaining to wildlife and fish resources and their management.

Strategies:

- Continue to hold 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 with the SCDNR on projects.
- The refuge manager will continue to serve as a board member of the SCDNR-managed NERR located in the ACE Basin and collaborate on projects of mutual interest.
- Renew as necessary and enthusiastically encourage cooperation and abide by the existing Memorandum of Understanding between the refuge and the SCDNR (and other ACE Basin Project partners) involving the sharing of equipment and expertise for project achieving common goals and objectives.

Goal 18: GLOBAL WARMING ISSUES

Objective 18A: Climate Change – Provide opportunities to study the effects of climate change by encouraging associated research on the refuge.

Discussion: South Carolina is home to an incredible diversity of wildlife species, including 313 species of birds, 96 species of mammals, 120 fish species, 72 species of reptiles, and 66 species of amphibians. Rising temperatures and sea level in the state will likely change the makeup of entire ecosystems, forcing fish and 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 30-80 years.

No one can be certain exactly how climate change would affect the refuge's plants and animals; however, there is little doubt that the effects would be quite noticeable when comparing biological notations over a span of 30-80 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. Because 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:

- Within 5 years of the date of this CCP, develop partnerships with other wildlife management agencies to share climate change issues and possible solutions to those changes.
- Throughout the 15-year duration of this CCP, train all refuge staff and volunteers to look for and document any notable change in wildlife and/or wildlife habitat.
- 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.

Objective 18B: Carbon Sequestration – Seek to make the refuge have a carbon-neutral footprint.

Discussion: Global warming and its varied predicted effects are attributable to the release of carbon compounds into the atmosphere from a variety of sources. Plants are primarily carbon dioxide consuming (binding) during transpiration, so efforts are underway globally to sequester excess atmospheric carbon by means of planting long-rotation forests and other plant communities as an offset to the millions of acres of plant communities that have been developed for other uses by mankind.

Strategy:

- Where opportune, seek partnerships to restore forest communities (replant longleaf forests) on the refuge and within the ACE Basin Project Area.

V. Plan Implementation

INTRODUCTION

Refuge lands are managed as defined under the Improvement Act. 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 CCP for ACE Basin NWR, this chapter identifies the projects, funding and personnel needs, partnership and volunteer opportunities, step-down management plans, a monitoring and adaptive management plan, and CCP review and revision.

PROPOSED PROJECTS

Listed below are summaries of the proposed projects and their associated costs for fish and wildlife population management, habitat management, resource protection, visitor services, and refuge administration over the next 15 years. These proposed projects reflect the priority needs identified by the public, the planning team, and the refuge staff based upon available information. The projects were generated for the purpose of achieving the refuge's objectives and strategies.

The projects described below are grouped according to the goals for the refuge.

FISH AND WILDLIFE POPULATION MANAGEMENT

Project 1 – Painted Bunting Habitat Use Study

The painted bunting is the breeding landbird that requires the most management attention at ACE Basin NWR. Although the painted bunting is already a species of Continental Conservation Interest, the eastern subspecies (possibly a separate species) is among the highest ranking taxa in the southeast in need of conservation attention. ACE Basin NWR may represent an important location for supporting eastern painted buntings in the outer Coastal Plain habitat. Research will address unanswered questions about its preferred territorial boundary establishment, nesting habitat, and long-term welfare. In addition to the painted bunting, other scrub/shrub species should benefit from maintaining appropriate conditions, including American woodcock (nesting and diurnal foraging habitat), prairie warbler, northern bobwhite, field sparrow, and eastern towhee.

Project 2 – Perform Reptile, Amphibian, Bat, Shorebird, and Marshbird Surveys

This project would conduct systematic standardized surveys to determine the presence and distribution of priority wildlife species and to provide baseline data to assist managers in developing appropriate management practices. The information collected would serve as the foundation for implementing the CCP, formulating habitat management, and developing adaptive habitat management strategies for species of conservation concern.

HABITAT MANAGEMENT

Project 3 – Hire Full-time Forester

This project would secure funding and hire a full-time GS-11 forester position. This position would implement and monitor all aspects of the refuge's Forest Management Plan, including mechanical thinning and harvest. This position would also coordinate with SCDNR's efforts to develop large-scale habitat protection initiatives connecting state and federal lands.

Project 4 – Improve water management capabilities for wintering waterfowl habitat, shorebirds migration habitat, wading bird habitat, and wood storks.

This project would repair, rehabilitate, and replace existing wetland management unit dikes, drainage features, and water control structures. The refuge's wetland management units comprise 2,735 acres between 27 different units, involve 30.4 miles of dikes (40 separate dikes), 2 bridges, 35 water control structures, 2 docks, approximately 80 miles of internal ditching, and 1 boat ramp.

Project 5 – Create Colonial Waterbird Nest Habitat

This project would install two water control structures and deepen existing ponds around pine islands on the Bonny Hall unit to promote colonial bird nesting.

Project 6 – Fire Effects Monitoring (especially long-term)

As the refuge implements its newly drafted Forest Management Plan, prescribed fire management techniques will be applied during the growing season on several units and within other units where fire activity has been nonexistent or occurring in widely spaced events. More aggressive forest management and fire application is planned for and fire effects monitoring is integral to adaptive management strategies for this plan to succeed in accomplishing its stated goals and objectives.

RESOURCE PROTECTION

Project 7 – Consider small properties within the refuge acquisition boundary for purchase as they become available and document conservation focus areas and wildlife corridors.

Through this project, the refuge would determine the wildlife value of small properties within the refuge acquisition boundary as they become available and work towards improving management of these lands. Furthermore, the refuge would document conservation focus areas and wildlife corridors in the vicinity of ACE Basin NWR and work to build conservation management agreements for these lands.

VISITOR SERVICES

Project 8 – Kitchen House Visitor Contact Station

This project would perform maintenance activities on the existing Kitchen House structure and install information panels and exhibits depicting the region's unique colonial rice field culture and its transition to modern day waterfowl, wading bird, marshbird, and other migratory and resident bird management.

Project 9 – Increase Outreach, Environmental Education and Interpretation

ACE Basin NWR hosts more than 20,000 visitors annually and is within 100 miles of 3 major metropolitan areas (Charleston, Columbia, and Savannah). The main focus of this project would be to build additional trails. In addition, the project would enable the refuge to employ an outreach and visitor services specialist to manage all visitor services and reach additional residents and school children to explain the refuge's role in the ACE Basin ecosystem, as well as ecological threats to the refuge and its resources. This position would improve partnership opportunities and expand educational and interpretive programs by working with sources, such as the friends group, volunteers, and other organizations and individuals. Refuge resources would be appropriately interpreted and communication with outside audiences via news releases, web media, and special events would be coordinated. One full-time park ranger for environmental education and outreach would be hired to develop education/outreach programs and train staff and volunteers to run the programs.

REFUGE ADMINISTRATION

Project 10 – Improve Maintenance Operations and Facilities Management

This project would provide one tractor operator/maintenance worker to improve refuge operations and facilities maintenance, including trails, roads and parking lots, kiosks, signs and water control structures. The worker would assist with maintenance of refuge buildings infrastructure and facilities. In addition, the worker would maintain over 40 miles of refuge dikes and roads, including the approximately 5 miles of causeways on Jehossee Island.

FUNDING AND PERSONNEL

Table 5 summarizes the projects described above. It also estimates the first year and recurring annual costs, and lists new staff positions. Figure 4 shows the refuge's current organizational chart, and Figure 5 shows the proposed organizational chart.

Table 5. Summary of projects

PROJECT NUMBER	PROJECT TITLE	FIRST YEAR COST (Dollars)	RECURRING ANNUAL COST (Dollars)	STAFF (FTEs)
Project 1	**Painted Bunting Habitat Use Study**	10,000	5,000	
Project 2	**Perform reptile, amphibian, bats, shorebirds and marshbird surveys**	30,000	20,000	
Project 3	**Hire Full-time Forester**	60,000	60,000	1 Forester

PROJECT NUMBER	PROJECT TITLE	FIRST YEAR COST (Dollars)	RECURRING ANNUAL COST (Dollars)	STAFF (FTEs)
Project 4	**Improve water management capabilities for wintering waterfowl habitat, shorebirds migration habitat, wading bird habitat, and wood storks**	785,000	50,000	
Project 5	**Create Colonial Waterbird nest habitat**	30,000	5,000	
Project 6	**Fire Effects Monitoring (especially long term)**	25,000	10,000	
Project 7	**Consider small properties within the refuge acquisition boundary for purchase as they become available and document conservation focus areas and wildlife corridors.**	25,000 – 500,000 (depending on property involved)	25,000 – 250,000	
Project 8	**Kitchen House Visitor Contact Station**	80,000	5,000	
Project 9	**Increase outreach and environmental education and interpretation**	50,000	50,000	1 Park Ranger
Project 10	**Improve maintenance operations and facilities management**	150,000	150,000	1 Tractor Operator + 1 Maintenance Employee

Figure 4. Current organizational chart, ACE Basin National Wildlife Refuge

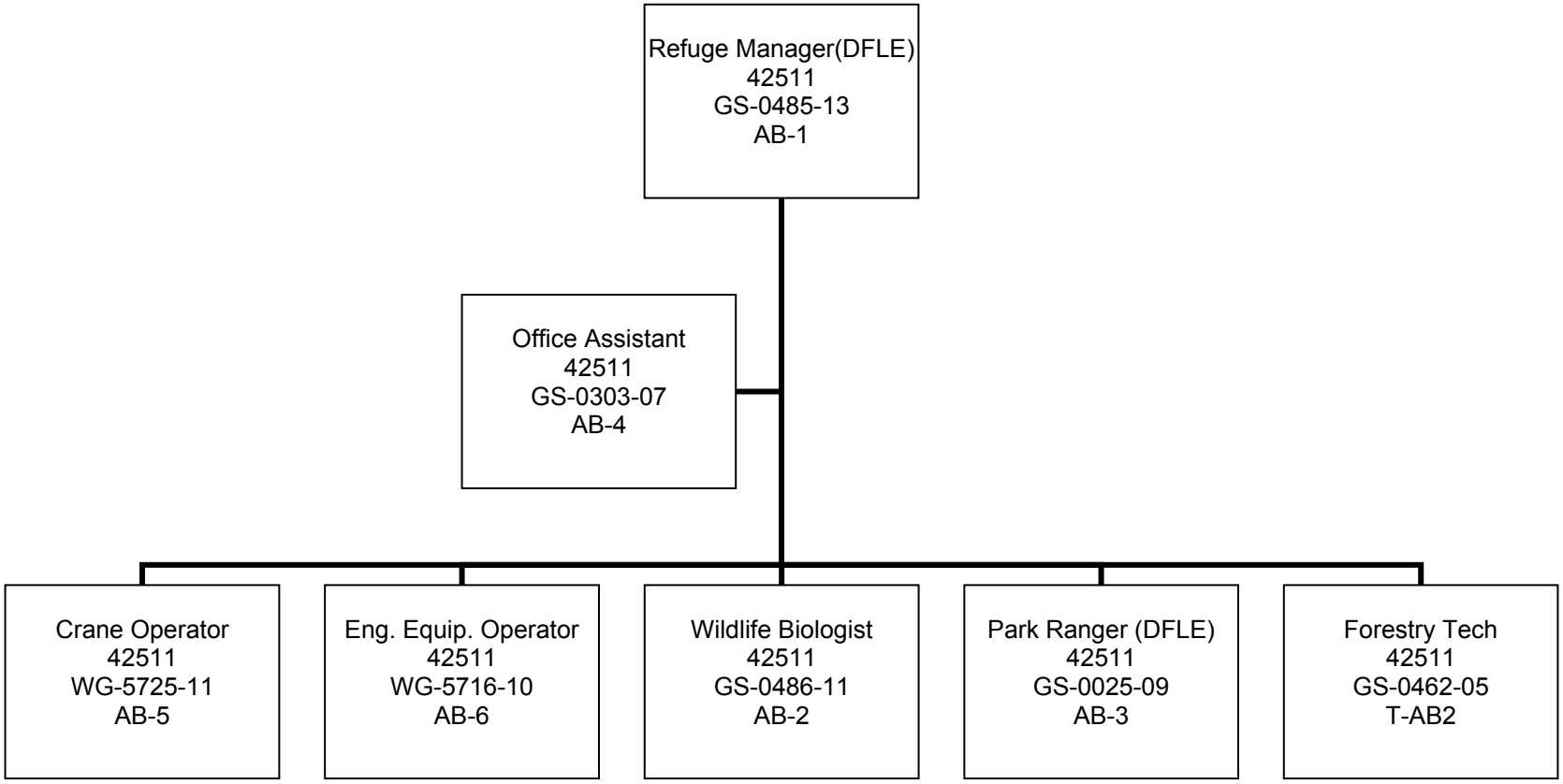
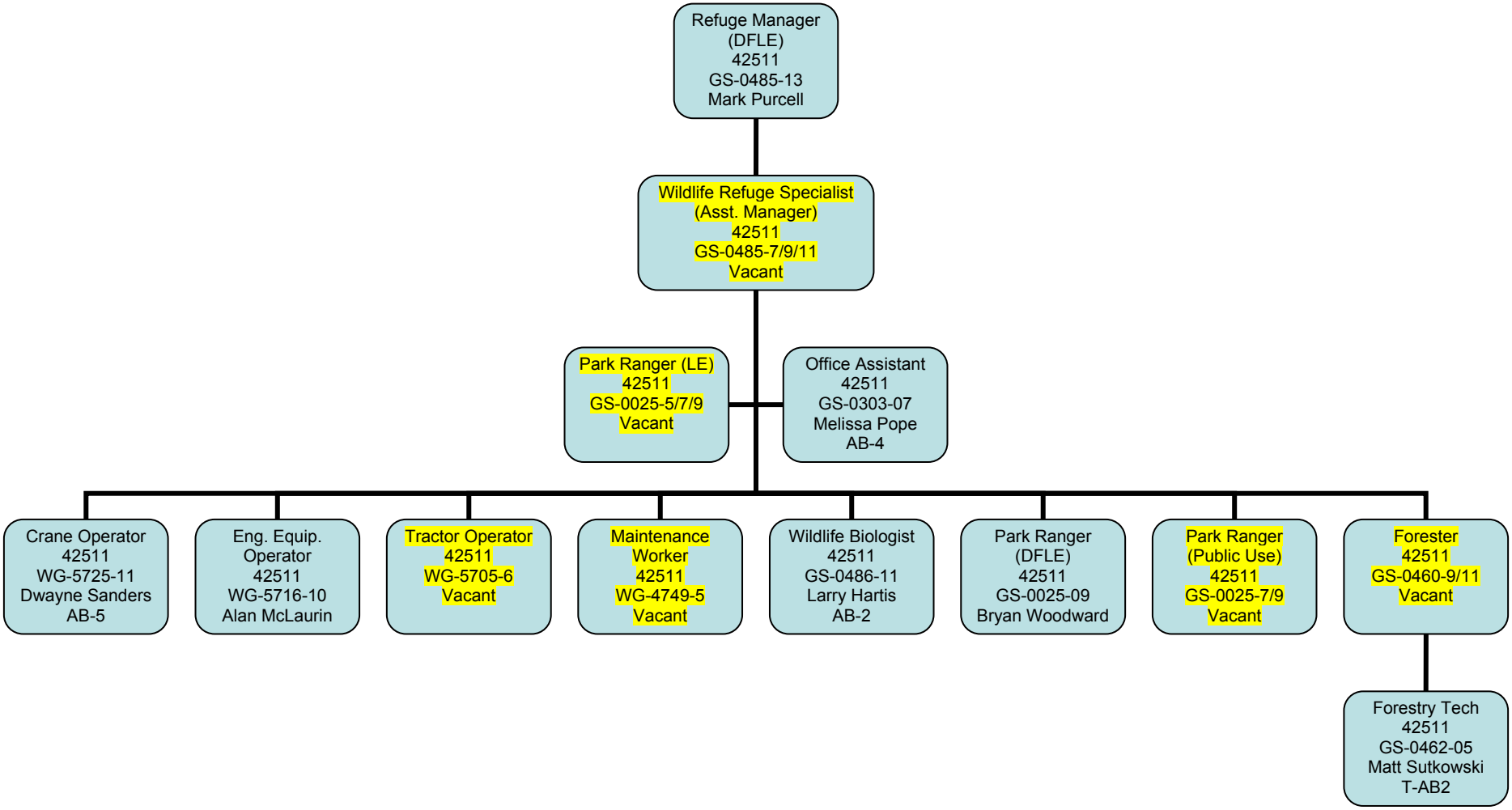


Figure 5. Proposed organizational chart for ACE Basin National Wildlife Refuge



PARTNERSHIP AND VOLUNTEER OPPORTUNITIES

A key element of this CCP is to establish partnerships with local volunteers, landowners, private organizations, and state and federal natural resource agencies. In the immediate vicinity of the refuge, opportunities exist to establish and/or enhance partnerships with the SEWEE Association; the elementary, middle and secondary schools in Charleston, Colleton, Beaufort and Hampton Counties; Caw Caw County Park; the Nemours Wildlife Foundation; Audubon's Francis Beidler Forest; and Edisto State Park. At regional and state levels, partnerships may be established or enhanced with organizations such as The Conservation Fund, Audubon Society, South Carolina Wildlife Federation, The Nature Conservancy, Ducks Unlimited, South Carolina Department of Natural Resources, National Park Service, National Estuarine Research Reserve, U.S. Geological Survey, U.S. Army Corps of Engineers, and other interested state and federal agencies.

STEP-DOWN MANAGEMENT PLANS

This CCP 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. These step-down management plans (Table 6) are also developed in accordance with the National Environmental Policy Act, which requires the identification and evaluation of alternatives and public review and involvement prior to their implementation.

Table 6. Refuge step-down management plans related to the goals and objectives of the comprehensive conservation plan

Step-down Plan	Completion Date
Forest Habitat Management Plan	2005
Hurricane and Disaster Action Plan	2008 (annual)
Wildlife Habitat Management Plan	2009
Visitor Services Review	2005
Fire Management Plan	2008
Hunting Plan	2006
Cultural Resources Management Plan (CRMP)	?
ACE Basin Project Memorandum of Understanding	2004
Sport Fishing Plan	1998
Biological Review	2006
Inventorying and Monitoring Plan	2011

MONITORING AND ADAPTIVE MANAGEMENT

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

To apply adaptive management, specific surveying, inventorying, 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 to 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, this CCP will be revised. Specific monitoring and evaluating activities will be described in the step-down management plans.

PLAN REVIEW AND REVISION

This CCP will be reviewed annually as the refuge's annual work plans and budgets are developed. 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. This 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 this CCP and the step-down management plans will be subject to public review and National Environmental Policy Act compliance.

VI. Consultation and Coordination

OVERVIEW

This chapter summarizes the consultation and coordination that occurred in developing this CCP.

The CCP for ACE Basin NWR was written by the CCP Planning Team (members listed below), with the participation and assistance of refuge and Service staff and the SCDNR.

In March 2004, a biological review of the refuge was completed. A team of 14 biologists conducted a comprehensive biological review of the refuge to help guide the development of the CCP. The participants in the biological review (listed below) were drawn primarily from the refuge, the Service, the Nemours Wildlife Foundation, Ducks Unlimited, and SCDNR.

A review of the refuge visitor services program was also conducted in 2004. The members of the visitor services review team included two professionals from the Service's Visitor Services and Outreach Division, Southeast Regional Office in Atlanta, and two public use experts from other national wildlife refuges.

The information and recommendations from the reports of both the biological review team and visitor services review team provided a valuable starting point for the development of this CCP. Subsequently, the refuge's CCP Planning Team hosted a public scoping meeting on July 25, 2007, and began an outreach campaign through various media to collect ideas and concerns from all stakeholders. Please refer to Chapter III, Plan Development, for more information on public scoping and the overall consultation and coordination that was involved in developing this CCP.

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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 a management plan. Analysis of results helps 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 (Service 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:	A category of actions that does 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:	A document that describes the desired future conditions of a refuge or planning unit and provides long-range guidance and management direction to achieve the purposes of the refuge; helps fulfill the mission of the Refuge System; maintains and, where appropriate, restores the ecological integrity of each refuge and the Refuge System; helps achieve the goals of the National Wilderness Preservation System; and meets other mandates (Service Manual 602 FW 1.6 E).
Concern:	See Issue
Cover Type:	The present vegetation of an area.

Cultural Resource Inventory:	A professionally conducted study designed to locate and evaluate evidence of cultural resources present within a defined geographic area. Inventories may involve various levels, including background literature search, comprehensive field examination to identify all exposed physical manifestations of cultural resources, or sample inventory to project site distribution and density over a larger area. Evaluation of identified cultural resources to determine eligibility for the National Register follows the criteria found in 36 CFR 60.4 (Service Manual 614 FW 1.7).
Cultural Resource Overview:	A comprehensive document prepared for a field office that discusses, among other things, its prehistory and cultural history, the nature and extent of known cultural resources, previous research, management objectives, resource management conflicts or issues, and a general statement on how program objectives should be met and conflicts resolved. An overview should reference or incorporate information from a field office's 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 U.S. 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 nonliving 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 “go along” with a course of action that they actually oppose (Bleiker).
Issue:	Any unsettled matter that requires a management decision [e.g., an initiative, opportunity, resource management problem, threat to the resources of the unit, conflict in uses, public concern, or other presence of an undesirable resource condition (Service Manual 602 FW 1.6K)].
Management Alternative:	See Alternative
Management Concern:	See Issue
Management Opportunity:	See Issue
Migration:	The seasonal movement from one area to another and back.
Mission Statement:	Succinct statement of the unit’s purpose and reason for being.
Monitoring:	The process of collecting information to track changes of selected parameters over time.
National Environmental Policy Act of 1969 (NEPA):	Requires all agencies, including the Service, to examine the environmental impacts of their actions, incorporate environmental information, and use public participation in the planning and implementation of all actions. Federal agencies must integrate NEPA with other planning requirements, and prepare appropriate NEPA documents to facilitate better environmental decision-making (40 CFR 1500).

National Wildlife Refuge System Improvement Act of 1997 (Public Law 105-57):	Under the Refuge Improvement Act, the Fish and Wildlife Service is required to develop 15-year comprehensive conservation plans for all national wildlife refuges outside Alaska. The Act also describes the six public uses given priority status within the Refuge System (i.e., hunting, fishing, wildlife observation, wildlife photography, and environmental education and interpretation).
National Wildlife Refuge System Mission:	The mission is to administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans.
National Wildlife Refuge System:	Various categories of areas administered by the Secretary of the Interior for the conservation of fish and wildlife, including species threatened with extinction; all lands, waters, and interests therein administered by the Secretary as wildlife refuges; areas for the protection and conservation of fish and wildlife that are threatened with extinction; wildlife ranges; game ranges; wildlife management areas; or waterfowl production areas.
National Wildlife Refuge:	A designated area of land, water, or an interest in land or water within the Refuge System.
Native Species:	Species that normally live and thrive in a particular ecosystem.
Noxious Weed:	A plant species designated by federal or state law as generally possessing one or more of the following characteristics: aggressive or difficult to manage; parasitic; a carrier or host of serious insect or disease; or nonnative, new, or not common to the United States. According to the Federal Noxious Weed Act (P.L. 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 occur from natural ignition or intentional ignition.
Priority Species:	Fish and wildlife species that 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 conservation 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 subunit." 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 of the Fish and Wildlife Service and the Secretary of the Department of the Interior, and recommended for designation by the President to Congress. These areas await only legislative action by Congress in order to become part of the Wilderness System. Such areas are also referred to as "pending in Congress" (Draft Service Manual 610 FW 1.5).
Record of Decision (ROD):	A concise public record of decision prepared by the federal agency, pursuant to NEPA, that contains a statement of the decision, identification of all alternatives considered, identification of the environmentally preferable alternative, a statement as to whether all practical means to avoid or minimize environmental harm from the alternative selected have been adopted (and if not, why they were not), and a summary of monitoring and enforcement where applicable for any mitigation (40 CFR 1505.2).
Refuge Goal:	See Goal
Refuge Purposes:	See Purposes of the Refuge

Songbirds: (Also Passerines)	A category of birds that is medium to small, perching landbirds. Most are territorial singers and migratory.
Step-down Management Plan:	A plan that provides specific guidance on management subjects (e.g., habitat, public use, fire, and 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, 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; and 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
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
FWS	U.S. Fish and Wildlife Service (also Service)
TFT	Temporary Full Time
USC	United States Code

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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 Secretaries of Interior and Commerce to enter into cooperative agreements with states and other nonfederal interests for conservation, development, and enhancement of anadromous fish and contribute up to 50 percent as the federal share of the cost of carrying out such agreements. Reclamation construction programs for water resource projects needed solely for such fish are also authorized.
Archaeological Resources Protection Act of 1979, as amended.	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, conservation of natural resources and protection of fish and wildlife. Some early refuges and hatcheries were established under authority of this Act.
Cave Resources Protection Act of 1988	Established requirements for the management and protection of caves and their resources on federal lands, including allowing the land managing agencies to withhold the location of caves from the public, and requiring permits for any removal or collecting activities in caves on federal lands.
Clean Air Act of 1970	Regulates air emissions from area, stationary, and mobile sources. This Act and its amendments charge federal land managers with direct responsibility to protect the "air quality and related values" of land under their control. These values include fish, wildlife, and their habitats.
Clean Water Act of 1974, as amended	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 Coastal Barrier Resources Act (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 Research Reserve 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 threatened and endangered species and the designation of critical habitats. Section 7 requires refuge managers to perform internal consultation before initiating projects that affect or may affect endangered species.
Environmental Education Act of 1990	This Act established the Office of Environmental Education within the U.S. 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 relative 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 national 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 nongame bird 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 System 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.
Fishery (Magnuson) Conservation and Management Act of 1976	Established Regional Fishery Management Councils comprised of federal and state officials, including the Fish and Wildlife Service. It provides for regulation of foreign fishing and vessel fishing permits.
Freedom of Information Act, 1966	Requires all federal agencies to make available to the public for inspection and copying administrative staff manuals and staff instructions; official, published and unpublished policy statements; final orders deciding case adjudication; and other documents. Special exemptions have been reserved for nine categories of privileged material. The Act requires the party seeking the information to pay reasonable search and duplication costs.
Geothermal Steam Act of 1970, as amended	Authorizes and governs the lease of geothermal steam and related resources on public lands. Section 15 c of the Act prohibits issuing geothermal leases on virtually all Service-administrative lands.

STATUE	DESCRIPTION
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 plants taken in violation of domestic or foreign laws. It regulates the introduction to America of foreign species.
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 the Interior for sea otter, walrus, polar bear, dugong, and manatee. The Department of Commerce is responsible for cetaceans and pinnipeds, other than the walrus. With certain specified exceptions, the Act establishes a moratorium on the taking and importation of marine mammals, as well as products taken from them.
Migratory Bird Conservation Act of 1929	Established a Migratory Bird Conservation Commission to approve areas recommended by the Secretary of the Interior for acquisition with Migratory Bird Conservation Funds. The role of the commission was expanded by the North American Wetland Conservation Act to include approving wetlands acquisition, restoration, and enhancement proposals recommended by the North American Wetlands Conservation Council.
Migratory Bird Hunting and Conservation Stamp Act of 1934	Also commonly referred to as the “Duck Stamp Act,” requires waterfowl hunters 16 years of age or older to possess a valid federal hunting stamp. Receipts from the sale of the stamp are deposited into the Migratory Bird Conservation Fund for the acquisition of migratory bird refuges.
Migratory Bird Treaty Act of 1918, as amended	This Act implements various treaties and conventions between the United States 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.

STATUE	DESCRIPTION
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-way over federal lands for pipelines.
Mining Act of 1872, as amended	Authorizes and governs prospecting and mining for the so-called "hardrock" minerals (i.e., 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 Congress. Several national trails cross units of the National Wildlife Refuge System.
National Wildlife Refuge System Administration Act of 1966	Prior to 1966, there was no single federal law that governed the administration of the various national 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 a refuge provided such use is compatible with the major purposes(s) for which the refuge was established.

STATUE	DESCRIPTION
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 Refuge System lands, identifies the Secretary of the Interior as responsible for managing and protecting the Refuge System, and requires the development of a comprehensive conservation plan for all refuges outside of Alaska.
Native American Graves Protection and Repatriation Act of 1990	Requires federal agencies and museums to inventory, determine ownership of, and repatriate certain cultural items and human remains under their control or possession. The Act also addresses the repatriation of cultural items inadvertently discovered by construction activities on lands managed by the agency.
Neotropical Migratory Bird Conservation Act of 2000	Establishes a matching grant 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, the United States, and Mexico. The North American Wetlands Conservation Council was 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 of fees for public uses.
Partnerships for Wildlife Act of 1992	Establishes a Wildlife Conservation and Appreciation Fund to receive appropriated funds and donations from the National Fish and Wildlife Foundation and other private sources to assist the state fish and game agencies in carrying out their responsibilities for conservation of nongame 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.

STATUE	DESCRIPTION
Rehabilitation Act of 1973	Requires nondiscrimination in the employment practices of federal agencies of the executive branch and contractors. It also requires all federally assisted programs, services, and activities to be available to people with disabilities.
Rivers and Harbors Appropriations Act of 1899, as amended	Requires the authorization by the U.S. Army Corps of Engineers prior to any work in, on, over, or under a navigable water of the United States. The Fish and Wildlife Coordination Act provides authority for the Service to review and comment on the effects on fish and wildlife activities proposed to be undertaken or permitted by the Corps of Engineers. Service concerns include contaminated sediments associated with dredge or fill projects in navigable waters.
Sikes Act (1960), as amended	Provides for the cooperation by the Departments of Interior and Defense with state agencies in planning, development, and maintenance of fish and wildlife resources and outdoor recreation facilities on military reservations throughout the United States. It requires the Secretary of each military department to use trained professionals to manage the wildlife and fishery resource under his jurisdiction, and requires that 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.
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.

STATUE	DESCRIPTION
Wilderness Act of 1964, as amended	This Act 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) program within the Departments 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 EOs and other actions in connection with 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 comprehensive conservation planning is the National Vegetation Classification System (NVCS), which is the adopted standard for vegetation mapping. Using NVCS facilitates the compilation of regional and national summaries, which in turn, can provide an ecosystem context for individual refuges.
EO 12962, Recreational Fisheries (1995)	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 July 25, 2007, at the Meggett Town Hall in Meggett, South Carolina. Meeting notices were published in the local newspapers; meeting notices were posted at the refuge and invitations were mailed to approximately 65 individuals and groups. A total of 3 members of the public attended the meeting. While attendance was low, it should be noted that when the ACE Basin Refuge was established in 1990, there were more than 60 public meetings with considerable attendance. Since the refuge's establishment, the surrounding community has embraced the refuge and has full confidence in refuge management.

ISSUES IDENTIFIED

Internal:

- Ensure up-to-date maintenance, rehabilitation, and replacement of the refuge water management and water delivery capabilities to meet migratory bird objectives (focus on waterfowl, waterbirds, and marsh birds) and include a comprehensive understanding of the ecology of wetlands and enhanced health of the wetland vegetative communities for all migratory birds. Maintenance of peat composition dikes and wooden rice trunk style water control structures requires atypical maintenance needs that can conflict with the existing SAMMS-based maintenance cycles.
- Control exotics and invasive and non-desirable plant communities on upland and wetland sites. This will include developing partnerships with SCDNR, USGS, USDA, and other agencies for funding to control exotic species.
- Develop the refuge volunteer program so that volunteers are available to assist with the biological program including bird monitoring, water quality monitoring, and 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, especially pertaining to youth.
- 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 (including prescribed fire smoke management).
- 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. Develop additional passive recreational uses on the refuge including the development of a canoe/kayak launch on the Toogoodoo River in concert with Charleston County "Greenbelt Conservation Funds."
- Reinvigorate efforts to acquire lands within the refuge acquisition boundary (as well as appropriate minor expansions), utilizing partners such as the ACE Basin Task Force, The Nature Conservancy, Ducks Unlimited, and Charleston County.
- Aggressively pursue timber management options to restore industrial-type timber lands to natural states.

- Achieve a full compliment of staffing at the refuge.
- Seek to eliminate easements and out parcels on the refuge by mutual agreements and willing buyer/seller opportunities.
- Seek long-term funding mechanisms and partnerships to adequately maintain the Grove Office and Jehossee Island caretaker's house: Historic Structures.
- Develop an effective cultural resources protection plan, to possibly include permanently restricting public access to Jehossee Island.
- Stabilize the bank/shoreline of Jehossee Island (south end) along the Edisto River.
- Expand threatened and endangered species recovery efforts on the refuge, including habitat management for whooping cranes.
- Consider seasonal closure zones of wetland management units during peak wintering waterfowl use periods.
- Expand pre- and post-season waterfowl banding operations, and summer mourning dove banding in concert with SCDNR.

State:

- Habitat loss, fragmentation, and/or alteration.
- Human disturbance of critical bird nesting areas.
- Chemical contamination of species from pesticides and other sources.
- Nonnative 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 accelerated 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, conservation 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:

- Plant survey of the refuge should be conducted with emphasis on rare native plants.
- Efforts should be made to increase Friends group participation.
- General concern regarding funding for refuge efforts, such as invasive exotic control and wetland impoundment maintenance.
- Jehossee Island should remain closed to general public access.
- The house on Jehossee Island should be restored or stabilized so that it does not collapse.
- The live oaks planted on Jehossee Island should be protected since these are planted in a very unusual spoke pattern rather than the typical "avenue-style" planting.
- The many cultural artifacts of the plantation era should be protected and preserved.
- Control of feral hogs is critical due to extreme habitat damage and cultural artifacts.
- There should be no hunting on the refuge.
- There should be some increased hunting opportunities on the refuge.
- Public use of the refuge for weddings, receptions, and commercial filming events.

SUMMARY OF COMMENTS ON THE DRAFT CCP/EA

All comments that were received on the Draft Comprehensive Conservation Plan and Environmental Assessment (Draft CCP/EA) for ACE Basin NWR are summarized in this appendix. Public comments on the Draft CCP/EA were accepted from May 1 to June 5, 2009, and comments from the State of South Carolina were submitted through the State Clearinghouse on May 1, 2009. A total of 5 individuals, organizations, businesses, and governmental agencies submitted comments on the Draft CCP/EA.

Under NEPA, the Service must respond to substantive comments. For purposes of this CCP, a substantive comment is one that was submitted during the public review and comment period which is within the scope of the proposed action (and the other alternatives outlined in the EA); is specific to the proposed action; has a direct relationship to the proposed action; and includes reasons for the Service to consider it. (For example, a substantive comment might be that the document referenced 500 individuals of a particular species, but that current research found 600. In such a case, the Service would likely update the plan to reflect the 600, citing the current research. While a comment that would not be considered substantive would be: "We love the refuge.")

The page numbers referenced relate to the original page numbers in the Draft CCP/EA that was released for public review and comment.

Comment: Take a more aggressive approach to dealing with the problem of feral hogs. The population has ballooned to monumental proportions in the last 7 years, and without all of us taking an aggressive approach, it's only going to be an increasingly severe problem.

Service Response: Objective 4-B of the CCP specifically addresses feral hog control. The refuge recognizes the feral hog problem and will undertake long-term intensive feral hog control utilizing multiple methods.

CHARLESTON ECOLOGICAL SERVICES FIELD OFFICE COMMENTS

Comment	Service Response
Cover page should read Ernest F. Hollings ACE (all caps) Basin NWR	Formatting determined according to Service standards
Throughout the document it goes back and forth from: refuge, Refuge, ACE Basin National Wildlife Refuge, and ACE Basin NWR; should be consistent throughout document	Editors maintained consistent terminology where applicable
pg. 12. third full paragraph, refers to the SC Wildlife and Marine Resources Department, which they were back then; however, in the remainder of the document when they refer to the beginning of the ACE Basin they refer to SC DNR	Changed to SC Department of Natural Resources
pg. 13. last paragraph, lists Carolina northern flying squirrel as federally protected species within SSPD, maybe it is but I am not aware of it.	Removed

Comment	Service Response
pg. 14. first paragraph, states that trust resources are endangered species – should be T&E	Added threatened
pg. 14. first paragraph under Regional Cons. Plans, lists acreage as of 2001, which is outdated – pg. 31 has a more updated acreage	Acreage figures updated
pg. 16. second paragraph under Biological Resources. Makes it sounds as if the wood stork has also been recovered.	Removed wood stork from sentence to avoid confusion
Pg. 16. last paragraph. In a lot of the ACE Basin the forested wetlands are relics of inland rice culture but there is no mention of this is in this description	Added that these areas are relics of inland rice fields
Pg. 17. last paragraph. Instead of the understory should use midstory for describing the sweetgum, hickory, etc.,	Changed
Pg. 19. second paragraph. RCW colonies are now referred to as clusters, says there are no RCWs in the ACE Basin but Brosnan Forest is within the ACE Basin focus area.	Changed to clusters, clarified language
Pg. 19. second paragraph, should probably refer to the puma as E. Cougar.	Changed to Eastern cougar
Pg. 22 Table 2 should have “spring peeper” listed, not spring pepper	Changed to peeper
Pg. 23 Table 2 heading needs to be corrected	Corrected
Pg. 28. fourth paragraph. Fish names are different than those used on pg. 23	The fish listed are different because the first instance relates to important species in general while the second instance refers to fish that anglers target.
Pg. 31. last paragraph. Is the ACE Basin project area the same as the focus area? If so then Dorchester, Orangeburg, and Bamberg Counties should also be included. These were not within the original focus area but are within the new focus area – in many places this document seems dated and may not have the most recent information.	Added the counties
Pg. 39. Discussion paragraph under Bald Eagle. States there are four active eagle nests on the refuge – conflicts with page 18, last paragraph, which states there are three active eagle nests; also – Bald eagle should be moved under Migratory Bird section since it is no longer federally listed.	Changed to three and section moved under migratory bird section

Comment	Service Response
Pg. 40. Wood stork strategies. Could mention working with the PFW program since we have done a lot in the past with wood stork pond management	Added to strategies
Pg. 43. second to last paragraph. Refers to dabbling ducks, last paragraph refers to puddle ducks – they are the same but they should stay consistent	Corrected
Pg. 44. rice trunk = $60,000? This is 5 – 6 times more than what other landowners pay per rice trunk – what's the difference?	The cost of a rice trunk for the refuge is approximately $50,000 to $60,000 if the location is accessible to vehicles, and double for locations accessible only by boat. Also, construction and size of a rice trunk affects cost. Refuge trunks tend to be larger and have greater engineering requirements than typical homeowner trunks.
Pg. 45. Wood ducks Discussion. Region 4 – who is this? Is this FWS Region 4? unclear;	Corrected
Pg. 45. Shorebirds. Discussion. Southbound migration – when is this? Most people probably know this but it should not be assumed.	Added that this occurs in autumn
Pg. 47. last section Strategies. Bugging habitat by 2005? May need to update.	Updated to 2015
Pg. 50. first paragraph. They want to convert pine plantations to mix pine/hardwoods just for deer? No shortage of deer habitat. Why not thin, burn, and convert to longleaf, which would also be good for deer?	The discussion is in the context of game animals. There is not an intent to convert everything to longleaf pine but a need to manage the various forest habitats for increased overall health.
Pg. 52. Reptiles and Amphibians. Want to restore isolated wetlands on the refuge – are there any to restore? No maps or aerials provided. Hard to say.	
Pg. 53. half way down. What is SC EPPC…hasn't been defined.	Corrected, Exotic Pest Plant Council
Pg. 54. last paragraph. Moist management is more intensive? There are no herbicides, fertilizers, lime applications, or cultivations with moist-soil management – just some soil disturbance and water level manipulations.	Modified to reflect that moist-soil management requires more active management as opposed to passive.
Pg. 56. first paragraph. SAV is used before acronym was provided; why are Latin names being used here but no where else?	Defined acronym.

Comment	Service Response
Pg. 57. Map is labeled both Figure 3 and Map 1. No north arrow, no label for river.	The image came from an existing document that could not be successfully modified to remove the text on the map itself.
Pg. 58. Upland Forest Strategies: there is no mention of basal areas, even vs. uneven age management, or converting to longleaf – all of which are important in upland forests. A lot of "ifs"…	This information is more detailed than a CCP and will be addressed in a forest management step down plan.
Pg. 59. first paragraph. As before – midstory should include the hardwood species in most cases. Strategies section - what are the 50'-60' strips for? 20-30 sq. ft. basal area? With loblolly? Are you underplanting longleaf?	Corrected the language to clarify.
Pg. 61. third paragraph. Prescribed and wildlife information?	Changed to wildfire.
Pg. 61. Strategies. Monitor effects of vegetative response not vegetations; Introduce fire back into forest habitats that **have** not seen….; Institute growing season burns…(Safe Harbor Program). – what does Safe Harbor have to do with the refuge's prescribed burning?	Corrected, Safe Harbor removed.
Pg. 91 – move bald eagle under migratory Birds in table	Moved

Appendix E. Appropriate Use Determinations

ACE Basin 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 a proposed use is not appropriate, it will not be allowed and a compatibility determination will not be undertaken.

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, 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. The Service considers 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. This law provides the authority for establishing policies and regulations governing refuge uses, including the authority to prohibit certain harmful activities. The 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 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. The 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 of fees for public uses.

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. The Service must comply with Executive Order 11644 when allowing use of off-highway vehicles on refuges. This order requires the Service to 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, Executive Order 11989 requires the Service to close areas to off-highway vehicles when it is determined 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 the Service's 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: EFH ACE Basin 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: Mark A. Purcell Date: 7/31/09

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: Brett E Hunter Date: 8/10/09

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

FINDING OF APPROPRIATENESS OF A REFUGE USE

Refuge Name: EFH ACE Basin National Wildlife Refuge

Use: Upland Game and Waterfowl 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: Mark A. Purcell Date: 7/31/09

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.

for Refuge Supervisor: Brett E. Hunter Date: 8/10/09

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

FINDING OF APPROPRIATENESS OF A REFUGE USE

Refuge Name: EFH ACE Basin 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: 7/31/09

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: 8/10/09

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

FINDING OF APPROPRIATENESS OF A REFUGE USE

Refuge Name: EFH ACE Basin National Wildlife Refuge

Use: Wildlife Observation & 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: Mat A. Purcell Date: 7/31/07

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: Brett E Hunter Date: 8/10/07

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

FINDING OF APPROPRIATENESS OF A REFUGE USE

Refuge Name: EFH ACE Basin National Wildlife Refuge

Use: Environmental Education & 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: Mark A. Purcell Date: 7/31/09

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.

for Refuge Supervisor: Brett E Hunter Date: 8/10/09

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

FINDING OF APPROPRIATENESS OF A REFUGE USE

Refuge Name: EFH ACE Basin National Wildlife Refuge

Use: Exotic & 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: W. A. Purcell Date: 7/31/09

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: for Brett E Bentzen Date: 8/10/09

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

FINDING OF APPROPRIATENESS OF A REFUGE USE

Refuge Name: EFH ACE Basin 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: Mike A. Prelis Date: 7/31/09

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: for Brett E. Hunter Date: 8/10/09

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

FINDING OF APPROPRIATENESS OF A REFUGE USE

Refuge Name: EFH ACE Basin 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 rescurces?	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: Mark A. Purcell Date: 7/31/09

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: for Brett E Hunter Date: 8/10/09

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

Appendix F. Compatibility Determinations

ERNEST F. HOLLINGS ACE BASIN NATIONAL WILDLIFE REFUGE COMPATIBILITY DETERMINATIONS

Introduction: The U.S. Fish and Wildlife Service has reviewed several uses for compatibility during the process of developing this CCP for Ernest F. Hollings ACE Basin National Wildlife Refuge (ACE Basin NWR). The descriptions and anticipated impacts of each of these uses are addressed separately. However, the "Uses" through "Public Review and Comment" sections, the "Literature Cited" section, and the "Approval of Compatibility Determinations" section apply to each use. If one of these uses is considered outside of the CCP for ACE Basin NWR, then those sections become part of that compatibility determination.

Uses: Several uses were evaluated to determine their compatibility with the mission of the National Wildlife Refuge System and the purposes of the refuge: upland game and waterfowl hunting, fishing/boating, wildlife observation and photography, environmental education and interpretation, bicycling, research, exotic and nuisance wildlife control, and forest management – commercial timber harvest.

Refuge Name: Ernest F. Hollings ACE Basin National Wildlife Refuge

Date Established: ACE Basin National Wildlife Refuge was established on September 20, 1990. The refuge was renamed the Ernest F. Hollings ACE Basin National Wildlife Refuge on May 16, 2005.

Establishing and Acquisition Authorities:

- Emergency Wetlands Resources Act of 1986 (16 U.S.C. 3901b; 100 STAT. 3582-91)
- Migratory Bird Conservation Act of 1919, as amended (16 U.S.C. 4601-4-4601-11; 90 STAT. 1313)
- Migratory Bird Hunting and Conservation Stamp Act of March 16, 1934, as amended (16 U.S.C. 718-718h).

Refuge Purposes: The primary purpose of Ernest F. Hollings ACE Basin NWR is for "... the conservation of the wetlands of the Nation in order to maintain the public benefit they provide and to help fulfill international obligations contained in various migratory bird treaties and conventions …" (Emergency Wetlands Resources Act of 1986).

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

Public Review and Comment: The notice of availability for a 30-day public review of the ACE Basin National Wildlife Refuge Draft Comprehensive Conservation Plan and Environmental Assessment (Draft CCP/EA) was published in the *Federal Register* on May 4, 2009. The Service sent the Draft CCP/EA to the 55 individuals on the CCP mailing list, the Catawba Indian Nation, the South Carolina Department of Natural Resources, the South Carolina Clearinghouse for state agency review, and to the local non-profit groups, consisting of The Nature Conservancy, Coastal Conservation League, and Ducks Unlimited. A new release was published in the Charleston *Post and Courier* and *Beaufort Gazette* newspapers on May 5, 2009. Additionally, the availability of the Draft CCP/EA was posted at the refuge headquarters and at the Cape Romain National Wildlife Refuge Visitor Center. There were no comments received specific to the compatibility determinations.

Description of Use: *Upland Game and Waterfowl 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 help to reduce the feral hog population on the refuge. Additionally, waterfowl hunting is permitted during established State of South Carolina seasons within specific areas of the refuge's wetlands and waters, not including functional wetland impoundments (rice fields). Implementing the upland game and waterfowl hunts will follow the existing refuge hunt plan, including posting an appropriate notice in the *Federal Register*; and establishing regulations in Title 50, Code of Federal Regulations.

Upland hunting for white-tailed deer and feral hogs is presently allowed in designated areas of the refuge. A special hunting program for hunters with disabilities (called a "mobility impaired hunt") is conducted on the Edisto Unit, with a quota for the number of hunters and harvest. Additional special hunts will be considered for small game, turkey, and deer/hogs within designated areas of the refuge. 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. Waterfowl hunting will continue to be permitted in certain areas not including functional impoundments (rice fields). All hunting on the refuge requires both State of South Carolina and refuge hunting permits, the latter of which is available at no cost to the participant.

Availability of Resources: A schedule has been established for administering the existing deer and hog hunt program that typically includes 4-day hunts (on Monday, Tuesday, Thursday, and Friday) for each week in October (excepting federal holidays) and a 2-day mobility impaired hunt (Friday and Saturday) in early November. Waterfowl hunting is available during state-established seasons. Funds are needed annually to mow, grade, and repair roads and parking areas open to hunter access; maintain signs; and 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 administrative need and will only be conducted if resources are available.

Anticipated Impacts of the 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 wildlife viewing and photography, with the exception of direct mortality to game species, short-term changes in the distribution and abundance of game species, and unrestricted travel through the hunt area. 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 upland hunts 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. Waterfowl hunting is not permitted within functional wetland management unit impoundments (rice fields) thereby minimizing disturbance to feeding and resting waterfowl. Nontoxic shot is required at all times during waterfowl hunts and the possession of lead shot is prohibited. The walk-in upland game 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 have an active hog removal program where the staff traps and removes 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. The known stipulations are listed as follows:

- 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, center fire rifles (mobility impaired hunt only), 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 nonnative species.
- Hunting will be allowed based on existing refuge rules and regulations.
- Waterfowl hunting requires the use of nontoxic shot and possession of lead shot during waterfowl hunts is prohibited.

Upland hunting would have little impact on other visitor activities. There are multiple units within the refuge. While one unit is open to hunting, the other units will be open to 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.

NEPA Compliance for Refuge Use Description:

_____Categorical Exclusion without Environmental Action Statement
_____Categorical Exclusion and Environmental Action Statement
__X__Environmental Assessment and Finding of No Significant Impact
_____Environmental Impact Statement and Record of Decision

Mandatory 15-Year Re-evaluation Date: 09/04/2024

Description of Use: *Fishing/Boating*

Fishing has been identified as a priority wildlife-dependent activity under the National Wildlife Refuge System Improvement Act of 1997 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 (nonimpounded) of the refuge, and bank fishing seasonally within most refuge impoundments.

Fishing is allowed in accordance with state regulations. Additionally, the refuge has implemented refuge-specific fishing regulations which can be updated annually in Title 50 Code of Federal Regulations. The following summarizes the refuge-specific fishing regulations:

- Fishing is allowed only during daylight hours.
- Boats, kayaks, canoes and other watercraft are prohibited within refuge impoundments (bank fishing only).
- Airboats, personal watercraft, or hovercraft are not allowed.

Inland and shoreline fishing is available. 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 watercraft, 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 submerged aquatic plants. Nonmotorized boats (e.g., canoes and kayaks) may have fewer 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 sport fishermen has increased and annual fishing visits are made by approximately 10,000 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, the refuge's rules and boundaries, and provide a quality priority wildlife-dependent use to continue. This strategy may also help reduce wildlife disturbance and minimize problems associated with submerged aquatic plants.

Fishing by boat represents the largest percentage of fishermen, but bank fishing opportunities are available along numerous impoundments and canals and along portions of the Combahee and Edisto Rivers and one small section of Toogoodoo Creek. 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 dual-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. 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 the Use: Anticipated impacts were identified and evaluated based on best professional judgment and published scientific papers. Overfishing has been known to cause ecological extinction of certain fish species and precedes all other human disturbance (Jackson et al. 2001). In recent history, overfishing in some areas has led to the decline of certain species. However, the river systems that border the refuge provide large amounts of nursery and adult fish habitat and contain robust fish populations which are aptly regulated by the South Carolina Department of Natural Resources. The primary game fish are the largemouth bass, black crappie, chain pickerel, channel catfish, flathead catfish, blue catfish, freshwater striped bass, and bream. Today, the state monitors fish populations and has set seasons, slot and size limits, and total bag limits for most sport fish, making the likelihood of overfishing or depleting fish stocks minimal. The areas of the refuge closed to boating and fishing also serve to recharge local waters. Collectively, the state's fishing regulations and the seasonally closed waterfowl sanctuary areas should minimize the likelihood of fish stocks declining on the refuge and 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 angle to the animal is less disturbing (Knight and Cole 1995). Dahlgren and Korschgen (1992) categorized human activities in order of decreasing disturbance to waterfowl, as follows:

- Rapid overwater movement and loud noise (e.g., power-boating, water skiing, and aircraft);
- Overwater movement with little noise (e.g., sailing, wind surfing, rowing, and canoeing);
- Little overwater movement or noise (e.g., wading and swimming); and
- 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. The 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, hovercraft, airboats, and personal watercraft, will assist in lowering disturbance to birds. Consideration for seasonal use of certain areas will also reduce impacts.

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 sportfishing regulations, which are paraphrased:

- A free refuge sportfishing permit is required.
- Fishing is allowed only during daylight hours from refuge shorelines.
- 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 refuge. Boat wakes can cause erosion of the shoreline and may be a safety issue for canoe and kayak operations. There are areas on the refuge (certain broken bank rice field canals) that are seasonally

closed to all entry including fishing (typically from November 1 to March 1) as a waterfowl sanctuary. 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 annually maintains these signs. Closed area buffers are depicted on refuge 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.

It is anticipated 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 motorboat 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.

NEPA Compliance for Refuge Use Description:

_____Categorical Exclusion without Environmental Action Statement
_____Categorical Exclusion and Environmental Action Statement
__X__Environmental Assessment and Finding of No Significant Impact
_____Environmental Impact Statement and Record of Decision

Mandatory 15-Year Re-evaluation Date: 09/04/2024

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 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 Edisto Unit (Goose Pond) and Combahee Unit (Bonny Hall fish ponds) and additional opportunities are being developed on the other areas of the refuge, such as along hiking trails 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. Two photography blinds currently exist on the refuge at the Edisto Unit (Grove). In addition to hiking trails, a proposed canoe/kayak trail on the Barrelville Unit along Toogoodoo Creek 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 nonmotorized boats. Certain areas may be closed to specific forms of transportation. Motorboat 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 the refuge kiosk 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 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 SEWEE Association also support these uses.

Anticipated Impacts of the Uses: This purpose of this section is to critically and objectively evaluate the potential effects that wildlife observation and photography could have on the wildlife, habitat, and other public use activities based on available information and best professional judgment. Each activity has the potential to have impacts, but the focus is to minimize impacts to levels within acceptable limits. This is based on the impacts at the existing and projected levels 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 the 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 Jehossee Island Road 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 causes 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 a 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 nonmotorized 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, when compared to motorboats, personal watercraft (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 overwintering 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 below.

- 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.
- Impacts from wildlife viewing and photography can be reduced by providing observation blinds.
- Re-routing, modifying, or eliminating activities which have demonstrated direct wildlife impacts should also be employed.
- Education is critical for making visitors aware that their actions can have negative impacts on birds.
- Establishing well-marked trails where human use is more predictable will lessen wildlife impacts.

Justification: Wildlife observation and photography are priority public uses of the National Wildlife Refuge System. Providing quality, appropriate, and compatible opportunities for these activities in areas where members of the public are generally allowed help fulfill the 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.

NEPA Compliance for Refuge Use Description:

_____Categorical Exclusion without Environmental Action Statement
_____Categorical Exclusion and Environmental Action Statement
__X__Environmental Assessment and Finding of No Significant Impact
_____Environmental Impact Statement and Record of Decision

Mandatory 15-Year Re-evaluation Date: 09/04/2024

Description of Use: *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 onsite staff-led or teacher-led environmental education programs; offsite 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 of 1997 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 (Earth Stewards). Over time, the program would grow to provide a diverse range of onsite staff-led education programs. The programs would explore various habitats of the refuge (i.e., river systems, wetlands, bottomlands, pinelands, hardwood uplands, and rice fields), 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 proposed interpretation program strives to increase public 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 Contact Station (Grove Plantation House) for exhibits, displays, staffing and developing interpretive trails; making improvements at the Goose Pond and Perimeter Pond observation platforms; and developing more interpretive wildlife viewing areas in the vicinity of the Bonny Hall fishing ponds.

Proposed changes in the environmental education and interpretive program are planned for areas currently open to the public or soon to be open to the public, such as the Barrelville/Toogoodoo Creek canoe and kayak launch. Current interpretive sites include the Visitor Contact Station (Grove Plantation House) and the Grove Unit rice fields. The refuge utilizes the Visitor Contact Station as the focal point for education programs, including a video presentation of the wildlife and cultural resources of the refuge and the greater ACE Basin Project Area. Supervised activities will encourage the exploration of the environment, but efforts will be made to return any collected item back to the habitat from which it came in an unharmed condition.

Availability of Resources: Annual refuge operation and maintenance funds support the visitor services program and activities. The development of proposed facilities is contingent upon successfully locating a funding source. Costs for improvements identified in the CCP will typically come from the SEWEE Association, the Fish and Wildlife Foundation, other grants or endowments, and refuge budget increases under the Refuge Operating Needs System (RONS). The SEWEE Association is supportive of the refuge's public use program, providing volunteers and supplementing refuge programs and facilities. The refuge's interpretive rangers, biologists, and volunteers provide the staffing for these uses.

Anticipated Impacts of the Uses: Environmental education primarily occurs at the Grove Plantation House and surrounding areas. The expansion of the program, as proposed, would increase disturbance in several new sites (Bonny Hall Unit Pecan Grove/Fish Ponds); however, impacts would be considered short-term and discreet due to the low anticipated frequency of use and the ability to move sites to a new area if the habitat shows 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 educational and awareness program is acceptable.

Impacts associated with interpretive activities generally occur at developed facilities such as the Grove Plantation House, trails, boardwalks, the proposed canoe/kayak launch, or other improved facilities. Adding the new interpretive sites will have some wildlife or habitat impacts. The proposed canoe/kayak launch would expand uses at existing sites on the Edisto Unit (Barrelville Unit) and only minimal clearing would be required for parking and launch areas. The existing parking area at the Bonny Hall Pecan Grove has been recently enhanced with the placement of additional crushed limestone to enable the parking of heavier vehicles (such as school buses), and a perimeter split rail fence has been added to restrict parking-related impacts on sensitive habitats.

Determination (check one below):

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

Stipulations Necessary to Ensure Compatibility: While the 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 public understanding and appreciation for the refuge and its natural resources. As use increases, wildlife disturbances are unavoidable, but through interpretive materials (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. Annual evaluations will be conducted to assess if objectives are being met and that the natural resources are not being adversely affected.

The refuge will modify or eliminate any use that results in unacceptable impacts.

Justification: Environmental education and interpretation represent two priority wildlife-dependent recreational activities listed under the National Wildlife Refuge System Improvement Act. Environmental education and interpretation are used to encourage all citizens to act responsibly in protecting natural resources. 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 costs 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, the Refuge System, and the purposes of the refuge. They highlight the areas that 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.

NEPA Compliance for Refuge Use Description:

_____Categorical Exclusion without Environmental Action Statement
_____Categorical Exclusion and Environmental Action Statement
__X__Environmental Assessment and Finding of No Significant Impact
_____Environmental Impact Statement and Record of Decision

Mandatory 15-Year Re-evaluation Date: 09/04/2024

Description of Use: *Bicycling*

While not one of the six priority wildlife-dependent recreational uses listed in the National Wildlife Refuge System Administration Act of 1997, 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 would occur year-round.

Availability of Resources: Operation and maintenance funds to support wildlife viewing are taken from the refuge's annual budget, which is adequate to sustain the program at the current level. Funds are needed annually to mow, grade, and fix roads open to the public; replace gravel on 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.

Anticipated Impacts of the 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 (ATV) 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 bicycle access on several refuge roads and rice field dikes is planned in the CCP. Bicycle riders are not permitted to ride on the refuge's 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 compatibility determination, the 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 refuge roads and rice field dikes 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 the 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 et al. 1993). 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 (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 overwintering 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, 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 refuge's roads and rice field dikes has not reached a level where disturbance is occurring to wildlife or other individuals participating in wildlife observation. However, as use of the areas or other trails increase, bicycling could become a greater disruption to wildlife or other visitors. Evaluation of bike riding on roads and rice field dikes 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 not 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 those listed as follows:

- 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 refuge roads and dikes 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 (roads and dikes) 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.

NEPA Compliance for Refuge Use Description:

_____Categorical Exclusion without Environmental Action Statement
_____Categorical Exclusion and Environmental Action Statement
__X__Environmental Assessment and Finding of No Significant Impact
_____Environmental Impact Statement and Record of Decision

Mandatory 10-Year Re-evaluation Date: 09/04/2019

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, cooperative units, nonprofit 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 the Nemours Wildlife Foundation. 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 housing facility on the Bonny Hall Unit to support temporary housing for researchers and students. Currently, two recreational vehicle (RV) pads are being constructed on the refuge (Grove Unit) to provide additional housing opportunities for researchers and volunteers. The refuge maintains a small and growing geographic information system (GPS) 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 their permits.

Justification: Research activities provide important benefits to the refuge and to the natural resources supported by the refuge. Supporting management, research conducted on the refuge can lead to new discoveries, new facts, verified information, and increased knowledge and understanding of resource management, as well as track current trends in fish and wildlife habitat and populations to enable better management decisions. Research has the potential to further the purposes of the refuge and the mission of the National Wildlife Refuge System.

NEPA Compliance for Refuge Use Description:

_____Categorical Exclusion without Environmental Action Statement
_____Categorical Exclusion and Environmental Action Statement
__X__Environmental Assessment and Finding of No Significant Impact
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Mandatory 10-Year Re-evaluation Date: 09/04/2019

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. Once trapped, State of South Carolina law prohibits the removal and transport of live hogs from one geographic location to another. Accordingly, all live hogs trapped or otherwise taken into possession will be humanely destroyed prior to removal from the refuge.

The CCP outlines the importance of removing feral hogs from the refuge, monitoring the feral hog population after this time, and adjusting the target take accordingly to reduce or eliminate feral hogs, limiting their 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 the Use: Minor, short-term, and discreet increased disturbance to native wildlife may be caused by trapping activities. Native wildlife such as the raccoon, opossum, 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 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.

NEPA Compliance for Refuge Use Description:

_____Categorical Exclusion without Environmental Action Statement
_____Categorical Exclusion and Environmental Action Statement
__X__Environmental Assessment and Finding of No Significant Impact
_____Environmental Impact Statement and Record of Decision

Mandatory 10-Year Re-evaluation Date: 09/04/2019

Description of Use: *Forest Management – Commercial Timber Harvest*

A Forest Management Plan was produced for ACE Basin NWR in 2005. 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 enhances 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 the South Atlantic Migratory Bird Initiative or the South Carolina Department of Natural Resources Strategic Plan; the creation of diversity in the landscape; the enhancement of red-cockaded woodpecker habitat; the implementation of founding principles of the ACE Basin Project Area to maintain historic timber management operations; and the maintenance of biological integrity. The strategies and techniques for these will be discussed in detail in the development of a Habitat Management Plan.

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 the needed disturbance to the forest floor and will enhance forest regeneration and succession. Mechanical disturbance is more desirable in the mixed hardwood where fire could damage hardwood species. Clearcutting industrial loblolly pine stands of pulpwood size may be considered to accelerate the restoration of native longleaf pine stands in certain xeric areas, primarily at the Barrelville Tract.

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 songbirds 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. If soil moisture reaches a point where excessive damage is being done to the site, operations will be shut down until conditions improve. Refuge staff will also check for damage to the residual stand and will make operators aware of any problems as soon as they are detected.

Justification: 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.

NEPA Compliance for Refuge Use Description:

_____ Categorical Exclusion without Environmental Action Statement
_____ Categorical Exclusion and Environmental Action Statement
__X__ Environmental Assessment and Finding of No Significant Impact
_____ Environmental Impact Statement and Record of Decision

Mandatory 10-Year Re-evaluation Date: 09/04/2019

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APPROVAL OF COMPATIBILITY DETERMINATIONS

The signature of approval is for all compatibility determinations considered within the Comprehensive Conservation Plan for ACE Basin 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: _____ 7/31/09
(Signature/Date)

Regional Compatibility Coordinator: _____ 8/24/09
(Signature/Date)

Refuge Supervisor: _____ 8/27/09
(Signature/Date)

Acting
Regional Chief, National Wildlife Refuge System, Southeast Region: _____ 8/31/09
(Signature/Date)

Appendix G. Intra-Service Section 7 Biological Evaluation

INTRA-SERVICE SECTION 7 BIOLOGICAL EVALUATION FORM

Originating Person: Mark A. Purcell
Telephone Number: (843) 889-3084
E-Mail: Mark_Purcell@fws.gov
Date: October 15, 2008

PROJECT NAME: EFH ACE Basin 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 Department of Natural Resources/USFWS

III. Station Name: Ernest F. Hollings ACE Basin National Wildlife Refuge

IV. Description of Proposed Action:

The proposed action consists of approving and implementing a Comprehensive Conservation Plan (CCP) for Ernest F. Hollings ACE Basin National Wildlife Refuge in Charleston, Colleton, Beaufort, and Hampton Counties, South Carolina. The CCP provides overall management guidance on the refuge over a 15-year period in the form of a vision and goals, objectives, and strategies related to fish and wildlife management, habitat management, resource protection, visitor use, and refuge administration.

The aim of the CCP is to provide specific guidance in the pursuit of the purposes for which the Ernest F. Hollings ACE Basin National Wildlife Refuge was established. Wildlife and fish and their respective habitats are the first priority in refuge management. Public uses (wildlife-dependent recreation) – in particular hunting, fishing, wildlife observation, wildlife photography, and environmental education and interpretation – are permitted as long as these uses are compatible with, or do not impinge upon, the refuge's primary wildlife-related purposes.

V. Pertinent Species and Habitat:

A. Include species/habitat occurrence map: See maps

Complete the following table:

SPECIES/CRITICAL HABITAT	STATUS[1]
Red-cockaded woodpecker (*Picoides borealis*) – not known to nest within the refuge acquisition boundary or ACE Basin Project Area, but suitable habitat in longleaf pine-dominated upland forests exists throughout the ACE Basin Project Area.	E
Wood stork (*Mycteria americana*) – have been observed foraging and loafing on wetland habitats within the refuge boundary, and nesting has been documented in the ACE Basin Project Area. The majority of the wood stork population leaves the refuge area and migrates south for the period November through February. During the warmer months of March through October, sporadic numbers of storks (1 -25 daily) may utilize any refuge-managed wetland unit or unmanaged natural wetland site as a foraging area. This occurs more readily on managed sites that have been flooded with water and then drawn down therefore concentrating forage type fish. These small fish attract storks in quarter drains and drainage ditches that are located throughout most refuge-managed wetland units. This window of time for wood stork foraging is relatively short. Intentional timed draw down for instance on two wetland units (J1 and J2) on Jehossee Island, specifically for storks after fledging young in July, has attracted as many as 900 storks for a brief period of time.	E
Shortnose sturgeon (*Acipenser brevirostrum*) – rivers and creeks within the refuge acquisition boundary represent important spawning habitat.	E
Pondberry *(Lindera melissifolia*) – inhabits seasonally flooded wetlands, sandy sinks, pond margins, and swampy depressions; not known to occur within refuge acquisition boundary, but potential habitat present in the refuge and ACE Basin Project Area	E
Canby's dropwort (*Oxypolis canbyi*) – inhabits a variety of coastal plain habitats including natural ponds dominated by pond cypress, grass-sedge dominated bays, wet pine savannahs, shallow pineland ponds, and cypress-pine swamps; unknown on refuge, but potential habitat present in sandy pinelands.	E
American chaffseed (*Schwalbea americana*) – pine flatwoods and savannahs with a history of frequent burning; unknown within the refuge acquisition boundary, but potential habitat is present within the refuge and throughout the ACE Basin Project Area.	E
Flatwoods salamander (*Ambystoma cingulatum*) – occurs in the southern half of the coastal plain of South Carolina in pine flatwoods. Breeding occurs in grass-dominated isolated depression wetlands.	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: Charleston, Colleton, Beaufort and Hampton Counties, South Carolina

Section, township, and range (or latitude and longitude):

32.679790° North Latitude, -80.388545° West Longitude (approx. center of refuge)

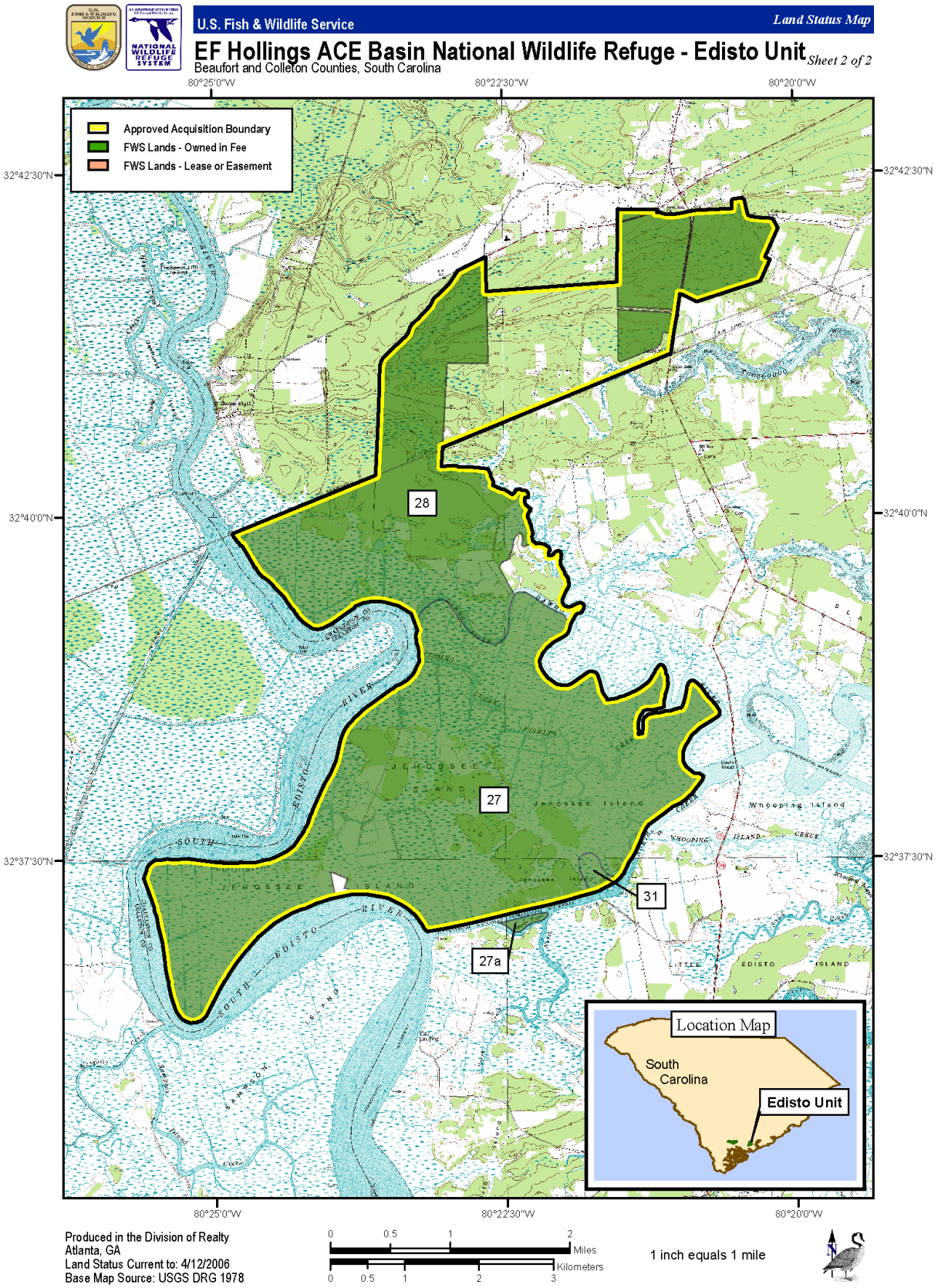
Distance (miles) and direction to nearest town(s):

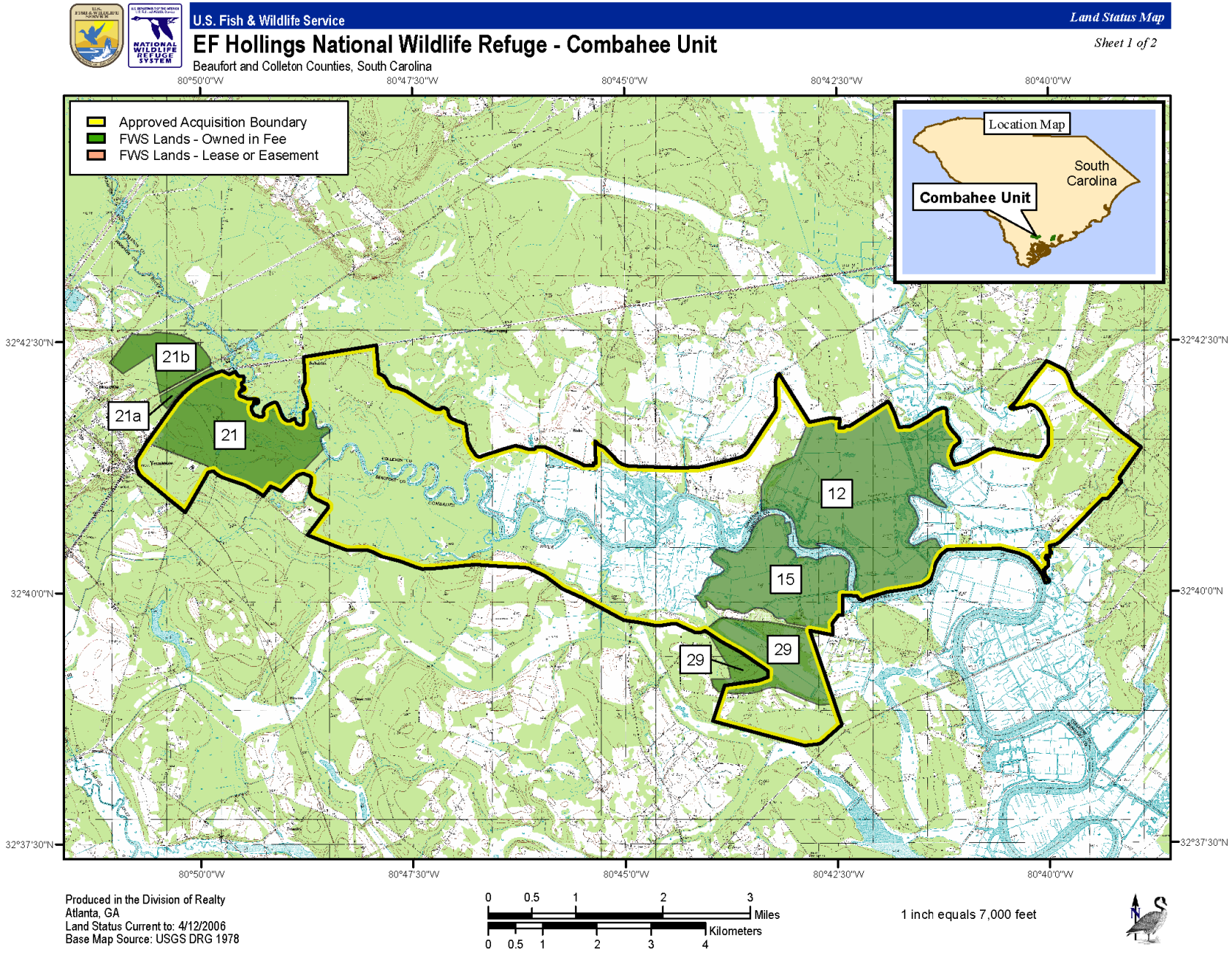
Adams Run, 3 miles to the north; Hollywood, 7 miles to the east of refuge

E. Species/habitat occurrence within EFH ACE Basin NWR acquisition boundary:

1. Red-cockaded woodpecker: habitat occurs (last recorded species occurrence in early 1970s)
2. Wood stork: habitat and species (foraging/loafing, not nesting) both occur
3. Shortnose sturgeon: habitat and species both occur
4. Pondberry: potential habitat present but species not known to occur
5. Canby's dropwort: potential habitat present but species not known to occur
6. American chaffseed: potential habitat present but species not known to occur
7. Flatwoods salamander: habitat (foraging, and breeding) both occur, but species not known to occur

Location maps of EFH ACE Basin National Wildlife Refuge.




U.S. Fish & Wildlife Service
Land Status Map
EF Hollings National Wildlife Refuge - Combahee Unit
Sheet 1 of 2
Beaufort and Colleton Counties, South Carolina
Approved Acquisition Boundary
FWS Lands - Owned in Fee
FWS Lands - Lease or Easement
Location Map
South Carolina
Combahee Unit
21b
21a
21
12
15
29
29
80°50'0"W
80°47'30"W
80°45'0"W
80°42'30"W
80°40'0"W
32°42'30"N
32°40'0"N
32°37'30"N
Produced in the Division of Realty
Atlanta, GA
Land Status Current to: 4/12/2006
Base Map Source: USGS DRG 1978
0 0.5 1 2 3 Miles
0 0.5 1 2 3 4 Kilometers
1 inch equals 7,000 feet

VII. Determination of Effects:

Explanation of effects of the action on species and critical habitats in item V. B:

SPECIES/ CRITICAL HABITAT	IMPACTS TO SPECIES/CRITICAL HABITAT
Red-cockaded woodpecker – longleaf pine forests	Open structure of longleaf pine forests to be maintained by prescribed fire; impacts likely to be neutral to beneficial.
Wood stork – wetland areas	No impacts anticipated on existing refuge lands; proposed acquisition of additional areas would protect more habitat, and thus likely be beneficial.
Shortnose sturgeon – rivers and creeks	No impacts anticipated on existing refuge lands; proposed acquisition of additional areas would protect more watershed area, helping to maintain water quality and stream/river integrity.
Pondberry – seasonally flooded wetlands and pond Margins; undocumented on refuge but potential habitat present	No impacts anticipated on existing refuge lands; proposed acquisition of additional areas would protect more potential habitat, which would represent a possible benefit.
Canby's dropwort – natural ponds dominated by pond cypress, grass-sedge dominated bays, wet pine savannahs, shallow pineland ponds, and cypress-pine swamps; undocumented on	No impacts anticipated on existing refuge lands; proposed acquisition of additional areas would protect more potential habitat, which would represent a possible benefit.
American chaffseed – pine flatwoods and savannahs with a history of frequent burning; undocumented on refuge but potential habitat present	No impacts anticipated on existing refuge lands; proposed acquisition of additional areas would protect more potential habitat, which would represent a possible benefit.
Flatwoods salamander (Ambystoma cingulatum) – occurs in the southern half of the coastal plain of South Carolina in pine flatwoods. Breeding occurs in grass-dominated isolated depression wetlands.	Proposed habitat management and conservation would benefit potentially existing flatwood salamanders and suitable habitat on the refuge.

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

SPECIES/ CRITICAL HABITAT	ACTIONS TO MITIGATE/MINIMIZE IMPACTS
Red-cockaded woodpecker – longleaf pine forests	No mitigation measures needed. Conduct prescribed burns during the growing season in longleaf pine forests, and support the Safe Harbor Program in the ACE Basin Project Area.
Wood stork – wetland areas	No mitigation measures needed unless nesting is observed; if nesting is observed, implement buffer zone around nesting area.
Shortnose sturgeon – rivers and creeks	No mitigation measures needed or proposed.
Pondberry – seasonally flooded wetlands and pond margins; undocumented on refuge but potential habitat	Conduct targeted survey periodically for this and other listed plant species prior to prescribed burns.
Canby's dropwort – natural ponds dominated by pond cypress, grass-sedge dominated bays, wet pine savannahs, shallow pineland ponds, and cypress-pine swamps; undocumented on refuge	Conduct targeted survey periodically for this and other listed plant species prior to prescribed burns.
American chaffseed – pine flatwoods and savannahs with a history of frequent burning; undocumented on refuge but potential habitat present	Conduct targeted survey periodically for this and other listed plant species prior to prescribed burns.
Flatwoods salamander (*Ambystoma cingulatum*) – occurs in the southern half of the coastal plain of South Carolina in pine flatwoods. Breeding occurs in grass-dominated isolated depression wetlands.	Conduct prescribed burns during the growing season in pine forests and perform spring breeding surveys in and adjacent to isolated depression wetlands in the refuge.

VIII. Effect Determination and Response Requested:

SPECIES/CRITICAL HABITAT	DETERMINATION[1]			REQUESTED
	NE	NA	AA	
Red-cockaded woodpecker – longleaf pine forests	x			Concurrence
Wood stork – wetland areas		x		Concurrence
Shortnose sturgeon – rivers and creeks	x			Concurrence
Pondberry – seasonally flooded wetlands, sandy sinks, and pond margins	x			Concurrence
Canby's dropwort – natural ponds dominated by pond cypress, grass-sedge dominated bays	x			Concurrence
American chaffseed – pine flatwoods and savannahs with a history of frequent burning	x			Concurrence
Flatwoods salamander (*Ambystoma cingulatum*) – occurs in the southern half of the coastal plain of South Carolina in pine flatwoods. Breeding occurs in grass-dominated isolated depression wetlands.	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."

Mark A. Purcell

Mark Purcell, Refuge Manager
Ernest F. Hollings A.C.E. Basin NWR
Title

Date: July 24, 2009

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):

Melissa K. Burrili 12/23/08
Signature Date

Endangered Species Biologist Charleston ES Office
Title Office

Appendix H. Refuge Biota

Wildlife species likely found on ACE Basin National Wildlife Refuge

BIRDS

Common Name	**Scientific Name**
LOONS	
Common Loon	*Gavia immer*
GREBES	
Pied-billed Grebe	*Podilymbus podiceps*
PELICANS AND ALLIES	
Double-crested Cormorant	*Phalacrocorax auritus*
Anhinga	*Anhinga anhinga*
Brown Pelican	*Pelecanus occidentalis*
HERONS, EGRETS AND ALLIES	
American Bittern	*Botaurus lentiginosus*
Least Bittern	*Ixobrychus exilis*
Great Blue Heron	*Ardea herodias*
Great Egret	*Ardea alba*
Snowy Egret	*Egretta thula*
Little Blue Heron	*Egretta caerulea*
Tricolored Heron	*Egretta tricolor*
Cattle Egret	*Bubulcus ibis*
Green-backed Heron	*Butorides striatus*
Black-crowned Night-Heron	*Nycticorax nycticorax*
Yellow-crowned Night-Heron	*Nycticorax violaceus*
IBISES, SPOONBILL, STORK	
Glossy Ibis	*Plegadis falcinellus*
White Ibis	*Eudocimus albus*
Wood Stork	*Mycteria americana*

WATERFOWL

Fulvous Whistling-Duck	*Dendrocygna* bicolor
Tundra Swan	*Cygnus columbianus*
Snow Goose	*Chen caerulescens*
Canada Goose	*Branta canadensis*
Wood Duck	*Aix sponsa*
Green-winged Teal	*Anas crecca*
American Black Duck	*Anas rubripes*
Mottled Duck	*Anas fulvigula*
Mallard	*Anas platyrhynvchos*
Northern Pintail	*Anas acuta*
Blue-winged Teal	*Anas discors*
Northern Shoveler	*Anas clypeata*
Gadwall	*Anas strepera*
American Wigeon	*Anas americana*
Canvasback	*Aytha valisineria*
Redhead	*Aythya americana*
Ring-necked Duck	*Aythya collaris*
Greater Scaup	*Aythya marila*
Lesser Scaup	*Aythya affinis*
Common Goldeneye	*Bucephala clangula*
Bufflehead	*Bucephala albeola*
Hooded Merganser	*Lophodytes cucullatus*
Common Merganser	*Mergus merganser*
Red-breasted Merganser	*Mergus serrator*
Ruddy Duck	*Oxyura jamaicensis*

VULTURES, HAWKS AND ALLIES

Black Vulture	*Coragyps atratus*
Turkey Vulture	*Cathartes aura*
Osprey	*Pandion haliaetus*
American Swallow-tailed Kite	*Elanoides forficatus*
Mississippi Kite	*Ictinia mississippiensis*
Bald Eagle	*Haliaeetus leucocephalus*
Northern Harrier	*Circus cyaneus*
Sharp-shinned Hawk	*Accipiter striatus*
Cooper's Hawk	*Accipiter cooperii*
Red-shouldered Hawk	*Buteo lineatus*
Broad-winged Hawk	*Buteo platypterus*
Red-tailed Hawk	*Buteo jamaicensis*
American Kestrel	*Falco sparverius*
Merlin	*Falco columbarius*
Peregrine Falcon	*Falco peregrinus*

GALLINACEOUS BIRDS

Wild Turkey	*Meleagris gallopavo*
Northern Bobwhite	*Colinus virginianus*

RAILS, GALLINULES, COOTS AND CRANES	
Clapper Rail	*Rallus longirostris*
Black Rail	*Laterallus jamaicensis*
King Rail	*Rallus elegans*
Virginia Rail	*Rallus limicola*
Sora	*Porzana carolina*
Purple Gallinule	*Porphyrio martinica*
Common Moorhen	*Gallinula chloropus*
American Coot	*Fulica americana*
SHOREBIRDS AND GULLS	
Killdeer	*Charadrius vociferous*
Greater Yellowlegs	*Tringa melanoleuca*
Lesser Yellowlegs	*Tringa flavipes*
Spotted Sandpiper	*Actitis macularia*
Common Snipe	*Gallinago gallinago*
American Woodcock	*Scolopax minor*
Laughing Gull	*Larus atricilla*
Ring-billed Gull	*Larus delawarensis*
Herring Gull	*Larus argentatus*
Caspian Tern	*Sterna caspia*
Royal Tern	*Sterna maxima*
Sandwich Tern	*Sterna sandvicensis*
Forster's Tern	*Sterna forsteri*
Least Tern	*Sternula antillarum*
PIGEONS, DOVES	
Rock Dove	*Columba livia*
Mourning Dove	*Zenaida macroura*
Common Ground-Dove	*Columbina passerina*
CUCKOOS	
Yellow-billed Cuckoo	*Coccyzus americanus*
OWLS	
Barn Owl	*Tyto alba*
Eastern Screech-Owl	*Megascops asio*
Great Horned Owl	*Bubo virginianus*
Barred Owl	*Strix varia*
GOATSUCKERS	
Common Nighthawk	*Chordeiles minor*
Chuck-will's-widow	*Caprimulgus carolinensis*
Whip-poor-will	*Caprimulgus vociferus*

SWIFTS, HUMMINGBIRDS	
Chimney Swift	*Chaetura pelagica*
Ruby-throated Hummingbird	*Archilochus colubris*
KINGFISHERS	
Belted Kingfisher	*Megaceryle alcyon*
WOODPECKERS	
Red-headed Woodpecker*	*Melanerpes erythrocephalus*
Red-bellied Woodpecker*	*Melanerpes carolinus*
Yellow-bellied Sapsucker	*Sphyrapicus varius*
Downy Woodpecker*	*Picoides pubescens*
Hairy Woodpecker*	*Picoides villosus*
Red-cockaded Woodpecker	*Picoides borealis*
Northern Flicker*	*Colaptes auratus*
Pileated Woodpecker*	*Dryocopus pileatus*
FLYCATCHERS	
Eastern Wood-Pewee	*Contopus virens*
Acadian Flycatcher	*Empidonax virescens*
Eastern Phoebe	*Sayornis phoebe*
Great Crested Flycatcher	*Myiarchus crinitus*
Eastern Kingbird	*Tyrannus tyrannus*
MARTINS AND SWALLOWS	
Purple Martin	*Progne subis*
Tree Swallow	*Tachycineta bicolor*
Northern Rough-winged Swallow	*Stelgidopteryx serripennis*
Barn Swallow	*Hirundo rustica*
JAYS AND CROWS	
Blue Jay	*Cyanocitta cristata*
American Crow	*Corvus brachyrhynchos*
Fish Crow	*Corvus ossifragus*
CHICKADEES AND TITMICE	
Carolina Chickadee	*Parus carolinensis*
Tufted Titmouse	*Parus bicolor*
NUTHATCHES	
White-breasted Nuthatch	*Sitta carolinensis*
Brown-headed Nuthatch	*Sitta pusilla*

WRENS	
Carolina Wren	*Thryothorus ludovicianus*
House Wren	*Troglodytes aedon*
Sedge Wren	*Cistothorus platensis*
Marsh Wren	*Cistothorus palustris*
KINGLETS AND GNATCATCHERS	
Golden-crowned Kinglet	*Regulus satrapa*
Ruby-crowned Kinglet	*Regulus calendula*
Blue-gray Gnatcatcher	*Polioptila caerulea*
BLUEBIRDS, THRUSHES AND ROBIN	
Eastern Bluebird	*Sialia sialis*
Veery	*Catharus fuscescens*
Swainson's Thrush	*Catharus ustulatus*
Hermit Thrush	*Catharus guttatus*
Wood Thrush	*Hylocichla mustelina*
American Robin	*Turdus migratorius*
THRASHERS	
Gray Catbird	*Dumetella carolinensis*
Northern Mockingbird	*Mimus polyglottos*
Brown Thrasher	*Toxostoma rufum*
PIPITS	
American Pipit	*Anthus rubescens*
WAXWINGS	
Cedar Waxwing	*Bombycilla cedrorum*
STARLINGS	
European Starling	*Sturnus vulgaris*
SHRIKES	
Loggerhead Shrike	*Lanius ludovicianus*
VIREOS	
White-eyed Vireo	*Vireo griseus*
Solitary Vireo	*Vireo solitarius*
Philadelphia Vireo	*Vireo philadelphicus*
Red-eyed Vireo	*Vireo olivaceus*

WARBLERS	
Northern Parula	*Parula americana*
Black-throated Blue Warbler	*Dendroica caerulescens*
Black-throated Green Warbler	*Dendroica virens*
Yellow-rumped Warbler	*Dendroica coronata*
Black-throated Gray Warbler	*Dendroica nigrescens*
Yellow-throated Warbler	*Dendroica dominica*
Pine Warbler	*Dendroica pinus*
Prairie Warbler	*Dendroica discolor*
Palm Warbler	*Dendroica palmarum*
Black-and-white Warbler	*Mniotilta varia*
American Redstart	*Setophaga ruticilla*
Prothonotary Warbler	*Protonotaria citrea*
Swainson's Warbler	*Limnothlypis swainsonii*
Ovenbird	*Seiurus aurocapilla*
Northern Waterthrush	*Seiurus noveboracensis*
Kentucky Warbler	*Oporornis formosus*
Common Yellowthroat	*Geothlypos trichas*
Hooded Warbler	*Wilsonia citrine*
Yellow-breasted Chat	*Icteria virens*
TANAGERS	
Summer Tanager	*Piranga rubra*
Scarlet Tanager	*Piranga olivacea*
NEW WORLD FINCHES	
Northern Cardinal	*Cardinalis cardinalis*
Blue Grosbeak	*Passerina caerulea*
Indigo Bunting	*Passerina cyanea*
SPARROWS	
Rufous-sided Towhee	*Pipilo erythrophthalmus*
Chipping Sparrow	*Spizella passerine*
Field Sparrow	*Spizella pusilla*
Henslow's Sparrow	*Ammodramus henslowii*
Vesper Sparrow	*Pooecetes gramineus*
Savannah Sparrow	*Passerculus sandwichensis*
Sharp-tailed Sparrow	*Ammodramus caudacutus*
Seaside Sparrow	*Ammodramus maritimus*
Song Sparrow	*Melospiza melodia*
Swamp Sparrow	*Melospiza georgiana*
White-throated Sparrow	*Zonotrichia albicollis*

BLACKBIRDS, GRACKLES, COWBIRDS AND ORIOLES	
Bobolink	*Dolichonyx oryzivorus*
Red-winged Blackbird	*Agelais phoeniceus*
Eastern Meadowlark	*Sturnella magna*
Rusty Blackbird	*Euphagus carolinus*
Boat-tailed Grackle	*Quiscalus major*
Common Grackle	*Quiscalus quiscula*
Brown-headed Cowbird	*Molothrus ater*
Orchard Oriole	*Icterus spurious*

OLD WORLD FINCHES	
Purple Finch	*Carpodacus purpureus*
American Goldfinch	*Carduelis tristis*

WEAVER FINCHES	
House Sparrow	*Passer domesticus*

MAMMALS

Big Brown Bat	*Eptesicus fuscus*
Red Bat	*Lasiurus borealis*
Seminole Bat	*Lasiurus seminolus*
Hoary Bat	*Lasiurus cinereus*
Evening Bat	*Nycticeius humeralis*
Silver-haired Bat	*Lasionycteris noctivagans*
Eastern Pipistrel	*Pipistrellus subfiavus*
Rafinesque's Big-eared Bat	*Plecotus rafinesquii*
Southeastern Myotis	*Myotis austroriparius*
Whitetail Deer	*Odocoileus virginianus*
Bobcat	*Lynx rufus*
Raccoon	*Procyon lotor*
Opossum	*Didelphis marsupalis*
Eastern Cottontail	*Sylvilagus floridanus*
Marsh Rabbit	*Sylvilagus palustris*
River Otter	*Lutra canadensis*
Mink	*Mustela vison*
Longtail Weasel	*Mustela frenata*
Beaver	*Castor canadensis*
Gray Fox	*Urocyon cinereoargenteus*
Southern Flying Squirrel	*Glaucomys volans*
Eastern Gray Squirrel	*Sciurus carolinensis*
Eastern Fox Squirrel	*Sciurus niger*
Golden Mouse	*Peromyscus nuttalli*
Eastern Woodrat	*Neotoma floridana*

Rice Rat	*Oryzomys palustris*
Hispid Cotton Rat	*Sigmodon hispidus*
Meadow Vole	*Microtus pennsylvanicus*
Pine Vole	*Pitymys pinetorum*
Norway Rat	*Rattus norvegicus*
Black Rat	*Rattus rattus*
Shorttail Shrew	*Blarina brevicauda*
Eastern Mole	*Scalopus aquaticus*
Black Bear	*Ursus americanus*

AMPHIBIANS AND REPTILES

American Alligator	*Alligator mississippiensis*
Common Snapping Turtle	*Chelydra serpentina serpentina*
Common Musk Turtle (Stinkpot)	*Sternotherus odoratus*
Striped Mud Turtle	*Kinosternon bauri*
Eastern Mud Turtle	*Kinosternon subrubrum*
Carolina Diamondback Terrapin	*Malaclemys terrapin centrata*
Spotted Turtle	*Clemmys guttata*
Eastern Chicken Turtle	*Deirochelys reticularia reticularia*
Florida Cooter	*Chrysemys floridana*
Yellowbelly Slider	*Trachemys scripta scripta*
Eastern Box Turtle	*Terrapene carolina carolina*
Gulf Coast Spiny Softshell	*Trionyx spiniferus asperus*
Green Anole	*Anolis carolinensis*
Southern Fence Lizard	*Sceloporus undulates undulatus*
Ground Skink	*Scincella lateralis*
Five-lined Skink	*Eumeces fasciatus*
Broadhead Skink	*Eumeces laticeps*
Southeastern Five-lined Skink	*Eumeces inexpectatus*
Six-lined Racerunner	*Cnemidophrus sexlineatus sexlineatus*
Eastern Glass Lizard	*Ophisaurus ventralis*
Eastern Slender Glass Lizard	*Ophisaurus attenuatus longicaudus*
Banded Water Snake	*Natrix fasciata fasciata*
Redbelly Water Snake	*Natrix erythrogaster erythrogaster*
Brown Water Snake	*Natrix taxispilota*
Glossy Crayfish Snake	*Regina rigida*
Carolina Black Swamp Snake	*Seminatrix pygaea paludis*
Eastern Garter Snake	*Thamnophis sirtalis sirtalis*
Eastern Ribbon Snake	*Thamnophis sauritus. sauritus*
Pine Wood Snake	*Rhadinaea flavilata*
Midland Brown Snake	*Storeria dekayi*
Florida Redbelly Snake	*Storeria occipitomaculata*
Rough Earth Snake	*Virginia striatula*
Eastern Earth Snake	*Virginia valeriae valeriae*
Southern Ringneck Snake	*Diadophis punctatus punctatus*
Southern Hognose Snake	*Heterodon simus*
Eastern Hognose Snake	*Heterodon platyrhinos*
Eastern Worm Snake	*Carphophis amoenus amoenus*
Northern Scarlett Snake	*Cemophora copei copei*

Rough Green Snake	*Opheodrys aestivus*
Rainbow Snake	*Farancia erytrogramma erytrogramma*
Eastern Mud Snake	*Farancia abacura abacura*
Southern Black Racer	*Coluber priapus priapus*
Eastern Coachwhip	*Masticophis flagellum flagellum*
Northern Pine Snake	*Pituophis melanoleucus*
Yellow Rat Snake	*Elaphe obsoleta quadrivittata*
Corn Snake	*Elaphe guttata guttata*
Eastern Kingsnake	*Lampropeltis getulus getulus*
Mole Kingsnake	*Lampropeltis calligaster rhombomaculata*
Scarlet Kingsnake	*Lampropeltis traingulum elapsoides*
Southeastern Crowned Snake	*Tantilla coronata*
Eastern Cottonmouth	*Agkistrodon piscivorus piscivorus*
Southern Copperhead	*Agkistrodon contortrix*
Eastern Coral Snake	*Micrurus fulvius fulvius*
Carolina Pygmy Rattlesnake	*Sistrurus miliarius miliarius*
Timber Rattlesnake	*Crotalus horridus*
Eastern Diamondback Rattlesnake	*Crotalus adamanteus*
Greater Siren	*Siren lacertina*
Eastern Lesser Siren	*Siren intermedia intermedia*
Broad-striped Dwarf Siren	*Pseudobranchus striatus striatus*
Two-toed Amphiuma	*Amphiuma means*
Dwarf Waterdog	*Necturus punctatus*
Broken-striped Newt	*Notophthalmus viridescens dorsalis*
Mole Salamander	*Ambystoma talpoideum*
Mabees Salamander	*Ambystoma mabeei*
Flatwoods Salamander	*Ambystoma cingulatum*
Eastern Tiger Salamander	*Ambystoma tigrinum*
Spotted Salamander	*Ambystoma maculatum*
Marbled Salamander	*Ambystoma opacum*
Southern Dusky Salamander	*Desmognathus auriculatus*
Eastern Mud Salamander	*Pseudotriton montanus montanus*
Many-lined Salamander	*Stereocheilus marginatus*
South Carolina Slimy Salamander	*Plethodon variolatus*
Southern Two-lined Salamander	*Eurycea cirrigera*
Three-lined Salamander	*Eurycea longicauda guttolineata*
Dwarf Salamander	*Eurycea quadridigitata*
Eastern Spadefoot	*Scaphiopus holbrookii holbrookii*
Eastern Narrowmouth Toad	*Gastrophryne carolinensis*
Southern Toad	*Bufo terrestris*
Oak Toad	*Bufo quercicus*
Green Treefrog	*Hyla cinerea*
Pine Woods Treefrog	*Hyla femoralis*
Barking Treefrog	*Hyla gratiosa*
Squirrel Treefrog	*Hyla squirella*
Gray Treefrog	*Hyla chrysoscelis*
Northern Spring Peeper	*Pseudacris crucifer crucifer*
Brimleys Chorus Frog	*Pseudacris brimleyi*
Southern Chorus Frog	*Pseudacris nigrita nigrita*
Little Grass Frog	*Pseudacris ocularis*
Ornate Chorus Frog	*Pseudacris ornata*

Southern Cricket Frog	*Acris gryllus gryllus*
Pig Frog	*Rana grylio*
River Frog	*Rana heckscheri*
Carpenter Frog	*Rana virgatipes*
Bronze Frog	*Rana clamitans clamitans*
Bull Frog	*Rana catesbeiana*
Southern Leopard Frog	*Rana utricularia*
Carolina Gopher Frog	*Rana capito capito*
Pickerel Frog	*Rana palustris*

FISHES

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*
Brown Bullhead	*Ameiurus nebulosus*
Carp	*Cyprinus carpio*
Carolina Pygmy 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*
Eastern 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	*Gobionedllus schufeldti*
Gizzard Shad	*Dorosoma cepedianum*
Golden Shiner	*Notemigonus crysoleucas*
Golden Topminnow	*Fundulus chrysotus*
Goldfish	*Carassius auratus*
Hickory Shad	*Alosa mediocris*
Hogchoker	*Trinectes maculates*
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*
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*

Appendix I. Budget Requests

REFUGE OPERATING NEEDS SYSTEM (RONS)

Station Rank	Project Number	Project Title	Cost
1	FY08-4095	Park Ranger (public use) GS-0025-7/9	$94,588
2	FY08-4551	Wildlife Refuge Specialist GS-0485-7/9/11	$114,439
3	FY08-4543	Tractor Operator WG5705-6	$69,584
4	FY08-4550	Forester GS-0460-9/11	$114,439
5	FY08-4549	Maintenance Worker WG4749-5	$61,852
6	FY08-4584	Neotropical bird surveys	$72,000
7	FY08-4596	Perform reptile, amphibian, bat, shorebird, and marshbird surveys	$50,000
8	FY08-4603	Create colonial waterbird nest habitat	$35,000
9	FY08-4616	Transport barge	$100,000

The refuge's budget requests are contained in the Refuge Operating Needs System (RONS) and Service Asset and Maintenance Management System (SAMMS) databases that include a wide variety of new and maintenance refuge projects. The RONS and SAMMS lists are constantly updated and include priority projects. Please contact the refuge for the most current RONS and SAMMS lists.

Appendix J. List of Preparers

Mark Purcell, Refuge Manger, ACE Basin NWR

Van Fischer, Natural Resource Planner, South Carolina Lowcountry Refuge Complex

Larry Hartis, Biologist, ACE Basin NWR

Bryan Woodward, Park Ranger, ACE Basin NWR

Appendix K. Finding of No Significant Impact

Introduction
The U.S. Fish and Wildlife Service (Service) proposes to protect and manage certain fish and wildlife resources in Charleston, Beaufort, Colleton, and Hampton Counties, South Carolina, through the Ernest F. Hollings A.C.E. Basin National Wildlife Refuge (ACE Basin Refuge). An Environmental Assessment was prepared to inform the public of the possible environmental consequences of implementing the Comprehensive Conservation Plan (CCP) for ACE Basin NWR. A description of the alternatives, the rationale for selecting the preferred alternative, the environmental effects of the preferred alternative, the potential adverse effects of the action, and a declaration concerning the factors determining the significance of effects, in compliance with the National Environmental Policy Act of 1969, are outlined below. The supporting information can be found in the Environmental Assessment, which is Section B of the Draft Comprehensive Conservation Plan.

Alternatives
In developing the CCP for ACE Basin NWR, the Service evaluated three alternatives:

The Service adopted Alternative C, the "Preferred Alternative," as the CCP to guide management direction of the refuge for the next 15 years. The overriding concern reflected in this CCP is that wildlife conservation assumes first priority in refuge management; wildlife-dependent recreational uses are allowed if they are compatible with wildlife conservation. Wildlife-dependent recreation uses including hunting, fishing, wildlife observation, wildlife photography, and environmental education and interpretation will be emphasized and encouraged.

Alternative A. No Action Alternative
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, shorebirds, and wading birds. Primary management activities include managing wetland impoundments (primarily historically created "rice fields"), managing old farm fields in a grassland/scrub/shrub mosaic for neotropical migratory birds, basic species monitoring, wood duck banding, and moist-soil management strategies 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, foraging wood storks, over-wintering whooping cranes (experimental flock), maintaining upland and wetland forests, repairing wetland impoundment control water control structures (aluminum flash board risers and wooden "rice trunks," dikes and internal drainage ditches and canals, managing habitat for neotropical migratory birds, and providing opportunities for wildlife dependent recreation. Species monitoring would be limited due to staffing constraints, limited volunteer assistance, and limited research interest. Habitat management actions are intended to primarily benefit waterfowl, wading birds, shorebirds, and grassland-associated passerine birds; 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, grassland habitat 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 open to the public and some areas only seasonally open.

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

Alternative B
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 (enhanced moist-soil management practices) and greentree reservoirs would be increased to accommodate larger waterfowl numbers. Some open fields and scrub/shrub areas on the refuge would be more intensively managed to increase populations of neotropical migratory and breeding songbirds to higher levels than under Alternative A, but limited to maintaining existing areas suitable for these migratory species. There would be increased effort to control invasive exotic plants.

This alternative proposes to increase monitoring efforts to focus primarily on threatened and endangered species (such as wood storks), waterfowl, and other migratory birds, with less effort to address other non-migratory resident species. Under Alternative A, monitoring is focused almost entirely on waterfowl but does include other species as funding and time permits. This alternative would provide extensive waterfowl and endangered species 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 objectives of waterfowl and other migratory bird management.

The refuge would be staffed at current levels plus the addition of one refuge forester to increase components of the Forest Management Plan and a public use park ranger. Researchers (enhancement of the existing research partnership with the Nemours Wildlife Foundation) would be accommodated when projects benefit the refuge and focus mostly towards waterfowl habitat and management (old rice fields/moist-soil management units).

Alternative C. (Preferred Alternative)
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, threatened and endangered species, and other migratory birds will remain a focus of management, wetland habitat manipulations will also consider the needs of multiple species, such as marsh and wading birds. Management of upland forests and fields for neotropical migratory birds will be more actively managed than under Alternative B. Landscape level consideration of habitat management will include a diversity of open fields, upland and wetland forests, and additional managed wetlands. Upland loblolly pine plantations (relic industrial forest) will be heavily thinned to encourage multi-strata vegetation composition and hardwood interspersion. Some more xeric loblolly pine plantations will be converted to longleaf pine

savannas and subjected to frequent growing season prescribed fires to favor warm season grasses and forbs and the potential reintroduction of red cockaded woodpeckers in the ACE Basin Project Area. Multiple species consideration will include species and habitats identified by the South Atlantic Migratory Bird Initiative and the State Strategic Conservation Plan.

This alternative will 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 will be increased with the assistance of additional staff, trained volunteers, and academic research. Greater effort will be made to recruit academic researchers to the refuge to study and monitor refuge resources.

Wildlife-dependent uses of the refuge will continue. Hunting and fishing will continue to be allowed. However, hunting will be managed with a greater focus on achieving biological needs of the refuge, such as deer population management and feral hog elimination. Education and interpretation will be the same as Alternative A, but with additional education and outreach efforts aimed at the importance of landscape and diversity. A significantly greater effort will be made with outreach to nearby developing urban communities and a growing human population. Existing environmental education programs, such as the Earth Stewards Program conducted in concert with the SEWEE Association (refuge friends group), will be expanded to include additional elementary schools, students, and teachers.

The refuge will be staffed at the Region 4, 2008 staffing model to enhance all refuge services and management programs. Greater emphasis will be placed on recruiting and training volunteers and worker-camper opportunities will be expanded to facilitate the accomplishment of refuge maintenance programs and other refuge goals and objectives. Refuge biological programs will actively seek funding and researchers to study primarily management-oriented research needs. Refuge staff will place greater emphasis on developing and maintaining active partnerships, including seeking grants to assist the refuge in reaching primary objectives.

Selection Rationale
Alternative C was selected for implementation because it directs the development of programs to best achieve the refuge purpose and goals; emphasizes management and enhancement of all refuge habitat types; collects habitat and wildlife data; and ensures long-term achievement of refuge and Service objectives. At the same time, these management actions provide balanced levels of compatible public use opportunities consistent with existing laws, Service policies, and sound biological principles. It provides an appropriate mix of program elements to achieve desired long-term conditions.

Under this alternative, all lands under the management and direction of the refuge will be protected, maintained, and enhanced to best achieve national, ecosystem, and refuge-specific goals and objectives within anticipated funding and staffing levels. In addition, the action positively addresses significant issues and concerns expressed by the public.

Environmental Effects
Implementation of the Service's management action is expected to result in environmental, social, and economic effects as outlined in the CCP. Habitat management, population management, land conservation, and visitor service management activities on ACE Basin NWR will result in an overall increase in wildlife and habitat diversity, enhanced waterfowl habitat and food sources, increased

migratory bird utilization, and strengthened opportunities for wildlife-dependent recreation and education. These effects are detailed as follows:

1. Waterfowl use of the refuge should improve as intensive water management efforts will provide dependable flooded habitats to match the migration chronologies of these species. Forest breeding birds will benefit from refuge land acquisition, reforestation, and forest management actions.

2. Migratory bird production should increase by enhancing forest habitat quality for neotropical migratory birds, habitat and food availability for wintering waterfowl, and through hydrological restoration and reforestation. Forest management practices, such as reforestation, selective harvests, and conservation of mature stand components, will benefit nesting and feeding habitat for neotropical migratory birds.

3. Refuge land acquisition, reforestation, and protection will benefit the recovery of threatened and endangered species, trust species, and resident plants and animals.

4. Active habitat management of the refuge's habitat mix of wetland impoundments, open grassy fields, early successional reforestation areas, and bottomland hardwood forests will improve food and cover for resident wildlife species and enhance wetland communities within the refuge.

5. Habitat restoration and management, along with a focus on accessibility and facility developments, will result in improved wildlife-dependent recreational opportunities. While public use will result in some minimal, short-term adverse effects on wildlife, and user conflicts could occur at certain times of the year, these effects are effectively minimized by site design, time zoning, and implementing refuge regulations. Anticipated long-term impacts to wildlife and wildlife habitats of implementing the management action are positive. In the long run, wildlife habitat and increased opportunities for wildlife-dependent recreation opportunities could result in an increase in economic benefits to the local community.

6. Implementing the CCP is not expected to have any significant adverse effects on wetlands and floodplains, pursuant to Executive Orders 11990 and 11988, as management actions will not result in development of buildings and/or structures within floodplain areas, nor will any actions result in irrevocable, long-term adverse impacts. In fact, a major thrust of management actions is to implement habitat restoration within the wildlife communities of the refuge that have been severely impacted by actions of previous landowners. Implementing the management actions will result in substantial enhancement of forest and wetland communities.

Potential Adverse Effects and Mitigation Measures

Wildlife Disturbance

Disturbance to wildlife at some level is an unavoidable consequence of any public use program, regardless of the activity involved. Obviously, some activities innately have the potential to be more disturbing than others. The management actions to be implemented have been carefully planned to avoid unacceptable levels of impact.

As currently proposed, the known and anticipated levels of disturbance of the management action are considered minimal and well within the tolerance level of known wildlife species and populations present in the area. Implementation of public uses will take place through carefully controlled time and space zoning, establishment of protection zones around key sites, and routing of roads and trails to avoid direct contact with sensitive areas, such as nesting bird habitat, etc. All hunting activities (season lengths, bag limits, number of hunters) will be conducted within the constraints of sound biological principles and refuge-specific regulations established to restrict illegal or non-conforming

activities. Monitoring activities through wildlife inventories and assessments of public use levels and activities will be utilized, and public use programs will be adjusted as needed to limit disturbance.

User Group Conflicts

As public use levels may increase in the future, some conflicts between user groups may occur. Programs will be adjusted, as needed, to eliminate or minimize these problems and provide quality wildlife-dependent recreational opportunities. Experience has proven that time and space zonings, such as establishment of separate use areas, use periods, and restricting numbers of users, are effective tools in eliminating conflicts between user groups.

Effects on Adjacent Landowners

Implementation of the management action will not impact adjacent or in-holding landowners. Essential access to private property will be allowed through issuance of special use permits. Future land acquisition will occur on a willing-seller basis only and at fair market values within the approved acquisition boundary. Lands will be acquired through a combination of fee title purchases and/or donations and less-than-fee title interests from willing sellers (e.g., conservation easements, cooperative agreements). Funds for the acquisition of lands within the approved acquisition boundary will likely come from the Land and Water Conservation Fund or the Migratory Bird Conservation Act.

Land Ownership and Site Development

Proposed acquisition efforts by the Service could result in changes in land and recreational use patterns, because all uses on national wildlife refuges must meet compatibility standards. Land ownership by the Service also precludes any future economic development by the private sector. Potential development of access roads, dikes, control structures, and visitor parking areas could lead to minor short-term negative impacts on plants, soil, and some wildlife species. When site development activities are proposed, each activity will adhere to the appropriate National Environmental Policy Act consideration during pre-construction planning. At that time, any required mitigation activities will be incorporated into the specific project to reduce the level of impacts to the human environment and to protect fish and wildlife and their habitats.

As indicated earlier, one of the direct effects of site development is increased public use; this increased use may lead to littering, noise, and vehicle traffic. While funding and personnel resources will be allocated to minimize these effects, such allocations make these resources unavailable for other programs.

The management action should not have any significant adverse effects on wetlands and floodplains, pursuant to Executive Orders 11990 and 11988.

Coordination

The management action has been thoroughly coordinated with all interested and/or affected parties. Parties contacted include:

All affected landowners
Congressional representatives
Governor of South Carolina
South Carolina Department of Natural Resources
South Carolina State Historic Preservation Officer
Local community officials
Interested citizens
Conservation organizations

Findings

It is my determination that the management action does not constitute a major federal action significantly affecting the quality of the human environment under the meaning of Section 102(2)(c) of the National Environmental Policy Act of 1969 (as amended). As such, an environmental impact statement is not required. This determination is based on the following factors (40 C.F.R. 1508.27), as addressed in the Environmental Assessment for Ace Basin NWR:

1. Both beneficial and adverse effects have been considered and this action will not have a significant effect on the human environment. (Environmental Assessment, pages 117-138).

2. The actions will not have a significant effect on public health and safety. (Environmental Assessment, pages 117-138).

3. The project will not significantly affect any unique characteristics of the geographic area such as proximity to historical or cultural resources, wild and scenic rivers, or ecologically critical areas. (Environmental Assessment, pages 117-138).

4. The effects on the quality of the human environment are not likely to be highly controversial. (Environmental Assessment, pages 117-138).

5. The actions do not involve highly uncertain, unique, or unknown environmental risks to the human environment. (Environmental Assessment, pages 117-138).

6. The actions will not establish a precedent for future actions with significant effects nor do they represent a decision in principle about a future consideration. (Environmental Assessment, pages 117-138).

7. There will be no cumulatively significant impacts on the environment. Cumulative impacts have been analyzed with consideration of other similar activities on adjacent lands, in past action, and in foreseeable future actions. (Environmental Assessment, pages 117-138).

8. The actions will not significantly affect any site listed in, or eligible for listing in, the National Register of Historic Places, nor will they cause loss or destruction of significant scientific, cultural, or historic resources. (Environmental Assessment, pages 117-138).

9. The actions are not likely to adversely affect threatened or endangered species, or their habitats. (Environmental Assessment, pages 117-138).

10. The actions will not lead to a violation of federal, state, or local laws imposed for the protection of the environment. (Environmental Assessment, pages 117-138).

Supporting References

Fish and Wildlife Service. 2009. Draft Comprehensive Conservation Plan and Environmental Assessment for Ernest F. Hollings A.C.E. Basin National Wildlife Refuge, Clarendon County, South Carolina. U.S. Department of the Interior, Fish and Wildlife Service, Southeast Region.

Document Availability

The Environmental Assessment was Section B of the Draft Comprehensive Conservation Plan for ACE Basin NWR and was made available in May 2009. Additional copies are available by writing: ACE Basin NWR, P.O. Box 848, Hollywood, SC 29449. Electronic copies are available for download from the Service's Internet site: *http://southeast.fws.gov/planning/*.

Cynthia K. Dohner
Acting Regional Director

Date 9/4/09