
**DRAFT
COMPREHENSIVE CONSERVATION PLAN
AND
ENVIRONMENTAL ASSESSMENT**

CEDAR ISLAND NATIONAL WILDLIFE REFUGE
Carteret County, North Carolina

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

The U.S. Fish and Wildlife Service developed this Draft Comprehensive Conservation Plan and Environmental Assessment to guide the management of the Cedar Island National Wildlife Refuge in Carteret County, North Carolina. The plan outlines programs and corresponding resource needs for the next 15 years, as mandated by the National Wildlife Refuge System Improvement Act of 1997.

As part of the planning process, the Service conducted a biological review of the refuge's wildlife and habitat management program and conducted public scoping meetings to solicit public opinion of the issues the plan should address. The biological review team consisted of biologists from federal and state agencies and non-governmental organizations that have an interest in the refuge. The staff held the public scoping meetings in Beaufort and Cedar Island, North Carolina.

The Service developed and analyzed three alternatives. Alternative 1 was a proposal to maintain the current management. The staff would manage the refuge with prescribed fire of marshes and pine forests conducted by employees from other refuges according to the Fire Management Plan. The refuge would employ a single maintenance worker stationed on the refuge to maintain the buildings and grounds, clean up dumpsites, and pick up litter. Staff from other refuges would survey waterfowl from the air on a routine basis. The refuge would conduct no other surveys of wildlife or habitats. The refuge would provide opportunities for all six priority public use activities: waterfowl hunting, fishing, wildlife observation, wildlife photography, and environmental education and interpretation. The staff would not conduct environmental education and interpretation programs, but would allow others to conduct programs on the refuge. The Service would manage the refuge from Mattamuskeet National Wildlife Refuge, four hours away from Cedar Island Refuge. Staff from Mattamuskeet would handle peak workloads at Cedar Island Refuge.

Alternative 2 proposes minimum program increases. The refuge would document the presence of priority wildlife species, but not monitor habitat. Staff from the refuge would survey waterfowl from the air on a routine basis. The refuge would continue to provide opportunities for the six priority public use activities, but would have the capacity to increase the number of opportunities. The staff would conduct environmental education programs once a month. The staff would establish an interpretive and observation trail with a brochure and a photo blind. The staff would also control dominant pest plants and animals as time and opportunity would allow. There would be four staff members stationed at Cedar Island Refuge.

Alternative 3 proposes moderate program increases. The refuge would document the presence of priority wildlife species and mammals and monitor fire-dependent habitats. The staff would monitor vegetation in the marshes and pine forests before and after prescribed burns conducted by staff from other refuges according to the Fire Management Plan. Staff from the refuge would survey waterfowl from the air and the ground on a routine basis. The refuge would continue to provide opportunities for the six priority public use activities, but would have the capacity to increase the number of opportunities. The staff would conduct environmental education and interpretation programs once a month. The refuge would establish an interpretive trail with a brochure and a photo blind. The staff would also monitor pest plants and animals and control them according to an integrated pest management plan. There would be seven staff members stationed at the Cedar Island National Wildlife Refuge.

The Service selected Alternative 2 as its preferred alternative. It advances the refuge program considerably, addresses the highest priority needs, and is more realistic than Alternative 3 in terms of expected budgets and staffing levels to conduct the proposed program. It serves the purposes of the refuge, the mission of the National Wildlife Refuge System, and best serves the goals outlined.

SECTION A. COMPREHENSIVE CONSERVATION PLAN

Chapter I. Background

INTRODUCTION

The U.S. Fish and Wildlife Service developed this Draft Comprehensive Conservation Plan for Cedar Island National Wildlife Refuge to provide a foundation for its management and use. The plan will serve as a guide for the refuge's management programs and actions over the next 15 years.

The Service developed this plan in compliance with the National Wildlife Refuge System Improvement Act of 1997 and Part 602 (National Wildlife Refuge System Planning) of the Fish and Wildlife Service Manual. The actions described within this plan also meet the requirements of the National Environmental Policy Act of 1969. Public participation in the planning process (described in Chapter III of Section A and Appendix IV) and the incorporation of an Environmental Assessment in this document, with a description of the alternatives considered and an analysis of the environmental consequences of the alternatives (Chapters III and IV of Section B), constitutes compliance with this Act. When fully implemented, this plan will strive to achieve the vision and purposes of Cedar Island National Wildlife Refuge.

The plan's overriding consideration is to carry out the purposes for which the Service established the refuge. Fish and wildlife conservation is the first priority in refuge management, and the Service allows public use (wildlife-dependent recreation) and encourages it as long as it is compatible with, or does not detract from, the refuge's mission and purposes.

A planning team has prepared the plan. The team consisted of representatives from various Service programs, including Refuges, Fisheries, Ecological Services, Realty, and Migratory Birds. In developing this plan, the planning team and refuge staff have incorporated the input of local citizens and the general public through a series of stakeholder and public scoping meetings. A description of this public involvement and the planning process itself can be found in the Plan Development section.

The plan represents the Service's proposed alternative. The staff prepared it after considering three other alternatives, as described in the accompanying Environmental Assessment. After reviewing a wide range of public comments and management needs, the planning team developed these alternatives in an attempt to determine how to best meet the purposes and goals of Cedar Island National Wildlife Refuge. The proposed alternative is the Service's recommended course of action for the management of the refuge and is detailed in this comprehensive conservation plan.

PURPOSE OF AND NEED FOR THE PLAN

The purpose of this comprehensive conservation plan is to identify the role that Cedar Island National Wildlife Refuge 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. The plan is needed to:

Provide a clear statement of direction for the management of the refuge;

Provide refuge neighbors, visitors, and government officials with an understanding of the Fish and Wildlife Service's management actions on and around the refuge;

Ensure that the Service's management actions, including land protection and recreational and educational programs, are consistent with the mandates of the National Wildlife Refuge System Improvement Act of 1997;

Ensure that the management of the refuge is consistent with federal, state, and county plans; and

Provide a basis for the development of budget requests for the refuge's operational, maintenance, and capital improvement needs.

Perhaps the greatest need of the Service is to communicate with the public and include public participation in its efforts to carry out the mission of the National Wildlife Refuge System. Many agencies, organizations, institutions, businesses, and private citizens have developed relationships with the Service to advance the goals of the Refuge System. This draft comprehensive conservation plan supports the Partners-in-Flight Initiative, South Atlantic Coastal Plain Migratory Bird Conservation Plan, North American Waterfowl Management Plan, Western Hemisphere Shorebird Reserve Network, and National Wetlands Priority Conservation Plan.

THE U.S. FISH AND WILDLIFE SERVICE

The U.S. Fish and Wildlife Service is the primary federal agency responsible for the conservation, protection, and enhancement of the Nation's fish and wildlife populations and their habitats. Although the Service shares some conservation responsibilities with other federal, state, tribal, local, and private entities, it has specific trustee obligations for migratory birds, threatened and endangered species, anadromous fish, and certain marine mammals. In addition, the Service administers a national network of lands and waters for the management and protection of these resources.

As part of its mission, the Service manages more than 540 national wildlife refuges covering nearly 96 million acres. These areas comprise the National Wildlife Refuge System, the world's largest collection of lands and waters specifically managed for fish and wildlife. The majority of these lands, 77 million acres, lie in Alaska. The remaining 16 million acres lie in the other 49 states and several island territories.

THE NATIONAL WILDLIFE REFUGE SYSTEM

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

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

The National Wildlife Refuge System Improvement Act of 1997 established, for the first time, a clear mission of wildlife conservation for the National Wildlife Refuge System. The Act states that the Service shall manage each refuge:

- Fulfill the mission of the Refuge System;
- Fulfill the individual purposes of each refuge;
- Consider the needs of fish and wildlife first;
- Fulfill the requirement of developing a comprehensive conservation plan for each unit of the Refuge System, and fully involve the public in the preparation of these plans;
- 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.

Following passage of the Act in 1997, the Service immediately began efforts to carry out the direction of the new legislation, including the preparation of comprehensive conservation plans for all refuges. The development of these plans is now ongoing nationally. Consistent with the Act, the Service is preparing all refuge comprehensive conservation plans in conjunction with public involvement, and requires each refuge to complete its own plan within a 15-year schedule.

Approximately 39.5 million people visited the country's national wildlife refuges in 2003, mostly to observe wildlife in their natural habitats. As this visitation continues to grow, refuges generate substantial economic benefits to the local communities that surround them. Economists have reported that national wildlife refuge visitors contribute more than \$809 million annually in sales and \$315 million in employment income to local economies (U.S. Fish and Wildlife Service 2003). In addition, the National Survey of Fishing, Hunting, and Wildlife Associated Recreation reports that nearly 40 percent of the country's adults spent \$108 billion on wildlife-related recreational pursuits in 2001 (U.S. Fish and Wildlife Service 2001).

Volunteerism continues to be a major contributor to the successes of the Refuge System. In 1998, volunteers contributed more than 1.5 million person-hours on the refuges nationwide, a service valued at more than \$20.6 million.

The wildlife and habitat vision for the national wildlife refuges stresses the listed principles:

Wildlife comes first.

Ecosystems, biodiversity, and wilderness are vital concepts in refuge management.

Refuges must be healthy.

Growth of refuges must be strategic.

The National Wildlife Refuge System serves as a model for habitat management with broad participation from others.

REFUGES OF THE ECOSYSTEM

The refuge is one of the ten national wildlife refuges in eastern North Carolina. Those ten national wildlife refuges, Alligator River, Cedar Island, Currituck, Great Dismal Swamp, Mackay Island, Mattamuskeet, Pea Island, Pocosin Lakes, Swanquarter, Roanoke River; and the Back Bay National Wildlife Refuge in Virginia, are all located in the watersheds of the Roanoke, Tar, Neuse, and Cape Fear Rivers, which have been classified as Ecosystem Unit #34 by the U.S. Fish and Wildlife Service.

LEGAL POLICY CONTEXT

Administration of national wildlife refuges is guided by the mission and goals of the National Wildlife Refuge System, Congressional legislation, Presidential executive orders, and international treaties. Policies for management options of refuges are further refined by administrative guidelines established by the Secretary of the Interior and by policy guidelines established by the Director of the Fish and Wildlife Service. (See Appendix III for more information on legal and policy guidance for the operation of national wildlife refuges.)

NATIONAL CONSERVATION PLANS AND INITIATIVES

Along with the Service's legal mandates and initiatives, other planning activities directly influence the development of the comprehensive conservation plan. Various groups and agencies develop and coordinate planning initiatives involving federal, state, and local agencies; local communities, non-governmental organizations, and private individuals to help restore habitats for fish and wildlife on and off public lands.

The Service is initiating cooperative partnerships in an effort to reduce the declining trend in biological diversity. Biological planning for species groups targeted in this plan reflects the North American Waterfowl Management Plan. The North American Waterfowl Management Plan of 1986 brings together international teams of biologists from private and government organizations from Canada, Mexico, and the United States. The partnerships, called joint ventures, are working to restore waterfowl and other migratory bird populations to the levels of the early 1970s by protecting about 6 million acres of priority wetland habitats from the Gulf of Mexico to the Canadian Arctic.

The United States Shorebird Conservation Plan and Waterbirds for the Americas outline approaches to conserving those species groups. Restoration of migratory songbird populations is a high priority of the Partners-in-Flight Plan. It also provides strategies for conserving and managing wintering, breeding, and migration habitat for mid-continental wood duck and colonial bird populations.

The Partners-in-Flight Plan emphasizes land bird species as a priority for conservation. Habitat loss, population trends, and the vulnerability of species and habitats to threats are all factors used in the priority ranking of species. Further, biologists have identified focal species for each habitat type from which they will determine population and habitat objectives and conservation actions. This list of focal species, objectives, and conservation actions will aid migratory bird management on the refuge.

The Farm Bill programs administered by the U.S. Department of Agriculture provide cost-share funding and technical assistance to private landowners to install and manage conservation practices on working farms and forests and restore cropland to natural habitats. The programs provide opportunities for landowners in the vicinity of national wildlife refuges to manage their land better as wildlife habitat or protect it with easements.

RELATIONSHIP TO STATE PARTNERS

A provision of the National Wildlife Refuge System Improvement Act of 1997, and subsequent agency policy, is that the Service shall ensure timely and effective cooperation and collaboration with other federal agencies and state fish and wildlife agencies during the course of acquiring and managing refuges. This cooperation is essential in providing the foundation for the protection and management of fish and wildlife throughout the United States.

The North Carolina Wildlife Resources Commission (NCWRC) is the state-partnering agency with the Service that is charged with enforcement responsibilities for migratory birds and endangered species, as well as management responsibilities for the state's natural resources. The NCWRC also manages approximately 1.8 million acres of game lands in North Carolina.

The NCWRC coordinates the state's wildlife conservation program and provide public recreation opportunities, including an extensive hunting and fishing program, on several game lands and from several boat ramps located near Cedar Island National Wildlife Refuge. The agency's participation and contribution throughout this comprehensive conservation planning process has been valuable, and it is continuing its work with the Service to provide ongoing opportunities for an open dialogue with the public to improve the condition of fish and wildlife populations in North Carolina. Not only

has the agency participated in biological reviews, stakeholder meetings, and field reviews as part of the comprehensive conservation plan planning process, but the agency has also been an active partner in annual hunt coordination planning and various wildlife and habitat surveys. Cedar Island National Wildlife Refuge provides hunting opportunities for waterfowl in cooperation with the NCWRC. A key part of the comprehensive conservation planning process is the integration of common mission objectives between the Service and the state agency, where appropriate.

Chapter II. Refuge Overview

INTRODUCTION

LOCATION

Cedar Island National Wildlife Refuge is in Carteret County in the northeastern part of North Carolina. The Service named the refuge for the island on which it is located. The approved acquisition boundary lies entirely in Carteret County, North Carolina (population 59,383) (Figure 1). Morehead City, North Carolina (2000 population 7,651) is the closest city and lies 30 miles west of the refuge. Greenville, North Carolina (2000 population 60,476) lies 100 miles west of the refuge. The major metropolitan areas of Raleigh - Durham - Chapel Hill, North Carolina (2000 population 1,038,703) lies 180 miles west of the refuge and Norfolk - Virginia Beach – Hampton Roads (2000 population 1,569,541), Virginia lies 200 miles north of the refuge. The refuge covers a total of 14,480 acres in fee title ownership and has an approved acquisition boundary of 16,887 acres. Its western boundary is other land in Carteret County, eastern boundary is Cedar Island Bay and the Pamlico Sound, northern boundary is Long Bay and West Bay, and southern boundary is Thorofare Bay and Core Sound. This region is part of the physiographic area known as the South Atlantic Coastal Plain and the Fish and Wildlife Service administrative ecosystem known as the Roanoke-Tar- Neuse-Cape Fear Ecosystem.

ESTABLISHMENT

The Migratory Bird Conservation Commission approved the purchase of Cedar Island National Wildlife Refuge on August 10, 1964, by the authority of the Migratory Bird Conservation Act of 1929. The Migratory Bird Hunting Stamp Act of 1934 provided funding for the purchase. The Service has also purchased land with funds provided under the Fish and Wildlife Act of 1956. The Service approved an acquisition boundary of 16,887 acres.

ACQUISITION HISTORY

The Service acquired 12,526 acres in 1964 by fee simple purchase. Since 1985, the refuge has acquired 1,954 additional acres of fee simple purchase for a total of 14,480 acres. It has an approved acquisition boundary of 16,887 acres (Table 1).

Table 1. Acquisition history of the Cedar Island National Wildlife Refuge

YEAR	ACRES	COST	COST ACRE	TOTAL ACRES	TOTAL COST
1964	7,380.00	\$33,210.00	\$4.50	7,380.00	\$33,210.00
1965	3,171.71	\$107,900.80	\$34.02	10,551.71	\$141,110.80
1966	264.25	\$20,153.80	\$76.27	10,815.96	\$161,264.60
1967	221.74	\$27,956.21	\$126.07	11,037.70	\$189,220.81
<u>1968</u>	1,488.34	\$157,950.00	\$106.12	12,526.04	\$347,171.21
1990	1,956.00	\$0.00	\$0.00	14,482.04	\$347,171.21
1992	0.28	\$0.00	\$0.00	14,482.32	\$347,171.21
TOTAL	14,482.32	\$347,171.21			

All acquisitions were purchased fee simple. Acquisitions with no cost were donations.

PURPOSES

The purpose of Cedar Island National Wildlife Refuge, as reflected in the legislation under which Congress authorized the refuge and the Service has acquired land, is to protect and conserve migratory birds, and other wildlife resources through the protection of wetlands, in accordance with the listed laws.

...for use as an inviolate sanctuary, or for any other management purpose, for migratory birds... 16 U.S.C. Sec. 664 (Migratory Bird Conservation Act of 1929);

...for the development, advancement, management, conservation, and protection of fish and wildlife resources... 16 U.S.C. Sec 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).

SPECIAL DESIGNATIONS

The North Carolina Natural Heritage Program has designated most of the refuge, with the exception of the headquarters area, as a Significant Natural Heritage Area. The Nature Conservancy ranks certain vegetative communities as imperiled or rare (Table 2).

The North Carolina Division of Water Quality has designated several water bodies in the vicinity of Cedar Island National Wildlife Refuge as outstanding resource waters or high-quality waters (Table 6).

The North Carolina Division of Marine Fisheries has designated several streams and water bodies within and off the borders of the refuge as fish nurseries and anadromous fish spawning habitats.

ECOSYSTEM CONTEXT

Cedar Island National Wildlife Refuge lies within a physiographic region known as the South Atlantic Coastal Plain (Figure 2). The South Atlantic Coastal Plain was once a 25-million-hectare complex of forested wetlands and uplands, dunes, and marshes that extended from Florida to North Carolina. Historically, the extent and duration of seasonal flooding along the ecosystem's rivers fluctuated annually recharging the South Atlantic Coastal Plain's aquatic systems, and creating a rich diversity of dynamic habitats that supported a vast array of fish and wildlife resources.

REGIONAL CONSERVATION PLANS AND INITIATIVES

Beyond national conservation plans and initiatives and the Service's legal mandates and initiatives, regional planning activities directly influence the development of the comprehensive conservation plan. Various groups and agencies develop and coordinate planning initiatives involving regional, state, and local agencies; local communities; non-governmental organizations; and private individuals to help restore habitats for fish and wildlife on and off public lands.

The Service is initiating cooperative partnerships in an effort to reduce the declining trend in biological diversity. Biological planning for species groups targeted in this plan reflect the North American Waterfowl Management Plan, which includes the Atlantic Coast Joint Venture, the Joint Venture between North Carolina Wildlife Resources Commission and Fish and Wildlife Service, Partners-in-Flight Plan, and the South Atlantic Migratory Bird Initiative.

Table 2. The Nature Conservancy ranking of vegetative communities of Cedar Island National Wildlife Refuge

Vegetative Community	State Rank	Global Rank
Coastal Fringe Evergreen Forest	S1	G3
Coastal Fringe Sandhill	S1	G3
Bay Forest	S2	G3
Low Pocosin	S2	G3
Maritime Dry Grassland	S2	G3
Pine Savanna	S2	G3
Wet Pine Flatwoods	S3	G3
Maritime Shrub	S3	G4
Cypress – Gum Swamp	S3	G4
<p><i>S1 = Critically imperiled in North Carolina because of extreme rarity or otherwise very vulnerable to extirpation in the state.</i> <i>S2 = Imperiled in North Carolina because of rarity or otherwise very vulnerable to extirpation in the state.</i> <i>S3 = Rare or uncommon in North Carolina.</i> <i>G1 = Critically imperiled globally because of extreme rarity or otherwise very vulnerable to extinction throughout its range.</i> <i>G2 = Imperiled globally because of rarity or otherwise very vulnerable to extinction throughout its range.</i> <i>G3 = Either very rare or local throughout its range, or found locally in a restricted area.</i></p>		

The Atlantic Coast Joint Venture focus is that of the middle and upper Atlantic coast. Within the Atlantic Coast Joint Venture is a joint venture formed between the North Carolina Wildlife Resources Commission, Fish and Wildlife Service and private conservation organizations. The South Atlantic Coastal Plain serves as a primary migration habitat for migratory songbirds returning from Central and South America. It also provides wintering, breeding, and migration habitat for mid-continental wood duck and colonial bird populations. Restoration of migratory songbird populations is a high priority of the Partners-in-Flight Plan for the South Atlantic Physiographic Region.

The Partners-in-Flight Plan emphasizes land bird species as a priority for conservation. Habitat loss, population trends, and the vulnerability of species and habitats to threats are all factors used in the priority ranking of species. Further, biologists from local offices of the Service, the North Carolina Wildlife Resources Commission, conservation organizations, such as Audubon Society and The Nature Conservancy, have identified focal species for each habitat type from which they will determine population and habitat objectives and conservation actions. This list of focal species, objectives, and conservation actions will aid migratory bird management on the refuge.

The Farm Bill programs, administered by the Department of Agriculture, have state level plans and priority ranking systems in which the Service has input. The Service also utilizes those programs to assist private landowners in the vicinity of national wildlife refuges to manage habitat for wildlife or protect their land with easements.

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Figure 2. Cedar Island National Wildlife Refuge in the South Atlantic Coastal Plain Physiographic Area



The NCWRC has its own comprehensive wildlife conservation strategy to help direct the state's allocation of funds from the federally funded State Working Grants Program. The Service has provided input to the development and execution of the strategy.

ECOLOGICAL THREATS AND PROBLEMS

HABITAT LOSS AND FRAGMENTATION

The South Atlantic Coastal Plain has changed markedly over the last 100 years as civilization spread throughout the area. Scientists have estimated that land conversion has destroyed 40 percent of the natural vegetation in the area. The greatest changes to the landscape have been in the form of land clearing for agriculture and urban development (Hunter et al. 2001).

Although these changes have allowed people to settle and earn a living in the area, they have had a tremendous effect on biological diversity, biological integrity, and environmental health of the South Atlantic Coastal Plain. Vast areas of marshes and bottomland hardwood forests have become marsh and forest fragments, ranging in size from very small tracts of limited functional value to a few large areas that have maintained many of the original functions and values. Severe fragmentation has resulted in a substantial decline in biological diversity and integrity. Species endemic to the South Atlantic Coastal Plain that have become extinct, endangered, or threatened include the red wolf and red-cockaded woodpecker (Table 3).

Table 3. Federally listed threatened and endangered animal species of the Coastal Plain of North Carolina

Region	Status	Common name	Scientific Name
Coastal Plain	Endangered	Manatee, West Indian	<i>Trichechus manatus</i>
Coastal Plain	Endangered	Sea Turtle, Hawksbill	<i>Eretmochelys imbricata</i>
Coastal Plain	Endangered	Sea Turtle, Kemp's Ridley	<i>Lepidochelys kempii</i>
Coastal Plain	Endangered	Sea Turtle, Leatherback	<i>Dermochelys coriacea</i>
Coastal Plain	Endangered	Stork, Wood	<i>Mycteria americana</i>
Coastal Plain	Endangered	Sturgeon, Shortnose	<i>Acipenser brevirostrum</i>
Coastal Plain	Endangered	Tern, Roseate	<i>Sterna dougallii</i>
Coastal Plain	Endangered	Whale, Finback	<i>Balaenoptera physalus</i>
Coastal Plain	Endangered	Whale, Humpback	<i>Megaptera novaeangliae</i>
Coastal Plain	Endangered	Whale, Right	<i>Balaena glacialis</i>
Coastal Plain	Endangered	Whale, Sea	<i>Balaenoptera borealis</i>
Coastal Plain	Endangered	Whale, Sperm	<i>Physeter catodon</i>
Coastal Plain	Endangered	Wolf, Red	<i>Canis rufus</i>
Coastal Plain	Endangered	Woodpecker, Red-cockaded	<i>Picoides borealis</i>
Coastal Plain	Threatened	Alligator, American	<i>Alligator mississippiensis</i>
Coastal Plain	Threatened	Eagle, Bald	<i>Haliaeetus leucocephalus</i>
Coastal Plain	Threatened	Plover, Piping	<i>Charadrius melodus</i>
Coastal Plain	Threatened	Sea Turtle, Green	<i>Chelonia mydas</i>
Coastal Plain	Threatened	Sea Turtle, Loggerhead	<i>Caretta caretta</i>
Coastal Plain	Threatened	Silverside, Waccamaw	<i>Menidia extensa</i>

Breeding bird surveys show continuing declines in species and species populations. The avian species most adversely affected by fragmentation include those that are area-sensitive (dependent on large continuous blocks of hardwood forest); those that depend on forest interiors; those that depend on special habitat requirements (e.g., mature forests or a particular food source); and/or those that depend on good water quality. Nest parasitism is also common in fragmented forests.

More than 300 species of breeding migratory songbirds inhabit the region. Some of these species, including Swainson's warbler, prothonotary warbler, swallow-tailed kite, wood thrush, and cerulean warbler, have declined substantially and need the benefits of large forested blocks to recover and sustain their existence.

Fragmentation of marshes has left the remaining marsh tracts surrounded by commercial, industrial, and residential developments. These land uses generate excessive quantities of surface runoff, usually contaminated with pollutants from vehicles, industrial production, domestic waste disposal, and lawn maintenance. Percolates from septic systems pose the potential for contamination of shallow groundwater. The residential areas also bring pets that prey on wildlife, especially songbirds.

ALTERATIONS TO HYDROLOGY

In addition to the loss of vast acreages of marshes and bottomland forested wetlands, there have been substantial alterations in the region's hydrology due to managed stream flows from flood control and hydroelectric power generation reservoirs, drainage ditches, river channel modification, flood control levees, deforestation, and degradation to aquatic systems from excessive sedimentation and contaminants, and urban development.

The natural hydrology of a region is directly responsible for the connectedness of wetlands and indirectly responsible for the complexity and diversity of habitats through its effects on topography and soils. Natural resource managers recognize the importance of dynamic hydrology to wetlands and waterfowl-habitat relationships (Fredrickson and Heitmeyer 1988).

SILTATION OF AQUATIC ECOSYSTEMS

Deforestation and hydrologic alteration have degraded aquatic systems, including lakes, rivers, sloughs and bayous. Clearing of bottomland hardwood forests has led to an accelerated accumulation of sediments and contaminants in all aquatic systems. Sediment now fills many water bodies, greatly reducing their surface area and depth. Concurrently, the non-point source runoff of excess nutrients and contaminants is threatening the area's remaining aquatic resources. Turbidity caused by sediment limits light penetration into the water and consequently the growth of submerged aquatic vegetation. The federally listed threatened and endangered species include 4 species of aquatic organisms as threatened and 10 species as endangered that occur on the coastal plain of North Carolina.

Drainage ditches in coastal marsh habitats expose more areas of the marshes to fluctuations in water levels with tidal cycles. As the tides come into the marsh, water saturates more soil on ditch banks; as the tides go out, the banks erode and the tides carry sediments into the bays and sounds. Over the years, this erosion results in a loss of wetland acreage.

PROLIFERATION OF INVASIVE AQUATIC PLANTS

Compounding the problems faced by aquatic systems is the growing threat from invasive aquatic vegetation. These invasive aquatic species threaten the natural aquatic vegetation important to aquatic systems, and choke waterways to a degree that limits biodiversity and often prevents recreational use.

CONSERVATION PRIORITIES

The declines in the South Atlantic Coastal Plain's dune, marsh, shrub, and forest communities and their associated fish and wildlife resources have prompted the Service to designate the habitats and wildlife species of Cedar Island Refuge of special concern. A collaborative effort involving private, state, and federal conservation partners is now underway to implement a variety of tools to restore the functions and values of wetlands and other coastal habitats in the South Atlantic Coastal Plain. The goal is to prioritize and manage areas to most effectively maintain and possibly restore the biological diversity in the South Atlantic Coastal Plain. The Service has prioritized some areas as focus areas for intensive management, others for reforestation, and still others for preservation.

Conservation agencies and organizations have initiated several coordinated efforts to set priorities and establish focus areas to overcome the impacts of hydrologic changes and forest fragmentation. Conservationists established a cooperative private-state-federal partnership, known as the North American Waterfowl Management Plan, Atlantic Coast Joint Venture, in 1986 to help provide sufficient wintering waterfowl habitat throughout the Atlantic Coastal Plain.

The initial Atlantic Coast Joint Venture effort for waterfowl has expanded to also establish breeding bird objectives for shorebirds and neotropical migratory forest-nesting birds. The Atlantic Coast Joint Venture is working with the U.S. Shorebird Conservation Working Group to establish step-down objectives for shorebird foraging habitat for the fall migration period throughout the South Atlantic Coastal Plain.

Partners-in-Flight has developed bird conservation plans to focus a number of private, state, and federal restoration programs into specific areas in an effort to provide maximum program benefits for neotropical migratory songbirds. The goal of this collaborative restoration effort is to provide islands or blocks of habitat, especially forested habitat, in an otherwise highly fragmented landscape. The targeted block sizes range from 10,000 to 100,000 acres. Such areas are large enough to support viable populations of various suites of neotropical migratory songbirds. Of course, these areas will also support other species that depend on large forested blocks. Existing or proposed state wildlife management areas or national wildlife refuges are the anchors of the plans. These public lands serve as centers of biodiversity that landowners and managers enhance and support by the expansion of forested blocks, either through public or private management.

One of the biggest challenges to the management and restoration efforts underway in the South Atlantic Coastal Plain, and one that affects refuges in particular, is the need to meet long-term management objectives that address comprehensive ecosystem needs, including those of wintering migratory waterfowl, neotropical migratory birds, shorebirds, large mammals, and other wide-ranging species. Often management for one species, or species group, conflicts with the management for another species or species group. The tendency is to pursue short-term priorities that frequently change as scientific knowledge expands and interests in special resources shift. Agencies and organizations must exercise caution to prevent the start-up of management and restoration actions that are difficult to reverse and fail to meet the long-term, comprehensive management needs of the ecosystem or a specific area within the ecosystem. An example might be a tendency to totally manage Cedar Island National Wildlife Refuge in an effort to provide habitat for many species of neotropical migratory songbirds that require a pine savanna with an herbaceous understory. Such an approach may overlook the critical habitat needs of other songbirds that prefer a forest with a shrub understory.

The partners can only meet the habitat goals of the Atlantic Coast Joint Venture through active management of croplands, moist-soil areas, and forested wetlands on both public and private land (Reinecke and Baxter 1996). Active management (i.e., vegetation manipulation and hydrology restoration) is necessary to compensate for the spatial and temporal habitat changes that deforestation

and hydrologic alterations have caused throughout the South Atlantic Coastal Plain. When properly managed, the Cedar Island National Wildlife Refuge would make a substantial contribution to meeting the objectives of the Atlantic Coast Joint Venture. Setting habitat and species objectives from the perspective of the South Atlantic Coastal Plain is advantageous because it looks at the big picture and enables managers to plan and provide habitat for a diversity of species throughout their range.

CHALLENGES

In order for Cedar Island National Wildlife Refuge to meet its multiple objectives of national, regional, and local scope, ranging from marsh management to reducing habitat fragmentation to providing for public use, the Service must fund and staff the refuge well above current levels. Securing adequate funding and personnel and then implementing a variety of programs to achieve the best balance of all objectives, through a system of coordinated planning, is the refuge's biggest challenge. In the interim, as the needed funding and personnel become available, the refuge must concentrate on its highest priorities without committing irreversible actions that would preclude future implementation of the desired management programs.

PHYSICAL RESOURCES

CLIMATE

The Cedar Island National Wildlife Refuge exhibits a maritime climate because of its proximity to the Atlantic Ocean and surrounding bays and sounds. Winter temperatures on the average are milder than those of mainland weather stations, and in summer temperatures are cooler than those of mainland stations.

Since the flow of air over North Carolina is predominantly from west to east, the continental influence is much greater on most of the state than the ocean or marine influence. Therefore, the state experiences a fairly large variation in temperature from winter to summer.

The Gulf Stream current flows only a short distance off the North Carolina coast. One might think this "river" of warm water would have a profound effect on the climate. Its direct effects are limited by the fact that the prevailing winds in winter are westerly.

Lows usually reform along the coast as "Cape Hatteras lows" and then move north along the coast. Winter's low-pressure storms are usually more intense because of the large north-to-south contrasts.

Winter's storms bring prolonged periods of steady rain and are responsible for most of the winter precipitation. The forms of precipitation in spring begin to change from these steady rains to occasional thunderstorms. The Gulf of Mexico's warm, moist air produces warm, humid weather throughout the summer. Rainfall comes from occasional thunderstorms. Autumn, North Carolina's driest season, is to many people the most pleasant with its many clear, warm days and cool nights with little rain. This weather usually lasts until November.

The refuge is situated along a coastline with a long history of storm activity. Two basic storm types present a substantial threat to the coastal zone.

Tropical storms and hurricanes, spawned over the warm ocean waters of the Gulf of Mexico and the Atlantic Ocean, are probably the best known and feared storms. Hurricanes, which are characterized by winds greater than seventy-five miles per hour and accompanied by intense rainfall, plague the Gulf and Atlantic seabords from mid-summer to late autumn. During the 1950s, a total of nine hurricanes affected the North Carolina coastline. Since then, only two major hurricanes, Donna in

1960, and Isabel in 2003, have occurred along the Outer Banks.

Most storms pass off the coast east of the Cedar Island Refuge, but may bring large quantities of rain to the refuge. These extratropical storms, often called “northeasters” present a greater problem than hurricanes to the Atlantic coast, the Outer Banks in particular. Such storms may develop as strong low-pressure areas, and move slowly offshore into the Atlantic Ocean. The winds, sometimes reaching hurricane force, blow onshore from a northerly or easterly direction for sustained periods of time. The damage from these storms may ultimately far exceed the destruction from a hurricane. The March 1962 “northeaster”, also known as the “Ash Wednesday Storm”, proved that point decisively. Flood height and duration for extratropical storms often have equaled or exceeded those of hurricanes affecting North Carolina.

Most North Carolina tornadoes occur in the Piedmont and the interior of the coastal plain, which spares Carteret County.

On the refuge the average annual precipitation is 57.6 inches, while the average annual snowfall was 1 inch. The record snowfall was 9 inches recorded at Cedar Island, North Carolina. Snow accumulations of more than 1 inch for more than a day are rare. Rainfall is evenly distributed throughout the year: average monthly rainfall ranges from 3.25 inches in April to 7.11 inches in August. Nine months have average precipitation between three and five inches (Table 4).

Of the total annual precipitation, about 31 inches usually falls in April through September. The growing season for most crops falls within this period. In 2 years out of 10, the rainfall in April through September is less than 15 inches.

The average relative humidity in mid-afternoon is about 65 percent. Humidity is higher at night, and the average at dawn is about 80 percent. The sun shines 60 percent of the time possible in summer and 50 percent in winter. The prevailing wind is from the southwest. Average wind speed is highest, 12 miles per hour, in winter and spring. The top winds during Hurricane Isabel in September 2003 were 86 miles per hour.

In January the average temperature is 41 degrees, the average daily minimum temperature is 38 degrees, and the average daily maximum is 53 degrees. In July the average temperature is 81 degrees, the average daily maximum temperature is 89 degrees, and the average daily minimum is 73 degrees (Table 4).

The average growing season is 243 days-long. The average last date of frost in the spring is March 20 and the first frost in the fall is November 19.

GEOLOGY

There are five physiographic areas in Carteret County: the uplands of the Talbot Surface, the low marine terraces and stream terraces of the Pamlico Surface, the islands of the Outer Banks, the salt marsh, and the forested flood plains along streams. The Suffolk Scarp enters the county just west of Harlowe and runs generally south toward Morehead City. Elevation at the base of the scarp is about 20 feet. The scarp formed the shoreline of an ancient ocean, the Pamlico Sea. It separates the older, upland soils of the Talbot Surface to the west from the younger, lower soils on the Pamlico Surface. Narrow stream terraces on the Pamlico Surface extend inland along some of the larger creeks and rivers west of Morehead City.

Table 4. Climatological data, 1971-2000, Cedar Island, North Carolina

Month	Average High Temperature (°F)	Average Low Temperature (°F)	Average Precipitation (Inches)
January	53.4	37.9	5.29
February	55.6	39.5	3.50
March	62.9	45.7	4.61
April	71.7	52.9	3.25
May	79.1	61.1	4.16
June	85.4	68.6	4.13
July	89.0	72.7	6.23
August	82.0	72.1	7.11
September	82.2	68.4	6.49
October	73.1	58.1	4.42
November	64.8	49.1	3.84
December	56.8	41.1	4.54
Annual Average	71.8	55.6	
Annual Total			57.60

Elevation of the uplands of the Talbot Surface ranges from 20 feet to 40 feet above sea level. The low marine terraces east of the scarp and the stream terraces are generally less than 20 feet in elevation. Elevation on the Outer Banks to the east is much lower than Shackleford and Bogue Banks to the south. The salt marshes are less than 2 feet in elevation.

The general slope of the county is to the east and southeast. About 92 percent of the county is nearly level, 6 percent has slopes of 0 to 2 percent slope, and 2 percent has slopes of 2 to 30 percent.

MINERALS

Sand is the only mineral resource occurring in economic quantities. There are no sand pits in the vicinity of the refuge. The Service owns all mineral rights on the refuge.

SOILS

Soil types identified on the refuge are Baymeade fine sand, Beaches*, Carteret* sand, Lafitte* muck, Leon* sand, Mandarin sand, Murville* mucky sand, and Ponzer* muck (USDA, Soil Conservation Service 1987). Soils with an asterisk are listed as hydric in "Hydric Soils of the United States" (USDA, Soil Conservation Service 1987). Hydric soils are . . . "soils that in their undrained condition are saturated, flooded or ponded long enough during the growing season to develop anaerobic conditions that favor the growth and regeneration of hydrophytic (water loving) vegetation" (USDA, Soil Conservation Service 1985) (Figure 3) (Table 5).

Most of the refuge is Lafitte muck, an organic soil with sixty inches of muck over clay loam. It floods daily with tidal fluctuations and has a water table from the surface to a half-foot below the surface. Lafitte soils support freshwater and brackish herbaceous marsh vegetation.

Carteret sand occurs in narrow bands between Lafitte muck and Murville mucky sand. It has eighty inches of sand over clay or loam. It floods daily with tidal fluctuations and has a water table from the surface to a foot below the surface. Carteret soils support freshwater and brackish herbaceous marsh vegetation.

Murville mucky sands occur to the southwest and northeast of the Lafitte soils. They have ten inches of mucky sand over sand. The water table depth varies between being at the surface and a foot below the surface, but the soil does not flood. Murville soils support “pocosins” of dense shrubs and scattered trees.

Leon sands are interspersed with the Murville mucky sands. They have eighty inches of sand, but the sand is cemented between twenty-two and fifty-eight inches. The water table depth varies between being at the surface and a foot below the surface, but the soil does not flood. Leon soils support pine forests referred to as “flatwoods” or “savanna” because the understory is a low stand of grass with the frequent fires that are typical of the area.

There is a large area of Ponzer muck along the northern boundary of the refuge. It has twenty-six inches of muck over fifty inches of sand. The water table depth varies between being at the surface and a foot below the surface, but the soil does not flood. Ponzer soils support “pocosins” of dense shrubs and scattered trees.

Small areas of Mandarin sand occur with the Murville and Leon soils. These areas have eighty inches of sand with cemented sand between sixty and eighty inches. The water table depth is between one and three feet below the surface. Mandarin soils support drought tolerant forests characterized by longleaf pine, turkey oak, bluejack oak, and scrubby post oak.

A small area of well-drained Baymeade fine sand occurs within the Leon and Mandarin soils. It has twenty-nine inches of fine sand over thirty inches of sandy loam. The water table depth is between four and five feet below the surface. Baymeade soils support drought tolerant forests characterized by longleaf pine, turkey oak, bluejack oak, and blackjack oak. Coastal beaches are sandy areas that flood daily with the tidal cycle. They are areas of deep deposits of sand and shell with no vegetation.

Table 5. Characteristics of soils on Cedar Island National Wildlife Refuge

Soil Series	Surface Texture	Acres	Water Table Depth (Feet)	Flooding Frequency	Vegetative Community
Lafitte	Muck	11,656	0.0-0.5	Frequent	Marsh
Carteret	Sand	240	0.0-1.0	Frequent	Marsh
Murville	Mucky Sand	884	0.0-1.0	None	Pocosin
Ponzer	Muck	153	0.0-1.0	None	Pocosin
Leon	Sand	1,416	0.0-1.0	None	Pine Forest
Mandarin	Sand	76	1.0-3.0	None	Pine Forest
Beaches	Sand	45	>6.0	Frequent	None
Baymeade	Fine Sand	10	4.0-5.0	None	Pine Forest

Frequent Flooding = flooding more than once every two years

HYDROLOGY

Surface Water. Carteret County is drained by the Neuse, Newport, North, South, and White Oak Rivers, and numerous creeks that drain into the sounds and bays. The flow is sluggish in the rivers and creeks.

Ground Water. Ground water is plentiful throughout the county. It is near the surface in most places, particularly during the winter and early spring.

Thousands of feet of sedimentary deposits underlie the area. The upper part of these deposits contains aquifers that supply water for domestic use. The surficial aquifer ranges from near the surface to a maximum depth of 75 feet. It is thickest east of Morehead City. Early in the development of the county, the main source of domestic water was from shallow wells in this aquifer. The use of shallow wells has decreased considerably because of the small yield in some places, the high content of dissolved iron in the water, and the risk of contamination. The underlying limestone of the Yorktown or Castle Hayne Formations, or both, is a more productive artesian aquifer and is the main source of water supply in the county today. The water is generally hard, but low in iron. Water from wells near the coast and especially on the Outer Banks may be salty, but layers of fresh ground water are at lower depths (Legrand 1960).

WATER QUALITY

The Pamlico and Core Sound area is a highly productive ecosystem. Extending along the entire shoreline of Carteret County, the area exhibits a brackish to fresh wetland community. Local stream classifications are all high-quality water or outstanding resource waters (Table 6). The state sets minimum water quality standards based on the best uses listed for the waters.

Developments and agricultural operations in the area located on hydric soils, non-hydric soils with high water tables, or soils with rapid permeability all have the potential to pollute the water table with septic system percolate, household wastes, and nutrient, pesticide, and petroleum products.

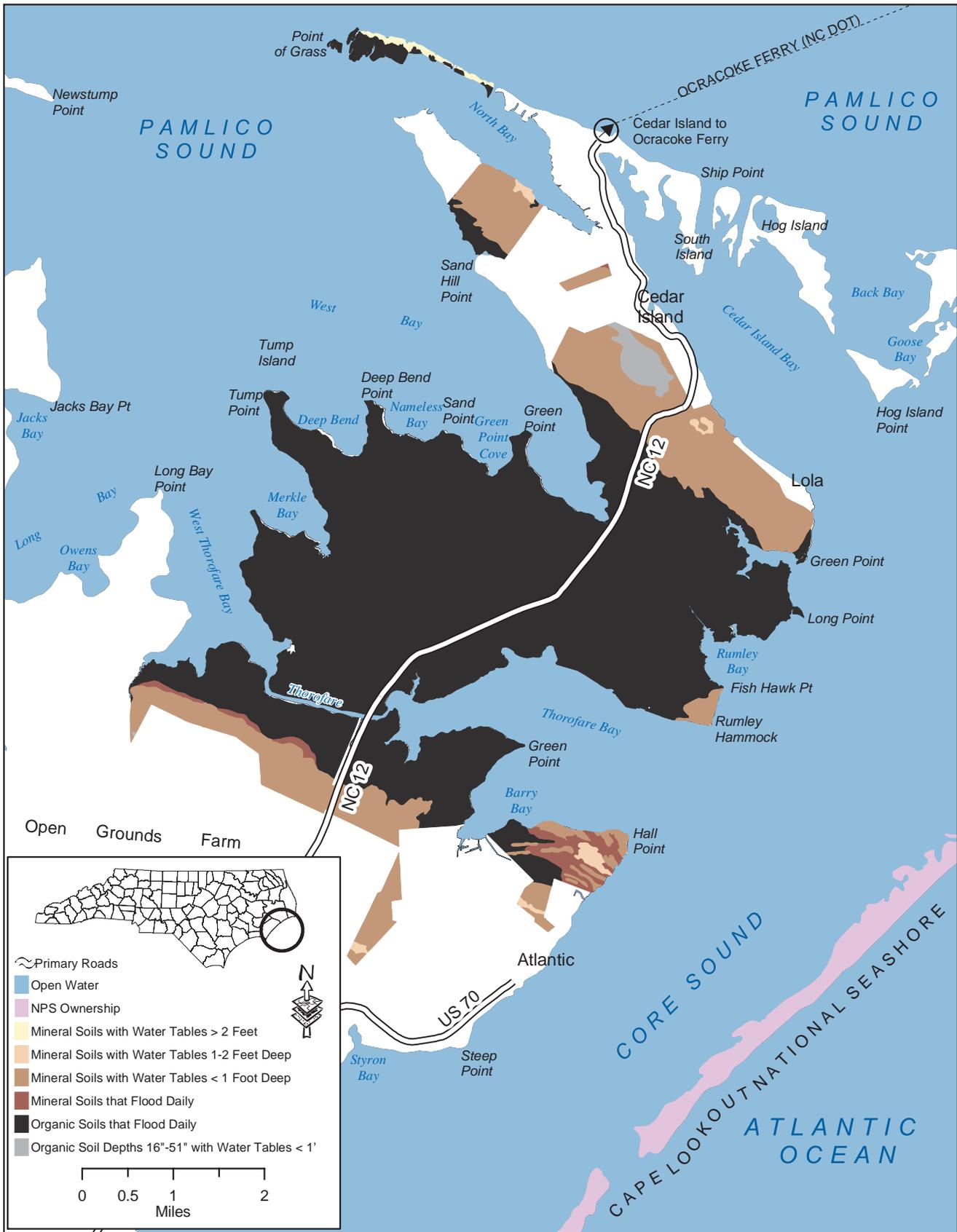
There is one facility in the vicinity of the refuge with a National Pollution Discharge Elimination System (NPDES) permit. That facility is at the ferry landing at the northern end of Cedar Island. There are no violations of the permit currently on file.

There are impaired waters in Cedar Island Bay east of the refuge, West Bay north of the refuge, and Merrimon Bay fifteen miles west of the refuge and immediately west of Open Ground Farms, a large corporate agricultural operation (Table 7) (North Carolina Division of Water Quality 2003).

AIR QUALITY

North Carolina law states that no source of air pollution shall cause any listed ambient air quality standard (Section .0400) to be exceeded or contribute to a violation of any listed ambient air quality standard (Section .0400) except as allowed by Rules .0531 or .0532 [.0401(c), NCAC, Title 15A, Subchapter 2D - Air Pollution Control Requirements (North Carolina Department of Environment and Natural Resources)].

Figure 3. Characteristics of soils on Cedar Island National Wildlife Refuge



Subchapter 2D lists ambient air quality standards for sulfur oxides (measured as sulfur dioxide), total suspended particulates, carbon monoxide, ozone, hydrocarbons, nitrogen dioxide, lead, and particulate matter. Section .0508 enumerates control of particulates from pulp and paper mills. Section 0.0520 (7) indicates that fires purposely set to forest lands for forest management practices acceptable to the North Carolina Division of Forestry and the Environmental Management Commission are permissible if not prohibited by ordinances and regulations of governmental entities having jurisdiction. The regulation also includes a disclaimer that addresses certain potential liabilities of burning even though permissible.

The area closest to the refuge that an environmental agency monitors is the Virginia Beach-Norfolk metropolitan area. The Environmental Protection Agency monitors carbon monoxide, nitrogen dioxide, ozone, sulfur dioxide and particulates in Norfolk, Virginia Beach, Hampton, Newport News, Suffolk, and Chesapeake. Despite the large population with the industry, traffic, and power plants, the area has exceeded only ozone level standards in 2002. Monitoring has indicated unhealthy levels twice and unhealthy levels for sensitive groups thirteen times. The air quality is due to the breezes blowing through the area from the ocean.

VISUAL RESOURCES/AESTHETICS

The Cedar Island National Wildlife Refuge is part of an extensive complex of brackish marshes along the Pamlico and Core Sounds. The marshes adjacent to the refuge are largely undisturbed - protected by government ownership of Cape Lookout National Seashore and Piney Island and the regulations promulgated under the Clean Water Act. Most of the soils are too unstable to make development very attractive.

Visitors to the refuge have the opportunity to experience wildness, spirit and adventure, and observe the signs and the sounds of activity in the marsh and forested wetlands. However, frequent military flights over the refuge at low levels with helicopters and jets often shatter the impression of isolation and solitude that would otherwise exist. The casual observer sees large expanses of brackish marsh and pine savanna. Breezes off the water move the dune and marsh grasses like flags waving across a vast landscape. During the growing season, the marshes appear alive with neotropical songbirds, raptors, wading birds, marsh birds, mink, otter, and other wildlife species. The forests of longleaf, loblolly and pond pine, red maple, black gum, sweetgum, green ash, and wax myrtle echo the sounds of songbirds, wood ducks, and deer. During the late fall, winter, and early spring, migrating waterfowl and songbirds fill the air, managed wetlands, sounds, bays, and streams with their sights and sounds.

BIOLOGICAL RESOURCES

HABITAT

The Cedar Island National Wildlife Refuge is a typical southeastern United States coastal barrier island system that has formed dunes, brackish marshes and forested swamps in the Coastal Plain region. Seabeach amaranth (*Amaranthus pumilus*) and rough-leaved loosestrife (*Lysimachia asperulaefolia*) are the only plant species from the Federal Endangered Species List that are known to occur on the refuge. The National Wetlands Inventory described the refuge as an estuarine emergent herbaceous or palustrine, forested wetland with deciduous or broad-leafed deciduous vegetation and a water regime ranging from temporarily flooded to semi permanently flooded (Cowardin et al. 1979). Schafale and Weakley (1990) identify nine natural communities within the refuge boundary: brackish marsh, maritime shrub, maritime dry grassland, coastal fringe sandhills, coastal fringe evergreen forest, cypress gum swamp, bay forest, pine savanna, and wet pine flatwoods. Figure 4 illustrates the national wetland inventory map classifications on the refuge.

Table 6. Classifications of water bodies and streams surrounding the Cedar Island National Wildlife Refuge

Water Body or Stream	Classification	Best Uses
Pamlico Sound West Bay Long Bay Flag Creek Golden Creek Benneys Creek Henrys Creek Fur Creek Stump Bay Old Canal Piney Island Bay Owens Bay Jacks Bay West Thorofare Bay Bull Creek Cadduggen Creek Goose Bay Merkle Bay Deep Bend Nameless Bay Green Point Cove Dowdy Bay Point of Island Bay Newestump bay North Bay	SA – Saltwater HQW - High Quality Waters NSW - Nutrient Sensitive	Shellfishing Quality
Core Sound Thorofare Bay Merkle Hammock Cr. Barry Bay Rumley Bay John Day Ditch Lewis Creek SW Prong, Lewis Cr. Big Gut Cedar Island Bay Great Pond Back Bay	SA – Saltwater ORW – Outstanding Resource Waters NSW - Nutrient Sensitive	Shellfishing Quality

**Table 7. Neuse River Basin Category 7 impaired waters
(Proper technical conditions do not exist to develop TMDL)**

Water Body	Acres	Cause of Impairment	Priority	Potential Sources
Merrimon Bay	1475	Fecal Coliform	Medium	Agriculture Silviculture
Cedar Island Bay	13	Fecal Coliform	Low	Marinas
West Bay	12	Fecal Coliform	Low	Natural Sources

Estuarine emergent wetlands correspond to brackish marshes; estuarine scrub/shrub and palustrine scrub/shrub wetlands correspond to maritime shrub; palustrine forested wetlands correspond to bay forest, coastal fringe evergreen forest, cypress gum swamps, maritime swamp forest, pond pine woodlands, wet pine flatwoods; uplands correspond to coastal fringe sandhills, dune grass, and pine savannas.

The large number of plant species listed in Appendix VI is indicative of the diverse habitats on the refuge. The vegetation communities present on the refuge include maritime shrub, marsh (brackish and freshwater), cypress-gum swamp, bay forest, low pocosin, pond pine woodlands, and longleaf pine-coastal fringe sandhill.

Maritime Shrub. This habitat type is similar to low pocosin with a maritime shrub component. It represents the transition zone between the brackish marsh and the higher, well-drained ridges of longleaf/pond pine that occurs on Cedar Island National Wildlife Refuge. The canopy is dominated by widely spaced pond pine with a dense understory dominated by wax myrtle, zenobia, bay species, fetterbush, and high-bush blueberry. Cedar Island National Wildlife Refuge has 150 acres of maritime shrub habitat.

Marsh. This category of habitat types includes brackish and freshwater marsh and associated high marsh. The majority of marsh at Cedar Island Refuge is brackish marsh with varying levels of salinity in the surface and groundwater. This habitat type is present on the refuge in large continuous blocks that are relatively intact and unaltered. Great marsh is a contiguous and unbroken expanse of 5,000 acres, and is a unique feature of the refuge. Much of the natural brackish marshes have a natural fire frequency of 1 to 3 years, but have endured fire exclusion during the past half century or longer. As a result, many of them are suffering from a lack of species diversity as only one to three species of marsh grasses dominate the wetter or lower marshes, and encroaching brush has now dominated the high marshes. Large mats of thatch and storm debris have drifted up in long wide tide lines, suffocating large strips of marsh. Dead grass makes up a large component of the remaining marsh stands, limiting plant productivity and nutrient availability and adversely affecting wildlife habitat. Cedar Island Refuge has 11,000 acres of marsh habitat.

Cypress Gum Swamp. Cypress and black gum dominated swamp provide habitat for important trust species like prothonotary, yellow-throated, and other priority warblers and forest songbirds, as well as nesting yellow-crowned night herons. Cedar Island Refuge has 50 acres of Cypress-Black Gum forests.

Bay Forest. This habitat type is characterized by shallow to deep organic soils, intermediate to long hydroperiods, and a canopy dominated by combinations of red maple, loblolly bay, sweet bay, red bay, black gum, and occasionally pond pine or loblolly pine. The understory consists of bitter gall berry, fetterbush, greenbrier and chain-fern. It's believed these areas are remnant ridge and swale zones. The presence of fire in this habitat type has been absent for many years. The refuge has about 100 acres of this habitat type. Though small in acreage, this habitat type adds diversity to the refuge.

Low (Short) Pocosin. Often called simply shrub pocosin, this habitat type falls into two categories according to Frost (1995): true ombrotrophic low pocosins (influenced by nutrient deficient deep organic soils) and fire maintained low pocosins. Fire on a frequency of between 1 and 7 years maintains fire-influenced low pocosin. Because these sites have more nutrients available for plant growth, the absence of frequent fire will lead to development of tall shrub pocosin and eventually decadent stands of shrub and succession to tall tree pocosin. Cranberry and pitcher plant bogs occur throughout these pocosins, especially where ground fires have created potholes in the soil. The refuge has one 100-acre low pocosin site.

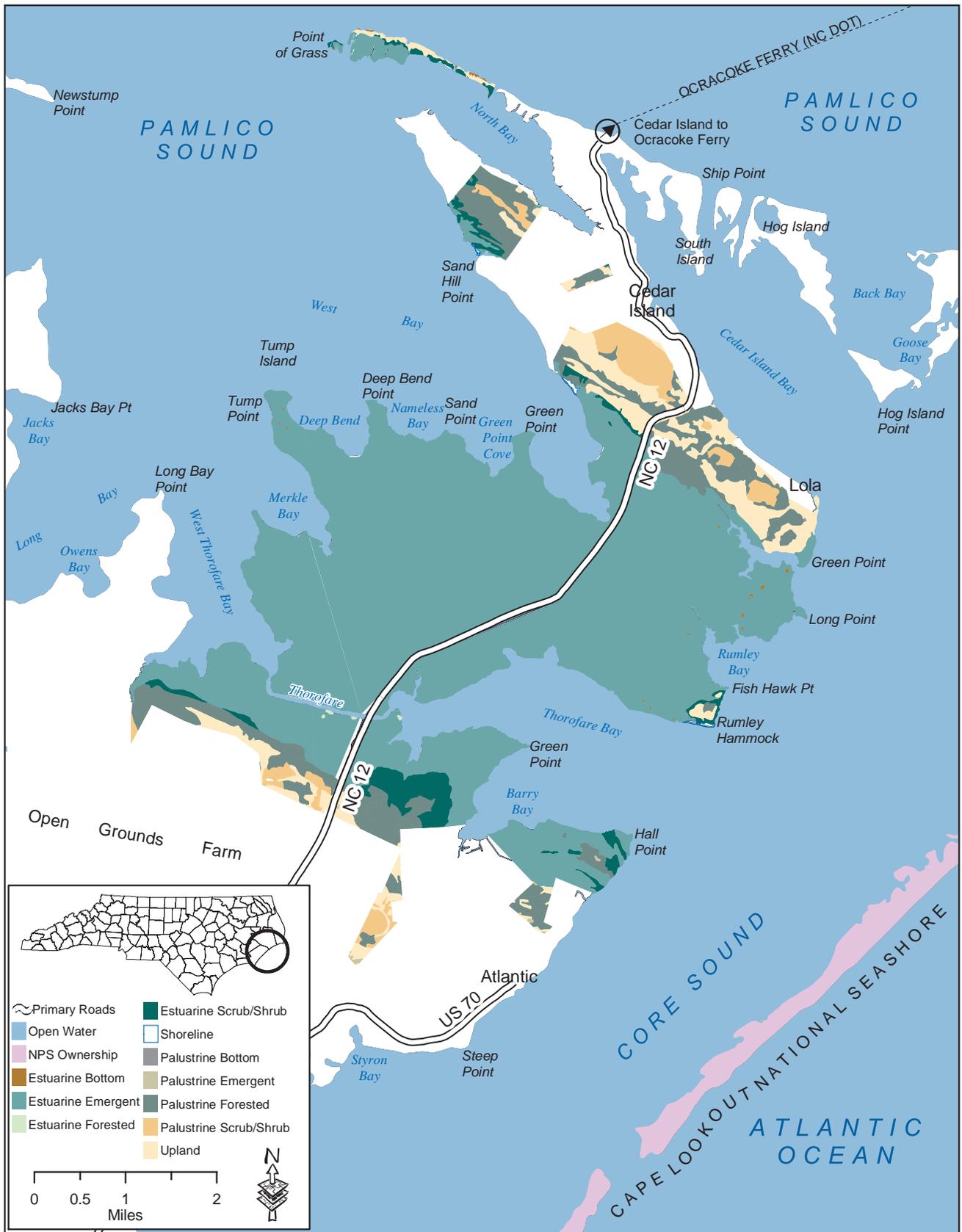
Pond Pine Woodlands. This habitat type is described as having a pond pine overstory with a pocosin shrub, switchcane, or shrub/cane/savannah understory. Trees, usually with a canopy closure greater than 70 percent, dominate the habitat. In older stands, trees tend to be of larger diameters (8-20+ dbh), taller (usually > 40 feet), and have "healthier" pond pine. They typically occur on shallow organics (16 to 51 inches of peat; Belhaven, Ponzer) and occasionally on mineral soils (Hyde loam, Cape Fear Loam) and the very shallow organics (<16 inches peat; e.g. Roper or Wasda). Pond pine pocosin, with a cane understory, typically occurs on sites with shallower organic or mineral soils and is maintained by regular fire. Pond pine pocosin with a shrub understory typically occurs on deeper organic soils. Management in pond pine pocosins will likely require a combination of fire and thinning to develop the stand structure and understory desired. Ideally, there should be little or no hardwoods or shrubs in the mid-story or over-story except in isolated inclusions or islands. Where these sites occur on more fertile (i.e., shallow organic) soils, they are capable of producing relatively large pond pines of sufficient age to manage for red-cockaded woodpecker cavity trees. The less fertile sites provide smaller trees but are ideal for red-cockaded woodpecker and other pine specialists as foraging habitat. Currently, these habitats are in need of restoration as the exclusion of fire and growth of hardwoods and shrubs are suppressing pine growth. Cedar Island Refuge has 125 acres of pond pine woodlands.

Longleaf Pine/Coastal Fringe Sandhill. Longleaf pine usually occurs on sandy, well-drained soils. Long sandy ridges on the northeast and southwest portions of the refuge have large stands of longleaf pine. Longleaf pine and associated understory of wiregrass is an important habitat type that once covered more than 200 million acres in the southeastern United States. Currently, less than 1 percent of the original longleaf habitat exists. Cedar Island Refuge has 1,580 acres of longleaf pine habitat.

WILDLIFE

Birds. The brackish marshes of Cedar Island National Wildlife Refuge and the adjacent open water bodies of Pamlico Sound provide important habitat for waterfowl, wading birds, secretive marsh birds, and colonial waterbirds. The refuge marshes are some of the most important locations for breeding black rails, a species of special management concern in the Southeast. They also provide important habitat for seaside sparrows, American black ducks, Virginia rails, and clapper rails. Isolated islands and sand spits are used as breeding sites for American oystercatchers, gull-billed terns, least terns, and other colonial species. The longleaf pine forests may support the federally endangered red-cockaded woodpecker.

Figure 4. National Wetlands Inventory map of Cedar Island National Wildlife Refuge



A total of 270 species of birds may be observed at the refuge. Of those, 99 are nesting species. A complete species list is located in Appendix VI. Waterfowl survey results are provided in Table 8.

Table 8. Cedar Island National Wildlife Refuge Aerial Waterfowl Survey Results, February 2004

Species	Number
Surf Scoter	383
Lesser Scaup	200
Green-winged Teal	100
Canvasback	100
American Black Duck	77
Bufflehead	77
Hooded Merganser	72
Blue-winged Teal	30
Northern Pintail	30
American Wigeon	2
Total Ducks	1071

Mammals. Gray squirrels and marsh rabbits are abundant. White-tailed deer are present, though not in high density. Furbearers that have been observed include raccoon, mink, muskrat, otter, fox, nutria, and opossum. Notable mammals not observed on the refuge, but expected to occur, include bobcat and beaver.

A total of 35 mammal species are believed to be present on the refuge, however, no formal inventory has been conducted. A list of species expected to occur in refuge habitats that are typical of the southeastern coastal plain is located in Appendix VI. This list contains 14 species that are primarily carnivorous and 18 rodent species.

Reptiles and Amphibians. A total of 92 amphibian and reptile species are believed to be present on the refuge, however, no formal inventory has been conducted. Species observed include southern leopard frog, green tree frog, black rat snake, eastern cottonmouth, yellow-bellied turtle, and snapping turtle. A list of species expected to occur in refuge habitats that are typical of the southeastern coastal plain is located in Appendix VI. This list contains 42 amphibian and 51 reptile species.

The largest group of amphibians is frogs, which include 18 species, followed by salamander/newts, 14 species; toads, 6 species; and other amphibians, 4 species. The largest group of reptiles is snakes, 31 species, of which 3 are venomous, followed by turtles, 11 species; and lizards/skinks, 9 species.

Threatened and Endangered Animals. No federally threatened or endangered species are known to inhabit Cedar Island National Wildlife Refuge. However, red-cockaded woodpeckers do occur on adjacent lands, and the refuge does contain appropriate habitat for red-cockaded woodpeckers, but the species has not been documented on the refuge.

Unique Animal Associations. Various state agencies and research biologists have identified numerous unique animal associations on the refuge. These associations are identified in Table 9 below.

Table 9. Species of management concern at Cedar Island National Wildlife Refuge

Species	Status	Brackish Marsh and Sounds	Maritime Shrub and Swamp Forest	Beach Dune Grass and Dry Grassland	Pine Forests and Savannas
Piping Plover	FL			X	
Roseate Tern	FL			X	
Red-cockaded Woodpecker	FL				X
Shortnose Sturgeon	FL	X			
Seabeach Amaranth	FL			X	
Rough-leaved Loosestrife	FL				X
Sharp-tailed Sparrow	SC	X			
Seaside Sparrow	SC	X			
Black Rail	SC	X			
Yellow Rail	SC	X			
King Rail	SC	X			
Sedge Wren	SC	X			
Northern Parula	SC	X	X		
Prairie Warbler	SC		X		
Eastern Painted Bunting	SC		X		
Yellow-throated Warbler	SC		X		
Wood Duck	SC		X		
Red Knot	SC			X	
Wilson's Plover	SC			X	
Least Tern	SC			X	
Black Skimmer	Sc			X	
American Oystercatcher	SC			X	
Reddish Egret	SC	X			
Canada Goose	SC	X			
American Black Duck	SC	X			

(FL=Federally-listed, SL=State-listed, SC=Species of Management Concern)

EXOTIC ORGANISMS

Invasive and exotic organisms present within the area include common reed (*Phragmites australis*), Asian clam (*Corbicula fluminea*), nutria (*Myocaster coypus*), fire ants (*Solenopsis invicta*) and the gypsy moth (*Lymantria dispar*). Refuge personnel monitor the impact of these exotic species and determine control options as they have opportunities. Compared to many southeastern refuges, Cedar Island Refuge is relatively intact with native vegetation and vertebrates. Non-native vegetation along the private land interface is the biggest challenge from invasive species on the refuge.

CULTURAL RESOURCES

Very few systematic archaeological and historic investigations have occurred on the refuge. These investigations have been conducted primarily to ensure compliance with Section 106 of the National Historic Preservation Act (Drucker 1981; Kanaski in prep.). Hutchinson and McSwain (2000) forensically analyzed three sets of pre-columbian human remains recovered from two sites on the refuge.

The refuge is near the southern limit of the northeastern North Carolina estuarine system, the largest barrier island embayment along the Atlantic Coast. Cedar Island Refuge is part of a region dominated by barrier-built estuaries and submerged river valleys. Its shorelines are bounded by several kilometers of brackish to freshwater marsh.

Four major geomorphic processes have been identified:

- Migration upward and landward of the barrier island over the eastern margin of the estuarine system;
- Flooding of lowlands adjacent to the estuaries that produce a vertical accumulation of marsh peat soil;
- Erosion of estuarine shorelines, which allow them to maintain size; and
- Deposition of fluvial and estuarine shoreline derived sediments as blanket sands and silts along flooded trunk estuaries, while suspended sediments are deposited in perimeter marshes and low energy, deep central bays and lateral tributaries.

Drucker (1981) used black-and-white aerial photography to distinguish submerged high ground based upon subtle relief and color (vegetation) changes. She identified three Carolina Bay remnants in the marsh south and southeast of Merkle Bay that range in size between 200 to 1,100 meters. Carolina Bays were typically areas of rich floral and faunal diversity bounded by higher elevations. In locations, such as the refuge, slight changes in elevations provide opportunities for human habitation and access to a variety of biotic resources.

Seven historic properties have been recorded on the refuge (see Table 10 for a brief description). The majority of the archaeological sites appear to be Woodland Period shell middens. Archaeological sites, structures, and cemeteries, which date to the 19th through 20th century, are located adjacent to the refuge and reflect the Island's and county's exploitation and dependence on the estuarine and marsh resources as a way of life. Detailed discussions of the area's history can be found in Barfield (1995), Feest (1978), Hutchinson (2002), Phelps (1983), and Ward and Stephens (1999). Swanton (1946) and Mook (1944) produced ethnohistories on the Coastal Algonkians, who occupied this portion of North Carolina at the time of European contact. Hutchinson (2002) documented the diversity of Native Americans' adaptation to the coastal zones of North Carolina between A. D. 800 to 1450. The Late Woodland outer coast populations during this period relied heavily on local marine resources and estuarine plants and animals. His study reinforced Green's hypothesis that maize agriculture did not play a major role in the coastal North Carolinians' subsistence practices until after A.D. 1400.

Table 10. Historic properties on the Cedar Island National Wildlife Refuge

Site	Description	National Register Status
Lola Radar Station	Mid-20 th century U.S. Navy facility consisting of three concrete block buildings and tower. One of the buildings has been converted into the refuge headquarters; the other two buildings are no longer used.	Not Eligible
Lewis Creek #1 [31Cr27]	Heavily eroded, relatively thin, but dense shell midden on Lewis Creek. Anthony and Drucker (1981) interpreted the site as a historic industrial/resource extraction and processing site.	Not Eligible
Fire Plow #1 [31Cr28]	Series of shell heaps containing Woodland and historic ceramics and structural debris (brick).	Potentially Eligible
Green Point Shell Midden [31Cr176]	Five loci of shell middens eroding along the bluff/beach facing Core Sound. The assemblage contains sand- and fabric impressed shell-tempered ceramics, 19 th and 20 th century ceramics, bottle glass, debitage, and faunal remains.	Eligible
31Cr7	Prehistoric site containing faunal remains. Size and integrity are not known.	Unknown
31Cr26	Woodland and historic period site whose size and integrity are unknown.	Unknown
31Cr310	Small Woodland Period shell midden containing debitage and ceramics. Size and integrity have not been determined.	Potentially Eligible
31Cr311	Small Woodland Period shell midden containing debitage and ceramics. Size and integrity have not been determined.	Potentially Eligible
Downing Cemetery	Small 20 th century family cemetery enclosed by a low wooden fence	Not eligible

SOCIOECONOMIC ENVIRONMENT

Cedar Island National Wildlife Refuge lies in Carteret County, North Carolina. Residents of the county are the most frequent visitors to the refuge. The staff must consider the social and economic conditions of the county in planning and implementing refuge activities. The land use in the communities influences the water and air quality in the sounds surrounding the refuge and on the refuge. The relative availability of open space will affect the availability of land for wildlife habitat and the habitat off the refuge that wildlife use.

SOCIOECONOMIC CONDITIONS

Carteret County is in the east central part of North Carolina with Cedar Island Bay and the Atlantic Ocean to the east; Core Sound to the south; Craven County, North Carolina to the west; and Pamlico Sound to the north. The southwestern corner of the county has the county's oldest cities and the resort area on the east side of the county is known as the "Crystal Coast." The remainder of the county is rural with the Croatan National Forest in the northwestern corner and a string of wetlands to the east terminating at the Cedar Island National Wildlife Refuge.

Carteret County is still predominantly rural, with the largest town and County Seat being Morehead City (with a 2000 population of 7,670). Like other rural areas throughout the country, outdoor activities are both popular and necessary. Hunting and recreational fishing are popular pastimes and farming, commercial fishing, and forestry are important elements of the economy.

HISTORY

The governor of colonial North Carolina established Carteret County in 1722 from part of Craven County and named it for Sir John Carteret, the Earl of Granville. Beaufort, the County Seat, was the first permanent settlement in the county in 1709 and is the third oldest town in North Carolina.

When the first European settlers arrived between 1700 and 1710, the Coree Indians inhabited the area (Sharpe 1961). The Coree Indians were Coastal Algonkians who inhabited the area south of the Neuse River. The Algonkians were the southernmost extent of a tribe that inhabited the Atlantic Coast north to Canada. They settled in relatively dispersed patterns with capital villages, villages, seasonal villages, and camps for specialized activities. The settlements were along the sounds, estuaries, major rivers, and tributaries. Some of the villages had regular internal organization with palisades and some were less organized with an open structure. They settled where they could conduct agriculture, fishing, shell fishing, hunting, and gathering close to the village. Extended families occupied the farmsteads. The Coastal Algonkians grew corn, squash, sunflowers, beans, and native plants on sandy ridges. They traded extensively with the Tuscarora who inhabited the area west of the Tidewater region (Mathis, M.A. and J.J. Crow 2000).

The first settlers were French Huguenots; the English, Scotch, Irish, Germans, and Swedes soon followed. They settled in fishing villages along the coast and made their living from the rich water resources of the county. A thriving fishing industry developed and shipbuilding was an important enterprise centered in the area that became Beaufort. The town, founded in 1709, is the third oldest in North Carolina. The Colonial legislature of North Carolina established it as the Port of Beaufort in 1723 with the right to collect customs. It became an important harbor and trade center (Sharpe 1961). In the 1700s, lumber was the chief export. Before the Civil War, the important exports were lumber, barrel staves, rum, and molasses. After the Civil War, shipping declined as the railroad became widely used and commercial fishing became the primary business.

The importance of Beaufort made it a target for countries at war with the United States. The Spanish plundered Beaufort in 1747 and the British captured it in 1782. To guard Beaufort Inlet, North Carolina leaders built a structure called Fort Dobbs in 1756 after the Spanish invasion and reinforced it with a masonry structure in 1809. A hurricane swept that structure into Beaufort Inlet in 1826 and the United States government built Fort Macon in 1834. The Confederate Army occupied the fort for a year in 1861-1862 during the Civil War. The Union Army retook the fort and Beaufort Harbor served as an important coaling and repair station for the Union Navy. Fort Macon State Park became the state's first state park in 1936 (North Carolina Division of Parks and Recreation 2003).

The barrier islands of Carteret County have played an important role in its history. In the early 1700s, the pirate Blackbeard victimized ships off the coast. In 1753, North Carolina established Portsmouth Village. By 1842, 1400 vessels and two-thirds of North Carolina's exports passed through Ocracoke Inlet. In 1860, there were 685 residents in the village. During the Civil War, many residents left the islands and never returned. After the war, the presence of shoals in the inlet and the advent of the railroad discouraged the return of commercial shipping. Fishing replaced shipping as the principal enterprise, but the islands never gained their former status. By 1956, only 17 residents remained and in, 1971, the last two residents left. The National Park Service established 28,243-acre, 56-mile-long Cape Lookout National Seashore on the islands in 1976.

In the 1970s, tourism became an important factor in the county's development. The popularity of the "Crystal Coast" on the barrier islands in the southwest corner of the county has changed the face of the county and brought more importance to retail trade, construction, and lodging and food service in the economy.

Today, Carteret County still leads North Carolina in commercial and sport fishing. In 1979, the county produced 35 percent of North Carolina's finfish and shellfish, according to the North Carolina Division of Marine Fisheries. The state port of Morehead City has allowed the county to remain an important center of commerce.

Forest products have been an important part of the county's economy since the colonial period. Tar, pitch, turpentine, and lumber were important early products. Newport was the center of the naval store industry in the 1800s. Today, sawtimber for lumber and pulpwood for paper are the major products harvested.

Early agriculture consisted of the production of corn; wheat; rice; oats; potatoes; cotton; and livestock including cattle, sheep, and hogs. A large number of wild ponies were on the Outer Banks. In 1934, the leading crops were corn, hay, sweet potatoes, Irish potatoes, peanuts, soybeans, and tobacco. Cotton acreage had decreased mainly because of the boll weevil. Recently, in the eastern part of the county, developers have drained a large acreage of poorly drained soils, and converted the land to cropland and pasture; thus doubling the acreage farmed in the county. Today, the main crops are soybeans, corn, and wheat (USDA 2002).

Tourism and water-based recreation have developed into a major local industry. The ocean beaches and extensive water areas for fishing, boating, and water sports attract large numbers of visitors to Carteret County each year.

LAND USE

The historic land use in Carteret County depended for the most part on the nature of the land. Hydric soils cover eighty percent of the county and they remained in forest or marsh until the twentieth century. Deep sandy dunes and beaches cover the eastern and southern shorelines of the county. Access across the marshes and dunes restricted use of the barrier island.

Native Americans and farmers descended from European settlers cultivated crops on the uplands for centuries. In the twentieth century, farmers drained much of the hydric mineral soil and shallow organic soil. Development of the dunes and beaches on the barrier island known as the Crystal Coast began in the 1970s.

Today Carteret County is 45 percent forested (154,000 acres), 18 percent cropland (60,000 acres), and 15 percent marsh (51,000 acres).

From 1997 to 2002, the number of farms increased from 101 to 128; land in farms decreased slightly from 59,869 acres to 59,755 acres; the average size of farms decreased 21 percent from 593 acres to 467 acres; full-time farm operators increased 3 percent from 59 to 61 farms; total market value of agricultural products sold increased 6 percent from \$14,964,000 to \$15,871,000; and average market value of agricultural products sold per farm decreased 34 percent from \$187,703 to \$123,994 (Table 11).

In 2002, soybeans and corn accounted for 20,954 and 20,742 acres of cropland respectively, the largest of any single crop in the county. Wheat has also been an important crop in Carteret County. Production of hogs has also been important, but the number of hogs sold has decreased substantially between 1997 and 2002 and so few were sold that they were not reported (Table 12) (USDA 2002).

Within the refuge's approved acquisition boundary the major visitor use is waterfowl hunting. There is little residential construction in the wetlands surrounding the refuge due to regulation and the instability of the hydric soils.

DEMOGRAPHICS

Carteret County is primarily rural with a total estimated population of 59,383 in 2000 (U.S. Census Bureau 2000). The county gained 13 percent of its population between 1990 and 2000 (U.S. Census Bureau 2000). Morehead City, the County Seat, is the largest town with 7,670 residents in 2000. Beaufort, the county seat, had a population of 3,771 in 2000. Twenty-four thousand residents live in the incorporated areas in the western end of the county, but 60 percent of the population is widely dispersed throughout the unincorporated areas of the county.

The population is 90.3 percent white, 7.0 percent black, 1.7 percent Hispanic, 0.4 percent Native American, and 0.5 percent Asian (U.S. Census Bureau 2000). In 2000, the median family income was \$34,348, slightly below the state average of \$35,320. The poverty rate was 11.8 percent of the population, slightly below the state average of 12.6 percent (U.S. Census Bureau 2000). The average unemployment rate in 2003 was 4.7 percent, slightly below the State of North Carolina unemployment rate of 5.5 percent (North Carolina Employment Security Commission 2004) (Table 13).

The percentage of high school graduates in the population older than 25 years is 63.8 percent; the percentage of college graduates is 13.4 percent. The state averages are 78.1 percent for high school and 22.5 percent for college (U.S. Census Bureau 2000). Home ownership rate is 76.6 percent, well above the state average rate of 69.4 percent. There are 2.31 persons per household in Carteret County, slightly below the state average of 2.49.

EMPLOYMENT

Retail trade is the largest employer in Carteret County, employing more than 3,600 of the county's 17,400 employees with an annual payroll of \$357 million in 2001 (U.S. Census Bureau Economic Census 2001). This is due in large part to Wal-Mart and Food Lion, the largest retail employers (North Carolina Economic Security Commission 2003).

In 2003, the sectors employing the largest numbers of persons were in decreasing order as follows: retail trade, health care, hotel and food service, manufacturing, construction, wholesale trade, administrative support, real estate, recreation, finance, agriculture, information, transportation, and education (U.S. Census Bureau, Economic Census 2001).

Table 11. Carteret County agricultural statistics from the 2002 USDA Census

Number of Farms	128
Acres in Farms	59,755
Average Size of Farms (Acres)	467
Market Value of Land Per Farm	\$985,532
Market Value of Land Per Acre	\$2,100
Market Value of Equipment Per Farm	\$102,802
Total Cropland (Acres)	46,573
Market Value of All Products Sold	\$15,871,000
Market Value of Products Sold Per Farm	\$123,994
Market Value of Crops Sold	\$15,467,000
Market Value of Livestock Sold	\$404,000
Operators with Farm as Principal Occupation	61
Operators with Anther Occupation as Principal Occupation	64
Hogs in Inventory	130
Hogs Sold	0
Beef Cows in Inventory	238
Beef Cows Sold	173
Land in Soybeans (Acres)	20,954
Land in Corn (Acres)	20,742
Land in Wheat (Acres)	415

Table 12. Commodity production in Carteret County in 2002 and 1997 from the 2002 and 1997 USDA Census

Commodity	2002 Production	1997 Production	1987-1997 Change
Soybeans (Acres)	20,954	19,948	Increased 5%
Corn (Acres)	20,742	19,822	Increased 5%
Wheat (Acres)	415	6,577	Decreased 94%
Hog Inventory	130	2,043	Decreased 94%
Hogs Sold	0	6,121	N/A
Cattle Inventory	238	130	Increased 83%
Cattle Sold	173	332	Decreased 48%

Table 13. Economic and population data for northeastern North Carolina counties

County	Average Income ¹	Poverty Rate (%) ¹	Average 2004 Unemployment Rate (%) ²	2000 Population ¹	Population Trend ¹
N. Carolina	\$35,320	12.6	5.5		+21% since 1990
County in the vicinity of the Cedar Island National Wildlife Refuge					
Carteret	\$34,348	11.8	4.7	59,383	+13% since 1990
Other northeastern North Carolina counties					
Beaufort	\$28,614	17.4	6.9	44,958	+6% since 1990
Bertie	\$22,816	12.6	8.2	19,773	Same as 1990
Camden	\$35,423	12.2	3.8	6,885	+16% since 1990
Chowan	\$27,900	18.7	4.9	14,526	+7% since 1990
Craven	\$33,214	13.8	4.9	91,436	+12% since 1990
Currituck	\$36,287	10.8	2.8	18,190	+166% since 1970
Dare	\$35,258	8.1	5.1	29,967	+328% since 1970
Gates	\$30,087	15.4	4.2	10,516	Same as 1900
Halifax	\$24,471	23.6	8.1	57,370	Same as 1950
Hertford	\$23,724	23.1	8.0	22,601	Same as 1960
Hyde	\$23,568	24.8	7.2	5,826	-37% since 1900
Martin	\$26,058	20.1	7.1	25,593	Same as 1940
Northampton	\$24,218	23.1	7.3	22,086	Same as 1980
Pamlico	\$28,629	16.8	4.7	12,934	+14% since 1990
Pasquotank	\$29,305	19.0	4.7	34,897	+11% since 1990
Perquimans	\$26,489	19.5	4.8	11,368	Same as 1920
Tyrrell	\$21,616	25.7	7.8	4,149	-17% since 1900
Washington	\$27,726	20.5	7.3	13,723	Same as 1960

¹ U.S. Census Bureau, 2000 Census of the United States

² North Carolina Economic Security Commission, December 2004

FORESTRY

Timber has always been a source of wealth for Carteret County. However, farmers cleared much of the timber in order to cultivate the land for corn, soybeans, and other crops.

Today, Carteret County is approximately 45 percent forested, with 154,000 acres of forestland. In contrast, 60 percent of North Carolina is forested. Forty-eight percent of the County's forest is in loblolly and shortleaf pine, 22 percent is in oak and pine, 17 percent is in oak-hickory 8 percent is in oak-gum-cypress, and 5 percent is in loblolly and slash pine (Conner 2001).

In 2000, the Federal Government was the largest forest landowner and owned 32 percent of the county's forested land. Private individuals owned 26 percent, forest industry owned 23 percent, and corporate non-industrial concerns owned 19 percent (Conner 2001).

The volume of sawtimber harvested in 2000 was 13.0 million board feet, all of it softwood; the volume of pulpwood was 3.2 million cubic feet, 2.9 million of softwood and 0.3 million of hardwood (Conner 2001).

Despite the diminished wooded acreage, timber is still a large source of income for Carteret County. In 1990, the value of timber sold was \$9.7 million. The payroll from forest products was \$10.5 million of the \$31 million from all manufactured products (USDA, Forest Service 1991).

Fish and wildlife resources have had a profound effect on recreation in the area. Carteret County has always had an abundance of fish and game, due to its diversity of lands and waters. The Service manages Cedar Island National Wildlife Refuge to conserve, manage, and restore habitat for migratory birds and native wildlife (U.S. Fish and Wildlife Service 1964). In addition to the refuge, the 28,243-acre Cape Lookout National Seashore, 161,000-acre Croatan National Forest, 385-acre Fort Macon State Park and the 2,675-acre Rachel Carson site of the North Carolina Estuarine Research Reserve provide outdoor recreation opportunities in the area. The North Carolina Wildlife Resources Commission manages 160,000 acres of the Croatan National Forest as a state game land and provides hunting opportunities.

Recreation in the area is also based on the water in the Pamlico, Core, and Bogue Sounds, as well as numerous bays and rivers. Boat ramps provide access to the river and sound. Numerous outfitters provide boats, fishing charters, and guided tours. Local events that revolve around natural resources include the Atlantic Beach King Mackerel Tournament, Big Rock Blue Marlin Tournament, Core Sound Waterfowl Weekend and the Core Sound Waterfowl Decoy Festival on Harker's Island, and the North Carolina Seafood Festival in Morehead City.

OUTDOOR RECREATION ECONOMICS

Fish and wildlife are not only the focus of the refuge but are also important to the local economy. A commercial fishery is present in the Pamlico and Core Sounds where shrimp, blue crab, flounder, striped bass, croaker, gray trout, Spanish mackerel, king mackerel, mullet, and sea bass are the major species harvested. Hunting and fishing are also economically important to local businesses, as both local and non-local sportsmen travel to Carteret County to fish for saltwater and freshwater fish and hunt for waterfowl, white-tailed deer, and other species.

Unfortunately, conversion of wildlife habitat to more intensive land uses combined with wetland clearing and draining, has led to the loss of valuable fishery spawning grounds and the loss of habitat for many wildlife species. In the attempt to restore and protect some of these resources, Cedar Island National Wildlife Refuge serves an important role, not only by providing habitat for a diversity of plant and wildlife species, but also by offering a place where people can go to enjoy these resources, either through observation or more directly through hunting or fishing.

The Fish and Wildlife Service surveyed participants in wildlife-dependent recreation in North Carolina in 2001. The survey documented an average expenditure of \$69 per day by anglers, \$74 per day for hunters, and \$199 per day for wildlife observers and photographers (U.S. Fish and Wildlife Service 2001).

The Partnership for the Sounds studied the economic impact of their facilities. The study demonstrated that the average visitor spent \$108 per visit, with a range of \$63.70 to \$332.55 per day (Vogelsang 2001). A similar study of visitors at the Chincoteague National Wildlife Refuge in Virginia also showed a range of expenditures from \$62 to \$101 per day (U.S. Environmental Protection Agency 1997).

A study commissioned by the State of New Jersey demonstrated that the average visitor to the shorebird migration spent \$130 per day (New Jersey Department of Environmental Protection 2000). Birdwatchers on eight national wildlife refuges in New Jersey reported a range of expenditures from \$25 to \$41 per day (Kerlinger 1994).

Ecotourists on Dauphin Island, Alabama, spent an average of \$60 per visitor per day (Kerlinger 1999).

Bird watchers (local residents) on High Island, Texas, spent an average of \$46 per day while non-residents reported \$693 per trip (Eubanks, Kerlinger, Payne 1993). The average visitor to the Great Texas Coastal Birding Trail spent \$78 per day (Eubanks and Stoll 1999).

Studies at the Santa Ana National Wildlife Refuge in south Texas demonstrated a range of expenditures from \$88 to \$145 per day on nature based tourist activities. The Laguna Atascosa National Wildlife Refuge in south Texas reported a range of \$83 to \$117 per day (U.S. Environmental Protection Agency 1997).

An increasing number of local officials view eco-tourism, hunting, fishing, wildlife observation and photography, and environmental interpretation as a desirable industry. As the population increases and the number of places left to enjoy wildlife decreases, the refuge may become even more important to the local community. It can benefit the community directly by providing recreational opportunities for the local population, and indirectly by attracting tourists from outside the county to generate additional dollars to the local economy.

TOURISM

Tourism in the area is based on the natural resources and cultural attractions of the region. Boat ramps provide access to the rivers, bays, and sounds for fishing, hunting, and boating. Numerous outfitters provide boats, fishing charters, and guided tours. The oceanfront attracts swimmers, surfers, sunbathers, and anglers. More developed tourist attractions based on natural resources include Cedar Island National Wildlife Refuge, Cape Lookout National Seashore, Croatan National Forest, Fort Macon State Park, Rachel Carson Estuarine Research Reserve, and the North Carolina Aquarium at Pine Knoll Shores. Local events that revolve around natural resources include the Atlantic Beach King Mackerel Tournament, Big Rock Blue Marlin Tournament, Core Sound Waterfowl Weekend and Core Sound Waterfowl Decoy Festival on Harker's Island, and the North Carolina Seafood Festival in Morehead City.

Carteret County has a number of historic attractions. There are five areas on the National Register of Historic Places: Beaufort Historic District, Morehead City Historic District, Cape Lookout Village Historic District, Cape Lookout Coast Guard Station, and Portsmouth Village. Fort Macon State Park interprets the role the Fort played in the history of the area. Cape Lookout National Seashore interprets the importance of the Cape Lookout Lighthouse and Portsmouth Village. The North Carolina Maritime Museum in Beaufort presents and interprets artifacts from maritime history. The Carteret County Museum of History and Art in Morehead City has an interesting collection of Carteret County artifacts.

TRANSPORTATION

In its early days, residents of the area relied on water transportation. The sounds, rivers, and streams that crisscross the county served as a means for transportation, trade, and communication between almost every community in the area. The Pamlico, Core, and Bogue Sounds and the streams they connected were once the major transportation avenues in the area. As the area grew and the railroad arrived, commercial boat traffic declined. The waterways are still important as sources of income and for recreation. Ferries still provide access across the sounds. A ferry connects Cedar Island to the Outer Banks, where seven million tourists spend their vacations.

In the twentieth century with the popularity of automobiles, the state developed a network of highways connecting the county to all areas of the eastern United States. State Route 12 and U.S. Highways 70 and 17 connect Carteret County with Interstate Route 95 and with the Virginia Beach-Norfolk-Hampton Roads, Virginia, metropolitan area. A number of smaller roads connect the various communities in the area. A 5-mile stretch of North Carolina Highway 12 connecting the Cedar Island ferry to Morehead City runs through the refuge. There are international airports in Raleigh, North Carolina, and Norfolk/Virginia Beach, Virginia.

Cedar Island Refuge, which is located in the eastern part of Carteret County, North Carolina, can be reached via U.S. Route 70 and North Carolina Route 12 and is a 30-mile drive to the east from Morehead City.

CULTURAL ENVIRONMENT

Carteret County is in predominantly rural east central North Carolina. Cultural opportunities in the immediate area are limited to the history-based facilities outlined in the tourism section; theater at local high schools and parks; music at local fairs, festivals, and nightclubs; and art at local fairs, festivals, and small galleries. Greenville, North Carolina, and East Carolina University, located 100 miles northwest of Carteret County, offer the nearest opportunities for large theatrical or musical performances.

The Raleigh-Chapel Hill-Durham, North Carolina metropolitan area located 180 miles to the west by highway has the area's closest large art museums and venues for performing arts with national touring collections and companies.

The Virginia Beach-Norfolk-Hampton Roads of the Virginia metropolitan area located 200 miles north of the refuge is another major metropolitan area that supports a wide range of cultural facilities and events.

REFUGE ADMINISTRATION AND MANAGEMENT

LAND PROTECTION AND CONSERVATION

The Migratory Bird Conservation Commission approved the acquisition of Cedar Island National Wildlife Refuge on August 10, 1964, by the authority of the Migratory Bird Conservation Act of 1929. The Migratory Bird Hunting Stamp Act of 1934 provided funds for the purchase. The Service has

also purchased land with funds provided by the Fish and Wildlife Act of 1956. The Service approved an acquisition boundary of 16,887 acres (Figure 5).

The Service acquired 12,526 acres in 1964 by fee simple purchase. Since 1985, the refuge has acquired 1,954 additional acres of fee simple purchase for a total of 14,480 acres.

A variety of federal and state agencies and non-governmental organizations have acquired land in the vicinity of the refuge. The National Park Service manages the 28,243-acre Cape Lookout National Seashore. The U.S. Forest Service manages the 308,234-acre Croatan National Forest. The United States Marine Corps manages the 1,470-acre Atlantic Field. The State of North Carolina manages the 385-acre Fort Macon State Park and the 2,675-acre Rachel Carson Estuarine Research Reserve.

VISITOR SERVICES

Cedar Island National Wildlife Refuge currently has one staff member, a maintenance worker, who is stationed on the refuge. Visitors are welcome to use the refuge during daylight hours. There are two public boat ramps with launching and parking facilities. The refuge headquarters on Lola Road has a visitor information area, and provides maps and directions to the refuge's firebreaks and access roads that are used by the public for hiking, biking, horseback riding, and bird watching (Figure 6).

Hunting

Waterfowl hunting is permitted in accordance with the Federal and State regulations. Hunting is restricted to an area of 400 acres north of Thorofare Canal and west of North Carolina Highway 12. The hunt area is marked on refuge maps and is posted by "Waterfowl Hunt Area" signs. Only temporary blinds are permitted on refuge lands, though local hunters erect permanent blinds in the open water immediately adjacent to refuge lands.

Environmental Education

The refuge does not have a developed environmental education program.

Interpretation

Interpretation is limited to visitor contact with the Maintenance Worker at the Lola Road office. Visitors are provided with an overview of the refuge, a wildlife list, and directions for desired outdoor activities.

Wildlife Observation

Wildlife observation areas include the firebreaks and access roads, and the boat ramp areas. The local community and visitors heavily use the Lola Road boat ramp and parking lot as a wildlife and scenic viewing area. In addition, canoes and kayaks are frequently launched at the ramp to tour the refuge wetlands. Visitors may observe wildlife anywhere on the refuge, where access is not restricted, during daylight hours. There are currently 10,000 visitors annually to the refuge for wildlife observation.

Wildlife Photography

The Lola Road boat ramp area is a popular spot for wildlife photography. There are no photography blinds available. There are currently 500 visitors to the refuge annually for wildlife photography.

Figure 5. Approved acquisition boundary of the Cedar Island National Wildlife Refuge

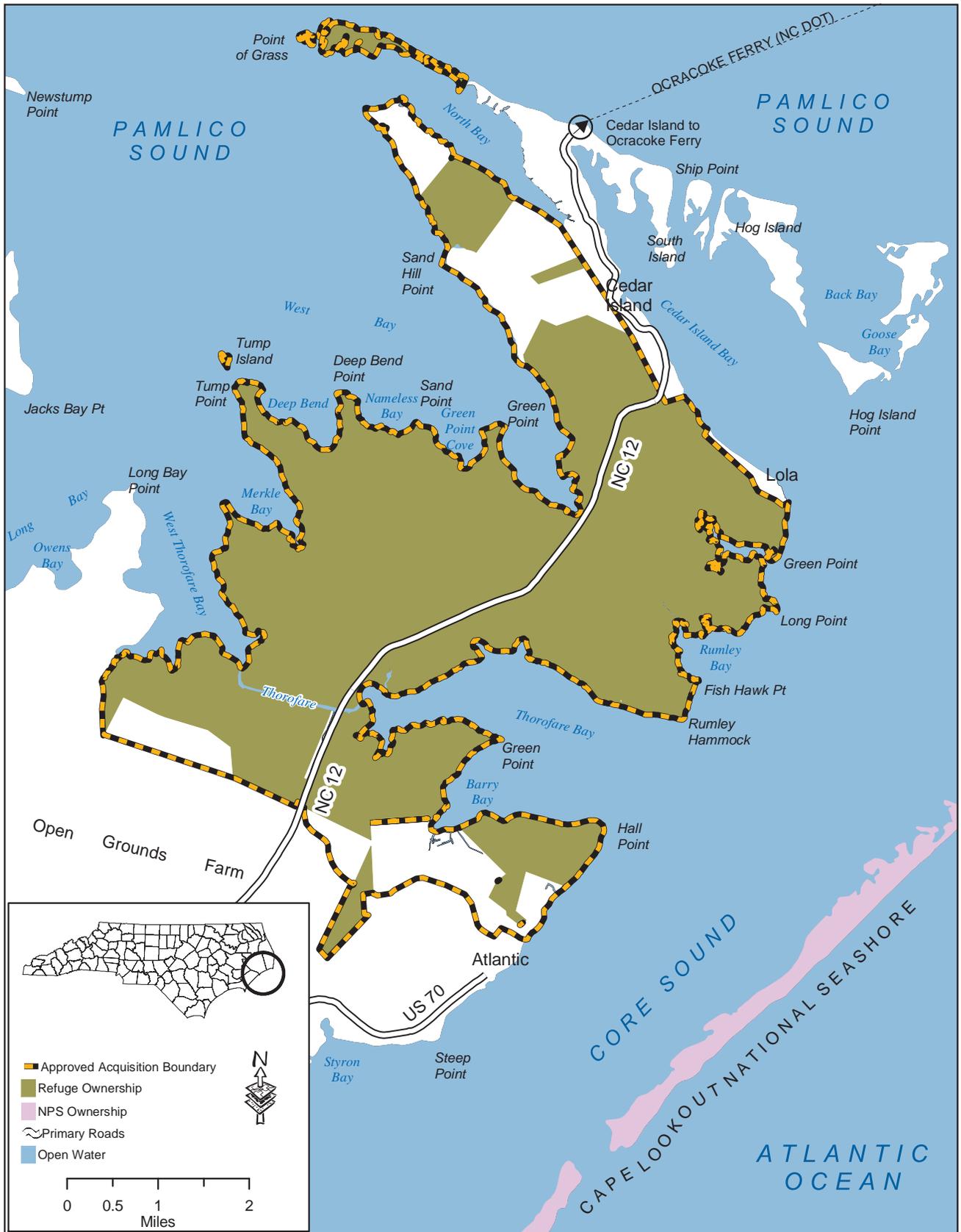
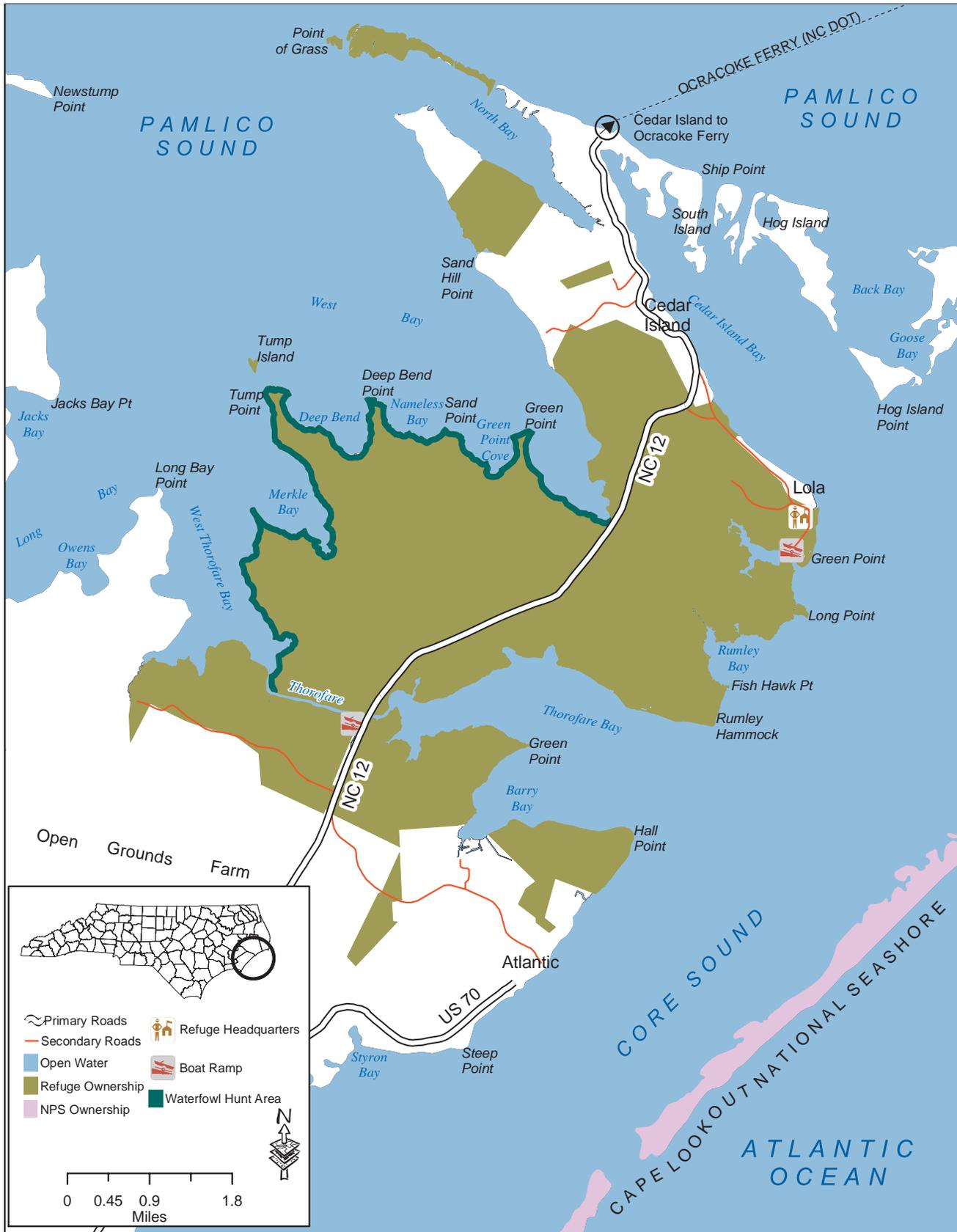


Figure 6. Current visitor facilities at the Cedar Island National Wildlife Refuge



PERSONNEL, OPERATIONS, AND MAINTENANCE

Personnel

The staff which serves Mattamuskeet, Swanquarter, and Cedar Island National Wildlife Refuges includes a Project Leader (GS-0485-13), a Deputy Project Leader (GS-0485-12), a Wildlife Biologist (GS-486-11), a Park Ranger (Law Enforcement)(GS-0025-9), an Office Assistant (GS-0303-8), a Forestry Technician (GS-0462-05), a Heavy Mobile Equipment Operator (WG-5803-10), a Crane Operator (WG-5725-10), and two Maintenance Workers (WG-4749-08) who are all headquartered at Mattamuskeet National Wildlife Refuge. There is a Maintenance Worker (WG-4749-08) stationed at the Cedar Island National Wildlife Refuge.

Table 14. Staff of Mattamuskeet, Swanquarter, and Cedar Island National Wildlife Refuges – 2005

Position	Status	Percent of Time on Cedar Island
Project Leader, GS-0485-13	PFT	0
Assistant Manager, GS-0485-12	PFT	10
Wildlife Biologist, GS-0486-11	PFT	0
Park Ranger (Law Enforcement), GS-0025-09	PFT	0
Office Assistant, GS-0303-08	PFT	10
Heavy Mobile Equipment Operator, WG-5803-10	PFT	0
Crane Operator, WG-5725-10	PFT	0
Maintenance Worker, WG-4749-08	PFT	0
Maintenance Worker, WG-4749-08	PFT	0
Maintenance Worker, WG-4749-08	PFT	100
Forestry Technician, GS-0462-05 (Fire)	PFT	0
<i>PFT = permanent full time</i>		

Operations

The Service administers the Cedar Island National Wildlife Refuge from an office located at the Mattamuskeet National Wildlife Refuge in Swan Quarter, Hyde County, North Carolina - 175 miles and a 4-hour trip from Cedar Island. The refuge staff administers Cedar Island, Mattamuskeet, and Swanquarter National Wildlife Refuges (Figure 1). A single maintenance worker is headquartered at the refuge. The refuge facilities include an office and equipment storage building.

Maintenance

The Maintenance Worker stationed on the refuge maintains the buildings, grounds, firebreaks, and boundary signs and removes litter and dumped refuse from the entrances to refuge roads. The fire crews from the other refuges in eastern North Carolina assist the refuge staff in conducting prescribed burns.

REFUGE INFRASTRUCTURE

Roads and Trails

There are two and a half miles of unimproved roads and fourteen miles of firebreaks on the refuge. The roads and firebreaks serve several functions including access to private landowner properties; prescribed fire operations and wildfire control; refuge habitat maintenance; and public walking, mountain bike riding, and horseback riding.

Utility Corridors and Distribution

Underground telephone and aboveground electric lines run parallel to North Carolina State Highway 12 that traverses north to south through the center of the refuge.

Communication Systems

Two-way radio communications for the refuge are integrated with the radio communications for the eastern North Carolina refuges. The refuge is scheduled to receive an upgrade in communications with a linked repeater that will provide reliable radio communications anywhere on the refuge. Cellular phone service is available throughout most of the refuge property and the refuge has one cellular phone. There is hard-wired phone service provided to the refuge office and adjacent remote automated weather station. Communication at the weather station is limited to data transfer between the weather data logger and remote access data retrieval software.

Solid Waste Collection and Disposal

The staff person removes all solid waste from the refuge and transports it to a Carteret County transfer station. He also disposes of materials such as paint, batteries, and tires at the Carteret County site.

Chapter III. Plan Development

PUBLIC INVOLVEMENT AND THE PLANNING PROCESS

Service and state wildlife agency personnel attended initial planning meetings beginning in June 2000. At these initial meetings, they discussed strategies for completing the plan; identified several issues and concerns; and compiled a mailing list of likely interested government agencies, non-governmental organizations, businesses, and individual citizens. The Service invited these agencies, organizations, businesses, and citizens to participate in two public scoping meetings on the afternoon and evening of September 21, 2000, in Beaufort and Cedar Island, North Carolina. They introduced the audience to the refuge and its planning process and asked them to identify its issues and concerns. The Service published announcements giving the locations, date, and times for the public meetings in local newspapers. The Service also sent press releases to local newspapers and public service announcements to television and radio stations. Service personnel placed fifty posters announcing the meeting in local post offices, local government buildings, and businesses. Sixty-five citizens attended the meetings.

The planning teams expanded the issues and concerns to include those generated by the agencies, organizations, businesses, and citizens from the local community. These issues and concerns formed the basis for the development and comparison of the objectives in the different alternatives described in the environmental assessment.

PLAN REVIEW AND REVISION

Once adopted, the Service will review this comprehensive conservation plan annually to determine the need for revision. A revision would occur if and when substantial information becomes available, such as a change in ecological conditions or a major refuge expansion. Detailed step-down management plans and annual plans will augment the final plan to address the completion of specific strategies in support of the refuge's goals and objectives. Revisions to the comprehensive conservation plan and the step-down management plans would be subject to public review and compliance with the National Environmental Policy Act.

SUMMARY OF PLANNING ISSUES, CONCERNS, AND OPPORTUNITIES

The Service generated a number of issues and concerns from a variety of sources: the input of local citizens and public agencies, the team members' knowledge of the area, and the resource needs identified by the staff and biological review team. The Service assembled a planning team (**Table ___**) to evaluate the resource needs; develop and evaluate alternatives for management; select an alternative; and develop goals, objectives, and strategies to implement the preferred alternative to shape the management of the refuge for the next 15 years.

These issues provided the basis for developing the refuge's alternative management objectives and strategies. These issues played a role in determining the desired conditions for the refuge and the staff considered them in the preparation of the long-term comprehensive conservation plan. They are of local, regional, and national significance and include the issues that the public identified at the planning meetings. The priority issues for the refuge to address during the 15-year life of the plan are divided into several categories: hydrology, fish and wildlife populations, habitats, public use, resource protection, and administration.

HYDROLOGY

Drainage

Previous owners of the refuge lands before it was a refuge dug drainage ditches to facilitate access for hunting, trapping, and fishing. The ditches effectively lower the water table draining subsurface water in the vicinity of the ditch. The previous owners also impounded water behind the piles of soil excavated from the ditches and allowed water from the rivers, bays, and sounds to flow into the wetland on the refuge more rapidly than would have occurred naturally. The drainage affects the plant communities by providing habitat for species adapted to better drainage close to the ditches and on the tops of spoil piles. The flooding of areas behind the spoil piles inhibits plant regeneration and favors species that are better adapted to more persistent flooding than would have occurred naturally.

Based on the public input provided during public scoping, the public is aware of this drainage issue and is supportive of restoring natural hydrology to the refuge.

Global Warming and Sea Level Rise

Most of the refuge lies at or within a few feet of sea level. Much of the refuge has a water table within a foot of the soil surface. Marshes cover the majority of the refuge. Wetland forest stands cover the balance of the refuge. Scientists predict that sea level along the North Carolina coast will rise from two to three feet in the next 100 years due to global warming. That rise in water level is expected to change the types of vegetative cover on the refuge; the grass-dominated marshes that occupy the majority of the refuge will lie below sea level and will become open water areas and the marshes will expand into areas currently covered by forest trees.

As the habitats change, the wildlife species that inhabit those habitats will also change. Wading birds, waterfowl, and marsh birds that use the marshes for cover, feeding, and nesting will lose that kind of habitat. Neotropical migratory songbirds and wood ducks that currently utilize trees will lose their feeding and nesting sites as trees die and fall. The species that utilize the areas that are currently marsh will move upslope as the marshes replace the trees. There is little the refuge can do to affect this issue, but it can realize it's occurring and adapt management as hydrology and plant communities change.

FISH AND WILDLIFE POPULATIONS

General

The refuge staff currently performs some surveys to document the populations of certain species groups. The public and cooperating agencies encouraged the refuge to continue performing those surveys and add more surveys for the most important wildlife resources as the staff takes on new responsibilities.

Threatened and Endangered Species

Recovery and protection of threatened and endangered plants and animals is an important responsibility delegated to the Service and its national wildlife refuges. Scientists estimate that twelve threatened or endangered animals and two plants use (or could use) Carteret County in which Cedar Island National Wildlife Refuge lies: the loggerhead, green, hawksbill, Kemp's ridley, and leatherback sea turtles; American alligator; piping plover; red-cockaded woodpecker; roseate tern; West Indian manatee; eastern cougar; shortnose sturgeon; rough-leaved loosestrife; and seabeach amaranth. The refuge staff must have an awareness of these species, their habitat requirements, and the management that would maintain their habitat.

However, habitat for the threatened loggerhead and green sea turtles and the endangered hawksbill, Kemp's ridley, and leatherback sea turtles, which utilize open sandy beaches for nesting, is very limited on the refuge, thus occurrence of these species is also likely to be very limited. Likewise, the presence of the threatened piping plover and seabeach amaranth and the endangered roseate tern, which also utilize open sandy beaches, would be very limited.

The threatened American alligator has occurred in the waters and marshes of Carteret County and areas further north. Biologists have documented alligators in the county within the past 20 years. The alligators rely on marshes with healthy vegetation to survive. The careful management of refuge lands and other private and public lands adjacent to the refuge is very important to the persistence of that vegetation. Extensive development and poor management of those lands can decrease the extent of that vegetation.

The endangered red-cockaded woodpecker has historically nested in mature pine forests in Carteret County. Biologists have documented woodpeckers in the county within the past 20 years. There is suitable habitat on the refuge in the pine savanna forest. As the forest ages and pine trees develop suitable nesting cavities, the refuge could support woodpeckers. Sustaining viable populations will require proper understory management.

The endangered West Indian manatee has occurred in the waters of Carteret County and areas further north, but Carteret County is outside the normal range of the manatee. Biologists have documented manatees in the county within the past 20 years. The manatees rely on aquatic vegetation to survive. Good water quality in the bays and sounds surrounding the refuge is very important to the persistence of that vegetation. The careful management of refuge lands and other private and public lands adjacent to the refuge will maintain that water quality. Extensive development and poor management of those lands can decrease water quality.

The endangered eastern cougar has occurred in Carteret County, but biologists have last documented cougars in the county more than 20 years ago. The cougars require large areas with an adequate food supply. Males occupy areas of more than 25 square miles; females 5 to 20 square miles. With a considerable expansion and linkages to the Croatan National Forest, the refuge could have sufficient habitat for cougar.

The endangered shortnose sturgeon probably occurs in the waters surrounding Carteret County during most of the year. Biologists have only documented its occurrence in the waters of adjacent counties within the past 20 years. The sturgeon is anadromous and requires access to freshwater to spawn. Dams built for flood control and hydroelectric power generation block the upstream migration of the sturgeon. Good water quality in the bays and sounds surrounding the refuge is very important to the survival of the shortnose sturgeon. The careful management of refuge lands and other private and public lands adjacent to the refuge will maintain that water quality. Extensive development and poor management of those lands can decrease water quality.

The endangered rough-leaved loosestrife occurs in the edges between fire-maintained longleaf pine uplands and pond pine pocosins on moist to seasonally saturated soil. Biologists have documented populations within the past 20 years in Carteret County on the same soil type and plant communities that occur on the refuge. The staff can create habitat for rough-leaved loosestrife by maintaining an open understory with prescribed fire.

WATERFOWL

The scoping process identified the management of all refuge marshes and forests, and the development of managed wetlands (moist-soil units) for waterfowl and expanding waterfowl hunting opportunities as issues. In order to meet the refuge's waterfowl purpose, the refuge must maintain the marsh and forest to meet waterfowl habitat needs and provide sufficient areas to provide undisturbed resting and feeding areas for waterfowl. The Service cannot establish managed wetlands (moist-soil units) on the land it currently owns due to restrictions on disturbing natural wetlands. Acquisition of prior converted croplands (former wetlands) would allow the development of managed wetlands. The Service can provide additional waterfowl hunting opportunities as the refuge acquires additional land, but the core waterfowl resting and feeding areas need to remain intact to meet the needs of waterfowl.

The refuge's waterfowl purpose guides all operation and management actions on the refuge. The refuge manages forested wetlands to meet the feeding, resting and breeding needs of migratory and resident waterfowl. Staff of the Fish and Wildlife Service and cooperating agencies and organizations conducted a Biological Review of Cedar Island National Wildlife Refuge in 1999 and 2000 as part of the comprehensive conservation planning process. They identified objectives to meet the minimum water, food, and resting/loafing habitat requirements of waterfowl. There was support from the public for increased monitoring of waterfowl and the addition of habitat and management of that habitat.

SHOREBIRDS

The refuge does not own much beach on which shorebirds feed and nest. It does have the potential to purchase additional land with shorebird habitat and develop shorebird habitat in moist-soil units (managed wetlands) by water management and areas behind the coastal dunes by clearing and excavating areas to mimic overwash areas. The management of managed wetlands will require the acquisition of prior converted cropland (former wetlands) on which the refuge can build impoundments. There was support from the public for increased monitoring of shorebirds and the addition of habitat and management of that habitat.

NEOTROPICAL MIGRATORY BIRDS

Neotropical migratory birds are a species group of special management concern. Providing habitat (i.e., forest and marshes) for these birds is one of the refuge's major objectives. Strategic forest management compatible with the refuge's waterfowl habitat objectives would contribute to the forest needs of neotropical migratory birds. The Biological Review identified objectives needed to meet the minimum feeding and nesting habitat requirements of neotropical migratory birds. Neotropical migratory birds are also a major focus of the refuge wildlife observation program as many birders visit the refuge to observe nesting, feeding, and loafing birds. There was support from the public for increased monitoring of neotropical migratory birds and the addition of habitat and management of that habitat.

HABITATS

BRACKISH MARSH AND MANAGED WETLANDS

Participants at the public scoping meetings expressed the expectation that the refuge was established to protect and manage the marshes and wetlands (moist-soil units). Part of that expectation was that the refuge would have open water areas in the marsh. The wetland disturbance provisions of the Clean Water Act prohibited those areas from being developed. Pursuit of that open

water habitat will require the acquisition of prior converted croplands (former wetlands) that the Service can legally convert into managed wetlands.

Local interest still exists in managing the refuge. The area's cultural tradition has a strong history of fishing and hunting, and marsh and moist-soil unit management is the first step toward maintaining the opportunities for hunting on adjacent lands (primarily for waterfowl).

Cedar Island National Wildlife Refuge is situated near several large marshes in the South Atlantic Coastal Plain Physiographic Zone. Cooperative private-state-federal partnerships under the North American Waterfowl Management Plan, Partners-in-Flight, and the Atlantic Coast Joint Venture recommend maintenance and stabilization of the marsh. With strategic management, the staff can provide quality marsh habitat with the proper prescribed burning and aquatic weed control.

Forests

There is also public recognition of the role of the refuge's forest area in supporting populations of white-tailed deer, red-cockaded woodpeckers, and neotropical migratory birds and the public use associated with these species. There was support from the public for increased monitoring of refuge forests, as well as the addition of habitat and management of that habitat with prescribed fire, thinning, and timber harvests.

Submerged Aquatic Vegetation

There is widespread recognition by the Fish and Wildlife Service, state agencies, non-governmental organizations, and the general public that submerged aquatic vegetation is on the decline in the areas around the refuge. This decline has resulted in corresponding declines in migrating diving duck populations and fish nursery productivity. There are several possible reasons for the decline from poor water quality to the impacts of storms. The agencies, organizations, and the public have encouraged the refuge to get involved and stay involved in the monitoring of submerged aquatic vegetation and water quality monitoring to assess the cause of its decline.

PUBLIC USE

Introduction

The refuge is in Carteret County, North Carolina (2000 population 59,383), just south of the Outer Banks of North Carolina where seven million tourists spend their vacations. There are several local initiatives to promote nature-based tourism in eastern North Carolina. A few commercial enterprises have interests in guiding canoeing and angling adventures. The refuge is an important link to the other natural areas that together make these experiences possible. Carefully selected and managed staff, programs, and facilities will provide the wildlife-dependent environmental education, interpretation, and recreation opportunities that refuge visitors expect. The refuge will require additional staff support to achieve its visitor-service potential.

Hunting

Hunting and fishing are integral parts of rural North Carolina culture. It is not surprising that there is a considerable interest from the state agencies and the local citizens in expanding hunting opportunities. The initial refuge strategy must be maintenance of the quality of waterfowl hunting at existing levels. Any additional hunting opportunities will be dependent on providing safe, quality experiences that are compatible with refuge purposes. The Cedar Island, Mattamuskeet, and

Swanquarter Refuges only have a single half-time park ranger headquartered four hours from the Cedar Island Refuge. This park ranger is shared with Pocosin Lakes National Wildlife Refuge where the other half of his time is spent. The refuge requires its own law enforcement personnel to administer any additional hunts.

Environmental Education and Interpretation

There is only one maintenance worker assigned to the Cedar Island National Wildlife Refuge and no education and interpretation staff at Mattamuskeet, Swanquarter, or Cedar Island Refuges. The public expressed a strong desire to have interpretive facilities and education programming at Cedar Island Refuge, especially during the summer vacation season. There are opportunities to utilize volunteers and develop partnerships with the Carteret County schools to provide programs or at least offer the refuge as an outdoor education classroom.

Outreach

The public expressed concern that the Service does not adequately publicize public use opportunities that are available on the Cedar Island Refuge. The public encouraged the refuge to utilize every avenue available (e.g., newspapers, television, local cable television, newsletters, posters in local schools and businesses) to let the community know what opportunities are available.

Roads and Trails, Exterior and Interior

There are no established trails on Cedar Island National Wildlife Refuge although the dirt roads and firebreaks are available for pedestrian use. The public expressed strong support for developing trails and wildlife observation platforms, photography blinds, and maintaining the boat ramp.

RESOURCE PROTECTION

Land Acquisition and Habitat Fragmentation

When the Service established the refuge, its goal in providing brackish marsh was providing additional habitat types for migratory waterfowl. Reevaluation has determined that those habitats are as important for marsh birds and neotropical migratory songbirds (in support of Partners-in-Flight) as they are for waterfowl habitat. The refuge's current acquisition boundary reflects the importance of protecting and managing the most valuable brackish marsh. Those properties are important links in protecting areas along the bays and sounds. To maintain the potential to protect these lands, the Service must have the ability and authority to manage and protect (through acquisition of fee title interest or conservation easements) the substantial habitat within the current acquisition boundary. There was support from the public to expand the acquisition boundary and acquire land that could be developed into impoundments for waterfowl. Acquisition of additional land would provide opportunities to develop moist-soil (managed wetland) habitat, hardwood forest habitat, and cropland habitat and would help lessen the agricultural impacts to water quality. Acquisition of new lands would also expand compatible public use opportunities; acquisition of conservation easements, however, would not.

Law Enforcement and Refuge Regulation

The refuge has enforced the applicable laws and regulations through the use of one full-time law enforcement officer shared with Mattamuskeet and Swanquarter Refuges and headquartered at Mattamuskeet, four hours away from the Cedar Island Refuge. There was considerable concern that

the refuge had become a dumping ground in the absence of staff and that the single staff member recently hired devoted a considerable amount of time removing dumped items.

Other Resource Protection

There are other threats to refuge resources that require closer monitoring and management. Pest plants, such as phragmites, and pest animals, such as nutria, along with wildlife disease are all concerns to which the refuge must pay close attention, yet has inadequate staffing to monitor effectively. The public supported the refuge's control of pest plants and animals.

ADMINISTRATION

Funding and Staffing

Funding has been insufficient to support refuge programs. Inadequate staff, facilities, and equipment have prevented the refuge from realizing its purpose and management objectives. Currently, the refuge is not meeting its wildlife habitat objectives beyond prescribed burning of the marsh and pine forest. It conducts few wildlife inventories beyond waterfowl; has few public use facilities; has outdated habitat/wildlife management plans; and provides few non-hunting or fishing wildlife-dependent recreational opportunities. The refuge only addresses other priority public uses (environmental education, interpretation, wildlife observation, wildlife photography) as the public requests them. The park ranger for law enforcement must divide his time between three refuges and is headquartered four hours away from the Cedar Island Refuge. The public supported the addition of staff to meet refuge objectives.

Facility and Grounds Maintenance

There was concern at the scoping meetings that the refuge buildings were in poor shape, and inadequate to fulfill an expanded role in interpretation and environmental education. The public felt that new buildings, constructed on North Carolina Highway 12 frontage, would provide better visibility. A permanent maintenance worker hired since the scoping meetings, and substantial expenditures on building rehabilitation have improved the condition of the refuge and its associated buildings.

There is excessive dumping of household refuse on the refuge. This littering and dumping detracts from the appearance of the refuge and consumes a great deal of the single maintenance worker's time. The refuge needs an increased law enforcement presence to make the refuge more aesthetically pleasing.

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.

Although officially there is no designated wilderness area within the refuge, a Final Environmental Impact Statement (FES-75-92) proposed wilderness for several Cedar Island National Wildlife Refuge roadless islands in 1974. Wilderness designation was recommended for 180 acres of islands at the northern end of the refuge. These areas consist of 150 acres of brackish marsh and 30 acres of beach and maritime shrub. There are no known mineral reservations or other interests outstanding on any of the islands that would prevent the designation. The Fish and Wildlife Service never forwarded the recommendation to Congress. The areas are still being managed as if they were Wilderness Areas until the Service forwards the recommendation to Congress and Congress either approves or denies the recommendation.

During this comprehensive planning process, the refuge staff reviewed the lands within Cedar Island National Wildlife Refuge for suitability in meeting the criteria for wilderness, as defined by the Wilderness Act of 1964. No lands in the refuge other than the areas already recommended were found to meet these criteria. Therefore, the suitability of refuge lands for wilderness designation is not further analyzed in this plan.

Chapter IV. Management Direction

The plan describes the management direction of the refuge in terms of a vision, goals, objectives, and strategies. That direction is more focused from the vision to the strategies. The projects outlined in Chapter V and listed in Appendix VIII implement groups of strategies with the maintenance and management of resources and additions or replacements of resources.

VISION

Cedar Island National Wildlife Refuge will play a vital role in the National Wildlife Refuge System. The refuge will establish a presence in the local community by increasing staffing levels, partnering with agencies, developing research groups, and organizing friends groups and volunteers. The refuge will conserve and manage fish and wildlife species, such as endangered and threatened species, species of management concern, and interjurisdictional fish. Refuge staff and volunteers will protect the diverse habitats typical of the mid-Atlantic coastal ecosystem within which the refuge is situated, including coastal fringe forest, estuarine marsh, and longleaf pine savanna and fish nursery areas. Through active enhancement and management, the refuge will provide high-quality, mid-Atlantic, coastal habitat for migratory birds and other priority species. The Service will encourage visitors to the refuge to participate in compatible wildlife-dependent recreational activities. Working with others, Cedar Island National Wildlife Refuge staff, partners, and volunteers will manage and protect the refuge's natural resources to preserve a legacy of fish, wildlife, and plants for people to experience and appreciate in the years to come.

GOALS

WILDLIFE AND FISH POPULATIONS: Conserve, protect, and maintain healthy and viable populations of migratory birds, wildlife, fish, and plants, including federal and state endangered, threatened, and trust species on the Cedar Island National Wildlife Refuge.

HABITAT: Protect and enhance diverse habitats, rare plant assemblages, and nursery areas associated with the Pamlico-Core Sounds and the mid-Atlantic coastal plain.

PUBLIC USE: Develop programs and facilities to increase public use opportunities, including fishing, hunting, wildlife observation, wildlife photography, and environmental education and interpretation, on the Cedar Island National Wildlife Refuge.

RESOURCE PROTECTION: Protect refuge resources by limiting the negative impacts of human development and activity on and around Cedar Island National Wildlife Refuge.

ADMINISTRATION: Provide adequate staff and funding to accomplish the refuge goals and objectives of the Cedar Island National Wildlife Refuge.

OBJECTIVES AND STRATEGIES

The goals, objectives, and strategies addressed below are the Service's response to the issues, concerns, and needs expressed by the planning team, the refuge staff, and the public. These goals, objectives, and strategies reflect the Service's commitment to achieve the mandates of the National Wildlife Refuge System Improvement Act of 1997, the mission of the National Wildlife Refuge System, the North American Waterfowl Management Plan, and the purpose and vision for Cedar Island National Wildlife Refuge. Depending upon the availability of funds and staff, the Service intends to accomplish these goals, objectives, and strategies during the next 15 years.

FISH AND WILDLIFE POPULATIONS

Fish

Objective: Survey and monitor fish populations and health as opportunities present themselves.

Discussion: There is a great diversity of fish in the streams and canals on the refuge, using nursery habitat in refuge marshes, and offshore in the rivers, bays, and sounds surrounding the refuge. The refuge would maintain the current management and assist with studies performed by others, but would not conduct any of its own studies.

Strategies:

Assist with studies conducted by other agencies, organizations, and universities as needed.

Invertebrate Species

Objective: Survey and monitor invertebrate populations and health as opportunities present themselves.

Discussion: There is a great diversity of invertebrates in refuge marshes and forests. The refuge would maintain the current management and assist with studies performed by others, but would not conduct any of its own studies.

Strategies:

Assist with studies conducted by other agencies, organizations, and universities as needed.

Land Birds

Objective: Survey and monitor land bird populations and health as opportunities present themselves.

Discussion: There is a great diversity of land birds in refuge marshes and forests. The refuge would maintain the current management and assist with studies performed by others, but would not conduct any of its own studies.

Strategy:

Assist with studies conducted by other agencies, organizations, and universities as needed.

Mammals

Objective: Survey and monitor mammal populations and health as opportunities present themselves.

Discussion: There are a number of mammals in refuge marshes and forests. The refuge would maintain the current management and assist with studies performed by others, but would not conduct any of its own studies.

Strategy:

Assist with studies conducted by other agencies, organizations, and universities as needed.

Marsh Birds

Objective: Document populations of marsh birds annually, where habitat is being actively managed.

Discussion: There are many marsh birds on the 11,000 acres of marsh on the refuge. Many are listed as threatened or endangered by both the federal and state government. The refuge improves on the current management by proposing to document population densities annually and conduct studies on the federal and state listed species.

Strategies:

Assist with studies conducted by other agencies, organizations, and universities as needed.

Document population densities annually.

Conduct studies and investigations to the extent possible, with emphasis on federal and state listed species.

Reptiles and Amphibians

Objective: Survey and monitor reptile and amphibian populations and health as opportunities present themselves.

Discussion: There are a number of reptiles and amphibians in refuge marshes and forests. The refuge would maintain the current management and assist with studies performed by others, but would not conduct any of its own studies.

Strategy:

Assist with studies conducted by other agencies, organizations, and universities as needed.

Shorebirds

Objective: Survey and monitor shorebird populations and health as opportunities present themselves.

Discussion: There is a limited number of shorebirds on refuge beaches and dunes. The refuge would maintain the current management and assist with studies performed by others, but would not conduct any of its own studies.

Strategy:

Assist with studies conducted by other agencies, organizations, and universities as needed.

Wading Birds and Colonial Nesting Birds

Objective: Document population densities of wading and colonial nesting birds annually in larger habitat types, where habitat is being actively managed.

Discussion: There are many wading and colonial nesting birds in the marshes, forests, streams, and ditches on the refuge. Many are listed as threatened or endangered both the federal and state government. The refuge improves on the current management by proposing to document population densities annually and conduct studies on the federal and state listed species.

Strategies:

Assist with studies conducted by other agencies, organizations, and universities as needed.

Document population densities annually.

Conduct studies and investigations to the extent possible, with emphasis on federal and state listed species.

Waterfowl

Objective: Document population densities of waterfowl annually.

Discussion: There has historically been a great diversity and large numbers of waterfowl in the streams and canals on the refuge and in the bays and sounds surrounding the refuge. Those populations are associated with the excellent habitat and water quality in the area. The refuge proposes to maintain the current management and survey waterfowl monthly.

Strategy:

Conduct monthly aerial waterfowl surveys annually from November through February when airspace is available.

HABITAT

Bay Forest

Objective: Protect 100 acres of habitat.

Discussion: The bay forest provides habitat for songbirds and mammals. The fruit-bearing shrubs and trees provide food and cover for songbirds and small mammals. The dense vegetation provides cover for white-tailed deer. The habitat does not require intensive management. The community is being patrolled to protect it; the refuge would continue that activity, however frequency of patrols would be increased substantially.

Strategy:

Patrol the area routinely to discourage timber theft and vandalism.

Beach

Objective: Protect 20 acres of habitat.

Discussion: The beaches provide habitat for sea turtles, shorebirds, and colonial nesting waterbirds. They also are potential habitat for seabeach amaranth. The species that utilize the habitat require exposed sand close to water. The beaches are being patrolled to protect them; the refuge would continue that activity, however frequency of patrols would be increased substantially.

Strategy:

Patrol the area routinely to discourage vandalism.

Brackish Marsh

Objective: Protect and manage 11,000 acres of marshlands to maintain a diversity of plant species and patchy structure for supporting priority birds (both waterfowl and nongame species), diamondback terrapin, and fisheries.

Discussion: The brackish marsh provides habitat for waterfowl, wading birds, marsh birds, songbirds, mammals, and aquatic organisms. Marsh birds are particularly well adapted to spending the majority of their time in the thick marsh. Wading birds use deeper water areas. Waterfowl use open water and short grass areas. Songbirds use seed and fruit-bearing grasses, grasslike plants, and forbs. Mammals graze on palatable grasses. Fish and other aquatic organisms bear their young in the sections of the marsh with deeper water. The staff currently manages the marsh community with prescribed fire. The refuge proposes to continue that management but increase fire frequency and schedule prescribed fires more effectively to meet habitat and wildlife objectives.

Strategies:

Patrol the area routinely to discourage vandalism.

Conduct regular prescribed burns as specified in the fire management plan to restore plant diversity.

Coastal Fringe Evergreen Forest

Objective: Protect, maintain, and improve existing 1,425 acres of coastal fringe evergreen forest for pine associated priority species on and off refuge lands wherever possible.

Discussion: The forest is habitat to songbirds and mammals. Some songbirds and small mammals utilize the fruit-bearing understory shrubs for food and cover. Other guilds of songbirds occupy the pine overstory. As the pines age, they would be potential nesting habitat for red-cockaded woodpeckers. The staff currently conducts prescribed burning at a 3-year frequency. The refuge would continue that management but schedule prescribed fires more effectively to meet habitat and wildlife objectives.

Strategies:

Patrol the area sporadically to discourage timber theft and vandalism, however, frequency of patrols would be increased substantially.

Conduct regular prescribed burns as specified in the fire management plan to maintain a fire-dependent vegetative community.

Coastal Fringe Sandhills

Objective: Protect, maintain, and improve existing 80 acres of coastal fringe sandhill habitat and restore longleaf pine to longleaf sites for pine associated priority species on and off refuge lands wherever possible.

Discussion: The forest is habitat to songbirds and mammals. Some songbirds and small mammals utilize the fruit-bearing shrubby understory shrubs for food and cover. Other guilds of songbirds occupy the pine overstory. As the pines age, they would be potential nesting habitat for red-cockaded woodpeckers. The staff currently conducts prescribed burning at a 3-year frequency. The refuge would continue that management but schedule prescribed fires more effectively to meet habitat and wildlife objectives.

Strategies:

- Patrol the area routinely to discourage timber theft and vandalism.
- ***Conduct regular prescribed burns as specified in the fire management plan to maintain a fire-dependent vegetative community.***

Cypress - Gum Swamp

Objective: Protect 50 acres of habitat.

Discussion: This habitat is for songbirds, waterfowl, colonial nesting waterbirds, anadromous fish, invertebrates, and small mammals. The community provides fruit and cavities for nesting songbirds and small mammals. Waterfowl utilize the open water under the trees and cavities in the trees. Colonial nesting waterbirds nest in the tops of the trees. The anadromous fish and invertebrates live in the water around the trees. The community is being patrolled to protect it; the refuge would continue that activity, however, frequency of patrols would be increased substantially.

Strategy:

- Patrol the area routinely to discourage timber theft and vandalism.

Dune Grass

Objective: Protect 20 acres of habitat.

Discussion: The dunes provide habitat for colonial nesting waterbirds, songbirds, and small mammals. The species that utilize the habitat require short grasses close to exposed sand and water. The dunes are being patrolled to protect them; the refuge would continue that activity, however, frequency of patrols would be increased substantially.

Strategy:

- Patrol the area routinely to discourage vandalism.

Maritime Shrub

Objective: Protect and maintain 150 acres of habitat.

Discussion: The maritime shrub inland of brackish marshes, dunes, and beaches provides nesting, resting, and escape cover for songbirds and mammals that feed on the grasses in the marshes and on the dunes. The fruit-bearing shrubs also provide food for songbirds. The staff currently manages the shrub community with prescribed fire. The refuge proposes to continue that management but schedule prescribed fires more effectively to meet habitat and wildlife objectives.

Strategies:

- Patrol the area routinely to discourage timber theft and vandalism.
- Conduct regular prescribed burns as specified in the fire management plan to maintain a fire-dependent vegetative community.

Maritime Swamp Forest

Objective: Protect 637 acres of habitat.

Discussion: The maritime swamp forest provides habitat for songbirds and mammals. The fruit-bearing shrubs and trees provide food and cover for songbirds and small mammals. The dense vegetation provides cover for white-tailed deer. The habitat does not require intensive management. The community is being patrolled to protect it; the refuge would continue that activity, however, frequency of patrols would be increased substantially.

Strategy:

- Patrol the area routinely to discourage timber theft and vandalism.

Pine Savanna

Objective: Protect, maintain, and improve existing 500 acres of longleaf pine stands and restore longleaf pine to longleaf sites for pine-associated priority species on and off refuge lands wherever possible.

Discussion: The forest is habitat to songbirds and mammals. Some songbirds and small mammals utilize the fruit-bearing understory shrubs for food and cover. Other guilds of songbirds occupy the pine overstory. As the pines age, they would be potential nesting habitat for red-cockaded woodpeckers. The staff currently conducts prescribed burning at a 3-year frequency. The refuge would continue that management but schedule prescribed fires more effectively to meet habitat and wildlife objectives.

Strategies:

- Patrol the area routinely to discourage timber theft and vandalism.
- Conduct regular prescribed burns as specified in the fire management plan to maintain a fire-dependent vegetative community.

Pond Pine Woodlands

Objective: Protect and manage 125 acres of existing pond pine woodland conditions found along marsh edges for a combination of pine associated canopy species and shrubby/grassy species in the understory.

Discussion: The forest is habitat to songbirds and mammals. Some songbirds and small mammals utilize the fruit-bearing shrubby understory shrubs for food and cover. Other guilds of songbirds occupy the pine overstory. As the pines age, they would be potential nesting habitat for red-cockaded woodpeckers. The staff currently conducts prescribed burning at a 3-year frequency. The refuge would continue that management but schedule prescribed fires more effectively to meet habitat and wildlife objectives.

Strategies:

- Patrol the area routinely to discourage timber theft and vandalism.
- Conduct regular prescribed burns as specified in the fire management plan to maintain a fire-dependent vegetative community.

Wet Pine Flatwoods

Objective: Protect, maintain, and improve existing 1,000 acres of wet pine flatwoods and restore longleaf pine to longleaf sites for pine-associated priority species on and off refuge lands wherever possible.

Discussion: The forest is habitat to songbirds and mammals. Some songbirds and small mammals utilize the fruit-bearing shrubby understory shrubs for food and cover. Other guilds of songbirds occupy the pine overstory. As the pines age, they would be potential nesting habitat for red-cockaded woodpeckers. The staff currently conducts prescribed burning at a 3-year frequency. The refuge would continue that management but schedule prescribed fires more effectively to meet habitat and wildlife objectives.

Strategies:

Patrol the area routinely to discourage timber theft and vandalism.

Conduct regular prescribed burns as specified in the fire management plan to maintain a fire-dependent vegetative community.

Administrative Areas

Objective: Maintain 10 acres of lawn and grounds on a regular basis.

Discussion: There is a small, intensively managed area around the office and equipment storage buildings. The staff mows the lawn regularly, but does not use fertilizer or pesticides.

Strategies:

- Mow the lawn regularly enough to maintain a good sod cover for erosion control.
- Manage weeds and insect pests that jeopardize the sod cover.

Open Water

Objective: Protect land base to ensure water quality in the 15,000 acres of adjacent nursery waters. Support the monitoring of submerged aquatic vegetation.

Discussion: The bays, sounds, and streams in the vicinity of the refuge have outstanding water quality and are important habitat for fish, other aquatic organisms, and migrating and wintering waterfowl and wading birds. Refuge management involves little tillage or application of fertilizers or pesticides that would affect water quality. That low intensity management would continue.

Strategies:

Use the minimum amount of tillage required to maintain firebreaks.

Apply fertilizer and pesticides necessary to maintain sod cover according to the recommendations of the Cooperative Extension Service and label instructions.

Support funding for the monitoring of submerged aquatic vegetation.

Threatened and Endangered Species

Objective: Document the presence of listed plant species and associated habitats as opportunities present themselves.

Discussion: The refuge has the potential to be habitat for seabeach amaranth on the beach and rough-leaved loosestrife in fire-dependent communities. Biologists have not seen either species on the refuge. Seabeach amaranth appears and disappears seemingly at random on beaches along the Atlantic Coast as favorable conditions occur and seed banks are exposed. The rough-leaved loosestrife may appear as natural fire cycles are restored on the refuge.

Strategy:

Work with other agencies, organizations, and universities as needed.

PUBLIC USE

Commercial Ecotours

Objective: Provide opportunities for commercial ecotour vendors to conduct tours.

Discussion: The refuge is currently under-utilized for public use activities. Permitting commercial ecotours is a viable option to provide public use opportunities and give the refuge visibility. There have been no inquiries about permits from ecotourism in the past. The refuge would now publicize that opportunity.

Strategy:

Review and evaluate proposed activities on a case-by-case basis.

Environmental Education

Objective: Provide opportunities for 100 visitors annually.

Discussion: The refuge currently is not utilized for environmental education. There is no resident staff to conduct programs and there have not been deliberate efforts to invite educational institutions to use the refuge as an outdoor classroom. The refuge would make those efforts and conduct monthly programs.

Strategies:

Publicize the availability of the refuge as an outdoor classroom facility for periodic programs conducted by local schools and universities.

Provide one program monthly on or off refuge.

Fishing

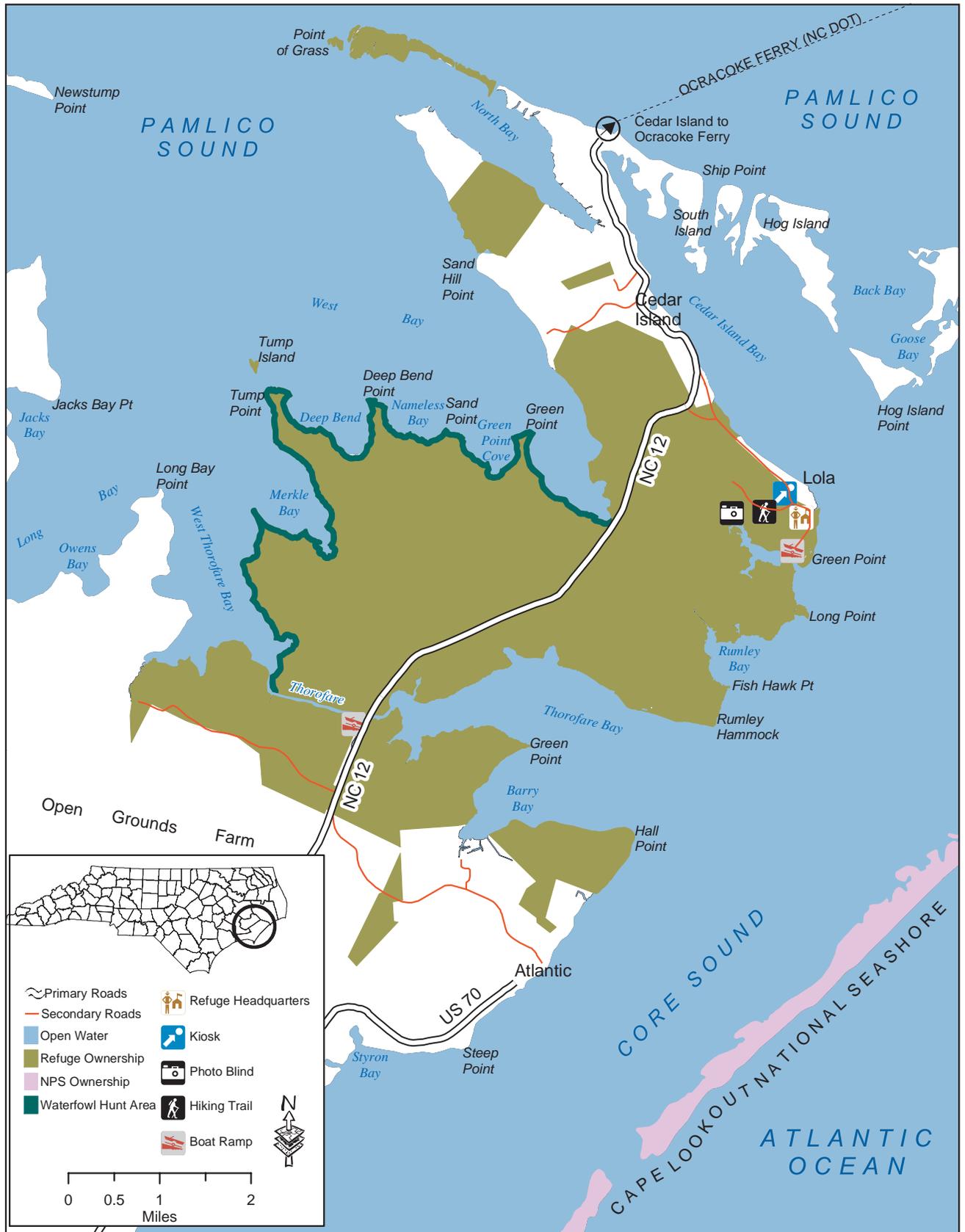
Objective: Provide opportunities for 15,000 visitors annually.

Discussion: The refuge will be formally opened for fishing pending development and approval of a fishing plan and environmental assessment. Fishing currently occurs along refuge canals, interior ponds, and adjacent waters but is not monitored.

Strategy:

Maintain two boat-launching facilities and advertise fishing opportunities.

Figure 7. Proposed visitor facilities at the Cedar Island National Wildlife Refuge under Alternative 2 (Preferred Alternative).



Hunting

Objective: Provide waterfowl hunting opportunities for 1,200 visitors annually on the approximately 400 acres on West Bay Marsh currently utilized during regular state hunting season. Conduct limited archery deer hunting.

Discussion: The refuge currently provides waterfowl hunting opportunities for 1,000 visitors annually. As the refuge becomes more visible and development continues to restrict hunting on private land, more hunters will use the refuge. The refuge anticipates increased use in waterfowl hunting and provides for limited archery deer hunting.

Strategies:

- Revise refuge hunting plan to include a limited archery hunt for deer.
- Adapt hunting plan in response to harvest of deer and hunter satisfaction.
- Revise refuge hunting brochure annually.
- Maintain special hunting information exhibit and regulatory signs.
- Enforce hunting regulations.

Interpretation

Objective: Provide opportunities for 1,500 visitors annually.

Discussion: The refuge currently provides opportunities for 1,000 visitors annually. As the refuge's visibility increases and the Service develops facilities, more visitors will utilize the refuge for interpretation. The refuge anticipates that increase.

Strategies:

Make leaflets available at the office, when open.

Develop one interpretive trail and brochure.

Develop an interpretive kiosk near the office.

Non-Wildlife Dependent Public Uses

Objective: Administer Service policy on non-wildlife-dependent public use.

Discussion: The refuge was unstaffed for more than a decade until recently. Local residents and traveling visitors have been using the refuge for non-wildlife-dependent recreational uses. The presence of a single maintenance worker currently headquartered on the refuge has curtailed those uses, but there is no resident staff to evaluate requests to engage in those uses or to enforce refuge regulations. The refuge would now evaluate and enforce permits for the uses.

Strategies:

Evaluate non-wildlife-dependent recreational uses on a case-by-case basis.

Conduct compatibility determinations on all proposed uses.

Provide picnic facilities for visitors engaged in priority public uses on the refuge.

Outreach

Objective: Implement an outreach program to reach an audience of 1,000 annually.

Discussion: The refuge's current outreach efforts are limited to staffing an exhibit at the Core Sound Waterfowl Weekend and developing news releases for major events. The refuge proposes to increase outreach activities to make the public aware of the wildlife, habitat management, and public use opportunities on the refuge.

Strategies:

Participate in the Core Sound Waterfowl Weekend.

Develop press releases on major events (National Wildlife Refuge Week, National Fishing Day, International Migratory Bird Day, etc.) throughout the year.

Develop a refuge display.

Develop a news release at least quarterly to announce activities and regulations on the refuge.

Conduct an off-refuge program quarterly.

Refuge Support

Objective: Accept support as opportunities present themselves.

Discussion: Many refuges have "Friends Groups" that raise funds for the refuges or serve as a non-federal partner for grants that require one. Community support for the refuge at the scoping meetings for this plan was extensive. As the refuge program develops, the staff should expect support from local civic organizations, businesses, and conservation organizations.

Strategy:

Accept support as opportunities present themselves.

Special Events

Objective: Conduct one open house annually.

Discussion: The refuge staff does and would continue to participate in community events for outreach, but would limit special events on the refuge to an annual open house.

Strategies:

Publicize open house.

Exhibit refuge wildlife, habitats, public use programs, and management activities.

Conduct refuge tours.

Visitor Protection

Objective: Protect visitors consistently.

Discussion: Visitor protection on the refuge is difficult. The refuge had been unstaffed for many years until a single staff person was hired in 2002. That maintenance worker establishes a presence, but is not a law enforcement officer. He can be proactive in reminding visitors of safety hazards, but cannot cite or arrest individuals who harm other visitors. The refuge is 4 hours away from the Mattamuskeet National Wildlife Refuge, where the closest law enforcement officers are located. The refuge proposes to add an onsite law enforcement officer to provide more timely response to incidents and public complaints and deter violations by having a visible presence.

Strategy:

Patrol refuge routinely.

Volunteer Program

Objective: Support and enhance designated refuge programs by recruiting, training, and coordinating volunteers to donate service annually to support and enhance designated refuge programs.

Discussion: Volunteers provide extensive assistance to refuge programs by helping with maintenance, biological, and public use activities. Local citizens expressed a willingness to volunteer during scoping meetings for this plan. The single staff person located on the refuge has successfully solicited volunteers from the community. The refuge proposes a proactive approach to recruitment.

Strategies:

Train and manage volunteers in accordance with Fish and Wildlife Service policy.

Accept volunteers as opportunities present themselves.

Pursue college interns to assist in refuge programs.

Wildlife Observation

Objective: Provide opportunities for 20,000 visitors annually.

Discussion: The refuge hosts a considerable amount of wildlife observation despite being unstaffed for most of the past decade. It is located on a major highway connecting a ferry from vacation destinations on Ocracoke Island and the Outer Banks to population centers west of the refuge. Motorists pass through 6 miles of the refuge and have access to the refuge parking lot 2 miles southeast of the highway. The refuge currently has no developed trails, but roads and firebreaks

provide pedestrian access for observation. The refuge would provide a trail to additional access.

Strategies:

Allow visitors to use 2.5 miles of unimproved roads, 14 miles of firebreaks, and other areas accessible to pedestrians.

Publicize the use of the interpretive trail for wildlife observation.

Wildlife Photography

Objective: Provide opportunities for 200 visitors annually.

Discussion: The refuge hosts a considerable amount of wildlife observation despite being unstaffed for most of the past decade. It is located on a major highway connecting a ferry from vacation destinations on Ocracoke Island and the Outer Banks to population centers west of the refuge. Motorists pass through 6 miles of the refuge and have access to the refuge parking lot 2 miles southeast of the highway. The refuge currently has no developed trails, but roads and firebreaks provide pedestrian access for photography. The refuge would provide a trail to additional access and a photo blind.

Strategies:

- Allow visitors to use 2.5 miles of unimproved roads, 14 miles of firebreaks, and other areas accessible to pedestrians.
- Publicize the use of the interpretive trail for wildlife photography.
- Construct at least one photo blind for wildlife photography.

RESOURCE PROTECTION

Communication Towers

Objective: Limit impacts to refuge resources from communication towers.

Discussion: There are two communication towers on the refuge. They pose a hazard to migrating birds. The refuge would maintain the current management.

Strategies:

- Review permits for two communication towers on refuge property and one on adjacent land every 5 years.
- Review requests for additional towers as necessary.

Corridors

Objective: Limit impacts to refuge resources from corridors and rights-of-way.

Discussion: There are highway and power line rights-of-way on the refuge that are currently not monitored for compliance with permit conditions. The refuge proposes to monitor the corridors periodically and coordinate maintenance.

Strategies:

- Monitor all corridors and rights-of-way for compliance with terms and conditions of permit annually.
- Coordinate with utility companies and North Carolina Department of Transportation to maintain corridors and rights-of-way.

Cultural Resources

Objective: Limit impacts to cultural resources on the refuge.

Discussion: Seven historic properties have been discovered on the refuge. There may be others that could be disturbed by construction or land disturbance. The refuge proposes increased oversight by a refuge manager who will ensure that the regional archaeologist is contacted before land is disturbed, as well as reporting incidental finds.

Strategies:

- Contact regional and state archaeologist and State Historic Preservation Office as new sites are discovered.
- Contact regional archaeologist before disturbing land for any proposed developments or improvements.
- Complete consultation with State Historic Preservation Office on any proposed developments or improvements.

In-holdings

Objective: Limit impacts to refuge resources from in-holdings.

Discussion: The Service does not own 2,407 acres of the 16,887 acres in the refuge approved acquisition boundary. The landowners of those areas may engage in activities that may have impacts on the refuge. The staff has issued permits with special use conditions to some landowners to allow them to engage in those activities. The refuge proposes to pursue the same strategies as the current management utilizes.

Strategies:

- Maintain cordial relationships with the landowners of in-holdings.
- Develop special use conditions for permitted in-holder activities on the refuge.

Interagency Coordination

Objective: Coordinate refuge activities with other agencies to accomplish the refuge mission.

Discussion: Effective management of the refuge relies on coordination and cooperation with many agencies. Sound fire management on the refuge and adjacent land and bird surveys rely on the refuge's cooperation with other agencies and organizations. The refuge proposes to pursue the same strategies as the current management utilizes.

Strategies:

- Coordinate with Marine Corps Air Station at Cherry Point for prescribed burns on Atlantic Field.
- Coordinate with North Carolina Division of Forestry on wildfire suppression.
- Cooperate with Cedar Island Volunteer Fire Department for wildfires on refuge.
- Coordinate with North Carolina Wildlife Resources Commission and Audubon Society to conduct colonial nesting bird surveys and banding studies.

Land Protection

Objective: Pursue acquisition of available parcels from willing sellers within approved acquisition boundary.

Discussion: The Service does not own 2,407 acres of the 16,887 acres in the refuge approved acquisition boundary. The habitat on these areas is important to the wildlife of concern to the Service. Acquiring this habitat would allow the service to provide better habitat through more effective management and resource protection. There have been no proactive efforts to acquire these areas. The refuge proposes to actively pursue acquisition and develop a land protection plan to address habitat needs outside of the approved acquisition boundary.

Strategies:

- Maintain knowledge of owners of parcels within the approved acquisition boundary.
- Maintain contact with the owners of parcels within the approved acquisition boundary.
- Develop a land protection plan to address the habitat needs of trust species.

Law Enforcement

Objective: Ensure public safety and protect refuge resources by encouraging voluntary compliance and enforcing refuge regulations as necessary.

Discussion: Law enforcement on the refuge is difficult. The refuge had been unstaffed for many years until a single staff person was hired in 2002. That maintenance worker establishes a presence, but is not a law enforcement officer. He can be proactive in reminding visitors of refuge regulations, but cannot enforce the regulations. The refuge is 4 hours away from the Mattamuskeet National Wildlife Refuge, where the closest law enforcement officers are located. The refuge proposes to add an onsite law enforcement officer to provide more timely response to incidents and public complaints and deter violations by having a visible presence.

Strategies:

- Erect signage and make information available to make refuge visitors aware of refuge regulations.
- Maintain a presence of staff that is not law enforcement officers to establish visibility and remind visitors of refuge regulations.
- Hire a law enforcement officer to conduct routine patrols to detect, deter, and investigate violations.

Military Activity

Objective: Tolerate military activity around the refuge.

Discussion: The refuge is in the flight path of military aircraft using Atlantic Field and Piney Island for military exercises. The refuge does not propose to monitor or document military sorties. One to three small military training exercises are authorized annually. The refuge proposes to tolerate the same level of activity as the current management.

Permits

Objective: Limit impacts to or enhance refuge resources annually by evaluating use proposals on a case-by-case basis.

Discussion: Visitors and researchers apply for permits to engage in recreation activities or perform research on the refuge. The staff reviews the permits, and establishes and enforces conditions under which applicants may engage in the activity. The refuge proposes to issue permits for all uses and develop and monitor permit conditions.

Strategies:

- Protect refuge resources annually by developing special conditions for those permitted uses that are compatible.
- Administer permits according to Service policy.

Pest Animals

Objective: Limit impacts to refuge resources from pest animals as resources allow.

Discussion: The refuge proposes to maintain the same as the current management. Pest animals, particularly feral cats, are a threat to wildlife populations. There is no active routine monitoring or control program at this time. As the staff increases in size, there will be additional opportunities to monitor pests and control them.

Strategy:

- Conduct limited control of pest animals by refuge staff or by issuing special use permits.

Pest Plants

Objective: Limit impacts to refuge resources from pest plants as resources allow.

Discussion: The refuge proposes to maintain the same as the current management. Pest plants, particularly common reed (*Phragmites australis*), are a threat to the natural vegetative communities on the refuge. The staff is currently not monitoring or managing pest plants routinely. As the staff increases in size, there will be additional opportunities to monitor pests and control them.

Strategy:

- Conduct limited monitoring of pest plants and control the most dominant.

Significant Natural Heritage Areas

Objective: Maintain characteristic vegetation on significant natural heritage areas.

Discussion: The refuge proposes to maintain the current management. The State of North Carolina has identified much of the refuge as a Significant Natural Heritage Area. The staff is using prescribed fire to maintain the characteristic vegetation.

Strategy:

- Utilize prescribed fire to maintain characteristic vegetation on significant natural heritage areas.

Water Quality

Objective: Conduct land management activities to minimize impacts to water quality.

Discussion: The refuge is surrounded by sounds, bays, and creeks, which the State of North Carolina rates as high-quality or outstanding-quality waters. Those waters are also used for shellfishing and are nutrient sensitive. The Service's management of the refuge is low intensity in terms of tillage and the use of fertilizers and pesticides. The refuge proposes to continue that level of management.

Strategy:

- Cooperate with state and federal agencies in water quality monitoring programs.

Wilderness Areas

Objective: There are no areas on the refuge considered candidate or designated wilderness areas.

Discussion: There are no areas on the refuge of over 5,000 acres without roads or firebreaks dissecting the areas. State smoke management guidelines require prescribed fire areas of less than 5,000 acres. Mechanized travel through the marshes is required to provide fire protection and track down fire lines for prescribed fire. Cleared and maintained firebreaks through forests are required to manage prescribed fires. Those fire management practices preclude the nomination of wilderness study areas because the firebreaks destroy the naturalness of the areas.

Strategy:

- Evaluate newly acquired areas as Wilderness Study Areas.

Wildlife Disease

Objective: Limit impacts to refuge resources from wildlife diseases as necessary.

Discussion: The refuge proposes to maintain the current management. The staff will remain vigilant about wildlife disease, but will not conduct any routine monitoring specifically for disease. There have not been any substantial incidences of wildlife disease on the refuge.

Strategies:

- Observe wildlife on the refuge during routine monitoring, note any disease symptoms, and report them to the appropriate authorities.
- Encourage all staff and volunteers to maintain vigilance while observing wildlife in the course of their routine duties and report disease symptoms to the appropriate authorities.
- Follow up on visitors' observations of potential disease symptoms.

REFUGE ADMINISTRATION

Capital Property

Objective: Manage capital property, in accordance with Fish and Wildlife Service policy, from the Mattamuskeet National Wildlife Refuge.

Discussion: The refuge proposes to improve on the current management by providing for the maintenance and acquisition of equipment often enough to keep it in good condition and support the refuge programs. The refuge is currently reasonably well equipped, but replacement schedules are not adequate to avoid major repairs of critical equipment.

Strategies:

- Maintain capital property in accordance with Fish and Wildlife Service policy.
- Replace capital property as funds are available.
- Conduct one capital property inventory annually.
- Add capital property to support additional staff.

Financial Management

Objective: Manage budget and develop and administer contracts, in accordance with Fish and Wildlife Service policy, from the Mattamuskeet National Wildlife Refuge.

Discussion: The refuge proposes to improve on the current management by providing a refuge manager at Cedar Island National Wildlife Refuge to assist with financial management. The management staff and office assistant at Mattamuskeet National Wildlife Refuge currently manage the finances of Cedar Island National Wildlife Refuge.

Strategies:

- Develop annual and long-term budgets.
- Develop and execute contracts.
- Process travel vouchers.
- Maintain Refuge Operating Needs System (RONS) and Maintenance Management System (MMS) databases by adding new needs and deleting funded projects.
- Apply for flex funding and other grants.
- Utilize the refuge manager to assist with financial management.

Office Space and Utilities

Objective: Provide and maintain safe, adequate office space, parking facilities, and utilities for the planned size of the staff in accordance with Fish and Wildlife Service policy.

Discussion: The staff has recently renovated the office facility at Cedar Island Refuge to provide safe, adequate space for the single staff person. The refuge proposes to improve on the current management by providing offices for the additional staff planned for the refuge.

Strategies:

- Maintain facilities that require upgrades.
- Provide fuel, office supplies, and utilities for refuge operations and staff.
- Convert one residential room to office space.

Personnel Management

Objective: Manage Cedar Island Refuge personnel from the Mattamuskeet National Wildlife Refuge in accordance with Fish and Wildlife Service policy.

Discussion: The refuge proposes to improve on the current management by providing a refuge manager at Cedar Island Refuge to conduct personnel management. The management and administrative staff at Mattamuskeet National Wildlife Refuge currently manage the personnel of Cedar Island National Wildlife Refuge.

Strategies:

- Recruit, hire, train, and manage four permanent staff members (a refuge manager, a biological technician, a law enforcement officer, and a maintenance worker).
- Provide staff professional technical and leadership development training as allowable under current funding levels.
- Evaluate performance; manage performance and conduct in accordance with Service policy.
- Recognize employee performance through the employee incentives program.
- Schedule personnel from other refuges and cooperating agencies to assist with maintenance, prescribed fire, and surveys.

Real Property Management

Objective: Manage real property buildings, grounds, firebreaks, structures, roads, and other facilities from Mattamuskeet National Wildlife Refuge in accordance with Service policy to protect the health and safety of the refuge staff and public.

Discussion: This objective improves on the current management by providing a refuge manager at Cedar Island Refuge to assist with property management. The management and administrative staff at Mattamuskeet National Wildlife Refuge currently manage the property of Cedar Island Refuge.

Strategies:

- Maintain buildings, structures, and other facilities in accordance with Service policy to support refuge programs.
- Evaluate the need for and acquire additional buildings, structures, and other facilities to support refuge programs.
- Conduct one real property inventory annually.
- Dispose of or demolish unneeded facilities.
- Build a small dock on Lola Road, an interpretive trail, and a photo blind.

Chapter V. Plan Implementation

INTRODUCTION

The Service will implement utilizing existing staff, facilities, and equipment and acquiring additional staff, facilities, and equipment. Tables 15 through 19 below outline the strategies from Chapter IV and list the existing and new staff, facilities, and equipment required to implement the strategies. Appendix VIII contains details of the new staff, facilities, and equipment as Refuge Operation Needs System (RONS) Projects or Maintenance Management System (MMS) Projects. The appendix also includes the priorities of those projects. Each project serves multiple goals, objectives, and strategies. The refuge staff will implement the strategies associated with specific projects as Service funds those projects.

Table 15. Projects supporting wildlife strategies

Personnel Projects	
Strategy	Projects
Conduct surveys, monitoring, studies, and investigations.	Use existing wildlife biologist from Mattamuskeet Refuge. Recruit, hire, train new biological technician (RONS 97013).
Protect wildlife.	Recruit, hire, train new law enforcement officer <i>(Not currently in RONS-needs to be added)</i>
Manage budget, contracts, personnel, and property.	Use existing refuge manager, assistant manager, and office assistant from Mattamuskeet Refuge. Recruit, hire, train new refuge manager (RONS 00004)
Apply for flexible fund and other grants.	Use existing wildlife biologist from Mattamuskeet Refuge. Recruit, hire, train new refuge manager (RONS 00004) and biological technician (RONS 97013).
Equipment Projects	
Maintain, repair, and replace equipment to survey and protect wildlife.	Replace equipment (various MMS projects). Replace vehicles (various MMS projects). Replace equipment shared by Mattamuskeet Refuge.

Table 16. Projects supporting habitat strategies

Personnel Projects	
Strategy	Projects
Conduct surveys, monitoring, studies, and investigations.	Use existing wildlife biologist from Mattamuskeet Refuge. Recruit, hire, train new biological technician (RONS 97013).
Conduct prescribed burning.	Use existing fire management officer, wildlife biologist, forestry technicians, and engineering equipment operators from other refuges.
Protect habitat.	Recruit, hire, train new law enforcement officer <i>(Not currently in RONS-needs to be added)</i>
Manage budget, contracts, personnel, and property.	Use existing refuge manager, assistant manager, and office assistant. Recruit, hire, train new refuge manager (RONS 00004).
Apply for flexible fund and other grants.	Use existing wildlife biologist from Mattamuskeet Refuge. Recruit, hire, train new biological technician (RONS 97013).
Equipment Projects	
Maintain, repair, and replace equipment to manage habitat.	Replace equipment (various MMS projects). Replace vehicles (various MMS projects). Replace equipment shared by Mattamuskeet Refuge.
Facility Projects	
Maintain, repair, and replace facilities to manage habitat.	Replace bulkheads and water control structures (various MMS projects).

Table 17. Projects supporting public use strategies

Personnel Projects	
Strategy	Projects
Plan, design and conduct programs and outreach.	Recruit, hire, train new refuge manager (00004) and biological technician (97013).
Maintain education, interpretation, wildlife observation, and photography facilities.	Use existing maintenance worker, volunteers, and staff from Mattamuskeet Refuge.
Protect visitors.	Recruit, hire, train new law enforcement officer <i>(Not currently in RONS-needs to be added)</i>
Manage budget, contracts, personnel, and property.	Use existing refuge manager, assistant manager, and office assistant from Mattamuskeet Refuge. Recruit, hire, train new refuge manager (RONS 00004).
Apply for flexible fund and other grants.	Use existing refuge manager, assistant manager, and wildlife biologist from Mattamuskeet Refuge.
Equipment Projects	
Maintain, repair and replace equipment to maintain facilities as necessary.	Replace equipment (various MMS projects). Replace vehicles (various MMS projects). Replace equipment shared by Mattamuskeet Refuge.
Facility Projects	
Maintain, repair, and replace facilities as necessary.	Replace parking lots, kiosks, boat ramp, and boat dock (various MMS projects).

Table 18. Projects supporting resource protection strategies

Personnel Projects	
Strategy	Projects
Maintain cooperation with agencies, organizations, and permit holders. Review permits and develop conditions for uses allowed by permits. Monitor pest animals and plants and permitted uses.	Use existing refuge manager, assistant manager, and wildlife biologist at Mattamuskeet Refuge. Recruit, hire, train new refuge manager (RONS 00004) and new biological technician (RONS 97013).
Maintain equipment and facilities.	Use existing maintenance worker, volunteers, and staff from Mattamuskeet Refuge.
Enforce regulations.	Recruit, hire, train new law enforcement officer <i>(Not currently in RONS-needs to be added)</i>
Manage budget, contracts, personnel, and property.	Use existing refuge manager, assistant manager, and office assistant at Mattamuskeet Refuge. Recruit, hire, train new refuge manager (RONS 00004).
Apply for flexible fund and other grants.	Use existing refuge manager, assistant manager, and wildlife biologist at Mattamuskeet Refuge.
Equipment Projects	
Maintain, repair, and replace equipment as necessary.	Replace equipment (various MMS projects). Replace vehicles (various MMS projects). Replace equipment shared by Mattamuskeet Refuge.
Facility Projects	
Maintain, repair, and replace facilities as necessary.	Replace parking lots, and kiosks (various MMS projects).

Table 19. Projects supporting refuge administration strategies

Personnel Projects	
Strategy	Projects
Manage budget, contracts, personnel, and property.	Use existing refuge manager, assistant manager, and office assistant. Recruit, hire, train new refuge manager (RONS 00004).
Maintain equipment and facilities.	Use existing maintenance worker and staff from Mattamuskeet Refuge.
Equipment Projects	
Maintain, repair, and replace equipment as necessary.	Replace equipment (various MMS projects). Replace vehicles (various MMS projects). Replace equipment shared by Mattamuskeet Refuge.
Facility Projects	
Maintain, repair, and replace facilities as necessary.	Replace bulkheads, water control structures, parking lots, kiosks, boat dock, and boat ramp (various MMS projects). Remove storage building (MMS 01001)

REFUGE ADMINISTRATION

The maintenance and operation of the refuge’s administrative facilities would continue, regardless of the alternative selected. Periodic updating of facilities is necessary for safety and accessibility and to support staff and management needs. The plan identifies funding needs for several projects, including providing additional facilities and equipment to support refuge operation and maintenance.

FUNDING AND PERSONNEL

Currently, the Service has approved a staff of one permanent position for the refuge. Staff members from Mattamuskeet National Wildlife Refuge and other refuges in northeastern North Carolina conduct management activities such as prescribed burning on the refuge. To complete the wildlife habitat management projects, conduct the necessary wildlife surveys, offer public use opportunities, and protect refuge resources, the refuge requires additional staff. The proposed staffing plan (Table 20) would enable the refuge to achieve its objectives and strategies within a reasonable time. The annual cost (including salaries and benefits) would be \$295,000. The rate at which this refuge realizes its full potential to contribute locally, regionally, and nationally to wildlife conservation and appropriate wildlife-dependent recreation and environmental education is totally dependent upon receiving adequate staffing and funding.

Table 20. Proposed staffing plan for Cedar Island National Wildlife Refuge

Position	Status	Percent of Time on Cedar Island
Project Leader, GS-0485-13	PFT	0
Refuge Manager, GS-0485-12	PFT	100
Assistant Manager, GS-0485-11	PFT	10
Wildlife Biologist, GS-0486-11	PFT	0
Biological Technician, GS-0404-07	PFT	100
Park Ranger (Law Enforcement), GS-0025-09	PFT	0
Park Ranger (Law Enforcement), GS-0025-07	PFT	100
Office Assistant, GS-0303-08	PFT	10
Heavy Mobile Equipment Operator, WG-5803-10	PFT	0
Crane Operator, WG-5725-10	PFT	0
Maintenance Worker, WG-4749-08	PFT	0
Maintenance Worker, WG-4749-08	PFT	0
Maintenance Worker, WG-4749-08	PFT	100
Forestry Technician, GS-0462-05 (Fire)	PFT	0
<i>PFT = permanent full time, TFT = temporary full time, Fire = funded by fire budget</i>		

VOLUNTEERS

The Service maintained the refuge without staff for more than a decade before recently assigning a maintenance worker to the facility. The lack of visibility damaged the reputation of the Service as the condition of the refuge deteriorated. There is support among local residents who are willing to volunteer in the maintenance of the refuge, construction of new facilities, wildlife and habitat surveys, and environmental education and interpretation. The maintenance worker utilizes volunteers in his duties, but further utilization of volunteers will depend on availability of staff to recruit, organize, train, and coordinate them.

PARTNERSHIP OPPORTUNITIES

A major objective of this comprehensive conservation plan is to establish partnerships with local volunteers, landowners, private organizations and state and federal natural resource agencies. In the immediate vicinity of the refuge, opportunities exist to establish partnerships with sporting clubs, elementary and secondary schools, and community organizations. At regional and state levels, the Service might establish partnerships with organizations such as the North Carolina Wildlife Resources Commission, North Carolina Division of Marine Fisheries, The Nature Conservancy, Ducks Unlimited, and National Audubon Society.

The refuge volunteer program and other partnerships generated would depend upon the number of staff positions the Service provides the refuge. As the Service commits staff and resources to the refuge, opportunities to expand the volunteer program and develop partnerships would increase.

STEP-DOWN MANAGEMENT PLANS

A comprehensive conservation plan is a strategic plan that guides the direction of the refuge. Before the staff can implement some of the strategies and projects, it must prepare or update detailed step-down management plans. To assist in preparing and implementing the step-down plans, the refuge staff will develop partnerships with local agencies and organizations. The staff will develop these plans 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.

Habitat Management Plan (Develop): This plan will describe the overall desired habitat conditions needed to fulfill refuge purpose and objectives. The plan will include three sections dealing with moist-soil/water management units, forests, and croplands. The plan will identify procedures, techniques, and timetables for achieving desired conditions.

Forest Management Plan (Develop): This plan will describe strategies for meeting refuge forest management objectives. It will include direction on reforestation, stand improvement, and harvest. Also, the plan will address scrub/shrub habitat management.

Fire Management Plan (Update): This plan will describe wild and prescribed fire management techniques that the staff will employ on the refuge. Wildfire control descriptions will include initial attack strategies and cooperative agreements with other agencies.

Integrated Pest Management Plan (Develop and Update): This plan will address the complex issue of bringing exotic and nuisance plants and animals to a maintenance control level on the refuge. It will cover chemical pesticide use (aerial and ground application), mechanical eradication, and biological controls. The Nuisance/Exotic Animal and Plant control plans will be sections of this plan.

Nuisance/Exotic Animal Control Plan (Update): This plan (as part of the Integrated Pest Management Plan) will describe survey, removal or control, and monitoring techniques for both terrestrial and aquatic nuisance and exotic animals (vertebrate and invertebrate).

Nuisance/Exotic Plant Control Plan (Develop): This plan (as part of the Integrated Pest Management Plan) will describe survey, removal or control, and monitoring techniques for both terrestrial and aquatic nuisance and exotic plants.

Biological Inventory/Monitoring Plan (Develop): This plan will describe inventory and monitoring techniques and time frames. The plan will include an inventory of all plant communities and associations in the refuge, as well as all trust species (migratory birds including songbirds, neotropical passerines, and waterfowl), listed species (federal and state threatened, endangered and species of concern), key resident species, and monitoring of population trends.

Visitor Services Plan (Develop): This plan will describe the refuge's wildlife-dependent recreation, environmental education, and interpretation. Specific issues or items that the plan will address include facility requirements, site plans, and handicapped accessibility. The environmental education, fishing, hunting, and sign plans will be sections of this plan.

Environmental Education Plan (Develop): This plan will reflect the objectives and strategies of the comprehensive conservation plan and address environmental education guidelines following Service standards.

Fishing Plan (Update): This plan (as part of the Visitor Services Plan) will address specific aspects of the refuge's fishing program. It will define fishing areas, including handicapped accessible areas, fishing methods, facilities needed, and refuge-specific regulations.

Hunting Plan (Update): This plan (as part of the Visitor Services Plan) will address specific aspects of the refuge's hunting program. It will define species to be hunted, season structures, hunt areas, methods, all-terrain vehicle use, handicapped accessibility, facilities needed, and refuge-specific hunting regulations.

Sign Plan (Update): This plan (as part of the Visitor Services Plan) will describe the refuge's strategy for informing visitors via signage. It will incorporate Service guidelines.

Law Enforcement Plan (Update): This plan will provide a reference to refuge policies, procedures, priorities, and programs concerning law enforcement.

MONITORING AND ADAPTIVE MANAGEMENT

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

To apply adaptive management, the staff would adopt specific survey, inventory, and monitoring protocols for the refuge. It would evaluate habitat management strategies systematically to determine management effects on wildlife populations. The refuge would use this information to refine approaches and determine how effectively the staff is accomplishing the objectives. Evaluations would include ecosystem team and other appropriate partner participation. If monitoring and evaluation indicate undesirable effects for target and non-target species and/or communities, the staff would make alterations to the management projects. Subsequently, the refuge's comprehensive conservation plan would be revised.

The refuge would describe specific monitoring and evaluation activities in the step-down management plans.

SECTION B. ENVIRONMENTAL ASSESSMENT

Chapter I. Background

PURPOSE AND NEED FOR ACTION

The purpose of the environmental assessment for the plan is to determine and evaluate a range of reasonable management alternatives for Cedar Island National Wildlife Refuge. The Service developed each alternative with the potential to be a final comprehensive conservation plan. The environmental assessment also predicts and evaluates the biological, physical, and socioeconomic effects of implementing each alternative. From this range of alternatives, the plan identifies the Fish and Wildlife Service's proposed management action.

In accordance with the guidelines of the National Environmental Policy Act, the Service identified a number of issues, concerns, and needs through discussions with the public, agency managers, and professionals. From these issues and concerns, the Service's planning team identified a range of three alternatives, evaluated the possible consequences of implementing each, and selected Alternative 2 as the proposed management action. In the opinion of the Service and the planning team, Alternative 2 addresses the high priority needs of the refuge over the next 15 years.

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

DECISIONS FRAMEWORK

Based on this draft environmental assessment, the Fish and Wildlife Service will select an alternative to implement the final Comprehensive Conservation Plan for Cedar Island National Wildlife Refuge. The Service will prepare a Finding of No Significant Impact (FONSI) if the selected alternative will not have a significant impact on the quality of the human environment. The Service will prepare an Environmental Impact Statement (EIS) if the selected alternative will have a significant impact on the quality of the human environment. The refuge staff will base this determination on an evaluation of the purposes for which the Service established the refuge, the mission of the Service and the National Wildlife Refuge System, and other legal mandates. Assuming that the Service finds no significant impacts, implementation of the plan will begin, and the staff will monitor the impacts of the plan on an annual basis and revise it when necessary.

PLANNING STUDY AREA

Cedar Island National Wildlife Refuge is in northeastern North Carolina on a coastal barrier island just west of the Atlantic Ocean, east of Long and West Bays, south of Pamlico Sound, and north of Core Sound. Morehead City and Beaufort are the nearest North Carolina cities. The cities of Raleigh, North Carolina, and Virginia Beach, Virginia, are the nearest major cities and are 180 miles west and 200 miles north of the refuge, respectively.

The planning study area for this environmental assessment includes lands outside the existing refuge boundary that the staff is studying for inclusion in the National Wildlife Refuge System and/or partnership planning efforts. The Service presently owns 14,480 acres of the 16,887 acres identified as lying within the refuge's approved acquisition boundary. The Service will seek to acquire, from

willing sellers, the remaining acres. This environmental assessment will identify management on existing refuge lands and discuss additional habitat needs in general terms.

AUTHORITY, LEGAL COMPLIANCE, AND COMPATIBILITY

The administration of Cedar Island National Wildlife Refuge is guided by a variety of international treaties, federal laws, and Presidential executive orders. The list of documents and acts in Appendix III lists management options under the refuge's establishing authority and the National Wildlife Refuge System Improvement Act of 1997 (the legal and policy guidance for the operation of national wildlife refuges).

PLANNING PROCESS AND ASSOCIATED ISSUES

Service and state wildlife agency personnel attended initial planning meetings beginning in June 2000. At these initial meetings, they discussed strategies for completing the plan, identified the staff's issues and concerns, and compiled a mailing list of likely interested government agencies, non-government organizations, businesses, and individual citizens. The Service invited these agencies, organizations, businesses, and citizens to participate in two public scoping meetings on the afternoon and evening of September 21, 2000, in Beaufort and Cedar Island, North Carolina. The audience was introduced to the refuge and its planning process and asked to identify any issues and concerns it might have. The Service published announcements giving the location, date, and time for the public meeting in the *Federal Register* and legal notices in local newspapers. Press releases were sent to local newspapers and public service announcements to television and radio stations. Service personnel placed fifty posters announcing the meeting in local post offices, local government buildings, and stores. Sixty-five citizens attended the meetings.

The planning teams expanded the issues and concerns to include those generated by the agencies, organizations, businesses, and citizens from the local community. These issues and concerns formed the basis for the development and comparison of the objectives in the different alternatives described in this environmental assessment.

PLAN REVIEW AND REVISION

The staff will review the comprehensive conservation plan annually to determine the need for revision. A revision would occur if and when substantial information becomes available, such as a change in ecological conditions or a major refuge expansion. Detailed step-down management plans and annual plans will augment the final plan to address the completion of specific strategies in support of the refuge's goals and objectives. Revisions to the comprehensive conservation plan and the step-down management plans would be subject to public review and compliance with the National Environmental Policy Act.

ISSUES AND CONCERNS

The staff generated a number of issues and concerns from a variety of sources: the input of local citizens and public agencies, the team members' knowledge of the area, and the resource needs identified by the refuge staff and biological review team. The Fish and Wildlife Service assembled a planning team (Table ___) to evaluate the resource needs. The team then developed a list of goals, objectives, and strategies to shape the management of the refuge over the next 15 years.

These issues provided the basis for developing the refuge's alternative management objectives and strategies. These issues played a role in determining the desired conditions for the refuge and the staff considered them in the preparation of the long-term comprehensive conservation plan. The issues and concerns are described below. They are of local, regional, and national significance and include the issues that the public identified at the planning meetings.

HYDROLOGY

Drainage

Previous owners of the refuge (prior to its becoming a refuge) dug drainage ditches to facilitate access for hunting, trapping, and fishing. The ditches effectively lower the water table draining subsurface water in the vicinity of the ditch. The ditches also impound water behind the piles of soil excavated and allow water from the rivers, bays, and sounds to flow into the wetland on the refuge more rapidly than it would naturally. The drainage affects the plant communities on the refuge by providing habitat for species adapted to better drainage close to the ditches and on the tops of spoil piles. The flooding of areas behind the spoil piles inhibits plant regeneration and favors species that are better adapted to more persistent flooding than would have occurred naturally. The public is aware of this drainage and is supportive of restoring natural hydrology to the refuge.

Global Warming and Sea Level Rise

Most of the refuge lies at or within a few feet of sea level. Much of the refuge has a water table within a foot of the soil surface. Marshes cover the majority of the refuge. Wetland forest stands cover the balance of the refuge. Scientists predict that sea level along the North Carolina coast will raise from two to three feet in the next 100 years due to global warming. That rise in water levels will change the types of vegetative cover on the refuge. The grass-dominated marshes that occupy the majority of the refuge will lie below sea level and will become open water areas. The marshes will expand into areas currently covered by forest trees.

As the habitats change, the wildlife species that inhabit those habitats will also change. Wading birds, waterfowl, and marsh birds, that use the marshes for cover, feeding, and nesting, will lose that kind of habitat. Neotropical migratory songbirds and wood ducks that currently utilize trees will lose their feeding and nesting sites as trees die and fall. The species that utilize the areas that are currently marsh will move upslope as the marshes replace the trees. There is little that the refuge can do to affect this issue, but it can realize it is occurring and adapt management as hydrology and plant communities change.

FISH AND WILDLIFE POPULATIONS

GENERAL

The refuge staff currently performs some surveys to document the populations of certain species groups. The public and cooperating agencies encouraged the refuge to continue performing those surveys and to add more surveys for the most important wildlife resources as the staff takes on new responsibilities outlined in the plan.

THREATENED AND ENDANGERED SPECIES

Recovery and protection of threatened and endangered plants and animals are important responsibilities delegated to the Service and its national wildlife refuges. Scientists estimate that twelve threatened or endangered animals and two plants use (or could use) Carteret County in which Cedar Island National Wildlife Refuge lies: the loggerhead, green, hawksbill, Kemp's ridley, and leatherback sea turtles, American alligator, piping plover, red-cockaded woodpecker, roseate tern, West Indian manatee, eastern cougar, shortnose sturgeon, rough-leaved loosestrife, and seabeach amaranth. The refuge staff must have an awareness of these species, their habitat requirements, and the management that would maintain their habitat.

However, habitat for the threatened loggerhead and green sea turtles and the endangered hawksbill, Kemp's ridley, and leatherback sea turtles, which utilize open sandy beaches for nesting, is very limited on the refuge, thus occurrence of these species is also likely to be very limited. Likewise, the presence of the threatened piping plover and seabeach amaranth and the endangered roseate tern, which also utilize open sandy beaches, would be very limited.

The threatened American alligator has occurred in the waters and marshes of Carteret County and areas further north. Biologists have documented alligators in the county within the past 20 years. The alligators rely on marshes with healthy vegetation to survive. The careful management of refuge lands and other private and public lands adjacent to the refuge is very important to the persistence of that vegetation. Extensive development and poor management of those lands can decrease the extent of that vegetation.

The endangered red-cockaded woodpecker has historically nested in mature pine forests in Carteret County. Biologists have documented woodpeckers in the county within the past 20 years. There is suitable habitat on the refuge in the pine savanna forest. As the forest ages and pine trees develop suitable nesting cavities, the refuge could support woodpeckers. Sustaining viable populations will require proper understory management.

The endangered West Indian manatee has occurred in the waters of Carteret County and areas further north, but Carteret County is outside the normal range of the manatee. Biologists have documented manatees in the county within the past 20 years. The manatees rely on aquatic vegetation to survive. Good water quality in the bays and sounds surrounding the refuge is very important to the persistence of that vegetation. The careful management of refuge lands and other private and public lands adjacent to the refuge will maintain that water quality. Extensive development and poor management of those lands can decrease water quality.

The endangered eastern cougar has occurred in Carteret County, but biologists have last documented cougars in the county more than 20 years ago. The cougars require large areas with an adequate food supply. Males occupy areas of more than 25 square miles; females 5 to 20 square miles. With a considerable expansion and linkages to the Croatan National Forest, the refuge could have sufficient habitat for cougar

The endangered shortnose sturgeon probably occurs in the waters surrounding Carteret County during most of the year. Biologists have only documented its occurrence in the waters of adjacent counties within the past than 20 years. The sturgeon is anadromous and requires access to freshwater to spawn. Dams built for flood control and hydroelectric power generation block the upstream migration of the sturgeon. Good water quality in the bays and sounds surrounding the refuge is very important to the survival of the sturgeon. The careful management of refuge lands and other private and public lands adjacent to the refuge will maintain that water quality. Extensive development and poor management of those lands can decrease water quality.

The endangered rough-leaved loosestrife occurs in the edges between fire-maintained longleaf pine uplands and pond pine pocosins on moist to seasonally saturated soil. Biologists have documented populations within the past 20 years in Carteret County on the same soil type and plant communities that occur on the refuge. The staff can create habitat for rough-leaved loosestrife by maintaining an open understory with prescribed fire.

WATERFOWL

The scoping process identified the management of all refuge marshes and forests, and the development of managed wetlands (moist-soil units) for waterfowl and expanding waterfowl hunting opportunities as issues. In order to meet the refuge's waterfowl purpose, the refuge must maintain the marsh and forest to meet waterfowl habitat needs and provide sufficient areas to provide undisturbed resting and feeding areas for waterfowl. The Service cannot establish managed wetlands (moist-soil units) on the land it currently owns due to restrictions on disturbing natural wetlands. Acquisition of prior converted cropland (former wetlands) would allow the development of managed wetlands. The Service can provide additional waterfowl hunting opportunities as the refuge acquires additional land, but the core waterfowl resting and feeding areas need to remain intact to meet the needs of waterfowl.

The refuge's waterfowl purpose guides all operation and management actions on the refuge. The refuge manages forested wetlands to meet the feeding, resting, and breeding needs of migratory and resident waterfowl. Staff of the Fish and Wildlife Service and cooperating agencies and organizations conducted a Biological Review of Cedar Island National Wildlife Refuge in 1999 and 2000, as part of the comprehensive conservation planning process. They identified objectives to meet the minimum water, food, and resting/loafing habitat requirements of waterfowl. There was support from the public for increased monitoring of waterfowl, as well as the addition of habitat and management of that habitat.

SHOREBIRDS

The refuge does not own much beach on which shorebirds feed and nest. It does have the potential to purchase additional land with shorebird habitat and develop shorebird habitat in moist-soil units (managed wetlands) by water management and areas behind the coastal dunes by clearing and excavating areas to mimic overwash areas. The management of managed wetlands will require the acquisition of prior converted cropland (former wetlands) on which the refuge can build impoundments. There was support from the public for increased monitoring of shorebirds, as well as the addition of habitat and management of that habitat.

NEOTROPICAL MIGRATORY BIRDS

Neotropical migratory birds are a species group of special management concern. Providing habitat (i.e., forest and marshes) for these birds is one of the refuge's major objectives. Strategic forest management compatible with the refuge's waterfowl habitat objectives would contribute to the forest needs of neotropical migratory birds. The Biological Review identified objectives needed to meet the minimum feeding and nesting habitat requirements of neotropical migratory birds. The neotropical migratory birds are also a major focus of the refuge wildlife observation program as many birders visit the refuge to observe nesting, feeding, and loafing birds. There was support from the public for increased monitoring of neotropical migratory birds, as well as the addition of habitat and management of that habitat.

HABITATS

BRACKISH MARSH AND MANAGED WETLANDS

Participants at the public scoping meetings held to solicit input to the plan expressed the expectation that the Service established the refuge to protect and manage the marshes and establish and manage managed wetlands (moist-soil units). Part of that expectation was that the refuge would have open water areas in the marsh. The wetland disturbance provisions of the Clean Water Act prohibited those areas from being developed. Pursuit of that open water habitat will require the acquisition of prior converted cropland (former wetlands) that the Service can legally convert into managed wetlands.

Local interest still exists in managing the refuge. The area's cultural tradition has a strong history of fishing and hunting, and marsh and moist-soil unit management is the first step toward maintaining the opportunities for hunting on adjacent lands (primarily for waterfowl).

Cedar Island National Wildlife Refuge is situated near several large marshes in the South Atlantic Coastal Plain Physiographic Zone. Cooperative private-state-federal partnerships under the North American Waterfowl Management Plan, Partners-in-Flight, and the Atlantic Coast Joint Venture recommend maintenance and stabilization of the marsh. With strategic management, the staff can provide quality marsh habitat with the proper prescribed burning and aquatic weed control.

Forests

There is also public recognition of the role of the refuge's forest area in supporting populations of white-tailed deer, red-cockaded woodpeckers, and neotropical migratory birds and the public use associated with these species. There was support from the public for increased monitoring of refuge forests, as well as the addition of habitat and management of that habitat with prescribed fire, thinning, and timber harvests.

Submerged Aquatic Vegetation

There is widespread recognition by the Fish and Wildlife Service, state agencies, non-governmental organizations, and the general public that submerged aquatic vegetation is on the decline in the areas around the refuge. This decline has resulted in corresponding declines in migrating diving duck populations and fish nursery productivity. There are several possible reasons for the decline from poor water quality to the impacts of storms. The agencies, organizations, and the public have encouraged the refuge to get involved and stay involved in the monitoring of submerged aquatic vegetation and water quality monitoring to assess the cause of its decline.

PUBLIC USE

Introduction

The refuge is located in Carteret County, North Carolina (2000 population 59,383), just south of the Outer Banks of North Carolina where seven million tourists spend their vacation. There are several local initiatives to promote nature-based tourism in eastern North Carolina. A few commercial enterprises have interests in guiding canoeing and angling adventures. The refuge is an important link to the other natural areas that together make these experiences possible. Carefully selected and managed staff, programs, and facilities will provide the wildlife-dependent environmental education, interpretation, and recreation opportunities that refuge visitors have come to expect. Additional staff support will be needed to achieve the refuge's visitor service potential.

Hunting

Hunting and fishing are integral parts of rural North Carolina culture. It is not surprising that there is a considerable interest from the state agencies and the local citizens in expanding hunting opportunities. The initial refuge strategy must be maintenance of the quality of waterfowl hunting at existing levels. Any additional hunting opportunities will be dependent on providing safe, quality experiences that are compatible with refuge purposes. The Cedar Island, Mattamuskeet, and Swanquarter Refuges only have a single half-time park ranger headquartered 4 hours from the Cedar Island Refuge. This park ranger is shared with Pocosin Lakes National Wildlife Refuge where the other half of his time is spent. The refuge requires its own law enforcement personnel to administer any additional hunts.

Environmental Education and Interpretation

There is only one maintenance worker assigned to the Cedar Island National Wildlife Refuge and no education and interpretation staff at Mattamuskeet, Swanquarter, or Cedar Island National Wildlife Refuges. The public expressed a strong desire to have interpretive facilities and education programming at Cedar Island National Wildlife Refuge, especially during the summer vacation season. There are opportunities to utilize volunteers and develop partnerships with the Carteret County schools to provide programs or at least offer the refuge as an outdoor education classroom.

Outreach

The public expressed concern that the Service does not adequately publicize the public use opportunities that are available on the Cedar Island Refuge. The public encouraged the refuge to utilize every avenue available (e.g., newspapers, television, local cable television, newsletters, and posters in local schools and businesses) to let the community know what opportunities are available.

Roads and Trails, Exterior and Interior

There are no established trails on Cedar Island National Wildlife Refuge although the dirt roads and firebreaks are available for pedestrian use. The public expressed strong support for developing trails and wildlife observation platforms, photography blinds and maintaining the boat ramp.

RESOURCE PROTECTION

Land Acquisition and Habitat Fragmentation

When the Service established the refuge, its goal in providing brackish marsh was providing additional habitat types for migratory waterfowl. Reevaluation has determined that those habitats are as important for marsh birds and neotropical migratory songbirds (in support of Partners-in-Flight) as they are for waterfowl habitat. The refuge's current acquisition boundary reflects the importance of protecting and managing the most valuable brackish marsh. Those properties are important links in protecting areas along the bays and sounds. To maintain the potential to protect these lands, the Service must have the ability and authority to manage and protect (through acquisition of fee title interest or conservation easements) the substantial habitat within the current acquisition boundary. There was support from the public to expand the acquisition boundary and acquire land that could be developed into impoundments for waterfowl. Acquisition of additional land would provide opportunities to develop moist-soil (managed wetland) habitat, hardwood forest habitat, and cropland habitat and would help lessen the agricultural impacts to water quality. Acquisition of new lands would also expand compatible public use opportunities; acquisition of conservation easements, however, would not.

Law Enforcement and Refuge Regulation

The refuge has enforced the applicable laws and regulations through the use of one full-time law enforcement officer shared with Mattamuskeet and Swanquarter National Wildlife Refuges and headquartered at the Mattamuskeet Refuge, 4 hours away from the Cedar Island Refuge. There was considerable concern that the refuge had become a dumping ground in the absence of staff and that the single staff member recently hired devoted a considerable amount of time removing dumped items.

OTHER RESOURCE PROTECTION

There are other threats to refuge resources that require closer monitoring and management. Pest plants and animals, along with wildlife disease, are all concerns to which the refuge must pay close attention, yet has inadequate staffing to monitor effectively. The public supported the refuge's control of pest plants and animals.

ADMINISTRATION

Funding and Staffing

Funding has been insufficient to support refuge programs. Inadequate staff, facilities, and equipment have prevented the refuge from realizing its purpose and management objectives. Currently, the refuge is not meeting its wildlife habitat objectives beyond prescribed burning of the marsh and pine forest. It conducts few wildlife inventories beyond waterfowl; has few public use facilities; has outdated habitat/wildlife management plans; and provides few non-hunting or fishing wildlife-dependent recreational opportunities. The refuge only addresses other priority public uses (environmental education, interpretation, wildlife observation, wildlife photography) as the public requests them. The park ranger for law enforcement must divide his time between three refuges and is headquartered 4 hours away from the Cedar Island Refuge. The public supported the addition of staff to meet refuge objectives.

Facility and Grounds Maintenance

There was concern at the scoping meetings that the refuge buildings were in poor shape, and inadequate to fulfill an expanded role in interpretation and environmental education. The public felt that new buildings, constructed on North Carolina Highway 12 frontage, would provide better visibility. A permanent maintenance worker hired since the scoping meetings, and substantial expenditures on building rehabilitation, has improved the condition of the refuge and its associated buildings.

There is excessive dumping of household refuse on the refuge. This littering and dumping detracts from the appearance of the refuge and consumes a great deal of the single maintenance worker's time. The refuge needs an increased law enforcement presence to make the refuge more aesthetically pleasing.

Chapter II. Affected Environment

See Chapter II, "Refuge Overview" of Draft Comprehensive Conservation Plan for Cedar Island National Wildlife Refuge.

Chapter III. Description of Alternatives

FORMULATION OF ALTERNATIVES

Alternatives are different approaches or combinations of management objectives and strategies designed to achieve the refuge purpose, vision, and the goals identified in the draft comprehensive conservation plan; the priorities and goals of the Roanoke-Tar-Neuse-Cape Fear Ecosystem Team; the goals of the National Wildlife Refuge System; and the mission on the Fish and Wildlife Service. The staff develops alternatives to address the significant issues, concerns, and problems identified by the Service and the public during public scoping.

The three alternatives identified and evaluated represent different approaches to provide permanent protection, restoration, and management of the refuge's fish, wildlife, plants, habitats and other resources. A major consideration in the formulation of the alternatives is the ability to obtain sufficient proprietary interest in lands to facilitate a physical and biological connection of dunes, maritime grasslands, maritime shrublands, and marshes; and to restore the functions and values of wetlands.

Refuge managers assessed the biological conditions and analyzed the external relationships affecting the refuge. This information contributed to the development of goals and objectives and, in turn, helped to formulate the alternatives. As a result, each alternative presents different sets of objectives for reaching refuge goals. The staff evaluated each alternative based on how much progress it would make and how it would address the identified issues related to fish and wildlife populations, habitats, land protection and conservation, education and visitor services, and refuge administration.

The staff designed all of the management alternatives for the area within the current approved acquisition boundary of 16,887 acres. Acquisition of a large area beyond the existing boundary will require a revision of the comprehensive conservation plan to develop programs that consider the larger area.

DESCRIPTION OF ALTERNATIVES

Serving as a basis for each alternative, the staff developed goals and sets of objectives to achieve the refuge's purpose and the mission of the National Wildlife Refuge System. Objectives are desired conditions or outcomes that the staff has grouped into sets (wildlife, habitat, public use, resource protection, and administration) and for this planning effort, consolidated into three alternatives. These alternatives, overall, represent a range of different management treatments or approaches for managing the refuge over a 15-year time frame. The three preliminary alternatives are below:

Management Alternative 1 - No Action

This alternative represents the current management of the refuge. Under this alternative, the Service would protect and maintain 14,480 acres of refuge lands for resident wildlife, waterfowl, migratory nongame birds, and threatened and endangered species (Figure 5). The staff would manage the refuge with little baseline biological information. The refuge would direct all management actions towards achieving the refuge's primary purposes (preserving migratory habitat for waterfowl; providing production habitat for marsh birds and shorebirds; and helping to meet the habitat conservation goals of the North American Waterfowl Management Plan), while contributing to other national, regional, and state goals to protect and restore neotropical breeding bird, colonial nesting bird, and anadromous fish populations. The staff would manage the refuge through prescribed

burning in brackish marsh, maritime shrub, coastal fringe evergreen forest, wet pine flatwoods, coastal fringe sandhills, and pine savanna habitats as specified in the fire management plan.

The Service would provide a low level of wildlife-dependent recreation activities (e.g., hunting, fishing, wildlife observation, wildlife photography, and environmental education and interpretation). The refuge would allow quality waterfowl hunting programs on 400 acres along the north shore of refuge marshes consistent with sound biological principles. Hunting would attract 1,000 visitors annually. The staff would maintain two boat ramps for boat access. Two and one-half miles of unimproved roads and fourteen miles of firebreaks would be available for pedestrian access. The refuge would attract 12,000 anglers annually, 1,000 visitors for interpretation, and 16,000 visitors for wildlife observation. It would make no improvements to support public use. There would be no interpretive trails or photography blinds. The staff would not conduct environmental education, interpretive and outreach programs. The refuge would participate in the Core Sound Waterfowl Weekend every year.

Under this alternative, the refuge would not actively seek acquisition of properties within the present acquisition boundary (Figure ____). It would make lands acquired as part of the refuge available to the public for compatible wildlife-dependent recreation and environmental education opportunities. Purchases from willing sellers would be the preferred option to expand conservation efforts in the acquisition area.

Law enforcement would be limited and sporadic. The refuge would not monitor or control pest animals or plants. The staff would control and prevent wildlife disease on a case-by-case basis.

Management Alternative 2 (Changes from Alternative 1 in italics and underlined)

This alternative represents a moderate increase in management activities on the refuge. Under this alternative, the Service would protect and maintain 14,480 acres of refuge lands for resident wildlife, waterfowl, migratory nongame birds, and threatened and endangered species (Figure ____). The staff would manage the refuge with annual survey information on habitats managed with prescribed burning and major animal species groups such as waterfowl, wading birds, and marsh birds. The refuge would direct all management actions towards achieving the refuge's primary purposes (preserving migratory habitat for waterfowl; providing production habitat for marsh birds and shorebirds; and helping to meet the habitat conservation goals of the North American Waterfowl Management Plan), while contributing to other national, regional, and state goals to protect and restore neotropical breeding bird, colonial nesting bird, and anadromous fish populations. The staff would manage the refuge through prescribed burning in brackish marsh, maritime shrub, coastal fringe evergreen forest, wet pine flatwoods, coastal fringe sandhills, pond pine woodlands, and pine savanna habitats as specified in the fire management plan. The staff would monitor the effects of burning by surveying vegetation before and after each fire.

The Service would provide a low level of wildlife-dependent recreation activities (e.g., hunting, fishing, wildlife observation, wildlife photography, and interpretation and environmental education opportunities). The refuge would allow quality waterfowl hunting programs on 400 acres along the north shore of refuge marshes and deer hunting with archery equipment consistent with sound biological principles. Hunting would attract 1,200 visitors annually. The staff would maintain two boat ramps for boat access. Two and one-half miles of unimproved roads and fourteen miles of firebreaks would be available for pedestrian access. The refuge would attract 15,000 anglers annually, 1,500 visitors for interpretation, and 20,000 visitors for wildlife observation. There would be one trail with a brochure for interpretation, wildlife observation, and wildlife photography, one photography blind, and one interpretive kiosk. The staff would conduct a monthly environmental education program and one quarterly outreach program off the refuge and participate in the Core Sound Waterfowl Weekend every year.

Under this alternative, the refuge would actively seek acquisition of all willing seller properties within the present acquisition boundary (Figure 5). It would make lands acquired as part of the refuge available for compatible public wildlife-dependent recreation and environmental education opportunities. Purchases from willing sellers would be the preferred option to expand conservation efforts in the acquisition area. Other important options include outreach and partnerships with adjacent landowners, hunt clubs, state agencies, non-governmental organizations, and the Natural Resources Conservation Service through conservation easements, cooperative agreements, and federal programs, such as the Wetlands Reserve Program. These land conservation options would promote the linkage of protected marshes and contribute to overall natural resource conservation within the acquisition area.

A park ranger would conduct routine law enforcement patrols and investigate all public reports of violations. The refuge would monitor or control the most dominant pest animals or plants. The staff would control and prevent wildlife disease through interagency cooperation.

Management Alternative 3 (Changes from Alternative 1 in italics and underlined)

This alternative represents a substantial increase in management activities on the refuge. Under this alternative, the Service would protect and maintain 14,480 acres of refuge lands for resident wildlife, waterfowl, migratory nongame birds, and threatened and endangered species (Figure __). The staff would manage the refuge with annual survey information on habitats managed with prescribed burning and major animal species groups such as waterfowl, shorebirds, wading birds, marsh birds, land birds, and mammals. The refuge would direct all management actions towards achieving the refuge's primary purposes (preserving migratory habitat for waterfowl; providing production habitat for marsh birds and shorebirds; and helping to meet the habitat conservation goals of the North American Waterfowl Management Plan), while contributing to other national, regional, and state goals to protect and restore neotropical breeding bird, colonial nesting bird, and anadromous fish populations. The staff would manage the refuge through prescribed burning in brackish marsh, maritime shrub, coastal fringe evergreen forest, wet pine flatwoods, coastal fringe sandhills, pond pine woodlands, and pine savanna habitats as specified in the fire management plan. They would monitor the effects of burning by surveying vegetation before and after each fire.

The Service would provide a low level of wildlife-dependent recreation activities (e.g., hunting, fishing, wildlife observation, wildlife photography, and environmental education and interpretation opportunities). The refuge would allow quality waterfowl hunting programs on 400 acres along the north shore of refuge marshes and deer hunting with archery equipment consistent with sound biological principles. Hunting would attract 1200 visitors annually. The staff would maintain two boat ramps for boat access. Two and one-half miles of unimproved roads and fourteen miles of firebreaks would be available for pedestrian access. The refuge would attract 20,000 anglers, 2,000 visitors for interpretation, and 35,000 visitors for wildlife observation annually. There would be one trail with a brochure for interpretation, wildlife observation and photography, one photography blind, and one interpretive kiosk. The staff would conduct a monthly environmental education program, one monthly interpretive program, and four annual outreach programs off the refuge and participate in four festivals and the Core Sound Waterfowl Weekend every year.

Under this alternative, the refuge would *actively* seek acquisition of all willing-seller properties within the present acquisition boundary (Figure 5). It would make lands acquired as part of the refuge available for compatible public wildlife-dependent recreation and environmental education opportunities. Purchases from willing sellers would be the preferred option to expand conservation efforts in the acquisition area. Other important options include outreach and partnerships with adjacent landowners, hunt clubs, state agencies, non-governmental organizations, and the Natural Resources Conservation Service through conservation easements, cooperative agreements, and federal programs such as the Wetlands Reserve Program. These land conservation options would promote the linkage of protected marshes and contribute to overall natural resource conservation within the acquisition area.

Law enforcement would be *proactive to encourage voluntary compliance*. The refuge *would* monitor or control *all* pest animals or plants according to an integrated pest management plan. The staff would control and prevent wildlife disease *through interagency cooperation*.

Table 21. Summary of wildlife objectives and strategies

Species Group	Activity	Alternative		
		1	2	3
Fish	Manage Land to Protect Water Quality	Yes	Yes	Yes
	Assist Cooperating Agencies, Organizations, Universities Conduct Studies	Yes	Yes	Yes
	Conduct Studies with Emphasis on Federal and State-listed Species	No	No	Yes
Invertebrate Species	Assist Cooperating Agencies, Organizations, Universities Conduct Studies	Yes	Yes	Yes
	Conduct Studies with Emphasis on Federal and State-listed Species	No	No	Yes
Land Birds	Assist Cooperating Agencies, Organizations, Universities Conduct Studies	Yes	Yes	Yes
	Conduct Studies with Emphasis on Federal and State-listed Species	No	No	Yes
	Document Presence by Habitat Type	No	No	Yes
Mammals	Assist Cooperating Agencies, Organizations, Universities Conduct Studies	Yes	Yes	Yes
	Conduct Studies with Emphasis on Federal and State-listed Species	No	No	Yes

Species Group	Activity	Alternative		
		1	2	3
	Document Presence	No	No	Yes
	Game Species Survey and Management Strategy	No	No	Yes
Marsh Birds	Assist Cooperating Agencies, Organizations, Universities Conduct Studies	Yes	Yes	Yes
	Document Population Densities Annually	No	Yes	Yes
	Conduct Studies with Emphasis on Federal and State-listed Species	No	Yes	Yes
Reptiles and Amphibians	Assist Cooperating Agencies, Organizations, Universities Conduct Studies	Yes	Yes	Yes
	Conduct Studies with Emphasis on Federal and State-listed Species	No	No	Yes
Shorebirds	Assist Cooperating Agencies, Organizations, Universities Conduct Studies	Yes	Yes	Yes
	Conduct Studies with Emphasis on Federal and State-listed Species	No	No	Yes
	Conduct Migration and Wintering Ground Surveys Annually	No	No	Yes
Wading Birds	Assist Cooperating Agencies, Organizations, Universities Conduct Studies	Yes	Yes	Yes
	Document Population Densities Annually	No	Yes	Yes
	Conduct Studies with Emphasis on Federal and State-listed Species	No	Yes	Yes
Waterfowl	Conduct Monthly Aerial Surveys	Yes	Yes	Yes
	Conduct Bi-Weekly Aerial and Ground Surveys	No	No	Yes
	Document Population Density Annually	No	No	Yes
	Conduct Two Black Duck Brood Surveys Annually	No	No	Yes

Table 22. Summary of habitat objectives and strategies

Habitat	Activity	Alternative		
		1	2	3
Bay Forest	Acreage	100	100	100
	Frequency of Patrols	Sporadic	Regular	Regular
Beach	Acreage	20	20	20
	Frequency of Patrols	Sporadic	Regular	Regular
Brackish Marsh	Acreage	11,000	11,000	11,000
	Frequency of Patrols	Sporadic	Regular	Regular
	Prescribed Burning According to Fire Management Plan	Yes	Yes	Yes
	Vegetative Monitoring Before and After Burns	No	Yes	Yes
Coastal Fringe Evergreen Forest	Acreage	1,425	1,425	1,425
	Frequency of Patrols	Sporadic	Regular	Regular
	Prescribed Burning According to Fire Management Plan	Yes	Yes	Yes
	Vegetative Monitoring Before and After Burns	No	Yes	Yes
Coastal Fringe Sandhills	Acreage	80	80	80
	Frequency of Patrols	Sporadic	Regular	Regular
	Prescribed Burning According to Fire Management Plan	Yes	Yes	Yes
	Vegetative Monitoring Before and After Burns	No	Yes	Yes
Cypress Gum Swamp	Acreage	50	50	50
	Frequency of Patrols	Sporadic	Regular	Regular
Dune Grass	Acreage	20	20	20
	Frequency of Patrols	Sporadic	Regular	Regular
Maritime Shrub	Acreage	150	150	150
	Frequency of Patrols	Sporadic	Regular	Regular
	Prescribed Burning According to Fire Management Plan	Yes	Yes	Yes
	Vegetative Monitoring Before and After Burns	No	Yes	Yes
Maritime Swamp	Acreage	637	637	637

Habitat	Activity	Alternative		
		1	2	3
Forest	Frequency of Patrols	Sporadic	Regular	Regular
Open Water	Acreage	15,000	15,000	15,000
	Manage Land to Protect Water Quality	Yes	Yes	Yes
	Support the monitoring of submerged aquatic vegetation.	Yes	Yes	Yes
Pine Savanna	Acreage	500	500	500
	Frequency of Patrols	Sporadic	Regular	Regular
	Prescribed Burning According to Fire Management Plan	Yes	Yes	Yes
	Vegetative Monitoring Before and After Burns	No	Yes	Yes
Pond Pine Woodlands	Acreage	125	125	125
	Frequency of Patrols	Sporadic	Regular	Regular
	Prescribed Burning According to Fire Management Plan	Yes	Yes	Yes
	Vegetative Monitoring Before and After Burns	No	Yes	Yes
Coastal Fringe Sandhills	Monitoring	None	Annual	Annual
Wet Pine Flatwoods	Acreage	1,000	1,000	1,000
	Prescribed Burning According to Fire Management Plan	Yes	Yes	Yes
	Vegetative Monitoring Before and After Burns	No	Yes	Yes
Threatened and Endangered Species	Documentation of Listed Species	Work with Partners	Work with Partners	Work with Partners
Administrative Areas	Maintenance	Regular	Regular	Regular
	Frequency of Patrols	Sporadic	Regular	Regular

Table 23. Summary of public use objectives and strategies

Use	Activity	Alternative		
		1	2	3
All Uses	Number of User Days	30,000	40,000	60,000
Commercial Ecotours	Review and Evaluate Proposals on a Case-by-Case Basis	No	Yes	Yes
Environmental Education	Number of User Days	0	100	500
	Publicize Refuge as Outdoor Classroom	No	Yes	Yes
	Student Programs	Periodic	1 Monthly	1 Monthly
	Partner with Local Citizens to Educate Youth	No	No	Yes
	Participate in North Carolina Environmental Education Initiatives	No	No	Yes
Fishing	Number of User Days	12,000	15,000	20,000
	Boat Ramps Maintained	2	2	2
	Boat Facilities Improved or Replaced	0	0	2
	Develop Fishing Plan	No	Yes	Yes
	Open Refuge Formally for Fishing	No	Yes	Yes
Hunting	Number of User Days	1,000	1,200	1,500
	Total Acres of Waterfowl Hunting	400	400	600
	Deer Hunting	None	Limited Archery	Limited Archery
Interpretation	Number of User Days	1,000	1,500	2,000
	Brochure Revision	0	0	1 Annually
	Kiosks	0	1	1
	Monthly Programs	0	0	1
	Signs throughout Refuge	No	No	Yes
	Develop and Maintain a Trail with a Brochure	No	Yes	Yes

Use	Activity	Alternative		
		1	2	3
Non-Wildlife-Dependent Recreational Public Uses	Tolerate Uses	Yes	No	No
	Evaluate on a Case-by-Case Basis	No	Yes	Yes
	Conduct Compatibility Determinations on All Proposed Uses	No	Yes	Yes
Outreach	Target Audience	1,000	1,000	50,000
	Participate in Core Sound Waterfowl Festival	Yes	Yes	Yes
	Issue Press Releases on Major Events	Yes	Yes	Yes
	Conduct Programs Off Refuge	0	Quarterly	Monthly
	Develop Refuge Displays	0	1	1
	Participate in Local Festivals	0	4 Annually	4 Annually
	Write News Articles	0	Quarterly	Monthly
	Develop Visitor Contact Station	No	No	Yes
	Design and Construct an Exhibit at the Core Sound Waterfowl museum	No	No	Yes
Visitor Protection	Patrol Frequency	Sporadic	Sporadic	Regular
	Identify and Eliminate Safety Hazards	No	No	Yes
	Control Access to Hazardous Areas	No	No	Yes
Volunteer Program	Manage According to Service Policy	Yes	Yes	Yes
	Recruit Volunteers	No	Yes	Yes
	Pursue College Interns	No	Yes	Yes
	Volunteers Workforce Goal	0	0	25
Pedestrian Access	Miles of Unimproved Roads	2.5	2.5	2.5
	Miles of Firebreaks	14	14	14
Non-Wildlife-Dependent	Tolerate Uses	Yes	No	No

Use	Activity	Alternative		
		1	2	3
Recreational Public Uses				
Wildlife Observation	Number of User Days Annually	16,000	20,000	35,000
	Publicize the Use of Interpretive Trail	No	Yes	Yes
	Signage Throughout Refuge	No	No	Yes
Wildlife Photography	Number of User Days Annually	160	200	350
	Publicize the Use of Interpretive Trail	No	Yes	Yes
	Blinds	0	1	1

Table 24. Summary of resource protection objectives and strategies

Topic	Activity	Alternative		
		1	2	3
Communication Towers	Permit Review	Every Five Years	Every Five Years	Every Five Years
Corridors	Permit Compliance Monitoring	None	Annual	Annual
	Coordinate Maintenance with Permit Holders	No	Yes	Yes
Cultural Resources	Inventory	Contact Authorities as Resources Found	Investigate Construction Sites	Conduct Complete Inventory
In-Holdings	Develop Special Use Permits for In Holder Activities	Yes	Yes	Yes
	Develop Cooperative Agreements or Easements on In-Holdings	No	No	Yes
Interagency Coordination	Prescribed Fire at Atlantic Field	Yes	Yes	Yes
	Wildfire Suppression with NC Forest Service	Yes	Yes	Yes
	Refuge Wildfire with CIVFD	Yes	Yes	Yes
	Colonial Nesting Bird Surveys with NCWRC and Audubon Society	Yes	Yes	Yes
	Participate in Off-Refuge Natural Resource Activities	No	No	Yes
	Develop Agreements to Develop Marine Protected Areas	No	No	Yes

Topic	Activity	Alternative		
		1	2	3
Land Protection	Acquisition	No Activity	Acquire Land within Approved Boundary	Acquire Land within Approved Boundary
	Develop Land Protection Plan for Acquisition beyond Current Approved Acquisition Boundary	No	Yes	Yes
Law Enforcement	Level of Activity	Limited and Sporadic Presence	Proactive Enforcement	Proactive Enforcement
	Cooperation with Other Law Enforcement Agencies	Limited	Extensive	Extensive
Military Activity	Monitoring and Documentation	No	Yes	Yes
Permits	Frequency of Permit Evaluation	Annual	Annual	Annual
	Permitting of All Uses	No	Yes	Yes
Pest Animals	Monitoring and Control	No	Limited to Most Dominant	Yes
	Pest Management Plan	No	No	Yes
Pest Plants	Monitoring and Control	No	Limited to Most Dominant	Yes
	Pest Management Plan	No	No	Yes
Significant Natural Heritage Areas	Manage Vegetation by Prescribed Burning According to Fire Management Plan	Yes	Yes	Yes
Wildlife Disease	Control and Prevention	Case-by-Case Evaluation	Case-by-Case Evaluation	Interagency Coordination

Table 25. Summary of administration objectives and strategies

Topic	Activity	Alternative		
		1	2	3
Capital Property	Management According to Service Policy	Yes	Yes	Yes
	Target Condition	Fair	Good	Good
	Acquisition of Enough New Property to Carry Out Refuge Operations	No	No	Yes
	Inventories per Year	One	One	Two
Financial Management	Management According to Service Policy	Yes	Yes	Yes
	Budget Managed from Mattamuskeet NWR	Yes	Yes	No
	Budget Managed from Cedar Island NWR	No	No	Yes
Office Space and Utilities	Office Space Target Condition	Safe	Safe	Functional and Efficient
	Upgrade Utilities	No	No	Yes
	Convert Residential Rooms to Offices	No	Two	As Needed
	Install Visitor Contact Area	No	No	Yes
Personnel	Management According to Service Policy	Yes	Yes	Yes
	Staff	1	4	7
	Utilize Staff from Other Refuges to Accomplish Mission	Yes	Yes	Yes
Real Property	Management According to Service Policy	Yes	Yes	Yes
	Maintenance According to Service Policy	No	Yes	Yes
	Inventories per Year	One	One	One
	New Construction	None	Dock on Lola Road, Interpretive Trail, Photo Blind	Dock on Lola Road, Interpretive Trail, Photo Blind

Table 26. Summary of projects proposed in each alternative

Project Description	Alternatives		
	1	2	3
Staff Projects			
Utilize existing staff from Mattamuskeet and other NC Refuges	X	X	X
Utilize existing WG-8 maintenance worker.	X	X	X
Recruit, hire, and train a new GS-11 refuge manager. (change RONS)		X	X
Recruit, hire, and train a new GS-7 biological technician.		X	X
Recruit, hire, train a new GS-7 park ranger (law enforcement) (add to RONS)		X	X
Recruit, hire, and train a new GS-9 wildlife biologist.			X
Recruit, hire, and train a new GS-7 forestry technician.			X
Recruit, hire, and train a new GS-5 park ranger (public use).			X
Recruit, hire, and train a new WG-8 equipment operator.			X
Budget Projects			
Process payroll, travel, purchasing, and contract documents.	X	X	X
Prepare annual budget, revise RONS and MMS.	X	X	X
Apply for grants.	X	X	X
Conduct cultural resource survey RONS 00018).			X
Equipment Projects			
Maintain vehicles and boats.	X	X	X
Maintain heavy equipment and hand tools.	X	X	X
Maintain computers and software.	X	X	X
Improve Fire Management Capabilities (RONS 00011).			X
Facility Projects			
Maintain roads.	X	X	X
Maintain parking lots and trails.	X	X	X
Maintain buildings.	X	X	X
Maintain public use facilities.	X	X	X
Rehabilitate Lola Road boat ramp and parking area (MMS90008).	X	X	X
Repair and paint exterior surfaces of concrete block building (MMS 93012).	X	X	X
Replace kiosk (MMS 98001).	X	X	X
Rehabilitate Lola Road boat dock (MMS 98003).	X	X	X
Replace road gates (MMS 98004).	X	X	X
Rehabilitate field office/work center (MMS 98005).	X	X	X
Remove storage building (MMS 01001)	X	X	X
Rehabilitate public use roads and associated parking lots (RONS 02002).			X
Design and construct outreach exhibit in the Core Sound Waterfowl Museum (RONS 03001).			X

Table 27. Summary of costs of projects proposed in all alternatives

Project Description	Costs		
Projects	First Year or One Time Costs	Recurring Costs	Total First Year Costs
Alternative 1			
Staff Projects	\$0	\$77,000	\$77,000
Budget Projects	\$0	\$0	\$0
Equipment Projects	\$0	\$2,000	\$2,000
Facility Projects	\$497,000	\$6,000	\$503,000
Total for Alternative 1 Projects	\$497,000	\$85,000	\$582,000
Alternative 2			
Staff Projects	\$210,000	\$287,000	\$497,000
Budget Projects	\$0	\$0	\$0
Equipment Projects	\$0	\$2,000	\$2,000
Facility Projects	\$497,000	\$6,000	\$503,000
TOTAL FOR ALTERNATIVE 2 PROJECTS	\$707,000	\$295,000	\$1,002,000
Alternative 3			
Staff Projects	\$447,000	\$459,000	\$906,000
Budget Projects	\$100,000	\$0	\$100,000
Equipment Projects	\$380,000	\$47,000	\$427,000
Facility Projects	\$627,000	\$6,000	\$633,000
Total for Alternative 3 Projects	\$1,554,000	\$512,000	\$2,066,000

Table 28. Cost of projects proposed in Alternative 1

Project Description	Costs		
	First Year or One Time Costs	Recurring Costs	Total First Year Costs
Staff Projects			
Existing staff from Mattamuskeet Refuge	\$0	\$77,000 Existing Base	\$77,000
Existing WG-8 maintenance worker			
Total Staff Project Cost	\$0	\$77,000	\$77,000
Budget Projects (Contracts, Research)	First Year or One Time Costs	Recurring Costs	Total First Year Costs
Process payroll, travel, purchasing, and contract documents	\$0	In Base	\$0
Prepare annual budget, revise RONS and MMS	\$0	In Base	\$0
Apply for grants	\$0	In Base	\$0
Total Budget Project Cost	\$0	In Base	\$0
Equipment Projects	First Year or One Time Costs	Recurring Costs	Total First Year Costs
Maintain vehicles and boats	\$0	\$2,000 Existing Base	\$2,000
Maintain heavy equipment and hand tools	\$0		
Maintain computers and software	\$0		
Total Equipment Project Cost	\$0	\$2,000	\$2,000
Facility Projects	First Year or One Time Costs	Recurring Costs	Total First Year Costs
Maintain roads	\$0	\$6,000 Existing Base	\$6,000
Maintain parking lots and trails	\$0		
Maintain buildings and grounds	\$0		
Maintain public use facilities	\$0		
Rehabilitate Lola Road Boat Ramp and Parking Lot (MMS 90008)	\$21,000	\$0	\$21,000
Repair and Paint Exterior Surface of Concrete Block Building (MMS 93012)	\$8,000	\$0	\$8,000
Replace Kiosk (MMS 98001)	\$47,000	\$0	\$47,000
Rehabilitate Lola Road Boat Dock (MMS 98003)	\$48,000	\$0	\$48,000
Replace Road Gates (MMS 98004)	\$36,000	\$0	\$36,000
Rehabilitate Field Office/Work Center (MMS 98005)	\$229,000	\$0	\$229,000
Remove Storage Building (MMS 01001)	\$108,000	\$0	\$108,000
Total Facility Project Cost	\$497,000	\$6,000	\$503,000
Grand Total Cost	\$497,000	\$85,000	\$582,000

Table 29. Cost of projects proposed in Alternative 2

Project Description	Costs		
	First Year or One Time Costs	Recurring Costs	Total First Year Costs
Staff Projects			
Existing staff from Mattamuskeet Refuge	\$0	\$77,000	\$77,000
Existing WG-8 maintenance worker		Existing Base	
Recruit, hire, train a new GS-11 refuge manager (RONS 00004)	\$65,000	\$79,000	\$144,000
Recruit, hire, and train a new GS-7 biological science technician (RONS 97013)	\$65,000	\$53,000	\$118,000
Recruit, hire, and train a new GS-7 park ranger (law enforcement) (Add to RONS)	\$80,000	\$68,000	\$138,000
Total Staff Project Cost	\$210,000	\$287,000	\$497,000
Budget Projects (Contracts, Research)			
Process payroll, travel, purchasing, and contract documents	\$0	In Base	\$0
Prepare annual budget, revise RONS and MMS	\$0	In Base	\$0
Apply for grants	\$0	In Base	\$0
Total Budget Project Cost	\$0	\$0	\$0
Equipment Projects	First Year or One Time Costs	Recurring Costs	Total First Year Costs
Maintain vehicles and boats	\$0	\$2,000	\$2,000
Maintain heavy equipment and hand tools	\$0	Existing Base	\$0
Maintain computers and software	\$0		\$0
Total Equipment Project Cost	\$0	\$2,000	\$2,000
Facility Projects	First Year or One Time Costs	Recurring Costs	Total First Year Costs
Maintain roads	\$0	\$6,000	\$6,000
Maintain parking lots and trails	\$0	Existing Base	
Maintain buildings and grounds	\$0		
Maintain public use facilities	\$0		
Rehabilitate Lola Road Boat Ramp and Parking Lot (MMS 90008)	\$21,000	\$0	\$21,000
Repair and Paint Exterior Surface of Concrete Block Building (MMS 93012)	\$8,000	\$0	\$8,000
Replace Kiosk (MMS 98001)	\$47,000	\$0	\$47,000
Rehabilitate Lola Road Boat Dock (MMS 98003)	\$48,000	\$0	\$48,000
Replace Road Gates (MMS 98004)	\$36,000	\$0	\$36,000
Rehabilitate Field Office/Work Center (MMS 98005)	\$229,000	\$0	\$229,000
Remove Storage Building (MMS 01001)	\$108,000	\$0	\$108,000
Total Facility Project Cost	\$497,000	\$6,000	\$503,000
Total Cost	\$707,000	\$295,000	\$1,002,000

Table 30. Cost of projects proposed in Alternative 3

Project Description	Costs		
	First Year or One Time Costs	Recurring Costs	Total First Year Costs
Staff Projects			
Existing staff from Mattamuskeet Refuge	\$0	\$77,000	\$77,000
Existing WG-8 maintenance worker		Existing Base	
Recruit, hire, and train a new GS-11 manager (RONS 00004)	\$65,000	\$79,000	\$144,000
Recruit, hire, and train a new GS-7 biological science technician (RONS 97013)	\$65,000	\$53,000	\$118,000
Recruit, hire, train a new GS-7 park ranger (law enforcement) (Add to RONS)	\$80,000	\$68,000	\$138,000
Recruit, hire, and train a new GS-7 wildlife biologist (RONS 00012)	\$65,000	\$53,000	\$118,000
Recruit, hire, and train a new GS-7 forestry technician	\$65,000	\$53,000	\$118,000
Recruit, hire, and train a new GS-5 park ranger (public use)	\$32,500	\$22,000	\$54,500
Recruit, hire, and train a new WG-8 equipment operator	\$65,000	\$54,000	\$119,000
Total Staff Project Cost	\$447,000	\$459,000	\$906,000
Budget Projects (Contracts, Research)	First Year or One Time Costs	Recurring Costs	Total First Year Costs
Process payroll, travel, purchasing, and contract documents	\$0	In Base	\$0
Prepare annual budget, revise RONS and MMS	\$0	In Base	\$0
Apply for grants	\$0	In Base	\$0
Conduct cultural resources survey (RONS 00018)	\$100,000	\$0	\$100,000
Total Budget Project Cost	\$100,000	\$0	\$100,000
Equipment Projects	First Year or One Time Costs	Recurring Costs	Total First Year Costs
Maintain vehicles and boats	\$0	\$2,000	\$2,000
Maintain heavy equipment and hand tools	\$0	Existing Base	
Maintain computers and software	\$0		
Improve fire management capabilities, equipment (RONS 00011)	\$380,000	\$45,000	\$425,000
Total Equipment Project Cost	\$380,000	\$47,000	\$427,000

Table 30. Cost of projects proposed in Alternative 3 (continued)

Facility Projects	First Year or One Time Costs	Recurring Costs	Total First Year Costs
Maintain roads	\$0	\$6,000 Existing Base	\$6,000
Maintain parking lots and trails	\$0		
Maintain buildings and grounds	\$0		
Maintain public use facilities	\$0		
Rehabilitate Lola Road Boat Ramp and Parking Lot (MMS 90008)	\$21,000	\$0	\$21,000
Repair and Paint Exterior Surface of Concrete Block Building (MMS 93012)	\$8,000	\$0	\$8,000
Replace Kiosk (MMS 98001)	\$47,000	\$0	\$47,000
Rehabilitate Lola Road Boat Dock (MMS 98003)	\$48,000	\$0	\$48,000
Replace Road Gates (MMS 98004)	\$36,000	\$0	\$36,000
Rehabilitate Field Office/Work Center (MMS 98005)	\$229,000	\$0	\$229,000
Remove Storage Building (MMS 01001)	\$108,000	\$0	\$108,000
Rehabilitate public use roads and associated parking lots (MMS 02002)	\$100,000	\$0	\$100,000
Design and construct an exhibit for the Core Sound Waterfowl Museum (MMS 03001)	\$30,000	\$0	\$30,000
Total Facility Project Cost	\$627,000	\$6,000	\$633,000
Grand Total Cost	\$1,554,000	\$512,000	\$2,066,000

FEATURES COMMON TO ALL ALTERNATIVES

LAND ACQUISITION

The acquisition of land adjacent to Service-owned lands within the refuge acquisition boundary would be given the highest priority. All land acquisitions are subject to contaminant surveys.

Funding for land acquisition would come from the Land and Water Conservation Fund, Migratory Bird Conservation Fund, or donations from conservation organizations. Conservation easements and leases will sometimes provide the minimum interests necessary to satisfy refuge objectives if the refuge staff can adequately manage uses of the areas for the benefit of wildlife. The Service can negotiate management agreements with local, state and federal agencies, and accept conservation easements. Other public or private conservation organizations may own some tracts within the proposed refuge acquisition boundary. The Service would work with interested organizations to identify additional areas needing protection and provide technical assistance if needed. The acquisition of private lands is entirely contingent on the landowners and their willingness to participate.

REFUGE REVENUE-SHARING

Annual refuge revenue-sharing payments to Carteret County would continue at similar rates under each alternative. If the Service acquires lands and adds them to the refuge, the payments would increase accordingly and the Service would pay them to the counties in which the land lies.

VISITOR SERVICES

As the refuge develops its visitor services program, the staff would continue to assess the program and its potential impact on refuge resources. They would implement changes in the program as needed to address any impacts identified and to respond to anticipated wildlife population increases. To ensure a quality wildlife-dependent recreation experience while achieving the wildlife first mandate, the staff may limit the number of users and conflicts among users by the following: (1) permitting uses; (2) designating roads, trails, and sites for specific kinds of wildlife-dependent recreational use; and (3) permitting uses at certain times of the year.

There are a number of situations that would warrant future refuge closures or restrictions on access. Examples of these situations include, but are not limited to, the following: protection of endangered species; protection of nesting birds and bear den sites; restriction of recreation activities to achieve specific wildlife population objectives; minimization of conflicts with other refuge management programs; and limitations from inadequate funds and/or staff to administer use.

REFUGE ADMINISTRATION

The maintenance and operation of the refuge's administrative facilities would continue, regardless of the alternative selected. Periodic updating of facilities is necessary for safety and accessibility and to support staff and management needs. The plan identifies funding needs for several projects, including providing additional facilities and equipment to support refuge operation and maintenance.

PROPOSED ACTION

The refuge Service selected Alternative 2 as the preferred alternative for the proposed comprehensive conservation plan for managing Cedar Island National Wildlife Refuge over the next 15 years. When the staff separates the final comprehensive conservation plan from the environmental assessment, it will include the goals, objectives, and strategies listed for Alternative 2 that the staff would use to achieve the refuge vision.

The planning team evaluated two other alternatives for managing the refuge. The other alternatives evaluated were *Alternative 1 - No Action* and *Alternative 3*. Descriptions of these alternatives are contained in this section of the draft plan.

Implementing the proposed alternative will result in better habitat management and increased public use opportunities, while meeting the refuge's primary purpose of protecting habitat for migratory birds. Specific results will include increased songbird, marsh bird, and shorebird use and production; enhanced habitat and increased protection for other wildlife species dependent on coastal marshes and pine forests; enhanced resident wildlife populations; optimum wetland conditions; and greater opportunities for a variety of compatible wildlife-dependent recreational and environmental education activities.

An overriding concern reflected in this plan is that wildlife conservation is the first priority in refuge management. The Service allows public uses if they are compatible and appropriate with wildlife and habitat conservation. The staff will emphasize wildlife-dependent public uses (e.g., hunting, fishing, wildlife observation, wildlife photography, and environmental education and interpretation).

COMPATIBLE SECONDARY USES

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

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

OTHER MANAGEMENT

The Service would manage all management activities that could affect natural resources, including subsurface mineral reservations, utility lines and easements, soil, water and air, and historical and archaeological resources to comply with all laws and regulations. The Service has a legal responsibility to consider the effects of its actions on cultural resources. Under all alternatives, the Service would manage these resources in accordance with public law and agency policy. Individual projects would require additional consultation with the Advisory Council on Historic Preservation and the State of North Carolina's Historic Preservation Office. The Service requires additional consultation, surveys, and clearance where it is conducting project development on the refuge or when activities would affect properties that the State Historic Preservation Office has listed or are eligible for listing on the National Register of Historic Places.

Chapter IV. Environmental Consequences

OVERVIEW

This section analyzes and discusses the potential environmental effects or consequences that the refuge can reasonably expect by the implementation of each of the three management alternatives described in Section III of this environmental assessment. The planning team selected the following impact topics for analysis: effects on the biological environment, effects on the physical environment, effects on the social environment, and effects on economic environment. Each alternative portrays the expected outcomes for fish and wildlife species through 2020, varying as to the intensity of management. Table 32 outlines a comparison of the effects of Alternative 2 and 3 to the existing condition (Alternative 1).

COMPARISON OF EFFECTS AMONG ALTERNATIVES

Pursuing the refuge's current management actions described in Alternative 1, such as its prescribed burning according to the fire management plan, would have minimally positive effects on the biological environment. The waterfowl hunting program would have minimally positive effects on the social and economic environment with minimal impact on the biological and physical environment. The single staff person maintains the appearance of the refuge and the buildings and equipment to minimum recommended levels.

Compared to Alternative 1, the proposed management actions described in Alternative 2, such as continued prescribed burning and limited control of pest animals and plants, would have a moderately positive effect on the biological environment. Implementing programs and building facilities for interpretation, environmental education, wildlife observation, and wildlife photography would have moderately positive effects on the social and economic environment. Acquiring land from willing sellers within the approved acquisition boundary would provide more habitats to be managed and accessible for public use. The substantial increase in surveys of wildlife populations and habitats would not have an effect, but the results of the surveys would guide better management.

Compared to Alternative 1, the proposed management actions described in Alternative 3, such as continued prescribed burning, control of pest animals and plants, and regular patrols of the refuge, would have moderately positive effects on the biological environment. Implementing programs and building facilities for interpretation, environmental education, wildlife observation, and wildlife photography would have moderately positive effects on the social and economic environment. Acquiring land from willing sellers within the approved acquisition boundary would provide more wildlife habitat to be managed and accessible for public use. The substantial increase in surveys of wildlife populations and habitat would not have an effect, but the results of the surveys would guide better management.

Biological Environment

Each alternative would protect existing habitat important to migratory birds, mammals, reptiles, amphibians, fish, and invertebrates. With only one person on staff at Cedar Island Refuge, Alternative 1 has no provisions for surveying wildlife or habitats and only has a provision to conduct prescribed burns according to the fire management plan with assistance from other refuges in the area. Alternative 2 would provide data on some high priority wildlife species and all habitats, and conduct prescribed burning according to the fire management plan to improve habitat for neotropical migratory songbirds, resident songbirds, waterfowl, wading birds, and marsh birds on the refuge. The

prescribed burning alone would maintain vegetative species diversity in the marsh and prevent dominance by black needle rush. In the pine forests, the prescribed burning would control shrubs and deciduous trees and favor an herbaceous understory. The 1- to 3-year prescribed fire frequency mimics the natural frequency (Frost 1995, 1998).

Alternative 3 would provide data on high-priority wildlife species and mammals and fire-dependent habitats and conduct prescribed burning according to the fire management plan to improve habitat for neotropical migratory songbirds, resident songbirds, waterfowl, wading birds, and marsh birds on the refuge. The prescribed burning alone would maintain vegetative species diversity in the marsh and prevent dominance by black needle rush. In the pine forests, the prescribed burning would control shrubs and deciduous trees and favor an herbaceous understory. The 1- to 3-year prescribed fire frequency mimics the natural frequency (Frost 1995, 1998).

Alternative 3 provides for the development of an integrated pest management plan. Alternative 1 would provide for no management of pests, Alternative 2 provides for limited management of the most dominant pest species, and Alternative 3 would provide the most management with monitoring and control when the population of pests exceeds established thresholds. Whenever possible, Alternatives 2 and 3 would use multiple pest control techniques to control these species. The staff would use pesticides as needed but would strive to limit the frequency of applications and the total amount of chemical applied. Only chemicals approved by the Fish and Wildlife Service for use on refuges would be used.

Nesting, resting, and foraging habitat for all wildlife species would improve under Alternative 3 because of the improved pest management and law enforcement. Breeding populations of marsh birds and songbirds would also increase under Alternative 3. Habitat for migrating waterfowl, shorebirds, and wading birds would increase under Alternative 3.

The management in Alternative 3 would provide moderate improvements in the biological environment; Alternative 2 would provide moderate improvements in the biological environment.

The increased public use provided in Alternatives 2 and 3 may affect the refuge's wildlife populations due to disturbance and the refuge habitat due to trampling. However, the recreation use and ground-based disturbance from pedestrians would be largely concentrated on trails, firebreaks, and the refuge's office and maintenance areas. Also, many of the trails are likely to receive light use during the nesting season of most bird species due to a tremendous population of biting insects that drives most people indoors. Despite this and dispersed activities, including hunting, public use could still have a negative effect on some nesting bird populations.

The deer population on the refuge is currently at a healthy carrying capacity. Under Alternatives 2 and 3, forest management actions could increase the deer population. The refuge's forests and adjacent shrub and marsh communities provide rich sources of forage for deer. Under Alternatives 2 and 3, the staff would monitor the deer populations and use limited hunting with archery equipment to manage their populations in order to prevent habitat damage while providing a compatible recreational activity. Hunting would also ensure the health of the deer herd and minimize the effects to other wildlife species and habitat.

Despite the potential negative impacts of public use, Alternative 2 should have effects similar to Alternative 1 and Alternative 3 should provide moderate improvements in the biological environment.

PHYSICAL ENVIRONMENT

Alternative 1 would have minimal effects on the physical environment. With the limited staff and budget, the Service manages habitat with prescribed burning and the refuge gets little public use that would cause soil compaction, erosion, or polluted runoff. The staff conducts prescribed burning according to the state's smoke management guidelines to minimize air pollution. The fire breaks are disked just enough to keep the areas clear during fires.

Alternatives 2 and 3 both propose to maintain the current frequency of prescribed burning according to the refuge fire management plan. The staff will conduct the burning under the same guidelines and manage the firebreaks the same as in Alternative 1.

Public use would increase in Alternatives 2 and 3, but most of the increased activity would take place on roads, trails, or firebreaks. The increased waterfowl hunting proposed in Alternative 3 would be from floating blinds. The limited deer hunting proposed in Alternatives 2 and 3 would be dispersed throughout the refuge.

Alternatives 2 and 3 would positively affect soil formation processes on lands the refuge acquires through improved management and more vigorous plant communities. Some disturbances to surface soils and topography would occur at those locations selected for administrative and public use facilities, maintenance operations, and forest management.

All alternatives would maintain water quality in individual streams and wetlands due to a relatively low level of soil disturbance and pesticide application. Other positive effects would result from the protection of groundwater recharge areas, runoff prevention, sediment retention, and minimizing non-point source pollution.

Each alternative would protect the aesthetic characteristics associated with beaches, marshes, shrublands, and forests. The staff would carry out management activities designed to improve habitat composition and structure in such a way to minimize any short-term negative impacts to aesthetics.

SOCIAL ENVIRONMENT

Alternative 1 concentrates on providing opportunities for waterfowl hunting. Local residents fish in streams and ditches from the banks on the refuge. Refuge boat ramps give anglers and waterfowl hunters access to area waters. A law enforcement officer located at Mattamuskeet Refuge and a local and state wildlife officer provide limited law enforcement. The refuge allows the other priority public uses (environmental education, interpretation, wildlife observation, wildlife photography), but does not provide facilities or programs to support them. The local citizens value outdoor recreation opportunities and the refuge provides some on the refuge and access to others off the refuge.

As staffing and funding increase under Alternatives 2 and 3, hunting, fishing, wildlife observation, wildlife photography, and environmental education and interpretation opportunities would increase. Under each alternative, the staff would consider most of the currently owned and newly acquired lands for public hunting of waterfowl and deer resulting in a net gain of public hunting opportunities in the area. Deer hunting with archery equipment would be a new opportunity under both Alternatives 2 and 3. Increases in waterfowl hunting opportunities in Alternative 3 would depend on the location of newly acquired land and whether it has access to water. Alternative 3 provides substantially more education and interpretation programming that would add to recreation opportunities available to local residents year-round, school children during the academic year, and summer tourists to the Outer Banks north of the refuge and the Crystal Coast west of the refuge.

All alternatives would limit public access to walking or boating and minimize wildlife disturbance and habitat degradation, while allowing compatible wildlife-dependent recreation. Visitor access would increase in Alternatives 2 and 3, under which the refuge would develop an interpretive trail with an accompanying brochure and a photo blind. Alternative 3 provides slightly more programs and facilities than Alternative 2.

Visitor use management on refuges concentrates on the experience, not the number of people coming into a refuge. The types and intensity of visitor activities would vary from tract-to-tract depending on its size, habitat type(s), and wildlife uses. Because much of the land in Carteret County is currently in private ownership, the general public realizes only minimal access privileges on that land. As the Service acquires more land and places it in the public trust, more opportunities for public access would become available.

The net effect of the alternatives on the social environment is slightly positive for Alternative 2 and moderately positive for Alternative 3.

ECONOMIC ENVIRONMENT

The staff estimates an average of 30,000 annual refuge visits between 1994 and 2003. Of the 30,000, 16,000 visitors observed wildlife, 12,000 fished, 1,000 hunted, and 1,000 visited for interpretation. Studies have documented expenditures of \$69 per day for anglers, \$74 per day for hunters (U.S. Fish and Wildlife Service 2001), and \$100 per day for other uses (Vogelsang 2001). The current level of use represents a local expenditure of \$2 million.

The wildlife-dependent recreational activities described under Alternatives 2 and 3 (i.e., expanded opportunities for hunting, wildlife observation, wildlife photography, and environmental education and interpretation) would increase visitation to the refuge and generate greater purchases of local goods and services in the economy of the surrounding communities. Under Alternative 2, annual visitation would increase to 40,000 with 20,000 visitors for wildlife observation, 15,000 for fishing, 1,200 for hunting, and 1,500 for interpretation. That use represents a local expenditure of \$4.5 million. Under Alternative 3, annual visitation would increase to 60,000 with 35,000 visitors for wildlife observation, 20,000 for fishing, 1,500 for hunting, and 2,000 for interpretation. That use represents a local expenditure of \$5.5 million.

Refuge visitation to support priority public uses would generally build over time as the Service develops visitor service programs and facilities, provides operational funds, and acquires refuge lands. Initially, much of the public use on the refuge would come from local, county, and state residents, although the staff predicts an increase in the number of tourists for hiking and wildlife observation. Although summer is the traditional tourist season, public use is likely to be spread throughout the year due to the attraction of spring and fall migration seasons, pleasant weather in the winter, and insects discouraging visitors in the summer. The number of visitors would depend on the season and would grow as the refuge land base increases and the staff conducts more public use programs.

Many of the wildlife-dependent recreational activities offered have yet to be discovered by local citizens. As a generator of economic benefits, each alternative identifies fishing and wildlife observation as important tourist attractions. Under Alternatives 2 and 3, development of wildlife-dependent recreation programs and facilities and improved publicity would lead to the greatest economic benefit from increased tourism.

Alternative 3 proposes to add more programs and facilities than Alternative 2; and should yield more economic benefits to the area.

Alternative 2 would have a slightly positive effect on the local expenditures with a slight increase in payroll and purchase of supplies and equipment. Alternative 3 would have a moderately positive effect with a moderate increase in payroll and purchase of supplies and equipment.

Land acquisition within the approved acquisition boundary would decrease the gross property tax revenues of Carteret County. However, there would be an increase in refuge revenue-sharing payments. Because the Service is a federal agency, it is not subject to state and local taxes. Under the Refuge Revenue Sharing Act, the Fish and Wildlife Service would make annual payments to the counties to offset the loss of property tax revenues. The Service computes these annual refuge revenue-sharing payments for owned and acquired lands on whichever of the following formulas is greatest: (1) three-fourths of 1 percent of the fair market value of the lands acquired in fee title; (2) 25 percent of the net refuge receipts collected; or (3) 75 cents per acre of the lands acquired in fee title within the counties. The Refuge Revenue Sharing Act also requires that the Service appraise its lands every 5 years to ensure that payments to local governments remain equitable. In 2004, Carteret County received a revenue-sharing payment of \$5,067 for 14,480 acres (\$.35 per acre) with an appraised value of \$1,450,000 at Cedar Island National Wildlife Refuge. This was only 47 percent of the amount due to the county under the Revenue Sharing Act. Congress did not appropriate sufficient funding to pay the full amount. If fully funded, revenue sharing would have paid \$10,875 to the county.

The State of North Carolina recommends that counties tax undeveloped land based on the present use of the land. The state publishes a use-value manual based on the area of the state (Major Land Resource Area or MLRA) and the soil series of the land (North Carolina Department of Revenue 2003). Cedar Island National Wildlife Refuge is in the Tidewater area (MLRA 153B) and has 11,941 acres of soils rated as unproductive and 2,539 acres of soils rated as Class V in forest (Table 31). The county tax rate is \$.42 per \$100 of assessed value. The county would have taxed \$629,980 of assessed value \$2,646 if the 14,480 acres (\$.18 per acre) of land were privately owned.

Table 31. North Carolina present use value calculation

Soil	Acreage	Class	Value/Acre	Total Value
Lafitte	11,941	VI (Unproductive)	\$40	\$477,640
Carteret				
Beaches				
Leon	2,539	V (Forest)	\$60	\$152,340
Murville				
Ponzer				
Mandarin				
Baymeade				
Total	14,480			\$629,980

The Revenue-Sharing Act payment of \$5,067 is almost twice the state-recommended tax of \$2,646. The Service would contribute revenue-sharing payments to all new acquisitions.

Table 32. A comparison of the effects of Alternatives 2 and 3 to Alternative 1

Area of Concern	Alternative 2	Alternative 3
Effect on Wildlife		
Fish Population	No Change	Slight Increase
Invertebrate Population	No Change	Slight Increase
Land Bird Population	Slight Increase	Slight Increase
Mammal Population	No Change	Slight Increase
Marsh Bird Population	No Change	Slight Increase
Reptile and Amphibian Population	No Change	Slight Increase
Shorebird Population	No Change	Slight Increase
Wading Bird Population	No Change	Slight Increase
Waterfowl Population	No Change	Slight Increase
Pest Animal Populations	Slight Decrease	Moderate Decrease
Effect on Wildlife Habitat		
Condition of All Habitats	No Change	Slight Improvement
Bay Forest Condition	Slight Improvement	Moderate Improvement
Beach Condition	No Change	Slight Improvement
Brackish Marsh Condition	Slight Improvement	Moderate Improvement
Coastal Fringe Sandhills Condition	No Change	Slight Improvement
Dune Grass Conditions	No Change	Slight Improvement
Maritime Shrub Condition	Slight Improvement	Moderate Improvement
Maritime Swamp Forest Condition	No Change	Slight Improvement
Pine Savanna Condition	Slight Improvement	Moderate Improvement
Pond Pine Woodland Condition	Slight Improvement	Moderate Improvement
Wet Pine Flatwoods Condition	No Change	Slight Improvement
Threatened and Endangered Species	No Change	Slight Increase
Pest Plant Populations	Slight Decrease	Moderate Decrease
Significant Heritage Area Condition	Slight Improvement	Moderate Improvement
Effect on Physical Environment		
Soil Condition		
Air Quality	No Change	No Change
Water Quality	No Change	No Change
Aesthetics	Slight Improvement	Slight Improvement
Effect on Social Conditions		
Hunting	Slight Increase	Moderate Increase
Fishing	Slight Increase	Slight Increase
Environmental Education	Slight Increase	Moderate Increase
Interpretation	Slight Increase	Moderate Increase

Area of Concern	Alternative 2	Alternative 3
Wildlife Observation	Slight Increase	Moderate Increase
Wildlife Photography	Slight Increase	Moderate Increase
Outreach	Slight Increase	Moderate Increase
Volunteer Program	Slight Increase	Slight Increase
Cultural Resource Protection	No Change	No Change
Effect on Economic Conditions		
Local Expenditures		
Revenue Sharing Payments	Slight Increase	Slight Increase
Local Property Taxes	Slight Decrease	Slight Increase

EFFECTS COMMON TO ALL MANAGEMENT ALTERNATIVES

REGULATORY EFFECTS

As indicated in the Background section of the draft comprehensive conservation plan, the Service must comply with a number of federal laws, administrative orders, and policies in the development and implementation of its management actions and programs. Among these mandates are the Endangered Species Act of 1973, the Clean Water Act of 1977, and compliance with Executive Orders 11990 (Protection of Wetlands) and 11988 (Floodplain Management). The implementation of any of the three alternatives described in this environmental assessment would not lead to a violation of these or other mandates.

CULTURAL RESOURCES

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

Service acquisition of land with known or potential archaeological or historical sites provides two major types of protection for these resources - protection from damage by federal activity and protection from vandalism or theft. The National Historic Preservation Act requires that a federal agency have any action reviewed that may affect archaeological or historical resources and must avoid or mitigate the identified effects, if any. The Service's policy is to preserve these cultural, historic, and archaeological resources in the public trust, and avoid any adverse effects wherever possible.

Land acquisition by the Service would provide some degree of protection to significant cultural and historic resources. If acquisition of private lands does not occur and these lands remain under private ownership, the landowner would be responsible for protecting and preserving cultural resources. Development of off-refuge lands has the potential to destroy archaeological artifacts and other historical resources, thereby decreasing opportunities for cultural resource interpretation and research. There is no designated wilderness area within the refuge.

Under Alternative 3, the Service would conduct a comprehensive cultural resources survey of the refuge.

ENVIRONMENTAL JUSTICE

The decision-making process used in developing this plan and environmental assessment followed the procedures outlined in the National Environmental Policy Act. The Service conducted public meetings in the area served by the refuge. Meetings were announced in the print media and with posters in government offices and business establishments. Management of the refuge is not intensive and does not involve the use of hazardous substances. The management practice with the most potential for environmental harm is prescribed burning. The Service uses prescriptions developed by the State of North Carolina to minimize the effects of smoke on human health. The hazards presented by the smoke are distributed equally among all residents of the area.

WATER QUALITY, WETLANDS, AND FLOODPLAINS

The water quality in the waters surrounding the refuge is good. None of the proposed actions in this plan should reduce that water quality. The majority of the refuge is classified as wetlands. The Service will apply for the appropriate permits from the federal and state agencies that regulate wetlands before starting any development on the refuge. The Service will avoid or minimize any disturbance to wetlands in its development process. The majority of the refuge also floods on a regular basis with the tides. The major activity in the areas subject to flooding will be prescribed burning, waterfowl hunting, and wildlife surveys in the marsh. None of these activities have impacts on the frequency or extent of flooding.

PUBLIC HEALTH AND SAFETY EFFECTS

None of the three alternatives would have a significantly negative effect on public health and safety. The only potential safety problems involve the possibility of hiking accidents occurring on the refuge's trails, and accidents occurring during the hunting season. As indicated below in the mitigation/minimization section, the Service has used time and space zoning successfully on national wildlife refuges to minimize the possibility of potential accidents and conflicts between hunters and other refuge user groups.

REFUGE REVENUE SHARING

The Refuge Revenue Sharing Act provides for the Fish and Wildlife Service to make annual payments to the counties to offset the loss of property tax revenues. The Service computes these annual refuge revenue-sharing payments for owned and acquired lands on whichever of the following formulas is greatest: (1) three-fourths of 1 percent of the fair market value of the lands acquired in fee title; (2) 25 percent of the net refuge receipts collected; or (3) 75 cents per acre of the lands acquired in fee title within the counties. The Refuge Revenue Sharing Act also requires that the Service appraise its lands every 5 years to ensure that payments to local governments remain equitable.

UNCERTAINTY OF FUTURE ACTION EFFECTS

In general, one of the components of each alternative is the inventory and monitoring of fish and wildlife populations on the refuge. Once the staff has this information, the Service would develop detailed step-down management plans to manage the fish and wildlife populations on the refuge, based on the application of sound fish and wildlife management principles and concepts. The specific content of the step-down management plans would provide the basis for further analysis of environmental effects.

The alternatives in this plan do present sufficient information to assess the full potential environmental effects of plans to be developed in the future.

CUMULATIVE EFFECTS

Cumulative effects on the environment result from incremental effects of a proposed action when these combine with other past, present, and reasonably foreseeable future actions. While cumulative effects may result from individually minor actions, they may, viewed as a whole, become significant over time.

The implementation of any of the three alternatives described in this document includes actions relating to site development, fish and wildlife habitat and population management, land acquisition, and recreational use programs. These actions would have both direct and indirect affects (e.g., site development would result in increased public use, thus increasing littering, noise, and vehicular traffic); however, the staff does not expect the cumulative effects of these actions over the 15-year planning period to be significant.

MITIGATION MEASURES

Described below are the measures the Service uses to mitigate and minimize the potential adverse effects.

Wildlife Disturbances

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 refuge staff has carefully planned all of the proposed alternative public use activities contained in this document to avoid unacceptable levels of impact.

As currently proposed, the staff does not consider the known and anticipated level of disturbance of the proposed alternative (Alternative 2) to be significant and is well within the tolerance level of known wildlife species and populations present in the area. Implementation of the proposed public use program would take place through carefully controlled time and space zoning, including the management of waterfowl resting and feeding areas, establishment of protection zones around key sites such as rookeries and eagle nests (if necessary), and the routing of roads and trails to avoid contact with sensitive areas such as rookery habitats, etc. In addition, the refuge would conduct all public hunting activities (i.e., season lengths, bag limits, number of hunters) within the constraints of sound biological principles and refuge-specific regulations established to restrict illegal or non-conforming activities. The North Carolina Wildlife Resources Commission sets the hunting seasons and bag limits enforced on the refuge.

General wildlife observation/photography activities may result in minimal disturbances to wildlife. If visitors venture too close to foraging songbirds, waterfowl, wading birds, or other wildlife, disruption of foraging or resting activities could result in more severe disturbances. To mitigate these potential disturbances, the Service would not place a trail or photography blind within sensitive wildlife forage and resting areas. The staff would educate visitors through signs and brochures to avoid disturbing

wildlife. The refuge staff would fence areas of nesting shorebirds to exclude pedestrian traffic. Also, the staff would close any area on the refuge to the public if disturbance becomes excessive.

Temporary initial disturbances to wildlife and habitat would occur during the construction of new facilities such as a trail, photo blind, and interpretive kiosk. However, once the refuge completes construction of such facilities, the experience gained by the public would offset these disturbances. Allowing these non-consumptive recreational opportunities on the refuge would help to maintain and build public support for the refuge and the Roanoke-Tar-Neuse-Cape Fear Ecosystem.

The Service would monitor the impacts of activities through wildlife inventories and assessments of public use levels and activities. The staff will adjust public use programs as needed to limit disturbance to acceptable levels.

User Group Conflicts

As public use levels expand across time, unanticipated conflicts between user groups may occur. The staff would adjust the refuge's public use programs as needed to eliminate or minimize each problem and provide quality wildlife-dependent recreational opportunities. Experience has proven that time and space zoning (i.e., establishment of separate use areas, use periods, and restrictions on the number of users) is an effective tool in eliminating conflicts between user groups. The current practice of discouraging activities where waterfowl are hunted, during the waterfowl hunting season, would continue.

Effects on Adjacent Landowners

Implementation of the proposed action would not impact adjacent or in-holding landowners. The plan allows essential access to private property through the issuance of special use permits. Future land acquisitions would occur on a willing-seller basis only and at fair market values. Existing state water quality criteria and use classifications are adequate to achieve desired on-refuge conditions. Thus, implementation of the proposed alternative would not impact adjacent landowners or users beyond the constraints already implemented under existing state standards and laws. Prescribed burning would protect adjacent landowners from wildfires in the pine forests and marshes.

Land Ownership and Site Development

Land acquisition within the approved acquisition boundary would result in changes in land and recreational use patterns, since 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 on these lands. The land within the approved acquisition boundary is subject to regulation under the Clean Water Act that would limit development of the land for residential, commercial, industrial, or agricultural use.

Potential development of access roads, buildings, trails, water control structures, visitor parking areas, and other improvements could lead to minor short-term negative impacts on plants, soils, and some wildlife species. When the refuge proposes site development activities, each activity would receive the appropriate National Environmental Policy Act consideration during pre-construction planning. At that time, the refuge staff would incorporate any required mitigation activities 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 increased littering, noise, and vehicle traffic.

Chapter V. Consultation and Coordination

The Service formed a planning core team composed of representatives from its various divisions to prepare the draft comprehensive conservation plan and environmental assessment (Table 33). Initially, the team focused on identifying the issues and concerns pertinent to refuge management. The team met on several occasions from June 2000 to December 2000. A biological review team (Table 34) met on the refuges within the ecosystem four times between December 1999 and December 2000 to assess the habitats on the refuges and the needs of wildlife species in the ecosystem, and make recommendations on land management and acquisition needs. The core team also sought the contributions of experts (Table 35) from various fields.

Table 33. Cedar Island National Wildlife Refuge core team members

Name and Title	Station, Agency, and Location
Bruce Freske, Project Leader Don Temple, Former Project Leader Jerry Fringeli, Deputy Refuge Manager Mike Legare, Former Wildlife Biologist John Stanton, former Wildlife Biologist Christopher Smith, Park Ranger Dan Shiel, Former Park Ranger Joyce Daniels, Former Office Assistant	Cedar Island National Wildlife Refuge U.S. Fish and Wildlife Service Cedar Island, North Carolina
Robert Glennon, Natural Resource Planner David Brown, Former Habitat Protection Biologist	Ecosystem Planning Office U.S. Fish and Wildlife Service Edenton, North Carolina

Table 34. Cedar Island National Wildlife Refuge biological review team members

Name and Position	Station, Agency, and Address
Bob Noffsinger, Former Supervisory Wildlife Management Biologist	Migratory Bird Field Office, Fish and Wildlife Service, Manteo, North Carolina
Frank Bowers, Former Migratory Bird Coordinator	Southeast Regional Office, Fish and Wildlife Service, Atlanta, Georgia
Chuck Hunter, Former Nongame Migratory Bird Coordinator	Southeast Regional Office, Fish and Wildlife Service, Atlanta, Georgia
Ronnie Smith, Fisheries Biologist	Fisheries Assistance Office Fish and Wildlife Service Edenton, North Carolina
John Stanton, Former Wildlife Biologist	Mattamuskeet National Wildlife Refuge Fish and Wildlife Service Swan Quarter, North Carolina
Wendy Stanton, Wildlife Biologist	Pocosin Lakes National Wildlife Refuge Fish and Wildlife Service Columbia, North Carolina
Dennis Stewart, Wildlife Biologist	Alligator River National Wildlife Refuge Fish and Wildlife Service Manteo, North Carolina
Ralph Keel, Wildlife Biologist	Great Dismal Swamp National Wildlife Refuge Fish and Wildlife Service Suffolk, Virginia
John Gallegos, Wildlife Biologist	Back Bay National Wildlife Refuge Fish and Wildlife Service Virginia Beach, Virginia
David Allen, Nongame Wildlife Biologist	North Carolina Wildlife Resources Commission Trenton, North Carolina
Jeff Horton, Site Manager	The Nature Conservancy Windsor, North Carolina

Table 35. Expert contributors to the Cedar Island National Wildlife Refuge Comprehensive Conservation Plan and their area(s) of expertise

Name, Position, Affiliation	Area of Expertise
Bill Grabill, Former Refuge Supervisor, Fish and Wildlife Service, Atlanta, Georgia	Refuge Management
Andrew Metts, District Conservationist USDA, Natural Resources Conservation Service Beaufort, North Carolina	Soil and Water Conservation Federal Land Conservation Programs
John Gagnon, Soil Scientist USDA, Natural Resources Conservation Service Edenton, North Carolina	Soil Science
Kevin Moody, Former NEPA Specialist Fish and Wildlife Service, Atlanta, Georgia	National Environmental Policy Act
John Ann Shearer, Private Lands Biologist, Fish and Wildlife Service, Raleigh, North Carolina	Wetland Management, Partners for Fish and Wildlife Program
Richard Kanaski, Regional Archeologist, Fish and Wildlife Service, Savannah, Georgia	Cultural Resources

The planning team met in June 2000. Shortly thereafter, on September 21, 2000, the planning team held two public meetings to gain the insights of local citizens and their perceptions of the issues and concerns facing the refuge. The planning team formulated the three alternatives based on expert opinion and local concerns.

The issues and alternatives generated from these meetings, coupled with the input of the planning team, are contained in Chapters 1 and 3 of this environmental assessment.

SECTION C. APPENDICES

Appendix I. Glossary

<i>Adaptive Management</i>	A process in which projects are implemented within a framework of scientifically driven experiments to test predictions and assumptions outlined within the comprehensive conservation plan. The analysis of the outcome of project implementation helps managers determine whether current management should continue as is or whether it should be modified to achieve desired conditions.
<i>Alternative</i>	Alternatives are different means of accomplishing refuge purposes, goals, and objectives and contributing to the National Wildlife Refuge System. A reasonable way to fix the identified problem or satisfy the stated need.
<i>Approved Acquisition Boundary</i>	A project boundary that the Director of the Fish and Wildlife Service approves upon completion of the detailed planning and environmental compliance process.
<i>Biological Diversity</i>	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. The National Wildlife Refuge System focus is on indigenous species, biotic communities, and ecological processes.
<i>Biological Integrity</i>	The biotic composition, structure, and functioning at genetic, organism, and community levels comparable with historic conditions, including the natural biological processes that shape genomes, organisms, and communities.
<i>Canopy</i>	A layer of foliage; generally the upper-most layer, in a forest stand. It can be used to refer to mid- or under-story vegetation in multi-layered stands. Canopy closure is an estimate of the amount of overhead tree cover (also canopy cover).
<i>Categorical Exclusion</i>	A category of actions that do not individually or cumulatively have a significant effect on the human environment and have been found to have no such effect in procedures adopted by a federal agency pursuant to the National Environmental Policy Act of 1969.
<i>CFR</i>	Code of Federal Regulations.

<i>Compatible Use</i>	A wildlife-dependent recreational use or any other use of a refuge that, in the sound professional judgment of the refuge manager, will not materially interfere with, or detract from, the fulfillment of the mission or the purposes of the refuge. A compatibility determination supports the selection of compatible uses and identifies stipulations or limits necessary to ensure compatibility.
<i>Comprehensive Conservation</i>	A document that describes the desired future conditions of the Refuge; provides long-range guidance and management direction for the refuge manager to accomplish the purposes, goals, and objectives of the refuge; and contributes to the mission of the National Wildlife Refuge System and meet relevant mandates.
<i>Conservation Easement</i>	A legal document that provides specific land-use rights to a secondary party. A perpetual conservation easement usually grants conservation and management rights to a party in perpetuity.
<i>Cooperative Agreement</i>	A simple habitat protection action in which no property rights are acquired. An agreement is usually long-term and can be modified by either party. Lands under a cooperative agreement do not necessarily become part of the National Wildlife Refuge System.
<i>Corridor</i>	A route that allows movement of individuals from one region or place to another.
<i>Cover Type</i>	The present vegetation of an area.
<i>Cultural Resources</i>	The remains of sites, structures, or objects used by people of the past.
<i>Cypress and Tupelo Swamp</i>	Found in low-lying areas, swales and open ponds that hold water several months, if not all of the year. Large hollow trees are used as bear den sites.
<i>Deciduous</i>	Pertaining to perennial plants that are leafless for sometime during the year.
<i>Ecological Succession</i>	The orderly progression of an area through time in the absence of disturbance from one vegetative community to another.
<i>Ecosystem</i>	A dynamic and interrelating complex of plant and animal communities and their associated non-living environment.
<i>Ecosystem Management</i>	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.

<i>Environmental Health</i>	It is the composition, structure, and functioning of soil, water, air, and other abiotic features comparable with historic conditions, including the natural abiotic processes that shape the environment.
<i>Even-Aged Forests</i>	Forests that are composed of trees with a time span of less than 20 years between oldest and youngest individuals.
<i>Endangered Species</i>	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.
<i>Endemic Species</i>	Plants or animals that occur naturally in a certain region and whose distribution is relatively limited to a particular locality.
<i>Environmental Assessment</i>	A concise 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.
<i>Fauna</i>	All the vertebrate or invertebrate animals of an area.
<i>Federal Trust Species</i>	All species where the Federal Government has primary jurisdiction including federally threatened or endangered species, migratory birds, anadromous fish, and certain marine mammals.
<i>Fee-title</i>	The acquisition of most or all of the rights to a tract of land. There is a total transfer of property rights with the formal conveyance of a title. While a fee title acquisition involves most rights to a property, certain rights may be reserved or not purchased, including water rights, mineral rights, or use reservation (the ability to continue using the land for a specified time period, or the remainder of the owner's life).
<i>Finding of No Significant Impact</i>	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.
<i>Floodplain Woods</i>	Bottomland Hardwood Forests. Consists of hardwoods (old growth and mid-succession age timber), cypress tupelo stands found on low ridges that drain slowly and subject to flooding, overcup, willow, water oaks, sweetgum, green ash. Old growth typically exceeds 120 years of age. Red oaks were removed in the 1940s. Mid-succession is logged timber that may need restoration to improve wildlife habitat. Some areas are missing several key oak species.

<i>Fragmentation</i>	The process of reducing the size and connectivity of habitat patches. The disruption of extensive habitats into isolated and small patches.
<i>Goal</i>	Descriptive, open-ended, and often-broad statements of desired future conditions that convey a purpose but does not define measurable units.
<i>Geographic Information System</i>	A computer system capable of storing and manipulating spatial data.
<i>Ground Story (flora)</i>	Vascular plants less than one meter in height, excluding tree seedlings.
<i>Herbaceous Wetland</i>	Annually or seasonally inundated with vegetation consisting primarily of grasses, sedges, rushes, and cattail.
<i>Historic Conditions</i>	These are the composition, structure, and functioning of ecosystems resulting from natural processes that we believe, based on sound professional judgment, were present prior to substantial human related changes to the landscape.
<i>Habitat</i>	The place where an organism lives. The existing environmental conditions required by an organism for survival and reproduction.
<i>Indicator Species</i>	A species of plant or animals that is assumed to be sensitive to habitat changes and represents the needs of a larger group of species.
<i>In-holding</i>	Privately owned land inside the boundary of a national wildlife refuge.
<i>Issue</i>	Any unsettled matter that requires a management decision.
<i>Migratory</i>	The seasonal movement from one area to another and back.
<i>Monitoring</i>	The process of collecting information to track changes of selected parameters over time.
<i>National Environmental Policy</i>	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 this Act with other planning requirements, and prepare appropriate policy documents to facilitate better environmental decision-making.
<i>National Wildlife Refuge</i>	A designated area of land, water, or an interest in land or water within the National Wildlife Refuge System.

<i>National Wildlife Refuge System</i>	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, wildlife ranges, game ranges, wildlife management areas, or waterfowl production areas.
<i>Native Species</i>	Species that normally live and thrive in a particular ecosystem.
<i>Neotropical Migratory Bird</i>	A bird species that breeds north of the United States/Mexican border and winters primarily south of that border.
<i>Objective</i>	An objective is a concise quantitative (where possible) target statement of what will be achieved. Objectives are derived from goals and provide the basis for determining management strategies. Objectives should be attainable and time-specific.
<i>Planning Area</i>	A planning area may include lands outside existing planning unit boundaries that are being studied for inclusion in the unit and/or partnership planning efforts. It may also include watersheds or ecosystems that affect the planning area.
<i>Planning Team</i>	A planning team prepares the comprehensive conservation plan. Planning teams are interdisciplinary in membership and function. A team generally consists of the a planning team leader; refuge manager and staff biologists; staff specialists or other representatives of Service programs, ecosystems or regional offices; and state partnering wildlife agencies as appropriate.
<i>Preferred Alternative</i>	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.
<i>Purpose of the Refuge</i>	The purpose of the refuge is 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 and refuge unit.
<i>Refuge Operating Needs System</i>	This is a national database that contains the unfunded operational needs of each refuge. Projects included are those required to implement approved plans and meet goals, objectives, and legal mandates.
<i>Refuge Purposes</i>	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.

<i>Seral Forest</i>	A forest in the mature stage of development, usually dominated by large, old trees.
<i>Sink</i>	A habitat in which local mortality exceeds local reproductive success for a given species.
<i>Sink Population</i>	A population in a low-quality habitat in which birth rate is generally less than the death rate and population density is maintained by immigrants from source populations.
<i>Source</i>	A habitat in which local reproductive success exceeds local mortality for a given species.
<i>Source Population</i>	A population in a high-quality habitat in which birth rate greatly exceeds death rate and the excess individuals leave as migrants.
<i>Step-down Management Plans</i>	Step-down management plans provide the details necessary to implement management strategies and projects identified in the comprehensive conservation plan.
<i>Strategy</i>	A specific action, tool, or technique or combination of actions, tools, and techniques used to meet unit objectives.
<i>Threatened Species</i>	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.
<i>Trust Species</i>	Species for which the Fish and Wildlife Service has primary responsibility, including most federally listed threatened and endangered species, anadromous fish once they enter the inland coastal waterways, and migratory birds.
<i>Understory</i>	Any vegetation with canopy below or closer to the ground than canopies of other plants.
<i>Wildlife Corridor</i>	A landscape feature that facilitates the biologically effective transport of animals between larger patches of habitat dedicated to conservation functions. Such corridors may facilitate several kinds of traffic, including frequent foraging movement, seasonal migration, or the once in a lifetime dispersal of juvenile animals. These are transition habitats and need not contain all the habitat elements required by migrants for long-term survival or reproduction.
<i>Wildlife-Dependent Recreation</i>	A use of a refuge involving hunting, fishing, wildlife observation, wildlife photography and environmental education and interpretation. The National Wildlife Refuge System Improvement Act of 1997 specifies that these are the six priority general public uses of the system.

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Appendix III. Relevant Legal Mandates

National Wildlife Refuge System Authorities

The mission of the Fish and Wildlife Service is to conserve, protect, and enhance the Nation's fish and wildlife and their habitats for the continuing benefit of the American people. The Service is the primary federal agency responsible for migratory birds, endangered plants and animals, certain marine mammals, and anadromous fish. This responsibility to conserve our Nation's fish and wildlife resources is shared with other federal agencies and state and tribal governments.

As part of this responsibility, the Service manages the National Wildlife Refuge System. This system is the only nationwide system of federal land managed and protected for wildlife and their habitats. The mission of the National Wildlife Refuge System is to administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans.

Cedar Island National Wildlife Refuge is managed as part of this system in accordance with the National Wildlife Refuge System Administration Act of 1966, as amended by the National Wildlife Refuge System Improvement Act of 1997, the Refuge Recreation Act of 1962, Executive Order 12996 (Management and General Public Use of the National Wildlife Refuge System), and other relevant legislation, Executive Orders, regulations, and policies.

Key Legislation/Policies for Plan Implementation

The Cedar Island National Wildlife Refuge Draft Comprehensive Conservation Plan describes and illustrates management area projects with standards and guidelines for future decision-making. The Service may adjust the plan through monitoring and evaluation, as well as amendment and revision. The plan approval establishes conservation and land protection goals, objectives, and specific strategies for the refuge and its expansion. The refuge manager has identified and approved compatible recreation uses specific to the refuge. This plan provides for systematic stepping down from the overall direction as outlined when making project or activity level decisions. This level involves site-specific analysis (e.g., Forest Habitat Management Plan) to meet National Environmental Policy Act requirements for decision-making.

Antiquities Act (1906): Authorizes the scientific investigation of antiquities on federal land and provides penalties for unauthorized removal of objects taken or collected without a permit.

Migratory Bird Treaty Act (1918): Designates the protection of migratory birds as a federal responsibility. This Act enables the setting of seasons, and other regulations including the closing of areas, federal or non-federal, to the hunting of migratory birds.

Migratory Bird Conservation Act (1929): Establishes procedures for acquisition by purchase, rental, or gift of areas approved by the Migratory Bird Conservation Commission.

Migratory Bird Hunting and Conservation Stamp Act (1934): Authorized the opening of part of a refuge to waterfowl hunting.

Fish and Wildlife Act (1956): Established a comprehensive national fish and wildlife policy and broadened the authority for acquisition and development of refuges.

Fish and Wildlife Coordination Act (1958): Allows the Fish and Wildlife Service to enter into agreements with private landowners for wildlife management purposes.

Refuge Recreation Act (1962): Allows the use of refuges for recreation when such uses are compatible with the refuge's primary purposes and when sufficient funds are available to manage the uses.

Land and Water Conservation Fund Act (1965): Uses the receipts from the sale of surplus federal land, outer continental shelf oil and gas sales, and other sources for land acquisition under several authorities.

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. (Refuge Administration 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 for which the Service established the refuge. The Refuge Improvement Act clearly defines a unifying mission for the Refuge System; establishes the legitimacy and appropriateness of the six priority public uses (hunting, fishing, wildlife observation, wildlife photography and environmental education and interpretation); establishes a formal process for determining compatibility; established the responsibilities of the Secretary of the Interior for managing and protecting the System; and requires a Comprehensive Conservation Plan for each refuge by the year 2012. This Act amended portions of the Refuge Recreation Act and National Wildlife Refuge System Administration Act of 1966.

Architectural Barriers Act (1968): Requires federally owned, leased, or funded buildings and facilities to be accessible to persons with disabilities.

National Environmental Policy Act (1969): Requires the disclosure of the environmental impacts of any major federal action significantly affecting the quality of the human environment.

Endangered Species Act (1973): Requires all federal agencies to carry out programs for the conservation of threatened and endangered species.

Rehabilitation Act (1973): Requires that programmatic and physical accessibility be made available in any facility funded by the Federal Government, ensuring that anyone can participate in any program.

Clean Water Act (1977): Requires consultation with the U.S. Army Corps of Engineers for major wetland modifications.

Executive Order 11988 (1977): Each federal agency shall provide leadership and take action to reduce the risk of flood loss and minimize the impact of floods on human safety, and preserve the natural and beneficial values served by the flood plain.

Emergency Wetlands Resources Act (1986): The purpose of the Act is to promote the conservation of migratory waterfowl and to offset or prevent the serious loss of wetlands by the acquisition of wetlands and other essential habitat, and for other purposes.

Federal Noxious Weed Act (1990): Requires the use of integrated management systems to control or contain undesirable plant species, and an interdisciplinary approach with the cooperation of other federal and state agencies.

Americans With Disabilities Act (1992): Prohibits discrimination in public accommodations and services.

Executive Order 12996 Management and General Public Use of the National Wildlife Refuge System (1996): Defines the mission, purpose, and priority public uses of the National Wildlife Refuge System. It also presents four principles to guide management of the system.

Executive Order 13007 Indian Sacred Sites (1996): Directs federal land management agencies to accommodate access to and ceremonial use of Indian sacred sites by Indian religious practitioners, avoid adversely affecting the physical integrity of such sacred sites, and where appropriate, maintain the confidentiality of sacred sites.

Emergency Wetland 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 also requires the Secretary of the Interior to establish a National Wetlands Priority Conservation Plan, requires the states to include wetlands in their Comprehensive Outdoor Recreation Plans, and transfers to the Migratory Bird Conservation Fund an amount equal to import duties on arms and ammunition.

Endangered Species Act of 1973 (16 U.S.C. 1531-1544, 87 Stat. 884), as amended: Public Law 93-205, approved December 28, 1973, repealed the Endangered Species Conservation Act of December 5, 1969 (P.L. 91-135, 83 Stat. 275). The 1969 act amended the Endangered Species Preservation Act of October 15, 1966 (P.L. 89-669, 80 Stat. 926). The 1973 Endangered Species Act provided for the conservation of ecosystems upon which threatened and endangered species of fish, wildlife, and plants depend, both through federal action and by encouraging the establishment of state programs. The Act authorizes the determination and listing of species as threatened and endangered; prohibits unauthorized taking, possession, sale, and transport of endangered species; provides authority to acquire land for the conservation of listed species, using land and water conservation funds; authorizes establishment of cooperative agreements and grants-in-aid to states that establish and maintain active and adequate programs for threatened and endangered wildlife and plants; authorizes the assessment of civil and criminal penalties for violating the Act or regulations; and authorizes the payment of rewards to anyone furnishing information leading to arrest and conviction of anyone violating the Act and any regulation issued there under.

Environmental Education Act of 1990 (20 USC 5501-5510; 104 Stat. 3325): Public Law 101-619, signed November 16, 1990, established the Office of Environmental Education within the Environmental Protection Agency to develop and administer a federal environmental education program. Responsibilities of the Office include developing and supporting programs to improve understanding of the natural and developed environment, and the relationships between humans and their environment; supporting the dissemination of educational materials; developing and supporting training programs and environmental education seminars; managing a federal grant program; and administering an environmental internship and fellowship program. The Office is required to develop and support environmental programs in consultation with other federal natural resource management agencies, including the Fish and Wildlife Service.

Executive Order 11988, Flood Plain Management: The purpose of this Executive Order, signed May 24, 1977, 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 flood plain 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 flood plains.

Fish and Wildlife Improvement Act of 1978: Congress passed this act 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 of the Interior 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.

Historic Preservation Acts include:

Antiquities Act (16 USC 431 - 433)--The Act of June 8, 1906, (34 Stat. 225): This act authorizes the President of the United States to designate as National Monuments objects or areas of historic or scientific interests on lands owned or controlled by the United States. The Act required that a permit be obtained for examination of ruins, excavation of archaeological sites and the gathering of objects of antiquity on lands under the jurisdiction of the Secretaries of Interior, Agriculture, and Army, and provided penalties for violations.

Archaeological Resources Protection Act (16 U.S.C. 470aa - 47011)-- Public Law 96-95, approved October 31, 1979, (93 Stat. 721): This act largely supplanted the resource protection provisions of the Antiquities Act for archaeological items. It established detailed requirements for issuance of permits for any excavation for or removal of archaeological resources from Federal and Indian lands. It also established civil and criminal penalties for the unauthorized excavation, removal, or damage of any such resources; for any trafficking in such resources removed from Federal and Indian lands in violation of any provision of federal law; and for interstate and foreign commerce in such resources acquired, transported or received in violation of any state or local law.

Public Law 100-588, approved November 3, 1988, (102 Stat. 2983) lowered the threshold value of artifacts triggering the felony provisions of the Act from \$5,000 to \$500, made attempting to commit an action prohibited by the Act a violation, and required the land managing agencies to establish public awareness programs regarding the value of archaeological resources to the nation.

Archaeological and Historic Preservation Act (16 U.S.C. 469-469c)--Public Law 86-523, approved June 27, 1960, (74 Stat. 220), and amended by Public Law 93-291, approved May 24, 1974, (88 Stat. 174): This act directed federal agencies to notify the Secretary of the Interior whenever a federal, federally assisted, or licensed or permitted project may cause loss or destruction of significant scientific, prehistoric or archeological data. The Act authorized use of appropriated, donated, and/or transferred funds for the recovery, protection and preservation of such data.

Historic Sites, Buildings and Antiquities Act (16 U.S.C. 461-462, 464-467)--The Act of August 21,1935, (49 Stat. 666) popularly known as the Historic Sites Act, as amended by Public Law 89-249, approved October 9,1965, (79 Stat. 971): This act declared it a national policy to preserve historic sites and objects of national significance, including those located on refuges. It provided procedures for designation, acquisition, administration and protection of such sites. Among other things, National Historic and Natural Landmarks are designated under authority of this Act. As of January 1989, thirty-one national wildlife refuges contained such sites.

National Historic Preservation Act of 1966 (16 U.S.C. 470-470b, 470c-470n)--Public Law 89-665, approved October 15,1966, (80 Stat. 915) and repeatedly amended: This act provided for preservation of significant historical features (buildings, objects and sites) through a grant-in-aid program to the states. It established a National Register of Historic Places and a program of matching grants under the existing National Trust for Historic Preservation (16 U.S.C. 468-468d).

The Act established an Advisory Council on Historic Preservation, which Congress made a permanent independent agency in Public Law 94-422, approved September 28,1976 (90 Stat. 1319). That Act also created the Historic Preservation Fund. The Act directs Federal agencies to take into account the effects of their actions on items or sites listed in, or eligible for listing in, the National Register of Historic Places. As of January 1989, ninety-one such sites on national wildlife refuges are listed in this Register.

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 of 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.

Migratory Bird Hunting and Conservation Stamp Act (16 U.S.C. 718-718j, 48 Stat. 452), as amended: The Duck Stamp Act, of March 16,1934, requires each waterfowl hunter, 16 years of age or older, to possess a valid federal hunting stamp. Receipts from the sale of the stamp are deposited in a special Treasury account known as the Migratory Bird Conservation Fund and are not subject to appropriations.

National and Community Service Act of 1960 (42 U.S.C. 12401:104 Stat. 3127), Public Law 101-610, signed November 16,1990: This act authorizes several programs to engage citizens of the United States in full- and/or part-time projects designed to combat illiteracy and poverty, provide job skills, enhance educational skills, and fulfill environmental needs. Several provisions are of particular interest to the Fish and Wildlife Service.

American Conservation and Youth Service Corps: A federal grant program established under Subtitle C of the law, the Corps offers an opportunity for young adults between the ages of 16-25, or in the case of summer programs, 15-21, to engage in approved human and natural resources projects which benefit the public or are carried out on Federal or Indian lands. To be eligible for assistance, natural resource programs must focus on improvement of wildlife habitat and recreational areas, fish culture, fishery assistance, erosion, wetlands protection, pollution control and similar projects. A stipend of not more than 100 percent of the poverty level will be paid to participants. A Commission established to administer the Youth Service Corps will make grants to States, the Secretaries of Agriculture and Interior and the Director of ACTION to carry out these responsibilities.

National Environmental Policy Act of 1959 (P.L. 91-190, 42 U.S.C. 4321-4347, January 1, 1970, 83 Stat. 852) as amended by Public Law 94-52, July 3, 1975, 89 Stat. 258, and Public Law 94-83, August 9, 1975, 89 Stat. 424): Title I of the 1969 National Environmental Policy Act requires that all federal agencies prepare detailed environmental impact statements for every recommendation or report on proposals for legislation and other major federal actions significantly affecting the quality of the human environment. The 1969 statute stipulated the factors to be considered in environmental impact statements, and required that federal agencies employ an interdisciplinary approach in related decision-making and develop means to ensure that unquantified environmental values are given appropriate consideration, along with economic and technical considerations. Title II of this statute requires annual reports on environmental quality from the President to the Congress, and established a Council on Environmental Quality in the Executive Office of the President with specific duties and functions.

National Wildlife Refuge System Improvement Act of 1997: Public Law 105-57, amended the National Wildlife Refuge System Act of 1966 (16 U.S.C. 668dd-ee), and provided guidance for management and public use of the Refuge System. The Act mandates that the Refuge System be consistently directed and managed as a national system of lands and waters devoted to wildlife conservation and management. The Act establishes priorities for recreational uses of the Refuge System. Six wildlife-dependent uses are specifically named in the Act: hunting, fishing, wildlife observation, wildlife photography, and environmental education and interpretation. These activities are to be promoted on the Refuge System, while all non-wildlife-dependent uses are subject to compatibility determinations. A compatible use is one that, in the sound professional judgment of the refuge manager, will not materially interfere with, or detract from, fulfillment of the National Wildlife Refuge System mission or refuge purpose(s). As stated in the Act, The mission of the system is to administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans. The Act also requires development of a Comprehensive Conservation Plan for each refuge and that management is consistent with the plan. When writing a plan for expanded or new refuges, and when making management decisions, the Act requires effective coordination with other federal agencies, state fish and wildlife or conservation agencies, and refuge neighbors. A refuge must also provide opportunities for public involvement when making a compatibility determination.

North American Wetlands Conservation Act (103 Stat. 1968; 16 U.S.C. 4401~4412) Public Law 101-233, enacted December 13, 1989: This act 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 Act converts the Pittman-Robertson account into a trust fund, with the interest available without appropriation through the year 2006, to carry out the programs authorized by the Act, along with an authorization for annual appropriation of \$15 million plus an amount equal to the fines and forfeitures collected under the Migratory Bird Treaty Act. Available funds may be expended, upon approval of the Migratory Bird Conservation Commission, for payment of not to exceed 50 percent of the United States' share of the cost of wetlands conservation projects in Canada, Mexico, or the United States (or 100 percent of the cost of projects on federal lands). At least 50 percent and no more than 70 percent of the funds received are to go to Canada and Mexico each year.

Refuge Recreation Act of 1952: 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.

Refuge Revenue Sharing Act (16 U.S.C. 715s): Section 401 of the Act of June 15, 1935, (49 Stat. 383) provided for payments to counties in lieu of taxes, using revenues derived from the sale of products from refuges. Public Law 88-523, approved August 30, 1964, (78 Stat. 701) made major revisions by requiring that all revenues received from refuge products, such as animals, timber and minerals, or from leases or other privileges, be deposited in a special Treasury account and net receipts distributed to counties for public schools and roads. Public Law 93-509, approved December 3, 1974, (88 Stat. 1603) required that moneys remaining in the fund after payments be transferred to the Migratory Bird Conservation Fund for land acquisition under provisions of the Migratory Bird Conservation Act. Public Law 95-469, approved October 17, 1978, (92 Stat. 1319) expanded the revenue sharing system to include National Fish Hatcheries and Service research stations. It also included in the Refuge Revenue Sharing Fund receipts from the sale of salmonid carcasses. The Service estimated the payments to counties as follows: on acquired land, the greatest amount calculated on the basis of 75 cents per acre, three-fourths of one percent of the appraised value, or 25 percent of the net receipts produced from the land; and on land withdrawn from the public domain, 25 percent of net receipts and basic payments under Public Law 94-565 (31 U.S.C. 1601-1607, 90 Stat. 2662). This amendment also authorized appropriations to make up any difference between the amount in the fund and the amount scheduled for payment in any year. Congress removed the stipulation that payments be used for schools and roads, but did require counties to pass payments along to other units of local government within the county that suffer losses in revenues due to the establishment of Service areas.

Wilderness Act of 1954: Public Law 88-577, approved September 3, 1964, directed the Secretary of the Interior, within 10 years, to review every roadless area of 5,000 or more acres and every roadless island (regardless of size) within National Wildlife Refuge and National Park Systems for inclusion in the National Wilderness Preservation System.

Appendix IV. Public Involvement

The Service invited federal, state, and local government agencies, non-governmental organizations, businesses, and citizens to participate in four public scoping meetings on the afternoon and evening of September 21, 2000, in the cities of Beaufort and Cedar Island, North Carolina. The staff introduced the audience of 65 citizens to the refuge and its planning process and asked them to identify their issues and concerns. The Service published announcements giving the location, date, and time for the public meeting in the *Federal Register* and legal notices in local newspapers. The staff also sent press releases to local newspapers and public service announcements to television and radio stations. Service personnel placed 50 posters announcing the meeting in local post offices, local government buildings, and stores.

The planning teams expanded the issues and concerns to include those generated by the agencies, organizations, businesses, and citizens from the local community. These issues and concerns formed the basis for the development and comparison of the objectives in the different alternatives described in this environmental assessment.

The issues raised at the meetings are listed on the next pages, followed by worksheets the participants completed at each workshop.

Cedar Island National Wildlife Refuge Comprehensive Conservation Plan Scoping Meetings September 21, 2000

Area of Concern	Issue	Disposition
Wildlife-General	Hire a biologist.	In alternative 3.
	Conduct wildlife surveys.	Survey of priority species in alternative 2 and 3.
	Cooperate with adjacent landowners on wildlife surveys.	Will be considered in monitoring step-down plan.
	Use local residents to collect survey data.	Will be considered in monitoring step-down plan.
Wildlife-Land Birds	Increase protection.	In plan.
	Preserve old buildings for barn swallows.	In plan.
Wildlife-Shorebirds	Increase protection.	In plan.

Area of Concern	Issue	Disposition
Habitat-General	Hire a biologist.	In alternative 3.
	Manage for wildlife.	In plan.
	Survey all habitats.	Survey of fire dependent habitat in alternative 3.
	Increase prescribed burns.	Currently fully implementing fire management plan.
	Restore habitat.	All habitats are natural.
	Add habitat.	In land protection step-down plan.
	Use conservation organizations for nest box installation and maintenance.	In alternative 3.
	Protect migratory pathways and habitats.	In plan.
	Consider aerial sowing of native seeds.	Not in plan. Not necessary.
	Consider planting strips of wildlife habitat plants.	Not in plan. Not necessary.
Habitat-Brackish Marsh	Use herbicides in old pond depressions and burn dead vegetation.	Will be considered in step-down plan development.
	Plant millet near old ponds.	Not in plan. Millets are not native species.
	Study old pond depressions.	In plan.
Habitat-Brackish Marsh	Conduct prescribed burns.	Currently fully implementing fire management plan.
	Use heavy equipment in management.	Will be used in conjunction with prescribed fire.
	Use herbicide to create nesting habitat.	Will be used in conjunction with prescribed fire.
	Develop impoundments.	Not in plan. Must purchase prior converted cropland (former wetland) to develop.

Area of Concern	Issue	Disposition
Habitat-Cropland	Plant crops for wildlife.	Must buy existing cropland to plant. To be addressed in land protection step down plan.
Habitat-Pine Savanna	Clear and maintain a firebreak between the refuge and the community.	In fire management step-down plan.
	Conduct prescribed burns.	In plan.
Habitat-Shoreline Erosion Control	Control erosion to protect concrete building that house barn swallows.	Not considered critical enough to put in plan; will continue to monitor.
	Control erosion at the end of Lola Road.	Not considered critical enough to put in plan; will continue to monitor.
Public Use-General	Hire full time park ranger to answer questions.	In alternative 3.
	Increase opportunities.	In plan.
	Mark roads 'Open for Pedestrian Access'.	Will be considered in sign step-down plan.
	Open some roads to vehicles.	Not in plan. Staff and funding is not adequate for maintenance of roads used by vehicles.
Public Use-Hunting	Open east side of the refuge between Thorofare Bay and Lewis Creek to waterfowl hunting	Adding 200 acres for waterfowl hunting is in alternative 3.
	Increase access for hunting on the eastern side of the refuge.	Adding boat ramps is not practical in wetland areas, not in plan.
Public Use-Fishing	Repair and maintain Lewis Creek boat ramp.	In plan.
	Build new boat ramps.	Improvement or replacement of existing boat ramps In alternative 3.
	Dredge canals and creeks around boat ramps to accommodate larger boats.	Not in plan.
	Mark canals and creeks.	Not in plan.
Public Use-Wildlife Observation	Develop trails.	One trail in plan.
	Develop observation platforms.	Trails, roads, firebreaks available; platforms are not in plan.
	Develop parking areas along State Highway.	Existing parking lot not fully utilized; will improve signage to encourage use; new parking areas are not in plan.

Area of Concern	Issue	Disposition
Public Use-Wildlife Observation	Create bridal paths and horse trails	Horseback riding is a non-wildlife dependent use, trails are not in plan.
Public Use-Wildlife Photography	Develop trails.	One trail in plan.
Public Use-Environmental Education	Develop trails.	One trail in plan.
	Develop education opportunities.	In plan.
	Increase education opportunities on and off the refuge.	In plan.
	Hire education specialist to teach school children.	Park ranger in alternative 3.
Public Use-Interpretation	Develop trails.	One trail in plan.
	Build interpretive facilities with restrooms.	One kiosk and one trail in plan.
Public Use-Volunteers	Use wildlife and environmental organizations to help on the refuge.	In plan.
	Create organization to help manage trails.	In alternative 3.
	Start a volunteer program.	In alternative 3.
Public Use-Outreach	Work with the public off the refuge.	In plan.
Public Use-Non Wildlife Dependent Use	Allow primitive camping.	Not in plan. Refuges are only open during daylight hours.
Resource Protection-Interagency Cooperation	Increase cooperation.	In plan.
Resource Protection-Land Acquisition	Add upland habitat areas to acquisition boundary.	To be addressed in land protection step-down plan.
	Expand refuge to the northwest.	To be addressed in land protection step-down plan.
	Do not trade land to developers.	Land exchanges very rare.
	Inform public of land acquisitions.	Details to be addressed in land protection step-down plan.

Area of Concern	Issue	Disposition
Resource Protection-Law Enforcement	Enforce laws judiciously.	In plan.
	Enforce waterfowl baiting regulations.	In plan.
	Enforce poaching regulations.	In plan.
	Enforce military aircraft ceilings.	In plan.
Resource Protection-Cultural Resources	Preserve cultural resources.	In plan.
Resource Protection-Permits	Increase emphasis on permits.	In plan.
Administration-General	Hire full time maintenance worker.	Employee is in place; position is retained in plan.
	Clean up area.	In plan.
Administration-Personnel	Hire permanent full time staff.	In plan.
Administration-Real Property	Turn headquarters into a visitor center with housing for interns and volunteers.	Establishing a visitor contact area is in alternative 3; housing facilities have been developed.
	Move headquarters to a more visible location.	Not practical, not in plan.
	Enforce utility right-of-way maintenance conditions.	In plan.
	Give community an easement around the community building.	Sale of Federal land not normally done; not in plan.

**CEDAR ISLAND NATIONAL WILDLIFE REFUGE
PLANNING ISSUES WORKSHEET (20 respondents)**

ACTIVITY	WHAT WOULD YOU LIKE US TO DO?			
	Keep the Same	Eliminate	Increase	Decrease
HABITAT MANAGEMENT ACTIVITIES				
Prescribed Burning	15%	15%	65%	5%
Forest Thinning	25%	20%	50%	5%
Mechanical Vegetation Management	35%	5%	50%	10%
Chemical Vegetation Management	0%	50%	40%	10%
Waterfowl/Waterbird Management	15%	0%	65%	0%
Shoreline Maintenance	30%	0%	65%	5%
Planting for Habitat Improvement	5%	0%	90%	5%
National Wilderness Status	20%	0%	75%	5%
PUBLIC USE ACTIVITIES AND FACILITIES				
Environmental Education (Students)	10%	5%	85%	0%
Environmental Education (Teachers)	20%	5%	75%	0%
Wildlife Interpretation (Programs)	25%	5%	70%	0%
Wildlife Interpretation (Printed Materials)	10%	5%	80%	5%
Wildlife Interpretation (Facilities)	25%	5%	65%	5%
Wildlife Interpretation (Signs)	15%	0%	80%	5%
Wildlife Photography	30%	0%	70%	0%
Wildlife Observation	20%	0%	80%	0%
Fishing	35%	0%	65%	0%
Hunting	30%	5%	50%	15%
Vehicle Parking Lots	35%	0%	65%	0%
Access for Fishing, Boating, Canoeing	20%	0%	70%	10%
Planting, Seeding for Facility Aesthetics	20%	0%	75%	5%
RESOURCE PROTECTION ACTIVITIES				
Visitor Protection	55%	5%	30%	10%
Wildlife Protection	30%	0%	70%	0%
Trespass Violations	30%	0%	60%	5%
Littering/Dumping Violations	5%	0%	95%	0%
OPERATION AND MAINTENANCE ACTIVITIES				
Road and firebreak Maintenance	35%	0%	65%	0%
Facilities Maintenance	25%	0%	75%	0%

Appendix V. Decisions and Approvals

INTRA-SERVICE SECTION 7 BIOLOGICAL EVALUATION

Originating Person: Bruce Freske

Telephone Number: 252-926-4021 (Mattamuskeet), 252-225-2511 (Cedar Island)

E-Mail: bruce_freske@fws.gov

Date: August 1, 2005

Project Name: Cedar Island National Wildlife Refuge Comprehensive Conservation Plan

I. Service Program:

- Ecological Services
- Federal Aid
- Clean Vessel Act
- Coastal Wetlands
- Endangered Species Section 6
- Partners for Fish and Wildlife
- Sport Fish Restoration
- Wildlife Restoration
- Fisheries
- Refuges/Wildlife

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

III. Station Name: Cedar Island National Wildlife Refuge

IV. Description of Proposed Action (attach additional pages as needed): Implementation of the Comprehensive Conservation Plan for Cedar Island National Wildlife Refuge by adopting the preferred alternative that will provide guidance, management direction, and operation plans for the next 15 years.

V. Pertinent Species and Habitat:

A. Include species/habitat occurrence map:

Complete the following table.

SPECIES/CRITICAL HABITAT	STATUS ¹
Loggerhead Sea Turtle	Threatened
Green Sea Turtle	Threatened
Hawksbill Sea Turtle	Endangered
Kemp's Ridley Sea Turtle	Endangered
Leatherback Sea Turtle	Endangered
American Alligator	Threatened
Piping Plover	Threatened
Roseate Tern	Endangered
Red-cockaded Woodpecker	Endangered
West Indian Manatee	Endangered
Eastern Cougar	Endangered
Shortnose Sturgeon	Endangered
Seabeach Amaranth	Threatened
Rough-leaved Loosestrife	Endangered

¹STATUS: E=endangered, T=threatened, PE=proposed endangered, PT=proposed threatened, CH=critical habitat, PCH=proposed critical habitat, C=candidate species

VI. Location (attach map):

- A. Ecoregion Number and Name:** Roanoke - Tar - Neuse - Cape Fear No. 34
- B. County and State:** Carteret, North Carolina
- C. Section, township, and range (or latitude and longitude):**
- D. Distance (miles) and direction to nearest town:** Thirty miles east of Morehead City, North Carolina.
- E. Species/habitat occurrence:**

Loggerhead Sea Turtle – Record of occurrence in Carteret County within the past 20 years.

Green Sea Turtle – No record of occurrence. Record of occurrence in past 20 years in adjacent counties.

Hawksbill Sea Turtle – No record of occurrence. Record of occurrence in past 20 years in adjacent county.

Kemp's Ridley Sea Turtle – No record of occurrence within the past 20 years. Record of occurrence within the past 20 years in adjacent county.

Leatherback Sea Turtle – Record of occurrence in Carteret County more than 20 years ago.

American Alligator – Record of occurrence in Carteret County within the past 20 years.

Piping Plover – Record of occurrence in Carteret County within the past 20 years.

Roseate Tern – Record of occurrence in Carteret County more than 20 years ago.

Red-cockaded Woodpecker - Record of occurrence in Carteret County within the past 20 years.

West Indian Manatee - Record of occurrence in Carteret County within the past 20 years.

Eastern Cougar – Record of occurrence in Carteret County more than 20 years ago.

Shortnose Sturgeon – No record of occurrence in Carteret County. Record of occurrence in adjacent counties within 20 years.

Seabeach Amaranth – Record of occurrence in Carteret County within 20 years.

Rough-leaved Loosestrife - Record of occurrence in Carteret County within 20 years.

VII. Determination of Effects:

A. Explanation of effects of the action on species and critical habitats in item V. B (attach additional pages as needed).

SPECIES/ CRITICAL HABITAT	IMPACTS TO SPECIES/CRITICAL HABITAT
Loggerhead Sea Turtle	Disturbance by staff and visitors during nesting season.
Green Sea Turtle	Disturbance by staff and visitors during nesting season.
Hawksbill Sea Turtle	Disturbance by staff and visitors during nesting season.
Kemp's Ridley Sea Turtle	Disturbance by staff and visitors during nesting season.
Leatherback Sea Turtle	Disturbance by staff and visitors during nesting season.
American Alligator	Disturbance by staff and visitors during nesting season.
Piping Plover	Disturbance by staff and visitors during nesting season.
Roseate Tern	Disturbance by staff and visitors during nesting season.
Red-cockaded Woodpecker	Disturbance by staff and visitors during nesting season. Lack of understory management.
West Indian Manatee	Disturbance by boaters and anglers. Water quality degradation and lack of submerged aquatic vegetation.
Eastern Cougar	Disturbance by staff and visitors.
Shortnose Sturgeon	Disturbance by boaters and anglers. Water quality degradation and lack of submerged aquatic vegetation.
Seabeach Amaranth	Trampling of plants by staff and visitors before seed maturation.
Rough-leaved Loosestrife	Trampling of plants by staff and visitors before seed maturation. Lack of understory management.

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

SPECIES/ CRITICAL HABITAT	ACTIONS TO MITIGATE/MINIMIZE IMPACTS
Loggerhead Sea Turtle	Restrict access to nesting area.
Green Sea Turtle	Restrict access to nesting area.
Hawksbill Sea Turtle	Restrict access to nesting area.
Kemp's Ridley Sea Turtle	Restrict access to nesting area.
Leatherback Sea Turtle	Restrict access to nesting area.
American Alligator	Restrict access to nesting area.
Piping Plover	Restrict access to nesting area.
Roseate Tern	Restrict access to nesting area.
Red-cockaded Woodpecker	Restrict access to nesting area. Allow pines to grow old enough to develop cavities. Manage understory to maintain height below cavities.
West Indian Manatee	Restrict access when manatees are in the area. Cooperate with state agencies to monitor and improve water quality.
Eastern Cougar	Restrict access when cougars are in the area.
Shortnose Sturgeon	Cooperate with state agencies to monitor and improve water quality.
Seabeach Amaranth	Restrict access to areas with plants until after seed maturation.
Rough-leaved Loosestrife	Manage pine stands with prescribed fire to maintain herbaceous understory.

VIII. Effect Determination and Response Requested:

SPECIES/ CRITICAL HABITAT	DETERMINATION¹			RESPONSE¹
	NE	NA	AA	
Loggerhead Sea Turtle		X		
Green Sea Turtle		X		
Hawksbill Sea Turtle		X		
Kemp's Ridley Sea Turtle		X		
Leatherback Sea Turtle		X		
American Alligator		X		
Piping Plover		X		
Roseate Tern		X		
Red-cockaded Woodpecker		X		
West Indian Manatee		X		
Eastern Cougar		X		
Shortnose Sturgeon		X		
Seabeach Amaranth		X		
Rough-leaved Loosestrife		X		

¹DETERMINATION/RESPONSE REQUESTED:

NE = no effect. This determination is appropriate when the proposed action will not impact directly, indirectly, or cumulatively, 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 or candidate species is Conference.

Signature (originating station)

Date

Title

IX. Reviewing Ecological Services Office Evaluation:

A. Concurrence _____ **Nonconcurrence** _____

B. Formal consultation required _____

C. Conference required _____

D. Informal conference required _____

E. Remarks (attach additional pages as needed):

Signature

Date

Title

Office

COMPATIBILITY DETERMINATION

Cedar Island National Wildlife Refuge Compatibility Determination

Uses: The staff considered the following uses for compatibility determination reviews: hunting, fishing, wildlife observation, wildlife photography, environmental education, interpretation, trapping of selected furbearers for nuisance animal management, forest management program, and refuge resource research studies. This compatibility determination addresses a description and the anticipated biological impacts for each use separately.

Refuge Name: Cedar Island National Wildlife Refuge

Date Established: 1964

Establishing and Acquisition Authority (ies): 16 U.S.C. Sec. 664 (Migratory Bird Conservation Act of 1929), 16 U.S.C. 742f(b)(1) (Fish and Wildlife Act of 1956).

Refuge Purpose: The purpose of Cedar Island National Wildlife Refuge, as reflected in the refuge's authorizing legislation, is to protect and conserve migratory birds, and other wildlife resources through the protection of wetlands, in accordance with the following laws:

...for use as an inviolate sanctuary, or for any other management purpose, for migratory birds... 16 U.S.C. Sec. 664 (Migratory Bird Conservation Act of 1929);

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

The refuge's purpose and importance to migratory birds, particularly waterfowl, is: *To preserve wintering habitat for waterfowl and wintering and production habitat for wood ducks to meet the habitat goals presented in the Ten-Year Waterfowl Habitat Acquisition Plan and the North American Waterfowl Management Plan.*

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

The staff considered compatibility determinations for each description listed separately. Although for brevity, the preceding sections from uses through other applicable laws, regulations, and policies are only written once within the plan, they are part of each descriptive use and become part of that compatibility determination if considered outside of the comprehensive conservation plan.

Hunting

Description of Use: The refuge is a mixture of marshes and forest blocks of pines and hardwoods, interconnected streams, ditches, and backswamps. The forests have a great variety of tree species that include baldcypress, tupelo gum, oak, sugarberry, black gum, hickory, elm, green ash, bitter pecan, and willow. This rich forested wetland provides good habitat for a number of game species including white-tailed deer, squirrel, raccoon, woodcock and waterfowl.

Many of the local residents enjoy an informal, rural lifestyle that includes frequent recreational use of the area's natural resources. Hunting and fishing have been, and continue to be, popular uses of refuge lands. The Service permits limited waterfowl hunting. The administration of the hunting program, as well as special regulations for hunting, has changed over time but the majority of the program has remained unchanged.

The refuge will continue waterfowl hunting on 400 acres for 1,000 users annually, and add deer hunting with archery equipment for 200 users annually. All hunts fall within the framework of the State's open seasons and follow State regulations. There are additional refuge-specific regulations to supplement State regulations. The Service reviews these refuge-specific regulations annually and incorporates them into the refuge hunting brochure. The refuge will increase law enforcement presence during hunting seasons; will evaluate the hunt program annually; and modify seasons, hunt areas, or regulations if necessary. The refuge could add hunting areas as the refuge expands through an active land acquisition program. Implementation of the comprehensive conservation plan will ensure that opportunities for various types of wildlife-dependent recreation will continue for future generations.

Availability of Resources: The refuge utilizes a law enforcement officer headquartered at Mattamuskeet National Wildlife Refuge and officers from the North Carolina Wildlife Resources Wildlife Commission to ensure compatibility and to administer this use at its current level. The refuge will add a permanent, full-time law enforcement officer and refuge manager at Cedar Island Refuge to assist with hunting program administration and visitor service.

Anticipated Impacts of the Use: The current waterfowl hunting program provides hunting opportunities to the public on the northwestern edge of the refuge's marsh area. The public has unlimited access to the bays and sounds beyond the land area of the refuge. The Service does not allow waterfowl hunting on the vast majority of the refuge land area. This limited opportunity permits waterfowl hunting from floating blinds and places limited demands on the refuge staff. Violations in the form of permanent blinds constructed on the shoreline do require the refuge staff to invest the time to remove them.

The deer herd has expanded and increased substantially since the Service established the refuge. Prior to refuge establishment, this portion of Carteret County was subject to excessive deer poaching that maintained the deer herd at low levels. Following refuge establishment and initiation of an effective wildlife law enforcement program, the deer herd has increased in and around the refuge. The refuge's marsh and forest habitat provides ideal habitat conditions for white-tailed deer.

The refuge will administer a limited archery hunting season for deer. Harvest management of big game (white-tailed deer) is the art of combining wildlife science and landowner objectives for the attainment of a specific management goal. Refuge hunt plan objectives should determine harvest management strategies. A complete analysis of biological data should determine the objectives. Specific harvest objectives allow the setting of hunting regulations. The refuge staff will thoroughly evaluate the results of each hunting season to ensure that the harvest management program remains dynamic and responsive to an evolving management environment (Bookhout 1994).

Current literature suggests that user take (<50 percent of total mortality) of most upland game is compensatory; that factors such as immigration from adjacent areas and density-dependent production operate in most upland game populations; and that hunting does not substantially impact populations. Hunting is substituted for natural mortality. Production of large, annual surpluses of young allows for lengthy seasons and generous bag limits with little concern for over-harvest and minimal chance of population impacts in most areas (Bookhout 1994).

Harvest management of migratory birds (e.g., ducks and woodcock) is more difficult to assess. Migratory bird regulations are established at the federal level each year following a series of meetings involving both state and federal biologists. Harvest guidelines are based on population survey data with regulations that are subject to change each year, including bag limits, season lengths, and framework dates (Bookhout 1994). Schmidt (1993) states that, in general, all studies have demonstrated a high degree of compensation of hunting mortality by other natural mortality factors for harvest levels experienced to date. He also reports, "...the proportion of waterfowl populations subject to hunting on refuges is very low, thus hunting is not likely to have an adverse impact on the status of any recognized waterfowl population in North America."

The refuge's great variety and abundance of high-quality wetland areas provide outstanding habitat for a variety of wading birds. Wading birds frequent these wetlands and two known rookeries are present on the property. Primary species include the great blue heron, little blue heron, green heron, cattle egret, snowy egret, great egret, anhinga, and night herons (Fish and Wildlife Service 1989). The potential of disturbance, especially during the nesting season, does exist for these rookeries due to the absence of overlap of hunting seasons with nesting season.

Similar to wading birds, the area's habitat for neotropical migratory birds is outstanding. Neotropical migratory birds use the interior hardwood forested areas and edges. Disturbance to these birds will be minimal and temporary, as the staff will alter habitat slightly for the betterment of these species.

Scientists have found threatened and endangered loggerhead sea turtles, piping plovers, red-cockaded woodpecker, West Indian manatees, seabeach amaranth, and rough-leaved loosestrife in Carteret County in the past 20 years. The staff anticipates that the current levels and expected future levels of hunting or other wildlife-dependent recreation activities will not directly, indirectly, or cumulatively impact any listed, proposed, or candidate species or designated or proposed critical habitat. Data gathered from future biological surveys regarding the importance or potential importance of the refuge to threatened or endangered species or critical habitat (or proposed threatened, endangered, or critical habitat), could result in changes to public use activities across time; however, these changes will have no effect on listed species.

Incidental take of other wildlife species, either illegally or unintentionally, may occur with any consumptive use program. At current and anticipated public use levels, incidental take will be very small and will not directly or cumulatively impact current or future populations of wildlife either on this refuge or in the surrounding areas. Implementation of an effective law enforcement program and development of site-specific refuge regulations and special conditions will eliminate most incidental take problems.

Determination (check one below):

Use is Not Compatible

Use is Compatible with Following Stipulations

Use: *Fishing*

Description of Use: The refuge is a mixture of salt marshes, forested wetlands, and upland hardwood and pine forests. The refuge is bordered on the west and north sides by Pamlico Sound and on the east side by Core Sound.

Many of the local residents enjoy an informal, rural lifestyle that includes frequent recreational use of the area's natural resources. Fishing access has been, and continues to be, a popular use of refuge lands.

The comprehensive conservation plan calls for continued fishing access. There are no additional refuge-specific fishing regulations to supplement State regulations. However, there are general regulations that apply to all visitors.

Availability of Resources: Based on a review of the refuge's budget allocated for this activity, there is adequate funding to ensure compatibility and to administer this use at its current level. Most fishing does not actually occur on the refuge but in the adjacent sounds, therefore, law enforcement demands to manage this activity are very limited.

Anticipated Impacts of the Use: Two boat ramps occur on the refuge. These boat ramps receive most of the refuge's fishermen. One of the boat ramps is located along the side of State Highway 12 and the other is at the end of Lola Road, near the refuge office.

A very limited amount of bank fishing occurs adjacent to the boat ramps and along the shoulders of Highway 12, particularly at the culvert for the John Day ditch.

Neither of the boat ramps or bank fishing areas is located in an area where launching or fishing activities would cause significant disturbance to wading birds, waterfowl, or threatened/endangered species.

Determination (check one below):

Use is Not Compatible

Use is Compatible with Following Stipulations

Stipulations Necessary to Ensure Compatibility: The refuge permits fishing in accordance with State of North Carolina regulations and licensing requirements. An Environmental Assessment is on file at the refuge headquarters as part of the Fishing Plan. All fishermen will comply with general visitor regulations.

Justification: Fishing is compatible with the purposes for which the Service established the refuge and the mission of the National Wildlife Refuge System. The 1997 National Wildlife Refuge System Improvement Act specifically identifies fishing as one of the public use recreational activities the Service should allow where possible on refuges.

NEPA Compliance for Refuge Use Description: *Place an X in appropriate space.*

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

Mandatory 10- or 15-year Re-evaluation Date: _____

Wildlife Observation and Photography

Description of Use: Nonconsumptive wildlife observation uses such as birdwatching, hiking, and nature photography are popular due to the area's proximity to the vacation destinations on the Outer Banks in Hyde, Dare, and Currituck Counties, and the Crystal Coast in western Carteret County. A ferry landing from the southern end of the Outer Banks is in the Town of Cedar Island, a few miles from the refuge boundary. Ferry users use North Carolina Highway 12 and travel 5 miles through the refuge. The staff estimates that the refuge has 16,000 visitors per year for wildlife observation and 160 visitors for wildlife observation.

The refuge staff anticipates that an increase to 20,000 visitors for observation and 200 visitors for photography will occur over the next few years as the refuge improves facilities and especially as the public and conservation groups become more aware of the excellent birding and wildlife viewing opportunities on the refuge's marshes and forests.

Availability of Resources: The Service currently has one person, a maintenance worker, headquartered on Cedar Island Refuge. The rest of the staff assigned to the Mattamuskeet, Swanquarter, and Cedar Island National Wildlife Refuges is stationed at the Mattamuskeet Refuge, a 4-hour trip away. There is only one wildlife biologist and no park ranger for public use on that staff. The refuge will add a permanent, full-time refuge manager and biological technician at Cedar Island Refuge to assist with wildlife observation and photography. To provide safe, quality wildlife observation and photography opportunities, the Service will also develop a photography blind and interpretive trail. The management of a volunteer program will be essential to successfully implement the visitor service program. The refuge staff will recruit and train volunteers to assist in developing and implementing wildlife observation and photography programs.

Anticipated Impacts of the Use: Wildlife observation and photography activities might result in some disturbance to wildlife, especially if visitors venture too close to bald eagle nests, colonial nesting bird rookeries, or resting waterfowl in migration. The refuge will prohibit visitors from traveling in areas around nests, rookeries, and managed wetlands. The staff will locate the foot trail and photography blind opened to pedestrian use by the public to minimize disturbance that could occur in these sensitive areas. If the staff identifies unacceptable levels of disturbance at any time, it will close sensitive sites to public entry. Some minimal trampling of vegetation also may occur.

Construction of a foot trail and photography blind and upgrading refuge roads will alter small portions of the natural environment. Proper planning prior to construction, sediment retention, and grade stabilization features will reduce negative impacts to wetlands, threatened and endangered species, and species of special concern. Impacts, such as trampling vegetation and wildlife disturbance by refuge visitors, do occur but are presently not significant. Visitors cause other potential negative impacts by violating refuge regulations such as littering or illegally taking plants or wildlife. Use of refuge roads by the public does incur added maintenance costs.

Determination (check one below):

Use is Not Compatible

Use is Compatible with Following Stipulations

Stipulations Necessary to Ensure Compatibility: Prior to construction, the refuge staff will obtain permits from local, state, and federal regulatory agencies to reduce the possibility of negatively impacting wetlands, cultural resources, or protected species. Law enforcement patrol of public use areas will continue to minimize violations of refuge regulations. The staff will monitor public use for wildlife observation and photography to document any negative impacts. If any negative impacts become noticeable, the Service will take corrective action to reduce or eliminate the effects on wildlife.

Justification: Wildlife observation and photography are an important and preferred public uses on Cedar Island National Wildlife Refuge and the National Wildlife Refuge System. The 1997 National Wildlife Refuge System Improvement Act identified wildlife observation and photography as priority public recreational uses the Service should facilitate on refuges. It is through permitted, compatible public uses such as this, that the public becomes aware of and provides support for our national wildlife refuges.

NEPA Compliance for Refuge Use Description: *Place an X in appropriate space.*

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- _____
- _____
- _____

Mandatory 10- or 15-year Re-evaluation Date: _____

Use: *Environmental Education and Interpretation*

Description of Use: Environmental education and interpretation are those activities that seek to increase the public's knowledge and understanding of wildlife, national wildlife refuges, ecology, and land management, as well as contribute to the conservation of natural resources. The refuge will develop interpretation programs for 1,500 annual users and environmental education programs for 100 annual users. Environmental education and interpretation activities have been largely nonexistent in prior years. Thousands of tourists drive through the refuge annually on their way from the North Carolina ferry landing at Cedar Island to western Carteret County. Many of them stop and are disappointed by the lack of facilities. The Carteret County school system is anxious to utilize the refuge as an outdoor classroom and has expressed a desire for environmental education programs. The refuge staff plans to develop this program with structured activities conducted by refuge staff or trained volunteers. Refuge staff will develop and provide curriculum and support materials to area teachers for use both on and off the refuge. The staff will develop an informational kiosk and interpretive panels at the refuge office and an interpretive trail through the forest behind the refuge office as part of the environmental education and interpretation program.

Availability of Resources: The Service only has one person, a maintenance worker, headquartered on Cedar Island Refuge. The rest of the staff assigned to the Mattamuskeet, Swanquarter, and Cedar Island National Wildlife Refuges is at the Mattamuskeet Refuge, a 4-hour trip away. There is only one wildlife biologist and no park ranger for public use on that staff. The refuge will add a permanent, full-time refuge manager and biological technician at Cedar Island Refuge to assist with environmental education and interpretation. To provide safe, quality wildlife observation and photography opportunities, the Service will also develop an interpretive trail and kiosk. The management of a volunteer program will be essential to successfully implement the visitor service program. The refuge staff will recruit and train volunteers to assist in developing and implementing environmental education and interpretation programs.

Anticipated Impacts of the Use: Construction of facilities such as a kiosk and interpretive trail will alter small portions of the natural environment on the refuge. Proper planning and placement of facilities will ensure that they do not negatively impact wetlands, threatened or endangered species, or species of special concern. The refuge staff will obtain proper permits through the county, state, and federal regulatory agencies prior to construction to ensure resource protection. The use of on-site, hands-on, action-oriented activities to accomplish environmental education and interpretive tours may impose a low-level impact on the sites used for these activities. These low-level impacts may include trampling of vegetation and temporary disturbance to wildlife species in the immediate area. Educational activities held off-refuge will not create any biological impacts on the resource.

Determination (check one below):

Use is Not Compatible

Use is Compatible with Following Stipulations

Stipulations Necessary to Ensure Compatibility: Zoning of visitor activities by time and space, clustering public use facilities, proper monitoring, educating visitors, and enforcement will ensure compatibility with the purposes of the refuge and mission of the National Wildlife Refuge System. Through periodic evaluation of trails and visitor contact points, the visitor services program will assess resource impacts. If the refuge staff determines that human impacts are detrimental to important natural resources, the staff will take actions to reduce or eliminate those impacts. Major portions of the refuge will remain undeveloped, without public interpretive facilities.

Justification: The 1997 National Wildlife Refuge System Improvement Act identified interpretation and environmental education as activities that the Service should provide and expand on refuges. Educating and informing the public through structured environmental education courses, interpretive materials, and guided tours about migratory birds, endangered species, wildlife management, and ecosystems will lead to improved support of the Service's mission to protect our natural resources.

NEPA Compliance for Refuge Use Description: *Place an X in appropriate space.*

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

Mandatory 10- or 15-year Re-evaluation Date: _____

Use: *Trapping of Selected Furbearers for Nuisance Animal Management*

Description of Use: The staff may direct management through trapping of raccoons and nutria. These species are at a sufficiently high level on the refuge to adversely affect ecosystem functions. Excessive numbers of raccoons can have negative effects on the reproduction of sea turtles, forest breeding birds, and wood ducks. Nutria are exotic animals that consume great quantities of marsh grass. Protection and management of habitat and improvements in game and nongame populations are central components of the refuge operation. To this end, trapping and/or hunting remain the only viable methods to reduce population levels of beaver, raccoon, and nutria. The Service will issue Special Use Permits to administer a trapping program consistent with sound biology, refuge purposes, and conservation of ecosystem functions.

Availability of Resources: The Service only has one person, a maintenance worker, headquartered on Cedar Island Refuge. The rest of the staff assigned to the Mattamuskeet, Swanquarter, and Cedar Island National Wildlife Refuges is at the Mattamuskeet Refuge, a 4-hour trip away. There is a refuge manager, assistant manager, wildlife biologist, and law enforcement officer on that staff. The refuge will add a permanent, full-time refuge manager, law enforcement officer, and biological technician at Cedar Island Refuge to assist with Special Use Permit review and enforcement.

Anticipated Impacts of the Use: Targeted removal of raccoon and nutria from portions of the refuge will reduce the negative impacts these species are having on ecosystem functions. Regulated trapping of raccoon populations will reduce the nest predation this species causes to sea turtles, neotropical migratory birds, and wood ducks. Nutria management will protect marsh grass. However, no trapping program, regardless of how well the staff designs it, can prevent the possible take of other species. The refuge staff will require trappers to report the incidental take of other species. There will be a negligible impact on other wildlife species in both the short and long term.

Determination (check one below):

Use is Not Compatible

Use is Compatible with Following Stipulations

Stipulations Necessary to Ensure Compatibility: As the refuge staff implements a trapping program on the refuge, it will monitor the program closely to assess the potential adverse effects on other wildlife, as well as the benefits to game and nongame species and their habitats. The staff will modify the program as needed to maintain compatibility. Trappers will carry out all trapping activities under a refuge Special Use Permit. The staff will limit trappers by number, area, and season in order to target problem areas and minimize any negative impacts. The staff will require each trapper to report the number and location of all traps and all wildlife taken. The implementation of a trapping program, under controlled conditions, provides an essential population control management tool and is compatible with the purposes of the refuge.

Justification: The purposes of Cedar Island National Wildlife Refuge emphasize conservation of wetlands and migratory birds. Trapping is a wildlife population management tool used to regulate the population of certain wildlife species when those species are disrupting ecosystem functions. There is documentation that raccoons cause negative impacts to forested wetlands and nesting birds. Nutria are exotic animals that cause negative impacts on marsh grass. When these negative impacts become significant on the refuge, wildlife managers need trapping as a management tool to control the level of damage. Certainly, the native raccoons are important components of the ecosystem, but when their populations and negative impacts become significant, wildlife managers need a regulated trapping program to reduce their populations to acceptable levels.

NEPA Compliance for Refuge Use Description: *Place an X in appropriate space.*

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- _____
- _____
- _____

Mandatory 10- or 15-year Re-evaluation Date: _____

Use: *Refuge Resource Research Studies*

Description of Use: This activity will allow university students and professors, non-governmental researchers, and government scientists access to the refuge's natural environment to conduct both short-term and long-term research projects. The outcome of this research will result in better knowledge of our natural resources and improved methods to manage, monitor, and protect refuge resources. The refuge will support research by the Fish and Wildlife Service, Geological Survey, and universities to study, survey, and monitor neotropical migrant birds, waterfowl, bottomland hardwood restoration, amphibians and reptiles, forest bats, and yellow-crowned night herons. The refuge would make efforts to expand partnerships with North Carolina State University and other area universities to conduct research on the refuge associated with neotropical migratory songbirds.

Availability of Resources: The refuge needs no additional fiscal resources to conduct this use if it is initiated by the university or agency conducting the research. Existing staff can administer permits and monitor use as part of routine management duties. Research initiated by the refuge will require funding through the Refuge Operations Needs System (RONS), Flex Fund Grants, or USGS Research Grants.

Anticipated Impacts of the Use: There should be no significant negative impacts from scientific research on the refuge. The knowledge gained from the research would provide information to improve management techniques and better meet the needs of trust resource species. Impacts such as trampling vegetation and temporary disturbance to wildlife will occur, but should not be significant. Researchers may collect a small number of individual plants or animals for further study. These collections would have an insignificant effect on refuge plant and animal populations.

Determination (check one below):

Use is Not Compatible

Use is Compatible with Following Stipulations

Stipulations Necessary to Ensure Compatibility. The staff will examine each request for use of the refuge for research on its individual merit. The questions of who, what, when, where, and why will be asked to determine if the requested research will contribute to the refuge purposes and if the researchers can conduct it on the refuge without significantly affecting the resources. If so, the refuge will issue a Special Use Permit to the researcher. The staff will monitor the progress and require the researcher to submit annual progress reports and copies of all publications derived from the research.

Justification. The benefits derived from sound research provide a better understanding of species and the environmental communities present on the refuge. These benefits far outweigh any short-term disturbance or loss of individual plant and animals that might occur.

NEPA Compliance for Refuge Use Description: *Place an X in appropriate space.*

Mandatory 10- or 15-year Re-evaluation Date: _____

Use: *Forest Management Program*

Description of Use: Cedar Island National Wildlife Refuge will initiate a forest management program in accordance with an approved Forest Management Plan. The staff will direct forest management, as described in the comprehensive conservation plan, towards protecting, restoring, and managing the functions and values of the refuge forest to support viable populations of native flora and fauna consistent with sound biological principles.

The refuge staff will inventory and map the entire refuge forest habitat as part of the development of a Forest Management Plan. This plan will provide a comprehensive forest management prescription to achieve forest habitat objectives over a 15-year planning cycle. Forest management prescriptions will include timber stand improvement, commercial timber harvest, and reforestation.

The staff will manipulate forest habitat by commercial timber harvests. Contractors will conduct all harvesting by Special Use Permit and carry it out in accordance with the Refuge Manual. The staff will carry out the sale and disposition of forest products by open market rules and formal bid solicitations.

Availability of Resources: Based on a review of the refuge's staff and budget, there is not adequate staff or funding to ensure compatibility and to administer a forest management program, which consists of thinning, water management, and fire protection. The comprehensive conservation plan proposes a forest management program that will utilize timber harvest to promote the enhancement of habitats for both threatened and endangered species, migratory birds, and resident wildlife; promote habitat restoration; protect cultural resources; and provide opportunities for public recreation and environmental education. Managing the forest will require additional funding and staffing to inventory forest stands, prepare a Forest Management Plan, develop forest prescriptions, and administer timber harvest.

Anticipated Impacts of the Use: It is anticipated that forest habitat management will enhance the existing forest and help restore the functions and values typically associated with bottomland hardwood forest. The refuge staff will direct forest management operations at providing more vertical diversity (i.e., understory, midstory, canopy and superemergent trees) within each forest block in support of the habitat requirements of forest dwelling birds and other resident wildlife.

Forest management will include the use of commercial timber harvest operations that, if not tightly controlled and supervised, have the potential to cause adverse impacts on environmental quality. The controls placed on harvesting operations minimize possible adverse effects caused by logging equipment, such as excessive defacement and negative impacts on surface water quality. However, minimum short-term impacts do occur from harvesting operations, such as actual mechanized operation disturbance to wildlife and trampling of the understory vegetation by equipment. The understory vegetation usually recovers in one growing season and usually is more beneficial to wildlife due to increased density and palatability caused by harvest operations (i.e., decreased competition and increased sunlight reaching the forest floor).

Determination (check one below):

Use is Not Compatible

Use is Compatible with Following Stipulations

Literature Cited

- Bookhout, T.A. 1994. Research and management techniques for wildlife and habitats. Fifth edition. The Wildlife Society, Bethesda, MD 740pp.
- Frost, C. 1995. Presettlement fire regimes in southeastern marshes, peatlands, and swamps. Pages 39-60 in Susan I. Cerulean and R. Todd Engstrom, Eds. Fire in wetlands, a management perspective. Proceedings of the Tall Timbers Fire Ecology Conference, No. 19. Tall Timbers Research Station, Tallahassee, FL.
- Frost, C. 1998. Presettlement fire frequency regimes in the United States: a first approximation. Pages 70-81 in Teresa L. Pruden and Leonard A. Brennan, eds. Fire in ecosystem management: shifting the paradigm from suppression to prescription. Proceedings of the Tall Timbers Fire Ecology Conference, No. 20. Tall Timbers Research Station, Tallahassee, FL.
- Hunter, W.C., L.H. Peoples, and J.A. Collazo. 2001. South Atlantic Coastal Plain Partners in Flight Bird Conservation Plan.
- Schmidt, P.R. 1993. Memorandum - Information request regarding impacts of hunting on national wildlife refuges. U.S. Department of the Interior, Fish and Wildlife Service, Office of Migratory Bird Management, Washington, D.C. 7pp.

Approval of Compatibility Determination

The signature of approval is for all compatibility determinations considered within the comprehensive conservation plan. If the staff considers one of the descriptive uses for compatibility outside of the comprehensive conservation plan, the approval signature becomes part of that determination.

Refuge Manager: _____
(Signature/Date)

**Regional Compatibility
Coordinator:** _____
(Signature/Date)

Refuge Supervisor: _____
(Signature/Date)

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

Appendix VI. Refuge Biota

FLORA BIRDS

Total Species – 270

**Species That Breed Locally*

A = Abundant, C = Common, U = Uncommon, O = Occasional, R = Rare

SPECIES	SPRING	SUMMER	FALL	WINTER
Avocet, American			R	
Bittern, American	C	U	C	C
Bittern, Least*	C	C	C	
Blackbird, Brewer's				R
Blackbird, Red-winged*	A	A	A	A
Blackbird, Rusty				O
Bluebird, Eastern				O
Bobolink	C		C	
Bobwhite, Northern*	U	U	U	U
Brant	O		U	C
Bufflehead	U		U	C
Bunting, Indigo*	O	U	O	
Bunting, Painted*	U	C	U	
Bunting, Snow				R
Canvasback	C		C	A
Catbird, Gray*	C	C	C	U
Cardinal, Northern*	C	C	C	C
Chat, Yellow-breasted*	O		O	R
Chickadee, Carolina*	U	U	C	C
Chuck-will's Widow*	C	C	C	
Cormorant, Double-crested	O	U	O	O
Coot, American	C	O	C	A
Cowbird, Brown-headed*	C	U	C	C
Creeper, Brown				O
Crow, American*	A	A	A	A
Crow, Fish*	C	C	C	C

SPECIES	SPRING	SUMMER	FALL	WINTER
FAUNA (CONTINUED)				
BIRDS (CONTINUED)				
Cuckoo, Black-billed	R		R	
Cuckoo, Yellow-billed	U	C		
Dickcissel		R		
Dove, Ground*	R	R	R	R
Dove, Mourning*	C	C	C	C
Dovekie				R
Dowitcher, Long-billed	R		R	
Dowitcher, Short-billed	O		O	O
Duck, American Black*	C	U	C	A
Duck, Ring-necked	O		O	U
Duck, Ruddy			U	C
Duck, Wood*	U	U	C	C
Dunlin				O
Eagle, Bald (Threatened)	R	R	R	R
Eagle, Golden			R	R
Egret, Cattle*	C	C	C	C
Egret, Common*	C	C	C	C
Egret, Snowy*	O	U	U	O
Falcon, Peregrine				R
Finch, Purple				U
Flicker, Northern*	C	U	C	C
Flycatcher, Acadian*	U	C	U	
Flycatcher, Great Crested*	C	C		
Flycatcher, Trali's	R		R	
Flycatcher, Yellow-bellied			R	
Gadwall	U	R	C	C
Gallinule, Common*	U	U	U	U
Gallinule, Purple		U	U	
Gannet, Northern			O	U
Gnatcatcher, Blue-gray*	O	O	O	R
Godwit, Marbled	R		R	
Goldeneye, Common	U		U	C
FAUNA (CONTINUED)				

SPECIES	SPRING	SUMMER	FALL	WINTER
BIRDS (CONTINUED)				
Goldfinch, American				U
Goose, Canada	U		C	A
Goose, Snow	O		O	U
Grackle, Boat-tailed*	C	C	C	C
Grackle, Common*	C	C	C	A
Grebe, Pied-billed	U		C	C
Grebe, Red-necked				R
Grosbeak, Blue		O		
Grosbeak, Evening				R
Grosbeak, Rose-breasted	R		R	
Gull, Bonaparte's				O
Gull, Great Black-backed			U	C
Gull, Herring	U	O	U	C
Gull, Laughing*	C	A	C	R
Gull, Ring-billed	U	U	U	C
Harrier, Northern*	C	C	C	C
Hawk, Broad-winged			O	
Hawk, Cooper's*	O	O	O	O
Hawk, Red'-shouldered*	U	U	U	U
Hawk, Red-tailed*	U	U	U	C
Hawk, Rough-legged				R
Hawk, Sharp-shinned*	C		C	C
Heron, Black-crowned Night*	U	U	U	U
Heron, Great Blue*	C	C	C	C
Heron, Green*	C	C	C	R
Heron, Little Blue*	C	C	C	R
Heron, Louisiana*		U	U	
Heron, Yellow-crowned Night		R		
Hummingbird, Ruby-throated*	C	C	C	
Ibis, Glossy	O	O		
Ibis, White		R		
Jay, Blue	R	R	R	R
FAUNA (CONTINUED)				
BIRDS (CONTINUED)				

SPECIES	SPRING	SUMMER	FALL	WINTER
Junco, Dark-eyed			R	U
Kestrel, American*	C	U	U	C
Killdeer*	U	U	U	C
Kingbird, Eastern*	C	C	U	
Kingfisher, Belted*	C	C	C	C
Kinglet, Golden-crowned				U
Kinglet, Ruby-crowned	U		U	C
Knot, Red	O	R	O	
Lark, Horned				R
Loon, Common	C	U	C	C
Loon, Red-throated				R
Mallard	U	U	C	A
Martin, Purple*	C	A		
Meadowlark, Eastern*	C	C	C	C
Merganser, Common	U		U	C
Merganser, Hooded	U		U	C
Merganser, Red-breasted	C	R	U	A
Merlin				U
Mockingbird, Northern*	C	C	C	C
Nighthawk, Common*	U	U	U	
Nuthatch, Brown-headed*	C	C	C	C
Nuthatch, Red-breasted			R	R
Nuthatch, White-breasted				U
Oldsquaw				U
Oriole, Orchard	U	U		
Osprey*	C	C	U	R
Ovenbird	R		R	
Owl, Barn*	U	U	U	C
Owl, Barred*	C	C	C	C
Owl, Eastern Screech*	C	C	C	C
Owl, Great Horned*	C	C	C	C
Owl, Short-eared				R
FAUNA (CONTINUED)				
BIRDS (CONTINUED)				
Oystercatcher, American*	C	C	C	C

SPECIES	SPRING	SUMMER	FALL	WINTER
Parula, Northern*	C	C	C	
Pelican, American White		R		
Pelican, Brown*	O	O	O	O
Petrel, Wilson's		R		
Phalarope, Northern	R		R	
Phalarope, Red	R		R	
Phoebe, Eastern*	U	R	U	C
Pintail, Northern	C		A	A
Pipit, American Water				U
Plover, American Golden	R		R	
Plover, Black-bellied	U	O	U	U
Plover, Piping	U	O	U	
Plover, Semipalmated	U	O	U	
Plover, Upland	R		R	
Plover, Wilson's	U	O	U	
Rail, Black*	C	C	C	C
Rail, Clapper*	C	C	C	C
Rail, King*	O	U	U	O
Rail, Virginia*	U	U	C	C
Rail, Yellow				O
Redhead	U		C	A
Redstart, American	U		U	
Robin, American	U		C	A
Sanderling	U	U	U	U
Sandpiper, Buff-breasted	R		R	
Sandpiper, Least	U		U	
Sandpiper, Pectoral	R		R	
Sandpiper, Purple				R
Sandpiper, Semipalmated	U	U	U	
Sandpiper, Solitary	C		C	
Sandpiper, Spotted	C		C	
FAUNA (CONTINUED)				
BIRDS (CONTINUED)				
Sandpiper, Stilt	R		R	
Sandpiper, Western	R		R	

SPECIES	SPRING	SUMMER	FALL	WINTER
Sandpiper, White-rumped	R		R	
Sapsucker, Yellow-bellied				C
Scaup, Greater				C
Scaup, Lesser	C		C	A
Scoter, Common			R	U
Scoter, Surf			R	U
Scoter, White-winged				R
Shearwater, Audubon's		R		
Shearwater, Sooty		R		
Shoveler, Northern	O		O	U
Shrike, Loggerhead				O
Siskin, Pine				O
Skimmer, Black*	C	C	C	
Snipe, Common			U	C
Sora		U	U	U
Sparrow, Bachman's*	R	O	R	
Sparrow, Chipping		O		
Sparrow, Field*	C	C	C	C
Sparrow, Fox				O
Sparrow, Grasshopper				O
Sparrow, Henslow's				R
Sparrow, House*	C	C	C	C
Sparrow, Saltmarsh Sharp-tailed				C
Sparrow, Savannah	U		U	C
Sparrow, Seaside*	C	U	C	C
Sparrow, Song	U		U	C
Sparrow, Swamp	U		U	C
Sparrow, Vesper				U
Sparrow, White-crowned			U	U
Sparrow, White-throated	U		U	C
FAUNA (CONTINUED)				
BIRDS (CONTINUED)				
Starling, European*	C	C	C	C
Stork, Wood		O		
Swallow, Bank	R		R	

SPECIES	SPRING	SUMMER	FALL	WINTER
Swallow, Barn	R	U	R	
Swallow, Cliff	R		R	
Swallow, Northern Rough-winged		C		
Swallow, Tree	U		U	C
Swan, Tundra	O		C	A
Swift, Chimney*	C	C	C	
Tanager, Summer		O		
Teal, American Green-winged	C		A	A
Teal, Blue-winged	C		C	C
Tern, Black		U	O	
Tern, Caspian*	O	O	O	
Tern, Common*	O	C		
Tern, Forster's	O	O	R	
Tern, Gull-billed	R	O		
Tern, Least*	U	C	U	
Tern, Royal*	U	C	U	
Tern, Sandwich		R		
Thrasher, Brown*	U	C	U	O
Thrush, Gray-cheeked	R		R	
Thrush, Hermit	U	U	C	
Thrush, Swainson's	O		O	
Thrush, Wood*	U	U	U	
Titmouse, Tufted*	U	U	U	U
Towhee, Rufous-sided*	C	C	C	C
Turnstone, Ruddy	R		R	
Veery	U		U	
Vireo, Philadelphia	R		R	
Vireo, Red-eyed*	C	C	C	
Vireo, Solitary			O	U
FAUNA (CONTINUED)				
BIRDS (CONTINUED)				
Vireo, White-eyed*	C	C	C	
Vireo, Yellow-throated	R			
Vulture, Black*	U	U	U	U
Vulture, Turkey*	C	C	C	C

SPECIES	SPRING	SUMMER	FALL	WINTER
Warbler, Black-and-White			U	R
Warbler, Black-throated Blue	O		O	
Warbler, Black-throated Gray	R		R	
Warbler, Black-throated Green	O		O	
Warbler, Blackpoll	O		O	
Warbler, Canada	R		R	
Warbler, Cape May	R		R	
Warbler, Cerulean	R		R	
Warbler, Connecticut	R		R	
Warbler, Hooded*	U	U		
Warbler, Kentucky		O		
Warbler, Magnolia	R		R	
Warbler, Mourning			R	
Warbler, Nashville	R		R	
Warbler, Orange-crowned			O	R
Warbler, Palm			O	R
Warbler, Pine*	U	U	U	U
Warbler, Prairie*	C	C		
Warbler, Prothonotary*	C	C		
Warbler, Swainson's	R			
Warbler, Tennessee			R	
Warbler, Worm-eating	R			
Warbler, Yellow	O	O		
Warbler, Yellow-rumped*	A		U	A
Warbler, Yellow-throated*	C	C	U	
Waterthrush, Louisiana		O		
Waterthrush, Northern	O		O	
Waxwing, Cedar				C
FAUNA (CONTINUED)				
BIRDS (CONTINUED)				
Whimbrel	O		O	
Whip-poor-will*	U	U	U	
Wigeon, American*	U		C	C
Willet*	C	C	C	O
Woodcock, American*	O	O	U	C

SPECIES	SPRING	SUMMER	FALL	WINTER
Woodpecker, Downy*	U	U	U	C
Woodpecker, Hairy*	U	U	U	U
Woodpecker, Pileated*	O	O	O	O
Woodpecker, Red-bellied*	C	C	C	C
Woodpecker, Red-headed*	C	C	C	C
Wood-pewee, Eastern*	U	C	U	
Wren, Carolina*	U	U	C	C
Wren, House	U	U	U	O
Wren, Long-billed Marsh*	A	A	A	A
Wren, Short-billed Marsh				O
Wren, Winter				O
Yellow-throat, Common*	C	C	C	C
Yellowlegs, Greater	C	C	C	O
Yellowlegs, Lesser	C	C	C	O

COMMON NAME	SCIENTIFIC NAME
FAUNA (CONTINUED)	
MAMMALS	
Bat, Big Brown	<i>Eptesicus fuscus</i>
Bat, Eastern Pipistrelle	<i>Pipistrelle subflavus</i>
Bat, Eastern Red	<i>Lasiurus borealis</i>
Bat, Evening	<i>Nycticeius humeralis</i>
Bat, Hoary	<i>Lasiurus cinereus</i>
Bat, Northern Yellow	<i>Lasiurus intermedius</i>
Bat, Rafinesque's Big-Eared	<i>Corynorhinus rafinesquii</i>
Bat, Seminole	<i>Lasiurus seminolus</i>
Bat, Silver-Haired	<i>Lasionyctens noctivagans</i>
Cottontail, Eastern	<i>Sylvilagus floridanus</i>
Deer, White-tailed	<i>Odocoileus virginianus</i>
Fox, Grey	<i>Urocyon cinereogreus</i>
Mink	<i>Mustela vison</i>
Mole, Eastern	<i>Scalopus aquaticus</i>
Mouse, Cotton	<i>Peromyscus gossypinus</i>
Mouse, Eastern Harvest	<i>Reithrodontomys humilis</i>
Mouse, House	<i>Mus musculus</i>

COMMON NAME	SCIENTIFIC NAME
FAUNA (CONTINUED)	
MAMMALS	
Mouse, White-footed	<i>Peromyscus leocopus</i>
Muskrat	<i>Ondathra zibethicus</i>
Nutria (Exotic)	<i>Myocastor coypus</i>
Opossum	<i>Didelphiidae virginiana</i>
Otter, River	<i>Lutra canadensis</i>
Rabbit, Marsh	<i>Sylvilagus palustris</i>
Raccoon	<i>Procyon lotor</i>
Rat, Marsh Rice	<i>Oryzomys palustris</i>
Rat, Norway (Exotic)	<i>Rattus norvegicus</i>
Shrew, Least	<i>Crytotis parva</i>
Shrew, Shorttail	<i>Blarina brevicauda</i>
Shrew, Southeastern	<i>Sorex longerosytris</i>
Squirrel, Eastern Grey	<i>Sciurus carolinensis</i>
Vole, Meadow	<i>Microtus pennsylvanicus</i>
Cooter, Florida	<i>Chrysemys floridana floridana</i>
Loggerhead, Atlantic	<i>Caretta caretta caretta</i>
Mudturtle, Eastern	<i>Kinosternon subrubrum subrubrum</i>
Stinkpot	<i>Sternotherus odoratus</i>
Turtle, Chicken	<i>Deirochelys reticularia</i>
Turtle, Eastern box	<i>Terrapeme carolina carolina</i>
Turtle, Eastern Painted	<i>Chrysemys picta picta</i>
Turtle, Green Sea	<i>Chelonia mydas</i>
Turtle, Kemp's Ridley Sea	<i>Lepidochelys kempii</i>
Turtle, Red-bellied	<i>Chrysemys rubiventris</i>
Turtle, Snapping	<i>Chelydra serpentine</i>
Turtle, Spotted	<i>Clemmys guttata</i>
Turtle, Yellow-bellied	<i>Chrysemys scripta scripta</i>
FAUNA (CONTINUED)	
SNAKES	
Copperhead, Southern	<i>Agkistrodon contortrix</i>
Cottonmouth, Eastern	<i>Agkistrodon piscivorus</i>
Racer, Northern Black	<i>Coluber constrictor constrictor</i>
Rattlesnake, Canebrake	<i>Crotalus horridus atricaudatus</i>

COMMON NAME	SCIENTIFIC NAME
FAUNA (CONTINUED)	
MAMMALS	
Snake, Black Rat	<i>Elaphe obsoleta obsoleta</i>
Snake, Brown Water	<i>Nerodia taxispilota</i>
Snake, Coastal Plain Milk	<i>Lampropeltis triangulum</i>
Snake, Corn	<i>Elaphe guttata guttata</i>
Snake, Eastern Garter	<i>Thamnophis sirtalis sirtalis</i>
Snake, Eastern hognose	<i>Heterodon platyrhinos</i>
Snake, Eastern King	<i>Lampropeltis getulus getulus</i>
Snake, Eastern Mud	<i>Farancia abacura abacura</i>
Snake, Eastern Ribbon	<i>Thamnophis sauritus sauritus</i>
Snake, Eastern Smooth Earth	<i>Virginia valeriae</i>
Snake, Eastern Woods	<i>Carphophis amoenus amoenus</i>
Snake, Northern Brown	<i>Storeria dekayi dekayi</i>
Snake, Northern Scarlet	<i>Cemophora coccinea copei</i>
Snake, Northern Water	<i>Nerodia sipedon sipedon</i>
Snake, Pine Woods	<i>Rhadinae flavilata</i>
Snake, Rainbow	<i>Farancia erythrogram</i>
Snake, Red-Bellied	<i>Storeria occipitomaculata</i>
Snake, Red-Bellied Water	<i>Nerodia erythrogaster erythrogaster</i>
Snake, Rough Earth	<i>Virginia striatulla</i>
Snake, Rough Green	<i>Opheodrys aestivus</i>
Snake, Southern Ringneck	<i>Diadophis punctatus punctatus</i>
Amphiuma, Two-toed	<i>Amphiuma means</i>
Newt, Red-Spotted	<i>Notophthalmus viridescens viridescens</i>
Salamander, Eastern Mud	<i>Pseudotriton montanus montanus</i>
Salamander, Many-Lined	<i>Stereochilus marginatus</i>
Salamander, Marbled	<i>Ambystoma opacum</i>
Salamander, Red-Backed	<i>Plethodone cinereus cinereus</i>
Salamander, Slimy	<i>Plethodone glutinosus glutinosus</i>
Salamander, Souther Dusky	<i>Desmognathus auriculatus</i>
Salamander, Spotted	<i>Ambystoma muculatum</i>
Siren, Greater	<i>Siren lacertian</i>

COMMON NAME	SCIENTIFIC NAME
FAUNA (CONTINUED)	
MAMMALS	
Waterdog, Dwarf	<i>Necturus punctatus</i>
LIZARDS	
Anole, Green (Carolina Anole)	<i>Anolis carolinensis</i>
Lizard, Fence	<i>Sceloporus undulatus hyacinthinus</i>
Lizard, Slender Glass	<i>Ophisaurus attenuatus</i>
Racerunner, Six-Lines	<i>Cnemidophorus sexlineatus</i>
Skink, Ground	<i>Leiopisma laterale</i>
Skink, Five-Lined	<i>Eumeces fasciatus</i>
Skink, Broad-Headed	<i>Eumeces laticeps</i>
Skink, Southeastern Five-Lined	<i>Eumeces inexpectatus</i>
FROGS AND TOADS	
Bullfrog	<i>Rana catesbeiana</i>
Frog, Brimley's Chorus	<i>Pseudacris brimleyi</i>
Frog, Carpenter	<i>Rana virgatipes</i>
Frog, Gray Tree	<i>Hyla chrysoscelis (diploid form)</i>
Frog, Gray Tree	<i>Hyla versicolor (polyploid form)</i>
Frog, Green	<i>Rana clamitans melanota</i>
Frog, Green tree	<i>Hyla gratiosa</i>
Frog, Northern Cricket	<i>Acris crepitans crepitans</i>
Frog, Northern Cricket	<i>Hyla crucifer crucifer</i>
Frog, Pickerel	<i>Rana palustris</i>
Frog, Pine Woods Tree	<i>Hyla femoralis</i>
Frog, Southern Cricket	<i>Acris gryllus gryllus</i>
Frog, Southern Leopard	<i>Rana utricularia</i>
Frog, Squirell Tree	<i>Hyla squirella</i>
Frog, Upland Chorus	<i>Pseudacris triseriata feriarum</i>
Grog, Little Grass	<i>Limnaoedus ocularis</i>
Peeper, Northern Spring	<i>Hyla cinera cinera</i>
Spadefoot, Eastern	<i>Scaphiopus holbrooki holbrooki</i>
Toad, Eastern Narrow-Mouthed	<i>Gastrophryne carolinensis</i>
Toad, Fowlers	<i>Bufo woodhousei fowleri</i>
Toad, Oak	<i>Bufo quercicus</i>
Toad, Southern	<i>Bufo terrestris</i>

COMMON NAME	SCIENTIFIC NAME
FAUNA (CONTINUED)	
MAMMALS	
FISH	
Alewife	<i>Alosa pseudoharengus</i>
Anchovy, Bay	<i>Anchoa mitchilli</i>
Bass, Largemouth	<i>Micropterus salmoides</i>
Bass, Spotted	<i>Micropterus punctulatus</i>
Bass, Striped	<i>Morone saxatilis</i>
Bluegill	<i>Lepomis macrochirus</i>
Bowfin	<i>Amia calva</i>
Bullhead, Black	<i>Ictalurus melas</i>
Bullhead, Brown	<i>Ictalurus nebulosis</i>
Bullhead, Yellow	<i>Ictalurus natalis</i>
Carp	<i>Cyprinus carpio</i>
Catfish, Channel	<i>Ictalurus punctatus</i>
Catfish, White	<i>Ictalurus catus</i>
Chubsucker, Lake	<i>Erimzon sucetta</i>
Crappie, Black	<i>Pomoxis nigromaculatus</i>
Croaker, Atlantic	<i>Micropogon undulatus</i>
Drum, Red	<i>Sciaenps ocellata</i>
Drum, Star	<i>Stellifer lanceolatus</i>
Eel, American	<i>Anguilla rstrata</i>
Fish, Lady	<i>Elops saurus</i>
Flier	<i>Centrarchus marcopterus</i>
Flounder, Southern	<i>Paralichthys lethostigma</i>
Flounder, Summer	<i>Paralichthys dentatus</i>
Gar, Longnose	<i>Lepisosteus osseus</i>
Goby, Darter	<i>Gobionellus boleosoma</i>
Goby, Naked	<i>Bogiosoma bosci</i>
Herring, Blueback	<i>Alosa aestivalis</i>
Killifish, Banded	<i>Fundulus diaphanus</i>
Killifish, Marsh	<i>Fundulus confluentus</i>
Madtom, Tadpole	<i>Noturus gyrinus</i>
Menhaden, Atlantic	<i>Brevoortia tyrannus</i>
Mullet, Striped	<i>Mugil cephalus</i>

COMMON NAME	SCIENTIFIC NAME
FAUNA (CONTINUED)	
MAMMALS	
Mullet, White	<i>Mugil curema</i>
Perch, Silver	<i>Bairdiella chrysura</i>
Perch, White	<i>Morone americana</i>
Perch, Yellow	<i>Perca flavescens</i>
Pickerel, Chain	<i>Esox niger</i>
Pickerel, Redfin	<i>Esox americans</i>
Pinfish	<i>Lagodon rhomboides</i>
Pipefish, Gulf	<i>Syngnathus scovelli</i>
Pumpkinseed	<i>Lepomis gibbosus</i>
Seatrout, Spotted	<i>Cynoscion nebulosus</i>
Shad, American	<i>Alosa sapidissima</i>
Shad, Gizzard	<i>Dorosoma cepedianum</i>
Shiner, Golden	<i>Notemigonus crysoleucas</i>
FISH	
Silverside, Tidewater	<i>Menidia beryllina</i>
Snapper, Gray	<i>Lutjanus griseus</i>
Spot	<i>Leiostomus xanthurus</i>
Sunfish, Bluespotted	<i>Enneacanthus gloriosus</i>
Warmouth	<i>Lepomis gulosus</i>
INSECTS	
Beatles, Whirligig	<i>Gyrinus sp.</i>
Beetle, Burrowing Water	<i>Suphisellus sp.</i>
Beetle, Water Scavenger	<i>Berosus sp.</i>
Beetle, Water Scavenger	<i>Derallus altus</i>
Bluets	<i>Enallagma durum</i>
Boatman, Water	<i>Corixa sp.</i>
Caddisflies	<i>Lepotoceridae</i>
Casemakers, Longhorned	<i>Oecetis sp.</i>
Damselfly, Common Blu	<i>Enallagma sp.</i>
Fork-Tail, Common	<i>Ischnura verticalis</i>
Mayfly	<i>Baetidae</i>
Midge	<i>Polypedium sp.</i>

COMMON NAME	SCIENTIFIC NAME
FAUNA (CONTINUED)	
MAMMALS	
Midge	<i>Tanytarsus sp.</i>
Pirate, Blue	<i>Pachydiplax longipennis</i>
Punkies, No-see-ums	<i>Palpomyia sp.</i>
Scorpion, Water	<i>Ranatra so.</i>
Waterscorpions	<i>Anax junius</i>
	<i>Arthripsodes sp.</i>
	<i>Coelotanypus concinnus</i>
	<i>Collotanypus sp.</i>
	<i>Corethra sp.</i>
	<i>Cryptochironomus sp.</i>
	<i>Paracymus nanus</i>
	<i>Prodladius sp.</i>
	<i>Tendipes riparius</i>
	<i>Tendipes sp.</i>
	<i>Triaenodes sp.</i>
	<i>Uvarus sp.</i>

COMMON NAME	SCIENTIFIC NAME
FLORA	
TREES	
Baldcypress	<i>Taxodium distichum</i>
Bay, Sweet	<i>Magnolia virginiana</i>
Cedar, Eastern Red	<i>Juniperus virginiana</i>
Cherry, Black	<i>Prunus serotina</i>
Dogwood, Flowering	<i>Cornus florida</i>
Holly, American	<i>Ilex opaca</i>
Locust, Black	<i>Robinia pseudo-acacia</i>
Oak, Laurel	<i>Quercus laurifolia</i>
Oak, Live	<i>Quercus virginiana</i>
Oak, Water	<i>Quercus nigra</i>
Oak, Willow	<i>Quercus phellos</i>
Persimmon, Common	<i>Diospyros virginiana</i>
Pine, Loblolly	<i>Pinus taeda</i>
Pine, Longleaf	<i>Pinus palustris</i>
Pine, Pond	<i>Pinus serotina</i>
Sweetgum	<i>Liquidambar styraciflua</i>
Tree, Toothache	<i>Zanthoxylum clava-herculis</i>
Tupelo, Swamp	<i>Nyssa sylvatica var. biflora</i>
Willow, Black	<i>Salix nigra</i>
Willow, Coastal Plain, Ward's, Swamp	<i>Salix caroliniana</i>
SHRUBS	
Bay, Red	<i>Persea borbonia</i>
Bayberry, Northern	<i>Myrica pensylvanica</i>
Blackberry, Serrate'Leaf	<i>Rubus argutus</i>
Blackberry, Sand	<i>Rubus cuneifolius</i>
Blueberry, Black Highbush	<i>Vaccinium atrococcum</i>
Blueberry, Elliott's	<i>Vaccinium ellioti</i>
Elder, Marsh	<i>Iva imbricata</i>
Elderberry, American	<i>Sambucus canadensis</i>
Fetterbush, Swamp	<i>Leucothoe racemosa</i>
Groundsel Tree, High Tide Bush	<i>Baccharis halimifolia</i>
FLORA (continued)	

COMMON NAME	SCIENTIFIC NAME
Holly, Yaupon	<i>Ilex vomitoria</i>
Huckleberry, Squaw	<i>Vaccinium stamineum</i>
Rose, Swamp	<i>Rosa palustris</i>
Shadbush, Serviceberry	<i>Amelanchier canadensis</i>
Sumac, Winged	<i>Rhus copallina</i>
Waxmyrtle	<i>Myrica cerifera</i>
WOODY VINES	
Creeper, Virginia	<i>Parthenocissus quinquefolia</i>
Grape, Mascadine	<i>Vitis rotundifolia</i>
Grape, Pigeon	<i>Vitis cinerea var. floridana</i>
Greenbrier, Cat	<i>Smilax gluca</i>
Greenbrier, Common	<i>Smilax rotundifolia</i>
Greenbrier, Ear-leaf	<i>Smilax auriculata</i>
Greenbrier, Laurel-Leaf	<i>Smilax laurifolia</i>
Greenbrier, Saw	<i>Smilax bona-nox</i>
Honeysuckle, Coral	<i>Lonicera sempervirens</i>
Ivy, Poison	<i>Rhus radicans</i>
Vine, Pepper	<i>Ampelopsis arborea</i>
FORBS (BROADLEAF HERBACEOUS PLANTS)	
Arrowhead, Awl-leaf	<i>Sagittaria subulata</i>
Arrowhead, Bulltongue	<i>Sagittaria falcata</i>
Aster, Slender	<i>Aster tenuifolius</i>
Beach Heath	<i>Hudsonia tomentosa</i>
Bean, Wild	<i>Strophostyles helvola</i>
Bedstraw, Catchweed	<i>Galium aparine</i>
Beggarticks, Smooth	<i>Bidens laevis</i>
Buttercup, Celery-Leaf	<i>Ranunculus sceleratus</i>
Cactus	<i>Opuntia compressa</i>
Camphor Weed	<i>Pluchea purpurascens</i>
Cherry, Ground	<i>Physalis visocosa ssp. maritima</i>
Chickweed, Mouse-Ear	<i>Cerastium vicosum</i>
Cocklebur, Rough	<i>Xanthium strumarium</i>
Cranesbill, Carolina	<i>Geranium carolinianum</i>
FLORA (continued)	
FORBS (BROADLEAF HERBACEOUS PLANTS) (continued)	

COMMON NAME	SCIENTIFIC NAME
Cress, Bitter	<i>Cardamine hirsuta</i>
Cucumber, Creeping	<i>Melothria pendula</i>
Cudweed, Narrow-Leaf	<i>Gnaphalium purpureum</i> var. <i>falcatum</i>
Daisy Fleabane	<i>Erigeron canadensis</i>
Daisy, False	<i>Eclipta alba</i>
Dandelion, Dwarf	<i>Krigia virginica</i>
Dock, Water	<i>Rumex verticillatus</i>
Dog Fennel, Small	<i>Eupatorium capillifolium</i>
Dropwort, Water	<i>Oxypolis rigidior</i>
Duckweed, Minute	<i>Lemna perpusilla</i>
Duckweed, Greater	<i>Spirodela polythiza</i>
Elephant's Foot	<i>Elephantopus nudatus</i>
Feather, Parrot	<i>Myriophyllum brasiliense</i>
Fimbry, Forked	<i>Fimbristylis dichotoma</i>
Goldenrod, Aniscented	<i>Solidago odora</i>
Goldenrod, Seaside	<i>Solidago sempervirens</i>
Goldentop, Slender	<i>Euthamia tenuifolia</i>
Grasswort, Carolina	<i>Lilaeopsis carolinensis</i>
Grasswort, Eastern	<i>Lilaeopsis chinensis</i>
Grounel, Woolly	<i>Senecio tomentosus</i>
Hemlock, Poison	<i>Cicuta maculata</i>
Hempweed, Climbing	<i>Mikania scandens</i>
Horehound, Water	<i>Lycopus virginicus</i>
Hyssop, Water	<i>Bacopa monnieri</i>
Jessamine, Yellow	<i>Gelsemium sempervirens</i>
Lobelia, Downy	<i>Lobelia puberula</i>
Loosestrife, False	<i>Ludwigia alternifolia</i>
Mallow, Seashore	<i>Kosteletzkya virginica</i>
Milfoil, Water	<i>Myriophyllum exalbescens</i>
Monarda, Dotted	<i>Monarda punctata</i>
Morningglory, Saltmarsh	<i>Ipomoea sagittata</i>
Mudflower, Shade	<i>Micranthemum umbrosum</i>
FLORA (continued)	
FORBS (BROADLEAF HERBACEOUS PLANTS) (continued)	
Mudwort, Awl-leaf	<i>Limosella subulata</i>

COMMON NAME	SCIENTIFIC NAME
Pearlwort, Trailing	<i>Sagina decumbens</i>
Pennywort, Many-Flower	<i>Hydrocotyle umbellata</i>
Pennywort, Floating	<i>Hydrocotyle ranunculoides</i>
Pennywort, False	<i>Centella asiatica</i>
Pickerelweed	<i>Pontederia cordata</i>
Pimpernel, Water	<i>Samolus parviflorus</i>
Pink, Sea	<i>Sabatia stellaris</i>
Pinweed, Hairy	<i>Lechea mucrontha</i>
Pinweed, Leggett's	<i>Lechea pulchella</i>
Plantain, Pale Seed	<i>Plantago virginica</i>
Pondweed, Leafy	<i>Potamogeton foliosus</i>
Pondweed, Sago	<i>Potamogeton pectinatus</i>
Pondweed, Claspig-Leaf	<i>Potamogeton perfoliatus</i>
Pondweed, Bushy	<i>Najas flexilis</i>
Pondweed, Horned	<i>Zannichellia palustris</i>
Pondweeds	<i>Najas spp.</i>
Primrose, Evening	<i>Oenothera humifusa</i>
Primrose, Evening	<i>Oenothera laciniata</i>
Purslane, Water	<i>Ludwigia palustris</i>
Rabbit Tobacco	<i>Gnaphalium obtusifolium</i>
Ragweed, Annual	<i>Ambrosia artemisiifolia</i>
Redstem, Pink	<i>Ammania teres</i>
Rocket, American Sea	<i>Cakile edentula</i>
Rocket, Harper's Sea	<i>Cakile harperi</i>
Salad, Corn	<i>Valerianella radiata</i>
Sandmat, Seaside	<i>Chamaesyce polygonifolia</i>
Smartweed, Dotted	<i>Polygonum punctatum</i>
Sorrel, Sheep	<i>Rumex hastatulus</i>
St. Andrews Cross	<i>Hypericum stragalum</i>
Starwort, Water	<i>Callitriche heterophylla</i>
Tea, Mexican	<i>Chenopodium ambrosioides</i>
FLORA (continued)	
FORBS (BROADLEAF HERBACEOUS PLANTS) (continued)	
Thistle, Russian	<i>Salsola kali</i>
Thistle, Yellow	<i>Cirsium horridulum</i>

COMMON NAME	SCIENTIFIC NAME
Thoroughwort	<i>Eupatorium pilosum</i>
Toadflax	<i>Linaria canadensis</i>
Tresses, Ladies	<i>Spiranthes vernalis</i>
Violet, Bog White	<i>Viola lanceolata</i>
Watercress	<i>Nasturtium officinale</i>
Weed, Mermaid	<i>Proserpinaca palustris</i>
Wild Sensitive Plant	<i>Cassia nictitans</i>
Wintergreen, Spotted	<i>Chimaphila maculata</i>
Wort, St. Johns	<i>Hypericum hypericoides</i>
Yarrow, Common	<i>Achillea millefolium</i>
GRASSES	
Beachgrass, American	<i>Ammophila breviligulata</i>
Bluegrass, Annual	<i>Poa annua</i>
Bluestem, Little	<i>Schizachyrium scoparium</i>
Broomsedge	<i>Andropogon virginicus</i>
Cordgrass, Big	<i>Spartina cynosuroides</i>
Cordgrass, Saltmeadow	<i>Spartina patens</i>
Cutgrass, Rice	<i>Leersia oryzoides</i>
Deertongue	<i>Dichanthelium clandestinum</i>
Eelgrass	<i>Vallisneria americana</i>
Grass, American Cupscale	<i>Sacciolepis striata</i>
Grass, Blue-eyed	<i>Sisyrinchium mucronatum</i>
Grass, Wigeon	<i>Ruppia maritima</i>
Grass, Yellow-eyed	<i>Xyris difformis</i>
Grass, Yellow-eyed	<i>Xyris jupicai</i>
Maidencane	<i>Panicum hemitomom</i>
Orangegrass	<i>Hypericum gentianoides</i>
Panicum, Bitter	<i>Panicum amarum</i>
Panicum, Fall	<i>Panicum dichotomiflorum</i>
Plumegrass, Sugarcane	<i>Saccharum giganteum</i>
FLORA (continued)	
GRASSES (continued)	
Reed, Common	<i>Phragmites australis</i>
Saltgrass, Seashore	<i>Distichlis spicata</i>
Sandspur	<i>Cenchrus tribuloides</i>

COMMON NAME	SCIENTIFIC NAME
Sawgrass, Jamaica	<i>Cladium jamaicense</i>
Seaots	<i>Uniola paniculata</i>
Switchgrass	<i>Panicum virgatum</i>
Woodsats, Slender	<i>Chasmanthium laxum</i>
GRASSLIKE PLANTS	
Beakrush, Clustered	<i>Rhynchospora glomerata</i>
Beakrush, Loosehead	<i>Rhynchospora chalorocephala</i>
Bulrush, Softstem	<i>Scirpus validus</i>
Cattail, Common	<i>Typha latifolia</i>
Cattail, Narrow-leaf	<i>Typha angustifolia</i>
Cattail, Southern	<i>Typha domingensis</i>
Flatsedge, Slender	<i>Cyperus fillicinus</i>
Rush, Turnflower	<i>Juncus biflorus</i>
Rush, Black Needle	<i>Juncus roemerianus</i>
Rush, Leathery	<i>Juncus coriaceus</i>
Rush, Soft	<i>Juncus effusus</i>
Sedge, Japanese	<i>Carex kobomugi</i>
Spikerush, Blunt	<i>Eleocharis obtusa</i>
Spikerush, Dwarf	<i>Eleocharis parvula</i>
Spikerush, Small-Fruit	<i>Elocharis microcarpa</i>
Spikerush, Yellow	<i>Eleocharis flavescens</i>
Threesquare, Common	<i>Scirpus americanus</i>
Threesquare, Olney	<i>Scirpus olneyi</i>
MOSS	
Moss, Spanish	<i>Tillandsia usneoides</i>

Appendix VII. Priority Bird Species and their Habitats

Species	Status	Habitat			
		Brackish Marsh and Sounds	Maritime Shrub and Swamp Forest	Beach, Dune Grass and Dry Grassland	Pine Forests and Savannas
Red-cockaded Woodpecker	FL				X
Sharp-tailed Sparrow	SC	X			
Seaside Sparrow	SC	X			
Black Rail	SC	X			
Yellow Rail	SC	X			
King Rail	SC	X			
Sedge Wren	SC	X			
Reddish Egret	SC	X			
Canada Goose	SC	X			
American Black Duck	SC	X			
Northern Parula	SC		X		
Prairie Warbler	SC		X		
Eastern Painted Bunting	SC		X		
Yellow-throated Warbler	SC		X		
Wood Duck	SC		X		
Piping Plover	FL			X	
Roseate Tern	FL			X	
Red Knot	SC			X	
Wilson's Plover	SC			X	
Least Tern	SC			X	
Black Skimmer	Sc			X	
American Oystercatcher	SC			X	

(FL=Federally-listed, SL=State-listed, SC=Species of Management Concern)

Appendix VIII. Budget Requests

Refuge Operation Needs System (RONS) Projects

Projects are ordered by project number; the first two digits of which stand for the fiscal year the project was developed. The numbers are listed in the management alternatives.

Projects are listed as tier 1 projects that support approved critical mission or approved minimum staff or as tier 2 projects that do not.

Project ranks are listed for Cedar Island National Wildlife Refuge. There are also projects proposed for Mattamuskeet and Swanquarter National Wildlife Refuges that will support the administration of Cedar Island National Wildlife Refuge.

Project 97007

First Year Request \$65,000, Recurring Request \$53,000

Station Rank - 4 (Cedar Island NWR Tier 1)

This project will provide the funding to hire a forestry technician to develop and implement a Forest Management Plan for the 14,480-acre refuge. The Service does not currently actively manage the refuge's forestland, which includes longleaf pine savannas, pond pine woodlands, wet pine flatwoods, maritime swamp forests, and bay forests. It does conduct prescribed burning in the pine forests according to a Fire Management Plan. A forestry technician will oversee the development of a management plan. After plan approval, the forestry technician will help implement the plan to improve forested areas on the refuge for the benefit of migratory songbirds, black bear, white-tailed deer, and other resident wildlife. This position will also assist with forest and fire management activities on nearby Mattamuskeet and Swanquarter Refuges. The management plan will cover approximately 9,000 total acres of forestland on all three refuges.

Project 97013

First Year Request \$65,000, Recurring Request \$53,000

Station Rank - 1 (Cedar Island NWR Tier 1)

This project will provide the funding to hire a biological technician to assist a wildlife biologist with overseeing and conducting habitat and wildlife management programs on the 14,480-acre refuge. One maintenance worker currently staffs the refuge. The manager of Mattamuskeet National Wildlife Refuge, which is located four hours away, administers the Cedar Island Refuge. The refuge provides a diversity of estuarine (a highly productive coastal area where seawater mixes with freshwater) and upland habitats (from brackish marsh to pine savanna forest) for a variety of waterfowl (black duck, redhead duck), shorebirds (endangered piping plover, least tern), and many species of commercially and environmentally important fish, shellfish, and crabs. A biological technician is needed to conduct essential habitat and wildlife management programs on the refuge to include surveys, vegetative surveys, aquatic surveys, prescribed fire, and law enforcement. This position will be required to have collateral law enforcement authority. The refuge and local area have a history of illegal activities that have resulted in wildlife resource poaching, destruction and vandalism of facilities, and unsafe conditions for visitor use.

Project 00004

First Year Request \$65,000, Recurring Request \$79,000

Station Rank - 2 (Cedar Island NWR Tier 1)

This project will provide the funding to hire a refuge manager to enhance the management and protection of the 14,480-acre refuge. One maintenance worker currently staffs the refuge. It is administered by Mattamuskeet National Wildlife refuge, which is located 4 hours away. The refuge provides a diversity of estuarine (a highly productive coastal area where seawater mixes with freshwater) and upland habitats (from brackish marsh to pine savanna forest) for a variety of waterfowl (black duck, redhead duck), shorebirds (endangered piping plover, least tern), and many species of commercially and environmentally important fish, shellfish, and crabs. The overall management, day-to-day operations, and protection of the refuge's facilities and resources will substantially improve with this position. A refuge manager will provide the daily professional guidance needed for biological and maintenance activities, public relations and visitor services, and law enforcement and resource protection at this isolated station.

Project 00008

First Year Request \$32,500, Recurring Request \$22,000

Station Rank - 3 (Cedar Island NWR Tier 1)

This project will provide the funding to hire a visitor service specialist (environmental interpretation specialist) to enhance and increase the public use, recreational, interpretive, environmental education, and outreach programs on the 14,480-acre refuge. Even though this coastal refuge is relatively isolated, it gets about 107,500 annual visitors from the surrounding community, nearby population centers, and tourists to the Outer Banks to the north and mainland Carteret County to the west. These visitors engage in fishing, crabbing, waterfowl hunting, and wildlife observation. This position is vitally important to create good public relations and to gain the support of the local community and schools for refuge programs and resources. This position will help develop and maintain an interpretive and wildlife observation trail on the Lola and Bayland units of the refuge. The visitor services specialist will also assist with public use programs at Mattamuskeet and Swanquarter Refuges.

Project 00010

First Year Request \$65,000, Recurring Request \$54,000

Station Rank - 5 (Cedar Island NWR Tier 1)

This project will provide the funding to hire a heavy equipment operator to enhance fire management operations on the 14,480-acre refuge. Located near an isolated coastal community, the refuge is administered by Mattamuskeet National Wildlife Refuge, which is located 4 hours away. The addition of a heavy equipment operator with primary duties for firefighting and prescribed fire activities will enhance fire management on the refuge. Prescribed fire is important for managing the refuge's diversity of coastal and upland habitats (from 11,000 acres of brackish marsh to 3,500 acres of maritime, shrub, and pine forests). A variety of waterfowl (black duck, redhead duck), shorebirds (endangered piping plover, least tern), and many species of commercially and environmentally important fish, shellfish, and crabs (which use the brackish marsh as nursery habitat) benefit from the refuge's fire management program. This position will enhance the program by developing and maintaining fire breaks, training and certifying others to operate bulldozers during wildfire suppression, operating a truck-tractor to transport fire equipment and supplies, and performing preventive and routine maintenance on equipment and vehicles. This position will also operate heavy equipment and perform maintenance in support of other refuge programs.

Project 00011

First Year Request \$380,000, Recurring Request \$45,000

Station Rank - 1 (Cedar Island NWR Tier 2)

This project will provide the funding to purchase and maintain firefighting equipment and a storage building to protect the equipment. The equipment will improve the refuge's capability to conduct prescribed burns, engage in fire pre-suppression programs, and respond to wildlife suppression activities. The refuge does not have the proper equipment to support an effective fire management program. The required equipment includes truck-tractor with a trailer to transport equipment, a medium sized crawler tractor, fire plow, portable pumps, and a well-supplied fire cache. The equipment will also support fire management activities at Mattamuskeet and Swanquarter Refuges and the Cherry Point Marine Corps Air Station.

Project 00012

First Year Request \$65,000, Recurring Request \$53,000

Station Rank - 6 (Cedar Island NWR Tier 1)

This project will provide the funding to hire a wildlife biologist to coordinate and enhance the habitat and wildlife management programs on the 14,480-acre refuge. Located near an isolated coastal community, the refuge is administered by Mattamuskeet National Wildlife Refuge, which is located 4 hours away and is responsible for the 16,400-acre Swanquarter National Wildlife Refuge. A wildlife biologist is needed to enhance the refuge's habitat and wildlife management programs by conducting wildlife and vegetation surveys, monitoring the effects of prescribed fire, and coordinating research studies with universities and other agencies and organizations. The refuge provides a diversity of estuarine (a highly productive coastal area where seawater mixes with freshwater) and upland habitats (from 11,000 acres of brackish marsh to 3,500 acres of maritime, shrub, and pine forests) for a variety of waterfowl (black duck, redhead duck), shorebirds (endangered piping plover, least tern), and many species of commercially and environmentally important fish, shellfish, and crabs. The biological program capabilities will be increased and improved with the addition of this position.

Project 00018

One Time Request \$100,000

Station Rank - 3 (Cedar Island NWR Tier 2)

This project will provide the funding to contract out a comprehensive cultural resource survey and literature background search. A limited cultural resource survey was done in 1980. This survey concentrated on potential development sites. The remaining areas of the refuge have never been surveyed. An intensive survey is needed to complete the cultural resource inventory. The information is needed to protect areas of significant cultural importance.

Project 03001

One Time Request \$30,000

Station Rank - 2 (Cedar Island NWR Tier 2)

This project will provide the funding to design and construct a waterfowl exhibit in the Core Sound Waterfowl Museum. An exhibit will be an excellent outreach and educational item that will reach a large segment of the public visiting the Museum and the Cape Lookout National Seashore. The Museum is located approximately 30 miles south of Cedar Island National Wildlife Refuge in a new 20,000-square-foot facility next to the Cape Lookout National Seashore visitor center/office building on Harkers Island. A Cedar Island National Wildlife Refuge Public Use Review in 2000 recommended the placement of a Fish and Wildlife Service exhibit in the new facility. The Outreach Committee of the Roanoke-Tar-Neuse-Cape Fear Ecosystem is also interested in placing an exhibit in the Museum. The Harkers Island community has a strong waterfowl hunting and decoy making tradition.

**Cedar Island National Wildlife Refuge
Refuge Operation Needs System (RONS) Projects Listed by Station Rank**

Station Rank/ Tier	Project Number	Cost (First Year, Recurring)	Positions	Project Title
1/1	97013	\$118K (\$65K, \$53K)	1.0	Improve Habitat and Wildlife Management Programs (Biological Technician)
2/1	00004	\$144K (\$65K, \$79K)	1.0	Improve Refuge Management and Protection (Refuge Manager)
3/1	00008	\$54.5K (\$32.5K, \$22K)	1.0	Improve Recreational and Interpretive Opportunities and Activities (Park Ranger – Interpretation)
4/1	97007	\$118K (\$65K, \$53K)	1.0	Develop and Implement a Forest Management Plan (Forestry Technician)
5/1	00010	\$119K (\$65K, \$54K)	1.0	Improve Fire Management Capabilities (Heavy Equipment Operator)
6/1	00012	\$118K (\$65K, \$53K)	1.0	Improve Biological Programs (Wildlife Biologist)
1/2	00011	\$425K (\$380K, \$45K)		Improve Fire Management Capabilities
2/2	03001	\$30K (\$30K, \$0K)		Design and Construct an Exhibit in the Core Sound Waterfowl Museum
3/2	00018	\$100K (\$100K, \$0K)		Conduct Cultural Resource Survey
Unranked	Not Entered	\$138K (\$80K, \$68K)	1.0	Improve Law Enforcement (Park Ranger – Law Enforcement)

MAINTENANCE MANAGEMENT SYSTEM (MMS) PROJECTS

Projects are ordered by the project number the first two digits of which stand for fiscal year the project was developed. The numbers are listed in the management alternatives.

Projects ranks are listed for Cedar Island National Wildlife Refuge. There are also projects proposed for the Mattamuskeet and Swanquarter Refuges that will support the administration of Cedar Island National Wildlife Refuge.

Project Number	Project Name	Year Planned	Cost	Station Rank	Type of Project
90008	Rehabilitate Lola Road Boat Ramp and Parking Area	2003	\$21,000	7	Deferred Maintenance
93012	Repair and Paint Exterior Surfaces of Concrete Block Building	2003	\$8,000	4	Deferred Maintenance
98001	Replace Kiosk	2003	\$47,000	5	Deferred Maintenance
98003	Rehabilitate Lola Road Boat Dock	2003	\$48,000	8	Deferred Maintenance
98004	Replace Road Gates	2003	\$36,000	1	Deferred Maintenance
98005	Rehabilitate Field Office/Work Center	2003	\$229,000	3	Deferred Maintenance
01001	Remove Storage Building	2005	\$108,000	2	Deferred Maintenance
02002	Rehabilitate Public Use Roads and Associated Parking Lots	2010	\$100,000	N/A	Deferred Maintenance
03001	Design and Construct an Exhibit for the Core Sound Waterfowl Museum	2010	\$30,000	N/A	New Construction