Lower Florida Keys National Wildlife Refuges

Comprehensive Conservation Plan

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

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COMPREHENSIVE CONSERVATION PLAN

LOWER FLORIDA KEYS REFUGES

National Key Deer Refuge
Key West National Wildlife Refuge
Great White Heron National Wildlife Refuge

Monroe County, Florida

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

Southeast Region
Atlanta, Georgia

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Executive Summary

The U.S. Fish and Wildlife Service (Service) prepared this Comprehensive Conservation Plan (CCP) to guide the management of three national wildlife refuges in the Florida Keys, as mandated by the National Wildlife Refuge System Improvement Act of 1997. The refuges include Key West, Great White Heron, and National Key Deer Refuges. These refuges are administered as a complex and headquartered on Big Pine Key, Monroe County, Florida. These refuges, known as the "Lower Florida Keys Refuges" are a collection of low-lying, subtropical islands between the Gulf of Mexico and the Atlantic Ocean that protect all the vital habitats representative of the Florida Keys ecosystem, including the globally imperiled pine rockland and tropical hardwood hammock. These geologically and climatically distinct islands provide a haven for a diversity of native flora and fauna, including endemic, threatened, endangered and candidate species. The CCP outlines management strategies and corresponding resource needs for the next 15 years to protect, enhance, and restore the natural diversity and integrity of the ecological landscapes of the Lower Florida Keys Refuges, and provides unique opportunities for research and compatible wildlife-dependent recreational uses in cooperation with our partners. Specifically, the CCP will be implemented through the funding and initiation of 19 projects as outlined in Chapter V of the CCP. Five new staff positions are proposed to take on new work and projects. They are shown in Table 6 and Figure 9 of Chapter V of the CCP.

Before the Service began planning, it conducted a biological review of the refuge complex's wildlife and habitat management program and a visitor services review of its outreach and environmental education and interpretation programs. An interagency team of government partners and public scoping meetings were held in 2005, to solicit opinions on the priority resource issues the CCP should address. The team subsequently developed and analyzed three alternatives to address these issues. Public meetings were held in Big Pine Key and Key West in 2008, to solicit public reaction to the proposed alternatives presented in a Draft Comprehensive Conservation Plan and Environmental Assessment.

The CCP provides a description of the environment and priority resource issues that were considered in developing the objectives and strategies that guide management over the next 15 years. It promotes the enhancement of wildlife populations by maintaining and enhancing a diversity and abundance of habitats for native plants and animals, especially imperiled species that are only found in the Florida Keys. Many of the objectives and strategies are designed to maintain and restore native plant communities and ensure the biological integrity across the landscape. Strategies are designed to restore and maintain the fire-dependent pine rocklands and to enhance habitat features of selected salt marsh transition and freshwater wetland communities that benefit priority species in the National Key Deer Refuge. Prescribed fire and mechanical or manual vegetation treatments will be used as habitat management tools to reduce wildland fuels and enhance habitat diversity where appropriate. Research and monitoring will provide essential information for implementing an adaptive management approach to strategic landscape conservation, providing flexibility in management strategies in order to incorporate new information and changing environmental conditions. This CCP also provides for obtaining baseline data and monitoring indicator species to detect changes in ecosystem diversity and integrity related to climate change.

Since a primary purpose of the refuges is to provide sanctuary for nesting and migratory birds, protection from human disturbance will be enhanced, particularly at colonial nesting bird rookeries and at beach habitats in the backcountry islands of the Key West and Great White Heron Refuges.

Additional limitations to public use may be implemented in sensitive beach areas important for shorebirds, terns, sea turtles, and butterflies as needed. Ongoing research to identify causal reasons for the marked, long-term decline in the great white heron nesting population, as well as studies on the impacts of sea level rise on wading birds, will be expanded.

Exotic plant control will continue as an ongoing operation within the refuges in order to maintain the natural integrity of habitats and to prevent new infestations. Cooperative efforts will be sought to control seed sources from private lands and to increase coordinated mapping and monitoring of areas with known infestations. Control of invasive exotic animals through an integrated predator management program will be implemented for the benefit of threatened and endangered species.

A primary focus of the visitor services program is to enhance environmental education and outreach efforts through existing venues and expanded partnerships to reach a diversity of local residents, businesses, students, educators, and visitors. This CCP focuses on increasing public awareness, understanding, and support for the refuges' conservation mission. It places priority on wildlife-dependent recreational uses, such as wildlife observation and wildlife photography. Non-wildlife dependent forms of recreation, such as beach picnicking and sunbathing, will be limited or restricted in sensitive areas. Awareness efforts will be expanded to inform visitors about protecting wilderness values. The construction of a new visitor center on U.S. Highway 1 on Big Pine Key is proposed to enhance the Service's ability to inform and educate the public about the unique fish and wildlife resources of the Lower Florida Keys Refuges.

The CCP calls for the development of 11 step-down management plans in specific program areas, such as visitor services and fire management. Much of the implementation of the CCP will be done through the development and approval of these plans. Some will provide opportunities for additional public review and comment. The CCP will be assessed yearly. It will be used and implemented through the development of annual work plans and budgets. At 5-year intervals, or as needed, the CCP will be assessed for revision. If major changes are not warranted or needed, the CCP will be revised within 15 years.

I. Background

INTRODUCTION

The Florida Keys National Wildlife Refuge Complex is comprised of four refuges situated in the Florida Keys (Figure 1). Crocodile Lake National Wildlife Refuge (NWR) is located at the northern end of the Florida Keys near Key Largo, Florida. The Lower Florida Keys Refuges are physically separated from Crocodile Lake NWR. This group of three refuges, National Key Deer Refuge, Key West National Wildlife Refuge (NWR), and Great White Heron National Wildlife Refuge (NWR), is situated between the city of Marathon and the Marquesas Keys, which are located west of Key West, Florida (Figure 2). The U.S. Fish and Wildlife Service (Service) developed the Lower Florida Keys Refuges' Comprehensive Conservation (CCP) to guide management and resource conservation for these three refuges over the next 15 years. The refuge complex is managed as a whole with administrative headquarters at National Key Deer Refuge on Big Pine Key, Florida. One CCP document has been prepared for the three Lower Florida Keys Refuges. This CCP contains background information on the refuges and presents a description of the planning process and the desired future conditions. The CCP states the refuges' vision, goals, and management actions necessary to achieve these goals and conditions.

Guiding the development of the CCP is Part 602 (National Wildlife Refuge System Planning) of the Fish and Wildlife Service Manual and the National Wildlife Refuge System Improvement Act of 1997. An overriding consideration reflected in this CCP is that fish and wildlife conservation has first priority in refuge management. All public use of refuges must be compatible with the purposes for which each refuge was established. The Improvement Act specifies six priority wildlife-dependent uses: hunting, fishing, wildlife observation, wildlife photography, and environmental education and interpretation. Except for hunting, these uses are allowed in specified areas of the Lower Florida Keys Refuges.

The refuges will consult with Ecological Services prior to implementation of any plans or actions identified in the CCP due to the potential to affect federally listed species and federal candidate species. Specifically, section 7(a)(2) of the Endangered Species Act (ESA) requires federal agencies to consult with the Service to ensure that actions they fund, authorize, permit, or otherwise carry out will not jeopardize the continued existence of any listed species or adversely modify designated critical habitats. Section 7(a)(1) of the ESA charges federal agencies to aid in the conservation of listed species.

The major issues addressed in this CCP include the complexity of managing geographically scattered islands and lands with mixed ownership and jurisdiction; changing public attitudes, needs and demands; habitat fragmentation; climate change; fire management; lack of ecological inventorying and monitoring; recovery of imperiled species; invasive exotic species; and staffing and facility needs. Based on these issues, three alternatives were identified for managing the refuges as outlined in the environmental assessment (EA). From these alternatives, the Service selected a preferred alternative, which is described in Chapter IV of this CCP. Implementation of the preferred management action is discussed in Chapter V.

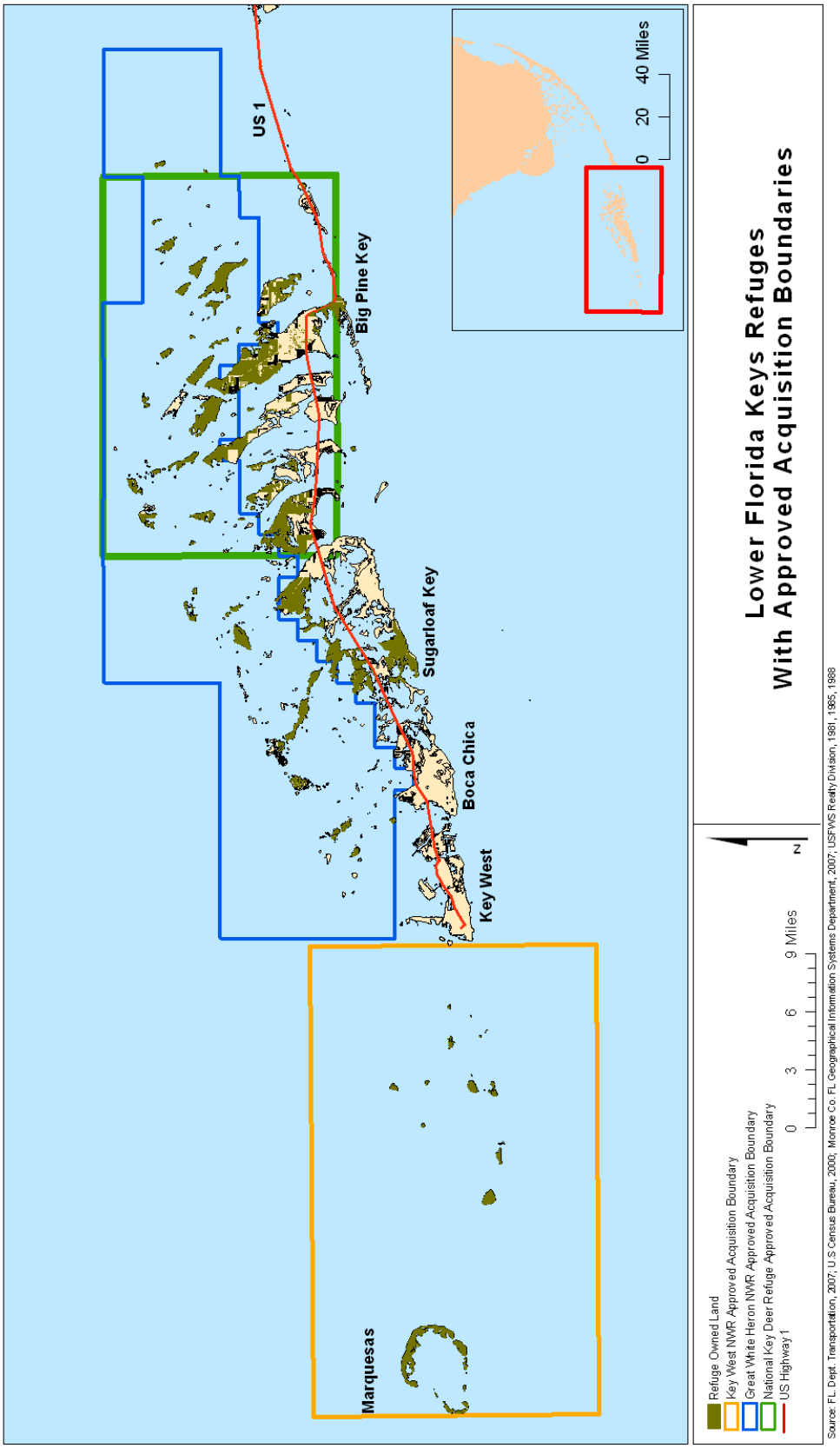
PURPOSE AND NEED FOR THE PLAN

The purposes of this CCP are to identify the role these refuges will have in support of the mission of the National Wildlife Refuge System (Refuge System) and to provide guidance in refuge management and public use activities. This CCP describes the Service's management direction (i.e., goals, objectives, and strategies) for the next 15 years.

Figure 1. Florida Keys Refuges

Source: FL. Dept. Transportation, 2007; U.S Census Bureau, 2000

Figure 2. Boundaries of Lower Florida Keys Refuges



The CCP:

- Provides a clear statement regarding future management of the refuges;
- Provides refuge neighbors, visitors, and government officials and other stakeholders with an understanding of the Service's management actions on and around the refuges;
- Ensures that refuge management actions are consistent with the purposes of the refuges and the mandates of the Refuge System;
- Provides long-term guidance and continuity for refuge management; and
- Provides a basis for the development of budget requests relative to the refuges' operational, maintenance, and capital improvement needs.

U.S. FISH AND WILDLIFE SERVICE

The U.S. Fish and Wildlife Service is the primary federal agency responsible for conserving, protecting, and enhancing the Nation's fish and wildlife populations and their habitats. Although the Service shares this responsibility with other federal, state, tribal, local, and private entities, it has specific trustee responsibilities for migratory birds, federally listed threatened and endangered species, anadromous fish, certain marine mammals, and the lands and waters administered by the Service for the management and protection of these resources.

NATIONAL WILDLIFE REFUGE SYSTEM

The National Wildlife Refuge System, managed by the U.S. Fish and Wildlife Service, is the world's premier system of public lands and waters set aside to conserve America's fish, wildlife and plants. Since President Theodore Roosevelt designated Florida's Pelican Island as the first wildlife refuge in 1903, the Refuge System has grown to more than 150 million acres, 550 national wildlife refuges and other units of the Refuge System, plus 37 wetland management districts. Most of these lands are in Alaska, with only about 20 percent situated within the other 49 states. There are also extensive waters within island territories designated as National Monuments in the Western Pacific Ocean. The Service manages 28 national wildlife refuges in Florida (Figure 3) that comprise approximately 964,992 land and water acres.

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." The Improvement Act establishes wildlife conservation as the primary mission of the Refuge System.

National wildlife refuges provide important habitat for native plants and many species of mammals, birds, fish, amphibians, reptiles, insects, and other invertebrates. They also play a vital role in the recovery of threatened and endangered species. Refuges offer a wide variety of wildlife-dependent recreational opportunities, and many have visitor centers, interpretive trails, and environmental education programs. In 2006, approximately 87 million people hunted, fished, or observed wildlife, and spent $120 billion pursuing those activities (USFWS and Census Bureau 2007).

Figure 3. Florida National Wildlife Refuges

Source: FL. Dept. Transportation, 2007; U.S. Census Bureau, 2000

LEGAL AND POLICY CONTEXT

Legal Mandates and Administrative and Policy Guidelines

Administration of national wildlife refuges is guided by the mission and goals of the Refuge System, congressional legislation, executive orders, and international treaties. Policies for management options of refuges are further refined by administrative guidelines established by the Secretary of the Interior and by policy guidelines established by the Director of the Fish and Wildlife Service. Select legal summaries of laws relevant to administration of the Refuge System and management of the Lower Florida Keys Refuges are provided in Appendix C.

Biological Integrity, Diversity, and Environmental Health Policy

The Improvement Act directs the Service to ensure that the biological integrity, diversity, and environmental health of the Refuge System are maintained for the benefit of present and future generations of Americans. The policy is an additional directive for refuge managers to follow while achieving refuge purpose(s) and the Refuge System's mission. It provides for the consideration and protection of the broad spectrum of fish, wildlife, and habitat resources found on refuges and associated ecosystems. When evaluating the appropriate management direction for refuges, refuge managers will use sound professional judgment to determine their refuges' contribution to biological integrity, diversity, and environmental health at multiple landscape scales. Sound professional judgment incorporates field experience, knowledge of refuge resources, ecosystem management, applicable laws, and best available science, including consultation with others both inside and outside the Service.

NATIONAL AND INTERNATIONAL CONSERVATION PLANS AND INITIATIVES

North American Bird Conservation Initiative

Begun in 1999, the North American Bird Conservation Initiative is a continent-wide coalition of government agencies, private organizations, academic institutions, and industry leaders in the United States, Canada, and Mexico, working to ensure the long-term health of North America's native bird populations by fostering an integrated approach to bird conservation to benefit all birds in all habitats. The Lower Florida Keys Refuges support the following: North American Waterfowl Management Plan; Partners in Flight Bird Conservation Plan; Southeastern Coastal Plain and Caribbean Region Shorebird Conservation Plan; and Southeastern Coastal Plain Colonial Waterbird Conservation Regional Plan.

North American Waterfowl Management Plan

Since the first European settlers arrived, more than 53 percent of the contiguous United States' original 221 million acres of wetlands have been destroyed, causing dramatic declines in waterfowl populations. Recognizing the importance of waterfowl and wetlands to North Americans, and the need for international cooperation to help in the recovery of this shared resource, the United States and Canadian governments developed a strategy to restore waterfowl populations to levels of the 1970s through habitat protection, restoration, and enhancement. The strategy was documented in the North American Waterfowl Management Plan, signed in 1986 by the Secretary of the Interior and the Canadian Minister of the Environment. With an update in 1994, Mexico became a signatory to the plan.

The plan identified important waterfowl habitat areas and established habitat and population goals. It developed interstate/international partnerships called Joint Ventures to implement plan goals. In 1997, the Atlantic Coast Joint Venture added Florida as its seventeenth state partner.

Partners in Flight Bird Conservation Plan

The Partners in Flight initiative was launched in 1990 in response to growing concerns about declines in the populations of many land bird species, particularly migratory passerines, for which no coordinated management was in place. It addresses the conservation of birds not covered by other conservation programs. The central premise of Partners in Flight is that the resources of public and private organizations in North and South America must be combined, coordinated, and increased in order to achieve success in conserving bird populations in this hemisphere. The Service is a member of the cooperative effort to promote research, land protection, and education about migratory birds. Other participants include federal, state, and local government agencies, philanthropic foundations, professional organizations, conservation groups, industry, the academic community, and private individuals.

The Partners in Flight initiative focuses on species that breed in the Nearctic (North America) and spend the winter in the Neotropics (Central and South America). These species are commonly known as neotropical migratory birds. Partners in Flight coordinates international conservation efforts for all neotropical migratory land birds in the United States and the Western Hemisphere. The goal of the initiative is to keep common birds common.

Southeastern Coastal Plain and Caribbean Region Shorebird Conservation Plan

The Southeastern Coastal Plain and Caribbean Region Shorebird Conservation Plan correlates roughly to the Partners in Flight initiative. It identifies priority species, outlines potential and present threats to shorebirds and their habitats, reports gaps in knowledge relevant to shorebird conservation, and makes recommendations for addressing identified problems. General habitat goals for the region are to: (1) Provide optimal breeding habitat for priority species; (2) provide high-quality managed habitat that supports the requirements of species migrating through or spending winter in the region; and (3) maintain human disturbances at tolerable levels for shorebirds throughout the year.

Southeastern Coastal Plain Colonial Waterbird Conservation Plan

The Southeastern Coastal Plain Colonial Waterbird Conservation Plan follows the same format as the previous two bird conservation plans, with a focus on herons, ibises, storks, seabirds, and their habitats. Through public-use-area closures and habitat protection, the Service provides important wintering habitat for 22 priority conservation species included in the plan. The refuges have regionally important habitats, such as intertidal seagrass, algal and mudflats, salt ponds, and beaches.

Important Bird Areas

All three refuges are designated as Important Bird Areas (IBA). Worldwide, there are 3,500 sites. The American Bird Conservancy identified the top 500 sites within the United States. For a site to be designated, it must, for at least part of a year, contain habitat that supports one of the following criterions: (1) A major population of a threatened and/or endangered; (2) a notable population of watch list species; (3) a population of a species with a limited range; or (4) large aggregations of breeding, migrating, or wintering birds, including waterfowl, seabirds, wading birds, raptors, or landbirds. The goal of the IBA program is to create public awareness of these sites and to obtain resources to protect them.

II. Refuges Overview

INTRODUCTION

DESCRIPTION OF REFUGES AND HISTORY OF THEIR ESTABLISHMENT

KEY WEST NATIONAL WILDLIFE REFUGE

Key West National Wildlife Refuge (Key West NWR) is among the first refuges established in the United States. President Theodore Roosevelt created the refuge in 1908 as a preserve and breeding ground for colonial nesting birds and other wildlife, during the period when widespread plume hunting was devastating bird populations throughout Florida. Key West NWR is west of Key West, Florida, and accessible only by boat. Key West NWR consists of the Marquesas Keys and 13 other keys distributed across over 375 square miles of open water (Figure 2). The refuge encompasses 208,308 acres of land and water, with only 1 percent (2,019 acres) being land. Most islands are dominated by mangrove plant communities. Exceptions are the hardwood hammock in the Marquesas Keys and the beaches and dunes there and on Boca Grande and Woman Keys. All islands lack freshwater and native, terrestrial mammals are absent.

Key West NWR provides habitat and protection for federally listed species, including piping plover and roseate terns. The refuge harbors the largest wintering population of piping plovers and the largest colony of white-crowned pigeons in the Florida Keys. It is a haven for over 250 species of birds, including 10 wading bird species that nest in the refuge. Other notable imperiled species include the Miami blue butterfly and sea turtles. Waters within the refuge's administrative boundaries are important developmental habitat for green, loggerhead, and hawksbill turtles. More loggerhead and green sea turtle nests are found each year in Key West NWR than any area of the Florida Keys except for the Dry Tortugas.

In 1975, Public Law 93-632 designated all islands in Key West NWR (except Ballast Key, which is privately owned) as a part of the National Wilderness Preservation System. Wilderness areas are managed to minimize human impacts and influences and to let natural processes occur without intervention. The refuge limits human use and influence in order to preserve the quality, character, and integrity of these protected wilderness lands. The Service co-manages the open water and submerged lands owned by the State of Florida through a Management Agreement for Submerged Lands within Boundaries of the Key West and Great White Heron NWRs (Management Agreement). Adopted in 1992, the Management Agreement prohibits the use of personal watercraft, airboats, waterskiing, hovercrafts, and the landing of seaplanes within the administrative boundary of the refuge, and it restricts public access in certain locations in order to protect sensitive wildlife resources.

GREAT WHITE HERON NATIONAL WILDLIFE REFUGE

Great White Heron National Wildlife Refuge (Great White Heron NWR) was established in 1938, by Executive Order 7993 signed by President Roosevelt, as a haven for great white herons, migratory birds, and other wildlife. The refuge encompasses 117,720 acres of land and water with 6,300 acres of land (Figure 2), of which 1,900 acres of land were designated Wilderness in 1975 under Public Law 93-632. While the islands are primarily mangroves, some of the larger islands contain pine rockland and tropical hardwood hammock habitats. This vast area, known locally as the "backcountry," provides critical nesting, feeding, and resting areas for more than

250 species of birds. As noted above, the Service co-manages the open water and submerged lands owned by the State of Florida through a Management Agreement.

Great white herons are a white color-phase of great blue herons. In the United States, nesting is restricted to extreme south Florida, including the Florida Keys. The refuge was created to protect great white herons from extinction since the population was decimated by the demand for feathered hats. Protection of great white herons was successful, and these magnificent birds can be observed feeding on tidal flats throughout the refuge. The refuge islands are also used for nesting by 10 wading bird species, including the reddish egret and many neotropical migratory bird species.

Three species of sea turtles rely on the backcountry for feeding and nesting. Green and loggerhead sea turtles successfully nest in the refuge. Hawksbill sea turtles are known to feed in seagrass beds throughout the refuge, but nesting has not been observed. Data are lacking on the frequency of Kemp's ridley turtles in the Great White Heron NWR, but this rare species is likely a sporadic visitor.

NATIONAL KEY DEER REFUGE

National Key Deer Refuge was established on August 22, 1957 to protect and conserve Key deer and other wildlife resources. It comprises 84,834 acres with nearly 8,983 acres of land on several islands within the approved acquisition boundary, as well as additional parcels located outside the boundary administered by the refuge (Figure 2). These lands host diverse habitats, most notably globally endangered tropical hardwood hammocks and pine rocklands. The refuge provides habitat for hundreds of endemic and migratory species, including 21 federally listed species, such as Key deer, Lower Keys marsh rabbit, and silver rice rat. It contains a variety of plants endemic to the Florida Keys.

When the refuge was established, the Key deer was nearing extinction. Less than 50 deer remained as a result of uncontrolled hunting. Establishment of the refuge, along with habitat acquisition and law enforcement efforts, has allowed the deer population to increase and stabilize. Today, there are about 600 Key deer located on Big Pine and No Name Keys, with around 100 more located on surrounding islands. Key deer continue to be classified as endangered because the population is isolated and confined to a small geographic area, which could allow a disease outbreak or hurricane to wipe out the entire species.

The refuge is an important stopping point for thousands of migrating birds each year and an important wintering ground for many North American bird species. Notable species include the piping plover and the peregrine falcon. The mosaic of upland and wetland habitats found in the Florida Keys is critical breeding and feeding ground for birds, and refuge land acquisition efforts strive to add to the lands already protected.

Loggerhead, green, and hawksbill turtles forage in the waters surrounding National Key Deer Refuge, but nesting is limited to refuge lands on Ohio Key, where a small number of loggerhead turtle nests occur annually. Data are lacking on the frequency of Kemp's ridley turtles in this refuge, but this rare species is likely a sporadic visitor.

REFUGE PURPOSES

The purposes of the refuges come from the executive orders and subsequent laws Congress passed as it established each refuge. There are also specific purposes Congress designated for managing the Refuge System as a whole. Each of the three refuges has different enabling legislation and purposes. This CCP has been designed with consideration of the distinct purposes of each refuge. The purposes of the refuges are as follows:

KEY WEST NATIONAL WILDLIFE REFUGE

- "... a preserve and breeding ground for native birds." Executive Order 923 dated August 8, 1908.

- "... particular value in carrying out the national migratory bird management program." 16 U.S.C. 667b (An Act authorizing the transfer of certain real property for wildlife, or other purposes).

- "…so as to provide protection of these areas…and to ensure…the preservation of their wilderness character…." (Wilderness Act of 1964, Public Law 88-577)

GREAT WHITE HERON NATIONAL WILDLIFE REFUGE

- "... as a refuge and breeding ground for great white herons [white phase of the great blue heron], other migratory birds and other wildlife." Executive Order 7993, dated Oct 27, 1938.

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

- "... to conserve (A) fish or wildlife which are listed as endangered species or threatened species .... or (B) plants ...." 16 U.S.C. 1534 (Endangered Species Act of 1973)

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

- "…so as to provide protection of these areas…and to ensure…the preservation of their wilderness character…." (Wilderness Act of 1964, Public Law 88-577)

NATIONAL KEY DEER REFUGE

- "... to protect and preserve in the national interest the Key deer and other wildlife resources in the Florida Keys." 71 Stat. 412, dated Aug. 22, 1957

- "... to conserve (A) fish or wildlife which are listed as endangered species or threatened species .... or (B) plants...." 16 U.S.C. 1534 (Endangered Species Act of 1973)

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

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

- "... conservation, management, and … restoration of the fish, wildlife, and plant resources and their habitats … for the benefit of present and future generations of Americans...." 16 U.S.C. 668dd(a)(2) (National Wildlife Refuge System Administration Act)

- "…so as to provide protection of these areas…and to ensure…the preservation of their wilderness character…." (Wilderness Act of 1964, Public Law 88-577)

These purposes and the mission of the Refuge System are fundamental to determining the compatibility of proposed uses of the refuge, including public recreation. The compatibility of these uses is discussed in Appendix F.

SPECIAL DESIGNATIONS

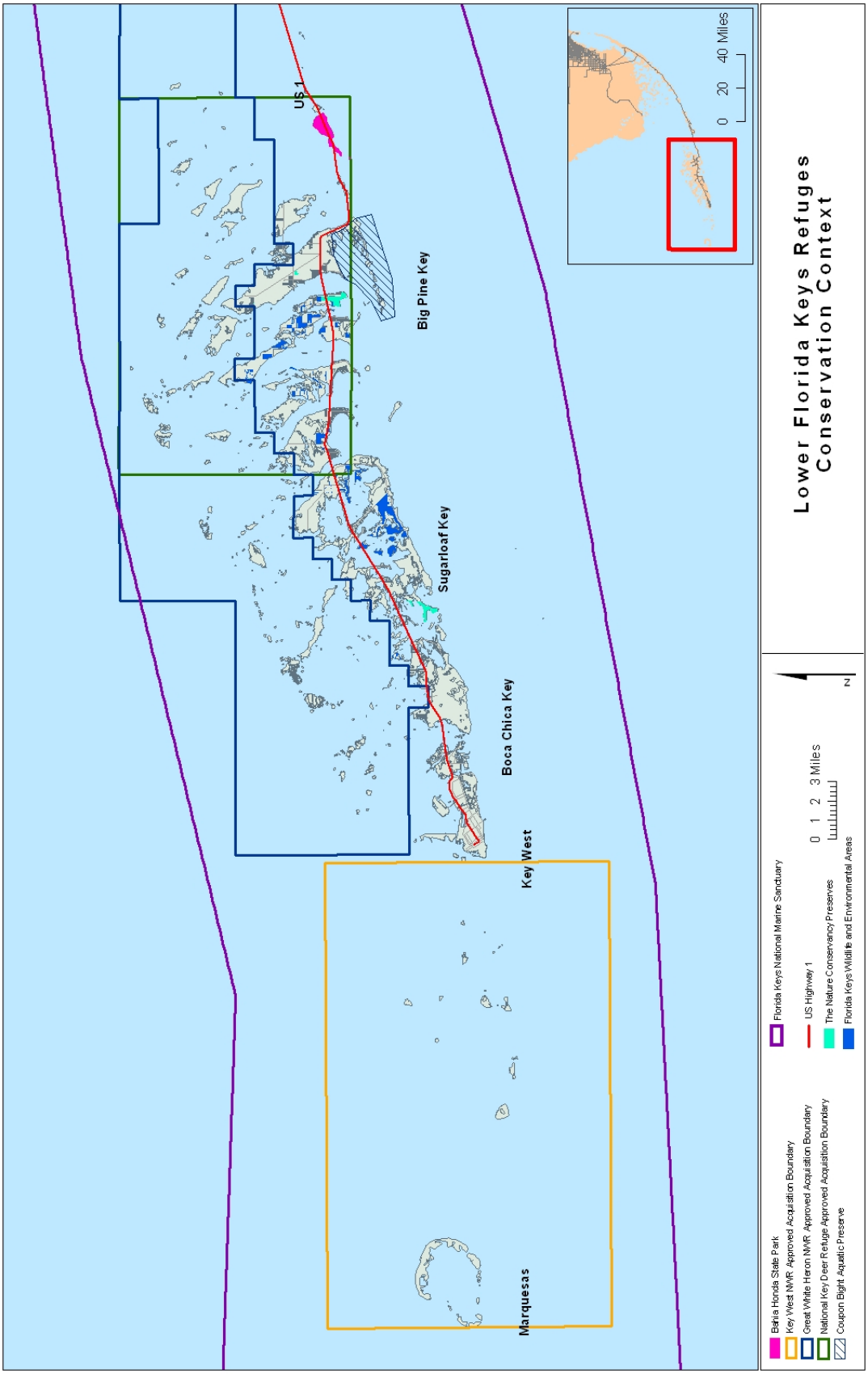
Outstanding Florida Waters Designation

Section 403.061(27), Florida Statutes, grants the Department of Environmental Protection (FDEP) the power to "Establish rules which provide for a special category of water bodies within the state, to be referred as 'Outstanding Florida Waters,' which shall be worthy of special protection because of their natural attributes." Among other public conservation lands within state and federal ownership, all waters in national wildlife refuges are designated as Outstanding Florida Waters (OFWs). Each of the Lower Florida Keys Refuges was designated in 1986 (Figure 4), with modifications made in 1988 and 1994. A Special Waters OFWs designation was made for the Florida Keys in 1985. The regulatory significance of the OFWs statute is to prevent the FDEP from issuing permits for direct or indirect pollutant discharges into OFWs, which would lower or degrade their existing water quality. Permits for new dredge and fill activities must clearly be in the public interest. For more information on OFWs, see: http://www.dep.state.fl.us/water/wqssp/ofw.htm.

Marine Protected Areas

Executive Order 13158 on Marine Protected Areas (MPAs) was issued May 26, 2000. It directs federal agencies to work with government and non-governmental partners to increase protection and sustainable use of ocean resources by strengthening and expanding a national system of MPAs. The definition of MPAs provided in the President's Executive Order is "any area of the marine environment that has been reserved by federal, state, territorial, tribal, or local laws or regulations to provide lasting protection for part or all of the natural and cultural resources therein." Each of the Lower Florida Keys Refuges is classified as an MPA by virtue of being in the Refuge System. All actions concerning the management of MPAs are left to the discretion of the local, state, or federal authorities that currently have those powers. For more information on MPAs see: http://mpa.gov/.

Figure 4. Conservation Context



Federal Wilderness Designation and Stewardship

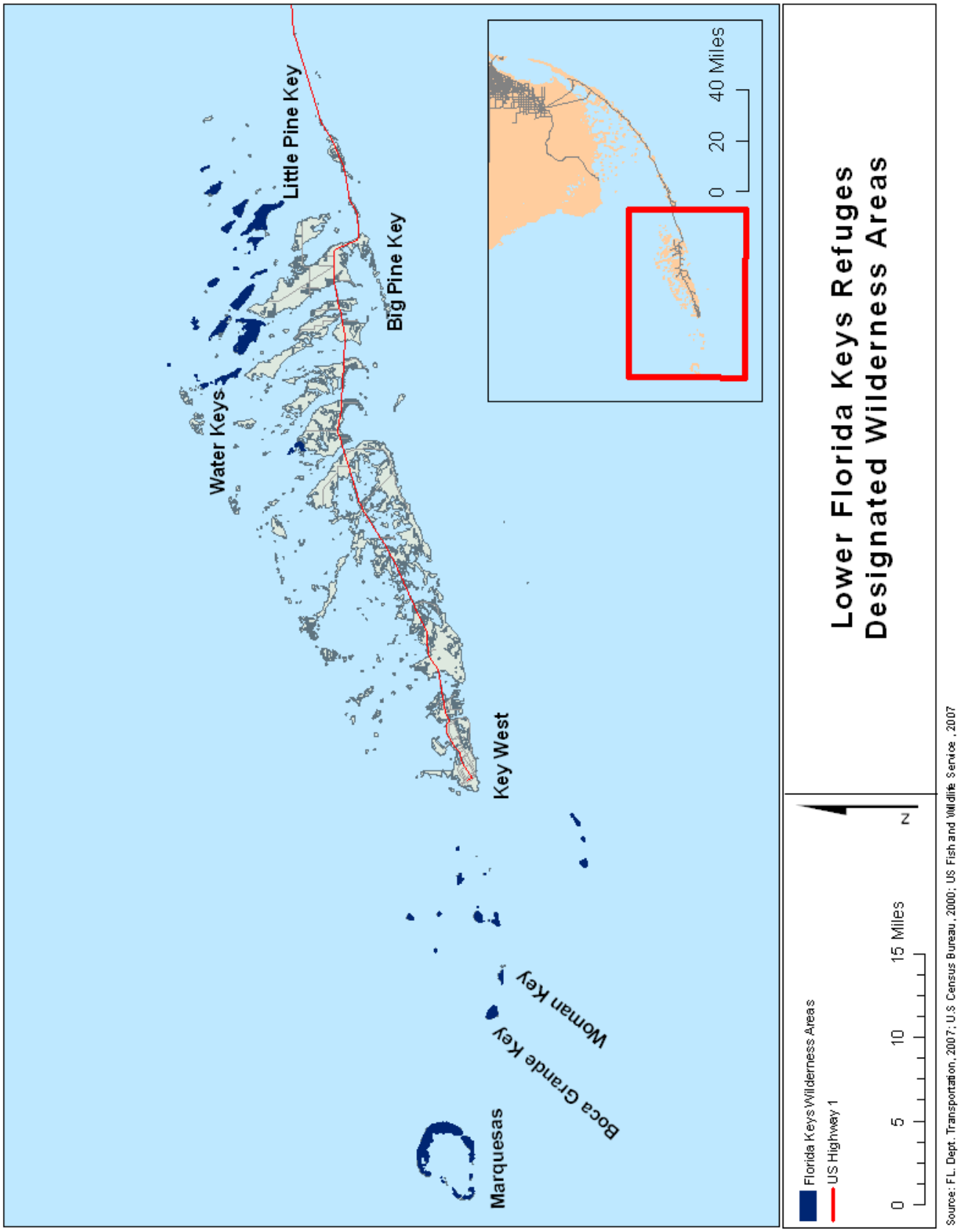
Congress designated wilderness areas in the Lower Florida Keys Refuges on January 3, 1975 (Public Law 93-632) to be managed under the Wilderness Act of 1964 (78 Stat. 890.892: 16 U.S.C. 1132). The wilderness areas include 1,990 acres in Great White Heron NWR, 2,019 acres in Key West NWR, and 2,278 acres in National Key Deer Refuge. They are shown in Figure 5.

Under the Wilderness Act, wilderness areas "…shall be administered for the use and enjoyment of the American people in such a manner as will leave them unimpaired for future use and enjoyment as wilderness, and so as to provide for the protection of these areas, the preservation of their wilderness character, and for the gathering and dissemination of information regarding their use and enjoyment as wilderness."

Sixteen principles of wilderness stewardship are derived from the Wilderness Act of 1964. They are:

- Manage wilderness as a distinct resource with inseparable parts;
- Manage the use of other resources and activities within wilderness in a manner compatible with the wilderness resource;
- Allow natural processes to operate freely within wilderness;
- Attain the highest level of primeval wilderness character within legal constraints;
- Preserve wilderness air and water quality;
- Produce human values and benefits while preserving wilderness;
- Preserve outstanding opportunities for solitude or a primitive and unconfined recreation experience in each wilderness;
- Control and reduce the adverse physical and social impacts of human use in wilderness through education or minimum regulation;
- Favor wilderness-dependent activities when managing wilderness use;
- Exclude the sight, sound, and other tangible evidence of motorized or mechanical transport wherever possible within wilderness;
- Remove existing structures and terminate uses and activities not essential to wilderness management or not provided for by law;
- Accomplish necessary wilderness management work with the minimum tool;
- Establish specific management direction with public involvement in a management plan for each wilderness;
- Harmonize wilderness and adjacent land management activities;
- Manage wilderness with interdisciplinary scientific skills; and
- Manage special provisions provided for by wilderness legislation with minimum impact on the wilderness resource.

Figure 5. Wilderness Areas



ECOSYSTEM CONTEXT AND REGIONAL CONSERVATION PLANS AND INITIATIVES

South Florida Multi-Species Recovery Plan

The purpose of the Endangered Species Act is to protect and recover imperiled species and the ecosystems upon which they depend. Several species known to occur in the refuges are listed under the Endangered Species Act as threatened or endangered (Appendix I). To be endangered means that a species is in danger of extinction throughout all or a major portion of its range, while threatened means that a species is likely to become endangered within the foreseeable future. Under the Act, all federal agencies must use their authorities to conserve listed species and make sure that their actions do not jeopardize the continued existence of listed species. Recovery plans are developed for federally listed threatened or endangered species with the objective of recovery, or restoring the species to a healthy population. For federally listed species in south Florida, the Service (USFWS 1999) developed a multi-species plan, referred to as the South Florida Multi-Species Recovery Plan (SFMSRP). Given the large habitat areas managed by the refuges for federally listed species in the Keys, many of the recovery tasks in the SFMSRP pertain directly to refuge lands. For more inforation on the SFMSRP see: http://www.fws.gov/verobeach/.

Florida Keys National Marine Sanctuary Management Plan

To protect the diverse marine ecosystem of the Florida Keys, Congress passed the Florida Keys National Marine Sanctuary (FKNMS) and Protection Act in 1990. The FKNMS Management Plan was approved in 1997 by the Florida Governor and Cabinet and Congress. Since the FKNMS encompasses both state and federal waters (Figure 4), it is managed cooperatively between the NOAA and the FDEP. The primary purpose of the FKNMS is to protect the unique marine habitats of the Florida Keys, especially the world's third largest coral reef system. For more information on the FKNMS Management Plan, see: http://floridakeys.noaa.gov/regs/welcome.html.

Coastal Barrier Resources Act

The Coastal Barrier Resources Act of 1982 designated many islands within the Florida Keys, including parts of the refuges, for inclusion within the John H. Chaffee Coastal Barrier Resources System. Areas so designated are not eligible for federal financial assistance that might support development. This law requires agencies that propose using federal expenditures within the Coastal Barrier Resources System to consult with the Service's Ecological Services Office for consistency with the Coastal Barrier Resources Act. For more information on the Coastal Barrier Resources Act see: http://www.fws.gov/habitatconservation/coastal_barrier.html

State Aquatic Preserves

The state has established a system of Aquatic Preserves throughout Florida, including Coupon Bight in the Lower Florida Keys in 1969 (Figure 4). Management intent is defined in the Florida Aquatic Preserve Act of 1975 as "for such preserves possessing ...exceptional biological, aesthetic and scientific value...to be set aside forever as aquatic preserves or sanctuaries for the benefits of future generations." (Section 258.36, Florida Statutes). Coupon Bight is south of Big Pine Key and encompasses 4,600 acres of seagrass meadows, hardbottom communities, mangrove wetlands, and coral patch reefs. For more information on Florida's Aquatic Preserves see: http://www.dep.state.fl.us/coastal/programs/aquatic.htm.

Florida Comprehensive Wildlife Conservation Strategy

Florida's Comprehensive Wildlife Conservation Strategy (Strategy) is an action plan for conserving all of the state's wildlife and vital natural areas for future generations (FWC 2006). It identifies which native wildlife and habitat are in need of conservation and proposes management strategies to address this need. The Strategy is part of a nationwide conservation program. To qualify for federal funding, each state and trust territory must develop an action plan. In Florida, the State Wildlife Grants Program provides funding. For more information see: http://myfwc.com/wildlifelegacy/strategy.html.

PHYSICAL RESOURCES

CLIMATE

The climate of the Lower Florida Keys is tropical (Jordan l99l) with a mean annual temperature of about 77 degrees Fahrenheit (F). The coldest average monthly temperature, 70 degrees F, occurs during January. The warmest mean monthly temperature is 84 degrees F and occurs in August (Thomas l974). Temperatures below 39 degrees F are unusual due to the moderating effects of the warm marine waters and the coastal Gulf Stream. Freezing temperatures and frost have never been recorded. The mean annual rainfall is 39 inches, of which 80 percent falls from May through October (Hanson l980). Compared to other seasons, winters are usually dryer with most rainfall occurring during passing cold fronts. Prevailing wind direction is east to southeast with an annual average of about 11 knots. Winds are strongest during the winter months (December through March) when cold fronts from the north move through the area. The mean annual sunshine is 3,300 hours, 10 percent more than the Florida Peninsula to the north.

GEOLOGY

The geology of the Lower Florida Keys (Big Pine Key west to Key West) has been described in detail by Hoffmeister (l974). Marine carbonate sediments nearly 20,000 feet in depth underlie the Keys. Along this submerged platform, coral reefs developed in a band from present day Miami to the Dry Tortugas. Two limestone formations of marine origin are found in the Lower Florida Keys. Miami oolite, a medium-to-hard limestone, overlies the Key Largo limestone formation. In the Lower Keys, Key Largo limestone is exposed only in a narrow band on the extreme southeast end of Big Pine Key. Elsewhere in the Lower Keys, it is overlain by Miami oolite, formed during the Pleistocene era in a high-energy, shallow-water environment containing an abundance of calcium carbonate. The configuration of limestone strata in the Lower Keys allows for the development of the freshwater lenses found there.

SOILS

Physical and chemical properties of soils in Monroe County have been described by the U.S. Department of Agriculture (1989). Saddlebunch marl is the dominant soil in tropical hardwood hammocks. In some hardwood hammock areas, humus may be present to a depth greater than 3 feet. Key Vaca, a very gravelly loam, is the dominant soil in the pine rocklands. Soil types in the freshwater wetlands are of the Rock-Outcrop-Cudjoe Complex, consisting of 55 percent rock outcrop and 45 percent Cudjoe marl. Soils within the fire-dependent pine rocklands are very thin; burning removes vegetative litter and exposes the bare oolitic caprock. Cracks and crevices in the exposed limestone cap rock form pockets of soil. The relationship between soil productivity and different forest cover types in the Florida Keys was studied by Ross et al. (2003).

PHYSIOGRAPHY

While refuge islands range in size from less than 1/4-acre (e.g., Hurricane Key) to nearly 6,300 acres (Big Pine Key), the majority of islands are under 100 acres. Elevation ranges from sea level on inundated mangrove islands (e.g., Little Crane Key) to approximately 9 feet above sea level (Big Pine Key) according to LiDAR-derived digital terrain maps (Keqi Zhang, Forida International University, personal communication, 2008). A complex network of narrow tidal creeks dissects small mangrove islands in some areas (e.g., between Snipe Point and Outer Narrows).

HYDROLOGY AND FRESHWATER RESOURCES

Except for limited shallow pooling following a rainstorm, freshwater is absent from Key West NWR and from nearly all backcountry islands (i.e., islands not linked by U.S. Highway 1) in the other refuges. A notable exception is Little Pine Key, which is underlain by a freshwater lens. The distribution of surface freshwater on refuge islands was mapped and described in detail by Folk et al. (1991). Refuge lands on Cudjoe, No Name, Upper Sugarloaf, Big Torch, Little Pine, Howe, and Big Pine Keys contain freshwater wetlands year-round. Freshwater wetlands reach their greatest extent and distribution on Big Pine Key. Rainwater collects and is held chiefly in shallow, impermeable limestone basins and solution holes distributed throughout the island's hardwood hammocks and pine rocklands. At slightly lower elevations amidst these habitats are freshwater wetland communities.

Big Pine Key is underlain by two distinct subterranean freshwater lenses. The largest one is north of Watson Boulevard; the other is south of this road (Hanson 1980). In both lenses, freshwater floats on the underlying saltwater with changes occurring seasonally due to tidal influences and rainfall-dependent freshwater recharge. During the highest spring tides, freshwater may be discharged above ground level (Folk et al. 1991). Extensive canals dug to create waterfront property accelerated the natural discharge from freshwater lenses, decreasing the size of the lens by 20 percent (Langevin et al. 1998). The freshwater layers are narrow for both lenses (20 to 23 feet), with only a 5- to 10-foot transition zone between freshwater and saltwater (Wightman 1990). Additionally, there are more than 60 miles of ditches on Big Pine Key alone that were dug in the 1960s to drain freshwater wetlands for mosquito control. These ditches criss-cross nearly every inhabited island along the Overseas Highway, and they have likely had a substantial impact on the natural hydrology and flow patterns across the island landscape.

WATER QUALITY AND QUANTITY

Studies of surface and nearshore water quality have been performed in the Florida Keys (Florida Department of Environmental Regulation 1985; 1987; Kruczynski 1999; Lapointe and Clark 1990). Florida International University's Southeast Environmental Research Center maintains a long-term water quality monitoring network for the marine waters of the Florida Keys National Marine Sanctuary, including several sampling points within the backcountry waters of the refuges. For more information, see: http://serc.fiu.edu/wqmnetwork. The Florida Department of Environmental Protection also conducts semi-annual monitoring of water quality in several wells in the Florida Keys. For more information, see: http://www.dep.state.fl.us/water/monitoring/index.htm.

Both the surface and subterranean freshwater resources of refuge lands on Big Pine Key are vulnerable to contamination because of sea level rise, runoff of fertilizers, herbicides and pesticides from lawns, and the outflow from septic tanks (Wightman 1990). The latter are a constant source of pollution (Paul et al. 1991) because of the geological characteristics of the Lower Florida Keys (Lapointe and Clark 1992). Septic tank densities in subdivisions adjacent to refuge lands greatly exceed the normally accepted national benchmark of 40 tanks per-square-mile. This benchmark was

set for areas unlike Big Pine Key where suitable soils are present (Saarinen 1989). Storm surges, such as that experienced in Hurricane Wilma in 2005, cause a short-term spike in salinity levels of freshwater solution holes, but normal levels are recovered over time.

AIR QUALITY

Air quality is a global concern. The U.S. Environmental Protection Agency (EPA) has lead responsibility for the quality of air. Through the 1990 Clean Air Act, EPA set limits on the amount of pollutants that can be legally discharged into the air. Nationally, more than 170 million tons of pollution is emitted into the air annually within U.S. borders, through either stationary sources (e.g., industrial and power plants) or mobile sources (e.g., automobiles, planes, trucks, buses, and trains). There are also natural sources of air pollution, such as fires, dust storms, volcanic activity, and other natural processes. The EPA has identified six principal pollutants that are the focus of its national regulatory program: lead, carbon monoxide, ozone, nitrogen dioxide, sulfur dioxide, and particulate matter.

Air pollution causes damage to the environment and property and affects human health. Both federal and state governments track air quality and visibility impairment, through a system of 5,200 monitors at 3,000 locations across the United States. Florida has 227 monitors at 141 sites. Carbon monoxide is from combustion or fire sources and is a problem mainly in cold weather climates. Lead has not been detected above standard levels, except in places that have a smelter source. Nitrogen dioxide is only monitored in large metropolitan areas, but Florida has never approached the standard. Sulfur dioxide is emitted from power plants and paper mills. None of these four principal pollutants are monitored near the refuges, since they are not considered problem pollutants in this area. The Clean Air Act provides for the protection of visibility in national parks and wilderness areas, also known as Class 1 areas; however, there are no monitoring stations within the refuges.

BIOLOGICAL RESOURCES

FLORA – PLANT COMMUNITIES AND COVER TYPES

The refuges harbor a very diverse assemblage of plants, with 423 native and 88 non-native species recorded (Appendix I computed from Gann et al. 2007a, b, c). Upland vegetation is primarily of West Indian origin (Dickson 1955, Weiner 1979). Native plant diversity is greatest in National Key Deer Refuge (410 species), followed by Key West NWR (182 species), and Great White Heron NWR (128 species) (Gann et al. 2007a, b, c). Federally listed species include the Key tree cactus (endangered) and Garber's spurge (threatened), with six candidate species under consideration for listing. On-line floristic databases maintained by the Atlas of Florida Vascular Plants (http:// www.plantatlas.usf.edu) and Institute for Regional Conservation (http://www.regionalconservation.org/) provide additional information on plant communities and species.

The Florida Keys are a disturbance-based ecosystem, affected periodically by wind and flooding events associated with hurricanes, drought, and fire. Due to the small size of the islands, flat topography, low elevation, depth to groundwater, close proximity to the sea, and geological substrate, very slight differences in elevation yield marked differences in plant communities (Ross et al. 1992). Major cover types described below include pine rockland, tropical hardwood hammock, freshwater wetlands, salt marsh transition, mangrove forest, inland salt ponds, beach ridge hammock, beach and dune, and marine (Figure 6). Each of these major cover types includes multiple plant communities, providing for a diverse mosaic of habitats across the island landscapes.

Pine Rockland

Pine rockland is a globally endangered plant community found only in the Lower Florida Keys, Everglades National Park, and in scattered parcels in Miami-Dade County, representing less than 3 percent of its original extent due to conversion to other land uses, significant ecological degradation, and outright destruction (Noss et al. 1995). Pine rocklands consist of an open canopy of slash pines with patchy understory and groundcover layers. The south Florida slash pine (*Pinus ellioti* var. *densa*) and palms (*Coccothrinax argentata, Thrinax morrisii, Thrinax radiata,* and *Serenoa repens*) are fire-adapted and dependent on periodic fires for their long-term persistence (Snyder et al. 1990). Sub-canopy layers include a diverse assemblage of tropical and temperate shrubs, palms, grasses, and herbs (Folk 1991). Pine rocklands occur at an elevation 3 to 8 feet above mean sea level and are usually underlain by a freshwater lens. Pine rocklands have the highest plant diversity of all plant communities in the Florida Keys. A total of 250 species of plants has been identified in the pine rocklands of south Florida and the Lower Keys. This community contains 14 herbs endemic to south Florida, 5 of which occur only in these Lower Keys settings (Avery and Loope 1980). Common plants associated with pinelands include long-stalked stopper, blackbead, Keys thatch palm, silver palm, locustberry, and poisonwood. Pine rocklands contain significant freshwater resources, including widespread freshwater solution holes and marshes that are important to Key deer.

Pine rocklands are dependent on fire to maintain the diverse assemblage of plants. Radiocarbon dating on soil samples taken from two water holes on Big Pine Key reveal repeated, local fires during the past ca. 450–500 years, documenting the long importance of fire in the Florida Keys' pine rocklands (Horn 2008). Pine rocklands typically burn once or twice every decade (Hofstetter 1974). Fire frequency has been shown to be an important parameter affecting the abundance and diversity of endemic herbs and the vegetation structure of pine rocklands (Lui et al. 2005, Bradley and Saha 2009, others). In the absence of fire, pine rocklands will succeed to hardwood hammock approximately within a 50-year-timeframe (Dickson 1955).

Pine rocklands are intolerant of saltwater. Of all refuge plant communities, flooding events from hurricanes and sea-level rise pose the greatest risks for the pine rocklands (Klimstra 1986). Flooding by sea water occurs only periodically due to storm surges associated with strong tropical storms. In the wakes of hurricanes in 1998 (Georges) and 2005 (Wilma), many slash pines were killed by this form of saltwater intrusion. Ross et al. (1994) reported that a 1/2-foot rise in sea level over a 70-year period reduced the size of the pine rocklands on Upper Sugarloaf Key by 66 percent.

Tropical Hardwood Hammock

Tropical hardwood hammocks are the climax terrestrial plant community in the Florida Keys. Occurring on uplands 2 to 8 feet above sea level, hammocks are hardwood forests consisting of a wide diversity of evergreen and semi-deciduous trees and shrubs, many of West Indian origin. These include paradise tree, gumbo limbo, Jamaican dogwood, pigeon plum, blolly, and wild dilly. Except during extreme storm events, these areas are not inundated by sea water. Although tropical hardwood hammocks are not fire-maintained communities, fire may periodically enter hammocks from a nearby pineland wildfire, especially during extreme drought conditions (Klimstra 1986).

Tropical hardwood hammocks serve as important stopover areas for neotropical migratory birds, particularly during inclement weather. Human development has severely reduced and fragmented this habitat in the Florida Keys, deleteriously affecting forest nesting birds and fruit foragers, such as the state-listed white-crowned pigeon (Bancroft and Bowman 1994, Bancroft et al. 1995).

Freshwater Wetlands

Freshwater wetlands are primarily isolated features in the Lower Keys, occuring in shallow basins or lowlands either surrounded by higher upland forests or between upland areas and transition zones. Within this category, there are natural mosaics of subtypes related to depressions, elevations, bedrock surface exposure, soil types, and fire regimes. They have standing freshwater levels that persist for extended periods. The average marsh elevation is 3 to 6.5 feet above mean sea level, with size varying up to 247 acres (Folk 1991). Wetland plant species include sawgrass (*Cladium* sp.), buttonwood, white-top sedge, and leather fern. These wetlands are important to amphibians, reptiles, insects, mammals, birds, and crustaceans. Freshwater wetlands reach their greatest extent and distribution on Big Pine Key, but refuge lands on Cudjoe, No Name, Upper Sugarloaf, Big Torch, Little Pine, and Howe Keys also contain freshwater wetlands year-round. Freshwater wetlands are absent in Key West NWR; however, ephemeral puddling occurs on a very small scale where limestone caprock is exposed on Boca Grande Key.

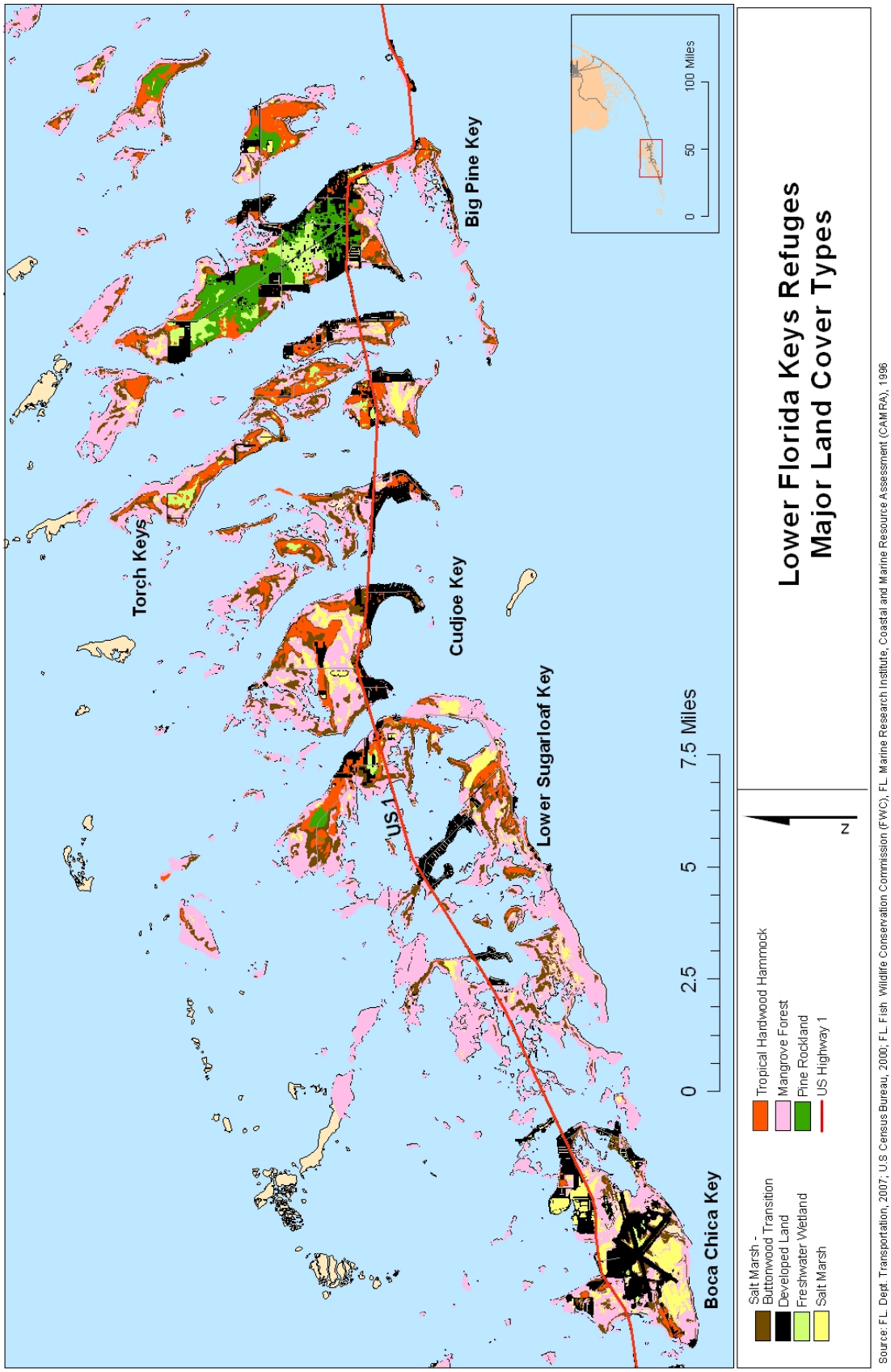
Salt Marsh Transition

This cover type includes salt marsh and transitional communities including buttonwood transition zones. Salt marsh communities consist of halophytic (salt tolerant) species that have developed biological and physiological mechanisms to adjust to a range in environmental conditions. In the Lower Keys, salt marsh transition communities occur primarily in the elevational transition zone between coastal mangrove forests and upland hardwood hammocks and pine rockland forests. Common plants include cordgrass, sea oxeye, saltgrass, saltwort, glasswort, buttonwood, joewood, saffron plum, key grass, Christmas berry, and sea purslane. The predominant characteristics of salt marsh transition vary among a broad range of subtypes that are distributed along even finer elevation gradients within this zone, depending on their tolerance and adaptability to salinity changes and periodic inundation. The range of subtypes includes open scrub salt marsh, buttonwood-dominated scrub salt marsh, and cordgrass (*Spartina* sp.) salt marsh. The salt marsh transition communities are used by a variety of resident and transient taxa. It is important habitat for the endangered Lower Keys marsh rabbit.

Mangrove Forest

Mangrove communities range from tall, coastal forest to low, dense scrub communities, each variety providing different physical habitats, topology, niches, microclimates, and food sources for a diverse assemblage of animals. This community type is dominated by black mangrove, white mangrove, or red mangrove. Elevation ranges from shallow submerged land to about 4 inches above sea level. The roots of these trees are usually either constantly submerged or inundated daily by the tides. Mangrove communities are among the most biologically productive ecosystems in the world (Lugo and Snedaker 1974). These forests are a vital component of the estuarine and marine environment, providing a major detrital base and essential nutrients to organic food chains; important habitat for arboreal, intertidal, and subtidal organisms; brooding areas for juvenile fish and crustaceans; nesting sites; cover and foraging sites for birds; and habitat for some reptiles and mammals, notably the sliver rice rat. Mangrove wetlands are excellent filters of runoff, and provide a protective barrier that diminishes the intensity of storm surges on interior upland habitats.

Figure 6. Land Cover



Source: FL. Dept. Transportation, 2007; U.S. Census Bureau, 2000; FL. Fish Wildlife Conservation Commission (FWC), FL. Marine Research Institute, Coastal and Marine Resource Assessment (CAMRA), 1996

Inland Salt Pond

Salt ponds are high-salinity, non-vegetated, shallow-water areas of at least an acre in size that occur landward of mangroves. Large salt ponds (greater than 3 acres) are found on Big Pine, Barracouta, Cudjoe, and Boca Grande Keys. High numbers of wading birds may gather in such areas, depending on water depths and fish density. Of special note is the salt pond on Boca Grande Key, which is used year-round by wading birds. Seasonally, it is used by piping plovers; white pelicans; black-necked stilts; and least, royal, and sandwich terns. This island and Barracouta Key harbor the largest known mangrove terrapin populations in Key West NWR.

Beach Ridge Hammocks

These hardwood hammocks occur on high sand berms, within a few feet above sea level, created by storm surge and wind events. Although many of the plants found there are also found in tropical hardwood hammocks, this habitat is sufficiently different to warrant a separate classification (Folk et al. 1991). Trees in this habitat type grow on a sand or calcareous gravel substrate with low freshwater retention and are usually long, narrow linear features immediately adjacent to beaches. Beach ridge hammocks normally have relatively low plant diversity with a sparse understory, which may contain limber caper, Bahama nightshade, and blackbead. However, the latter may serve as the dominant species over a large area in some beach ridge hammocks. A nearly pure, 4-acre stand on Boca Grande Key provides an example. Of all berm hammocks in Key West NWR, elevation is highest (6.5 to 10 feet) and size greatest on the northwest side of the Marquesas Keys. Within this hammock is the only viable population of yellowheart trees in the United States.

Beach and Dune

The beach and dune communities are closest to the high-energy shoreline. Within this high-energy zone, there are a number of naturally reoccurring events, such as wave action, tidal fluctuations, sand burial, and salt spray. Beaches and associated dunes are rare in the Lower Florida Keys Refuges. Except for a narrow beach on the extreme southeast side of Big Pine Key and on Ohio Key, this habitat is absent in National Key Deer Refuge. Short, narrow beaches are found on east Sawyer Key and Snipe Point in Great White Heron NWR. Beach and associated dunes are a prominent part of the Key West NWR, occurring on Man, Woman, Marquesas (7 separate beaches) and Boca Grande Keys. Beach length varies from 164 to 8,530 feet. All refuge beaches are narrow and coarse-grained, formed primarily of calcareous remains from various shallow water marine organisms. Green and loggerhead sea turtles nest on refuge beaches; hawksbill turtles nest occasionally on Key West NWR. The beaches also afford important nesting, foraging, and loafing habitat for a variety of shorebirds, including the threatened roseat tern and piping plover.

Dunes occur landward of the beaches and reach their greatest size and have the highest plant diversity on refuge islands in Key West NWR. Small patches of coastal prairie communities also occur among beach and dune systems in Key West NWR. The beach-dune interface is an important ecological front that produces sustained levels of biological activity. The beach and dune may function in a state of equilibrium with the nearshore system such that alteration of one of these elements may affect the others (Carter et al. 1990). Narrow dunes are the most vulnerable to overwash. On Boca Grande Key, for example, a small portion (about 165 feet) of the narrow dune on the extreme northwest side of the island is inundated during exceptional spring high tides. Dunes are a fragile habitat easily damaged by humans, the extent of which depends on dune size and profile, quantity and type of flora, beach characteristics, and surrounding water depth (Liddle and Greig-Smith 1975, McDonnel 1981, Nickerson and Thibodeau 1983).

Marine

The marine zone extends out from the shoreline's high water mark to the open gulf and ocean. Marine habitats include tidal flats, seagrass meadows, patch corals, and the coral reef tract. Bank reefs are considered unique due to the presence of elkhorn coral (*Acropora palmata*), coral zonation by depth, and seaward-oriented spur-and-groove formations. Soft corals are the predominant organisms on the Florida Keys reefs. The sea whips and sea fans are a unique Caribbean feature. Coral reef systems serve as barriers, protecting many coastal populations and developments from storm damage; they support commercial fisheries; they serve as major tourist attractions; and they hold the possibility of unimagined medicinal compounds in the diverse life forms within them. A portion of the main reef tract is located near Sand Key in the southeastern corner of Key West NWR.

The backcountry of the Lower Florida Keys Refuges is predominantly shallow water habitat with seagrass beds, scattered coral heads, and small patch reefs. There are several types of seagrasses in the Keys, with turtle, manatee, and shoal grass being most common. The depths at which seagrasses grow are limited by water clarity, which determines the amount of light reaching the plant. The seagrass beds provide important foraging habitat for sea turtles. Tidal flats provide essential foraging habitat for wading birds that hunt small fish and crustaceans during low tide cycles.

FAUNA – FISH AND WILDLIFE

For a listing of the wildlife known to occur in the Lower Florida Keys Refuges, see Appendix I.

Fish

Although marine reef fishes in the Florida Keys have been studied extensively (Bohnsack et al. 1998), those inhabiting freshwater and brackish wetlands on refuge lands have received little attention. There is no freshwater in Key West NWR. Freshwater is absent on nearly all islands in Great White Heron NWR and occurs sparingly (excepting Little Pine Key) on a few islands which are located within the overlapping boundaries of the National Key Deer Refuge. Thus, the following discussion pertains only to National Key Deer Refuge. Freshwater resident fish are largely limited to small freshwater holes (also known as solution holes), freshwater wetland ponds and man-made mosquito ditches. The few published works have been species-specific and narrowly focused (Travis et al. 1990, Turner 1992). The Florida Audubon's Tavernier Science Center, on behalf of the Keys Environmental Trust Fund, conducted a baseline inventory of non-tidal fish habitats on Big Pine Key and surrounding islands and sampled fish assemblages in 16 mosquito ditches. A total of 13 fish species were identified, including 2 species listed as Species of Special Concern by the State of Florida, the mangrove gambusia (*Gambusia rhizophorae*) and mangrove rivulus (*Rivulus marmoratus*) (Faunce et al. 2001, Hobbs 2003). Periodic monitoring of the status of resident fish is needed, including detection and removal of invasive exotic fish.

Birds

More than 250 bird species have been observed in the refuges (Appendix I). Avian species that are listed under the provisions of the Endangered Species Act and documented in the refuges include the roseate tern and piping plover. The red knot is a candidate species. State-listed species include the aforementioned species, as well as the least tern, peregrine falcon, snowy plover, bald eagle, and white-crowned pigeon.

The refuges provide important breeding, wintering, and stopover habitat for neotropical migratory birds, including songbirds, shorebirds, and raptors. Through the Partners in Flight Initiative, federal, state, and private agencies are developing and implementing a comprehensive approach for managing selected species of migratory nongame birds (Appendix I, Priority Birds in Need of Conservation Attention for Subtropical Florida Physiographic Area BCR 31). In an attempt to prevent the listing of most of these birds as threatened or endangered species, these trust species are given high priority in management decisions. Nesting bald eagles, wading birds, white-crowned pigeons, and some terns are also surveyed annually.

Shorebirds, Waterbirds, and Marshbirds

The Lower Florida Keys Refuges contain extensive mangrove and shallow-water habitats that are important loafing and foraging sites for local wading birds and migratory shorebirds. With the exception of the wood stork, the refuges harbor all species of Florida wading birds as either nesters or vagrants. Known nesters include all Florida herons and egrets, as well as the white ibis. The refuges are particularly important to nesting great white herons. A peak of 336 nests was documented in 1998, but thereafter nesting declined yearly to less than 100 (Wilmers 2003; 2008).

Other birds that nest in the refuges include the brown pelican and double-crested cormorant. Brown pelican nesting has declined markedly in Key West NWR since 1987. The historic (1986-2005) nesting colony in the Marquesas Keys was abandoned in 2005, with no sign of nesting activity in 2006-2008. In 2008, only one rookery near Key West was active and no young were produced. Non-nesting, fish-eating birds include various tern and gull species. Descriptions of piping plover, roseate tern, and red knot can be found under the section on Endangered, Threatened, and Candidate Species.

Raptors (Hawks and Allies)

The Lower Florida Keys Refuges are situated along a major migratory pathway for raptors. Sixteen migratory species have been observed in the refuges. Migration begins in late August with the passage of American swallow-tailed kites and ends in November with Swainson's hawks. Broad-winged and sharp-skinned hawks and American kestrels are the most abundant migratory birds. More peregrine falcons pass over the Keys than any other hawk observation sites in North America (Lott 2006). While most of the migratory raptors use the refuges as a resting and feeding stopover enroute to the tropics, significant numbers of certain species overwinter, such as the broad-winged and short-tailed hawks. Bald eagle nesting has been monitored annually since 1985 with four to six active nests sighted yearly. Some islands were used for nesting for over 20 years and others for only a few years, with pairs moving elsewhere. Osprey and red-shouldered hawks are also nesters in the refuges.

Waterfowl

Waterfowl do not nest in the Lower Florida Keys Refuges. Apart from small numbers of overwintering red-breasted mergansers and blue-winged teal seen annually, other migratory waterfowl are rarely observed.

Resident Landbirds

Red-bellied woodpeckers, red-winged blackbirds, gray kingbird, black-whiskered vireo, white-crowned pigeon, and mangrove clapper rail are among the more common resident breeding birds. The only warbler species known to breed in the Lower Florida Keys Refuges are Cuban yellow and prairie warblers. Both are common breeders in the backcountry islands. The mangrove cuckoo is a species of concern, but data are lacking on its status and ecology in the Florida Keys.

Neotropical Migratory Birds

Neotropical migratory birds are species that breed in North America and winter in Mexico, Central America, the Caribbean, and South America. These species are of keen interest to birdwatchers and conservationists because they migrate remarkable distances in all weather conditions, and they provide a diversity of viewing opportunities during the spring and fall migration, more than doubling the number of species seen in the Florida Keys compared to the nesting season. Many are experiencing range-wide declines due to the destruction and fragmentation of breeding and wintering habitat, poisoning by pesticides, collisions with towers and large buildings, and feral cat predation.

Mammals

As with many island chains, few land-dwelling species occur in the Florida Keys. Most of the native mammals represent sub-species of those found on mainland Florida, but they have become genetically distinct due to thousands of years of geographic isolation. Key deer and raccoons are the most commonly seen native mammals in the Lower Florida Keys Refuges. Marsh rabbits and silver rice rats occur in low numbers and due to their behavioral habits, are rarely seen. Native mammals are absent from Key West NWR. Bottlenose dolphins are the most common sea-dwelling mammal within the refuges' boundaries. The Florida manatee is a rare, transient visitor. Descriptions of Key deer, Lower Keys marsh rabbit, and silver rice rat can be found under the section on Endangered, Threatened, and Candidate Species.

Amphibians

Amphibians require freshwater and therefore are absent in Key West NWR and most of the back country islands in the Great White Heron NWR. They occur on National Key Deer Refuge, most notably in freshwater solution holes, wetland ponds and man-made mosquito ditches on Big Pine Key. At least seven native amphibians occur on this refuge. The most common is the southern leopard frog. Inventories are needed to establish baseline data on the status and distribution of amphibians.

Reptiles

A comprehensive survey of reptilian species in the Lower Florida Keys Refuges is lacking and a precise number of species is not known. Eleven species of lizards, nine species of snakes, and eleven species of turtles have been documented; however, many are non-native. The American alligator, American crocodile, Big Pine ringneck snake, eastern diamondback rattlesnake, and eastern indigo snake (likely extirpated) are among the noteworthy native species. The green, loggerhead, and hawksbill sea turtles are nesting species, while Kemp's ridley forages in waters surrounding the refuges. Box turtles inhabitat upland areas of National Key Deer Refuge (Verdon 2004). Inventories are needed to establish baseline data on the status and distribution of reptiles as only sea turtles have been the subject of long-term monitoring. Descriptions of marine turtles and eastern indigo snake can be found under the section on Endangered, Threatened, and Candidate Species.

Invertebrates

No attempt has been made by the Service to catalogue the entire suite of invertebrate species on the Lower Florida Keys Refuges, although other researchers have studied certain species or groups of tree snails, dragonflies, and butterflies. There are a variety of *Liguus* tree snails that inhabit similar hammock communities that merit attention and conservation. Currently, there is little substantively

known about the numbers of the *Liguus* snails on Big Pine Key, which are likely phenotypes of the Florida tree snail (*Liguus fasciatus*) (Close 2000, Hillis et al. 1991). Butterfly assemblages have been studied (Minno and Emmel 1993, Minno et al. 2005). At least eight resident butterflies have disappeared from the Keys since the late 1970s, and another eight species of butterflies found in the lower Keys are highly imperiled (M. Minno pers. comm. 2008). The causes of this widespread decline are likely due to many factors, especially habitat destruction and fragmentation, as well as mosquito control spraying, exotic predatory ants, hurricanes, and poaching. The application of insecticides to control adult mosquitoes is known to deleteriously impact butterfly populations (Emmel 1991, Salvato 2002). The Service must continue to build a cooperative relationship with the Florida Keys Mosquito Control District in an effort to further reduce or eliminate the use of broad-spectrum adulticides on refuge lands. Three federal candidate butterflies that occur in the refuges (Bartram's hairstreak, Florida leafwing, and Miami blue) are described in more detail in the section under Endangered, Threatened, and Candidate Species below.

Endangered, Threatened, and Candidate Species

Table 1 depicts species that are federally listed as threatened or endangered, as well as candidate species. "Endangered" means a species is in danger of extinction throughout all or a significant portion of its range. "Threatened" means a species is likely to become endangered within the foreseeable future. "Candidate" species are those for which the Service has enough information to warrant proposing them for listing but is precluded from doing so by higher listing priorities; however, the Service carries out priority conservation actions for these species to prevent further decline and possibly preclude the need to list. Most of these species are declining or experiencing severe population losses due to alteration and/or degradation of their habitats. By perpetuating intact natural communities, restoring degraded natural communities and processes, and eliminating adverse human impacts, the refuges can contribute to species recovery goals and benefit other plants and animals dependent on the unique and imperiled ecosystems in the Florida Keys. Monitoring efforts of sufficient intensity and duration to determine refuge-specific status and trends of federally listed species are needed.

Table 1. Federally Listed Threatened (T), Endangered (E), and Candidate (C) Species of the Lower Florida Keys Refuges

NKDR	GWH NWR	KW NWR	SPECIES	LATIN NAME	FEDERAL STATUS
MAMMALS		*** = occurs at this refuge**		**(CH) = critical habitat**	
*	*		Key deer	*Odocileus virginianus clavium*	E
*	*		Lower Keys marsh rabbit	*Sylvilagus palustris hefneri*	E
*	*		Silver rice rat	*Oryzomys palustris natator*	E (CH)
*	*	*	West Indian manatee	*Trichecus manatus*	E (CH)

NKDR	GWH NWR	KW NWR	SPECIES	LATIN NAME	FEDERAL STATUS
BIRDS					
possible	possible	possible	Kirtland's warbler	*Dendroica kirtlandii*	E
*	*	* (CH)	Piping plover	*Charadrius melodus*	T (CH)
possible	possible	*	Roseate tern	*Sterna dougallii dougallii*	T
*	*	*	Red knot	*Calidris canutus rufa*	C
REPTILES					
*	*		American Alligator	*Alligator mississippiensis*	T (S/A)
*			American crocodile	*Crocodylus acutus*	T (CH)
*			Eastern indigo snake	*Dymarchon corais couperi*	T
*	*	*	Green sea turtle	*Chelonia mydas*	E (CH)
*	*	*	Hawksbill sea turtle	*Eretmochelys imbricata*	E (CH)
*	*	*	Kemp's ridley sea turtle	*Lepidochelys kempii*	E
*	*	*	Leatherback sea turtle	*Dermochelys coriacea*	E (CH)
*	*	*	Loggerhead sea turtle	*Caretta caretta*	T
FISH					
*	*	*	Smalltooth sawfish (U.S. Distinct Population Segment)	*Pristis pectinata*	E, NMFS
INVERTEBRATES					
*			Stock Island tree snail	*Orthalicus reses (not including nesodryas)*	T

NKDR	GWH NWR	KW NWR	SPECIES	LATIN NAME	FEDERAL STATUS
*	Possible	Possible	Bartram's hairstreak butterfly	*Strymon acis bartrami*	C
*	Possible	Possible	Florida Leafwing	*Anaea troglodyta floridalis*	C
*	Possible	*	Miami blue butterfly	*Cyclargus thomasi bethunebaker*	C
			Staghorn coral	*Acropora cervicornis*	T, NMFS – Listed May 9, 2006 (71 FR 26852)
			Elkhorn coral	*Acropora palmata*	T, NMFS – Listed May 9, 2006 (71 FR 26852)
PLANTS					
*			Blodgett's silverbush	*Argythamnia blodgettii*	C
*			Big Pine partridge pea	*Chamaecrista lineata var. keyensis*	C
*			Wedge spurge	*Chamaesyce deltoidea spp. serpyllum*	C
*		*	Garber's spurge	*Chamaesyce garberi*	T
		*	Cape Sable thoroughwort	*Chromolaena frustrata*	C
*			Sand flax	*Linum arenicola*	C
*			Florida semaphore cactus	*Consolea corallicola*	C
*			Key tree cactus	*Pilosocereus robinii*	E

The South Florida Multi-Species Recovery Plan referenced in Chapter I provides a description of all federally listed species and ecological communities located within the Lower Florida Keys Refuges. A brief description of selected federally listed threatened and endangered species follows.

Endangered Species

Key deer. The Key deer is the smallest subspecies of the North American white-tailed deer. It historically ranged from Key Vaca to Key West, but the current range includes approximately 26 islands from Big Pine Key to Sugarloaf Key, with the center of its population on Big Pine and No-Name Keys. Most lands within its current range, including privately owned lands, lie within the administrative boundaries of National Key Deer Refuge. Key deer use all cover types, including those normally above tidal influence (pine rockland, hardwood hammock, freshwater wetlands), as well as tidally influenced types (mangrove, salt marsh transition). They also use residential areas extensively where they feed on ornamental plants and grasses and seek freshwater. The Key deer remains listed as endangered due to its restricted range, sea level rise, habitat fragmentation, and high human-related mortalities and disturbances.

The Key deer population increased markedly during the 1990s and now likely exceeds habitat carrying capacity in areas of high animal densities on No Name Key and parts of Big Pine Key. The result has been degradation of native plant communities and loss of habitat diversity, with probable but as yet unstudied impacts on other wildlife species. Several once-common plant species that are highly palatable to deer, such as black torch, have disappeared or been greatly reduced over large areas of Big Pine and No Name Keys. Deer at high densities may exist at a lowered nutritional plane and are more susceptible to epizootic diseases.

For many years, Key deer aggregations have been particularly high near subdivisions, such as Port Pine Heights and Koehn. Their burgeoning numbers are due to the reproductive output of a large number of resident does, the availability of ornamental plants for feeding, and feeding by tourists and residents. Deer roadkill numbers have increased steadily with deer population growth, with annual mortality sometimes exceeding 100 animals. Despite this elevated mortality, deer numbers have remained high and are offset by annual population recruitment.

Although deer numbers have increased on Big Pine and No Name Keys, there was a reduction or extirpation in other parts of the deer's range, including Johnson, Cudjoe, and Sugarloaf Keys. More than 30 deer were translocated to suitable habitat on Cudjoe and Sugarloaf Keys in recent years. The fate of these herds must be monitored over time to assess the efficacy of translocation as an effective management strategy to ensure the long-term viability of the species. Deer on backcountry islands also need to be monitored. To date, detailed demographic studies have only been conducted on the core population on Big Pine and No Name Keys.

Lower Keys marsh rabbit. The Lower Keys marsh rabbit is a subspecies of the marsh rabbit, which is more widely distributed in the southeastern United States. This subspecies originally ranged throughout the Lower Florida Keys, including Key West. The current range appears to consist of three separate metapopulations: the Boca Chica area (Boca Chica, Geiger, East Rockland and Saddlehill Keys), the Sugarloaf area (Sugarloaf and Saddlebunch Keys), and the Big Pine area (Big Pine, Annette, East Water, Howe, Johnson, Little Pine, Mayo, Newfound Harbor, Porpoise, and No Name Keys) (Forys and Humphrey 1999a). Lower Keys marsh rabbits are predominantly found in salt marsh transition communities that have dense ground cover created by a clump grass, cordgrass (*Spartina spartinae*). Rabbits are also widely distributed among freshwater wetlands and they travel through all cover types, including pine rockland. Habitat for rabbits provides for forage, nest cover, and predator avoidance. The amount of thick ground cover

within a patch of habitat was the single most important variable in predicting whether a patch would be consistently occupied by marsh rabbits (Forys and Humphrey 1999b). Although habitat loss from human development is responsible for the original decline of the Lower Keys marsh rabbit, current threats include predation by cats, encroachment of woody overstory into grassy habitats, and road mortalities caused by vehicles (USFWS 2007).

Silver rice rat. The silver rice rat is a primarily nocturnal, semi-aquatic, wetland rodent that forages in intertidal zones, feeding on fish, crabs, grasses and forbs (Perry et al. 2005). Compared to other small mammals, silver rice rats inhabit large home range areas. Its habitat includes areas of contiguous mangrove swamps and salt marsh transition. Populations are found at extremely low densities on at least 13 islands, ranging from Big Pine Key to Lower Sugarloaf Key. Silver rice rats were listed as endangered due to habitat destruction from human development. Loss of mangrove habitats was greatly curtailed after the passage of the Clean Water Act of 1974 that restricted development in wetlands; however, threats due to sea level rise are an emerging concern for silver rice rat conservation.

Florida manatee. Manatees are rare in the Lower Florida Keys Refuges, partly because freshwater outflows into the nearshore marine waters are lacking. The Service staff provide logistical assistance to local and state wildlife agencies, as needed, if sick, injured, or dead animals are found.

Kemp's ridley sea turtle. This is a small-to-medium-sized turtle with a nearly circular shell. Primarily a Gulf of Mexico species, it inhabits marine coastal waters with sand or mud bottoms. Juveniles frequent bays. Nesting occurs on Gulf beaches in south Texas and northern Mexico, although a few nests have been confirmed in Florida. Data is lacking on this species, but it likely occurs at least sporadically in the waters within the boudaries of the Lower Florida Keys Refuges.

Green sea turtle. This large sea turtle inhabits marine coastal and oceanic waters and occurs in Florida year-round. Nesting occurs on four beaches in the Key West NWR: Boca Grande Key, Sawyer Key, and two beaches in the Marquesas Keys. The number of nests in the Marquesas Keys has doubled since 1998, with as many as 20 nests recorded in a single year. Since 1990, nest numbers have remained stable on Boca Grande and Sawyer Keys thus far, despite progressive degradation of nesting habitat from wave action caused by storm events and boat traffic. Climate change effects, such as sea level rise and more frequent storms, could have a substantial impact on nesting habitat for sea turtles.

Hawksbill sea turtle. This is a small-to-medium-sized sea turtle that is found throughout Key West NWR in hard-bottom and reef habitats containing sponges. Nesting is rare and has only been documented once on Boca Grande Key and several times in the Marquesas Keys. On the latter island, nesting has been restricted to the fall and winter months.

Key tree cactus. The Key tree cactus is endemic to the Florida Keys, and grows in hardwood hammocks. It was listed as endangered due to severe population declines caused by destruction of upland areas. Historically distributed from Key Largo to Key West, the species presently occurs only on Big Pine Key in the National Key Deer Refuge, Long Key State Park, Dagney Johnson Key Largo Hammock State Botanical Park, and private lands on Upper and Lower Matecumbe Keys. The Key tree cactus population continues to decline even on public conservation lands, attributed to saltwater intrusion from recent hurricanes and maturing hammocks that may be shading out seedlings and young plants. Its ability to persist in light of climate change may be tenuous without direct intervention, such as assisted migration to suitable habitat at higher elevations or captive propagation.

Threatened Species

Piping plover. The piping plover is found on open, sandy beaches and on tidal mudflats and sand flats, and winters along both coasts of Florida. Piping plovers have been observed on four refuge islands – Boca Grande, Woman, and the Marquesas Keys in Key West NWR, and Ohio Key in National Key Deer Refuge. A peak of 29 piping plovers was observed on Woman Key in February 1998.

Roseate tern. Roseate tern nesting is rare in the United States. The location of roseate tern breeding sites is dependent on the distribution and abundance of islands with open sandy or broken coral substrates. Other important factors include the absence of predators and minimal amounts of human disturbance. One of the most crucial and recurring mortality factors is human interference during nesting, which may cause birds to abandon their nests and young. Fewer than 100 pairs of roseate terns nest in the entire Florida Keys, including the Dry Tortugas, in 2007. Nesting occurred annually outside refuge boundaries on Pelican Shoal, but that island was obliterated by hurricanes in 2004 and 2005. For the first time on record in 2006 and again in 2007, roseate terns nested within the Key West NWR on Wilma Key, a small sand island that was created by Hurricane Wilma; however, this island is eroding and may prove to be ephemeral. In 2005, Hurricane Wilma also created a large expanse of sand on the interior of Boca Grande Key that may be marginally suitable for roseate tern nesting. In July 2007, 82 non-nesting roseate terns were observed in this area.

Loggerhead sea turtle. This large sea turtle inhabits marine coastal and oceanic waters and is present in Florida year-round. Nesting has been monitored annually since 1990 and occurs yearly in Key West NWR on Woman, Boca Grande, and the Marquesas Keys and on Sawyer Key in Great White Heron NWR. A peak of 70 nests was found in Key West NWR in 1995, but has declined sharply since then to less than 30 nests (Wilmers pers. comm.). Begun in 2003, an ongoing project by the Inwater Research Group is assessing the genetic origin, health, demographics, and species composition of the sea turtle populations in developmental habitats and adult turtle wintering areas in the marine waters of Key West NWR.

Eastern indigo snake. This large, stout-bodied, shiny black snake can grow up to 8 feet long. It is docile, non-poisonous, and occurs throughout Florida, but is rare in the Lower Keys. It is a habitat generalist inhabiting the pine rocklands, tropical hardwood hammocks and buttonwood-dominated scrub salt marsh. There have been no confirmed sightings within the Keys in more than a decade. So, although its status has not been assessed, it is thought to be extirpated from the Florida Keys.

Stock Island tree snail. The Stock Island tree snail is found in hardwood hammocks in the Florida Keys. The snail historically occurred on Stock Island and Key West where it is virtually extirpated. Habitat loss and a major decline in the original Stock Island population led snail collectors to move snails to other hammocks throughout the Keys. The translocation of snails successfully prevented extinction of the species, but several of the few remaining populations are at risk due to continuing habitat loss to development. The National Key Deer Refuge contains one of the last established populations of this snail. Strategies for protecting hardwood hammocks will benefit the Stock Island tree snail.

Garber's spurge. Populations of Garber's spurge in the Florida Keys historically occurred on beach dunes, coastal rock barrens, hammock edges and canopy gaps, and to a lesser extent pine rockland. Populations on dunes have the potential to be threatened by trampling from beach goers. Small isolated populations could become extirpated due to a number of factors, including natural events, such as hurricanes and tidal surges, or manmade factors, such as mowing or herbicide application. It probably occurs on less than half of the islands where it once occurred in the Florida Keys.

Candidate Species

Bartram's hairstreak. The Bartram's hairstreak is a small butterfly approximately 1 inch (in) (25 millimeters [mm]) in length with a forewing length of 0.4 to 0.5 in (10 to 12.5 mm) and has an appearance (i.e., color, size, body shape) characteristic of the hairstreak genus (Minno and Emmel 1993). The Bartram's hairstreak requires pine rockland that retain its hostplant, pineland croton. The mainland population is within Long Pine Key in Everglades National Park, with sporadic and localized occurrences within pine rockland fragments on lands owned by Miami-Dade County. In the Florida Keys, the butterfly occurs only on Big Pine Key within National Key Deer Refuge, private, state, and other lands (Salvato and Hennessey 2003; M. Salvato, Service, pers. comm. 2008).

Florida leafwing. The Florida leafwing butterfly is a medium-sized butterfly approximately 2.75 to 3 inches (in) (76 to 78 millimeters [mm]) in length with a forewing length of 1.3 to 1.5 in (34 to 38 mm) and has an appearance characteristic of its genus (Minno and Emmel 1993). The upper-wing (or open wing) surface color is red to red-brown, the underside (closed wings) is gray to tan, with a tapered outline, cryptically looking like a dead leaf when the butterfly is at rest. As with the Bartram's hairstreak, the Florida leafwing occurs only within pine rocklands that retain its hostplant, pineland croton. The Florida leafwing has not been seen on Big Pine Key since 2006 (M. Salvato, Service, pers. comm. 2008).

Miami blue butterfly. The Miami blue is a small, brightly colored butterfly approximately 0.8 to 1.1 inches (1.9 to 2.9 centimeters) in length with a forewing length of 0.3 to 0.5 inches (8.0 to 12.5 millimeters) (Minno and Emmel 1993). Wings of males are blue above (dorsally), with a narrow black outer border and white fringes; females are bright blue dorsally, with black borders and a red and black eyespot near the anal angle of the hindwing. There are two distinct wild metapopulations, with one in Bahia Honda State Park and the other on several islands within the Key West NWR (Cannon et al. 2009). The Miami blue is a coastal butterfly reported to occur in and around the edges of hardwood hammocks near the coast, including landscapes prone to frequent natural disturbances immediately adjacent to the coast (e.g., coastal berm hammocks, dunes, and scrub), but also tropical pinelands and along trails, using open sunny areas. In the Keys, it was most abundant near disturbed hammocks where weedy flowers provided nectar (Minno and Emmel 1993, 1994).

Blodgett's silverbush. On the mainland, Blodgett's silverbush grows in pine rockland and edges of rockland hammock (Bradley and Gann 1999). In the Keys, this species grows in pine rockland, rockland hammock, coastal berm, and on roadsides, sometimes disturbed areas in close proximity to a natural area, especially in sunny gaps or edges (Bradley and Gann 1999). The pine rockland habitat where it occurs in Miami-Dade County and the Florida Keys requires periodic fires to maintain an open sunny understory with limited hardwoods. Occupied sites within the National Key Deer Refuge currently include Cactus hammock, Long Beach coastal berm, Koehn's subdivision, and Watson's hammock.

Big Pine partridge pea. The Big Pine partridge pea is a small prostrate to ascending herbaceous shrub with yellow flowers and pinnately compound leaves. Big Pine partridge pea occurs mostly in pine rockland on Big Pine Key and Cudjoe Key, where it is widely but unevenly distributed (Bradley 2006). Plants also occur on conservation lands owned by the State of Florida, Monroe County, and The Nature Conservancy. Additional sites occur on county and state road rights-of-way and private properties. Big Pine partridge pea is fire-adapted, and fire history and time since fire are important parameters that affect the abundance of this species (Lui et al. 2005a). While the storm surge from Hurricane Wilma in 2005 resulted in significant population declines in all areas, post-hurricane recovery has been greater in burned plots, suggesting that fire may have a positive impact on the recovery of candidate species and species richness (Bradley and Saha 2009).

Wedge spurge. Wedge spurge is a small prostrate perennial herb. The stems are slender and numerous, radiating out from the tap root. Wedge spurge is known only from pine rockland vegetation on Big Pine Key (Small 1933, Long and Lakela 1971, Wunderlin 1998, Ross and Ruiz 1996). Most of the range is encompassed within the National Key Deer Refuge. The remainder occurs on State of Florida, Monroe County, and private lands, including the Terrestris Preserve owned by The Nature Conservancy. A similar relationship between fire and hurricanes exists for wedge spurge as was discussed above for the Big Pine partridge pea (Bradley and Saha 2009).

Cape Sable thoroughwort. Bradley and Gann (2004) found Cape Sable thoroughwort on five islands in the Keys (Upper Matecumbe Key, Lignumvitae Key, Big Munson Island, Boca Grande, Long Key) and one small area in Everglades National Park. The only large population is on Big Munson Island, a privately owned island adjacent to Big Pine Key (Bradley and Gann 2004). It occurs in Key West NWR on Boca Grande Key. This herb has been observed most commonly in open sun to partial shade at the edges of rockland hammock and in coastal rock barren. It was historically known from coastal berm along the northern edges of Florida Bay. Periodic storm events may be responsible for maintaining the community (Bradley and Gann 1999).

Sand flax. Sand flax is a wiry, yellow-flowered herb found in pine rockland, disturbed pine rockland, marl prairie, roadsides on rocky soils, and disturbed areas (Bradley and Gann 1999; Hodges and Bradley 2006). There are 11 extant occurrences in the Florida Keys and extreme south Florida, with only 3 of these sites located on public conservation lands. The largest population in Monroe County is located on Big Pine Key within National Key Deer Refuge and surrounding lands (Gann et al. 2002; Bradley 2006; Hodges and Bradley 2006).

Florida semaphore cactus. The Florida semaphore cactus is an erect, trunk-forming cactus endemic to the Florida Keys. The branches may grow in one or multiple planes from the trunk. The spines are not barbed. There is only one naturally occurring population in the Lower Keys, on The Nature Conservancy's Torchwood Hammock Preserve on Little Torch Key. There are outplanted populations on north Key Largo, Big Pine Key, and at the Key West Tropical Forest and Botaincal Garden. This cactus grows close to saltwater on bare rock with a minimum of humus-soil cover in hammocks near sea level (Small 1933, Benson 1982). It occurs in buttonwood-dominated scrub salt marsh areas between rockland hammocks and mangrove swamps and possibly other habitat such as openings in rockland hammocks (Gann et al. 2002). Like the Key tree cactus and other cactus species in the Lower Keys, its ability to persist in light of climate change may be tenuous without direct intervention.

CULTURAL RESOURCES

At the end of the late Pleistocene, Florida's shoreline extended 100 to 125 miles seaward of its current location. Pollen profiles from south Florida indicate that the area supported an arid scrub-shrub habitat between 14000 to 10000 before present (B.P.). Evidence of Florida's earliest inhabitants is very limited. Less than 100 Paleoindian sites are known statewide; none of these are located in the Keys. The Cutler-Fossil Site in Miami-Dade County yielded bones of humans and late Pleistocene fauna, a possible hearth, and stone and bone tools. The hearth yielded a radiocarbon date of about 9,670 B.P. The site is situated on the Atlantic Coastal Ridge and overlooked forested and open savannahs, open marshes, and wetlands. Like for the region's later occupants, potable water was a limiting factor for settlement and population size (Borremans 1990).

By 4000 years ago, sea level had risen and formed the modern shorelines, and the Florida Keys were established as a chain of islands off the southern tip of Florida. The establishment and spread of shellfish species, such as conch, whelk, oyster, and clam, began in this period. The Archaic Period

(10000-3000 B.P.) is denoted by the presence of large coastal shell middens, often containing fiber- and sand-tempered pottery, and interior black earth middens situated on hardwood hammocks or along natural drainages. To date, no archaeological sites dating to the Archaic Period have been identified on uplands in the Keys. The now-submerged landscape holds a higher probability for sites dating to the Paleoindian and Archaic Periods (Borremans 1990; Mathewson 1992).

The best-documented precolumbian site in the Keys is the Upper Matecumbe Key Site (Goggin 1944). Decorated pottery recovered from the site shows its occupation during the later part of the Glades II Period (750 – 1200 A.D.) and the Glades III Period (1200 – 1500 A.D.). The Archaeological and Historical Conservancy, Inc., has conducted large-scale archaeological and historical reconnaissance of the Keys, documenting a number of historic properties or verifying the locations of previously identified sites (Carr, Allerton, and Rodriguez 1987; Carr and Fay 1990; Carr and Rodriguez 1988).

Ethnohistoric accounts dating to the 16th century indicate the Keys were occupied by groups either affiliated with the Tequesta or the Calusa. The Tequesta primarily occupied the area around Biscayne Bay, but they were also present throughout most, if not all, of southeastern Florida (Wheeler 2004). The Calusa was a maritime-based chiefdom centered in the Charlotte Harbor region, but whose reach extended well into the Ten Thousand Islands area. These chiefdoms relied heavily on the rich estuarine and maritime resources of south Florida (Marquardt 1992; Widmer 1988). Fontaneda, a Spanish sailor shipwrecked on the Florida coast in the mid-16th century, listed the caciques or political leaders, as well as the provinces and towns that they controlled. Three caciques listed as being in the “land of the Martines” are Guarungunve, Cuchiyaga, and Matecumbe (Worth 1995). In 1675, Bishop Calderon visited the Viscaynos, the Matacumbeses, the Bayahondos, and the Cuchiagaros. The Viscaynos are thought to have occupied the area around Biscayne Bay; the Matacumbeses occupied either Upper or Lower Matacumbe Key; the Bayahondos occupied Bahia Honda Key or Key Vaca; and the Cuchiagaros occupied Big Pine Key (Griffin, Fryman, and Miller 1979). By the late 18th century, the Keys and much of south Florida appeared to have been abandoned by the Calusa, the Tequesta, and other Indian groups.

The Miccosukees, Seminoles, and their Oconee and Creek ancestors began to move into Florida from Georgia and Alabama during the mid-1700s. It does not appear that either tribe ever occupied the Keys, though the Seminole established the town of Ochupocrassa near Biscayne Bay about 1820 (Leynes and Cullison 1998).

Prior to the Spanish cession of Florida to the United States in 1821, the Keys had no permanent settlements. The Straits of Florida were an important, but treacherous, passage from the Gulf of Mexico to the North Atlantic and Europe. Native American, Spanish, Bahamian, and American “wreckers” established temporary camps to salvage cargo from ships that had run aground and would occasionally refloat seaworthy vessels. The construction of the Florida Reef lighthouses between 1852 and 1878 lead to the industry’s decline. Havana, Cuba, was the center of the salvage industry during the period of Spanish dominance in the Caribbean and Florida. By the 17th century, the industry’s efforts shifted to New Providence and Nassau in the Bahamas. The United States Congress passed legislation in 1825 that required any wreck salvaged in American waters be brought to an American port for adjudication. A number of Bahamians moved to the Keys following the establishment of a U.S. Navy base and federal court on Key West (Leynes and Cullison 1998). These early immigrants became known as “Conchs” and made their living primarily by exploiting maritime resources, such as fish, sponges, turtles, and ship wrecks (Griffin, Fryman, and Miller 1979).

Until the late 1870s, the Keys' economy continued to focus on the sea, although hunting, charcoal production, and small-scale agricultural operations were becoming more important (Table 2). The Watson Homestead, located on Big Pine Key and within the present National Key Deer Refuge, provides a glimpse into this period. Robert B. Watson and his family, who owned a 107-acre tract from 1905 to 1924, grew limes, plantains, guavas, tomatoes, and onions. Bee-keeping and operating a small grocery store augmented their income (Carr and Fay 1990).

The earliest "plantations" produced fruits and vegetables for the market in Key West. Shortly after 1900, pineapples became a lucrative crop, leading to the deforestation of scrubby woods and mature hardwood hammocks for fields. Aiding the commercial success of pineapple and lime plantations was the extension of Florida East Coast Railway from Miami to Key West. Railroad construction began in 1900 and was completed by 1912. Pineapple production was in decline by 1906. Clearing of the pine rockland and hammocks for fields led to erosion that left "old stony fields." Limes were introduced by Dr. Henry Perrine from the Yucatan in 1838; the first trees were planted on Indian Key and possibly nearby keys. The Conchs used the limes for seasoning and medicinal purposes. Although wild limes sold for very high prices, the lime industry only took off following the demise of the pineapple plantations, reaching peak production in 1923. A hurricane in 1926 devastated most of the Keys' lime groves. Competition from West Indies and Mexican growers slowed recovery. Production in 1935 was only a quarter of 1923 yield (Griffin, Fryman, and Miller 1979; Leynes and Cullison 1998; Windhorn and Langley 1974).

The Hurricane of 1935 destroyed the Florida East Coast Railway, but not access to the Keys. Construction of the Overseas Highway began in the early 1920s. By 1928, the highway ran from Miami to within 40 miles of Key West, with the remainder connected by ferry runs between islands. Following the 1935 hurricane, the former railway bridges and landfill islands supported the remaining stretch of the Overseas Highway to Key West. The Highway opened up the Keys to the emerging saltwater fishing, recreational, and tourist markets (Griffin, Fryman, and Miller 1979; Windhorn and Langley, 1973 and 1974). Residential and commercial development expanded quickly after World War I.

SOCIOECONOMIC ENVIRONMENT

Purpose

The purpose of this section is to provide information on (1) the current social and economic status of Monroe County and its residents; (2) the economic value of wildlife-dependent recreation; and (3) the Service's recreation opportunities and environmental education programs in the Lower Florida Keys Refuges.

Background

Monroe County includes the Florida Keys and a section of the southwest tip of the Everglades. This report is only concerned with the socioeconomics of the Florida Keys. The Florida Keys are sparsely populated compared to Florida as a whole. Many of the islands are semi-rural though there are several large, densely developed island communities--Islamorada, Marathon, and Key West. According to the U.S. Census Bureau, for the year 2000, compared to the state as a whole, the county represents only a half percent of the state population and about 0.7 percent of the state's housing. The Keys represent only 5.6 percent of Monroe County's total area, 1.8 percent of the state's land area, and 23 percent of the state's waters.

Table 2. Residents on islands now within the National Key Deer Refuge, circa 1870

Name	Age	Occupation	Place of Birth	Wife/Family
Ramrod Key				
W. Benj. Saunders	61	Farmer	Bahamas	Wife
John Saunders	32	Seaman	Bahamas	Wife & Family
Richard Curry	34	Seaman	Bahamas	Wife & Family
Little Pine Key				
Samual Bird (Black)	55	Farm Laborer	Tennessee	None listed
Howes Key				
Household number assigned by no entry made.				
Big Pine Key				
George Wilson	30	Charcoal Burner	New York	None listed
No Name Key				
William Thrift	29	Farmer	Bahamas	None listed
Joseph Thrift	60	Farmer	Bahamas	Wife
William Cary	27	Farmer	Bahamas	Wife & Family
Thomas Knowles	64	Farmer	Bahamas	
John Sands	39	Seaman	Bahamas	Wife & Family
Joseph Lowe	60	Farmer	Bahamas	
William Knowles	23	Farmer	Bahamas	Wife
Nicholas Matcovich	45	Farmer	Louisiana	Wife & Farmer
Alaexander Knowles	24	Seaman	Bahamas	Wife
William Cates	25	Seaman	Bahamas	Wife
Joseph Thompson	79	Farmer	Bahamas	None listed
John Thompson	34	Farmer	Bahamas	None listed
John Sands	47	Farmer	Bahamas	Wife & Family
John Cary	50	Seaman	Bahamas	Wife & Family
James Knowles	35	Seaman	Bahamas	Wife & Family
Two other households numbers assigned but no entry made.				
Cudjoe Key				
John T. Knowles	60	Farmer	Bahamas	None listed
Knockemdown Key				
William Pent	26	Seaman	Florida	Wife & Family
John Pent	32	Seaman	Florida	None listed
Justin Knowles	22	Farmer	Bahamas	Wife & Family
Charles Hopkins	16	Seaman	Georgia	In above home
William Russell	60	Farmer	Bahamas	Wife
Torch Keys				
One household number assigned, but no entry made.				
Summerland Key				
John Roberts	38	Farmer	Bahamas	Mother

Source: 1870 U.S. Census (taken from Griffin, Fryman and Miller 1979: 37).

There is still much undeveloped land that is in private ownership. The county and state have limited the rate of development to prevent the human population from exceeding the carrying capacity of the water, electric, sewage, and road services. The latter pertains to concerns about hurricane evacuation times of the current resident and tourist populations with the present road and bridge infrastructure. With many private lands in the Lower Florida Keys containing habitat for threatened or endangered species, habitat loss or degradation from development remains a concern.

The economy of the Keys is supported primarily by tourism. There is extensive service support for the tourist industry and local resident needs. Almost every island accessible by U.S. Highway 1 has one or more residential subdivisions, trailer parks, recreational vehicle parks and/or campgrounds, and associated commercial services. Water-based sports (e.g., sport fishing, diving, and kayaking) and the night life of Key West have become major draws to the area, with associated economic gains. Also important to the economy of the Keys is real estate—the renting, selling, and buying of homes, many of them to seasonal residents.

Regional Demographics and Economy

Information for 2000 is available for Monroe County from the following websites:

http://www.census.gov/main/www/cen2000.html
http://www.census.gov/census2000/states/fl.html

Table 3 compares the population, housing units, land area, and density of the Florida Keys to that of the State of Florida. The population density of the Keys is approximately one-quarter of the rest of Florida, and the housing unit density is approximately one-third of the rest of Florida.

Table 3. Monroe County – population, housing units, area, and density

		Area in Square Miles			Density per square mile of land area	
Population	**Housing Units**	**Total Area**	**Water Area**	**Land Area**	**Population**	**Housing Units**
FLORIDA						
15,982,378	7,302,947	65,754.59	11,827.77	53,926.82	296.4	135.4
MONROE COUNTY						
79,589	51,617	3,737.15	2,740.24	996.91	79.8	51.8

Source: U.S. Census Bureau, 2005 American Community Survey, page 1.

Monroe County residents enjoy a higher average income than other areas of the United States and Florida; however, average income figures may be skewed high due to the number of wealthy residents. The overall cost of living is higher with housing costs in particular being very high for working class residents.

Table 4. Income and population statistics

*Median Family Income (2005)		Percent of Population over 65	
United States	$55,832	United States	12.1%
Florida	$50,465	Florida	16.6%
Monroe County	$62,638	Monroe County	15.6%

Source: U.S. Census Bureau, 2005 American Community Survey, page 1.

Table 5. Monroe County demography statistics

CHARACTERISTICS	2000	2007	PERCENT CHANGE
Population	79,589	73,223	- 8.0%
Age 18 – 65	65,984	50,231	- 23.8%
Age 65+	11,648	11,423	- 1.9%
Median family income	$ 50,734	$55,054	+ 7.8%

Source: U.S. Census Bureau 2000 and http://enwikipedia.org./wikiMonroe County, Florida

The average age of residents over 65 living in the Florida Keys is higher than the U.S. average; there has been a decline in population of residents between the ages of 18 to 65. The Florida Keys are experiencing a decline of local residents who grew-up with the knowledge of the intrinsic and economic value of the Keys' natural resources. This is pertinent to the refuges in terms of the continuing effort needed to educate new residents about natural resources and the needs of endangered and imperiled species, especially with a large, seasonal influx of visitors.

Economic Contribution of Recreating Visitors to the Florida Keys/Key West

The tourist-industry activities of boating, fishing, scuba diving/snorkeling, and sightseeing generate $147 million per year. All of these activities occur on the three refuges. The Monroe County Tourist Development Council conducted a survey of over 3,000 visitors from March 2005 – February 2006. Visitors were asked to choose among 10 categories of activities as reasons for their visit to the Keys. Thirty-six percent of respondents identified diving, snorkeling, wildlife viewing, and boating as their primary visitor activities.

Recreation Use and Visitor Services

The National Survey of Fishing, Hunting, and Wildlife-Associated Recreation has been conducted about every 5 years since 1955. It provides information on the number of participants in fishing, hunting, and wildlife watching (observing or photographing wildlife, and birdfeeding), and the amount of time and money spent on these activities. Over 87 million U.S. residents, aged 16 years old or older, fished, hunted, or watched wildlife in 2006 (USFWS and U.S. Census Bureau 2007). Nearly 34 million people fished or hunted and more than 71 million participated in at least one type of wildlife-watching activity. Wildlife recreators' enthusiasm was reflected in their spending, which totaled $122 billion in 2006, and amounted to 1.1 percent of the gross domestic product. Wildlife watchers spent more than $45 billion on trips, equipment, and other related items.

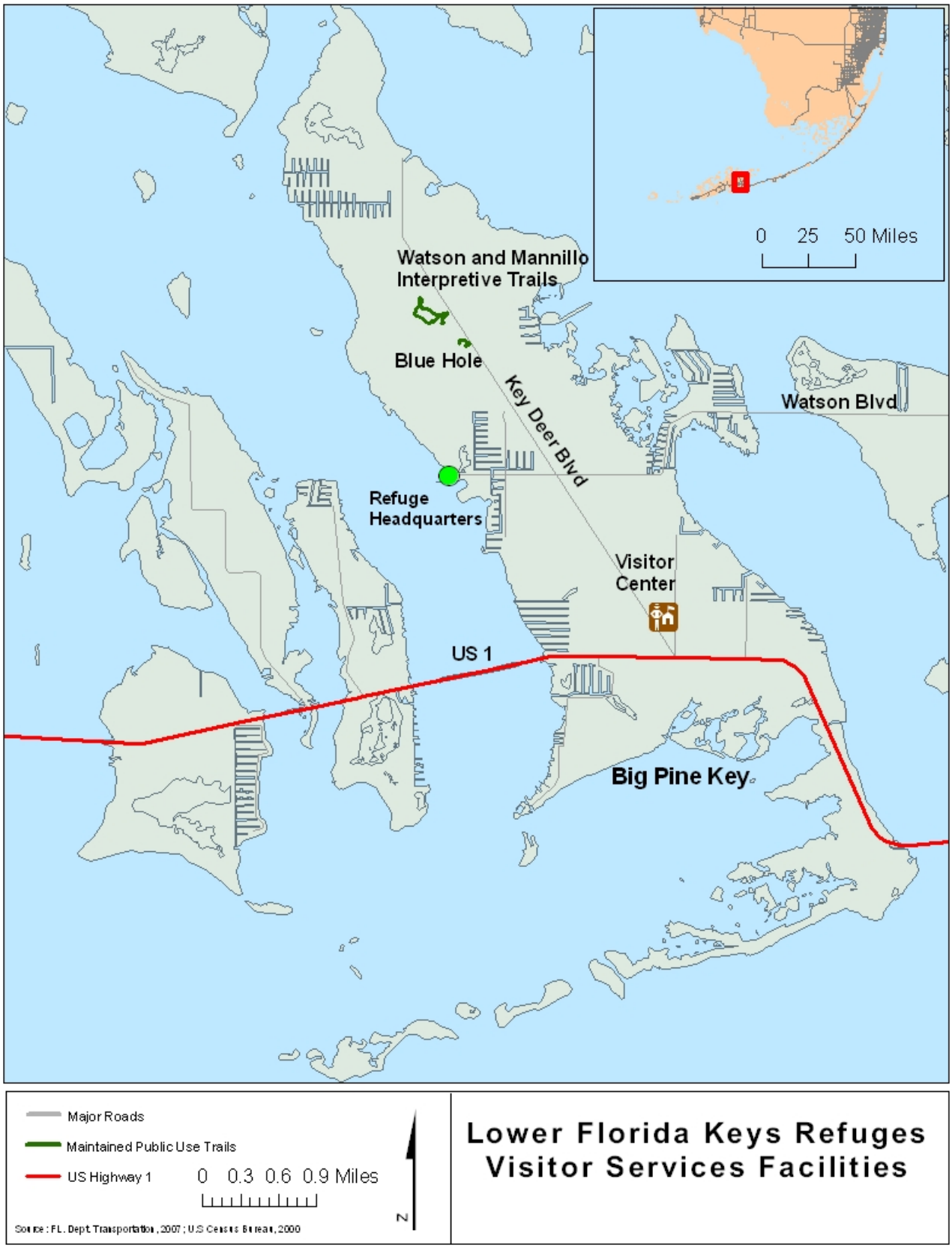
The Service's *Banking on Nature 2007: Economics Benefits to Local Communities of National Wildlife Refuge Visitation* report states, "Recreational visits to national wildlife refuges generate substantial economic activity. In Fiscal Year 2006, more than 34.8 million people visited refuges in the lower 48 states for recreation. Their spending generated more than $1.7 billion of sales in regional economies. As this spending flowed through the economy, nearly 27,000 people were employed and $542.8 million in employment income were generated. About 82 percent of total expenditures were by non-consumptive activities on the refuges" (Carver and Caudill 2007).

According to the Monroe County Tourist Development Council, the Florida Keys receive approximately 1.9 to 2 million visits by car annually (Leeworthy and Wiley 1997). An important part of the revenue income in the Lower Florida Keys is related to the three refuges, which collectively receive about 861,750 visits annually: National Key Deer Refuge--139,000 visits; Key West NWR--436,500 visits; and Great White Heron NWR--146,125 visits. About 10,000 visitors come into the Refuge Visitor Center in the Big Pine Key Plaza annually, and approximately 80,000 visitors have been recorded annually at the Blue Hole interpretive site on Big Pine Key. The estimates for Key West and Great White Heron NWRs are estimated from recent observations from staff of customers to the diving, snorkeling, fishing, and kayaking industries.

The National Wildlife Refuge System Improvement Act of 1997 established six priority wildlife-dependent public uses on national wildlife refuges, assuming that they are compatible with the purpose of each refuge: hunting, fishing, wildlife observation, wildlife photography, and environmental education and interpretation. Hunting is prohibited on all complex refuge lands and throughout the Florida Keys. Collectively, the three refuges provide opportunities for the other five priority wildlife-dependent activities. Some non-priority recreation uses have been allowed on the refuges, for example, horseback riding occurs on certain trails in the National Key Deer Refuge and picnicking occurs on refuge beaches that are open to public access. Refuge lands with public access are free of charge and open 7 days a week. Hours are from 1/2-hour before sunrise to 1/2-hour after sunset. Some refuge lands are closed to public access to protect environmentally sensitive wildlife or habitats.

Most of the refuge-owned lands within the National Key Deer Refuge are located on the mainline keys (islands that are accessible by vehicles) and open to public access via fire roads and other trails. Many visitors come to the National Key Deer Refuge to observe and photograph the unique, tiny Key deer; most of the deer population is found on Big Pine and No Name Keys. Other popular wildlife viewing areas on Big Pine Key include Long Beach Road and at the north end of Key Deer Boulevard. The Service provides extensive interpretive information at the Refuge Visitor Center on Big Pine Key, the Blue Hole interpretive site, and the 2/3-mile Watson and the 1/8-mile Mannillo nature trails, the latter of which is accessible for persons using wheel chairs (Figure 7). The Blue

Figure 7. Lower Florida Keys Refuges Visitor Services Facilities



Hole is an old quarry with an observation deck and a partial trail that provides for viewing of a variety of turtles, fish, green herons and other birds, and the occasional alligator, Key deer, and raccoon. There are many other undeveloped trails open to wildlife-dependent recreational activities on Big Pine, No Name, Cudjoe, and Lower and Upper Sugarloaf Keys. Ohio Key also has beach access. The backcountry islands that have Key deer are designated as Wilderness and are only open to public access on a case-by-case basis with a special use permit.

Fishing on any of the three refuges is not specifically listed as a refuge-regulated activity in the Code of Federal Regulations. Saltwater fishing along the refuges' shorelines and in state-owned marine waters adjacent to the refuges' lands is regulated by the State of Florida and occurs primarily on Ohio Key. Saltwater fishing activities in the backcountry areas include hook and line for finfish, baitfish netting, crabbing, and lobstering. There is no freshwater fishing allowed on any Keys refuge lands.

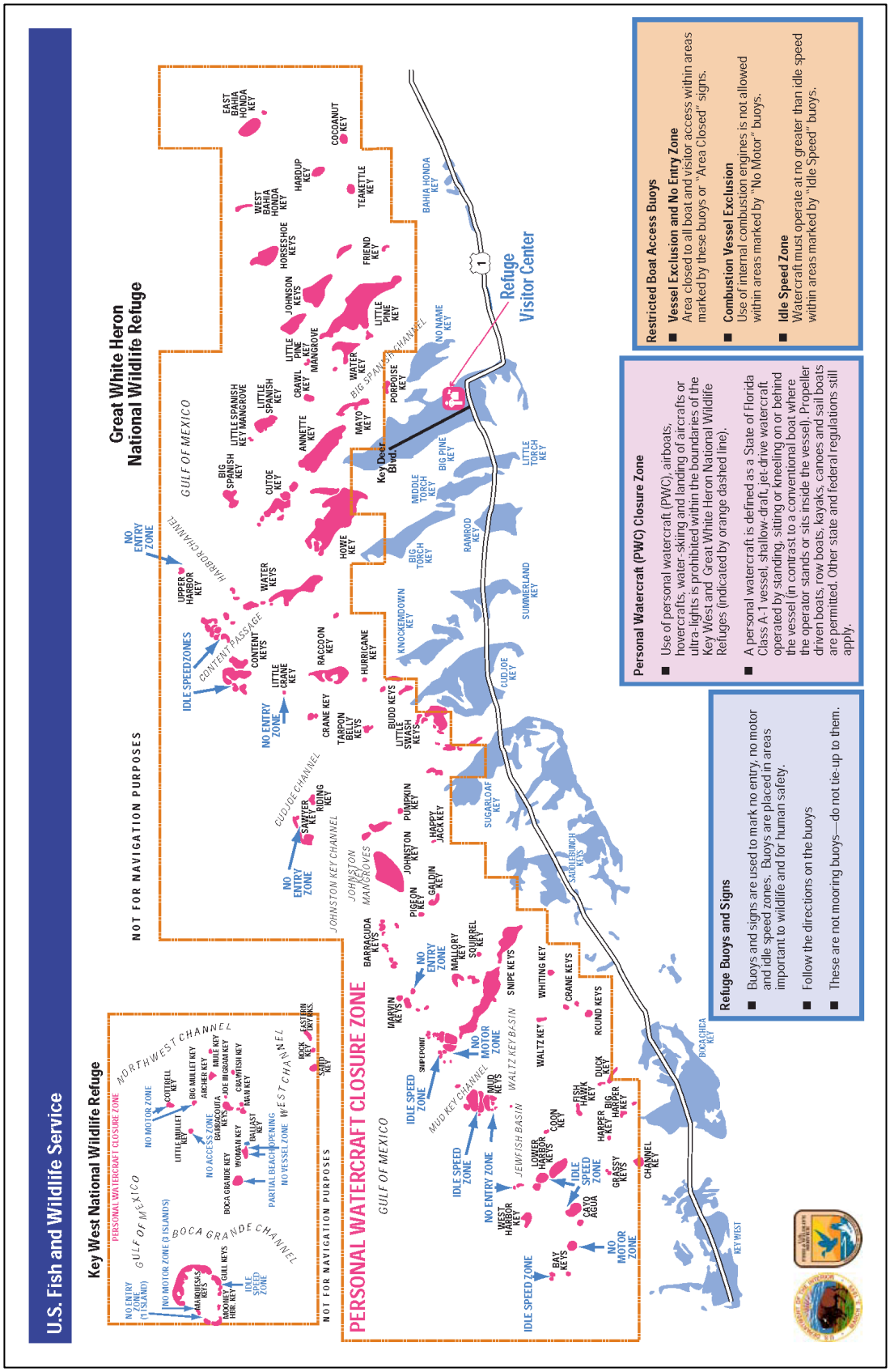
Key West and Great White Heron NWRs contain over 300,000 acres of marine waters, dozens of mangrove islands, and several islands with pristine undeveloped beaches that are designated as Wilderness. The marine waters are some of the best waters for saltwater sport fishing in North America. Visitors come from all over the world to fish these waters and numerous tournaments are held to catch and release fish. The dozens of mangrove islands and shallow waters are home for nesting, feeding, and resting birds, such as pelicans, cormorants, herons, egrets, plovers, and frigate birds, to name a few. Due to an abundance of birds, the refuges are havens for birders. Boaters travel to the pristine beaches of Woman and Boca Grande Keys to enjoy a leisurely day in a secluded beach setting.

Management of the marine waters is limited as they are state-owned waters. This limited authority is granted by the State of Florida via the Management Agreement with the State of Florida for Submerged Lands within the Boundaries of the Key West and Great White Heron National Wildlife Refuges, authorizing certain measures to be implemented within the state-owned waters to minimize wildlife disturbance and habitat destruction from non-wildlife-dependent recreational activities. The Management Agreement specifically allows the Service to regulate access within 300 feet of certain islands, to enforce boating speed zones and no-entry areas, and to prohibit the use of personal water craft (e.g., jet skis), aircraft landings, hovercraft, airboats, and waterskiing within the administrative boundaries of the two refuges (Figure 8). All other marine activities (e.g., fishing) within the refuges' administrative boundaries are regulated by the State of Florida and Florida Keys National Marine Sanctuary.

The visitor services' park ranger operates a Visitor Center and oversees management of various sites on National Key Deer Refuge. The Service is actively involved in several environmental educational and interpretive organizations and events including, but not limited to, the Monroe County Environmental Education Advisory Council, the Florida Keys Birding and Wildlife Festival, the Florida Keys Scenic Highway Initiative, the Florida Keys Overseas Heritage Trail, and the interagency Florida Keys Eco-Discovery Center. Environmental education opportunities are provided on National Key Deer Refuge for local students from schools on Big Pine and Sugarloaf Keys, though teachers can bring students from elsewhere to the refuge.

Volunteers continue to be a major contributor to the success of the Refuge System. In 2005, nearly 38,000 volunteers contributed 1.4 million hours on refuges nationwide, a service valued at more than $25 million. The Lower Florida Keys Refuges depend on a volunteer base of about 50 individuals. Inerrant workers, such as college students doing alternative spring breaks, and other organized programs, such as Student Conservation Association and AmericCorps, also assist. Combined, these volunteers contributed almost 5,000 volunteer hours in 2008.

Figure 8. Boating zones and restrictions



III. Plan Development

SUMMARY OF ISSUES, CONCERNS, AND OPPORTUNITIES

This CCP was prepared in compliance with the National Environmental Policy Act of 1969. This law requires the Service to include public involvement in environmental planning. A public notice announcing that the comprehensive planning process had begun was published in the *Federal Register* on May 9, 2003, with the initiation of the Crocodile Lake NWR CCP. In 2003, a Visitor Services' program review was conducted for National Key Deer Refuge. In 2005, a review of the Service's biological programs and resources was conducted for the Lower Florida Keys Refuges. A wilderness review of these refuges was conducted in 2006. These professional reviews were done to determine issues of importance to be addressed in the long-term plan. A list of experts from the Service and partnering agencies that participated in the reviews is included in Appendix D. The information garnered from the reviews helped the Service's planning team analyze and develop recommendations for the CCP.

In preparation for this CCP, public scoping meetings for the Lower Florida Keys Refuges were conducted in March 2005. The March 8 meeting was held on Big Pine Key at the local charter school with approximately 40 people in attendance. The March 9 meeting was held in Key West at the Board of County Commissioners' meeting room with approximately 20 people in attendance. Meeting notices were published in the local newspapers and flyers were displayed at several locations, such as the post office and supermarkets. The public provided comments on issues that should be addressed in the 15-year CCP. A summary of the comments from these meetings is included in Appendix D.

In June 2006, a core CCP planning team of Service staff started meeting regularly to develop the CCP for the Lower Florida Keys Refuges. The team considered all public and interagency comments. The team prioritized the most critical issues to be addressed by the refuges over the 15-year life of the CCP.

The notice that the Draft CCP was available was published in the *Federal Register* on May 23, 2008. Press releases were also issued through local newspapers and radio public service announcements. Over 200 notices were sent to interested parties and stakeholders on the Lower Florida Keys CCP mailing list. The 30-day public review and comment period for the Draft CCP was from May 23 though June 23, 2008. At least 47 persons attended two public meetings during the open comment period. The meetings were held in Big Pine Key on June 9, 2008, and in Key West on June 10, 2008.

Under the National Environmental Policy Act, the Service must respond to substantive comments received during the open comment period. This includes both written comments and oral statements made at public meetings. The Service does not reply directly to each commenter. Instead, the Service responds to the comments by category. These responses and a summary of the public review process are included in Appendix D. Editorial comments on text or grammar were incorporated into this CCP document as applicable. See Appendix N for the EA.

PRIORITY RESOURCE ISSUES

The following section provides a description of the priority resource issues affecting the management of the Lower Florida Keys Refuges now and foreseeably into the future within the CCP's timeframe of 15 years. The discussions below offer insight into the decision-making framework in which the goals, objectives, and strategies were developed by the CCP Planning Team and further refined based on public and agency comments.

OVERARCHING ISSUE (APPLIES TO ALL REFUGES ACROSS MOST PROGRAM AREAS)

1. Climate change.

Climate change and its interrelationship to existing problems of conserving fish and wildlife is the transformational conservation challenge of the 21st century. The Intergovernmental Panel on Climate Change (IPCC) reported that the warming of the world's climate system is unequivocal based on documented increases in global average air and ocean temperatures, unprecedented melting of snow and ice, and rising average sea level (IPCC 2007). While the distribution and abundance of fish and wildlife are naturally dynamic relative to a variety of environmental factors, climate change may drastically alter and accelerate the natural cycles that we are familiar with today. Some effects may include changes in precipitation, increased frequency and intensity of extreme weather events, rising sea levels and tidal fluctuations, and invasions of new exotic species. Consequently, climate change is a challenge not only because of its direct effects, but also because of its potential to amplify the other stressors that have and will continue to be major conservation priorities, such as habitat fragmentation, urbanization, and invasive exotic species.

Low-lying islands, such as the Florida Keys, will face the most direct and dramatic impacts of climate change, particularly from a rising sea level and from the increasing frequency and intensity of coastal storms. Effects have already been experienced in the Lower Florida Keys Refuges. For example, widespread mortality of slash pine trees resulted from saltwater inundation due to Hurricane Wilma's storm surge in 2005. Also, there have been shifts in plant community composition along the coastal fringe due to higher spring tides from an incremental sea level rise over the past hundred years. Saline intrusion into the subsurface freshwater lens from this historic sea level rise has reduced the extent of pine rockland and freshwater wetlands on Sugarloaf Key, resulting in more salt-tolerant plant communities (Ross et al. 1994). Storm events also cause considerable physical damage to beach berms and native vegetation along vulnerable shorelines, impacting nesting habitat for sea turtles and shorebirds. Rising sea levels may decrease the availability and abundance of prey for wading birds that forage in shallow waters on the expansive tidal flats of the backcountry. Climate change is expected to amplify and hasten these effects, potentially at rates that exceed the normal resiliency of plant communities to recover, shift, or adapt accordingly (Stanton and Ackerman 2007, Clough 2008).

The effects of climate change are expected to become more frequent and severe within the 15-year time period covered by this CCP. The current level of uncertainty is high regarding the actual impacts and their extent both in time and space, but new research and modeling efforts will lead to enhanced capabilities to model and predict future scenarios. The Service is actively engaging with the scientific community and its partners to evaluate the effects of projected sea level rise on wildlife and their habitats in the Florida Keys. It will begin to develop strategies to enhance the resiliency of natural communities to adapt to climate change, as well as formulate criteria for when direct intervention may be necessary to save a species, such as assisted migration or removal to captivity (Hoegh-Guldberg et al. 2008, Ross et al. 2009).

FISH AND WILDLIFE POPULATION MANAGEMENT

2. Limited inventories and monitoring.

Baseline data are lacking for a number of species found in the Lower Florida Keys Refuges. Wildlife populations and their habitats need to be adequately inventoried and monitored for an adaptive management approach (Williams et al. 2007) to establish baseline data, determine trends, identify management needs, set priorities, and evaluate the effects of management actions, such as prescribed fire, wetland restoration, and exotic species control. The Service needs to prioritize its

work allocation to carefully choose indicator species representative of all habitat types and to establish monitoring protocols that will document and quantify data for these species over the long-term. At a minimum, baseline data of flora and fauna are needed at a level that can provide for detecting changes from catastrophic wildfires, hurricanes, and other events in order to determine if a management response is necessary. Baseline inventorying and long-term monitoring are essential for detecting effects of climate change that are expected to accelerate over time.

The Service does not have the capability to monitor all species that occur on the Lower Florida Keys Refuges, and specific information on some species may remain lacking as a result. High priority needs and limited resources actually place substantial restraints on how many, and which, species and assemblages are monitored. Because of the urgent needs to protect and recover listed species, the Service and its partners have historically focused their inventorying and monitoring efforts on a few priority species, most notably Key deer, sea turtles, and great white herons. More recent efforts have expanded to include the Lower Keys marsh rabbit, Key tree cactus, and candidate butterfly species. Species selected for long-term monitoring are chosen for one or more of the following reasons: the species' role in the ecosystem (e.g., the great white heron as an apex predator); the ability to correlate their relative abundances with ecosystem management targets; the ability to correlate their status with the health of ecosystem components, including factors that threaten the viability of their habitat, demographics, and/or genetic health; and/or regulatory and or recovery requirements under the Endangered Species Act. In some cases, availability of effective monitoring techniques also influences whether a given species is monitored or not.

3. Recovery of imperiled species.

The primary mission of the Lower Florida Keys Refuges is to maintain the population viability and prevent the extinction of species by managing the ecosystems in which they reside, pursuant to the original purposes for establishing the refuges and trust responsibilities under the Endangered Species Act. The Lower Florida Keys Refuges provide habitat for 21 threatened and endangered species, as well as 10 federal candidate species. The Service has limited financial resources and staff to address all imperiled species, therefore setting priorities and selecting appropriate indicator species is essential. Key deer, in particular, have long been protected as an umbrella species and consequently benefited from habitat management programs since the establishment of National Key Deer Refuge. Today, the Key deer population is currently at or above the habitat's carrying capacity in the core areas of Big Pine and No Name Keys, increasing the likelihood of density-dependent disease transmission and over-browsing of native plants. Consequently, the Service needs to evaluate the effects of deer over-browsing on native plant communities and consider effective strategies to protect both the Key deer and their habitats. Furthermore, because populations of both the Lower Keys marsh rabbit and Key tree cactus are so low that extinction may occur – a condition existing before, but exacerbated by recent hurricanes (i.e., Georges in 1998, Wilma in 2005) – expeditious management measures focused on both species are prudent and warranted. The effects of pesticide applications to control nuisance mosquitoes on non-target species, such as butterflies and insect-pollinated plants, need to be fully evaluated. The future effects of climate change on the long-term sustainability of imperiled species and their habitats also need to be evaluated in addition to other stressors that are currently present.

4. Controlling injurious, invasive, and exotic species.

Invasive exotic plants and animals can occupy both disturbed areas and natural communities. In disturbed areas, they supply a source for invading adjacent natural areas. Within natural communities, they displace native species and alter ecosystem structure and functions. There are at least 25 terrestrial invasive exotic plant species known to occur on the refuges. The most widespread

and problematic species include Brazilian pepper, Australian pine, Asiatic columbrina, seaside majoe, lead tree, and non-native grasses. Continual monitoring and treatment are required to keep exotics under control and prevent new infestations.

The eradication of invasive exotic plants is extremely difficult for both Great White Heron NWR and Key West NWR because affected areas are located on the uplands of remote offshore islands. Eradication is also problematic on National Key Deer Refuge because infestations on private lands and the Overseas Highway, and other road rights-of-way serve as seed sources that may re-infest refuge lands, requiring frequent remedial treatment and flexible control strategies. The use of non-native, invasive plants in residential and commercial landscaping may trigger the introduction of exotics to refuge lands. The Service has invested substantial time and money in removing and controlling the spread of exotic plants, and participates as a member on the Florida Keys Invasive Exotics Task Force. For additional information on exotic plant species, visit the Florida Exotic Pest Plant Council website: www.fleppc.org.

The distribution and impact of invasive exotic animals on native plants and wildlife within the refuges are less well known. Feral and free-roaming cats are predators of the endangered Lower Keys marsh rabbit, silver rice rat, and other native species (USFWS 1999). The Virginia opossum is not native to the Lower Keys, but has recently become well established. Imported fire ants and other exotic insects attack young sea turtles, endangered endemic mammals, and butterfly larva. Black rats may eat bird eggs and the young of small mammals and out-compete the latter for habitat. Exotic freshwater fish could reduce the abundance and genetic integrity of native fish species and may require management attention. Non-native amphibians, such as marine toads and Cuban tree frogs, may be impacting their native counterparts. The Burmese python and boa constrictor snakes, monitor lizard, and spiny-tailed iguanas are aggressive predators that are being observed more frequently in the Florida Keys. Perhaps the most common exotic reptile is the green iguana, the population of which has increased greatly over the past decade. Shiny cowbirds, now present in Key West NWR, and the Gambian pouch rat, established some 30 miles from refuge boundaries, are notable exotics to monitor closely. Early detection and rapid response efforts are critical to keeping these exotic species from spreading or establishing breeding population in the Florida Keys. The removal of established invasive exotic animals must carefully consider consequences of altering predator-prey relationships within the ecosystem (Zavaleta et al. 2001).

HABITAT MANAGEMENT

5. Habitat fragmentation.

The rapid loss of habitats from residential and commercial development in the Florida Keys up through the 1990s resulted in habitat fragmentation and decline of ecosystem function. Canals, mosquito ditches, surface fill, and roads alter the natural hydrologic processes on those islands connected by the road system, disrupting water flow and creating standing water. Publically owned and managed conservation lands are consequently interspersed with privately owned parcels, creating a mosaic of natural plant communities and parcels landscaped with non-native invasive and exotic plant species. Structures and fencing impede the movement of wildlife. Residential development within the boundaries of the National Key Deer Refuge has expanded the wildland-urban interface, which affects the Service's ability to effectively use prescribed burning, eradicate exotic species, and minimize trespassing and dumping. In some areas, wetland and upland restoration is necessary to re-establish natural habitats. Land acquisition will continue to be an essential tool to minimize habitat loss and fragmentation and to improve connectivity between natural areas.

6. Fire management.

Fire has been a critical force in shaping the diverse landscapes of Florida for thousands of years from both natural (lightning) and human ignitions (Fowler and Konopik 2007, Kimmerer and Lake 2001). Radiocarbon dating on soil samples taken from two water holes on Big Pine Key in National Key Deer Refuge reveal repeated, local fires during the past ca. 450–500 years, documenting the long importance of fire in the Florida Keys pine rocklands (Horn 2008). Indigenous groups on mainland Florida frequently used fire for land clearing, vegetation control, and hunting game (Robertson 1954). Members of the Tequesta and Calusa cultures likely used fire during their occupation in the Florida Keys as well. Later settlers burned regularly to flush deer from the woods to facilitate hunting and to support an active buttonwood charcoal industry at various periods from the early 1800s to the 1950s (Klimstra 1986, Williams 1991). Historically, fire movement across the landscape was unimpeded by barriers, such as roads and canals, allowing fire to spread between plant communities. The National Key Deer Refuge has consequently used prescribed fire sporadically for maintaining the fire-dependent pine rocklands and select areas of open grassland to benefit Key deer (Klimstra 1986). However, the fire management program has fallen behind in maintaining adequate fire intervals due to various management issues, such as personnel turnover and storm damage.

Variability in a fire regime is critical to maintaining the diverse elements of the pine rockland floral community (Heirs et al. 2000, Lui and Menges 2005, Snyder et al. 2006). In the absence of fire, pine rockland transitions into hardwood hammock in approximately 50 years (Dickson 1955) and the abundance of rare endemic herbs declines (Bradley and Saha 2009). Freshwater wetlands and salt marsh transition communities readily burn. Fire in these communties reduces excessive buildup of dead plant material, recycles nutrients, and stimulates plant growth (Hofstetter 1974, USDA Forest Service 1980). It also controls hardwood encroachment (Craighead 1971, Forthman 1983, Wade et al. 1980, Knickerbocker et al. 2009). Like pine rocklands, wetlands and grassy areas on Big Pine Key become encroached by hardwoods in the absence of fire (Alexander and Dickson 1970, Klimstra 1986). With the lack of consistent prescribed burning, fuel loads have also increased to hazardous levels in many areas, which could result in a catastrophic wildfire that threatens the refuge's ecological integrity as well as human lives and property.

VISITOR SERVICES

7. Changing public use attitudes, needs, and demands.

There is a need to continually educate the public about the requirements for management of imperiled species and their habitats in the Lower Florida Keys Refuges. Seasonal residents, mostly retired individuals, comprise approximately 35 percent of the local population. Tourists make up the bulk of visitors inquiring about the refuges. A majority of the resident population of the Florida Keys reportedly turns over every 5 years. New residents and tourists are often unaware or unconcerned about the illegality of feeding Key deer or the problems associated with exotic invasive plants and animals. A unique and varied approach for environmental education and outreach is necessary to reach an ever-changing public audience.

Changes in public use attitudes, needs, and demands constrain the refuges' ability to ensure quality, appropriate, and compatible wildlife-dependent recreational opportunities and adequate facilities. The priority wildlife-dependent public uses for the Lower Florida Keys Refuges are fishing, wildlife observation, wildlife photography, and environmental education and interpretation. Equally important are efforts to curtail inappropriate and non-compatible recreation in order to maintain resource protection and integrity of wildlife habitats and wilderness areas. In particular, there is an increasing demand for non-priority public and commercial uses of the few beaches in the Key West and Great

White Heron NWRs, which provide critical habitat for sea turtles and migratory birds. Management strategies implemented 10 to 20 years ago when there were fewer people using the backcountry may no longer be adequate to protect wildlife or preserve the wilderness character today with increasing numbers of users. The impacts of visitor use on wildlife and habitats have been assessed in select areas of Key West NWR, but the overall human carrying capacity in all the refuges has not been assessed. These impacts need to be evaluated and appropriate measures developed and implemented to minimize adverse impacts.

RESOURCE PROTECTION

8. Violations

Violations that occur on the Lower Florida Keys Refuges include the following activities: trespassing in closed areas; setting-up homeless camps (Big Pine Key); roaming pets; using personal watercraft in the backcountry; dumping of garbage on refuge lots; smuggling of drugs and immigrants; digging for antiquities; vandalizing refuge property; and poaching, disturbing or feeding wildlife. Such violations damage habitat, disturb wildlife, and/or diminish the wilderness character of the refuges. The Service currently has two full-time Refuge Law Enforcement Officers to patrol all the Lower Florida Keys Refuges, which are situated across 545 square miles of land and water. Law enforcement is crucial to prevent and investigate illegal activities, in addition to ensuring visitor and employee safety and protecting the refuges' wildlife resources, wilderness values, cultural resources, and government facilities.

REFUGE ADMINISTRATION

9. Managing a complex of islands.

A unique challenge to the management and operation of the Lower Florida Keys Refuges results from their geography. The three refuges are comprised of islands that are scattered across an expanse of water extending nearly 75 miles from the Seven Mile Bridge west to the Marquesas Keys. The refuges' approved acquisition boundaries cover vast amounts of land and water. Road access is limited to only a few mainline islands connected by U.S. Highway 1. Boat access to the majority of islands is dependent on weather and tides, and requires local knowledge and planning.

This complex of islands creates jurisdictional challenges as well. The administrative boundaries of all the Lower Florida Keys Refuges encompass more than 400,000 acres of sovereign submerged lands and waters owned by the State of Florida. In 1992, the Service entered into a Management Agreement with the State of Florida that authorizes certain measures to be implemented within the state-owned waters to minimize wildlife disturbance and habitat destruction from non-wildlife-dependent recreational activities (this Management Agreement is also known as the Backcountry Management Plan). It prohibits personal watercraft, airboats, water skiing, hovercraft, and aircraft landings within the majority of Key West and Great White Heron NWRs. It also established idle speed, no motor, and no access buffer zones near critical wildlife habitats. These zones were subsequently incorporated as Wildlife Management Areas in the FKNMS's General Management Plan. Actions to prevent or minimize the destruction or loss of marine resources are implemented under the State of Florida's sovereign suberged land regulations and the National Marine Sanctuary Act. The Service's Office of Law Enforcement has legal responsibilities under the Endangered Species Act and Migratory Bird Treaty Act to protect federal trust resources, wherever they may occur.

Additionally, within the administrative boundary of National Key Deer Refuge, there is a patchwork of conservation lands owned and managed by multiple agencies and groups. Federally owned parcels

range from a couple-hundred acres to less than a half-acre in size, interspersed among vacant private lots within residential subdivisions and commercial zones. In addition to refuge-owned lands, the Service manages through lease agreements about 700 acres of Florida Forever and other State-acquired lands, and about 200 acres of county lands acquired by the Monroe County Land Authority. Additionally, the South Florida Water Management District has contributed substantial funding for wetlands acquisition in central Big Pine Key. Private groups, such as The Nature Conservancy, Trust for Public Land and The Conservation Fund, provide funds and expertise to assist in expedited acquisitions of environmentally sensitive lands that may be imminently threatened by development.

10. Administrative resources.

Resources are needed to fulfill the refuges' missions and purposes and to implement the vision for these refuges over the next 15 years. Refuge management is increasingly dependent on partnerships and the use of volunteer labor to carry-out refuge functions. The Service's emphasis on wildlife conservation and species recovery will require a larger biological and fire management staff. Establishing partnerships with universities, other government agencies, community groups and non-governmental organizations is essential for both assessing and monitoring biological resources and implementing effective education and outreach programs over time. More coordinated effort is needed to work with Monroe County, the FDEP, and the FKNMS to cooperatively address shared issues, such as marine debris and declining water quality in Florida Bay. Maintaining and training a steady, active volunteer corps is necessary, but challenging for a small staff without a designated volunteer coordinator position.

WILDERNESS REVIEW

Refuge planning policy requires a wilderness review as part of the comprehensive conservation planning process. The Service inventoried other refuge lands within the planning area and found no areas that meet the eligibility criteria for a wilderness study area as defined by the Wilderness Act. Therefore, the suitability of refuge lands for wilderness designation is not further analyzed in the CCP. The results of the wilderness review are included in Appendix H.

IV. Management Direction

INTRODUCTION

This section outlines the provisions of the CCP for managing the three refuges for the next 15 years. According to the Service's mission for wildlife refuges, this CCP places wildlife conservation first as its priority for management of the refuges. This CCP contains the goals, objectives, and strategies that will be used to achieve the collective vision of the refuges.

VISION

The Lower Florida Keys Refuges are a collection of low-lying, subtropical islands between the Gulf of Mexico and the Atlantic Ocean that protect all the vital habitats representative of the Florida Keys ecosystem, including the globally imperiled pine rockland and tropical hardwood hammock. These geologically and climatically distinct islands provide a haven for a diversity of native flora and fauna, including endemic, threatened, endangered and candidate species. We will protect, enhance, and restore the natural diversity and integrity of the ecological landscapes of the Lower Florida Keys Refuges, and provide unique opportunities for research and compatible wildlife-dependent recreational uses in cooperation with our partners for present and future generations.

GOALS, OBJECTIVES, AND STRATEGIES

Refuge Goals

Goal 1. Habitat Management

Maintain, restore, and enhance a natural diversity and integrity of habitats for native plants and animals.

Goal 2. Fish and Wildlife Population Management

Protect, restore, and enhance populations of endangered, threatened, and candidate plants and animals within their native habitats.

Goal 3. Migratory Birds

Provide, protect, and enhance essential habitat for nesting, resting, and wintering migratory birds.

Goal 4. Visitor Services

Promote an understanding and appreciation of natural and cultural resources and provide visitors with a quality, safe, and enjoyable experience compatible with wildlife and wildland conservation.

Goal 5. Cultural Resource Protection

Protect archaeological, cultural, and historic resources for future generations as examples of human interaction with the natural environment.

Goal 6. Wilderness Resource Protection

Protect and preserve the wilderness character of those refuge lands designated by Congress as part of the National Wilderness Preservation System.

Goal 7. Refuge Administration

Provide administrative support and sufficient funding to ensure that the goals and objectives for refuge habitats, fish and wildlife populations, land conservation, visitor services, and partnerships are achieved.

SUMMARY

This proposed management plan assumes a slow-to-moderate growth of refuge resources over the 15-year implementation period of the CCP. It provides for a proactive and adaptive ecosystem-management approach for the enhancement of wildlife populations by promoting a natural diversity and abundance of habitats for native plants and animals, especially Keys' endemic, trust, and keystone imperiled species. Many of the objectives and strategies are designed to maintain and restore native communities. Active management strategies would be applied particularly within the globally imperiled pine rockland, salt marsh transition, and freshwater wetland habitats, and island beach berm communities. Research and long-term monitoring will be initiated to expand the collection of baseline data and measure variables of ecosystem health. Cooperative studies to monitor and model the immediate and/or long-term effects of natural catastrophic events (e.g., hurricanes, wildfire) and global climate change, particularly sea level rise, would be promoted.

Current ongoing and proposed programs and efforts focus on threatened, endangered, and candidate species of plants and animals. The need for more comprehensive inventorying and long-term monitoring is addressed in this plan, particularly for priority imperiled species and their habitats within the refuges. The feasibility of managing the core population of Key deer to minimize the effects of overbrowsing on native plants would be considered in accordance with the Endangered Species Act.

Habitat enhancement for critically imperiled species, such as the Lower Keys marsh rabbit and Key tree cactus, would occur to ensure the long-term sustainability of these species. Opportunities for land acquisition would focus more strategically on protecting environmentally sensitive habitat by contacting specific property owners to determine their willingness to sell, with a particular emphasis on enhancing habitat connectivity and protecting marsh rabbit habitat. Off-refuge nursery propagation of the Key tree cactus would be implemented for later translocation to suitable refuge habitats. Cooperative partnerships with nurseries and botanical gardens would be developed to secure seed and plant material of rare and endemic plant species to ensure genetically viable sources for future restoration needs. Research would be initiated to identify causal reasons for the marked, long-term decline in the great white heron nesting population and to evaluate the potential impacts of sea level rise on the ecology of wading birds.

Since a primary purpose of the refuges is to provide sanctuary for nesting and migratory birds, greater protection from human disturbance would be provided, particularly at colonial nesting bird rookeries and at beach habitats in the backcountry islands. Additional limitations to public use may be implemented in sensitive beach areas important for shorebirds, terns, sea turtles, and butterflies.

Strategies are proposed to enhance the biological diversity and resiliency of the fire-dependent pine rocklands and to enhance fire-adapted habitat features in salt marsh transition and freshwater wetlands that benefit priority species in the National Key Deer Refuge. Prescribed fire and mechanical or manual vegetation treatments would be used as habitat management tools to reduce

wildland fuels and restore desirable habitat features where appropriate. Predictive modeling and fire effects monitoring would be used on all prescribed-fire treatments in an adaptive management approach to develop site-specific burn prescriptions and to determine whether objectives were met. Research on fire behavior, fuels response, and fire history would be conducted. The fire management step-down plan would be revised and implemented accordingly in conjunction with the development of a habitat management step-down plan.

Exotic plant control would continue as an ongoing operation within the refuges to maintain native habitats and prevent new infestations. Cooperative efforts would be sought with private property owners and homeowners associations to control seed sources from private lands. Existing partnerships would be reinforced to increase coordinated mapping and monitoring of treated areas with known infestations and ongoing control needs. Management of non-native exotic predators would be implemented as directed by the South Florida Multi-Species Recovery Plan for the benefit of threatened and endangered species. An early detection and rapid response program would be implemented in cooperation with county, state and federal authorities to address the increasing invasion by and potential establishment of exotic snakes, lizards and other non-native animals in the Florida Keys.

A primary focus of the visitor services program, as proposed, is to enhance environmental education and outreach efforts substantially to reach larger numbers of residents, students, educators, and visitors. This alternative also focuses on increasing public awareness, understanding, and support for the refuges' conservation mission. It places priority on wildlife-dependent uses, such as photography and wildlife observation; the details of these allowable uses are specified in appropriate use and compatibility determinations (Appendices E and F). A new visitor center on U.S. Highway 1 on Big Pine Key and enhanced visitor facilities at existing sites (e.g. Blue Hole and Watson-Mannillo NatureTrails) are proposed. Non-wildlife dependent forms of recreation would be limited or restricted in sensitive areas and awareness efforts would be stepped-up to inform visitors about protecting wilderness areas. A Visitor Services step-down plan will specify program details consistent with the Service's visitor service program standards.

The basic administrative and operational needs of the refuges have been addressed. Essential new staffing is proposed through the addition and funding of five permanent, full-time employees. Daily operation of the refuge would be guided by the CCP and the development and implementation of 19 projects and 11 step-down management plans. Wilderness and cultural resource protection objectives and strategies would be incorporated within the appropriate step-down management plans. The modest growth in administrative resources would be used for wildlife monitoring and habitat enhancement to better serve the refuges' purposes and the CCP's vision. With the exception of a new Visitor Center that is proposed, the existing number of facilities would be maintained. Energy efficiency standards will be applied wherever feasible during facility maintenance, repair or renovation projects. Existing vehicles will be replaced with alternative fuel vehicles to increase fuel efficiency and reduce carbon emissions.

HABITAT MANAGEMENT

Goal 1. Maintain, restore, and enhance the natural diversity and integrity of habitats for native plants and animals.

Objective 1: Implement habitat management actions that foster biological diversity and ecosystem resiliency while perpetuating viable populations of endangered, threatened and candidate plant and animal species.

Discussion: The majority of habitats in National Key Deer Refuge are impaired, whereas the backcountry islands of Key West and Great White Heron Refuges remain in a relatively pristine condition. The greatest disturbance factors on backcountry islands are impacts from hurricanes and sea level rise. Strategies for maintaining those habitats include removal of invasive exotic plants and minimizing damage from human activities.

Habitats on the mainline islands within the National Key Deer Refuge have been irreversibly altered and fragmented since the 1950s by commercial and residential development and associated roads, canals, and mosquito ditches. These impaired habitats are further stressed by introduced exotic plants, human encroachment, wildfires, fire suppression, as well as by the natural disturbances of hurricanes and sea level rise. Consequently, strategies in this plan for maintaining habitats within National Key Deer Refuge are focused on direct intervention where operationally feasible and ecologically appropriate. Prescribed fire is an effective tool for maintaining the fire-dependent pine rocklands and desired features of fire-adapted plant communities. Given current habitat conditions and limited fiscal resources, it may take up to 20 years of deliberative and strategic burning in priority areas to re-establish a consistent fire regime that maintains the ecological integrity and protects the wildland-urban interface from catastrophic wildfire. Other habitat management tools include mechanical treatment, replanting, control of invasive exotic plants, and other restoration methods.

The final objective promotes land acquisition as an important tool for habitat management. More than $35 million has been spent since the 1950s on land acquisition for the Lower Florida Keys Refuges. The Service acquires land for national wildlife refuges on a willing seller basis, generally purchasing the title to a property in simple fee (full ownership). Other acquisition options include land exchanges, donations, conservation easements, leases, or life-use reservations. In addition to directly acquiring lands, the Service manages state- and county-owned lands under lease agreements where these parcels are intermingled with existing refuge properties.

An overarching conservation challenge for the Service is to prevent the extinction of listed species in the Lower Florida Keys Refuges by managing the ecosystems in which they reside, pursuant to the original purposes for establishing the refuges and the Services' responsibilities under the Endangered Species Act. Federally listed species occur in every major plant community in the Lower Keys, and every plant community supports at least two listed species. Ecosystem management is a widely accepted approach for the recovery of imperiled species; therefore, the objectives for both habitat management and fish and wildlife populations must work together to address this conservation challenge. The proposed management strategies were designed in consideration of the implications of climate change. They must be flexible in their implementation in order to incorporate new information and changing environmental conditions through an adaptive management process.

Strategies:

- Develop and implement a step-down Habitat Management Plan that will guide habitat management on the refuges, using a structured decision-making process to ensure the integration of strategic landscape conservation and adaptive management principles.
- Update and implement the step-down Fire Management Plan to incorporate new scientific information, altered habitat conditions, and climate change.
- Document current conditions and obtain baseline information on structural components and species composition of the major plant communities.
- Design and implement a habitat monitoring program to document changes in species composition and vertical and horizontal structure of plant communities over time in response to management actions, natural disturbances (e.g. hurricanes, flooding), and climate change.

- Document the distribution and location of listed, candidate, rare, keystone, and other targeted species that are most likely to be impacted by habitat management actions or inactions.
- Apply the Service's Strategic Habitat Conservation approach—i.e., set objectives, design and implement management actions, conduct monitoring and adaptive management, and support research.
- Integrate inventory, monitoring, and research activities to guide management actions.
- Continue participation in the Florida Keys Invasive Exotics Task Force to share treatment strategies and to leverage funding for exotics' removal and native plant restoration.
- Work with landowners and communities to eradicate invasive exotic plants on adjacent private lands and to prevent their spread to public lands.
- Eradicate or control infestations of non-indigenous, invasive exotic plants as categorized by the Florida Exotic Pest Plant Council on all refuge-owned and refuge-managed lands.
- After removing exotic plants, replant native species to the extent practicable in order to restore native plant communities.
- Maintain current relationships and encourage new partnerships with nationally recognized organizations, universities and colleges, and other agencies to provide valuable scientific data that will enhance the protection and restoration of native species and habitats in the Keys.
- Develop partnerships to contribute seed sources for potential seed banks and propagation to ensure genetic diversity and future sustainability of endemic and imperiled plant species.
- Continue to work with partners in developing models to predict the effects of sea level rise and coastal storms on refuge habitats and species.
- Assess and monitor the quality and quantity of subterranean freshwater lenses to detect changes related to sea level rise.
- Develop a partnership with Friends and Volunteers of Refuges (FAVOR), Master Gardeners, and local Native Plant Society to establish a volunteer-run native plant demonstration garden and/or nursery.

Objective 2: Manage pine rocklands to maintain structural integrity and biological diversity to support endangered, threatened, candidate, and other imperiled species.

Strategies:

- Update and implement the step-down Fire Management Plan to incorporate new scientific information, altered habitat conditions, and climate change considerations in regard to restoring and maintaining pine rocklands.
- Refine current prescribed burning practices via an adaptive-management approach. This approach is based on research, pre- and post-burn monitoring, and evaluation in order to improve subsequent burns. Data collection would include species composition and structural variables, such as slash pine, palm and hardwood densities, litter depth, pine diameter-at-breast-height (DBH) and tree height, and post-fire pine survival by size classes.
- Implement prescribed fire in pine rocklands. Consider factors such as: the amount of time since the last fire in the burn unit; fire return intervals at a landscape level; fire intensity and severity; fuel loads; and seasonality in order to affect persistence of desired species.
- Delineate areas that will be actively maintained as pine rocklands as opposed to areas that will be allowed to transition into hardwood hammock due to management constraints or species-specific population management needs.
- Identify alternative treatments for maintaining stands of pine rocklands and reducing organic fuels where prescribed burning is no longer feasible due to adjacent, high-density neighborhoods.

- Assess whether restoration of hurricane-damaged pine rockland communities is merited and feasible.
- Continue monitoring changes in distribution and condition of pine rocklands resulting from sea level rise and storm events.
- Expand collection and analysis of peat and sediment cores to sample for pollen and charcoal. This is done to determine historic fire frequency and species composition.
- Maintain all firebreaks as necessary to ensure safe and efficient prescribed burning projects and to protect adjacent residential areas from the potential spread of wildfire.
- Maintain the organic fuels in the wildland-urban interface (WUI) at a level which precludes the danger of a wildfire spreading to nearby residences or threatening native habitats.
- Continue participation in the Lower Florida Keys Wildfire Hazard Reduction Initiative, Lower Keys Community Wildfire Protection Plan, and South Florida Pine Rockland Working Group.

Objective 3: Protect tropical hardwood hammock and the endangered, threatened, candidate and other imperiled species that inhabit hammock.

Strategies:

- Protect hardwood hammock stands that support populations of Stock Island tree snails and Key tree cactus.
- Maintain public closure to Watson and Cactus Hammocks (National Key Deer Refuge) to protect sensitive biological and cultural resources
- Allow limited access to Watson and Cactus hammocks by Special Use Permit for research and environmental education purposes.
- Enhance regeneration of plants that have become rare because of deer herbivory.
- Reintroduce rare and endemic plant species that have been lost due to hurricanes, such as inkwood and *Cupania*, on Big Pine Key (National Key Deer Refuge).
- Maintain the policy of prohibiting the spraying of insecticides used to control adult mosquitos to protect non-target invertebrate species in Watson and Cactus Hammocks and on No Name Key (National Key Deer Refuge), and expand to other tropical hardwood hammocks.

Objective 4: Manage freshwater wetlands for the benefit of native wildlife, with an emphasis on priority imperiled species.

Strategies:

- Initiate long-term monitoring of freshwater resources, including salinity and other water chemistry parameters, to detect changes in water quality and quantity.
- Evaluate the impacts of landscape alterations (e.g., abandoned roads, canals, and mosquito ditches) on freshwater wetlands. Conduct restoration where feasible.
- Delineate areas where prescribed burning would be an appropriate tool for maintaining and enhancing freshwater wetland vegetation and diversifying seral stages in different freshwater wetland communities.
- Update and implement the step-down Fire Management Plan accordingly to incorporate scientific information, altered habitat conditions, and climate change considerations in regard to enhancing and maintaining selected freshwater wetlands using fire.
- Assess the applicability of manual and mechanical removal of decadent vegetation and siltation to restore water availability in freshwater solution holes for Key deer where appropriate.

- Evaluate the distribution and movements of the American alligator and its role in maintaining open freshwater wetlands in National Key Deer Refuge.

Objective 5: Manage salt marsh transition communities to benefit native wildlife, with an emphasis on recovery actions for the Lower Keys marsh rabbit.

Strategies:

- Evaluate the impacts of landscape alterations (e.g., abandoned roads, canals, and mosquito ditches) on salt marsh transition communities. Conduct restoration where feasible.
- Evaluate selectively removing buttonwoods to create and maintain optimal habitat conditions for marsh rabbits.
- Delineate areas where prescribed burning would be an appropriate tool for increasing within-community diversity, enhancing herbaceous ground cover, and reducing overstory encroachment in buttonwood and cordgrass salt marsh communities and transitional ecotones.
- Update and implement the step-down Fire Management Plan accordingly to incorporate scientific information, altered habitat conditions, and climate change considerations in regard to maintaining selected salt marsh communities and and rabbit habitat using fire.
- Evaluate effects of sea level rise and flooding from storms on salt marsh transition communities, and adapt management strategies accordingly.

Objective 6: Maintain mangrove forest communities for the benefit of nesting and wintering migratory birds and forage fish.

Strategies:

- Expand cooperative efforts with Friends and Volunteers of Refuges (FAVOR), the Florida Keys National Marine Sanctuary, Monroe County, and community volunteer groups to remove and reduce marine debris (e.g. traps, lines, monofilament, plastic products, and abandoned boats) from mangrove habitats.
- Coordinate with partners on outreach and education efforts to reduce dumping practices and to prevent marine debris and oil spills.
- Encourage research and monitoring regarding the role of mangrove habitats in serving as critical nurseries for fish.

Objective 7: Protect and restore beach and dune habitats for the benefit of sea turtles, shorebirds, and butterflies.

Strategies:

- As islands accrete or erode, evaluate their potential as critical wildlife habitat and take protective measures as necessary.
- Restrict public use to minimize trampling in sensitive dune habitats.
- Restore damaged dune habitats through closures, plantings, or other protective measures.
- Monitor the distribution and extent of beach and dune habitats to detect impacts from sea level rise and storm events.

Objective 8: Cooperatively manage marine habitats in coordination with the State of Florida and Florida Keys National Marine Sanctuary (FKNMS) for the purpose of protecting marine wildlife resources.

Strategies:

- Review and revise the Management Agreement and associated Backcountry Management Plan in cooperation with the State of Florida and FKNMS to address current resource impacts and public use issues.
- Work collaboratively with the State of Florida, FKNMS, Monroe County, and marine conservation organizations on shared interests in studying and protecting marine habitats within the boundaries of the Lower Florida Keys Refuges.
- Encourage research and monitoring on the status and distribution of important marine habitats and unique features (e.g., patch reefs) found in the backcountry.
- Continue participation on the FKNMS's Sanctuary Advisory Council and Water Quality Protection Program Steering Committee to provide technical assistance and ensure that the refuges' trust resources and establishment purposes are considered in decision-making.
- Continue coordination with the FKNMS, FWC, U.S. Coast Guard, U.S. Customs and Border Patrol, and the Monroe County Sheriff's Office on law enforcement patrols and investigations in marine waters within the refuges' administrative boundaries.
- Develop and distribute information to the public regarding proper etiquette for marine wildlife viewing and wilderness recreation.
- Participate in regional and national planning and conservation initatives for the seamless network of marine protected areas.

Objective 9: Continue strategic land acquisition efforts by working with willing sellers to ensure the conservation of sustainable plant communities and quality wildlife habitats in perpetuity. Work with partners to cooperatively managing areas of mutual interest.

Strategies:

- Update and implement the step-down land acquisition plan (known as a Land Protection Plan) by continuing to seek willing sellers and acquire fee title to lands within the approved refuge acquisition boundaries whenever acquisition funds are available.
- Continue to coordinate with the State of Florida and Monroe County on their conservation land acquisition programs to strategically identify high-quality parcels and optimize land acquisition efforts to foster landscape conservation.
- For state and local conservation land purchases, accept management authority for parcels that contribute to the mission and purposes of the Lower Florida Keys Refuges.
- Continue to work with partners to apply land conservation tools, such as conservation easements, partnership agreements, mitigation banks, and technical assistance to protect, restore, and manage priority habitats throughout the Florida Keys ecosystem.
- Develop criteria for strategic land acquisition using geographic information on vegetation communities, wildlife species distribution, and sea level rise models to target acquisition efforts on the most environmentally sensitive lands.
- Purchase and/or exchange lands of lesser conservation value for lands within or adjacent to larger tracts of existing refuge properties to enhance habitat connectivity and management capabilities for the long-term benefit of wildlife.
- Seek approval to expand the approved acquisition boundaries to encompass existing refuge lands and acquire additional lands that meet the conservation purposes of the Lower Florida Keys Refuges.

FISH AND WILDLIFE POPULATION MANAGEMENT

Goal 2. Protect, restore, and enhance populations of endangered, threatened, and candidate plants and animals within their native habitats.

Discussion: Management would prioritize the protection and enhancement of state and federally listed species and the ecosystems upon which they depend. In the Lower Florida Keys, this incorporates all natural ecosystems. The refuge and surrounding waters host a number of federal and state listed threatened and endangered species of plants and animals, candidate species, and rare or declining species considered "species of special concern." Many of these species are declining due to loss and/or degradation of their habitat. By restoring and maintaining diverse communities and eliminating adverse human impacts to the extent possible, the plight of many of these species can improve substantially. Other species may require additional attention and direct intervention to increase their population and improve their long-term viability. Staff of the Lower Florida Keys Refuges work in close collaboration with the Service's Ecological Services Field Office, the FWC, and a wide array of collaborators to implement ongoing and evolving land management and recovery actions, including those found in the South Florida Multi-Species Recovery Plan (SFMSRP) (USFWS 1999), five-year species reviews, candidate species reviews, and other related recovery documents. Section 7(a)(1) of the ESA charges federal agencies (including national wildlife refuges) to aid in the conservation of listed species. Section 7(a)(2) requires federal agencies to consult with the Service to ensure that actions they fund, authorize, permit, or otherwise carry-out, will not jeopardize the continued existence of any listed species or adversely modify designated critical habitats.

Objective 1: Implement necessary measures to ensure the viability of all imperiled species and their habitats.

Strategies:

- Develop a step-down Biological Inventorying and Monitoring Plan to address inventory, long-term monitoring, and research needs for priority species.
- Conduct rapid ecological assessments and emergency response strategies as needed following catastrophic events, such as wildfires and hurricanes.
- Include protection of imperiled species and their habitats in environmental education, interpretive programs, and literature offered by the refuge.
- Develop and implement a step-down Integrated Predator Management Plan to control exotic predator species that are adversely affecting threatened and endangered species.
- Maintain sufficient law enforcement presence in collaboration with the Service's Office of Law Enforcement to prevent illegal take and disturbance of federally listed species.
- Adopt a step-down Mosquito Management Plan according to Service policy guidance that will reduce or eliminate impacts of the Florida Keys Mosquito Control District's operations to non-target species on and adjacent to refuge lands.
- Work with partners to conduct a vulnerability assessment to model the potential effects of climate change, especially sea level rise and storm events, on imperiled species and their habitats. Develop management strategies to enhance species adaptability and habitat resiliency to climate change, as feasible.

<u>Mammals</u>

Objective 2: Lower Keys marsh rabbit – Recover and enhance the population viability of the Lower Keys marsh rabbit.

Strategies:

- Maintain, restore, or enhance Lower Keys marsh rabbit habitat through all appropriate means.
- Continue to assess the benefits and impacts of habitat management techniques, such as prescribed fire and mechanical clearing, in a scientific framework.
- Compile geographic information databases to identify and select priority sites for enhancing rabbit habitat based on suitability and connectivity.
- Use geographic information databases to identify suitable rabbit habitat on undeveloped privately-owned lands. Seek willing sellers to acquire parcels for conservation.
- Increase connectivity between patches of suitable marsh rabbit patches, including transient-use areas.
- Refine the methodology for rangewide presence-absence monitoring of patches within an occupancy-model framework that corrects for detection probabilities and calculates patch colonization and extinction rates relative to environmental stressors and management actions.
- Apply research findings to focus management actions where they will be most effective in reducing local extinctions and increase colonization of the patches.
- Expand studies on ecological functions and dynamics of salt marsh transition communities and habitat influences on rabbit population dynamics.
- Expand research on rabbit genetics to examine interrelationships of subpopulations, dispersal mechanisms, and prevalence of inbreeding in order to better guide recovery efforts.
- Acquire and interpret detailed elevation models for the entire range of Lower Keys marsh rabbits in order to evaluate species vulnerability to sea level rise and storm events under future scenarios of climate change.
- Continue reintroductions and translocations of marsh rabbits into suitable habitats within their historic range (e.g., the Torch Keys).
- To create suitable habitat for rabbits, evaluate habitat restoration projects, such as road removal and canal infilling.
- Implement a step-down Integrated Predator Management Plan to reduce the potential for predation by feral and free-roaming cats and large-bodied, exotic snakes on marsh rabbits.
- Conduct outreach efforts aimed at educating residents, particularly those living near rabbit habitat, about the effects of cat predation on rabbits and other native wildlife.
- Encourage research on the behavioral and physiological attributes of rabbits that characterize their anti-predator strategies.
- Continue to assess whether raccoon predation, which appears to be opportunistic and limited, is of significance to the productivity and persistence of marsh rabbits.
- Evaluate the potential impact of exotic fire ants on marsh rabbit survivorship.
- Continue to work cooperatively with Monroe County, State of Florida and other stakeholders to address marsh rabbit impacts from cat predation, vehicle mortality, and habitat alteration, and carry-out provisions of the Habitat Conservation Plan for Big Pine and No Name Keys, SFMSRP, and other pertinent recovery documents.
- Continue to work closely with the Naval Air Station Key West at Boca Chica Key to share mutually beneficial findings and promote management actions that benefit the Lower Keys marsh rabbit across its range.
- Initiate restoration of contaminated refuge lands to eliminate known lead deposits in marsh rabbit habitat on Boca Chica Key.
- **Develop a detailed pre- and post-emergency response strategy for marsh rabbits in the event of catastrophic hurricanes.**

Objective 3: Key deer – Maintain the population viability of the Key deer.

Strategies:

- Assess the genetic diversity of the Key deer throughout the metapopulations in order to monitor genetic health and to advise management on ways to implement recovery strategies.
- While maintaining continuity of long-term data, assess the efficacy of the traditional, road-count-survey method. Refine it by using more rigorous sampling designs that account for detectibility.
- Continue to monitor the abundance of deer monthly throughout the core area of Big Pine and No Name Keys using current and/or refined methods.
- Continue to monitor translocated deer populations on Cudjoe and Sugarloaf.
- Add "deer crossing" warning signs to Cudjoe and Sugarloaf Keys if the Key deer population growth creates a greater localized hazard to motorists, increased risk of deer-vehicle collisions, or is otherwise indicated by deer population impacts.
- Conduct studies and monitor demographic and home-range characteristics of Key deer populations on backcountry islands.
- Continue translocation efforts of deer from the core areas on Big Pine and No Name Keys to Sugarloaf and Cudjoe Keys and other suitable islands as determined by ongoing studies.
- Continue to send Key deer too injured for release to approved captive facilities in mainland Florida as currently authorized.
- Through environmental education and law enforcement efforts, actively discourage the illegal feeding of Key deer.
- Assess the efficacy of using immuno-contraceptives to reduce high deer density on No Name Key and parts of Big Pine Key. Manage deer at or below carrying capacity to reduce habitat degradation and to reduce the change of spreading density-dependent diseases.
- Continue partnership with the Southeast Cooperative Wildlife Disease Study (SCWDS) and other deer health experts to monitor for Johne's disease and deer exposure to epizootic viruses.
- Perform necropsies on adequate sample of Key deer mortalities (of any cause) throughout its range to obtain body fat indices to assess the herds' nutritional status.
- Assess the effect of deer herbivory on native habitats. At five-year intervals sample the composition and structure of plant communities to estimate carrying capacities for Key deer on all occupied islands.
- Maintain and restore freshwater holes on islands inhabited by deer as necessary and feasible.
- Conduct studies to quantify forage biomass and nutritional ecology in natural areas and developed settings. Define linkages between urban foraging energetics, carrying capacity, and metapopulation dynamics.
- Apply research findings on forage distribution, quality, and quantity, forage biomass and nutritional ecology to adaptively apply management strategies, such as using prescribed fire to enhance habitat, and reducing artificial feeding and watering in urban areas.
- Conduct studies to delineate potential problems associated with the spatial and temporal dynamics of prescribed fire in an over-browsed environment.
- Obtain detailed hydrology and terrain data to refine the currently available population viability models in oreder to account for effects of the distribution and attributes of freshwater resources on deer, and to predict future impacts from sea level rise.
- Assess habitat conditions for Key deer on undeveloped privately-owned parcels and identify contiguous important parcels to acquire that would serve as potential corridors for transient deer among islands.

- **Develop a detailed pre- and post-emergency response strategy for Key deer in the event of catastrophic hurricanes.**

Objective 4: Silver rice rat – Maintain the population viability of the silver rice rat.

Strategies:

- **Periodically repeat trapping surveys to monitor silver rice rat population status and update recovery requirements.**
- Conduct studies on silver rice rat population ecology including demographics, movement, and dispersion.
- Acquire and interpret detailed elevation models for the entire range of silver rice rat to evaluate species vulnerability to sea level rise and storm events under future scenarios of climate change.
- Conduct research on how mangrove and salt marsh transition communities function in the Lower Keys in order to better understand habitat influences on silver rice rat population dynamics.
- Use geographic information databases to identify suitable silver rice rat habitat on undeveloped privately-owned lands. Seek willing sellers to acquire parcels for conservation.
- Evaluate the potential impacts of predation by domestic cats and native predators (e.g. raccoons) and competition from black rats on silver rice rat populations.
- Conduct outreach efforts aimed at educating residents, particularly those living near rice rat habitat, about the effects of cat predation on silver rice rats and other native wildlife.
- Implement an Integrated Predator Management Plan to reduce the potential for predation by feral and free-roaming cats and large-bodied, exotic snakes on silver rice rats.
- Remain vigilant about potential toxicological threats to rice rats from rodenticides used to control non-native black rats, and conduct public outreach as necessary.

Objective 5: Florida manatee – Assist in the protection and recovery of the Florida manatee.

Strategy:

- Cooperate on an as-needed basis with the FWC and its contractor, the Dolphin Research Center, on any manatee stranding events within the refuges.

<u>Birds</u>

Objective 6: Piping plover – Protect wintering piping plovers from human disturbance on beaches designated as critical habitat.

Strategies:

- Increase law enforcement patrols to eliminate chronic human trespass and resulting disturbance to piping plovers within areas closed to public access on Boca Grande and Woman Keys in Key West NWR. These islands are designated as critical habitat under the ESA for this species.
- Expediently replace missing, worn, or marred signs and buoys delineating area closures and restrictions for piping plovers.
- Continue to conduct winter piping plover surveys in Key West NWR to monitor population abundance and distribution.

- Institute monthly winter piping plover surveys on Ohio Key in National Key Deer Refuge to monitor population abundance and distribution in relation to human activities, and take protective measures to curtail disturbance if warranted.

Objective 7: Roseate tern – Contribute to the conservation of roseate tern population of Key West NWR.

Strategies:

- Conduct periodic bird surveys to document species diversity, population abundance and habitat use in Key West NWR.
- Assess the potential for providing for and attracting a roseate tern nesting colony using decoys and nest boxes for chick shelters at suitable locations.
- Increase law enforcement patrols to eliminate chronic human trespass within areas closed to public access on Boca Grande Key to prevent disturbance to roseate terns.
- As islands accrete, evaluate their potential as nesting habitat for roseate terns and take protective measures.

Objective 8: Red knots – Provide red knots with roosting and feeding areas that are free from human disturbance.

Strategies:

- Increase law enforcement patrols to eliminate chronic human trespass within areas closed to public access on Boca Grande and Woman Keys in Key West NWR to prevent disturbance to red knots.
- Conduct periodic bird surveys to document species diversity, population abundance and habitat use in Key West NWR.

<u>Reptiles</u>

Objective 9: Sea Turtles – Maintain a viable nesting population of green and loggerhead sea turtles in support of the recovery plan efforts for these species.

Strategies:

- Continue sea turtle nesting surveys at Woman, Boca Grande, Marquesas, and Sawyer keys to monitor the nesting population trend with special attention on the noted decline of nesting loggerhead turtles.
- Increase law enforcement patrols to Woman, Boca Grande, Marquesas, and Sawyer keys to protect nesting sea turtles and to eliminate egg poaching in the Marquesas Keys.
- Reduce disturbance to nesting turtles by eliminating human trespass at night on nesting beaches, particularly in the Marquesas Keys.
- Work cooperatively with all appropriate agencies (e.g., U.S. Customs and Border Patrol) to curtail or minimize the night arrival on beaches of human refugees and reduce attendant large-scale littering, which can deter or impede nesting turtles.
- Evaluate the feasibility of removing mangroves that, due to an anthropogenic cause, are encroaching on beach habitat and impeding sea turtle nesting on Sawyer Key. This is the only site where green turtles nest in Great White Heron NWR.
- Prior to the annual sea turtle nesting season assess the need to remove debris that could entangle sea turtles or interfere with turtle nesting.

- Continue supporting the Inwater Research Group's field surveys and satellite tracking of free-ranging sea turtles in Key West NWR.
- Cooperate on an as-needed basis with the FWC and Marathon Turtle Hospital on any sea turtle stranding events and releases within the refuges.

Objective 10: Other reptiles – Protect endemic reptile species.

Strategies:

- Determine the local population status of endemic reptiles and develop appropriate management strategies to ensure their viability.
- Implement mitigation measures to protect reptiles from direct impacts from prescribed burning and other habitat management strategies.
- Determine the abundance, distribution and movements of the American alligator and American crocodile in Lower Florida Keys Refuges.
- Cooperate on an as-needed basis with the FWC on any nuisance alligator or crocodile issues within the refuges.

Invertebrates

Objective 11: Lepidopterans – Maintain or restore refuge populations of lepidopterans of special conservation concern, particularly Bartram's hairstreak, Florida leafwing and Miami blue butterflies.

Strategies:

- **Develop a step-down Mosquito Management Plan in cooperation with the Mosquito Control District, state public health officials and entomologists to balance the conservation of native insect species on refuge lands with public health concerns with nuisance and potentially disease-carrying mosquito populations.**
- **Continue cooperative efforts in developing improved methods of mosquito control which reduce the use of broad-spectrum aldulticides and minimizes impacts to natural resources.**
- **Maintain and expand the "no spray" zones in pine rockland, hardwood hammock and other sensitive habitat.**
- **Perform refuge-wide surveys of butterflies, including** representative samples of Lepidopteran distribution, abundance, and demographics throughout the refuges.
- Refine field survey methods for monitoring Lepidopteran populations to increase sampling confidence, rangewide coverage, and cost effectiveness.
- **Monitor effects of prescribed burning on host and nectar plants to evaluate effectiveness of enhancing their abundance and vigor to the benefit of butterflies.**
- Assess the current distribution and abundance of host and nectar plants for species of concern.
- Explore the possibility of planting host and nectar plants in disturbed areas deemed appropriate to benefit imperiled butterflies.
- Assess the current and projected impact of Mexican twig ants, fire ants, and other tramp ants as butterfly predators and respond accordingly.
- Determine whether additional non-native predators and parasitoids have become established, and whether predators and parasitoids in general are a limiting factor in either occupied and potentially occupied areas.
- Prevent the illicit collection of butterflies.

- Continue to work with the South Florida Imperiled Butterfly Working Group, the Florida Coordinating Council on Mosquito Control, the Florida Keys Mosquito Control District, the North American Butterfly Association, and others to benefit butterfly conservation.

Objective 12: Stock Island tree snail – Ensure the long-term survival of the Stock Island tree snail.

Strategies:

- Assess the current distribution and abundance of Stock Island tree snail.
- Continue to prohibit the Mosquito Control District's use of broad-spectrum adulticides on the southern half of No Name Key to control mosquitos.
- **Continue cooperative efforts in developing improved methods of mosquito control which reduce the use of broad-spectrum aldulticides and minimizes impacts to natural resources.**
- Expand analyses of genetic relationships between populations of tree snails, presumably using microsatellite markers.
- Assess the relationship of the Stock Island (*Orthalicus reses reses*) and Florida Keys (*Orthalicus reses nesodryus*) tree snails to determine if the two subspecies should be lumped taxonomically, or alternatively, if the Florida Keys tree snail warrants listing either due to similarity of appearance or level of imperilment.
- Assess the current distribution of exotic fire ants and their predation impacts on tree snails, and respond accordingly.
- Re-establish native hardwood hammock species in disturbed areas in order to increase habitat area and continuity and thwart advances by fire ants.
- Work with all right-of-way maintenance entities to ensure that best management practices are implemented to minimize impacts to tree snails.
- Determine whether green iguana or opossum predation occurs and poses a threat to the Stock Island tree snail.
- Assess the habitat values and importance of particular tree species to Stock Island tree snails, and determine relationships of land use and ecological characteristics that affect the abundance and distribution of the various trees.
- Identify and implement a viable means to obtain a representative, periodical sample of Stock Island tree snail distribution and abundance throughout its range.
- Assess, prepare for, and execute introductions of Stock Island tree snails to suitable habitat within the Lower Keys and elsewhere if deemed appropriate.
- Encourage surveys and research by partner organizations and universities that will increase the understanding of *Liguus* phenotypes, distribution and numbers.

<u>Fish</u>

Objective 13: Conserve freshwater fish assemblages in the Lower Florida Keys Refuges.

Strategies:

- Inventory freshwater wetlands and mosquito ditches to determine the composition and relative abundance of native and non-native fish species.
- Evaluate the potential threats posed by non-native fish species on native fish populations and develop an appropriate management response.
- Educate the public about the negative impacts of releasing aquarium fish in natural areas.

- Continue partnership with the Keys Environmental Restoration Fund to implement non-tidal fish habitat restoration and monitoring projects for the benefit of resident freshwater fish species.

Plants

Objective 14: Key tree cactus – Prevent the extirpation of the Key tree cactus.

Strategies:

- Continue studies of the ecological factors associated with the presence of the extant Key tree cactus populations.
- Continue partnering with private holders of genetically pure Key tree cactus to grow and provide propagules from their stock for reintroduction to suitable habitats on refuge lands.
- Characterize the habitat and identify suitable sites for outplantings of Key tree cactus as appropriate.
- Identify and monitor pollinators and include them in the development and implementation of management strategies to benefit Key tree cactus.
- Prevent illicit collections of Key tree cactus.
- Maintain the prohibition of aerial application of mosquito spraying to avoid impacts to pollinators of Key tree cactus.
- Continue to prohibit public access on areas occupied by the Key tree cactus, such as Cactus Hammock on Big Pine Key.
- Provide technical assistance to property owners that own areas occupied by Key tree cactus, such as the Villages of Islamorada.
- Investigate the effect of habitat change from hurricanes and sea level rise on the persistence of Key tree cactus.

Objective 15: Maintain and expand populations of the threatened Garber's spurge.

Strategies:

- Monitor the status of Garber's spurge in coastal dune and pine rockland habitats to document its distribution and abundance to identify any threats to this species.
- Evaluate management options for maintaining and enhancing habitat features that support this species.
- Monitor and evaluate the impacts of management actions on Garber's spurge. Collect information on species distribution (i.e., presence/absence before and after burns), abundance and demographic information on individual plants.

Objective 16: Maintain and expand populations of candidate plant species, including Wedge spurge, Big Pine partridge pea, Blodgett's silverbush, sand flax, Cape sable thoroughwort, and Florida semaphore cactus.

Strategies:

- Complete baseline inventories to document the distribution and abundance and identify any threats to candidate species and their respective habitats.
- Implement and evaluate land management techniques for maintaining and enhancing habitats that support these plant species.

- In an effort to expand the populations of various candidate plant species, develop techniques for planting individual plants (i.e., from seed, seedling or mature plants). Assess sites, particularly previously altered sites, for their potential as suitable habitat locations to plant these imperiled species. **Continue cooperative efforts in developing improved methods of mosquito control, which reduce the need for and use of broad-spectrum aldulticides and thereby minimizes impacts to natural resources.**
- Monitor and evaluate impacts of management actions on candidate plants, including information on species distribution (presence/absence before and after burns), abundance, and demographic information on individual plants.
- Continue to work with the Key West Tropical Forest Botanical Garden, Fairchild Botanical Garden, and others to expand efforts to develop effective propagation and outplanting techniques.

GOAL 3. Provide, protect, and enhance essential habitat for nesting, resting, and wintering migratory birds.

Objective 1: Minimize disturbance of sensitive nesting areas, particularly colonial bird rookeries, white-crowned pigeon nesting colonies, bald eagle nests, and wintering areas for piping plovers and shorebirds.

Strategies:

- Increase law enforcement patrols in the backcountry to eliminate chronic human trespass within areas closed to public access to prevent disturbance to birds.
- Maintain and enhance signage to ensure adequate public notification and increase voluntary compliance.
- Encourage prompt public reporting of instances of human trespass through public service announcements in available media outlets.
- As islands accrete, evaluate their potential as nesting, roosting and foraging habitat for imperiled bird species and take protective measures.

Objective 2: Great white herons – Expand survey efforts to determine the cause of decline in nesting population of great white herons and assess potential recovery efforts.

Strategies:

- Continue aerial surveys during peak months to monitor great white heron nesting populations.
- Add three aerial surveys to monitoring efforts in order to gauge nesting during non-peak months.
- Encourage research to determine causal factors for the decline in the nesting population, using radio and satellite telemetry to focus on productivity, foraging energetics, and adult and juvenile dispersal and survival.
- Encourage research on modeling potential impacts of sea level rise and storm events on nesting and foraging habits of great white herons under future scenarios of climate change.

Objective 3: Reddish egret – Continue and expand ongoing monitoring efforts.

Strategies:

- Expand current studies to implement a monthly (i.e. 2-3 days/month) nesting survey of reddish egrets for one year to assess the number and distribution of nesting pairs. The study will help determine if there is a nesting season. If a season is well defined, subsequent years of study would be more intensive but limited to this season and may compliment new telemetry work.
- Revise, as necessary, the Backcountry Management Plan in consultation with the State of Florida to protect important reddish egret foraging and nesting areas from boater disturbance in waters under state jurisdiction.
- Use satellite telemetry to document daily and seasonal movements, foraging patterns, and juvenile dispersal and survival.
- Encourage research on modeling the potential impacts of sea level rise and storm events on nesting and foraging habits of reddish egrets under future scenarios of climate change.
- Obtain detailed bathymetry and tidal data to apply to research and monitoring.

Objective 4: Brown pelican – Protect nesting rookeries of brown pelicans.

Strategies:

- Work with the State of Florida to create a 100-meter buffer zone in state waters surrounding any newly established brown pelican rookeries within refuge boundaries under provisions of the Backcountry Management Plan.
- Continue to monitor brown pelican nesting at Cottrell Key and any newly established rookery in the refuges.
- Expand outreach to ecotour operators in Key West NWR to ensure that they practice proper wildlife viewing etiquette, including safe viewing distances to prevent nest abandonment.

Objective 5: White-crowned pigeon – Monitor white-crowned pigeons and promote range-wide recovery efforts through international partnerships.

Strategies:

- Monitor the nesting population, with emphasis on islands that harbored high-density colonies prior to the 2005 hurricane season.
- Participate in international cooperative efforts (i.e., with Caribbean countries) to formulate range-wide conservation strategies. Provide technical assistance to foster initiation of population monitoring and assessment of harvest levels in Caribbean countries.
- Identify, map, and quantify the size and distribution of white-crowned pigeon foraging sites.

Objective 6: Least tern – Protect roosting and nesting least terns from human disturbance.

Strategies:

- Monitor the nesting population on Boca Grande Key and monitor other potential nesting sites in Key West NWR.
- Install artificial nesting platforms at suitable sites in National Key Deer Refuge, including the Castillo Pit restoration site.

Objective 7: Bald eagle – Monitor the nesting population and limit disturbances.

Strategies:

- Continue to monitor bald eagle productivity annually throughout the refuge complex.
- Examine islands for bald eagle nesting activity according to the refuges' bald eagle inventory protocol.
- Prevent trespass on islands where eagles nest.

Objective 8: Other priority land birds – Implement a monitoring program for other priority landbirds.

Strategies:

- Continue to work with partners to inventory and monitor land birds in representative cover types to determine the composition, productivity, and trends in populations throughout the refuges.
- Establish point counts or other appropriate survey methods for breeding land birds and migratory birds on the refuge complex where feasible.
- Use point-count data to highlight areas of special concern for birds.
- Implement a volunteer program to report bird observations on refuge lands and develop a geographic information system to document bird sightings.
- Continue to support regional efforts to inventory and monitor mangrove birds in Florida.

VISITOR SERVICES

GOAL 4. Promote an understanding and appreciation of natural and cultural resources and provide visitors with a quality, safe, and enjoyable experience compatible with wildlife and wildland conservation.

Discussion: The public will be provided with opportunities for quality wildlife-dependent recreational activities that are compatible with the primary purpose of wildlife conservation, as staffing levels allow. As identified in the National Wildlife Refuge System Improvement Act of 1997, there are six priority wildlife-dependent activities. Of these, five – fishing, wildlife observation, wildlife photography, and environmental education and interpretation – are conceptually compatible, appropriate, and occur in the Lower Florida Keys Refuges (hunting is prohibited). The Lower Florida Keys Refuges will promote outreach opportunities that lead to a greater understanding of and stewardship for the refuges' fish and wildlife and their habitats, cultural resources, and wilderness values. Appropriate use and compatibility determinations for allowable public uses are addressed in Appendices E and F.

To ensure a quality, compatible wildlife-dependent recreational experience, various management tools and restrictions will be applied. For example, some uses may be prohibited in certain areas of the refuges to minimize impacts to environmentally sensitive habitats or wildlife. Other restrictions might be used to prevent conflicts among users. Certain uses may be limited on a seasonal, year-round or permanent basis.

The Keys are a dynamic system of islands. Storms can alter the size and shape of mangrove islands or create or destroying sand islands. Conditions may warrant closures to protect sensitive species or habitats. Refuge lands are closed to the public unless specifically opened by regulation, in recognition of the "wildlife first" purpose established by the Refuge Improvement Act. Refuge authorities provide flexibility for quickly closing or re-opening public lands as needed to protect wildlife and their habitats. Commercial uses occurring on refuge islands need to be documented and

addressed in a step-down management plan as appropriate. All visitor services activities need to be fully evaluated for impacts to threatened and endangered species in order to balance the need for public outreach and education with our priority goals to conserve and recover listed species.

The Service currently operates and staffs a visitor center in a leased storefront on Big Pine Key, which includes a gift store operated by FAVOR. In 2008, the Service acquired commercial property on U.S. Highway 1 on Big Pine Key to be used for the construction of a new visitor and environmental education center. The Service will coordinate with Monroe County and the Service's South Florida Ecological Services Office to discuss options to avoid, minimize and mitigate impacts under the Big Pine and No Name Keys Habitat Conservation Plan (HCP). The HCP dictates the amount and type of development that can occur (Monroe County et al. 2006). The Service will also consult with other agencies, community organizations and the public to develop facilities that are consistent with the local community character as envisioned in the HCP, the Big Pine Key and No Name Key Livable Communikeys Master Plan (Monroe County 2004), and the Big Pine Key/US 1 Corridor Area Enhancement Plan (Monroe County 2003). The Service also maintains two interpretive sites at the Blue Hole and Watson/Mannillo Nature Trails on Big Pine Key. Other public-access points have minimal signs detailing which activities are allowed along the unmaintained trails.

Objective 1: Continue to provide opportunities for appropriate, compatible wildlife-dependent recreational uses of the Lower Florida Keys Refuges.

Strategies:

- Complete a step-down Visitor Services Management Plan, which would include a sign plan.
- Update, approve and implement the step-down Commercial Use Management Plan.
- Revise and update the Service's Appropriate Use and Compatibility Determinations as needed.

Objective 2: Enhance environmental education programs to increase student, teacher, and parent awareness and understanding of the refuge's ecology, native flora and fauna, wildlife and habitat management, and environmental history.

Strategies:

- Continue and expand environmental education, including a multi-faceted program for use by teachers and students on and off the refuges, consistent with the No Child Left Indoors and other outdoor education intiatives.
- Work with subject matter experts to expand curricula that meet Sunshine State and Florida's Comprehensive Aseesment Test standards.
- Institute onsite programs at the Big Pine Key Elementary Academy (grades K-6) and onsite programs at the National Key Deer Refuge.
- Continue hosting the Key Kids In Nature program at the Sugarloaf Elementary School and nearby refuge lands on Upper Sugarloaf Key (National Key Deer Refuge).
- Seek ways to expand the environmental education program to other schools and to bring more students to the refuge as staffing and facilities allow.
- Establish environmental education at a new (proposed) visitor center and use designated sites at National Key Deer Refuge for environmental education activities.
- Use volunteers and develop partnerships in order to enhance and expand current environmental education programs for the Lower Florida Keys Refuges.

Objective 3: Enhance environmental interpretation and outreach efforts to increase the public's awareness and understanding of the refuges' ecology, native flora and fauna, wildlife and habitat management, and cultural resources.

Strategies:

- Consider relocating the visitor center operations to a Service-owned facility on U.S. Highway 1 on Big Pine Key.
- Develop additional interpretive information as needed at the refuge visitor center and continually update and improve the information presented on refuge brochures.
- Annually participate in the Florida Keys Birding and Wildlife Festival.
- Provide multimedia programs about the refuges at community venues and events to audiences including homeowners associations, civic groups, and environmental organizations.
- Weave key conservation messages into facility development, visitor center renovations, interpretive signage replacement efforts and environmental education programs.
- Attend off-refuge events with appropriate themes that are related to refuge issues and provide a refuge booth and interpretive information.
- Create and install additional kiosks or interpretive panels at the Blue Hole, Watson/Mannillo Nature Trails, and/or proposed visitor center that focus on a comprehensive "living with deer" message to discourage illegal feeding of Key deer and other native wildlife.
- Distribute information sheets to residential neighborhoods and homeowners associations to discourage illegal feeding of Key deer and other native wildlife.
- Develop a tear-sheet map for visitors to better orient them to National Key Deer Refuge lands.
- Create an interpretive program focusing on the appreciation and protection of cultural and historic resources.
- Create an interpretive program focusing on the appreciation and protection of wilderness resources, promoting awareness of wilderness area boundaries and delineating areas closed to or to certain public uses.
- Partner with the Lower Keys Chamber of Commerce to educate Chamber customers and businesses about appropriate and compatible wildlife-dependent recreational uses, promote proper wildlife viewing etiquette, and ensure public awareness of closed areas and prohibited uses, thereby enhancing stewardship of the refuges' natural resources.

Objective 4: Fishing – Promote resource protection and stewardship of fisheries resources.

Strategies:

- Continue partnership with the FWC and FKNMS on implementing sustainable fishing practices.
- Provide information on proper saltwater fishing and boating safety etiquette.
- Continue to enforce the State of Florida's saltwater fishing regulations in marine waters of the refuges.
- Continue implementing a focused law enforcement patrol operation during the recreational lobster mini-season to protect refuge resources.

Objective 5: Wildlife and habitat observations and photography – Continue to provide quality opportunities and facilities for wildlife observation and photography in different habitats of the refuges.

Strategies:

- Assess needs and opportunities for enhancing or expanding the existing improved trails.
- Assess the feasibility and need to replace the existing ground-level deck on the National Key Deer Refuge's Watson Nature Trail with an elevated wildlife-viewing platform. This will enhance visitors' opportunities to view and photograph wildlife and habitats with minimal environmental impact.
- Install a wildlife basking area in the Blue Hole pond to increase safe wildlife viewing opportunities for visitors and to ensure protection of wildlife.
- Develop an interpretive nature trail in association with the proposed visitor center on Big Pine Key to provide wildlife and habitat observation opportunities on-site. This should reduce visitor impacts on other areas of the refuge.

Objective 6: Other public uses and recreation – Allow non-priority, non-wildlife-dependent uses, such as horseback riding, picnicking, and bicycling at current levels in specified areas where they are compatible with the refuges' purposes.

Strategies:

- Conduct an in-depth assessment of current visitor use to: 1) document impacts on refuge resources; 2) predict future uses and impacts; and 3) determine the feasibility of implementing group size limits.
- Monitor non-priority, non-wildlife-dependent public uses to ensure that the stipulations specified within the compatibility determinations are being met.
- Remain vigilant for potential introduction of invasive plants and animal diseases from horses that may be transmittable to native wildlife and habitats.
- Monitor and strictly enforce leash rules for dogs and other pets on National Key Deer Refuge.

Objective 7: Continue to expand and foster participation of volunteers to achieve visitor services' objectives.

Strategies:

- Seek a volunteer to assist in coordinating the Service's volunteer program.
- Continue to recruit, train, and motivate volunteers to staff the visitor center, outreach booths at special events, and environmental education efforts.
- Improve recruitment and orientation procedures for volunteers.
- Develop a table-top display with information on volunteering that can be taken to various outreach events for recruitment purposes.

Objective 8: Foster partnerships with appropriate organizations that promote the key interpretive conservation messages of the refuges.

Strategies:

- Continue supporting and encouraging FAVOR, a refuge friends group that provides financial and in-kind support of refuge programs.
- Continue to provide refuge staff support to various education and outreach intiatives, including the Monroe County Environmental Education Advisory Council, Seagrass Outreach

Partnership, Florida Keys Birding and Wildlife Festival, Florida Keys Scenic Highway Plan, Florida Keys Overseas Heritage Trail, and Florida Keys Eco-Discovery Center.
- Continue participation in public events hosted by other Florida Refuges to educate the public about the Florida Keys National Wildlife Refuges Complex.

RESOURCE PROTECTION

GOAL 5. Protect archaeological, cultural, and historic resources for future generations as examples of human interaction with the natural environment.

Discussion: With the enactment of the Antiquities Act of 1906, Congress emphasized the importance of cultural resources and sought to protect archaeological sites and historic structures on lands owned, managed, or controlled by the United States. The body of historic preservation laws has grown dramatically since 1906. Associated regulations call for: (1) each agency to systematically inventory the historic properties on its holdings and to scientifically assess each property's eligibility for the National Register of Historic Places; (2) federal agencies are to consider the effects of management actions on cultural resources and seek to avoid or mitigate adverse effects; (3) cultural resources are to be protected from looting and vandalism via informed management, law enforcement efforts, and public education; and (4) groups, such as Native American tribes and African American communities, should be consulted to address how a project or management activity may impact specific cultural sites and landscapes deemed important to those groups. The objectives and strategies below outline the Service's plan to achieve its mandated historic preservation responsibilities.

Objective 1: Integrate cultural resource preservation concepts and practices into refuge programs, and modify operations and management plans to protect cultural resources in perpetuity.

Strategies:

- Coordinate with the Regional Archaeologist to complete a cultural resources overview for the three refuges.
- A section addressing cultural resource management will be included in all step-down management plans.
- Prior to any non-emergency, ground-disturbing activity, on an on-going basis, the Service will continue to complete the Request for Cultural Review Compliance form and forward it to the Regional Archaeologist for review and subsequent action, including consultation with Tribes, pursuant to Section 6 of the National Historic Preservation Act.
- Coordinate with the Seminole Tribe of Florida, the Seminole Nation of Oklahoma, the Muscogee (Creek) Nation of Oklahoma, the Poarch Band of Creek Indians of Alabama, and the Miccosukee Indian Tribe for information on and input into the management of important cultural and sacred sites located within the refuges.

Objective 2: Protect the refuges' cultural resources and diminish site destruction due to looting and vandalism.

Strategies:

- Refuge personnel will routinely submit Listing of Outlaw Treachery (LOOT) forms to the Regional Archaeologist. Past archaeological violations, including un-permitted collecting cited in 50 CFR, will be entered into the LOOT system.

- Establish and implement a regular system of patrolling and monitoring known cultural sites.
- Law enforcement officers will participate in cultural resource protection training at annual law enforcement refresher courses.

Objective 3: Maintain museum property.

Strategies:

- Scan historic photographs, maps, and documents and archive originals at the Service's National Conservation Training Center and/or National Archives, as appropriate.
- The Regional Archaeologist will arrange for the permanent curation of historic and/or archaeological collections and associated documentation derived from cultural resources investigations on the refuges.
- Identify potential partnerships on archaeological and historic investigations and museum property curation to promote interdisciplinary research.

Objective 4: Enhance public understanding and appreciation of the refuges' ecology in relation to the historic human influence on the region's ecosystems.

Strategies:

- Develop an interpretive display and related brochures and educational materials that convey the refuges' cultural history to the public.
- Incorporate information that promotes responsible use of culturally important areas into the Service's education and outreach programs.

GOAL 6. Protect and preserve the wilderness character of those refuge lands designated by Congress as part of the National Wilderness Preservation System.

Discussion: Refuge planning policy requires a Wilderness Review concurrent with the comprehensive conservation planning process. The Service inventoried other refuge lands within the planning area and found no additional areas that met the eligibility criteria for a Wilderness Study Area as defined by the Wilderness Act. Therefore, the suitability of additional refuge lands for designation as wilderness areas is not analyzed further in this plan. The results of the wilderness review are included in Appendix H.

Objective 1: Minimize human activities on wilderness areas that are open to public use in the Lower Florida Keys Refuges.

Strategies:

- Enforce existing regulations regarding allowable public uses on refuge wilderness areas by providing a consistent law enforcement presence at Boca Grande Key, Woman Key, and the Marquesas Keys, as well as islands in Great White Heron NWR (e.g., East Harbor Key) to minimize disturbance to resources and to maintain the wilderness character of these islands.
- Review and update the 1992 Management Agreement for Submerged Lands within the Boundaries of Key West and Great White Heron NWRs in collaboration with the State of Florida and the FKNMS to determine if existing protective measures are adequate to protect wildlife resources and wilderness values.

- Evaluate the need to close Boca Grande Key during peak-use periods to reduce overcrowding, minimize visitor use effects on beach dune habitats and wildlife, and enhance the visitors' wilderness experience. Consider full closure of this key if short-term closures are not enough to minimize impacts upon resources to an acceptable level.
- Evaluate the feasibility of limiting public use of the Marquesas Keys to protect its unique wilderness and ecological values.
- Incorporate wilderness protection measures in all applicable step-down management plans.

Objective 2: Convey an understanding and appreciation of the value and character of the refuges' designated wilderness areas.

Strategies:

- Develop an interpretive display and related brochures and educational materials to distribute at public events that convey the wilderness area locations and allowable public uses for visitors.
- Incorporate information that promotes responsible use and management of wilderness areas into all step-down management plans.

REFUGE ADMINISTRATION

GOAL 7. Provide administrative resources to ensure that the goals and objectives for refuge habitats, fish and wildlife populations, land conservation, visitor services, and partnerships are achieved.

Discussion: The administrative functions associated with the refuges include a wide array of activities that are critical to the mission of the National Wildlife Refuge System and the purposes of the refuges. These functions include staffing, training, budgeting, planning, and partnering, as well as biological monitoring, prescribed fire management, law enforcement, community relations, facilities construction, and maintenance. Protecting the natural resources of the refuges and ensuring the safety of visitors are fundamental responsibilities of the Service.

The approved staffing chart for the Lower Florida Keys Refuges currently (2009) includes 17 positions based at the complex headquarters on Big Pine Key. The permanent personnel include a project leader, a deputy refuge manager, 2 law enforcement officers, an administrative support assistant, 4 biologists, 2 biological technicians, a park ranger dedicated to environmental education and outreach, a fire management specialist, a forestry technician, 2 maintenance workers, and a laborer. Due to funding limitations, five of these positions are unfunded and may remain vacant in order to redistribute funds to operating expenses, such as the rising costs of personnel benefits, utilities, and fuel. The refuge complex also relies extensively on staff specialists from the South Florida Ecological Services Field Office, other Florida refuges, and the Southeast Regional Office for program accomplishments, including endangered species recovery, fire management, land acquisition, information technology, and contracting.
In Fiscal Year 2009, the Florida Keys National Wildlife Refuges Complex (including Crocodile Lake NWR in the upper Keys) was allocated a budget of $898,696 for payroll, utilities, operational and maintenance needs, and special funding to address the maintenance backlog, research partnerships, and challenge cost share projects.

Objective 1: Secure resources necessary to complete projects and tasks as outlined in the Refuge Annual Performance Plan in support of the Service's Strategic Plan and the Lower Florida Keys Refuges CCP.

Strategies:

- Identify and secure funding through grants and other cost-sharing sources to supplement annual operating funds in support of ecological research and monitoring projects that enhance the conservation of ecosystem functions of native species and their habitats.
- Enhance and maintain an active, dynamic volunteer and student intern program to assist in all refuge operations, including public outreach, environmental education, wildlife interpretation, biological monitoring, habitat restoration, and facilities maintenance.
- Construct, rehabilitate, and/or maintain an appropriate suite of refuge complex facilities to support its programs and to ensure safe and efficient operations. Facilities include the administrative headquarters office and marina, maintenance shop, visitor center, itinerant bunkhouse, and employee quarters, as well as signs, gates, kiosks, trails, and boardwalks.
- Procure and maintain equipment and vehicles needed to perform refuge operations and to ensure adequate maintenance of refuge native habitats, landscaped grounds, buildings, facilities, heavy equipment, motorboats and vehicles.
- To fulfill the workload need identified in this CCP, fund all approved positions and increase permanent staff by a total of 5 new positions. Use temporary employees as operating funds allow.

Objective 2: Maintain a safe, efficient and professional working atmosphere for staff and visitors.

Strategies:

- Regularly review and revise the safety, hurricane, and emergency contingency plans as necessary.
- Ensure that Service personnel meet all annual, mandatory training requirements.
- Provide continuing education, training, and professional development opportunities to all staff to ensure a highly competent and motivated team.
- Encourage training in state-of-the-art processes, such as adaptive management, structured decision making, geographic information systems (GIS), modeling, and integrated database management, to apply advances in wildlife and habitat management strategies.
- Procure and maintain safe and efficient equipment and vehicles to perform operations and maintenance.
- Incorporate sustainable "green" building technology into all future construction and renovation projects for government facilities, consistent with the Leadership in Energy and Environmental Design (LEED) Green Building Rating System, developed by the U.S. Green Building Council.
- Purchase new motor vehicles and equipment that incorporate the highest energy efficiency standards available to reduce the refuges' carbon footprint from operations and maintenance functions.

Objective 3: Maintain a law enforcement program that will ensure the safety, security, and protection of employees, visitors, real property, equipment, and the natural and cultural resources of the refuge.

Strategies:

- Review and update the step-down Law Enforcement Management Plan as needed.
- Continue to enhance law enforcement capabilities through collaboration, partnerships, and cooperative agreements with local, state, and federal enforcement agencies in the Florida Keys, including, but not limited to, the FWC, the FKNMS, the National Park Service, Florida Park Service, and the Monroe County Sheriff's Office.
- Continue to provide support to the U.S. Customs and Border Patrol and the U.S. Coast Guard in matters of homeland security, illegal immigrants, and resource protection.
- Continue to provide emergency response for natural disasters (e.g. hurricane details) or other response and recovery activities (e.g., oil spills), and search and rescue efforts.
- Work cooperatively with the Service's Office of Law Enforcement to protect against illegal trade, unlawful commercial exploitation, habitat destruction, and environmental hazards.

Objective 4*:* Continue developing internal Service and external partnerships to share equipment, manpower and expertise in all aspects of refuge administration.

Strategies:

- Maintain current relationships and encourage new partnerships with conservation organizations, academic institutions, and other agencies to provide scientific data that will enhance the management, protection, and restoration of native species and habitats in the Florida Keys. See Appendix L for a listing of current and potential partners. See Appendix M for a list of recently completed and ongoing research and monitoring activities.
- Continue participation in the Service's South Florida Ecosystem Team, which is a partnership of the following Service offices: Refuges, Ecological Services, Migratory Birds, Fisheries, and Law Enforcement.
- Integrate the Service's strategic habitat conservation principles into refuge programs in collaboration with partners in the newly formed (2009) South Florida Landscape Conservation Cooperative.
- Use cooperative agreements, interagency agreements and memorandums of understanding to facilitate collaborative research and management activities to meet refuge objectives.
- Expand cooperative efforts with state and local agencies, civic groups, homeowners associations, and other stakeholders to appropriately manage the complex of public lands that are intermixed with private lands in order to effectively eliminate prohibited uses of public parcels. The prohibited uses include trash disposal, camping, arson fies, encroachment, equipment storage, and habitat damage.
- Develop partnerships with "green" specialists and organizations, such as the Florida Keys Green Living and Energy Education (GLEE) forum, to incorporate sustainable "green" practices into all refuge operations and maintenance functions.

V. Plan Implementation

INTRODUCTION

The future of this and most national wildlife refuges is dependent upon a public constituency that is knowledgeable of refuge resources and mandates, as well as environmental issues, and that is willing to support the Service's work. To build and maintain this needed constituency, this CCP not only provides actions to protect, restore, and conserve wildlife habitat, but it also expands wildlife-dependent recreational opportunities. Promoting the refuge as an asset to local communities, Monroe County, and the State of Florida will enhance the refuge's image and help to expand local support. To achieve the proposed management plan for these refuges, this section identifies 19 projects; proposes increased staffing, equipment, and funding needs; lists partnership opportunities; describes step-down management plans; and discusses plan updates and reviews.

PROPOSED PROJECTS

Listed below are the proposed project summaries and their associated costs for wildlife habitat and population management, resource management, visitor services, and refuge administration over the next 15 years. This proposed project list reflects the priority needs identified by the public, planning team, and refuge staff based upon available information. These projects were generated for the purpose of achieving the refuges' objectives and strategies as identified in Chapter IV, the management direction. The primary linkages of these projects to the goals, objectives, and strategies identified in Chapter IV are noted in parenthesis at the end of each summary. RONS project numbers are those correlated to the Service's Refuge Operating Needs System (RONS), which are also detailed in Appendix J, Budget Requests. The RONS projects all have the naming convention "FY08-" before a 4-digit number. Only the 4-digit numbers are listed in the linkages below.

The cost of each project is shown in Table 6. The approximate annual cost of each proposed staff position is shown in Table 6. Cost estimates reflect 2009 dollars. Costs will vary during the 15-year implementation period of the CCP and inflation will need to be taken into consideration.

FISH AND WILDLIFE POPULATION MANAGEMENT

1. Fire Management Program – Biological Evaluations

Fire is a natural part of the Lower Keys ecosystem and is necessary to maintain the globally imperiled pine rockland ecosystem. The role and application of fire in maintaining freshwater wetlands and salt marsh transition communities have not been as extensively researched in the Lower Keys, but fire is considered to be important component of the historic disturbance regime and an appropriate management tool. Baseline inventorying and monitoring data must be obtained for all habitat types treated with prescribed fire. Research on the response of listed, rare, and other targeted species will contribute to an adaptive management approach as implemented through National Key Deer Refuge's fire management plan. Fire response studies for taxonomic groups likely affected by fire management actions will be supported by a Fire Ecologist (GS-9/11). The annual operational cost for prescribed burning and related research and monitoring activities is $50,000. This project will have a first-year and a recurring annual cost of $112,040 (GS-9 salary at $62,040 and operational expenses). The total project cost over the 15-year period of the CCP is $1,680,600. (Linkages: RONS 4702, 4856, 4870, 5041, 5071, and 5086; Goal 1, Objectives 1, 2, 4, and 5; Goal 2, Objectives 1, 2, 3, 10, 11, 15, and 16; and Goal 7, Objective 1.)

2. Eradicate or Control Invasive Exotic Plants

In order to eradicate or control populations of invasive exotic plant species, continued emphasis must be placed on detecting and monitoring the presence, spread, and damage caused by these plants, particularly upon listed native plant and wildlife species and their habitats. Outreach and education must also be expanded to inform the public about the negative impacts of introducing invasive exotic species for landscaping adjacent to natural areas, and to solicit public support for controlling invasive species on private lands as well. This project consists of funding an existing biological technician position (GS-5/7/9, $39,405) with funds for invasive exotic plant control and native plant restoration ($250,000 for first-year treatment followed by $45,000 annual control and monitoring costs). The first-year cost of this project is $289,405, with an annual recurring cost of $84,405. The total project cost over the 15-year period of the CCP is $2,285,075. (Linkages: RONS 4700, 4701, 5071 and 5086; Goal 1, Objective 1; Goal 7, Objective 1).

3. Hydrologic Monitoring and Restoration

Development, including dredge and fill activities and road building, has altered the natural hydrology of many islands in the National Key Deer Refuge. The project will develop predictive models and collect long-term monitoring data on the water quality and quantity of surface freshwater solution holes and underground freshwater lenses as well as the condition and extent of tidal habitats to detect changes from sea level rise due to climate change. The results from hydrologic studies will be used to design and implement projects to restore hydrologic conditions to maintain freshwater wetlands, improve water flows and tidal connections, and ameliorate impacts associated with hurricane storm surges. The first-year costs include $50,000 to conduct a hydrologic survey to determine the current status and extent of the underground freshwater lenses, with subsequent annual recurring costs of $10,000 to monitor water quality and quantity. The total project cost over the 15-year period of the CCP is $190,000. (Linkages: RONS 5041; Goal 1, Objectives 1, 2, and 4-7; Goal 2, Objectives 1-4, 10 and 13.)

4. Science-based Inventorying and Monitoring of Plant and Animal Populations

Science-based inventorying and monitoring of plant and animal populations are critical to ensuring the biological integrity of the refuge. The information collected through a systematic inventorying and monitoring program forms the basis for developing, implementing, revising, and evaluating management actions; enables informed decisions; and guides refuge management activities. To date, comprehensive inventories have not been completed for all taxonomic groups in the Lower Florida Keys Refuges and only a few species are adequately monitored. This project will address this shortfall by expanding the inventorying and monitoring of top-priority species through the addition of biological staffing and the funding of several important surveys. As a result, the refuges will improve management and provide valuable long-term contributions to national and regional objectives for ecosystem management, endangered, threatened and candidate species, shorebirds, wading birds, and neotropical migratory birds. The project consists of funding an existing biological technician position (GS-5/7/9 - $39,405). Contractual studies and grant agreements with partners and subject matter experts will be used to supplement refuge efforts, at an annual recurring cost of $50,000. The total first-year and annual recurring cost is $89,405. The total project cost over the 15-year period of the CCP is $1,341,075. (Linkages: RONS 4702, 4812, 4864, 5041 and 5086; Goal 1, Objectives 1-7; Goal 2, Objectives 1-16; Goal 3, Objectives 2-10; Goal 7, Objective 1.)

5. Ensure the Population Viability of the Lower Keys Marsh Rabbit

This project will aim to recover the population of the Lower Keys marsh rabbit to sustainable levels. Now one of the rarest mammals in the United States, this species exists in scattered, disjunct populations. Numbers have plummeted drastically over the past several decades and its population viability rests on a concerted effort to manage currently occupied sites and enhance formerly occupied

sites using all appropriate measures, including removal and control of its primary predators, feral and free-roaming cats. Further translocations of Lower Keys marsh rabbits are planned. Following habitat restoration, re-introduction of rabbits to formerly occupied habitats is needed to enhance connectivity and genetic flow among the scattered populations. In-situ breeding to provide a translocation source population will be evaluated as a recovery strategy. This project includes hiring a new biological technician (GS-5/7/9 - $39,405) to annually monitor rabbit occupancy and productivity; document rabbit habitat use and dispersal movements; survey, trap, and remove cats on public lands; coordinate with the Monroe County Animal Shelter and animal welfare groups in relocating captured cats; and assist with public education and outreach campaigns. This position will also support early detection and rapid response activities to control the introduction and spread of other invasive exotic predators such as large-bodied snakes and lizards that may also threaten the future viability of the marsh rabbit. The first year cost of $59,405 includes salary ($39,405 for GS-5/7/9), and purchase of field equipment ($20,000 for GPS, traps, radio telemetry equipment, etc.). The annual recurring cost of $44,405 includes salary and operational expenses. The total project cost over the 15-year period of the CCP is $681,075. (Linkages: RONS 4856 and 5042, Goal 1, Objectives 1, 4-5, and 9; Goal 2, Objectives 1-2; Goal 7, Objective 1.)

6. Maintain the Population Viability of the Key Deer

This project includes three field components to evaluate and implement complementary strategies for maintaining the population viability of Key deer and conserving the natural integrity of native habitats throughout their current range in the Lower Florida Keys Refuges. Translocated deer on Cudjoe and Sugarloaf Keys would be monitored intensively for a 3-year period to gauge herd growth and demographics, evaluate habitat condition and carrying capacity, and include additional translocation of deer from other islands, for a total project cost of $150,000. A second 3-year project will be conducted to evaluate the efficacy of using a wildlife immuno-contraceptive vaccine to manage deer overabundance on No Name Key and selected areas of Big Pine Key, in order to avoid catastrophic disease outbreaks and reduce excessive herbivory on the native plant community, for a total project cost of $250,000. Thirdly, the Southeast Cooperative Wildlife Disease Study Group will be contracted to perform annual herd health checks to monitor for the presence of diseases, for an annual recurring cost of $10,000. This project includes one-time costs of $410,000 with annual recurring costs of $10,000. The total project cost over the 15-year period of the CCP is $550,000. (Linkages: RONS 5042; Goal 1, Objectives 1-6; Goal 2, Objectives 1 and 3.)

7. Silver Rice Rat

Prior to Hurricane Wilma in 2005, the population of silver rice rats was stable, but its status since the hurricane is unknown. This project provides for an **initial 2-year intense survey followed by regular monitoring efforts using live traps and mark-recapture methods. The initial project cost includes a range-wide survey for $70,000, followed by an annual recurring cost for monitoring of $10,000.** The total project cost over the 15-year period of the CCP is $210,000. **(Linkages:** RONS 4856 and 5042; **Goal 1, Objectives 1, 5, 6, and 9; Goal 2, Objectives 1 and 4.)**

8. Lepidopterans

Both the Bartram's hairstreak and Florida leafwing butterflies are restricted to slash pine rocklands in National Key Deer Refuge that contain pine croton, the only known host plant for both species. The Miami blue butterfly is present on six islands in Key West NWR, where it occupies narrow beach ridge hammocks. Both the range and populations of these three species are but a fraction of their historical distribution and numbers. Further, the numbers and distribution of other tropical butterfly species are monitored sporadically, but thought to be declining due to various factors, including habitat loss, pesticide use, hurricanes, and illicit

collecting. The project includes a 2-year comprehensive inventory to assess presence and numbers of rare butterflies throughout refuge lands and to formulate management measures to enhance their numbers. The initial project cost includes $50,000 for the 2-year inventory, **followed by an annual recurring cost for monitoring of** $10,000. The total project cost over the 15-year period of the CCP is $190,000. (Linkages: RONS 5041 and 5042, Goal 1, Objectives 1-5, 7 and 9; Goal 2, Objectives 1 and 11).

9. Sea Turtles

Refuge islands provide some of the last remaining nesting habitat for green, loggerhead, and hawksbill sea turtles in the Florida Keys. Loggerhead turtle nesting has declined dramatically over the past 10 years, and beach profiles were greatly altered by Hurricane Wilma in 2005. Saltwater inundation of nests on the narrow beaches from sea level rise and greater storm intensity is a growing concern in light of climate change. Poaching, while infrequent, occurs in the Key West NWR. Annual monitoring of nesting sea turtles in Key West NWR has contributed to understanding regional trends in turtle numbers and population health. This project allocates $10,000 per year for surveys of nesting turtles and assessment of factors associated with nesting and productivity. The total project cost over the 15-year period of the CCP is $150,000. (Linkages: RONS, 4863, 4864, 4867, 4870, 5040 and 5042; Goal 1, Objectives 1, 7, and 8; Goal 2, Objectives 1 and 9.)

10. Rare Plant Survey

Refuge-wide surveys are needed to assess the status of rare plants that are currently candidates for listing under the Endangered Species Act as well as other endemic plants of the Florida Keys. A comprehensive inventory of candidate plants in the pine rocklands was completed in 2008; however, this inventory needs to be expanded to all other habitat types in the Lower Florida Keys Refuges. Ecological factors associated with the presence of these plants need to be assessed in order to design and implement effective management measures that will increase population abundance, expand distribution, and identify threats to their long-term conservation. This project includes an initial 3-year comprehensive inventory to establish baseline information across all refuges, with follow-up monitoring efforts. The initial project cost is $100,000 for the baseline inventory across all habitats on all refuge islands, followed by an annual recurring cost for monitoring of $20,000. The total project cost over the 15-year period of the CCP is $380,000. (Linkages: RONS 4700, 4701, 5071, 5077 and 5086; Goal 1, Objectives 1-7; Goal 2, Objectives 1, 15 and 16.)

11. Great White Heron Monitoring

The Great White Heron NWR was established to conserve nesting populations of this wading bird species. Long-term aerial surveys (1986-2006) of nesting great white herons show the population declined precipitously after 1998. Compared with a peak of 338 nests in 1998, only 82 (24 percent) and 103 (31 percent) were found in 2005 and 2006, respectively. Survey efforts need to be expanded to include the months of September, October, and March. A study, using radio-tagged juvenile and adult herons, was implemented in 2007 to determine the causal factors for the decline. An allocation of $35,000 per year is needed to survey the nesting population, including both large scale fixed-wing aerial surveys across their range augmented by boat-based ground surveys at selected rookeries to obtain productivity data. The total project cost over the 15-year period of the CCP is $525,000. (Linkages: RONS 4812; Goal 1, Objectives 1, 6 and 8; Goal 3, Objectives 1-2).

12. White-crowned Pigeon Monitoring

Most white-crowned pigeons that nest in the United States are migratory and spend winters on Caribbean islands. The United States nesting population is confined to the Florida Keys. Nesting occurs on uninhabited, mangrove islands in the Florida Keys backcountry, but to obtain

forage, these fruit-eating birds must fly to tropical hardwood hammocks on mainline keys (linked by U.S. Highway 1). Long-term refuge studies (2000-2006) of nesting white-crowned pigeons revealed a peak of 4,830 nests in 2004, with a substantial decline after Hurricanes Dennis and Wilma (July and October 2005, respectively). Both storms severely damaged nesting and/or foraging areas. Recovery to pre-storm numbers has not yet occurred: only 2,866 nests (decline of 41 percent compared to 2004) were recorded during the 2006 nesting season. An allocation of $10,500 per year is needed to continue population monitoring. The total project cost over the 15-year period of the CCP is $157,500. (Linkages: RONS 4863, 4864, and 5040; Goal 1, Objectives 1, 3 and 6; Goal 3, Objectives 1 and 5.)

REFUGE ADMINISTRATION AND RESOURCE PROTECTION

13. Land Protection

The Lower Florida Keys Refuges are composed of hundreds of parcels of land that have been acquired in fee simple or leased through management agreements with the State of Florida or Monroe County. These properties need to be posted to facilitate the public's understanding of the lands that make up the refuge. Gates and barriers are needed to control problems from prohibited activities, such as vehicular access, trash dumping, personal property storage, camping, and destruction of habitat. This project includes hiring a refuge operations specialist (GS-9/11) to assume responsibility for property and facilities management, recurring reporting and administrative requirements, and coordinating with county government and homeowners associations to address trash dumping, trespass, encroachment, habitat damage, and exotic species issues on public lots intermixed with private lands in the refuge. The initial project cost is $82,040 (includes GS-9 salary of $62,040 and set-up costs), with an annual recurring cost of $67,040 (includes GS-9 salary plus $5,000 annual operating expenses). The total project cost over the 15-year period of the CCP is $1,020,600. (Linkages: RONS 4515, 4544, 4867, 4702, 4960 and 5086; Goal 1, Objectives 1-9; Goal 7, Objectives 1 and 4).

14. Land Acquisition

Many land in-holdings of vacant parcels with high quality wildlife habitat remain within the acquisition boundaries for National Key Deer Refuge and Great White Heron NWR. These refuges consistently rank high in the Service's Land Acquisition Priority System and thus qualify for funding from the Land and Water Conservation Fund. The Service would like to acquire all available in-holdings of vacant native habitat from willing sellers to enhance its ability to manage large tracts of habitat, expand connectivity across the landscape to facilitate native plant and animal dispersal and movement, and reduce habitat fragmentation for the recovery of threatened and endangered species. Land values change rapidly in the Florida Keys, thus the estimated costs will vary. Given consistently rising property values, the faster the vacant properties can be acquired from willing sellers, the lower the costs will be. An estimated annual recurring cost of $1 million will be needed to acquire much of the remaining privately-owned vacant habitat within the refuges' acquisition boundaries. The total project cost over the 15-year period of the CCP is $15 million. (Linkages: RONS 4864, 5042, 5077; Goal 1, Objective 9.)

15. Improve Administrative Capabilities

This project includes the hiring of an administrative officer (GS-9) to oversee the complex and extensive administrative duties of the Lower Florida Keys Refuges, including budget planning and implementation, contracting, personnel management, property inventory and management, data reporting, and training. The first-year cost is $82,040 (includes GS-9 salary and office set-up costs), with an annual recurring cost of $62,040 for salary. The total project cost over the 15-year period of the CCP is $950,600. (Linkages: RONS 4967; Goal 7, Objectives 1-2).

16. Visitor Use Survey

An in-depth assessment of current visitor use and its impacts is desired, particularly for some of the remote backcountry islands which may require additional public use restrictions to protect the wildlife and wilderness values. This study would document the current impacts of recreational and public uses on refuge resources and predict future use impacts in order to determine carrying capacities for various sites on the refuges. This study will guide enhancements and improvements to the visitor services program and facilities. The estimated one-time cost is $25,000. The total project cost over the 15-year period of the CCP is $25,000. (Linkages: RONS 4697, 4863, 4865, and 4868; Goal 4, Objectives 1-5; Goal 6, Objective 1).

17. Visitor and Environmental Education Center

The Service recently acquired commercial property on U.S. Highway 1 on Big Pine Key in order to redevelop the existing structure into a new facility and operate a federally-owned visitor center. The center will contain a meet-and-greet desk and state-of-the-art interactive exhibits. The center will also be the hosting site for increased environmental education efforts and community outreach. Outdoor education interpretive signs and activities would be planned on the site. The project includes purchasing environmental education supplies and equipment to provide outdoor education programs to students. The facility would be built with state-of-the-art energy and water conservation standards to achieve the Leadership in Energy and Environmental Design (LEED) Green Building Rating System. A traffic study would also be commissioned to identify and minimize impacts of a new visitor center on Key deer and public safety related to traffic. The first-year cost for this project is $4,280,000 million for design, construction and related traffic study, with an annual recurring facility operational cost of $50,000. The total project cost over the 15-year period of the CCP is $4,980,000. (Linkages: RONS 5082; Goal 4, Objectives 1-2, 4, and 6-7; Goal 5, Objective 4; Goal 6, Objective 2, Goal 7, Objectives 1-2.)

18. Expand Visitor Services Capabilities

This project includes the hiring of a supervisory park ranger (RONS 99010, GS-11) to oversee a more comprehensive visitor services and education program to accommodate increasing demands and changing demographics and public attitudes. The position will coordinate all aspects of the visitor services program, including environmental education and outreach, recreation and visitor facilities, partnerships, visitor center operations, media, and the volunteer program. This project will have a first-year cost of $95,020 (GS-11 salary at $75,020 plus set-up costs, such as computer and office supplies), followed by an annual recurring cost of $95,020 (salary and program expenses). The total project cost over the 15-year period of the CCP is $1,425,300. (Linkages: RONS 4697, 4865, 4868 and 4989; Goal 4, Objectives 1-8; Goal 5, Objective 4; Goal 6, Objective 2, Goal 7, Objectives 1-2.)

19. Outdoor Visitor Facility Improvements

Outdoor visitor facility improvements have been proposed for National Key Deer Refuge over the 15-year life of the CCP, including an elevated wildlife-observation platform with interpretive signs at the Watson Nature Trail to provide an elevated view of the refuge's habitats and nearby waters, and a wildlife resting platform at the Blue Hole, and additional interpretive kiosks at existing venues. No visitor facilities will be provided on refuge lands in Key West NWR or Great White Heron NWR, but interpretive kiosks will be provided to partners such as the Florida Keys Overseas Heritage Trail and Florida Keys National Marine Sanctuary to place in locations that

provide a view of backcountry islands (e.g. bridges and boat ramps). The initial project costs associated with these projects are $50,000 with an annual recurring cost for maintenance of $2,000. The total project cost over the 15-year period of the CCP is $78,000. (Linkages: RONS 4697 and 4865; Goal 4, Objectives 3 and 5).

STAFFING AND FUNDING

The approved staffing chart for the Lower Florida Keys Refuges currently (2009) includes 17 positions based at the complex headquarters on Big Pine Key. However, due to funding limitations, 5 of the positions are unfunded and remain vacant. The projects listed above include costs to fill 2 of the 5 existing--but unfunded--positions (i.e., the 2 biological technicians). Five new positions are proposed to be added. These are: 1 refuge operations specialist, 1 supervisory park ranger, 1 biological technician, 1 fire ecologist, and 1 administrative officer. See Figure 9 for an organization chart of current staff, vacant positions (i.e. those which are existing, but unfunded) and newly proposed positions.

PARTNERSHIP OPPORTUNITIES

To achieve the goals and objectives of this CCP, maintaining existing partnerships and developing new ones with a variety of resource agencies, organizations, and individuals are essential. For a list of existing and potential partnerships, see Appendix L. The use of partnerships not only helps the refuge complex achieve its vision and carry out various programs, but it also can lessen refuge operation costs considerably. Partnerships are necessary to implement the CCP via the development and implementation of the various step-down management plans, annual operating plans, and special projects.

Refuge personnel need to develop memoranda of understanding or agreements with various partners (e.g., FDEP, FWC, and Monroe County) to enhance coordination and cooperation on resource management issues.

PROPOSED POJECT COSTS

The initial project cost is either a one-time or a first-year project cost. The asterisk (*****) denotes projects that have recurring costs for less than 14 years. For the grand total of annual recurring costs, the highest-year cost was used to compute the total. Regarding the proposed positions, some will have multiple responsibilities, but they are listed in the first project that the position is referenced in the project descriptions. The salaries for these positions are only listed once in the project costs since they are shared positions. The supervisory park ranger will have responsibilities for all aspects of the visitor services program, including their respective projects 17 through 20 below. The biological technician positions will share responsibility for multiple biological inventory and monitoring projects on this list.

Table 6. Summary of project costs (in 2009 dollars)

Projects Proposed to Implement Management Plan	Initial Project Cost ($)	Annual Recurring Costs ($) *	Staffing FTEs (2 existing, 5 new)
1. Fire Management Program – Biological Evaluations	112,040	112,040	Fire Ecologist
2. Eradicate or Control Invasive and Exotic Plants and Animals	289,405	84,405	Biological Technician
3. Hydrologic Monitoring and Restoration	50,000	10,000	
4. Science-based Inventorying and Monitoring of Plant and Animal Populations	89,405	89,405	Biological Technician
5. Ensure the Population Viability of the Lower Keys Marsh Rabbit	59,405	44,405	Biological Technician
6. Maintain the Population Viability of the Key Deer	410,000	10,000	
7. Silver Rice Rat	70,000	10,000	
8. Lepidopterans	50,000	10,000	
9. Sea Turtles	10,000	10,000	
10. Rare Plant Survey	100,000	20,000	
11. Great White Heron Monitoring	35,000	35,000	
12. White-crowned Pigeon Monitoring	10,500	10,500	
13. Land Protection	82,040	67,040	Refuge Operations Specialist
14. Land Acquisition	1,000,000	1,000,000	

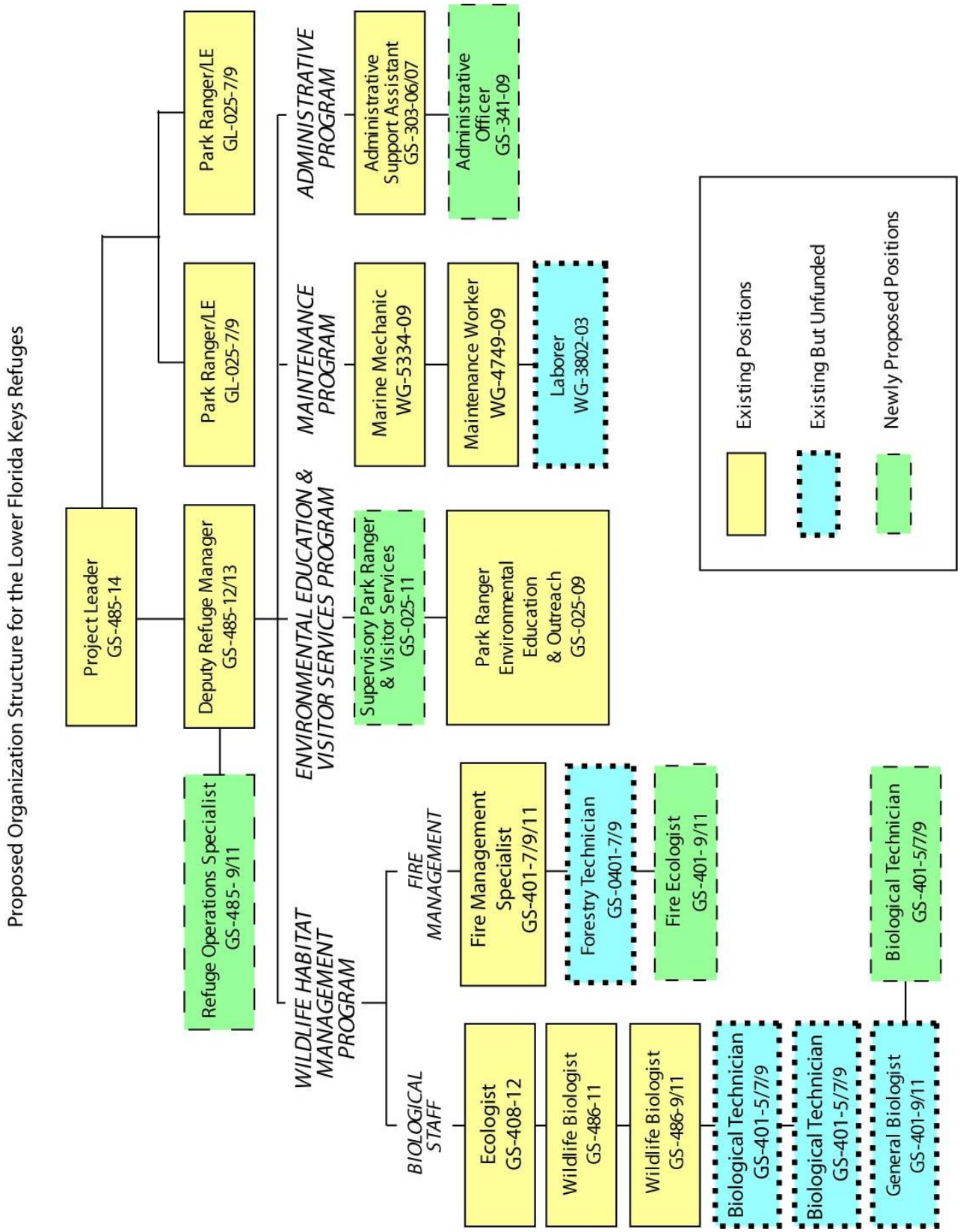
Projects Proposed to Implement Management Plan	Initial Project Cost ($)	Annual Recurring Costs ($) *	Staffing FTEs (2 existing, 5 new)
15. Improve Administrative Capabilities	82,040	62,040	Administrative Officer
16. Visitor Use Survey	25,000	0	
17. Visitor and Environmental Education Center	4,280,000	50,000	
18. Expand Visitor Services Capabilities	95,020	95,020	Supervisory Park Ranger
19. Outdoor Visitor Facility Improvements	50,000	2,000	
Grand Totals:	**6,899,855**	**1,721,855**	
Grand Total Without Land Acquisition:	**5,899,855**	**721,855**	

Table 7. Approximate annual costs of proposed new staff positions in 2009 dollars

Title	Responsibility	RONS Project Number	Grade	Annual Cost
Administrative Officer	Administrative Support	4967	GS-9	$62,040
Biological Technician	Marsh Rabbit Recovery	5042	GS-5/7/9	$39,405
Fire Ecologist	Prescribed Fire Management	5041	GS-9/11	$62,040
Refuge Operations Specialist	Refuge Operations	4544	GS-9/11	$62,040
Supervisory Park Ranger	Visitor Services	4868	GS-11	$75,020

Note: *These figures have been incorporated into the project descriptions and their associated costs in Table 5. They are not additional costs to Table 5.*

Figure 9. Proposed organization structure for the management of the Lower Florida Keys Refuges



Step-Down Management Plans

A comprehensive conservation plan is a strategic plan that guides the general direction of the refuge over the next 15 years. A step-down management plan provides more details and specific guidance on certain refuge program areas or activities, such as habitat management, prescribed fire operations, and visitor services programs. As implementation strategies of the CCP, step-down plans are also developed in accordance with the National Environmental Policy Act. Each of these plans will further address the priority issues raised during the comprehensive conservation planning process, the recommendations of the CCP review teams, and comments made by the public and other interested parties.

The Lower Florida Keys Refuges propose to initiate, update, revise, and/or implement 11 step-down plans within the 15-year time frame of the comprehensive conservation plan. A list of these plans and their associated completion dates is presented in Table 8. The following section describes the proposed step-down plans.

Backcountry Management Plan

The Service and the State of Florida signed a Management Agreement for Submerged Lands within the Boundaries of the Key West and Great White Heron National Wildlife Refuges. It established several special management areas within state sovereign submerged lands and waters where public access is restricted or prohibited to minimize disturbance to wildlife. The Management Agreement was completed in 1992 and provides for jointly reviewing and revising the plan every five years as necessary. The life of the original Management Agreement is 25 years and it is due to be renewed in 2017. The renewal will involve a partnership of the Service, FKNMS and the State of Florida. Since refuge personnel commonly refer to the Management Agreement as the Backcountry Management Plan, the step-down plan is referenced as such.

Biological Inventorying and Monitoring Plan

A priority issue and critical need is for data collecting in order to guide wildlife habitat management on the refuges. Wildlife populations need to be adequately monitored to properly determine population trends, identify management needs, and evaluate the impacts of management actions. This plan will identify target species, and describe inventorying and monitoring techniques for surveys of priority species or species groups. Priorities will include ecosystem resiliency and diversity at the species, community and landscape levels, as well as listed species. The plan will designate key species and species assemblages and associated habitats to be inventoried and monitored. A timetable for inventorying and monitoring will be developed.

Integrated Predator Management Plan

Native and non-native animal species on the refuge may require direct management strategies and intervention to control their abundance, distribution, and effect upon refuge resources, particularly predation of endangered species at risk of extinction. Examples of non-native invasive exotic animal species this plan will focus on include: feral and stray cats and dogs, green iguanas, black rats, pythons/boas, monitor lizard, and Gambian pouch rat. Management of native raccoon populations may also be addressed to reduce high concentrations or densities of raccoons due to artificial food sources, such as garbage and feeding. The Integrated Predator Management Plan will outline management strategies incorporating the most practicable and humane techniques to monitor and control pest species, including trapping and removing targeted animals, eliminating unauthorized feeding and watering stations, reducing animal access to garbage, actively enforcing refuge regulations and local ordinances, and conducting coordinated public outreach and education campaigns. Annual plan evaluation and revision will allow for the assessment of new or emerging threats.

Fire Management Plan
The purpose of this plan is to implement the policies, objectives, and standards for fire management presented in the Fire Management Handbook (621 FW 1-5), Department Manual (620 DM), and Service Manuals (095 FW 3, 232 FW6, 241 FW 3, and 241 FW 7). It will provide guidance for achieving the resource management objectives defined in refuge resource management plans and the comprehensive conservation plan. Guidance will be provided to staff for carrying-out fire management operations, such as prescribed burning for habitat improvement and fuel reduction, and wildfire suppression activities. A Fuels and Fire Effects Monitoring Plan will be included as an appendix to this plan.

Habitat Management Plan
This plan will guide all habitat management activities on the refuge. The plan will be developed within a structured decision-making framework to ensure the integration of adaptive management principles. The plan will delineate the current and desired future condition of major cover types, and identify the habitat needs of associated wildlife. It will outline the appropriate application of various management tools, such as prescribed fire, herbicide treatments, and mechanical or hand removal of vegetation. Wildlife and habitat monitoring will be incorporated into the plan. It will include parameters for using adaptive management principles to fine-tune management and to improve results for targeted priority wildlife species, species assemblages, and habitats.

Land Protection Plan
In 1991 a land acquisition plan was completed. It is entitled the "Final Land Protection Plan for the Establishment of Deer Corridors on National Key Deer Refuge." It is more commonly referred to as the Land Protection Plan (LPP). In the past several years, major progress has been made by the Service, State of Florida, and Monroe County in acquiring lands for conservation purposes. The LPP will be updated to strategically identify remaining vacant parcels in all three refuges that should be acquired from willing sellers to achieve the refuge's purposes and recovery of threatened and endangered species. This plan would describe the affected environment within and adjacent to the refuges and current and future threats to refuge resources. It would provide alternatives for land protection, including various levels of fee simple acquisition, leases, cooperative agreements, and conservation easements.

Law Enforcement Plan
This plan provides a ready reference to Service, regional and local law enforcement resources regarding refuge policies, procedures, and programs for refuge law enforcement. It will describe the objectives of the law enforcement function on the refuges. It will address the type of jurisdiction, active memoranda of understanding, and authorities of refuge officers both on and off the refuge. It will describe current assets that are available (e.g., vehicles, boats). This plan will discuss the procedures for addressing crimes on refuge lands, including patrols, traffic control, plain clothes operations, surveillance, and investigations. It will outline procedures for custodial arrests, execution of warrants, intrusion alarm responses, searches and rescues, medical emergencies, and crowd control. The plan will show procedures for physical security of refuge personnel and assets.

Mosquito Management Plan
Currently, the Service allows the Florida Keys Mosquito Control District to conduct mosquito population control on portions of National Key Deer Refuge and Great White Heron NWR under an annual special use permit. Refuge lands are interspersed with private property and development making it impossible to develop separate mosquito spraying programs for both public and private lands. Control of mosquitos in developed areas of the Keys requires that some refuge lands be treated. A new mosquito management plan would be developed to evaluate the current mosquito control program in relation to forthcoming Service policy that would allow populations of native

mosquito species to exist unimpeted unless they pose a specific wildlife or human health threat. Mosquito control measures on refuge lands will comply with federal laws and must be compatible with the purposes and mission of the refuges. The mosquito management plan would be developed in coordination with federal, state and local public health aurtorities that have expertise in vectorn-borne diseases, vector control agencies, and state fish and wildlife agencies. The plan will identify the specific conditions under which mosquito populations would be managed on the refuge, taking into account the local environment, as well as current and historical mosquito-associated health threats.

Visitor Services Management Plan
This plan will guide the Visitor Services program on the refuges. The plan will include strategies to avoid or minimize visitor impacts to wildlife and their habitat, and address trail maintenance needs, five wildlife-dependent recreation priorities, recreation in the wilderness area and valuable cultural resources. It will provide quality visitor opportunities for present and future visitors. Specific emphasis will be placed on assessing and enhancing the environmental education program, and developing the new visitor and environmental education center. As a part or appendix to this plan, a sign plan will be written to improve communication of information and regulations to visitors.

Commercial Use Monitoring Plan
The plan will address commercial uses on refuge lands within the Florida Keys National Wildlife Refuges Complex, including National Key Deer Refuge, Great White Heron NWR, and Key West NWR.

Safety and Emergency Preparedness Plan
This plan will address all procedures required by law or policy, or as otherwise needed, to provide for the personal safety of employees and visitors and to protect property from loss due to accidents. It will address staff responsibilities for safe operations, employee training requirements, required safety equipment, and industrial hygiene. While the plan emphasizes prevention of accident or injury, it will also include special response procedures and contact information for a number of specific threats, problems, or incidents, such as hurricanes, fires, spills of hazardous chemicals, and responses to serious accidents.

Table 8. Lower Florida Keys Refuges step-down management plans and completion dates in chronological order

Plan (Year Written)	Revision or Completion Date
Fire Management Plan (2001)	2009
Integrated Predator Management Plan (new)	2010
Visitor Services Management Plan (new)	2010
Mosquito Management Plan (new)	2010

Plan (Year Written)	Revision or Completion Date
Habitat Management Plan (new)	2011
Land Protection Plan (1991)	2011
Law Enforcement Plan (2006)	2011
Biological Inventory and Monitoring Plan (new)	2012
Commercial Use Management Plan (drafted 1997)	2013
Backcountry Management Plan (1992)	2017
Safety and Emergency Preparedness Plan (2009)	Annually

MONITORING AND EVALUATION

Adaptive management is a flexible approach to long-term management of biotic resources directed over time by the results of ongoing monitoring activities and other information. To apply adaptive management, specific survey, inventorying and monitoring protocols will be adopted by the refuge. Habitat management strategies will by systematically evaluated to determine management effects on wildlife populations. This information will be used to refine approaches and to determine how effectively the management objectives are being accomplished. Evaluations will include the use of ecosystem team and other appropriate partner participation.

PLAN REVIEW AND REVISION

The CCP will be reviewed every year as the refuges' annual work plans and budgets are developed. A revision will occur if and when substantive information becomes available, ecological conditions change, or there is a major refuge expansion. The CCP will be augmented by detailed step-down management plans to address the completion of specific strategies in support of the refuges' goals and objectives. Revisions to the CCP and some step-down management plans are subject to public review and compliance with the National Environmental Policy Act.

Appendix A. Glossary and Acronyms

Adaptive management	The rigorous application of management, research, and monitoring to gain information and experience necessary to assess and modify management activities. A process that uses feedback from refuge research and monitoring and evaluation of management actions to support or modify objectives and strategies at all planning levels.
Alternative	A set of objectives and strategies needed to achieve refuge goals and the desired future condition.
Arboreal	Of or like a tree or adapted for living in trees.
Areal	A measurement relating to the extent of an area across a surface plane, such as the earth.
Anadromous	Fish that move from salt water to fresh water for reproduction.
Approved acquisition boundary	A project boundary which the Director of the Fish and Wildlife Service approves upon completion of the detailed planning and environmental compliance process. The line(s) on a map enclose those lands the Service has the authority to acquire, in whole or in part. This boundary often encompasses both public and private land, but does not imply that all private parcels within the boundary are targeted for acquisition. Not all are priority and Service policy is to only acquire land from willing sellers. The approved acquisition boundary can originate from a variety of means, for example, Executive, Congressional, Secretarial or Public Land orders, Service or Regional Directors or the Migratory Bird Conservation Commission.
ATV	all terrain vehicle
Backcountry Management Plan	Common name for the Management Agreement for Submerged Lands within Boundaries of the Key West and Great White Heron National Wildlife Refuges, which gives the Service certain authorities within state-owned water surrounding island refuges.
BMP	Best Management Practice – land use practices that prevent or minimize pollution or soil erosion.
BPKTRA	Big Pine Key Trail Riders Association
Bio-accumulation	The process in which industrial waste, toxic chemicals or pesticides gradually accumulates in living tissue, or in the food web/chain.

Biomass	The total mass, or the amount of living material, in a particular area.
Biological diversity	The variety of life forms and its processes, including the variety and relative abundances of living organisms, the genetic differences among them, and the communities and ecosystems in which they occur.
Biological integrity	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.
Biota	The plant and animal life of a region.
BTI	*Bacillus thuringiensis Israelis,* a selective, microbial insecticide applied in breeding areas to be ingested by larval mosquitoes as a control agent.
Buffer	A multi-use transitional area designed and managed to protect core reserves and critical corridors from increased development and human activities that are incompatible with habitat and/or wildlife values. In this document, agricultural lands are also considered buffer lands.
CAMA	Florida Department of Environmental Protection's Coastal and Aquatic Managed Areas program, which includes aquatic preserves.
Canopy	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).
Candidate species	Plants and animals for which the Service has sufficient information on their biological status and threats to propose them as endangered or threatened under the Endangered Species Act, but for which development of a proposed listing regulation is precluded by other higher priority listing activities. The current list of candidate species is available at http://www.fws.gov/endangered/candidates/index.html. Candidate species receive no statutory protection under the ESA. The Service encourages cooperative conservation efforts for these species because they are, by definition, species that may warrant future protection under the ESA.

Category I	The Florida Exotic Pest Plant Council has developed ranking categories to classify the threat of exotic plants to the natural environment. Category I species are those that have caused ecological damage by invading and disrupting native plant communities in Florida.
Category II	Invasive exotics that have increased in abundance or frequency, but have not yet altered Florida plant communities to the extent shown by Category I species.
CFR	Code of Federal Regulations
Commensal species	A close union or relationship between organisms or species where one is benefited by the relationship and the other is neither benefited nor harmed.
Compatible use	An appropriate, wildlife-dependent recreational use or any other use on a refuge that is within the mandates laid down in the National Wildlife Refuge System Improvement Act of 1997. The refuge manager may also determine if an activity will or will not materially interfere with or detract from the fulfillment of the mission of the Refuge System or the purposes of the refuge.
Comprehensive Conservation Plan CCP	A document that describes the desired future conditions of a refuge or other planning unit. It provides long-range guidance and management direction in order to promote the purposes of the refuge, contribute to the mission of the refuge system and to meet other relevant mandates.
Conservation Easement	A legal agreement between a landowner and a land trust (a private, nonprofit conservation organization) or government agency that permanently limits the use of a property in order to protect its conservation value.
Cooperative Agreement	A legal instrument used when the principle purpose of the transaction is the transfer of money, property, services or anything of value to a recipient in order to accomplish a public purpose authorized by federal statute.
Cultural resources	The physical remains of human activity (e.g., artifacts, ruins and burial mounds) and conceptual content or context (as a setting for legendary, historic, or prehistoric events, such as a sacred area of native peoples) of an area. It includes historically, archaeologically, and/or architecturally significant resources.
Diameter at Breast Height DBH	The diameter of a tree at breast height (4.5 feet above ground).
Detrital	Debris; material originating from debris.
District	Monroe County Mosquito Control District

Ecosystem	A dynamic and interrelated complex of plant and animal communities and their associated non-living environment.
Ecosystem management	The practice of wildlife and habitat management in the context of the natural ecosystem or ecosystems being managed, with the goal of conserving or restoring the system to its natural state. Management of an ecosystem that includes all ecological, social, and economic components which make up the whole of the system.
Endangered species	Any species of plant or animal defined through the federal Endangered Species Act as being in danger of extinction throughout all or a significant portion of its range. The State of Florida has its own designation and list under the Florida Wildlife Code Title 68A, Florida Administrative Code.
Endemic species	Plants or animals that occur naturally in a certain region and whose distribution is relatively limited to a particular locality.
Environmental Assessment (EA)	A systematic analysis to determine if proposed actions would result in a significant effect on the quality of the environment.
Environmental health	The composition, structure and functioning of soil, water, air and other abiotic (non-living) features compared with historic conditions, including the natural abiotic processes that shape the environment.
Ephemeral	Short lived or transitory.
Episodic	Divided into episodes or periods.
Estuarine	Pertaining to an estuary, a semi-enclosed body of water with a significant freshwater source and a free connection with the ocean.
Extant	Still in existence.
Executive Order - EO	A legally binding edict issued by the executive branch of the government.
Extirpation	The abolishment or extermination of a species.
Exotic species	A non-indigenous or alien plant or animal species, or one introduced to this state, either purposefully (horticulture trade) or accidentally that escaped into the wild where it reproduces on its own, either sexually or asexually. Any introduced plant or animal species that is not native to the area and may be considered a nuisance.
FAVOR	The refuge complex's non-profit support organization, Friends And Volunteers Of Refuges

FCAT Florida Comprehensive Assessment Test

FDEP	Florida Department of Environmental Protection
FWC	Florida Fish and Wildlife Conservation Commission
Fee title acquisition	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).
Feral	A wild, free-roaming domestic animal which has become established as a breeding population.
Finding of No Significant Impact - FONSI	A document prepared in compliance with the National Environmental Policy Act, supported by an environmental assessment that describes why a federal action will have no significant effect on the human environment.
FKNMS	Florida Keys National Marine Sanctuary – a marine protection program jointly administered by the National Oceanic and Atmospheric Administration and State of Florida.
Forbs	Broad-leafed, flowering plants as distinguished from the grasses and sedges.
FPS	Florida Park Service, part of the FDEP
Fragmentation	The process of reducing the size and connectivity of habitat areas. The disruption of extensive habitats into small and/or isolated patches.
FTE	Full-time equivalent; relating to an employment position
FWS	The U.S. Fish and Wildlife Service also known as the Service or FWS.
Fuel	Living and dead plant material that is capable of burning.
Geographic Information System - GIS	A computer based system for the collection, processing and managing of spatially referenced data. GIS allows for the overlay of many data layers and provides a valuable tool for addressing resource management issues.
Goal	A descriptive, open-ended and often broad statement of desired future conditions that conveys a purpose, but does not define measurable units.

HSUS	Humane Society of the United States
Habitat	The native environment of a plant or animal.
Herbicide	A chemical agent used to kill plants or inhibit plant growth.
Homeostatically	Maintaining the status of equilibrium.
Hydric	A term used to define a habitat based on soil moisture conditions. Hydric habitats are those which regularly flood for at least a portion of a typical year.
Hydrological	Involving water flows or their distributions as related to evaporation, or flow to wetlands, springs, aquifers, seas, estuaries, etc.
Hydrology	The scientific study of the properties, distribution, and effects of water in the atmosphere, on the earth's surface, and in soil and rocks.
Hydroperiod	The seasonal pattern of the water level typical for a given wetland. The residence (retention) time that water spends in a wetland.
Imperiled species	Plants and animals whose status is of concern, in decline, vulnerable, or in danger. Such species may be endangered, threatened, or candidate species or otherwise rare species with no formal protective status.
Improvement Act of 1997	The National Wildlife Refuge System Improvement Act of 1997 (see Appendix C. Legal Mandates)
Indicator species	A species which, in the context of the surrounding landscape, or in comparison with related communities, seems to be most indicative of the particular community.
In-holding	Privately owned land inside the boundary of the refuge.
Intertidal	The area of shoreline between low and high tides.
In-situ	In position; it its original place.
Invasive exotic species	Non-native species which have been introduced into an ecosystem, and, because of their aggressive growth habits and lack of natural predators, displace native species.
KDPA	Key Deer Protection Alliance
Keystone species	A species whose presence is important to the health and proper functioning of a biotic community or ecosystem.

LE	Law Enforcement
LiDAR	Light Detection and Ranging is an optical, remote-sensing technology that measures properties of scattered light to find range and/or other information of a distant target.
Listed species	Any species of fish, wildlife, or plant that has been determined to be at risk by a state or the federal government. In this document, at risk may include threatened, endangered, species of special concern, species of management concern, or species included in the Convention on International Trade in Endangered Species.
LKMR	Lower Keys marsh rabbit, a native, highly-endangered species
LOOT	LOOT is the acronym for the Listing of Outlaw Treachery Information Clearinghouse which is maintained by the National Park Service. It contains voluntarily submitted summary records of prosecuted cases in hardcopy files and computerized database formats. Any federal agency may adopt the LOOT form as part of their program to comply with Section 14 (c) of the Archaeological Resources Protection Act.
Management Agreement	Management Agreement for Submerged Lands within Boundaries of the Key West and Great White Heron National Wildlife Refuges, also known as the Backcountry Management Plan.
Marshbirds	A term that encompasses non-colonial, non-waterfowl aquatic species including loons, bitterns, non-colonial grebes, rails, gallinules, coots, limpkin and cranes. They are often secretive and feed primarily in fresh waters.
Memorandum of Understanding - MOU	A voluntary agreement between two partnering agencies.
Mesic	Pertaining to habitat requiring moderate amounts of moisture in the soil. Moisture is readily available for use by vegetation and the sites may flood in short durations.
Midden	A slightly elevated mound composed of shell fragments and other debris left as waste by indigenous people; shell mounds found throughout the ecosystem constructed by indigenous people.
Migrant passerine	Of or relating to the order of Passeriformes of small or medium-sized, chiefly perching songbirds having grasping feet with the first toe directed backwards.
Migration	The seasonal movement of an animal from one area to another and back.

Mitigation or to mitigate	Avoiding or minimizing the impacts of an action.
Monitoring	The process of collecting information to track changes of selected parameters over time.
National Environmental Policy Act - NEPA	Requires all federal 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.
National Wildlife Refuge - NWR	A designated area of land or water, or and interest in land or water, within the National Wildlife Refuge System.
National Wildlife Refuge System or System	A national network of lands and waters administered 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.
Native Species	A species already occurring in Florida at the time of European contact (1500 AD). With respect to a particular ecosystem, a species that, other than as a result of an introduction, historically occurred or currently occurs in that ecosystem.
Naturalized exotic species	An exotic that sustains itself outside cultivation.
Neotropical migratory birds	Birds that migrate from North America back and forth to South or Central America. These birds usually breed in the United States or Canada and winter in Mexico, the Caribbean, or Central or South America.
Objective	A concise statement of what we want to achieve, how much we want to achieve, when and where we want to achieve it, and who is responsible for the work. Objectives derive from goals and provide the basis for determining strategies, monitoring refuge accomplishments and evaluating the success of strategies.
OSHA	Federal Occupational Safety and Health Administration
PACA	Pine Acres Conservation Association
Partnership	A mutually beneficial, joint relationship between two agencies or an agency and a landowner, etc.
Prescribed fire	A planned or intentional fire set by resource land managers to improve or restore wildlife habitat and reduce potentially dangerous fire fuel loads. It is also known as a controlled burn.

Priority public uses	As identified in the National Wildlife Refuge System Improvement Act of 1997, these are the six priority public uses allowed on a refuge when compatible with the purposes of the refuge, the mission of the Refuge System and each other: hunting, fishing, wildlife observation, wildlife photography, and environmental education and interpretation.
Proposed alternative	The Service's alternative identified in an environmental assessment that best achieves the refuge purpose and vision, contributes to the Refuge System mission, addresses significant issues, and is consistent with sound wildlife and habitat management.
PWC	Personal water craft, also known as jet ski.
Refuge Operating Needs System - RONS	A national database which contains the unfunded operational needs of each refuge. Projects included are those required to implement approved plans and meet goals, objectives, and legal mandates.
Refuge Purposes	The purposes specified in or derived from the laws, proclamations, executive orders or administrative memorandums establishing, authorizing or expanding a refuge.
Restoration	Management actions to return a vegetative community or ecosystem to its original, natural condition. To bring a disturbed site or an area changed from its native state back to its historic structure, including water regimes, plant community, and wildlife components. In this document, restoration can refer to exotic plant removal, planting native plants, and/or reintroductions of native plants or animals.
RV	A recreational vehicle that can be lived in, such as a motor coach or camper.
Scoping or Public Scoping	A process for determining the scope of issues to be addressed by a comprehensive conservation plan and for identifying priority issues. Involved in the scoping process are federal, state, and local agencies, private organizations, and individuals.
Service Asset Maintenance and Management Systems - SAMMS	A national database and accounting system used by refuges to document expenditures for the maintenance and management of facilities and equipment.
Service, USFWS or FWS	U.S. Fish and Wildlife Service; the federal agency, under the Department of the Interior, which guides the management of wildlife refuges.

Shorebirds	Any of a large group of birds commonly called sandpipers and plovers, but also including others, such as gulls, terns, skimmers, oystercatchers, avocets and stilts. Typically found along the shorelines of oceans, rivers and lakes, they are commonly characterized by long bills, legs and toes.
Species	A group of organisms all of which have a high degree of physical and genetic similarity, generally interbreed only among themselves, and show persistent differences from members of allied groups of organisms. Species have an independent evolutionary lineage.
Step-down management plans	Specific, program-area plans which provide the details necessary to implement management strategies and projects identified in the comprehensive conservation plan.
Strategy	A specific action, tool, technique or combination of these used to meet objectives.
Subtidal	An area of shoreline below the tides.
Threatened species	Those plant or animal species listed under the federal Endangered Species Act that are likely to become endangered throughout all or a significant portion of their range within the foreseeable future. The State of Florida has its own designation and list under Chapters 68A-27 (animals) and 5B-40 (plants), Florida Administrative Code.
Trust species	Animal and plant species that are federal responsibility and include migratory birds, threatened and endangered species, anadromous fish, and certain marine mammals. The term is broadly used in this document to include federal, state, and internationally listed species, including threatened and endangered species, species of special concern, and species of management concern.
Vegetation	Plants in general, or the sum total of the plant life in an area.
Wading birds	Long-legged birds that wade in fresh or brackish water in search of food, including herons, egrets, bitterns, ibis, storks, spoonbills, flamingos, and cranes.
Waterfowl	Ducks, geese, and coots.
Wetland	Areas such as lakes, marshes, and streams that are inundated by surface or ground water for a long enough period of time each year to support, and do support under natural conditions, plants and animals that require saturated or seasonally saturated soils.

Wilderness Area	Congress defined Wilderness in the Wilderness Act as "…an area where the earth and its community of life are untrammeled by man, where man himself is a visitor who does not remain….an area without permanent improvements or human habitation, which is protected and managed so as to preserve its natural conditions and which (1) generally appears to have been affected primarily by the forces of nature, with the imprint of man's work substantially unnoticeable; (2) has outstanding opportunities for solitude or a primitive and unconfined type of recreation...".
Wildfire	An uncontrolled fire started naturally by lightning or accidentally/intentionally by man.
Wildlife-dependent recreation	The public uses of hunting, fishing, wildlife observation, wildlife photography, and environmental education and interpretation.
Wildlife management	The art and science of producing, maintaining, benefiting, and/or enhancing wildlife populations and their associated habitats.
Wildland-Urban Interface - WUI	The condition that develops as residential development expands into rural (primarily forested) landscapes, creating special fire hazards and fire management problems.

Appendix B. References and Literature Cited

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Appendix C. Relevant Legal Mandates and Executive Orders

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. 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.

The Lower Florida Keys Refuges are managed as part of this system in accordance with the Refuge Recreation Act of 1962, the National Wildlife Refuge System Administration Act of 1966 as amended by the National Wildlife Refuge System Improvement Act of 1997, Executive Order 12996 (Management and General Public Use of the National Wildlife Refuge System), and other relevant legislation, executive orders, regulations, and policies.

FEDERAL LAWS AND MANDATES

The following list includes statutes and executive orders that are relevant to the acquisition, administration, and management of national wildlife refuges. The brief descriptions provided highlight some aspects of these laws and policies that are relevant to comprehensive conservation planning; however, they are not legal interpretations. The entire act or executive order should be referenced for additional detail. Further information can be obtained from the following website: http://laws.fws.gov/lawsdigest.

STATUTE	DESCRIPTION
American Antiquities Act of 1906	Provides penalties for unauthorized collection, excavation, or destruction of historic or prehistoric ruins, monuments, or objects of antiquity on lands owned or controlled by the United States. The Act authorizes the President to designate as national monuments objects or areas of historic or scientific interest on lands owned or controlled by the Unites States.
American Indian Religious Freedom Act of 1978	Protects the inherent right of Native Americans to believe, express, and exercise their traditional religions, including access to important sites, use and possession of sacred objects, and the freedom to worship through ceremonial and traditional rites.

STATUTE	DESCRIPTION
Americans With Disabilities Act of 1990	Intended to prevent discrimination of and make American society more accessible to people with disabilities. The Act requires reasonable accommodations to be made in employment, public services, public accommodations, and telecommunications for persons with disabilities.
Anadromous Fish Conservation Act of 1965, as amended	Authorizes the Secretaries of Interior and Commerce to enter into cooperative agreements with states and other non-federal interests for conservation, development, and enhancement of anadromous fish and contribute up to 50 percent as the federal share of the cost of carrying out such agreements. Reclamation construction programs for water resource projects needed solely for such fish are also authorized.
Archaeological Resources Protection Act of 1979, as amended.	Strengthens and expands the protective provisions of the Antiquities Act of 1906 regarding archaeological resources. It also revised the permitting process for archaeological research.
Architectural Barriers Act of 1968	Requires that buildings and facilities designed, constructed, or altered with federal funds, or leased by a federal agency, must comply with standards for physical accessibility.
Bald and Golden Eagle Protection Act of 1940, as amended	Prohibits the possession, sale or transport of any bald or golden eagle, alive or dead, or part, nest, or egg except as permitted by the Secretary of the Interior for scientific or exhibition purposes, or for the religious purposes of Indians.
Clean Air Act of 1970	Regulates air emissions from area, stationary, and mobile sources. This Act and its amendments charge federal land managers with direct responsibility to protect the “air quality and related values” of land under their control. These values include fish, wildlife, and their habitats.
Clean Water Act of 1974, as amended	This Act and its amendments have as its objective the restoration and maintenance of the chemical, physical, and biological integrity of the Nation’s waters. Section 401 of the Act requires that federally permitted activities comply with the Clean Water Act standards, state water quality laws, and any other appropriate state laws. Section 404 charges the U.S. Army Corps of Engineers with regulating discharge of dredge or fill materials into waters of the United States, including wetlands.
Coastal Barrier Resources Act of 1982 (CBRA)	Identifies undeveloped coastal barriers along the Atlantic and Gulf Coasts and included them in the John H. Chafee Coastal Barrier Resources System (CBRS). The objectives of the Act are to minimize loss of human life, reduce wasteful federal expenditures, and minimize the damage to natural resources by restricting most federal expenditures that encourage development within the CBRS.

STATUTE	DESCRIPTION
Coastal Barrier Improvement Act of 1990	Reauthorized the Coastal Barrier Resources Act (CBRA), expanded the CBRS to include undeveloped coastal barriers along the Great Lakes and in the Caribbean, and established "Otherwise Protected Areas (OPAs)." The Service is responsible for maintaining official maps, consulting with federal agencies that propose spending federal funds within the CBRS and OPAs, and making recommendations to Congress about proposed boundary revisions.
Coastal Zone Management Act of 1972, as amended	Established a voluntary national program within the Department of Commerce to encourage coastal states to develop and implement coastal zone management plans and requires that "any federal activity within or outside of the coastal zone that affects any land or water use or natural resource of the coastal zone" shall be "consistent to the maximum extent practicable with the enforceable policies" of a state's coastal zone management plan. The law includes an Enhancement Grants Program for protecting, restoring, or enhancing existing coastal wetlands or creating new coastal wetlands. It also established the National Estuarine Research Reserve System, guidelines for estuarine research, and financial assistance for land acquisition.
Emergency Wetlands Resources Act of 1986	Authorized the purchase of wetlands from Land and Water Conservation Fund moneys, removing a prior prohibition on such acquisitions. The Act requires the Secretary to establish a National Wetlands Priority Conservation Plan, required the states to include wetlands in their Comprehensive Outdoor Recreation Plans, and transfers to the Migratory Bird Conservation Fund amounts equal to import duties on arms and ammunition. It also established entrance fees at national wildlife refuges.
Endangered Species Act of 1973, as amended	Provides for the conservation of threatened and endangered species of fish, wildlife, and plants by federal action and by encouraging the establishment of state programs. It provides for the determination and listing of threatened and endangered species and the designation of critical habitats. Section 7 requires refuge managers to perform internal consultation before initiating projects that affect or may affect endangered species.
Environmental Education Act of 1990	Established the Office of Environmental Education within the U.S. Environmental Protection Agency to develop and administer a federal environmental education program in consultation with other federal natural resource management agencies, including the Fish and Wildlife Service.

STATUTE	DESCRIPTION
Estuary Protection Act of 1968	Authorized the Secretary of the Interior, in cooperation with other federal agencies and the states, to study and inventory estuaries of the United States, including land and water of the Great Lakes, and to determine whether such areas should be acquired for protection. The Secretary is also required to encourage state and local governments to consider the importance of estuaries in their planning activities relative to federal natural resource grants. In approving any state grants for acquisition of estuaries, the Secretary was required to establish conditions to ensure the permanent protection of estuaries.
Estuaries and Clean Waters Act of 2000	Creates a federal interagency council that includes the Director of the Fish and Wildlife Service, the Secretary of the Army for Civil Works, the Secretary of Agriculture, the Administrator of the Environmental Protection Agency and the Administrator for the National Oceanic and Atmospheric Administration. The council is charged with developing a national estuary habitat restoration strategy and providing grants to entities to restore and protect estuary habitat to promote the strategy.
Federal Noxious Weed Act of 1990, as amended	The Secretary of Agriculture was given the authority to designate plants as noxious weeds and to cooperate with other federal, State and local agencies, farmers' associations, and private individuals in measures to control, eradicate, prevent, or retard the spread of such weeds. The Act requires each Federal land-managing agency, including the Fish and Wildlife Service, to designate an office or person to coordinate a program to control such plants on the agency's land and implement cooperative agreements with the states, including integrated management systems to control undesirable plants.
Fish and Wildlife Act of 1956	Establishes a comprehensive national fish, shellfish, and wildlife resources policy with emphasis on the commercial fishing industry but also includes the inherent right of every citizen and resident to fish for pleasure, enjoyment, and betterment and to maintain and increase public opportunities for recreational use of fish and wildlife resources. Among other things, it authorizes the Secretary of the Interior to take such steps as may be required for the development, advancement, management, conservation, and protection of fish and wildlife resources including, but not limited to, research, development of existing facilities, and acquisition by purchase or exchange of land and water or interests therein.
Fish and Wildlife Conservation Act of 1980, as amended	Requires the Service to monitor non-gamebird species, identify species of management concern, and implement conservation measures to preclude the need for listing under the Endangered Species Act.

STATUTE	DESCRIPTION
Fish and Wildlife Coordination Act of 1958	Promotes equal consideration and coordination of wildlife conservation with other water resource development programs by requiring consultation with the Fish and Wildlife Service and the state fish and wildlife agencies where the "waters of a stream or other body of water are proposed or authorized, permitted or licensed to be impounded, diverted…or otherwise controlled or modified" by any agency under federal permit or license.
Improvement Act of 1987	Passed to improve the administration of fish and wildlife programs and amends several earlier laws, including the Refuge Recreation Act, the National Wildlife Refuge System Administration Act, and the Fish and Wildlife Act of 1956. It authorizes the Secretary to accept gifts and bequests of real and personal property on behalf of the United States. It also authorizes the use of volunteers on Service projects and appropriations to carry out volunteer programs.
Freedom of Information Act, 1966	Requires all federal agencies to make available to the public for inspection and copying administrative staff manuals and staff instructions; official, published and unpublished policy statements; final orders deciding case adjudication; and other documents. Special exemptions have been reserved for nine categories of privileged material. The Act requires the party seeking the information to pay reasonable search and duplication costs.
Land and Water Conservation Fund Act of 1948	Provides funding through receipts from the sale of surplus federal land, appropriations from oil and gas receipts from the outer continental shelf, and other sources for land acquisition under several authorities. Appropriations from the fund may be used for matching grants to states for outdoor recreation projects and for land acquisition by various federal agencies, including the Fish and Wildlife Service.
Marine Mammal Protection Act of 1972, as amended	Established a federal responsibility to conserve marine mammals with management vested in the Department of the Interior for sea otter, walrus, polar bear, dugong, and manatee. The Department of Commerce is responsible for cetaceans and pinnipeds, other than the walrus. With certain specified exceptions, the Act establishes a moratorium on the taking and importation of marine mammals, as well as products taken from them.
Migratory Bird Conservation Act of 1929	Established a Migratory Bird Conservation Commission to approve areas recommended by the Secretary of the Interior for acquisition with Migratory Bird Conservation Funds. The role of the commission was expanded by the North American Wetland Conservation Act to include approving wetlands acquisition, restoration, and enhancement proposals recommended by the North American Wetlands Conservation Council.

STATUTE	DESCRIPTION
Migratory Bird Hunting and Conservation Stamp Act of 1934	Also commonly referred to as the "Duck Stamp Act," requires waterfowl hunters 16 years of age or older to possess a valid federal hunting stamp. Receipts from the sale of the stamp are deposited into the Migratory Bird Conservation Fund for the acquisition of migratory bird refuges.
Migratory Bird Treaty Act of 1918, as amended	Implements various treaties and conventions between the United States and Canada, Japan, Mexico, and the former Soviet Union for the protection of migratory birds. Except as allowed by special regulations, this Act makes it unlawful to pursue, hunt, kill, capture, possess, buy, sell, purchase, barter, export, or import any migratory bird, part, nest, egg, or product.
National Environmental Policy Act of 1969	Requires analysis, public comment, and reporting for environmental impacts of federal actions. It stipulates the factors to be considered in environmental impact statements, and requires that federal agencies employ an interdisciplinary approach in related decision-making and develop means to ensure that unqualified environmental values are given appropriate consideration, along with economic and technical considerations.
National Historic Preservation Act of 1966, as amended	Established a National Register of Historic Places and a program of matching grants for preservation of significant historical features. Federal agencies are directed to take into account the effects of their actions on items or sites listed or eligible for listing in the National Register.
National Trails System Act (1968), as amended	Established the National Trails System to protect the recreational, scenic, and historic values of some important trails. National recreation trails may be established by the Secretaries of Interior or Agriculture on land wholly or partly within their jurisdiction, with the consent of the involved state(s), and other land managing agencies, if any. National scenic and national historic trails may only be designated by Congress. Several national trails cross units of the National Wildlife Refuge System.
National Wildlife Refuge System Administration Act of 1966	Prior to 1966, there was no single federal law that governed the administration of the various national wildlife refuges that had been established. This Act defines the National Wildlife Refuge System and authorizes the Secretary of the Interior to permit any use of a refuge provided such use is compatible with the major purposes(s) for which the refuge was established.

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

STATUTE	DESCRIPTION
Refuge Revenue Sharing Act of 1935, as amended	Provided for payments to counties in lieu of taxes from areas administered by the Fish and Wildlife Service. Counties are required to pass payments along to other units of local government within the county, which suffer losses in tax revenues due to the establishment of Service areas.
Rehabilitation Act of 1973	Requires nondiscrimination in the employment practices of federal agencies of the executive branch and contractors. It also requires all federally assisted programs, services, and activities to be available to people with disabilities.
Water Resources Planning Act of 1965	Established Water Resources Council to be composed of Cabinet representatives, including the Secretary of the Interior. The Council reviews river basin plans with respect to agricultural, urban, energy, industrial, recreational, and fish and wildlife needs. The Act also established a grant program to assist States in participating in the development of related comprehensive water and land use plans.
Wild and Scenic Rivers Act of 1968, as amended	Selects certain rivers of the nation possessing remarkable scenic, recreational, geologic, fish and wildlife, historic, cultural, or other similar values; preserves them in a free-flowing condition; and protects their local environments.
Wilderness Act of 1964, as amended	Directs the Secretary of the Interior to review every roadless area of 5,000 acres or more and every roadless island regardless of size within the National Wildlife Refuge System and to recommend suitability of each such area. The Act permits certain activities within designated wilderness areas that do not alter natural processes. Wilderness values are preserved through a “minimum tool” management approach, which requires refuge managers to use the least intrusive methods, equipment, and facilities necessary for administering the areas.

EXECUTIVE ORDERS	DESCRIPTIONS
EO 923 (1908)	Established the Key West NWR on August 8, 1908 as a breeding ground for native birds.
EO 7993 (1938)	President Roosevelt established Great White Heron NWR on October 27, 1938.
EO 11593, Protection and Enhancement of the Cultural Environment (1971)	States that if the Service proposes any development activities that may affect the archaeological or historic sites, the Service will consult with Federal and State Historic Preservation Officers to comply with Section 106 of the National Historic Preservation Act of 1966, as amended.
EO 11644, Use of Off-road Vehicles on Public Land (1972)	Established policies and procedures to ensure that the use of off-road vehicles on public lands will be controlled and directed so as to protect the resources of those lands, to promote the safety of all users of those lands, and to minimize conflicts among the various uses of those lands.
EO 11988, Floodplain Management (1977)	The purpose of this Executive Order is to prevent federal agencies from contributing to the “adverse impacts associated with occupancy and modification of floodplains” and the “direct or indirect support of floodplain development.” In the course of fulfilling their respective authorities, federal agencies “shall take action to reduce the risk of flood loss, to minimize the impact of floods on human safety, health and welfare, and to restore and preserve the natural and beneficial values served by floodplains.”
EO 11989 (1977), Amends Section 2 of EO 11644	Directs agencies to close areas negatively impacted by off-road vehicles.
EO 11990, Protection of Wetlands (1977)	Federal agencies are directed to provide leadership and take action to minimize the destruction, loss, or degradation of wetlands, and to preserve and enhance the natural and beneficial values of wetlands.
EO 12372, Intergovernmental Review of Federal Programs (1982)	Seeks to foster intergovernmental partnerships by requiring federal agencies to use the state process to determine and address concerns of state and local elected officials with proposed federal assistance and development programs.

EXECUTIVE ORDERS	DESCRIPTIONS
EO 12898, Environmental Justice (1994)	Requires federal agencies to identify and address disproportionately high and adverse effects of their programs, policies, and activities on minority and low-income populations.
EO 12906, Coordinating Geographical Data Acquisition and Access (1994), Amended by EO 13286 (2003). Amendment of EOs and other actions in connection with transfer of certain functions to Secretary of DHS.	Recommended that the executive branch develop, in cooperation with state, local, and tribal governments, and the private sector, a coordinated National Spatial Data Infrastructure to support public and private sector applications of geospatial data. Of particular importance to comprehensive conservation planning is the National Vegetation Classification System (NVCS), which is the adopted standard for vegetation mapping. Using NVCS facilitates the compilation of regional and national summaries, which in turn, can provide an ecosystem context for individual refuges.
EO 12962, Recreational Fisheries (1995)	Federal agencies are directed to improve the quantity, function, sustainable productivity, and distribution of U.S. aquatic resources for increased recreational fishing opportunities in cooperation with states and tribes.
EO 13007, Native American Religious Practices (1996)	Provides for access to, and ceremonial use of, Indian sacred sites on federal lands used by Indian religious practitioners and direction to avoid adversely affecting the physical integrity of such sites.
EO 13061, Federal Support of Community Efforts Along American Heritage Rivers (1997)	Established the American Heritage Rivers initiative for the purpose of natural resource and environmental protection, economic revitalization, and historic and cultural preservation. The Act directs Federal agencies to preserve, protect, and restore rivers and their associated resources important to our history, culture, and natural heritage.
EO 13084, Consultation and Coordination With Indian Tribal Governments (2000)	Provides a mechanism for establishing regular and meaningful consultation and collaboration with tribal officials in the development of federal policies that have tribal implications.

EXECUTIVE ORDERS	DESCRIPTIONS
EO 13112, Invasive Species (1999)	Federal agencies are directed to prevent the introduction of invasive species, to detect and to respond rapidly to control populations of such species in a cost effective and environmentally sound manner, accurately monitor invasive species, provide for restoration of native species and habitat conditions, conduct research to prevent introductions and to control invasive species, and promote public education on invasive species and the means to address them. This EO replaces and rescinds EO 11987, Exotic Organisms (1977).
EO 13186, Responsibilities of Federal Agencies to Protect Migratory Birds. (2001)	Instructs federal agencies to conserve migratory birds by several means, including the incorporation of strategies and recommendations found in Partners in Flight Bird Conservation plans, the North American Waterfowl Plan, the North American Waterbird Conservation Plan, and the United States Shorebird Conservation Plan, into agency management plans and guidance documents.

PRIMARY STATE WILDLIFE REGULATIONS

The primary state wildlife regulations are found in Chapter 327.072, Florida Statutes and Chapter 68A-27, Florida Administrative Code (FAC). The Florida Fish and Wildlife Conservation Commission maintains the state list of animals designated as threatened, endangered, or species of special concern, in accordance with Rules 68A-27.003 to .005, FAC. See also http://fac.dos.state.fl.us/. This list is also found on the Commission's website: http://myfwc.com. The state list of plants, which are designated as threatened, endangered, and commercially exploited, are administered and maintained by the Florida Department of Agriculture and Consumer Services via Chapter 5B-40, FAC. This list of plants can be obtained at the Department's website: http://www.doacs.state.fl.us/~pi/index.html.

Appendix D. Public Involvement

SUMMARY OF PUBLIC SCOPING

Two public scoping meetings for the Lower Florida Keys Comprehensive Conservation Plan were conducted on March 8 and 9, 2005. About 40 persons attended the March 8 meeting held on Big Pine Key at the local charter school. Roughly 20 persons attended the March 9 meeting at the Key West Board of County Commissioners' meeting room. Public comments centered on several topics including: support for the mission of the Service; public uses in wildlife refuges; commercial uses of the wildlife refuges; refuge law enforcement/curtailing of illegal activities; and species and habitat protection. The comments received by the public during the scoping period are summarized below by these categories.

Support for the mission of wildlife refuges – wildlife first:

- Wildlife needs should trump human desires for recreation.
- Wildlife should always be given priority and preference over human recreation in national wildlife refuges. Layering on additional human disturbance to appease the recreational industry runs counter to the refuge mission.
- The CCP should seek to reduce pressure on the refuges from all sources and dismiss proposals for increased use that do not benefit wildlife.
- Wildlife must come first in the CCP. Growing human disturbance in the Keys is killing wildlife in the Keys.
- Protection of animals and their habitats should be first and foremost.

Public uses in wildlife refuges:

- Maintain the ban on personal watercraft (PWC) in Great White Heron and Key West NWRs.
- Allow PWC into the backcountry.
- Ban PWC from the entire Keys.
- Strengthen the ban on PWC, airboats, and aircraft.
- Human activities on beaches should be absolutely prohibited between sunset and sunrise, except for absolute emergencies.
- Ban waterskiing, towed activities, airboats, PWC, seaplane landings, ultra-light planes, and hovercraft in the refuges.
- Develop criteria to prohibit excessively noisy aircraft and watercraft from entering the refuges.
- Each refuge should have a sizable designated "no motor zone" for exclusive use by kayaks, canoes, rowboats, sailboats, poled skiffs, and other watercraft with no motors.
- Water sports should be allowed in the refuges in reasonable areas.
- A speed limit (e.g. 35 mph) should be established for the backcountry refuges.
- No rental boats should be allowed in the refuges without a guide on board.
- Make it a goal to provide refuge visitors the opportunity to enjoy compatible forms of recreation while visiting the refuge. The refuge should survey existing recreational activities to determine those that are not compatible.
- Re-open Watson hammock to limited public use (permit should be required).

Commercial uses of wildlife refuges:

- Commercial uses in refuges should be strictly limited and absolutely confined to those with clear educational merit and minimal environmental impact.
- Any commercial activities within the refuges should require a free license that requires licensees to follow established rules for commercial use. Violations of the license rules would result in termination of the license.
- Prohibit all commercial operators from using high-capacity vessels or vehicles from operating within refuge areas.

Law Enforcement Issues:

- Establish a communications base of operations where local aircraft pilots can report boat groundings, intrusion into closed areas, poaching, and illegal activities in the refuges.
- Establish a communications base with fishing guides, commercial fisherman, Coast Guard, and state FWC officers.
- Assign all office-based personnel at least one day of field work each week.
- Enforcement efforts should be increased, especially for motor vehicle speeding on Big Pine Key (NKDR).
- There needs to be stronger enforcement of refuge regulations prohibiting feeding of Key deer and other wildlife.
- Increase the amount of education and interpretive signage in the Keys refuges.
- Increase education efforts to the public regarding the restrictions on interaction with Key deer.
- Install “No feeding” signs at the Port Pine Heights subdivision.
- Install “No feeding” signs on No Name Key to notify visitors it is a crime.
- Increase the number of signs on the refuge that explain the negative effects of feeding wildlife.
- More attention needs to be paid to illegal feeding of Key deer, alligators and other wildlife.
- On Cudjoe and Sugarloaf Keys (NKDR) some deer crossing signs should be requested from the Florida DOT to help make people aware of translocated deer.
- Increasing enforcement of 500,000 acres is difficult, so general prohibitions that are easy to comprehend are, as a practical matter, much easier to enforce than complex regulations full of loopholes and exceptions.
- Organized powerboat racing in Turkey Basin (GWHNWR) should be stopped immediately since boats racing at 50+ miles per hour are a hazard to other boaters and wildlife.
- Islands in KWNWR and GWHNWR need more law enforcement attention.

Species and habitat protection:

- The path behind the Blue Hole (NKDR) should be closed to protect alligators.
- Extend boundaries and increase numbers of closed areas (e.g., Boca Grande on GWHNWR, nesting areas).
- Prescribed fire burns need to be evaluated more closely with regards to timing and method of burning. Habitat and wildlife needs should drive the burns, not the cost of a burn.
- An overarching goal of the CCP must be that in 2021, the conditions of the refuge are no worse than in 2005.
- Land acquisition needs to be accelerated since costs are rising at such a rapid rate in the Keys.
- Bait fish and other food for upland species needs to be as strongly protected as the upland species themselves.

- Work with Monroe County to promote the use of native plants for landscaping.
- Establish an invasive exotic control plan to deal with dangerous invasive animals and plants.
- Continue with the great invasive exotics eradication programs.
- Iguanas must be monitored and studied to evaluate any negative impacts to refuge lands prior to just exterminating iguanas because they are an exotic species.
- The impact of feral cats and iguanas needs to be addressed.
- Consider adding additional islands to the Florida Keys Wilderness Area.
- Habitat for the Lower Keys marsh rabbit needs to be protected with adequate buffer zones.

Other comments:

- Offer classes in responsible boating, new fishing techniques, bird watching, emergency motor repairs, ecotourism, biological field work, ecology, native plants, weather, dangerous wildlife and plants, wildlife management, nature photography, etc.
- The Service should provide leadership by using the most energy efficient vehicles available. All boats should use the cleanest burning motors available.
- Augment education programs in Monroe County public and private schools.

SUMMARY OF PUBLIC COMMENT ON THE DRAFT CCP

The notice that the Draft CCP was available was published in the Federal Register on May 23, 2008. The public review and comment period for the Draft CCP was from May 23 though June 23, 2008. At least 47 persons attended two public meetings held on the draft CCP during the open comment period. Table 1 shows the locations and details of the public meetings.

Location	County	Date	Attendees	Speakers
Lord of the Seas Lutheran Church Big Pine Key, Florida	Monroe	6-09-08	39	8
Florida Keys Eco-Discovery Center Key West, Florida	Monroe	6-10-08	8	0
		Totals	47	8

Refuge staff and other participants at the meetings included the following individuals:

Mary Morris – Natural Resource Planner (meeting moderator)
Anne Morkill – Project Leader, Florida Keys Refuges Complex
Thomas Wilmers – Wildlife Biologist
James Bell – Refuge Ranger
Steven Berger – Refuge Law Enforcement Officer
*Ivy Stewart - Wildlife Refuge Specialist
*Phillip Hughes – Endangered Species Biologist, FWS, Ecological Services
*Holly Gaboriault, Deputy Area Supervisor
*denotes attendance on June 9 at Big Pine Key

Several speakers identified themselves as representing the following organizations: The Nature Conservancy, the Key Deer Protection Alliance (KDPA), Last Stand, and the Big Pine Key Trail Riders Association (BPKTRA).

Notices of the plan's availability and public meetings were sent to over 200 persons on the CCP mailing list, including six representatives of the following five tribes: The Miccosukee Tribe of Indians of Florida, Seminole Tribe of Florida, Seminole Nation of Oklahoma, Poarch Band of Creek Indians of Alabama, and the Muscogee (Creek) Nation of Oklahoma. Comments were received from the Miccosukee Tribe's designated tribal liaison, Mr. Steve Terry. **Twenty-five** comment letters were received by mail or email from 16 persons and the following organizations: The Nature Conservancy, Friends and Volunteers of the Refuge (FAVOR), Florida Guides Association, Key West and Lower Keys Fishing Guides Association and Marathon Guides Association (collectively referred to as the Guides), Big Pine Civic Association, Last Stand, KDPA, Pine Acres Conservation Association (PACA), Fairchild Tropical Botanic Garden, Human Society of the United States (HSUS), and the BPKTRA). Additionally, comments were received from the following government agencies: U.S. Geological Survey- Florida Integrated Science Center, U.S. Department of Agriculture- Forest Service Southern Research Station, Florida Department of Agriculture and Consumer Services- Bureau of Pesticides, and Florida Department of State, Division of Historical Resources.

The plan was circulated through the Florida State Clearinghouse to 8 state, regional, and local governments: The South Florida Regional Planning Council (SFRPC), Monroe County, Florida Department of Community Affairs (FDCA), Florida Fish and Wildlife Conservation Commission (FWC), Florida Departments of State (FDOS), Transportation (FDOT), Environmental Protection (FDEP) and the South Florida Water Management District (SFWMD). The clearinghouse agencies review documents pursuant to Presidential Executive Order 12372, Gubernatorial Executive Order 95-359, the Coastal Zone Management Act, and the National Environmental Policy Act. Monroe County and the FWC replied that the agencies had no comments on the Draft CCP. The FWC had commented on the Service's Internal Review Draft and all appropriate comments were incorporated into or addressed within the Draft CCP. The FDCA found the plan to be in compliance with the Monroe County Comprehensive Plan. The SFWMD recommended implementation of the preferred alternative, Alternative B. The Florida State Clearinghouse issued a letter dated June 26, 2008 and signed by Sally B. Mann, Director of the Office of Intergovernmental Programs, FDEP. It states that the Draft Lower Florida Keys Refuges CCP is consistent with the Florida Coastal Management Program.

Under the National Environmental Policy Act, the Service must respond to substantive comments received during the open comment period. This includes both written comments and oral statements made at public meetings. For purposes of this CCP, a substantive comment is one that is: 1) within the scope of the proposed action and the alternatives that were considered under the EA; 2) is specific to the proposed action, or 3) is directly related to the proposed action. The Service does not reply directly to each commenter. Instead, the comments submitted during the open comment period were evaluated, summarized, and grouped into the following categories:

Habitat Management
Fish and Wildlife Population Management
Visitor Services
Resource Protection
Refuge Administration
Environmental Assessment
Other

The Service's responses to the comments are provided below by category, as are the related goals and objectives in the CCP, Chapter IV, Management Direction. Editorial comments on text or grammar were incorporated in the revision of the CCP document as applicable.

HABITAT MANAGEMENT

Comment: Several persons noted factual errors and omissions (e.g. elevations, soil depth, species status, etc.) in the Draft CCP.

Response: Factual errors and omissions were corrected in the Final CCP.

Comment: Some expressed support for the principles of adaptive management and requested that the general public and organizations continue to be consulted during periods of re-evaluation.

Response: Comment noted.

Single-species versus Ecosystem Management

Comment: The statement that habitat enhancement for critically imperiled species, such as the Lower Keys marsh rabbit and Key tree-cactus, would occur to ensure the long-term sustainability of these species implies single-species management, which is contrary to the goal of ecosystem management. The mandate for this refuge is to protect certain priority species. However, basic ecology has taught us that the best and most effective way to accomplish this is to manage for the health of their whole, intact ecosystem. To manipulate the habitat in an attempt to "enhance" it for a single species ends up skewing and distorting natural systems often to the detriment of the very species we are trying to protect. The past emphasis of traditional management on single species led to misguided efforts, such as predator eradication, which resulted in disastrous and unexpected consequences.

Response: Long-term sustainability of species requires ecosystem management. Accordingly, the Service does not assess endangered species management outside the context of ecosystem management. The mission of the Lower Florida Keys Refuges is to maintain the population viability and prevent the extinction of species by managing the ecosystems in which they reside, pursuant to the original purposes for establishing the refuges and trust responsibilities under the Endangered Species Act. The CCP goals and objectives for fish and wildlife populations--and the habitats upon which they depend--promote biodiversity and the recovery of imperiled species. Federally listed species in the Lower Florida Keys Refuges alone are represented in every major habitat type, and every habitat has at least two such species. All habitats in the Lower Keys are altered and fragmented and many ecosystem functions are degraded or impaired to various degrees. Within impaired systems, habitat enhancement is a necessary component of ecosystem management. It is a widely accepted strategy for the recovery of imperiled species (which in turn benefits the ecosystem). For example, fire in pine rocklands is an ecosystem process that imparts benefits for Key deer and numerous other species over different time-frames. Because populations of both the Lower Keys marsh rabbit and Key tree cactus are so low that extinction may occur – a condition existing before, but exacerbated by recent hurricanes (i.e., Georges in 1998, Wilma in 2005), expeditious management measures focused on both species are prudent and warranted. The Final CCP has been revised to expand on this discussion.

Comment: Habitat enhancements within ecosystems should be evaluated not only for federally listed threatened, endangered, or candidate species, but for all species or habitats that may be involved. In an environment as small and complex as the Lower Florida Keys the ramifications of refuge management will most assuredly be pronounced.

Response: Comment noted.

Comment: The Service should support the natural process of regeneration and restore habitats to a natural state rather than artificially create non-historic conditions, pursuant to the NWRS Improvement Act and policy on Maintaining the Biological Integrity, Diversity and Environmental Health of the National Wildlife Refuge System.

Response: The Service concurs that it should support natural processes and functions, and restore habitats to more naturally functioning states to the greatest extent feasible using the best available science. Historic conditions are useful in guiding benchmark actions towards a more desired future landscape. However, the landscape in the Lower Keys has been substantially altered since the 1950s by roads, canals, mosquito ditches, commercial and residential development, as well as by sea level rise. Consequently, only a partial restoration of historic conditions will ever be achieved in the Lower Keys given current levels of habitat fragmentation and degradation due to private land ownership and development surrounding and intermingled with refuge lands. If imperiled species or degraded communities are compared to historic conditions, then the initial treatment(s) required to reach a desired state after decades of resource degradation may seem drastic or artificial. Rather, each restoration project should build successively toward restoring biological integrity across the landscape over the long-term. Future settings under various scenarios of accelerated sea level rise and storm events due to climate change must also be considered in defining desirable conditions. The NWRS Improvement Act provides discretion to the Service to take certain management actions to restore natural processes in order that the Service can fulfill the full range of statutory trust responsibilities embodied in the Improvement Act. These augment, but do not preempt, other trust responsibilities embodied in the establishing purposes of each Refuge, Endangered Species Act, Migratory Bird Treaty Act, Lacey Act, Antiquities Act and others.

Comment: Protecting the limited freshwater resources on which Keys wildlife depends is critical. We suggest that the Service use the site specific field monitoring of salinity and other data collected for Folk, M. L., et al. 1991. This valuable information should be the baseline for determining the health and condition of over 1000 non-tidal and freshwater wetlands in the Lower Keys. It is likely that a number of these on the margins of uplands have already been lost or modified as a result of sea level rise in the 20 years since this data was collected.

Response: The CCP includes a strategy to initiate long-term monitoring of all freshwater resources within NKDR to gauge salinity and other water chemistry parameters in order to document changes in water quality and quantity that have occurred since the baseline inventories noted by the commenter. The Service is also seeking funds to re-measure the extent of freshwater lenses on Big Pine Key and to establish monitoring systems that will detect changes in freshwater quality and quantity in relation to sea level rise and storm events, both of which are predicted to accelerate under climate change.

Comment: We agree with Goal 1, Objective 6 regarding maintenance and conservation of mangrove communities in the refuges. Goal 4, Objective 5 regarding promoting resource protection by providing information on proper fishing and boating etiquette. Providing access for angling allows the use of a renewable resource without adverse impacts on that resource or other resources.

Response: Comment noted.

Comment: Encourage the Service to continue to work cooperatively with the State and the FKNMS to better protect for marine wildlife and wilderness resources, and to explore cooperation with other organizations that may be able to provide financial, research and management support.

Response: The Service has fostered multiple cooperative partnerships to leverage resources and integrate protection, monitoring, and science by collaborating with diverse associates in academia, government, private, and non-governmental sectors. Additionally, intra-agency collaboration has been greatly expanded and diversified. See Appendix L.

Comment: CAMA and FKNMS look forward to working with the Service on revising the Management agreement for Submerged Lands within the Boundaries of KWNWR and GWHNWR.

Response: The Backcountry Management Plan description will reflect the Service's partnership with the FDEP/CAMA and FKNMS.

Climate change

Comment: Several comments were received regarding the effects of sea level rise due to climate change on the wildlife and habitats of the refuges, and encouraging the Service to relate ongoing conservation actions, such as invasive species control and fire management, as strategies for enhancing the resiliency of native habitats to adapt to climate change. One stated that no studies have been done by refuge staff or researchers on sea level rise or storm surge.

Response: The Service is partnering with Florida International University, U.S. Geological Survey Biological resources Division, Institute for regional Conservation, The Nature Conservancy, and other investigators to conduct research and modeling on community responses to fire, exotic plants, storm surges and sea level rise in order to enhance our understanding of ecosystem resiliency in the face of climate change. Products will include an accurate digital elevation map for islands within the National Key Deer Refuge, which can be used to model various scenarios of accelerated sea level rise and storm surge rates. Participants are working toward a common goal of quantifying probabilities about potential changes in plant communities, ecosystems, and wildlife populations, and subsequently, formulating options for monitoring protocols to detect change and implementing adaptive strategies. Staff of the Lower Florida Keys Refuges are actively engaged in discussions and planning at the national, regional and state levels regarding the challenges of climate change on wildlife and their habitats, as are numerous personnel in other Service offices in South Florida and elsewhere. The Final CCP text has been revised to better reflect current and future efforts. More information on the Service's current efforts to address the impacts of climate change on fish and wildlife can be found on the Service's web page at http://www.fws.gov/home/climatechange/index.html.

Comment: The Service should research possibilities of raising elevations in hardwood hammocks and dead pinelands, gradually augmenting ridges in former LKMR habitat, and artificially enhancing banks in the backcountry now becoming too deep for wading birds to mitigate for sea level rise.

Response: The Service is actively working with partners to: 1) model the effects of sea level rise on terrestrial habitats; 2) seek practical ways to enhance the resiliency of wildlife populations and their habitats to adapt to climate change; and 3) design practical methods to mitigate its effects.

Land acquisition

Comment: There were several comments in support of land acquisition, stating it should be a priority issue of the Service and some felt it was not a priority in the CCP.

Response: More than $35 million has been spent by the federal government on land acquisition for the Lower Florida Keys Refuges since the 1950s. NKDR continues to rank in the top tier of national priorities due to the high number of rare and endangered species. Congress appropriated $1.5

million to acquire lands in 2007-2008. The Service also actively collaborates with state, county, and non-governmental land trusts to coordinate strategic land acquisitions and manage lands for the conservation of threatened and endangered species. Acquisitions to date have accomplished a large portion of the purposes of the NKDR Land Protection Plan on the establishment of deer movements corridors (USFWS 1991). The plan will be updated to reflect current priority needs. The discussion on land acquisition under Goal 1, Objective 9 has been expanded in the Final CCP.

Comment: The Service should revise the refuges' boundaries to reflect current and potential future Service land ownership and management of lands owned by other agencies, but not managed by the Service.

Response: The Final CCP has been revised by adding a new strategy under the Habitat Management goal's land acquisition objective.

Invasive and exotic plant management

Comment: Several commenters noted that the invasive exotics program needs more emphasis, and that an educated and involved public can be easily motivated and trained for early detection/rapid response work, and also mobilized for support of prevention policies.

Response: The Service agrees that an educated and involved public can assist in the early detection and rapid response for exotic species control, and will strive to grow those efforts. Invasive exotic plant removal work has been performed to date by refuge staff, contractors, and volunteers. The Service will continue to rely on a variety of staffing resources and partnerships. Since 2006, the Service has partnered with FWC, TNC, and beginning in 2008 with the Institute for Regional Conservation, in conducting re-treatments, inventory, monitoring, and control activities on federal, state, and county properties under a cooperative agreement using funding from the FDEP's Bureau of Invasive Plant Management. New staff positions to support the proposed management action include a full-time permanent Biological Technician. This position will focus on invasive exotic species control (Table 6).

Comment: The goal of invasive exotic vegetation management should be eradication of Brazilian pepper on an island-wide basis within five years.

Response: Complete eradication of invasive plants on the Lower Florida Keys Refuges is both desirable and the goal for certain species. Controlling invasive exotic plants will be a continuing challenge for several reasons. The islands are vulnerable to ongoing and new infestations as seeds readily disperse. The local climate provides ideal growing conditions for the establishment and spread of invasive exotic plants. Also, infestations on adjacent private lands serve as sources for re-infesting natural areas. The TNC's Project GreenSweep, funded by the Service's Partners for Fish and Wildlife, Coastal and Private Stewardship Programs and the SFWMD, seeks to control invasive exotic plants on private lands which may retain invasive plants that can serve to re-infest adjacent natural areas.

Fire management

Comment: Is the Service planning to mimic the historical fire cycle that was present pre-settlement or post-settlement times?

Response: Given that the Florida Keys ecosystems are highly fragmented and altered due to roads, canals, and development compared to pre-settlement and even post-settlement periods up to the 1950s, it will be impossible to fully mimic the historical fire cycle. Based on plant and fire-ecology

studies from the Lower Florida Keys, mainland Florida, several Caribbean islands, and coastal Central American regions, the Service is using the best available scientific information to restore fire as an integral process in the ecosystem. These studies have aided in the understanding of historic fire regime attributes in fire-adapted habitats.

Comment: Fire personnel are often on wildfire details in other parts of the country during the summer months. Having a narrow prescribed-fire window (i.e. burning only in the summer months) results in unmet burn objectives and longer fire-return intervals. The fire management plan should broaden the application of fires to allow prescriptions whenever conditions can be met. It is critical that fire frequency should take precedence over seasonality, both for ecological and fuels management reasons.

Response: The Service concurs. Specific management actions regarding fire will be addressed in the revised step-down Fire Management Plan, which will expand the application of prescribed fire during the entire growing season in order to meet ecological objectives as well as fuel reduction priorities.

Comment: All prescribed burns need more data collection and analysis across the board.

Response: A Fuels and Fire Effects Monitoring Plan will be implemented as an important component of the step-down Fire Management Plan. The step-down Biological Inventory and Monitoring Plan will also be integrated with the habitat management program (including fire) to monitor and evaluate the effects of habitat management strategies on wildlife resources. There have been numerous research studies on fire management at NKDR, and wherever practical, the fuels and fire effects monitoring plots will be co-located within existing plots to facilitate long-term monitoring and comparative studies.

Comment: Prescribed burning has eliminated the Big Pine Key ringneck snake from many acres of refuge land.

Response: There are no substantive data supporting the statement that prescribed burning has explicitly eliminated this species from many areas. Overall, fires have benefitted the pine rockland communities and diverse flora and fauna that depend on them.

Comment: There is a confusion or inconsistency through out this document between salt marsh, buttonwood transition zone, transitional wetlands, salt marsh/buttonwood, marl prairie, and buttonwood prairie.

Response: Terminology has been clarified in the Final CCP by using widely recognized vegetation cover types, each of which encompasses several more distinct plant communities.

Comment: We strongly disagree with the Draft CCP statement: *"*Prescribed fire is also an appropriate tool to manage the encroachment of overstory vegetation and to restore open habitat features of coastal salt marsh and freshwater marsh habitats*"*. There is a lack of scientific support that fire is a natural process in Keys wetlands and decision to use prescribed burns to manage the NKDR's salt marshes.

Response: The Service's decision to carefully and judiciously apply prescribed fire to selected salt marsh transition and freshwater marsh habitats to enhance habitat diversity and benefit LKMR was based on a thorough review of the available scientific literature. Grass-dominated wetlands in Florida and worldwide typically carry fire very readily and most are fire-adapted, if not fire-dependent. Prior to widespread alteration and fragmentation of habitats in the NKDR by roads, mosquito ditches, and

development, historic fires most likely spread from ignitions in higher elevation pine rocklands into the grassy fuels of adjacent freshwater wetlands and saltmarsh transition zones under optimal conditions. Because prescribed fire is commonly used to promote the vigorous growth of herbaceous vegetation, reduce woody encroachment (open the canopy), and improve forage quality, the Service has determined that prescribed fire has great potential as a tool to meet this habitat management objective. Pre- and post-burn monitoring will provide valuable information on the effectiveness of this management treatment in select salt marsh transition and freshwater marsh habitats to increase habitat and landscape diversity, and benefit recovery of the LKMR. The Final CCP has been revised to include further discussion and references on this topic.

Comment: The Service provides no scientific evidence in support of burning Keys marshes to benefit the ecosystem and/or marsh rabbit, and should not be experimenting with fire. The Service needs to study the historic and ecological role of fire in these areas and not take any actions that create and perpetuate an artificial, unnatural condition. Therefore, any action to "enhance" the salt marshes and LKMR habitat through prescribed burning at this time would be inappropriate and not consistent with the goals of wildlife sustainability. The plan should call for more scientific data and analysis in a published report before a decision is made on whether or not to burn any salt marsh habitat, especially that which is occupied by the LKMR.

Response: The request for more study, scientific data and analysis, and a published report while also implementing a moratorium on prescribed burning presents a paradox. Unless prescribed burning is conducted and evaluated in the Keys, substantive data can not be collected, its value for restoring habitat diversity and benefiting wildlife cannot be evaluated, and adaptive management cannot be applied. The Service has concluded that its past practices of confining fire to the pine rockland alone and excluding fire elsewhere was itself creating and perpetuating an artificial condition that the commenters wish to avoid. Revised fire management strategies strive to restore the more natural movement of fire across ecotones under the most optimal conditions where feasible, appropriate, and safe in order to maintain habitat diversity and benefit species associated with those habitats.

Comment: Saltmarsh/buttonwood communities need to be managed for the overall health of the system. These communities should not be experimentally altered to benefit one species. The result will likely be negative impacts on the rabbit.

Response: While buttonwood is a typical element of the Keys salt marsh flora, its level of dominance likely varied under natural disturbance regimes. In south Florida, it has been well documented that the lack of fire and hurricanes over several decades in marsh and grass prairies results in buttonwood and other overstory hardwood species. In the Keys, the Service postulates that the advancement of buttonwood or other hardwoods may be a factor in patch extinctions of LKMR because critical ground cover is lost. Such one-sided advancement may be due to the absence of disturbances, such as fire, or some other perturbation to the system.

Comment: I fully support the use of fire to enhance the rare grassy *Spartina* communities that are a disappearing element of the Keys landscape. I believe the use of fire to maintain this community is a clear and ecologically defensible management objective.

Response: The careful and judicious application of prescribed fire in select areas is included as a habitat management strategy under objectives for freshwater wetland and salt marsh transitional plant communities, and will be evaluated in more detail in the step-down Fire Management Plan.

Comment: Fire kills many salt marsh species and removes the thin soil, making it more vulnerable to hurricanes and rising sea levels.

Response: The Service is aware of no substantive data that carefully planned and prescribed burning would remove the soil or predispose it to greater damage by hurricanes or sea level rise. Herbaceous wetlands in south Florida are fire-adapted systems with fire-resilient plants. Early studies of fire and changes in vegetation communities on Big Pine Key by Alexander, Dickson and Klimstra indicate that more frequent fire sustains salt marsh species whereas infrequent fire results in the fragmentation and reduction of salt marsh species. Constituent species may exhibit a variety of responses to fires with various characteristics. The Service will investigate whether there are constituent species in salt marshes of the Keys that are relatively sensitive to fire due to particular life history traits, and mitigate as needed.

Comment: LKMR nesting vegetation will be temporarily destroyed along with their food source. There is no way to ensure the evacuation of the entire community (mammals, amphibians, reptiles...) prior to an experimental burn.

Response: Because the LKMR is a highly mobile animal, the Service does not believe that prescribed fire poses a risk to LKMR. Loss of cover would be temporary since herbaceous vegetation grows vigorously following fire. Burns would also not be scheduled during LKMR nesting season peaks so that any loss of nesting habitat would be temporary. The Service concurs that there is no way to ensure total absence of wildlife in an area prior to a prescribed burn, but the potential benefits far outweigh potential risks.

Comment: There is an ongoing shift in fire management paradigms driven by the realization that a focus on management-by-objective instead of trying to recreate natural fire regimes or historical conditions will result in more ecological benefits and be more likely to succeed. This shift is largely driven by the fact that resource managers are operating in a no-analog environment, with novel landscapes, a changing climate and invasive species among many other unprecedented conditions. Management by objective provides concrete targets (better marsh rabbit habitat, maintenance of a rare plant community) as compared to diffuse and poorly defined goals (e.g. a more “natural” landscape).

Response: The Service is advancing such a shift in management paradigms. We propose to apply fire as a critical management tool. This would be done to restore and maintain fire-dependent pine rockland and to control the encroachment of woody overstory, where appropriate, in selected salt marsh transition and freshwater wetland communities adjacent to pine rocklands. The purpose of this is to maintain landscape diversity. See also previous responses. Fire management objectives and strategies will be more fully addressed in the revised step-down Fire Management Plan.

Comment: The unfortunate lack of clearly stated objectives as well as consistent post-burn monitoring has led to several devastating prescription burns that have decreased the acreage of healthy pine rockland. We ask the Service to initiate a moratorium on prescribed burning until there is a comprehensive, objective assessment of the results of all past prescription burns, what worked and what didn’t, and a burn plan tailored to the special conditions of the Keys and site specific to each individual burn unit. Prescription burning may be appropriate in pine rocklands, but on a smaller Keys scale and at greater time interludes.

Response: The Service recognizes that there has been a long history of variability in the application of prescribed fire on National Key Deer Refuge, resulting in mistrust and uncertainty in the Refuge’s fire management program. Consequently, in response to input from the biological and fire program review, public comments received in various public forums, as well as newly

published scientific information, the Service is making a sincere and concerted effort to integrate contemporary science and local knowledge into its fire management program. The CCP includes several strategies for studying ecological processes and functions. The revised step-down Fire Management Plan will reflect a shift that is more consistent with state-of-the-art knowledge about fire ecology and recognizes the unique and vulnerable condition of each island, each habitat, and each unit targeted for management.

Comment: Prescribed burning practices appropriate in other parts of North America need to be adapted to the tropical Caribbean pinelands of the Keys. The uniqueness of Keys pine rocklands has not been appreciated in the past. In addition to killing pines, prescription burns have removed soil, decreased biodiversity, and made these ecosystems more vulnerable to hurricanes and sea level rise. Pine rocklands on Cudjoe and Sugarloaf, for example, stressed by sea level rise, devastated by prescription burns, and flooded by Hurricane Wilma, have all but disappeared. There is the risk that these globally endangered ecosystems may become extinct in our lifetimes, and the Service's burning practices may actually be hastening that process.

Response: The Service suggests that a key approach for building the adaptive capacity of natural systems to remain resilient against and recover from disturbance events, including future scenarios of climate change, is to enhance diversity at various scales of the landscape. Carefully planned prescribed burning does not devastate habitats, but can be a restorative tool. The adaptive management process of planning, implementation, monitoring and evaluation as implied throughout the CCP is the cornerstone of continuing to manage habitats where necessary, while ensuring actions are consistent with a dynamic and uncertain environment.

Comment: There were multiple comments on the frequency of natural fire: The natural fire frequency in Lower Keys pine rocklands is not very frequent. It is in the order of 12 to 40 years. In the past 25 years we have had maybe 3 small natural fires. We rarely have fires from lightning in the Keys. It is unnatural to burn this pine rockland habitat at any frequency. There is no proof that the fire regime has been significantly altered to the detriment of the habitat.

Response: In the Lower Keys, the Service acknowledges that, when compared to nearby mainland sites, the probability of natural fire ignition is lower due to island size and shape, and due to the configuration of habitat patches on the island. This condition is magnified by habitat fragmentation and man-made barriers to natural fire spread, and active fire suppression associated with human development. However, a recently completed study of sediment records from solution holes in NKDR documents the long importance of fire in the pine rocklands of Big Pine Key for more than 1,600 years before present. The charcoal record revealed repeated, local fires during the past ca. 450–500 years on a relative frequency of burning twice a decade (see Final CCP for reference).
The prevailing view of scientists and land managers is that slash pine forests of the Keys, south Florida, the Caribbean Basin, and most pine forests in general, are fire dependent.
Wholesale exclusion of fire would constitute a major perturbation to the ecosystem including widespread site conversions to hardwood communities due to succession. The result would be reduced structural and species diversity within forest stands and increasing homogeneity among stands, and an eventual inability of the system to return to pine rockland. In retaining the appropriate use of fire, the Service and collaborators will maintain the system's capacity to sustain itself and facilitate the survival of component rare plant species that depend on the community. The absence of fire over prolonged periods results in dangerously high fuel loads and an elevated risk of a catastrophic (stand replacement) wildfire.

Comment: Concentrate on mechanical and manual fuel removal from pine rockland.

Response: Mechanical and manual fuel removal will be used by the Service on small parcels of public land interspersed with private residential properties in the dense wildland-urban interface to reduce hazardous fuel loads. However, mechanical and manual fuel removal on anything but a small scale are not effective surrogates for prescribed burning, and may or may not be warranted or beneficial depending on characteristics of an individual forest stand. Mechanical and manual fuel removal requires substantial manpower, is very expensive, and does not confer the known benefits of a fire such as rapid nutrient recycling. Mechanical removal operations can cause unforeseen problems, such as damage to substrate and non-targeted plants by equipment, and introduction of invasive exotic plants.

Comment: Under Fire Management, within the same paragraph it promotes the idea of burning as a management tool and then states that no post burn studies have been done to know if we have achieved desired results! What about pre-study, how can we know what to post study if we don't know what was there to begin with. My evidence of documented past prescribed burn disasters was presented live to the public and the refuge, what more can I say. It never worked here and it never will, this is a fragile island ecosystem not Yellowstone National Park. If every manager has to make the same mistake for themselves because nobody thought it was important enough to document past results, then we are in serious trouble regarding saving what little is left of our so called Wilderness.

Response: The Service acknowledges a lack of clarity in the Draft CCP in regard to these issues, and the Final CCP has been revised to clarify that numerous research and monitoring projects have been conducted by the Service, adjacent land owners, and other collaborators within pine rocklands of the Keys. These studies incorporated community-level methods ranging from intensive research on experimental plots to correlative analyses of plant composition in extensive plots, as well as research on individual species. In addition to providing for research on the short- and long-term effects of experimental fires, and the derivation of inferences from these studies, additional studies are generating extensive baseline data of pre-fire conditions throughout the pine rocklands. All of the completed studies recognized one or more important roles of fire in pine rockland communities, and most have advanced our understanding of fire frequency effects. Regarding the effects monitoring component of our fire program in the past, we acknowledge a general lack of consistency. However, monitoring to facilitate adaptive management is a high priority and prominent objective of the current and future fire program, as indicated in the CCP.

Comment: Hammocks occur on elevations of 2.2 feet to 8 feet above mean sea level. Fire rarely if ever enters hammocks without the action of man. Management has fragmented and burned into hammocks to their detriment. Many areas that were pinelands should be allowed to naturally become low hammock. The hammocks of No Name Key are the best (largest) hammocks at present. Most of Watson Hammock has entered a sub-climax state.

Response: Watson Hammock has changed dramatically over the past two decades; however, this is primarily due to wind and storm surges from several hurricanes. Large trees died, most notably by the flooding. The fringes of hardwood hammocks are a natural firebreak, and there is no evidence that prescribed fires have been directed at hammocks.

Comment: Fires have destroyed *Liguus* snails especially on No Name Key.

Response: While fire kills *Liguus* snails, it is essential for maintaining pine rockland habitat. *Liguus* snails feed on confervoid algae, fungi, sooty molds and lichens that grow on tropical hardwood species such as Jamaica dogwood, and thus are more abundant in tropical hardwood hammocks than pine rocklands.

Comment: Under Plan Implementation, "The role and application of fire in maintaining hardwood hammocks, freshwater marshes, and salt marshes in the Lower Keys are not as well understood, but are considered to be important components of the disturbance regime." Considered by whom? These ecosystems are not fire adapted or fire tolerant. Fire can kill hammock trees, and there is no evidence that fire is "an important component" in any of these habitats. This statement admits this issue is not well understood, but proceeds anyway to make a statement that without support should be deleted.

Response: The Service acknowledges its inadvertent error in including hardwood hammocks in the discussion of fire management in the Draft CCP. The Final CCE/EA has been revised accordingly.

Comment: The Service should allow pine rockland in the urban interface to succeed naturally into hardwood hammock.

Response: In the Lower Keys Community Wildfire Protection Plan (dated July 10, 2007), participants including the Service agreed to prohibit the use of prescribed fire within a designated High Risk Urban Interface Zone, which encompasses much of the densely developed residential subdivisions and commercial corridors on Big Pine, No Name, and Cudjoe Keys. Within this zone, there are small, (less than half-acre) scattered parcels that include remnant pine rockland habitat, which would be allowed to transition into hardwood hammock to mitigate the potential for catastrophic wildfire in the urban interface. Hazardous fuel loads would be managed in this zone using mechanical or manual methods, with an emphasis on removing flammable materials, such as dead vegetation and exotic species, while promoting the growth of native hardwood species.

Comment: Excluding fire in pine rocklands results both in the release of broadleaved species and the development of an organic soil horizon. The broadleaved canopy produces less-flammable litter and a moister under-canopy microclimate, both of which inhibit ignition and fire spread. Mechanical treatments would be effective for removing excess stems, but would do nothing for the accumulated duff. Furthermore, opening up the understory could exacerbate the fire risk by drying the accumulating organic soil horizons making their ignition more likely. Smoldering duff fires are a great hazard, because of their long duration, smoke production, high post fire tree mortality and the threat of other fuels reigniting. It is rare that fire cannot be safely employed even in the WUI. If fires are impossible, then allowing succession to broadleaved hammocks could be carefully considered as another option. Mechanical treatments are best employed as an intermediate step in the reintroduction of fire, not as a substitute for fire.

Response: The Service will more fully address the various options of prescribed fire, mechanical treatment, and manual removal in the step-down Fire Management Plan.

Comment: In light of climate change effects, it is hoped that the Service will take elevational differences into account when setting priorities on which habitat areas to burn. Highest ground will last the longest.

Response: The Service concurs, and has consequently been collaborating with various partners to obtain state-of-the-art digital elevation maps to accurately determine elevation ranges and model future scenarios of sea level rise in order to strategically locate and implement management actions, habitat restoration, and land acquisition.

Comment: The revision or completion date for the Fire Management step-down plan is not until 2013, but the refuge is planning prescription burns in the meantime. Burns should be put on hold to allow habitats to recover from hurricane Wilma and until an appropriate, scientifically supported fire plan is adopted.

Response: The Congressional mandate to develop CCPs recognizes that refuges will continue operations until the plan and step-down plans are developed. Revision of the current step-down Fire Management Plan is a high priority in 2009.

Other Habitat Management Comments

Comment: Because the widespread mortality of slash pine following Hurricane Wilma, collection of seed and establishment of a seed bank is warranted.

Response: The Service proposed two such strategies under the Habitat objectives in the Draft CCP that are carried forward in the Final CCP.

Comment: Reintroducing plants lost to hurricanes is the role of a botanical garden, not a refuge. High deer numbers would negate the value of any plantings.

Response: The Service's role in managing and restoring habitat is clear under our enabling legislation and refuge purposes. The Service collaborates with botanical gardens to propagate species of interest so that local native seeds and/or seedlings would be available for plantings as necessary. Any such plantings would be on a very small scale, with more rare and palatable plants protected from deer herbivory by a small exclosure until they mature above browse height.

Comment: Hardwood hammock should be managed for the whole ecosystem, not just for individual species. As noted in this CCP, hardwood hammocks require little management except for removal of exotic plants and animals.

Response: There are some instances where direct intervention may be warranted in addition to removal of exotic plants and animals; for example, the reintroduction of native inkwood to Watson's Hammock.

Comment: The heavily-used channel on the north and east side of Boca Grande should be a no-motor zone as wake action is creating a lip on the beach, which has to be affecting turtle nest success. Many large boats make the lakes passage [local placename for protected area between islands] and enter Boca Grande Channel here and their wakes are enormous.

Response: The Service is closely monitoring the beach erosion on Boca Grande due to wave fetch caused by both vessel traffic and storms, as well as considering the foreseeable impacts from climate change on beach and dune habitats. The potential need for a no-motor or no-wake zone will be considered when the Backcountry Management Plan is updated.

FISH AND WILDLIFE POPULATION MANAGEMENT

Single-species versus Ecosystem Management

Comment: Several commentors expressed concern for focus on individual species rather than the ecosystems in which they occur. Further, "In what manner will 'indicator species representative of all habitat types' be chosen for future monitoring? This leaves management possibilities wide open for interpretation and allows great flexibility, but may result in many important species being neglected."

Response: The Service does not have the capability to monitor all species that occur on the Lower Florida Keys Refuges, and specific information on some species may remain lacking as a result. High priority needs and limited resources actually place substantial restraints on how many, and which, species and assemblages are monitored. Species that are currently monitored are chosen for one or

more of the following reasons: the species' role in the ecosystem (e.g. the great white heron is an apex predator); the ability to correlate their relative abundances with ecosystem management targets; the ability to correlate their status with the health of ecosystem components, including factors that threaten the viability of their habitat, demographics, and/or genetic health; and regulatory and or recovery considerations (e.g., ESA Section 4 [Listing], Section 7 [Consultation], Section 10 [HCP], and recovery plans [SFMSRP]). In some cases, availability of effective monitoring techniques also influences whether a given species is monitored. However, while some species will not be specifically monitored, they are not neglected because the overall intent is focused on understanding ecosystem structures, processes, and functions that support all species. The Final CCP was revised to clarify the selection of indicator species and how this provides for ecosystem-oriented management.

Comment: We acknowledge and appreciate the USFWS in recognizing that the refuges must balance the need for single species management to enhance recovery of imperiled species with an overall landscape approach. Although in such a small, isolated and complex ecosystem as the Florida Keys, even the smallest biological alteration can have cascading effects. We hope that the Service will consider such factors when implementing wildlife management agendas.

Response: Comment noted.

Comment: The new emphasis on inventory and monitoring is wonderful. You should make new data or analyses available to the public once it is appropriate for distribution.

Response: Comment noted.

Comment: The USFWS should promote responsible ecological stewardship, employ humane wildlife management agendas, and base decisions on sound scientific evidence rather than mere speculation. We remain hopeful that the Lower Florida Keys Refuge Complex can act as a model for sound management within the refuge system, but fear that outdated paradigms witnessed throughout historical times will continue to drive management decisions. The USFWS has an opportunity to replace archaic decision-making processes with innovative and forward thinking initiatives, which would greatly benefit both specific wildlife and the ecosystems of the Lower Florida Keys, as well as refuge users and people living in the Lower Florida Keys region.

Response: Comment noted.

Lower Keys Marsh Rabbit (LKMR)

Comment: The Service should rely on more current [LKMR] population data in making its management decisions. If such data is unavailable, the Service needs to ascertain the current population before trying to determine best management actions.

Response: The Service conducts annual presence-absence rabbit surveys in patches throughout the range. The Service has carefully assessed LKMR status and threats, and identified important management actions in species recovery documents and the CCP. The Draft CCP cited earlier estimates of LKMR derived from a period in which the whole population was not yet delineated or assessed. The Final CCP has been revised to better reflect the extent of more recent data.

Comment: The USFWS should conduct more extensive studies of the LKMR. Research is needed to determine the current status of the LKMR, their specific habitat needs, what they eat, etc.

Response: The Service has accelerated LKMR population and habitat research and monitoring in recent years, engaged multiple collaborators, and added population genetics and food habits research programs.

Comment: As of late, all of the annual surveys conducted throughout [NKDR] have been patch occupancy studies. Future efforts should be focused on obtaining population abundance and density estimates.

Response: The Service finds that occupancy-based surveys, as opposed to population abundance and density surveys, provide the most efficient means to model and manage rabbit populations and the environmental factors that effect them. LKMR exist in metapopulations comprised of habitat patches, some of which will not be occupied at all times due to variable circumstances. For that reason, the Service and collaborators have focused on patch occupancy as opposed to absolute numbers to determine population trends, consistent with current scientific theories of metapopulations and advances in statistical methods. Occupancy-based modeling of populations will be used to estimate extinction and colonization probabilities among patches, relative to environmental variables. Alternatively, absolute abundance of marsh rabbits can be exceedingly difficult to measure, and often reveals little about the underlying influences on population dynamics. Further, using conventional methods to estimate population density require extensive use of mark-recapture methods that are unsuitable for a number of reasons, including limited sample sizes and excessive effort relative to benefits. In the context of adaptive management, the Service will continue to actively investigate the most efficient and viable methods for monitoring rabbit populations in order to achieve recovery goals for the LKMR.

Comment: There is a lack of scientific evidence that selectively removing buttonwoods is necessary to create and maintain optimal habitat conditions for Lower Keys marsh rabbit.

Response: The Service relies on the best available information in assessing habitat conditions, developing conservation strategies, and identifying specific management actions for trust species and the ecosystems on which they depend. The SFMSRP's recovery strategy to enhance Lower Keys marsh rabbit habitat by the removal of "overstory vegetation in transitional areas in order to promote understory" was based on previous studies that identified vegetation type and height as important indicators as to whether LKMR will occupy a site. Subsequent studies affirmed that LKMR select areas with relatively high visual obstruction, less canopy coverage, and more bunchgrasses, and they avoid areas with mature buttonwoods and high canopy cover, consistent with similar studies on other lagomorphs. Historical records and personal accounts indicate that some areas of the higher saltmarsh transition zone on Big Pine Key have become increasingly dominated by a denser buttonwood overstory, with a concurrent reduction in herbaceous cover and continuity, as a result of fire exclusion and other perturbations. *Sporobouls*, the primary plant species used for forage, nesting, and hiding by LKMR, is intolerant to shade. Consequently, the Service concluded that selectively cutting buttonwoods to open the canopy and/or prescribed burning to promote the vigorous growth of herbaceous ground cover vegetation and improve forage quality, could have potential as a habitat enhancement tool. The proposed adaptive management approach--with integrated monitoring and evaluation--will provide valuable information on the effectiveness of management treatments in areas occupied by LKMR. It will complement the Service's comprehensive efforts to recover the species. If management objectives are not achieved as determined through monitoring and evaluation, then strategies will be modified to ensure recovery of LKMR in concert with conserving habitat diversity.

Comment: We object to the removal of buttonwoods on north Big Pine Key because the marsh rabbits' darker coloring adapts them to the shadier buttonwood habitats. Rabbits on Big Pine Key currently use buttonwood habitats and have evolved to depend on buttonwood trees for protection from predators.

Response: While there is evidence of genetic and possibly morphological differences between LKMR in different parts of the range (e.g., Boca Chica and Big Pine Key metapopulations), there is no evidence in the scientific literature that these differences translate into different behavior, habitat preference, or distinct fitness capacities which infer an evolutionary connection with buttonwoods. Available evidence indicates that: 1) LKMR share most of the same predators in different parts of the range; 2) LKMR require dense ground cover for persistence; and 3) dense ground cover in open canopy environments provides the same functions for LKMR on BPK as it does elsewhere. The discussion on LKMR in this regard has been expanded with relevant references in the Final CCP.

Comment: Just because there are a number of rabbits on Boca Chica, the Service should not try to make Big Pine Key resemble the openness of a military installation.

Response: There is no intention to duplicate on Big Pine Key the open fields of Boca Chica Naval Air Station. The open fields are maintained for military aircraft operations. The Service will manage LKMR habitat to enhance desired features in a manner that is effective and appropriate within the natural matrix of habitat types found on Big Pine Key in NKDR. The Service's strategy is to maintain a mosaic of open canopy and grassy habitat. Research indicates these communties along with buttonwood, are more suitable for self-sustaining persistent LKMR populations. LKMR recovery currently requires that stable populations are distributed on at least five islands connected to U.S. Highway 1 and three outer islands. Big Pine Key represents a major portion of the current range and is among the most important of these keys for LKMR.

Comment: The cut trees left on the ground appear to be killing the desirable grasses that the rabbits eat. They make perfect, artificial habitats for rattlesnakes known to prey on rabbits. The Service needs to study and address such unintended consequences before doing more habitat alteration. Human alteration of habitat is known to be one of the leading causes of extinction.

Response: On north Big Pine Key, two small clearings were created in one area several years ago. Thinning of buttonwood was conducted in another area in 2007. The Service intended to follow with prescribed fire, which would have consumed the cuttings and facilitated opening of the canopy to enhance herbaceous understory. The Service subsequently postponed the fire, however to allow for further public input.

Comment: It is not clear how prescribed burning will directly benefit the LKMR. Granted the food source will regenerate and thus the habitat will provide greater resources for the LKMR post-burning, but how long does this type of succession take? Since no post-burning monitoring has been conducted to date, we suspect that the Service does not have data to allow for such an interpretation. Direct and ill effects of fire, along with temporary loss of habitat, could prove to be detrimental. The Service should expand upon the discussion of the relationship between fire management and the LKMR.

Response: Mitigation measures to reduce the risk of unintended, adverse effects to LKMR and other imperiled species are developed under ESA Section 7 consultation procedures and reflected in the integration of monitoring information into management actions. The discussion on the relationship between fire management and the LKMR has been expanded with relevant references in the Final CCP.

Comment: The use of the phrase 'all appropriate means' is too much of a blanket statement. It should instead be recognized that protection measures will be used as long as other species and habitats are not compromised.

Response: The word "appropriate" references a commitment to recover species within an ecosystem management context using a comprehensive suite of methods. Methods would be selected based on the best available information and implemented with the least adverse consequences to both target species and/or habitat and all non-target species.

Comment: Research is needed to determine the potential effects of removing rabbits from their natural habitat. Any establishment of mainland populations or captive breeding should be done on a small trial basis (maybe 3 pairs of rabbits) and taking into account the sizeable genetic differences between populations.

Response: The Service and collaborators have initiated a LKMR genetics research program to inform translocation actions and any captive breeding needs that may be realized in the future. This program was initiated in recognition of the increasingly reduced numbers and insular nature of LKMR subpopulations as well as differences between metapopulation members. LKMR would only be translocated to suitable habitats within their range in the Lower Florida Keys. The only mainland populations of LKMR would be in captivity. The Service would consider captive propagation only as a last resort to prevent extinction of the subspecies. The Service is pursuing a variety of actions to preclude the need for relying on captive propagation, including habitat restoration, exotic predator control, and land acquisition strategies. If the establishment of a captive population on the mainland should be deemed necessary, substantially more than three pairs of rabbits would be required for genetic viability purposes alone. The Service will continue to assess any proposals that could potentially offer further security for the subspecies.

Comment: Using only the rated category of a hurricane as a trigger for response is unwise, but instead should be based on the severity of the hurricane and its actual impacts. A Category 1 hurricane could be significant if accompanied by a significant surge.

Response: The Final CCP was revised to incorporate this suggestion.

Comment: Prior predator trapping campaigns in the name of LKMR protection resulted in the unnecessary and senseless killing of a great number of raccoons and the trapping of hundreds of native raccoons has resulted in the rapid spread of non-native Virginia opossums and reduced seed dispersal of native plants. Such activity will surely be felt on the Lower Keys for years to come given the ecological importance of raccoons as seed dispersers and rodent control.

Response: The Service initiated a pilot study in 2007 in coordination with USDA Wildlife Services to research effects of the removal of raccoons and cats on LKMR compared to areas without removal. A total of 81 raccoons were captured, 28 of which were euthanized and 53 were released alive; not "hundreds" as noted by commenters. The removal of 28 raccoons over one period is not likely to reduce the raccoon's ecological role in seed dispersal over any measurable spatial or temporal scale. On the contrary, surviving raccoons alone would be expected to fill the role without interruption. Additionally, raccoons are only one of the many important seed dispersers in the Keys. The Service acknowledges that there needs to be more research on the ecological role of the raccoon in the Lower Keys before any raccoons are removed for predator management purposes. Such a strategy is included in the Final CCP and will be further developed under the forthcoming step-down Integrated Predator Management Plan.

Comment: Several raccoon sub-species were formally listed as candidate species under the ESA and it is vital to determine their current status.

Response: There are currently no listed or candidate raccoon sub-species in the Florida Keys. The Key Vaca raccoon (*Procyon lotor auspicatus*) and Key West raccoon (*Procyon lotor incautus*) were category 2 candidate species in 1994, but the designation was removed in 1996 due to the lack of persuasive data on biological vulnerability and threats to support listing. Given that raccoons are considered relatively numerous, status assessments have not previously been warranted. Genetic assessments among different raccoon populations are also desirable, particularly because indiscriminant movement of raccoons among islands by humans potentially has disrupted the distinctiveness of any geographic races.

Key Deer

Comment: If carrying capacity is known for large carnivores which occupy thousands of acres, why not for the Key deer, which are distributed over a small area? Carrying capacity should have been determined long ago, and deer managed accordingly, which is critical for the health of the herd as well as the plant communities in which it resides.

Response: Key deer carrying capacity varies greatly among areas because of differences in the distribution and availability of fresh water (particularly during prolonged droughts). Additionally, the presence of palatable, ornamental plants in residential and commercial areas, and the illegal feeding of deer, may raise carrying capacity in some areas compared to a hypothetical case in which only natural forage existed across a landscape. For most of the refuge's history, Key deer were at such low numbers that bolstering their numbers and reducing roadkills to prevent possible extinction were the primary goals; carrying capacity remained a secondary concern. Recently, the focus has shifted to include concerns about overabundance on Big Pine, No Name, and Big Munson as compared to too few deer elsewhere, and the foreseeable effects of sea level rise on deer habitat. Because carrying capacity is not a static or definitive number of deer that the landscape can support, it is assessed indirectly using indices. These include: 1) monitoring plant communities for evidence of excessive deer browse (browse line); 2) checking herd health to examine for density dependent diseases; and 3) performing necropsies to evaluate fat indices (e.g., kidney, heart, and pericardium). The Key deer's endangered status puts constraints on implementing typical measures used to curb high deer densities in other parts of the country, such as hunting.

Comment: There were opposing comments on the use of immuno-contraception to manage Key deer numbers. Immuno-contraception should not be implemented because herd size is dropping and negative effects of sea level [rise] compound this problem. This statement is contrasted with another: We applaud the use of immuno-contraception as a means of reducing key deer populations and fully support the ban on hunting key deer throughout their range.

Response: Road count and mortality indices suggest that deer density within the population core (Big Pine and No Name Keys) is not dropping, but is fluctuating around a plateau-like level, which may represent a peak capacity for the environment as it currently exists. Browsing impacts within the core (high deer density) relative to other (lower density) areas have been documented, and disease frequency appears to be higher in the last ten years compared to previous decades. The negative effects of sea level rise and future storm surges could compound these problems by further reducing the habitat's carrying capacity such that density-dependent disease and poor health further threaten population viability. Hunting is routinely used by deer managers nationwide to reduce herd size and manage deer at carrying capacity; however, this is not an option for Key deer. Wildlife contraception administered by

vaccine has been used to manage a wide variety of mammals, including white-tailed deer, and may warrant evaluation as a population control method for Key deer in high deer density settings.

Comment: The Key deer have exceeded carrying capacity. The capture of 100 Key deer and their relocation to zoos is warranted. This would solve two problems: reducing herd size and providing a source for restocking deer in the event of a catastrophic hurricane.

Response: The CCP includes strategies to continue sending Key deer too injured for release to approved captive facilities in mainland Florida, as provided for in the species recovery plan. Further assessment is warranted to evaluate the feasibility and suitability of establishing a captive breeding group for replenishing the wild population in the event of a catastrophic hurricane or disease outbreak.

Comment: The Key deer are well above their carrying capacity and are impacting native plant communities, including the widespread loss of many plant species. Key deer herbivory is preventing reproduction of certain plant species.

Response: The CCP includes strategies for reducing the negative effects of high deer densities on plant communities, including restoration of native plants, translocating deer from the core areas (Big Pine and No Name Keys) to lower density areas, and evaluating the feasibility of using immuno-contraception in high density deer settings.

Silver Rice Rat

Comment: The Service should actively acquire known silver rice rat habitat.

Response: The silver rice rat's habitat includes mangrove forest, scrub mangrove, and components of saltmarsh transition zones. Extensive areas of silver rice rat habitat are now precluded from development by wetland protection laws, and much of these habitats are currently owned by public agencies for conservation purposes. Strategic acquisitions by the Service generally prioritize upland parcels that include intact habitat for endangered species, including saltmarsh transition zones that benefit Lower Keys marsh rabbit and silver rice rat. The silver rice rat has been more stable than that of most other listed species.

Comment: The Service should control feral cats and black rats to protect the silver rice rat.

Response: The Service is embarking on a comprehensive effort to remove feral and free-roaming cats from refuge lands to reduce predation on native species. Black rats may also pose threats to silver rice rats, Stock Island tree snails, and other native fauna, particularly in the wildland-urban interface where black rats are more common around artificial structures. Although control of black rats is desirable, it is problematic since the only available control measures involve trapping or poisoning, both of which could impact the silver rice rat. A further problem is the black rat's high fecundity and ability to thrive in both wild and urban settings. This will be evaluated in more depth in the forthcoming step-down Integrated Predator Management Plan.

Birds

Comment: Managing incompatible recreation activities in the feeding habitat of the great white heron is warranted as a measure to increase its fecundity. Prey is scared by the boat traffic and boat wakes.

Response: Most of the areas used for foraging by great white herons are in waters too shallow for use by all but very-shallow-draft boats. This, and the refuge-wide ban on personal watercraft since 1992, suggest that direct disturbance to foraging herons by boaters is not a primary factor in their decline. Continued monitoring and studies of their population trends and foraging habits is warranted.

Comment: A plan of action should be in place for any sand islands created by a hurricane, with automatic closure of any new sand islands created by storm activity to protect shorebirds.

Response: All refuge lands, including newly created islands, are closed unless specifically opened to the public. Wilma Key in KWNWR presents an example of an island that was created by storm activity. It warrants closure because public access was incompatible with the refuge's purpose for wildlife conservation. It is exposed even at the highest tides affording sanctuary to a large number of shorebirds, including piping plovers and nesting roseate terns.

Comment: The Service, FKNMS and other regulatory agencies, as relevant, should adapt vessel exclusions to the changing resource conditions. If a bird rookery moves from an island in a Wildlife Management Area to an unprotected island, the Wildlife Management designation should move as well.

Response: The Service concurs with this concept. We are presently collaborating with the FKNMS to evaluate the effectiveness and relevance of vessel restrictions around bird nesting islands that were originally designated for protection in 1991 under the Backcountry Management Plan. We will identify locations that no longer need protection. An example is Little Crane Key in GWHNWR, which was destroyed during the 2005 hurricane season. Likewise, we will evaluate new locations to determine if they require protection. The islands in KWNWR now used for nesting by brown pelicans are one example. The Service, FKNMS and State of Florida will continue to expedite the permitting process to install buoys in State-owned waters around new or shifting islands in a timely fashion to protect migratory birds.

Invertebrates

Comment: The statement that fire suppression and inconsistent use of prescribed fire may have reduced the abundance of pine rockland butterfly species is unsupported by data. There have been few natural fires to suppress…mosquito spraying is a more significant cause of population declines.

Response: The Draft CCP states that "fire suppression and inconsistent use of prescribed burning may have reduced the abundance of pine rockland butterfly larval-host species, such as pine croton." (p. 56, Objective 11). It does not state that these practices have reduced the abundance of pine rockland butterfly species. The CCP includes a variety of strategies to conserve butterfly species, including continued restrictions on the application of pesticides to control mosquitoes. None of the strategies specifically focus on fire, though prescribed fire is one tool available for achieving the habitat restoration strategy since pine croton is a fire-dependent pine rockland species.

Comment: There were a few comments that expressed support for the refuge's prohibition or partial prohibition of broad-spectrum adulticides on refuge lands and efforts to modify the current mosquito control operations to minimize impacts of insecticides on wildlife while still providing control for human health reasons. Some stated that, due to the risk to sensitive species, spraying should not be allowed on refuge lands.

Response: Due to the extensive intermix of public and private lands in NKDR, the Service faces a complex challenge of balancing wildlife conservation with needs of the human population, especially regarding mosquito control operations. The application of adulticides in limited areas of the refuge is

restricted to levels that minimize exposure to non-target species, based on an ecological risk assessment for threatened and endangered species. The Service is currently funding field and laboratory research to document exposure and risk of butterflies to mosquito spraying in order to refine the mosquito management strategies and further minimize environmental effects.

Comment: There are a variety of critically endangered *Liguus* tree snails that merit attention and conservation.

Response: The Service's attention is focused on the Stock Island tree snail because of its listed status as threatened under the ESA. The Service concurs that there is little substantively known about *Liguus* snail numbers on Big Pine Key, but these species would presumably benefit from conservation actions taken on behalf of the Stock Island tree snail as they inhabit similar habitats. The Service recently funded a project to determine the geographic distribution of Stock Island tree snail and other snail species in the Florida Keys by Florida Agricultural and Mechanical University. A strategy to specifically determine *Liguus* phenotypes, distribution and numbers was added to the Final CCP.

Fish

Comment: Inadequate attention was given to the topic of fresh, brackish and salt water fish species.

Response: Additional information has been provided on freshwater fish species in the Final CCP. Saltwater fish will not be addressed in the CCP since they occur within state sovereign waters, and they are beyond the scope of Lower Florida Keys Refuges' limited authorities and fiscal resources.

Comment: Although it is stated that marine waters around the refuges are under State jurisdiction, the USFWS has a responsibility to contribute to the protection and preservation of all native fish. The Service should seriously consider taking more of a hands-on approach to saltwater fish management in waters of the Florida Keys given the enormous pressure applied by local and seasonal fishing interests.

Response: As noted above, saltwater fish will not be addressed in the CCP since they occur within state sovereign waters and they are beyond the scope of Lower Florida Keys Refuges' limited authorities and fiscal resources. Other Service divisions, including Ecological Services and Office of Law Enforcement, are actively engaged in cooperatively managing marine fisheries resources. Fish species that are listed as threatened or endangered under the ESA, such as the small tooth sawfish, are managed by NOAA Fisheries Service as the lead agency for recovery efforts.

Key Tree Cactus

Comment: To prevent trampling by members of the general public or refuge staff, the Service should consider posting areas where cacti are present as a means of increasing their visibility.

Response: The Cactus Hammock on Big Pine Key has been closed to public entry for more than a decade to prevent illicit collection and prevent trampling of this critically imperiled species. In the one other Big Pine area where the cactus is found, the plants are scattered amidst a densely vegetated setting, and they are very difficult to find and access. Protection is better afforded when locations of highly sensitive resources (for example, individual rare plants, eagle nests, or archeological sites) are not specifically posted to attract public attention.

Comment: Damage to Key tree cactus by rutting and foraging Key deer has been observed and may be impacting the plant's population and recovery.

Response: The effect of storm damage and sea level on the demise of the Key tree cactus appears more dominant and direct than limited incidental damage by Key deer. The Service is currently funding research and working with partners to propagate and plant cactus in other suitable areas in order to offset these impacts.

Invasive and exotic animal management

Comment: The report states that the Service will develop and implement an animal control plan to control non-native and predator species. More details should be provided. Is the Integrated Predator Management Plan (IPMP) for this purpose? Will there be an opportunity for public involvement?

Response: The Service will develop an IPMP for the purpose of reducing predation on critically endangered species, such as the LKMR, through the management of predator populations. Management strategies will range from direct removal of predators (e.g. feral and free-roaming cats) to indirectly controlling predator numbers by reducing artificial food sources (e.g. raccoons). Extensive collaboration and public input was gathered in 2007-2008 on this subject, and additional public review and comment will be provided for the IPMP itself.

Comment: The Service is lumping together a native species [raccoons] that evolved in this habitat and a dangerous, introduced, exotic species- cats. Raccoons are not predators of the LKMR.

Response: Ample **s**cientific literature documents that raccoons prey on other mammals, including rabbits. In the Keys, raccoons have been known to kill adult LKMR when their movement is restricted, and raccoons have the potential to prey upon LKMR kits (young) that are restricted to ground nests. The Service acknowledges that the significance of raccoon predation on LKMR remains uncertain; consequently, further field studies will be conducted. If further investigations show evidence of significant predation by raccoons on LKMR, then limited removal of raccoons might merit consideration if LKMR numbers remain very low. In the short-term, artificially inflated raccoon numbers will be indirectly controlled in a community-wide strategy to reduce artificial food sources, such as household garbage. Management of raccoons will be further detailed in the forthcoming step-down Integrated Predator Management Plan.

Comment: One commenter states that the green iguana is not an invasive species and may instead be the product of a remnant native population that is undergoing range expansion.

Response: There is no substantive evidence that green iguanas are native to Florida. Iguanas noted in the historical record likely invaded the Florida Keys from their known range within the Caribbean through transport on ships and/or floating debris during major tropical storms. However, the recent population explosion of iguanas and increased numbers of other exotic reptiles, such as the monitor lizard and Burmese python, are widely believed to have occurred primarily because of accidentally escaped pets or intentional releases of unwanted pets into natural areas.

Comment: In reference to exotic animal management, one commenter stated that “Keeping iguanas absent from the Blue Hole experience would be a great step towards passive education.”

Response: Due to the intermix of public and private lands on the mainline islands where green iguanas are most abundant and concentrated in residential areas, a comprehensive interagency approach towards population management of iguanas is first needed before direct management actions on refuge lands alone will be effective. The Final CCP includes a strategy to develop and promote public outreach and education about invasive species, which could include interpretive signage at visitor facilities, such as the Blue Hole.

Comment: The Service should consider and implement non-lethal control options when dealing with exotic animal issues. Such strategies are by far the most effective, responsible, humane and publicly acceptable methods in wildlife control.

Response: The Integrated Predator Management Plan will consider the use of all viable control options. Lethal control may be implemented when non-lethal options are exhausted or not effective, as allowed by Service policy.

VISITOR SERVICES

Comment: Several persons expressed support for the National Wildlife Refuge System's mission of "wildlife first," noting that there are many federal, state, county and city parks for people to use for recreational purposes and activities.

Response: Comment noted.

Comment: Most opposition comes from a vocal minority who are able to convince other residents of their position because the refuge is not able to pro-actively engage and educate the populace. Educated and involved ambassadors for the refuge can only build upon itself and help counteract the detractors.

Response: Comments noted.

Trails

Comment: There were multiple comments expressing concern for new trails. "The Service should only direct visitors to the Blue Hole and Watson-Mannillo Nature Trails. New trails should be eliminated; refuges are not national parks or entertainment venues requiring maximum visitation. It's Wildlife First." "While roads, residential development, ditches, and canals have all contributed to habitat fragmentation, increased recreational opportunities, such as trails, may further contribute to habitat fragmentation."

Response: The Refuge Improvement Act of 1997 does provide a singular wildlife conservation mission for the National Wildlife Refuge System, but also recognized that wildlife-dependent recreational uses, such as wildlife observation, photography, environmental education and interpretation are legitimate, appropriate, and priority general public uses when compatible with the purposes of the refuge(s). The Service currently promotes public uses at two formally maintained and signed nature trails (Blue Hole and Watson-Mannillo sites), but also allows public access along unnamed trails and firebreaks to provide for passive wildlife-dependent recreational activities. The Service's intent is not to maximize visitation nor undermine the primary purpose of conserving wildlife and their habitats.

Comment: Opposition was expressed to the "newly opened" trail at the north end of Big Pine Key and it was requested that this trail be closed due to potential human interference with the Lower Keys marsh rabbit.

Response: The trail on the north end of Big Pine Key has always been open to the public and was designated as a nature trail in the first plan written for the Lower Florida Keys Refuges in 1968. It is currently marked on the general refuge brochure as a hiking trail in a similar manner as other selected firebreaks. Figure 7 of the Draft CCP depicted this trail as a "designated trail" in addition to the Blue Hole and Watson-Mannillo Interpretive Trails. The Service has deleted this trail on the subject figure in the Final CCP in response to public comments, and will continue to handle it as an

undesignated passive use trail similar to other existing footpaths and firebreaks. The Service had also proposed in the Draft CCP to install an interpretive kiosk at this trailhead to educate visitors about the wildlife and habitats along the trail, but this strategy has been deleted in response to public comments to minimize attracting increased numbers of trail users. The Service presently does not consider the level of public use on the subject trail to be excessive enough to warrant closure at this time, but retains the discretion to close it in the future if deemed necessary.

Comment: Opposition was expressed to designating a "new" trail on Cudjoe Key and it was requested that this trail be closed due to potential human interference with the recently translocated Key deer, as well as creating conflicts for residents in the neighboring subdivision.

Response: The trail on Cudjoe Key has been open to the public for many years, and it is currently marked on a visitor handout as a hiking trail in a similar manner as other firebreaks and abandoned roads on Cudjoe and Sugarloaf Keys. Figure 8 of the Draft CCP depicted the Cudjoe trail as a "designated trail" in addition to a portion of Crane Boulevard on Upper Sugarloaf. The Service has deleted Figure 8 in the Final CCP in response to public comments, and will continue to handle these locations as undesignated passive use trails similar to other existing footpaths and firebreaks. The Service presently does not consider the level of public use in this area to negatively affect Key deer enough to warrant closure at this time, but retains the discretion to close in the future if deemed necessary.

Comment: There were opposing views regarding the Service's proposed strategy to construct a hiking trail to link the Blue Hole and Watson-Mannillo Nature Trails, with one stating that "Linking trails is long overdue--not only Blue Hole trails, but others as well," versus others stating that "Creating additional trails will decrease and fragment habitat and we oppose construction of a new trail linking the Blue Hole to the Mannillo and Watson trails".

Response: Based on an analysis of public comments, strategic priorities, and potential impacts, the Service has determined that there are adequate links between existing trails, firebreaks, and bicycle paths along roadways to provide the public with multiple routes of travel; consequently, the new trail proposed in the Draft CCP has been dropped from consideration.

Comment: There are so many old, scarified roads that are "access prohibited"; these could be put into use and linked up to trails providing hours of walking enjoyment.

Response: Most of the old, scarified roads and firebreaks are open to public access. The Service's standard white refuge boundary sign is misleading in that it only states "Unauthorized Access Prohibited." Newer brown signs have been added to most road entry points to inform the public about what activities are authorized (such as walking) or prohibited. There are a few trails and areas that are closed to the public to protect sensitive natural resources, and these are clearly marked with "Area Closed" signs.

Comment: Very few of us ever get to see Watson Hammock or Cactus Hammock.

Response: The Watson and Cactus Hammocks were closed to protect sensitive natural resources. Limited access is given at the Refuge Manager's discretion on a case-by-case basis under a Special Use Permit for environmental education and scientific research purposes.

Comment: While environmental education efforts are an important component of the National Wildlife Refuge System, increased visitation may negatively impact several sensitive endangered species and other wildlife in the NKDR if it results in the introduction of visitors into undisturbed areas. The extension of such visitor services as kiosks, ecotourism maps, and new recreational trails into

previously untrammeled areas is incompatible with the purposes of the NKDR because they will materially impair the recovery efforts underway for a number of listed species. These areas may not be able to support a substantial increase in the number of visitors and could be degraded by the increased waste, foot traffic, and noise that would result from increased use.

Response: There are no proposals to introduce visitors into undisturbed or previously untrammeled areas of the refuge. The Service has dropped the new trail to link the Blue Hole and Watson-Mannillo Trails and two new kiosks at the end of Key Deer Boulevard in response to public comments on the Draft CCP, and no other new trails are proposed. New kiosks at existing sites, as well as brochures and maps, will emphasize the sensitivity of wildlife to human disturbance, encourage proper wildlife viewing etiquette, and increase public awareness about prohibited activities.

Visitor Center

Comment: There were multiple views on the proposed strategy to construct a new refuge visitor center on U.S. Highway 1 on Big Pine Key. Some favored the proposal as long as it was based on careful siting and conservative size with facilities for environmental education and information "to assist understanding of refuge species and why public use restrictions are critical to preservation of the biodiversity…while also helping to reduce the 'aimless wanderers' frivolously driving around Big Pine and No Name Keys." Some suggested that a new center should be constructed on scarified land already owned by the federal government to avoid destroying native habitat.

Response: Since the release of the Draft CCP in June 2008, the Service has acquired a one-acre scarified commercial property on the north side of U.S. Highway 1 east of the traffic light on Big Pine Key from a willing seller, formerly a commercial plant nursery and animal feed store. The Service proposes to replace the existing structure with a same-sized building that will accommodate a visitor and environmental education center operated by the Service, FAVOR and other potential partners. The site is adjacent to Service-owned property with intact pine rockland habitat, which provides a suitable setting for outdoor interpretive signage and viewing of natural habitat. The Service will consult with Monroe County, Florida Department of Transportation, local organizations, and the public in designing a facility that complies with the development restrictions under the Big Pine and No Name Keys Habitat Conservation Plan, as well as reflects the local community character envisioned in the Big Pine Key and No Name Key Livable Communikeys Master Plan and the Big Pine Key/ U.S. Highway 1 Corridor Area Enhancement Plan. A new visitor center will consider building size and orientation, parking, traffic flow, staffing, low cost maintenance, and energy efficiency. The Final CCP has been revised accordingly.

Comment: Concern was raised about the location of a new building relative to highway traffic flow and Key deer road crossings. Traffic issues included parking, ingress and egress, left turns during the main tourist season in winter, increased deer-vehicle collisions from more traffic on U.S. Highway 1 and Key Deer Boulevard, and increased damage to habitat.

Response: The Service will consult with traffic engineers on completing a traffic study to determine the level of traffic impacts resulting from a new visitor center at the recently acquired site on U.S. Highway 1, and to incorporate design features that minimize negative impacts to Key deer and public safety. For example, one design feature would be to prohibit lefthand turns across highway traffic, such that visitors enter the site with a righthand turn from westbound traffic only. Visitors would also exit to the right and travel westward on U.S. Highway 1, proceed up Key Deer Boulevard to existing interpretive sites at the Blue Hole or Watson/Mannillo trails, or to visit other commercial businesses. In preliminary discussions with Monroe County and Florida Department of Transportation, planners have also suggested that the center turn lane project on Big Pine Key slated for construction in 2010-2011 will improve the level of

service on U.S. Highway 1 by alleviating traffic congestion. The Service assumes that a new facility on U.S. Highway 1 will capture visitors at a similar level to what is presently visiting the current visitor center located in the Winn Dixie Shopping Plaza (about 10,000 annually) plus incidental drive-by tourists already traveling on the highway that see the new facility. A new visitor center on U.S. Highway 1 is an opportunity to provide a full interpretive and educational experience for most visitors and thus potentially diminish their desire to travel elsewhere on Big Pine and No Name Keys.

Comment: One person suggested locating a new facility at the north end of Key Deer Boulevard on Big Pine Key to reduce the number of tourists wandering without direction through neighborhood subdivisions. An organization suggested that the Service build the visitor center on an island other than Big Pine Key to avoid potential conflict and negative reaction from the community.

Response: The Service has determined that constructing a visitor center outside of the existing commercial center of Big Pine Key, such as at the north end of Key Deer Boulevard as suggested, would have much greater impacts on wildlife and their habitats, as well as local residents. A facility on Key Deer Boulevard would require clearing of native habitat. Also, it would be contrary to the community's vision of consolidating public activities in the commercial center on U.S. Highway 1 near the traffic light and Winn Dixie Shopping Plaza. With regards to building a new visitor center on another island, many visitors expect to view Key deer within pine rockland habitat. These are best represented and most easily viewed on Big Pine Key. The Service already maintains the popular interpretive site at the Blue Hole on Big Pine Key.

Comment: Expansion should be taken slowly and the impacts of vastly increased ecotourism monitored carefully.

Response: The Final CCP covers a time span of 15 years during which proposed projects will be implemented only as feasible and necessary, based on the availability of limited fiscal resources, unforeseen events, and adaptive management principles that include monitoring and evaluation. The Service's strategies do not promote "vastly increased ecotourism." The Service must be prepared to meet current and future demands for wildlife-dependent recreational opportunities that will accompany increases in tourism in the Florida Keys.

Comment: Include a penned area of native vegetation with a few Key deer (rehabilitated from injuries) providing a photo-op for visitors.

Response: The Service does not support the idea of operating its own captive, penned Key deer for public viewing, but rather it will continue to provide compatible and appropriate opportunities to observe and photograph free-ranging Key deer in a natural setting on refuge lands. The public can view unreleasable captive Key deer at three permitted facilities: the Monroe County Sheriff's Animal Farm in Key West, Homosassa Springs State Wildlife Park near Crystal River, and Lowry Park Zoo in Tampa.

Blue Hole Improvements

Comment: Installing a large, wildlife-basking area in the Blue Hole may make alligators, who are already a target of harassment, more vulnerable. Keep it a safe distance from observation deck. We agree small basking areas, to be utilized by turtles would be beneficial, allowing turtles' shells to dry thereby inhibiting parasites. Install a Blue Hole live webcam to be viewed at Visitors Center to enhance visitor education, which would make it a safer place for both the visitors and the wildlife that reside there. We have lost at least 5 alligators (in 13 years), to poaching, illegal feeding or carelessness, not to mention other wildlife.

Response: The proposed wildlife basking area would likely be a floating platform that is not accessible to the public. Live web cameras are a popular and effective tool for providing the public with wildlife viewing opportunities without impacting the wildlife. The Service appreciates this suggestion and will consider it in development of the step-down Visitor Services Management Plan in cooperation with FAVOR.

Comment: The Watson and Mannillo Nature Trails parking lot is underutilized by 50 percent or greater and has been for the past 15 years. Since then there has been no noticeable increase in use. In other words, half the lot is wasted space. Restoring half the lot, though it may be difficult, will at least increase habitat for wildlife by that much more and not take away from visitor services facilities.

Response: The Service concurs, and has already reduced the size of the parking area by half and planted native vegetation.

Kiosks & Observation Platform

Comment: Kiosks seem to be a dismal failure in South Florida environments. Passive, informative kiosks can be fruitful, but staffed (full or part time) kiosks simply do not work. The sitting and waiting for visitors in the heat and bugs, by paid or volunteer staff, has proved futile and would not be cost effective.

Response: Contrary to the commenter's statements, the kiosk and wildlife viewing platform at the Blue Hole is staffed nearly full-time by dozens of dedicated volunteers during the tourist season in winter, becoming a highly effective means of contacting and educating thousands of visitors annually about the unique and fragile ecosystems of the Florida Keys. At present, eight times as many people visit the Blue Hole (80,000) compared to the visitor center (10,000), owing to its popularity for local residents who take their family and guests to see wildlife at the Blue Hole. Upon review of public comments on the Draft CCP, the Service has deleted strategies to add kiosks in new locations at the end of Key Deer Boulevard, and will focus future enhancements at the Blue Hole and Watson-Mannillo interpretive sites. The Service also promotes the construction of a new visitor center on U.S. Highway 1 to provide a full interpretive experience, which may reduce the demand for driving around the island to view wildlife.

Comment: We oppose the current practice by the Service of promoting vehicular trips to the Port Pine Heights subdivision at the far north end of Key Deer Boulevard and to No Name Key, which is about 4.5 miles from U.S. Highway 1.

Response: The Refuge Improvement Act recognizes that wildlife-dependent recreational uses, such wildlife observation, photography, environmental education and interpretation are legitimate, appropriate, and priority general public uses when compatible with the purposes of the refuge(s). Visitors are directed primarily to the Blue Hole and Watson/Mannillo sites to view wildlife and habitat, but they are also informed that they may safely view Key deer along public roads adjacent to refuge lands along Key Deer and Watson Boulevards. Visitors are discouraged from driving off the main roads into the subdivisions in order to provide an appropriate balance between visitor access to view wildlife while minimizing disturbance to local residents.

Comment: Some commenters are opposed to the construction of kiosks and an observation platform in any area that will attract additional visitors into a wild area, including the north end of Key Deer Boulevard on Big Pine Key or the east end of Watson Boulevard on No Name Key. Suggested sites for a wildlife observation platform are at a new visitor center or in the parking area for the Mannillo and Watson trails.

Response: Upon review of public comments on the Draft CCP, the strategies have been revised in the Final CCP to include a proposal to replace the existing ground-level platform on the Watson Nature Trail with an elevated platform that would provide viewing opportunities over the tree canopy to open water. The Service also deleted strategies to add kiosks in new locations at the end of Key Deer Boulevard, and will focus future enhancements at the Blue Hole and Watson-Mannillo interpretive sites in addition to the new visitor center on U.S. Highway 1.

Priority Wildlife-Dependent Recreational Uses

Comment: Visitor services should focus on five of the big six wildlife-dependent public uses before it considers any other permitting any other non-wildlife-dependent uses.

Response: The visitor services goal is designed around those priority public uses. Also, the compatibility determinations assessed and allow for other, non-priority public uses that would not substantively affect resources.

Comment: The appropriate uses and compatibility determinations for fishing and other public uses are correctly and properly made consistent with the 1997 Act and applicable Service policies.

Response: Comment noted.

Comment: The associations of fishing guides expressed support for continued cooperation with the State via the Management Agreement for Submerged Lands. They stated that when that Agreement is updated in the coming years, it should recognize the values of water-dependent recreation, the value of angling opportunities, and the continuing contributions of guides.

Response: Comments noted.

Comment: The Fishing compatibility determination should include all types of fishing currently allowed under state regulations including cast netting for bait.

Response: The Final CCP has been revised accordingly.

Comment: Many of the visitors to Keys waters are tourists who are uninformed about the refuge and the rules and a greater emphasis needs to be placed on placing signs and or hand out brochures to inform these people. These should be placed at all launching ramps and in marinas. Professional flats guides are some of the most frequent users of the Keys backcountry and these individuals should be contacted through the guide organizations and made fully aware of the plan and encouraged to monitor it and to report violations and missing signage.

Response: Currently, there are 12 informational signs located at various public and business-owned boat ramps in the Lower Keys that notify boaters about the Refuges' backcountry islands and applicable regulations. Refuge management provides a brochure with a backcountry map and refuge regulations to the public at various visitor centers and marine-related businesses through out the Lower Keys. The Service will engage in partnership with the Florida Keys Overseas Heritage Trail, Florida Keys Scenic Highway, FKNMS, fishing guides, guide associations, and others to provide information about the Refuges and fish and wildlife resources and to expand signage.

Comment: The plan is focused on more enforcement AND education. Education is the key.

Response: Enforcement and education are complementary. Primary duties of the Lower Florida Keys Refuges' Refuge Law Enforcement Officers are to educate the public and to promote voluntary compliance.

Non-Priority Recreational Uses

Comment: Horseback riders have always ridden on No Name Key and occasionally ridden the firebreaks on Cudjoe and Sugarloaf Keys. What is the justification for not allowing horseback riding (while permitting bicycling)?

Response: Based on an analysis of the public comments on the Draft CCP and additional information provided by the Big Pine Riders Association, the Service has revised the Compatibility Determination for Horseback Riding to allow for current levels of use on specified firebreaks and hardened trails on Big Pine, No Name, Cudjoe and Upper Sugarloaf Keys.

Comment: We object to the use of the term "non-traditional use." The use of horses for riding has been traditional in the United States for a few hundred years. Horseback riding has been a regular, passive use of the Refuge for much longer than the stated "a couple of decades." Bicycling and jogging are not referred to as non- traditional and certainly horses were ridden here longer ago than these leisure activities have occurred.

Response: The Service's use of the term "non-traditional" relates only to the fact that horseback riding is not specified as a priority, wildlife-dependent recreational use within the National Wildlife Refuge System. The Compatibility Determination for Horseback Riding has been revised to reflect that horseback riding has occurred in certain areas within National Key Deer Refuge for decades. Bicycling, beach use, and horseback riding will be referred to in the Final CCP as non-priority public uses to distinguish them from the priority, wildlife-dependent recreational uses highlighted in the Refuge Improvement Act.

Comment: It is my understanding that pets are not permitted on any beaches.

Response: Refuge regulations do allow leashed pets on refuge lands that are open to public access on National Key Deer Refuge. Free-roaming pets are prohibited on refuge lands in National Key Deer Refuge. Pets are prohibited (leashed or not) on all islands of the Key West and Great White Heron National Wildlife Refuges.

Comment: Allow umbrellas, tents and chairs on beaches for sunbathing.

Response: Umbrellas, tents with stakes, and chairs installed in sand on beaches detrimentally risks intruding into a sea turtle nest and destroying the eggs of these endangered species. The refuges were established for the purpose of protecting and conserving wildlife, and only compatible public uses are allowed. The public has access to many state and municipal beaches in the Florida Keys where sea turtle nesting is limited, providing alternative locations for sunbathing activities.

RESOURCE PROTECTION

Cultural Resources

Comment: There is no mention whatsoever of the Indians that pre-date the white man who lived in the Florida Keys. It is a known fact that there are prehistoric archaeological sites scattered throughout the Florida Keys yet there is no mention of these in this document.

Response: A summary of prehistoric archaeology, Native American occupation, and early settlement by Caribbean and European cultures in the Lower Keys has been added to the Final CCP.

Comment: While there is mention that any impacts to archaeological sites will be reviewed by the FWS Archaeologist, Richard Kanaski, there is no mention of consultation with the Tribes. Richard Kanaski has been consulting with the Tribes on all FWS impacts to archaeological sites, which we greatly appreciate. We are certain that he will continue to do so, but would appreciate that the Draft CCP include language to that effect under IV, Environmental Consequences, Cultural Resources.

Response: The Final CCP has been revised accordingly to place coordination with affected Tribes as the first strategy under the first cultural resources objective. Also, review of impacts to archaeological sites has been revised to explicitly include consultation with Tribes

Comment: Watsons Hammock was an Indian shell mound, site of the pre-Columbian village of Cuchiaga. The shells, soil, and other remains have been removed over the years, and there has been little effort to protect this cultural resource or educate the public. Artifacts at the refuge, such as an old dugout canoe, should be properly curated and preserved. Archaeological surveys have been done by the state on the refuge.

Response: The Final CCP has been revised to include a detailed description of the cultural history of the refuges. Strategies include preparing an annotated bibliography, archiving artifacts, and conducting archaeological surveys as needed for any ground-disturbing activity. Partnerships for archaeological and historical investigations will be pursued. The dugout canoe was stored for many years in the refuge maintenance shop, but was subsequently donated about four years ago to the Florida Keys Land and Sea Trust for display with their historical artifacts at the Crane Point Museum and Nature Center in Marathon.

Wilderness Protection

Comment: Several persons expressed their support for current closures, buffer zones, and additional protections proposed in the Draft CCP to protect nesting, resting and feeding sites for birds, protect nesting habitat for sea turtles, and reduce noise in the wilderness setting of the backcountry islands.

Response: Comments noted.

Comment: If the Service is not prepared to fully close an island and, instead, plans to evaluate the impacts of users to determine when to close an island, the Service should make it clear to the public through every means possible exactly what criteria they will be judged upon so they have a chance to comply.

Response: The Service will issue public notices in advance of proposed closures, and request public review and comment, unless prior notice is not feasible in an emergency situation in cases where there is an imminent threat to trust resources.

Comment: Closing islands only on holiday weekends seems difficult to explain and difficult to enforce. If the impact is so great, the day of the year is not relevant to its occurrence.

Response: Based on current use trends, the possibility of closing certain islands on holiday weekends is justified as that is when use is highly concentrated, sometimes numbering more than a hundred people along less than 100 meters of narrow beach.

Comment: We ask for a cap on capacity of public users on day-use beaches, where allowed. Station an enforcement officer at Boca Grande on high-use weekends to enforce the predetermined capacity and prevent trespass in this island's no-entry zone.

Response: The Service has the authority to cap the number of daily visitors on refuge islands; however, a detailed visitor use and impact assessment would be required to adequately determine an effective carrying capacity. The Service's two Refuge Law Enforcement Officers currently patrol popular beach areas on known high-use weekends, and frequently solicit additional officers from cooperating agencies to assist.

Comment: Continue the ban of personal watercraft in the refuges. This is entirely appropriate as the mission of the refuge is to protect wildlife habitat and thrill craft is not listed as an appropriate activity in the 1997 Refuge Improvement Act.

Response: Comment noted.

Comment: I support the concepts of developing criteria to prohibit excessively noisy aircraft and watercraft from entering the refuges; sizable designated "no motor zone" for exclusive use of kayaks, canoes, rowboats, sailboats, poled skiffs and other watercraft using self propelled or displacement vessels with "non combustion motors (solar/battery/electric/fuelcell etc", and both a refuge speed limit and requiring rental boats to have a USCG licensed captain on board.

Response: The Service collaborates with the State of Florida and FKNMS in the identification, implementation and enforcement of management actions that minimize negative impacts of wildlife and wilderness areas under the provisions of the Backcountry Management Plan. This plan is scheduled to be renewed in 2012, when existing restrictions will be evaluated and revised as needed, and new restrictions may be proposed as appropriate.

Comment: The Service is commended for not including extensive no-motor or closed zones in the backcountry although some interests advocated such unwarranted restrictions (p. 149). The National Park Service overreached with a series of proposed closures and restrictions in Florida Bay, which would severely curtail access for anglers. The subsequent controversy did not advance the cause of Florida Bay conservation. Please remain steadfast in rejecting comparable closures, no entry zones, and similar unwarranted restrictions.

Response: Comment noted.

Comment: During implementation of the preferred alternative, the Service needs to exercise special care and caution in taking actions to provide "sanctuary and protection" to bird populations and species such as turtles. Any associated restrictions on water-dependent recreation and related activities, including the services provided by the Guides, should be kept to a minimum.

Response: The Backcountry Management Plan provides necessary protections for wildlife and wilderness values in critical areas while also accommodating compatible wildlife-dependent public uses such as fishing and wildlife observation.

Comment: One person commented on his dealings with having [Cuban] refugee vessels removed from the Marquesas Keys.

Response: The Service coordinates efforts with the FWC, Monroe County, Department of Homeland Security, and the USCG by reporting migrant vessels and landed migrants, and facilitating the removal of grounded vessels and related debris. Citizen involvement should focus on reporting such incidents to the authorities if witnessed.

Comment: We strongly endorse your determination that no additional refuge lands are suitable for Wilderness designation (p. 43, 205, Appendix H). In too many instances, interests are seeking to expand Wilderness recommendations and designations and use them as a tool to impose restrictions on recreation access – motorized and un-motorized. Recent federal court cases in California are requiring other federal agencies to make stringent "necessity" determinations before allowing any commercial recreation services (i.e., horsepacking) within Wilderness units. Expansion of Wilderness designations in the Lower Florida Keys units would simply raise the risk that similar litigation could be pursued by anti-angling/anti-boating interests in Florida.

Response: Decisions regarding Wilderness are based on appropriate laws, regulations, and policies, which include criteria for designating wilderness areas.

REFUGE ADMINISTRATION

Staffing

Comment: There were several comments regarding the need to expand efforts to combat illegal activities (speeding, wildlife feeding, trespassing in closed areas, using personal watercraft in the backcountry, using all-terrain vehicles on refuge lands, vandaling refuge property or facilities, poaching, and other prohibited activities on refuge properties. More enforcement personnel are desperately needed and should be called for in the plan.

Response: Two Refuge Law Enforcement Officers are assigned to the Lower Florida Keys Refuges at present. Additional law enforcement support is provided by the Service's Office of Law Enforcement, Monroe County Sheriff's Office, Florida Fish and Wildlife Conservation Commission, FKNMS and others. Current and proposed staffing levels shown in the Draft and Final CCPs are limited to a set number of full-time permanent positions based on Service and Regional policy. Staffing needs among the various program areas have consequently been prioritized within these limitations. Public education and outreach by visitor services staff and volunteers are also key elements to increase public awareness and promote voluntary compliance.

Comment: Six new, specific positions are identified in the Draft plan. Suggestions were made for what these positions should be--a land acquisition specialist, biologists to inventory and monitor wildlife populations, and two full-time positions to coordinate invasive and exotic eradication and control.

Response: The Service has amened the management direction to include 5 positions. A Realty Specialist for South Florida Refuges provides direct support for planning and implementation of land acquisition priorities, so that suggested position is not needed. The CCP's proposed management action includes funding for current biological positions that are on the refuges' present organization chart, but have been unfunded recently. These positions would further implement biological monitoring and exotic species control. One new biological position has been added to focus on marsh rabbit recovery and other imperiled species issues. Temporary field staff will supplement permanent staff as funding allows.

Comment: I have concerns that there will be even fewer field personnel if the staffing of a Visitor Center takes priority.

Response: Funding is allocated separately for the biological and visitor services program, and the Lower Florida Keys Refuge's priority focus will continue to be on wildlife conservation and secondarily on visitor services. The CCP's proposed management action includes funding for several biological positions as well as a new Fire Ecologist, and only one new position for the visitor services program. Temporary staff will supplement permanent staff as funding allows, and the visitor services program will continue to rely on FAVOR and refuge volunteers to assist in its efforts.

Comment: Add more specificity in defining the duties and tasks for proposed staff positions, such as the biological technicians.

Response: While Chapter V, Plan Implementation outlines some of the tasks of staff positions, refuge management will determine the specific duties and responsibilities of each staff member. Position descriptions are developed by the Service's Human Capital Management personnel specialists based on standard agency guidelines, and are beyond the level of detail normally included in a CCP.

Comment: I have noted that in many instances the Service plans on using volunteers to construct staff and maintain Refuge projects. The changing demographic and economic realities of the Keys make dependence on volunteer staff a dangerous notion. Please do not bite-off more than you can chew as the tax payers and/or the animals, plants, and habitats are the ones that pay the consequences.

Response: All strategies and tasks identified in the CCP will only be implemented if staffing and funding resources (including volunteers) are available. Volunteers are a critical resource for National Wildlife Refuges and allow the Service to provide more services and accomplish more tasks than staff could do alone.

Comment: Educated volunteers can be a great help in administrative duties as well.

Response: Comment noted. The Service will continue to seek volunteers for administrative purposes.

Comment: Since the refuge staff relies so heavily on the assistance of volunteers, it is essential for the USFWS to employ a volunteer coordinator position to contribute to the effective management of the Refuge Complex. This will also allow for greater public education opportunities and increase involvement and cooperation between the Service and residents of the Lower Keys.

Response: The CCP proposes the addition of a new Supervisory Park Ranger position, which would serve as a volunteer coordinator.

Comment: A new Forestry Technician position was proposed in the draft to support the Fire Management Program's Biological Evaluations. A biologist, not a forestry technician, should have this position.

Response: In the Final CCP, the Forestry Technician was revised to a Fire Ecologist position, which would be responsible for conducting plant inventories, fire ecology studies, and fuels and fire effects monitoring, in coordination with wildlife studies and monitoring conducted by refuge biological staff and partners.

Comment: Visitor Services program staff could work with refuge biologists to train and use citizen scientists to help with baseline figures. This is a crucial step towards changing public opinion and detecting/documenting climate change.

Response: The Service will explore such possibilities in development of the step-down Biological Inventory and Monitoring and Visitor Services Management plans.

Funding

Comment: Wasting large amounts of hard earned taxpayers' money on $3.5 million facilities and $400,000 houses is out of control. Spending millions more on a visitor center is wasteful and falls far outside our small town character we have worked so hard to maintain.

Response: The proposed management plan does not include any provision for constructing additional employee housing; that was included in the EA Alternative C. With regard to constructing a Service-owned visitor center, there is a Service directive to reduce annual operating costs by eliminating expensive leases. Currently, a commercial storefront is leased. The Service will consult with Monroe County, Florida Department of Transportation, local organizations, and the public in designing a facility that complies with the development restrictions under the Big Pine and No Name Keys Habitat Conservation Plan, as well as reflects the local community character envisioned in the Big Pine Key and No Name Key Livable Communikeys Master Plan and the Big Pine Key/U.S. Highway 1 Corridor Area Enhancement Plan.

Comment: The two million dollar price tag (ie. the estimated cost to construct a visitor center) would buy a lot of wildlife habitat.

Response: Land acquisition funds are specifically allocated by Congress to National Wildlife Refuges under the Land and Water Conservation Fund and other revenue sources; whereas facility construction is funded through a separate appropriation for annual refuge operations and maintenance. Construction of a visitor center would not compete against or reduce land acquisition funds.

Equipment and Operations

Comment: The federal government should be a positive example of conservation and energy efficiency. In line with climate change statement to reduce harmful emissions and the possibility of a new visitors center…the plan should include green construction, solar and wind generated electricity, use the highest-rated insulation materials, hurricane resistant windows and shutters, energy efficient

appliances, low water-use devices (eg. waterless urinals), and reclamation of gray water to drip-irrigate native landscaping. Green building, alternative fuels, efficiencies in operations and procurement could also go a long way towards community efforts to lessen climate change impacts.

Response: The Service is developing national policy that will guide future construction and renovation of government facilities to reduce, reuse and recycle waste and emissions, use energy efficient materials and systems, and purchase fuel efficient vehicles and equipment in its effort to reduce its carbon footprint and mitigate greenhouse gas emissions. A new strategy has been added to the Final CCP, which states that the Lower Florida Keys Refuges staff will work with "green" specialists and organizations, such as the Florida Keys Green Living and Energy Education (GLEE) forum, to design and build the proposed visitor center using the Leadership in Energy and Environmental Design (LEED) Green Building Rating System, developed by the U.S. Green Building Council.

Partnerships

Comment: The Service may also want to propose partnering with other agencies, organizations and academics interested in wildlife ecology and conservation.

Response: The Service concurs that partnering with other agencies and academia is a critical element for achieving its goals and objectives. The recent trend in expanding and fostering partnerships will continue. There are many examples throughout the CCP where such partnerships are noted or proposed. See also Appendix L.

Comment: The Nature Conservancy (TNC) looks forward to ongoing collaboration with the Service in meeting our mutual goals in the Florida Keys.

Response: Comment noted. TNC is listed as a partner in Appendix L.

Comment: Consider the Key West Tropical Forest (KWTF) as a partnering arm for reintroductions of certain species, and more importantly, an educational site for the refuge. We have a grand opportunity to educate thousands of people on our habitats and it would be so vital to have the Service formally partner through this plan.

Response: Comment noted. KWTF is listed as a partner in Appendix L.

Comment: The Florida Guides Association, Key West and Lower Keys Fishing Guides Association and Marathon Guides Association (Guides) are the Service's de facto partners since fishing guides help achieve the "facilitation" of water-dependent recreation by enabling members of the public to use and enjoy backcountry resources. We look forward to working with the Service to strengthen this partnership.

Response: The Service is an active member of the Florida Keys National Marine Sanctuary Advisory Council through which it interacts and partners with diverse stakeholders groups, such as the Guides. We look forward to enhancing this partnership.

Comment: In reference to a strategy to partner with the Chamber of Commerce to promote ecotourism, one organization commented that the NKDR and its designated wilderness areas "need to be protected and preserved, and not serve as moneymaking opportunities for local businesses. We fear that an ecotourism initiative could ultimately, over time, turn this rare and special place into a de facto theme park full of trams, parking lots, and commercial vendors and guides."

Response: The Service's intent in partnering with the Chamber of Commerce would be to advance our mission of wildlife conservation. This is done by educating Chamber customers and businesses about appropriate and compatible wildlife-dependent recreational uses, promoting wildlife viewing etiquette, and ensuring public awareness of closed areas and prohibited uses with the goal of enhancing stewardship of the refuges' natural resources. The Service has full authority to limit commercial operations on refuge lands to avoid impacts to wildlife and wilderness resources. There are no proposals either explicitly stated or implicitly implied in the CCP that would turn the NKDR or backcountry wilderness into a "theme park."

Commercial Uses

Comment: There were multiple comments regarding commercial uses. "Commercial uses in wildlife refuges should be strictly limited and absolutely confined to those with clear educational merit and minimal environmental impact." "While [commercial] operations, such as large kayak and snorkeling tour groups, are few at this time, similar operations could easily infest the refuges and threaten the refuges wilderness quality with their continued presence."

Response: The CCP calls for a review of the 1997 Draft Commercial Use Management Plan, which will be updated and revised based on current use patterns and resource concerns. Commercial uses are prohibited on refuge lands and islands unless authorized under a Special Use Permit issued by the Service. Special Use Permits may restrict specific elements of a proposed commercial use in order to minimize impacts to wildlife resources and wilderness values, such as group size, length of stay, time of year and/or day, etc.

Comment: Prohibit all commercial operators from using high-capacity vessels or vehicles from operating within refuge areas.

Response: The Service has full authority to regulate commercial activities that occur on refuge lands above mean high tide. Further, the Service has law enforcement authority in any area in which trust resources such as endangered species and migratory birds are impacted. However, the authority to regulate commercial activities that operate solely in state-owned marine waters and sovereign submerged lands within the refuge boundaries is under the jurisdiction of the State of Florida.

Comment: Commercial services within refuge units can be restricted or regulated by the Service. The fact that the Draft CCP does not seek to regulate fishing guides is also commended. There are clearly some fundamental authority issues associated with any type of regulatory effort since the backcountry waters overlay State-owned submerged lands and are subject to a cooperative management agreement between the Service and the State of Florida.

Response: As noted above, the authority to regulate commercial fishing activities that occur only in state-owned marine waters and sovereign submerged lands within the refuge boundaries is under the jurisdiction of the State of Florida.

Comment: Any commercial activities within the refuges should require a free license that requires licensees to follow established rules for commercial use. Violation of the license rules would result in termination of the license.

Response: Service policy requires that commercial operators that are authorized under a Special Use Permit to operate on refuge lands must pay an administrative fee for issuing the permit as well as a portion of day-use fees. All authorized commercial operations are subject to stipulations and termination.

ENVIRONMENTAL ASSESSMENT

Note: Comments that referred specifically to sections in the Draft EA, but which were deemed duplicative or reflected similar comments on sections in the Draft CCP, were incorporated above. The following Comments and Responses on the EA (Section B) address new items not previously included above.

Description of Alternatives (Chapter III)

Comment: Alternative B--with its emphasis on protecting wildlife habitat--seems appropriate.

Response: Comment noted.

Comment: The descriptions of alternatives are vague. More detail should be given in Alternative B (Proposed Alternative).

Response: Chapters 4 (Management Direction) and 5 (Plan Implementation) in the CCP provide the necessary detail for Alternative B (Proposed Alternative), as required under regional and national policy guidance for developing a CCP. The other alternatives are described in the EA in sufficient detail to allow a comparison of similarities and differences with Alternative B. Specific actions that detail time, location, duration, methodology, etc., are provided in step-down management plans, annual work plans, permitting and normal refuge field operations based upon refuge policies and using best available science and professional judgment.

Comment: Prescribed fire strategies are so vague it is nearly impossible to comment on them precisely.

Response: A CCP describes the Service's overall management direction (i.e., goals, objectives, and strategies) for the next 15 years. Specific fire management details are to be provided in the step-down Fire Management Plan. The Service is currently revising the Fire Management Plan for NKDR, which will be made available for public review and comment.

Comment: We urge special caution in preparing the visitor use carrying capacity analysis. There is no evidence of widespread overuse of the backcountry and we want to work closely with the Service on any such analysis that might trigger proposed backcountry use limitations or restrictions.

Response: The Service concurs that there is no evidence of widespread overuse of the backcountry; however there are a few specific locations, such as Boca Grande Key in Key West NWR, that receive heavy public use at certain times which may be detrimentally impacting the wildlife and wilderness values. Further limitations or restrictions would be considered as a part of the review and update of the Backcountry Management Plan, unless an emergency action is necessary to protect trust resources from imminent threat.

Comment: I strongly encourage you to consider including in your chosen proposal [Alternative B] the action proposed in Alternative C on p. 96: *Obtain data to detect gradual environmental changes due to global climate change, such as sea level rise. Work with climate specialists and hydrologists to create a model of projected sea level rise and its areal coverage on refuge lands. Focus habitat management, species conservation, and land acquisition accordingly*. Refuge lands will undoubtedly experience major changes due to climate change in the coming decades, which will affect plant communities, freshwater resources and will impact rare species. The more predictive knowledge resource managers have to work with, the better equipped and effective they will be in dealing with the challenges that climate change brings.

Response: The discussion of climate change impacts on refuge resources has been expanded and this strategy is included in the final plan.

Alternatives

Comment: The alternative analysis for this CCP is severely lacking in both the range of alternatives considered and the extent to which they are evaluated. The draft CCP offers only three alternatives, a no action Alternative (A), the preferred Alternative (B) and a third alternative, Alternative C. However, alternatives B and C essentially call for the same management practices in a number of different areas, including visitor services (p. 92), habitat loss and fragmentation (p. 94), and control of invasive and exotic species (p. 101). They call for an increase in visitor services and rather modest land acquisition and exotic species removal programs. As such, they do not explore other ways of managing these issues, such as limiting the expansion of trails, hiring additional staff that specialize in acquiring private lands, and controlling invasive species by limiting the amount of additional human disturbance in sensitive areas and increased predator control programs.

Response: The Service has concluded that the Lower Florida Keys Refuges Final CCP fully presents three alternative approaches in sufficient detail that meets regional and national guidance for producing a CCP. The proposed alternative as presented in Chapters 4 (Management Direction) and 5 (Plan Implementation) in the CCP provide a comprehensive and adaptive management approach to the conservation and recovery of imperiled species and the habitats upon which they depend.

Comment: Refuge staff should consider analyzing a wider range of alternatives that take different management approaches to these and other issues. For example, the Service could look to the CCP for the Sherburne NWR in Minnesota, which many feel is the “gold standard” for CCPs, for guidance. In that CCP, the Service examined five alternatives. These alternatives differed in many respects, including the ecological frame of reference (pre-settlement vs. pre-European), priority species (wetland and grassland birds vs. migratory species) and the Refuge’s place in a larger, ever-changing landscape…The Service should take a similar approach here and explore additional alternatives, which will facilitate the development of a preferred alternative that focuses on the larger ecosystem and honors the Refuge’s primary mission of wildlife protection.

Response: Many good regional and national plans were reviewed, especially those focusing on island and coastal resources. NEPA allows for three alternatives to be presented, including the no-action (current management) alternative. The CCP Planning Team developed three viable alternatives specifically tailored to the three Lower Florida Keys Refuges and their unique resources, and selected the best option for managing this complex of refuges. The major emphasis of the Lower Florida Keys Refuges’ management direction is the conservation and recovery of imperiled species and the habitats upon which they depend given the constraints of a highly fragmented landscape influenced by a dynamic disturbance regime. Service reviewers and regional managers believe that the Lower Florida Keys Refuges CCP does indeed focus on the larger ecosystem and achieves the Refuge Improvement Act’s primary mission of wildlife conservation. Some of your concerns were addressed in the final CCP: the expansion of trails has been limited and a new predator control program is being proposed. As previously stated, we have land acquisition expertise and staff abailable to us at a regional level. There is not a need to duplicate this at a specific refuge.

Comment: The Service must also better analyze the purpose, need and effects of the three proposed alternatives. For the most part, the EA summarizes the specific management actions of all three plans in a chart and does not actually explain for example, what Alternative C would actually call for. A more thorough explanation of Alternative C is necessary because unlike Alternative A,

which is the current management approach, and Alternative B, which the CCP embodies, Alternative C is the one alternative the public knows the least about.

Response: The summary description of the three alternatives (Draft EA chapter III) has been expanded in the Final EA to provide more clear distinctions between the alternatives.

Comment: The Proposed Alternative (i.e. Alternative B) has limited coverage and the level of detail provided is too broad, thereby making comment on its effectiveness difficult. Most statements are overly vague and the strategies suggested do not allow for easy interpretation….Instead, we believe that having specific goals, with concrete and actionable steps to achieve such objectives, would be far more useful in the final CCP…Currently, no such information is provided within this draft CCP for any of the proposed actions. This is a glaring flaw within this document in its present condition and one that sorely needs to be rectified and re-evaluated.

Response: The proposed alternative is detailed in Chapters 4 (Management Direction) and 5 (Plan Implementation) of the CCP, as referenced in the EA. The strategies listed in Chapter 4 provide information on what actions may be taken to meet the objectives. Details on specific location and timing of actions will be developed and described in relevant step-down management plans and annual operating plans, and further assessed for environmental impacts through IntraService Section 7 Biological Consultations. The CCP is only meant to provide broad guidance for a 15-year timeframe; whereas all strategies will be prioritized, implemented, and evaluated in an adaptive management approach within the constraint of limited fiscal resources, environmental conditions at the time, and other relevant factors.

Environmental Consequences (Chapter IV)

Effects on the Biological Environment

Comment: Although it is acknowledged that unavoidable impacts occur, the manner in which such impacts would be minimized should be solidly stated here. How, for example, will prescribed burns be coordinated to prevent box turtles, and other slow moving animals, from succumbing to fire-induced mortality? Such steps should be adequately discussed.

Response: The discussion of mitigation measures has been revised in the Final CCP. However, detailed and specific mitigation measures are beyond the general scope of a CCP. Specific measures to protect species from fire-induced mortality, for example, will be included in step-down Fire Management Plan and its associated Environmental Assessment and IntraService Section 7 Biological Consultation.

Comment: The potential for environmental consequences has been grossly downplayed by the Service in its review. One such example, under Section IV: Environmental Consequences (pp. 105-119), can be found on p. 105 in sub-section Soils where the USFWS states that the impacts of burning of coastal salt marshes and freshwater marshes "would be negligible and more than offset by potential benefits conferred on marsh rabbit habitat." Earlier in this document, on p. 67, under Fish and Wildlife Population Management: Fire Management Program, the Service admits that "the role and application of fire in maintaining …freshwater marshes, and salt marshes in the Lower Keys are not as well understood." How then can the Service consider the impact of fire in these environments to be "negligible"? We believe that the USFWS needs to carefully consider its actions when using prescribed burning tactics in environments with unknown disturbance regimes. This is just one example from the draft CCP of how glossing over pivotal issues can lead to a determination of no

significant environmental impact when, as in the above instance, this cannot be conveyed with reasonable certainty without more detailed analysis.

Response: The statement that the role of prescribed fire in salt and freshwater marshes in the Lower Keys is not well understood is merely an acknowledgement that this management tool has been used only a few times in the refuge. A comprehensive historical account of the presence of fire in the Florida Keys landscape prior to extensive habitat loss and degradation is lacking; consequently, resulting in an acknowledged level of uncertainty. However, studies in similar habitats in south Florida with the same assemblage of plant species demonstrate the efficacy and appropriateness of using fire in a careful and judicious manner in an adaptive management approach. The Service believes that given the extremely low numbers of Lower Keys marsh rabbits, deliberative actions must be taken to bolster its population. The decision to burn such habitats was based on available scientific literature and peer review, and the discussion of impacts has been expanded in the Final CCP.

Cumulative Impacts

Comment: Although the Service concludes that they are not aware of any significant cumulative impacts, it should be acknowledged that this environment is susceptible to natural environmental disturbances of substantial magnitude. The impact of hurricanes and other natural disasters, and their potential consequences, cannot be ignored. It is our hope that the Service has carefully weighed their proposed alternative against the backdrop of periodic hurricanes, storm surges and the like.

Response: The Service fully recognizes the role of natural disturbances, such as hurricanes, in influencing the diverse characteristics and dynamic conditions of Florida Keys ecosystems. The Final CCP incorporates more discussion on the Service's implementation of an adaptive management approach, which will take into account such events and their effects on wildlife and habitats, and modify its management objectives and strategies accordingly. Several strategies have been clarified or added addressing the need to document and further our understanding of these dynamic relationships, especially in light of climate change.

Comment: We concur with the Cumulative Effects conclusion (that there are no significant adverse cumulative effects arising from existing authorized activities). Unfortunately, the socio-economic effects section of the EA is deficient as it fails to include references or incorporate the recognized benefits associated with angling in the backcountry and the economic value contributed by professional fishing guides and related services (p. 114).

Response: The EA is meant to point out any negative socio-economic impacts associated with implementing the preferred alternative. The CCP text discusses general eco-tourism benefits, not specific benefit values from each use, such as angling.

Comment: A cumulative impact is an impact on the natural or human environment, which results from the incremental impact of the proposed action when added to other past, present, and reasonably foreseeable future actions regardless of which agency or person undertakes such other actions. See 40 CFR 1508.7. The Service's cumulative impacts analysis is entirely deficient. It is entirely unclear why the Service concluded that it was simply "unaware of any past, present, or future planned actions that would result in significant cumulative impacts." The Keys are under incredible development pressure, including everything from residential housing, marinas, commercial/retail development and even airport expansion.

Response: The Final EA has been revised to further address cumulative impacts.

Direct and Indirect Impacts on the Environment

Comment: This EA fails to consider a wide range of foreseeable direct and indirect impacts on the area's resources. In addition, many of your discussions on direct and indirect impacts are contradictory and inconsistent with past findings. You must correct these and other deficiencies and provide a thorough and well-reasoned discussion of all direct, indirect and reasonably foreseeable environmental impacts.

Response: The EA has been revised to expand the discussion on direct and indirect impacts, as well as other sections, and included in the Final CCP.

Fire Impacts

Comment: The EA makes several false, contradictory and/or unsupported assumptions as to the importance and role of fire in Keys freshwater wetland and saltmarsh/buttonwood transition communities. In some instances the Service characterizes these communities as "fire dependent" (P.112); in other portions of the CCP fire is considered an appropriate tool (P. 49); and in others the role and application is "not as well understood." (P. 67). The EA later concedes "the historic and ecological role of fire in this habitat is currently being studied." (P. 105). Because of these false and/or contradictory assumptions and the lack of information on the role of fire in these areas, the Service cannot accurately determine at this time that the soil impacts would be "negligible" (P. 105), or that impacts to water quality should not be discussed. In addition, because the role of fire needs additional study, the Service should address the number of potential environmental impacts associated with the use of fire in salt marshes such as injury or death to listed animal and plant species such as the LKMR, silver rice rat, mangroves, and other state protected tree species. None of these impacts has been analyzed.

Response: The Final CCP has been revised to clarify the discussion on fire with more detailed discussion and references on the ecological role of fire in freshwater wetlands and salt marsh transition communities, and thus establishing the careful and judicious use of prescribed fire as a clear and defensible management strategy. The EA has been revised accordingly to expand the discussion on potential impacts associated with the use of fire.

Visitor Impacts

Comment: While we recognize the need for a new center, we are troubled by the Service's desire to capture 50,000 persons. While the Service suggests closing beaches in Key West NWR because over use is damaging the resource, it proposes increasing visitation at NKDR by 500 percent. We believe that this is short-sighted and will lead to negative impacts on Big Pine Key and its many endangered species, the protection of which is supposed to be the highest priority.

Response: The Service did not state that it "desire[s] to capture" nor does it "propose increasing" visitation by building a new visitor center. Rather, the Draft CCP stated under the Environmental Consequences that a new visitor center would be "expecting to generate a 500 percent increase in annual visitation from 10,000 visits to 50,000 visits." However, the Service concedes that that was a very coarse estimate with no statistical basis. As stated previously, the Service assumes that a new facility on U.S. Highway 1 will capture visitors at a similar level to what is presently visiting the current visitor center located in the Winn Dixie Shopping Plaza, plus incidental drive-by tourists already traveling on the highway that see the new facility. Without a detailed visitor use survey, it

would be very difficult to predict the number or percent increase in annual visitation beyond a general upward trend, based on trends observed in tourism throughout the Florida Keys. The Service does not deliberatively attract new visitors through advertising or promotional materials, but it must be prepared to meet current and future demands for use of the Lower Florida Keys Refuges where compatible and appropriate for wildlife and habitat. The Final CCP has been revised accordingly to further discuss potential impacts.

Comment: The EA contains a number of contradictory statements on the human impacts to wildlife and habitat, resulting from a significant increase in visitors to the Refuge. While the EA estimates that the new visitor center will likely generate a 500 percent increase in annual visitation, Blue Hole visitation will double from 90,000 visits to 180,000 visits, and nature trails will experience an increase from 60,000 to 120,000 visitors, no additional vehicle traffic would be generated on U.S. Highway One is entirely unclear how the Service reached this determination absent some sort of traffic study or polling. Instead, it is much more likely that at least a modest if not significant increase in traffic would result from a five-fold increase in visitors. The Service's statements that ecotourism opportunities could result in an additional 30,000 more vehicles annually (P. 114) cast further doubt on the agency's conclusions that traffic patterns will remain unchanged.

Response: As previously noted, the Service concedes that the Draft CCP included very coarse estimates of expected increases in visitation with no statistical basis. Without a detailed visitor use survey, it would be very difficult to predict the number or percent increase in annual visitation beyond a general upward trend, based on trends observed in tourism throughout the Florida Keys. Until a traffic study is completed, the Service assumes that a new facility on U.S. Highway One will capture visitors at a similar level to what is presently visiting the current visitor center located in the Winn Dixie Shopping Plaza plus incidental drive-by tourists already traveling on the highway that see the new facility. The Final CCP has been revised accordingly to further discuss potential impacts.

Comment: The new visitor center is presented only as a concept in the draft CCP. Without knowing the specifics, it is impossible to accurately evaluate the impacts. For example, will the visitor center be on BPK or on another island? Will it be in an existing building or new construction? Will it be located on an already scarified parcel, or will it require some clearing of native habitat. What Tier will it be in? Which side of the highway and which side of the BPK traffic light will it be located on? What will be the size of the visitor center and parking facilities? If located on BPK, how will the huge projected increase in visitors affect traffic flow, turning, and level of service? How will all these additional visitors impact the number of road kills? Have the impacts of projected visitor increases been adjusted for peak season use? If level of service is decreased, will a building moratorium be reinstated as in the past? Will FDOT be forced to build a fourth lane? If so, will road kills of endangered species increase? Increasing the level of take of deer could reopen the HCP. Since road improvements are tied into the HCP, and require mitigation, will the Service provide mitigation, even though it is not subject to the HCP? Will it abide by the restrictions in the county comprehensive plan? The real impacts have not been addressed at all and will depend upon the specifics. We are unable to support a new visitor center on U.S. Highway 1, until the details have been completely described and traffic and other impacts assessed.

Response: Since the release of the Draft CCP in June 2008, the Service has acquired a one-acre scarified commercial property on the north side of U.S. Highway 1 east of the traffic light on Big Pine Key from a willing seller, formerly a commercial plant nursery and animal feed store. The Service proposes to replace the existing structure with a same-sized building that will accommodate a visitor and environmental education center operated by the Service, FAVOR and other potential partners. The site is adjacent to Service-owned property with intact pine rockland habitat, which provides a suitable setting for outdoor interpretive signage and viewing of natural habitat. The Service fully

intends to consult with Monroe County, Florida Department of Transportation, local organizations, and the public in designing a facility that complies with the development restrictions under the Big Pine and No Name Keys Habitat Conservation Plan, as well as reflects the local community character envisioned in the Big Pine Key and No Name Key Livable Communikeys Master Plan and the Big Pine Key/ U.S. Highway One Corridor Area Enhancement Plan. A new visitor center will consider building size and orientation, parking, traffic flow, staffing, low cost maintenance, and energy efficiency. The Final CCP has been revised accordingly; however, the commenter's desired level of specificity is not typically contained within a CCP. Once a detailed site plan and design have been completed, a more thorough environmental analysis (including an IntraService Section 7 Biological Consultation) and public review will be conducted along with the traffic study.

Comment: Regardless of the impacts from a new visitor center and increased traffic, there is no discussion of the impacts all of these visitors would have on NKDR. The EA does not discuss the potential degradation of air quality caused by additional automobiles, the noise impacts of additional visitors to NKDR, the additional waste that is likely to be generated by these visitors along the trails, and the increased needed for law enforcement to control ongoing illegal feeding of deer and other wildlife. The EA also glosses over the real potential for increased wildlife disturbance resulting from a significant increase in visitors and the potential for user group conflicts as all these visitors compete for a limited number of resources. The Service must analyze these impacts now rather simply state that the agency will "adjust its programs" to address these impacts should they occur. The EA also improperly characterizes the impact to vegetation resulting from the creation of additional trails as "short-term." The creation of new trails will likely require the removal of a number of trees, many of which are federal or state listed. However, the impacts do not stop there. In addition to a loss and fragmentation of habitat, the removal of these trees may encourage the growth of invasive or exotic species in these areas, which then compete with the remaining native plants and trees. Disturbed sites also encourage the introduction of other invasive species such as fire ants, which could threaten the young of certain listed animal species, including LKMR.

Response: The discussion of potential impacts from increased number of visitors has been expanded in the EA based on the revised strategies of the Final CCP.

Endangered, Threatened and Sensitive Species

Comment: We do not believe the Service has adequately evaluated the impacts of prescribed burns in salt marshes on threatened and endangered species, particularly the LKMR. As we explained in our January and February 2008 letters to the Service regarding this issue, the intra-service biological evaluation (BE) on the use of prescribed fire in the NKD Refuge was not only deficient but also recognized the potential harm prescribed burns posed to LKMR. Following our March 2008 meeting with Service staff in Big Pine Key, we were assured that the burns would be cancelled pending additional review and preparation of a response by Refuge staff to our letters. We have not yet received a response from the Service. We believe that in view of the unanswered questions surrounding the impacts of these burns and the inadequacy of the BE, the Service should reinitiate consultation and prepare a Biological Opinion that provides a comprehensive assessment of its Refuge management plans and activities as it had done in the past for Boca Chica.

Response: As previously mentioned, the Final CCP has been revised to clarify the discussion on fire with more detailed discussion and references on the ecological role of fire in landscape management. The step-down Fire Management Plan requires consultation through an IntraService Section 7 Biological Evaluation, and that consultation process will determine if a formal Biological Opinion is necessary. The Service will also complete an Environmental Assessment on the revised Fire

Management Plan for public review and comment. In reference to the response letter from the Service, it was provided to the commenter on June 26, 2008.

Other Comments

Comment: In order to ensure that the important and sensitive resources in the NKDR, KWNWR and GWHNWR are protected and conserved, more analysis and public discussion is required than is offered in the draft CCP. Given its failure to fully consider and adequately disclose the environmental impacts associated with the alternatives reviewed in the draft CCP, the USFWS must prepare an Environmental Impact Statement (EIS) in order to fully discharge its duties under the National Environmental Policy Act (NEPA).

Response: The Draft EA for the Lower Florida Keys Refuges has been revised and included with the Final CCP. The Service has determined that an Environmental Assessment provides a sufficient level of review and discussion for the CCP. It meets regional and national standards under the National Environmental Policy Act. Additionally, the Service has committed to including a more-detailed Environmental Assessment with each the Fire Management and Integrated Predator Management step-down plans as well as the Visitor Center environmental permitting.

Comment: In determining the significance of a proposed action's effects on the environment, an agency must evaluate "[t]he degree to which the effects on the quality of the human environment are likely to be highly controversial." 40 C.F.R. § 1508.27(b)(4). A controversy sufficient to require preparation of an EIS occurs "when substantial questions are raised as to whether a project…may cause significant degradation of some human environmental factor, or there is a substantial dispute [about] the size, nature or effect of the major Federal action." … A substantial dispute exists when evidence, raised prior to the preparation of an EIS or FONSI casts serious doubt upon the reasonableness of an agency's conclusions…There is a substantial public controversy with respect to a major component of the draft CCP- the Service's plans for prescribed burns in the NKD Refuge....In view of the EA's failure to analyze the impacts of these burns and the public controversy surrounding these burns, the Service should prepare a more thorough analysis of the environmental impacts of these burns before it issues a final CCP. Burning even fire-adapted pine rocklands has been controversial because of the significant pine mortality resulting from some past burns. Manual thinning of vegetation in the urban interface has also aroused controversy because of the killing of listed species.

Response: As previously noted, the Service has conducted extensive reviews in recent years and evaluated input from agency biological and fire program specialists, academic and other non-governmental field researchers, and public comments received through various public forums in order to inform the planning and decision-making for the fire management program. The Service is making a sincere and concerted effort to integrate contemporary science and local knowledge into its fire management program. The Final CCP has been revised to more thoroughly discuss the issues of fire management to the extent appropriate for a CCP, per Service policy. The revised step-down Fire Management Plan will be reviewed through internal consultation (IntraService Section 7 Biological Evaluation) as well as public comment (Environmental Assessment).

Comment: An Environmental Impact Statement is warranted. In consideration of the significant environmental impacts that could result from the use of "experimental" prescribed fire in salt and freshwater marshes and the number of adverse impacts that could result from the Service's overly ambitious plans to increase visitation up to 500 percent, amidst the continued decline of a number of listed species within Refuge boundaries, we believe the Service should prepare an EIS for the Lower Keys Refuge System.

Response: The Service has addressed the public concerns and comments on the Draft CCP in this Appendix, and the Final CCP has been substantially revised to clarify, and in some cases modify, the issues and strategies in response to public comments. Consequently, the Service does not agree that an Environmental Impact Statement is warranted.

Comment: A few complaints were received about the open [public] comment period being only 30 days.

Response: The allowable timeframe under the National Environmental Policy Act for comments is 30 days. Due to having a tight timeframe and multiple CCPs underway within the Southeast Region, the decision to have a 30-day comment period was made by the Regional Office.

Comment: From the descriptions of the NKDR, the KWNWR and the GWHNWR, outlined under Refuge Overview (p. 9-10), it appears that these three refuges have distinct habitat features unique to each. As such, it is entirely inappropriate to arbitrarily lump these three locations under one broad draft CCP. Given the high degree of endemism at each refuge, the great sensitivity of each environment to artificial disturbance and the immense biological diversity present at each site, it is our opinion that all three locations should be examined separately. The practice of treating these sites as a wildlife refuge complex simply based on geographic proximity to one another, rather than ecologically significant variables, is highly irresponsible and draws into question the validity of this draft CCP. Clumping of vastly different refuges to provide ease of review should not be conducted.

Response: The decision to write one CCP to address the three refuges is the best course of action. While each refuge was originally established for different reasons based on the prevalent threat at the time (plume hunting in early 1900s, the continued decline of wading birds such as great white herons in 1930s, and the near extinction of the key deer in the 1950s), the three refuges today encompass a continuous chain of tropical islands that geologists and ecologists consistently refer to as the Lower Keys ecosystem. Accordingly, it is most appropriate to address it as a single complex rather than three distinct units.

Appendix E. Appropriate Use Determinations

Lower Florida Keys Refuges Appropriate Use Determinations

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

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

- Six wildlife-dependent recreational uses - As defined by the National Wildlife Refuge System Improvement Act of 1997, the six wildlife-dependent recreational uses (hunting, fishing, wildlife observation, wildlife photography, and environmental education and interpretation) are determined to be appropriate. However, the refuge manager must still determine if these uses are compatible. Monroe County does not allow hunting in the Keys.

- Take of fish and wildlife under state regulations - States have regulations concerning take of wildlife that includes hunting, fishing, and trapping. The Service considers take of wildlife under such regulations appropriate. However, the refuge manager must determine if the activity is compatible before allowing it on a refuge.

Statutory Authorities for this policy:

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

Refuge Recreation Act of 1962, 16 U.S.C. 460k. The Act authorizes the Secretary of the Interior to administer refuges, hatcheries, and other conservation areas for recreational use, when such uses do not interfere with the area's primary purposes. It authorizes construction and maintenance of recreational facilities and the acquisition of land for incidental fish and wildlife oriented recreational development or protection of natural resources. It also authorizes the charging of fees for public uses.

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

Definitions:

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

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

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

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

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

- Promotes safety of participants, other visitors, and facilities;
- Promotes compliance with applicable laws and regulations and responsible behavior;
- Minimizes or eliminates conflicts with fish and wildlife population or habitat goals or objectives in a plan approved after 1997;
- Minimizes or eliminates conflicts with other compatible wildlife-dependent recreation;
- Minimizes conflicts with neighboring landowners;
- Promotes accessibility and availability to a broad spectrum of the American people;
- Promotes resource stewardship and conservation;
- Promotes public understanding and increases public appreciation of America's natural resources and the Service's role in managing and protecting these resources;
- Provides reliable/reasonable opportunities to experience wildlife;
- Uses facilities that are accessible and blend into the natural setting; and
- Uses visitor satisfaction to help define and evaluate programs.

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

FINDING OF APPROPRIATENESS OF A REFUGE USE

Refuge Name: Key West NWR, Great White Heron NWR, National Key Deer Refuge

Use: Public Use on Wilderness and Backcountry Islands

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

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

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

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

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

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

Not Appropriate_____ **Appropriate** X

Refuge Manager: Anne E. Morkill Date: 7-27-09

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

Refuge Supervisor: Elizabeth Souzaann Date: 8-13-09

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

FINDING OF APPROPRIATENESS OF A REFUGE USE

Refuge Name: National Key Deer Refuge

Use: Beach Use (Picnicking, Sunbathing, Shelling, Swimming, Snorkeling)

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

Decision Criteria:	YES	NO
(a) Do we have jurisdiction over the use?	X	
(b) Does the use comply with applicable laws and regulations (Federal, State, tribal, and local)?	X	
(c) Is the use consistent with applicable executive orders and Department and Service policies?	X	
(d) Is the use consistent with public safety?	X	
(e) Is the use consistent with goals and objectives in an approved management plan or other document?	X	
(f) Has an earlier documented analysis not denied the use or is this the first time the use has been proposed?	X	
(g) Is the use manageable within available budget and staff?	X	
(h) Will this be manageable in the future within existing resources?	X	
(i) Does the use contribute to the public's understanding and appreciation of the refuge's natural or cultural resources, or is the use beneficial to the refuge's natural or cultural resources?	X	
(j) Can the use be accommodated without impairing existing wildlife-dependent recreational uses or reducing the potential to provide quality (see section 1.5D, 603 FW 1, for description), compatible, wildlife-dependent recreation into the future?	X	

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

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

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

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

Not Appropriate____ **Appropriate** X

Refuge Manager: Annette L. Markie Date: 8/28/09

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

Refuge Supervisor: Elizabeth Souheaver Date: 9/3/09

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

FINDING OF APPROPRIATENESS OF A REFUGE USE

Refuge Name: National Key Deer Refuge

Use: Bicycling

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

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

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

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

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

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

Not Appropriate_____ **Appropriate** X

Refuge Manager: [signature] Date: 7-27-09

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

Refuge Supervisor: [signature] Date: 8-13-09

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

FINDING OF APPROPRIATENESS OF A REFUGE USE

Refuge Name: National Key Deer Refuge

Use: Hiking/Daypacking, Jogging and Walking

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

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

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

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

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

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

Not Appropriate_____ **Appropriate** X

Refuge Manager: Annie Morkill Date: 7-27-09

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

Refuge Supervisor: Elizabeth Imbrecum Date: 8-13-09

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

FINDING OF APPROPRIATENESS OF A REFUGE USE

Refuge Name: National Key Deer Refuge

Use: Horseback Riding

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

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

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

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

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

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

Not Appropriate_____ **Appropriate** X

Refuge Manager: Anne E. Morkill Date: 7-27-09

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

Refuge Supervisor: Elizabeth Salzman Date: 8-13-09

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

FINDING OF APPROPRIATENESS OF A REFUGE USE

Refuge Name: Great White Heron NWR and National Key Deer Refuge

Use: Mosquito Management

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

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

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

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

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

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

Not Appropriate_____ **Appropriate** X

Refuge Manager: [signature] Date: 7-27-09

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

Refuge Supervisor: [signature] Date: 8-13-09

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

FINDING OF APPROPRIATENESS OF A REFUGE USE

Refuge Name: Key West NWR, Great White Heron NWR, National Key Deer Refuge

Use: Research and Monitoring

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

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

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

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

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

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

Not Appropriate_____ **Appropriate** X

Refuge Manager: [signature] Date: 7-27-09

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

Refuge Supervisor: Elizabeth Souzanne Date: 8-13-09

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

Appendix F. Compatibility Determinations

National Key Deer Refuge (NKDR), Great White Heron (GWHNWR) and Key West National Wildlife Refuges (KEY WEST NWR) Compatibility Determinations

Uses: The following uses were evaluated to determine their compatibility with the Refuge System's mission and the purpose of the Lower Florida Keys Refuges: (1) environmental education and interpretation; (2) hiking/daypacking, jogging, and walking (National Key Deer Refuge); (3) bicycling (National Key Deer Refuge); (4) wildlife observation and photography; (5) fishing; (6) beach use (National Key Deer Refuge); (7) beach use (Key West NWR); (8) research and monitoring; (9) mosquito management (National Key Deer Refuge and Great White Heron NWR); and (10) horseback riding (National Key Deer Refuge). A description of each use and its anticipated biological impacts is presented in this Compatibility Determination.

Refuge Names/(Date Established):
National Key Deer Refuge (August 22, 1957)
Great White Heron National Wildlife Refuge (October 27, 1938)
Key West National Wildlife Refuge (August 8, 1908)

Establishing and Acquisition Authorities:

Executive Order 923 established Key West NWR
Executive Order 7993 established Great White Heron NWR
71 Statute 412 established National Key Deer Refuge

Refuge Purposes: These purposes and the mission of the National Wildlife Refuge System are fundamental to determining the compatibility of proposed uses of the refuge. The purposes of the refuges are as follows:

National Key Deer Refuge

"... to protect and preserve in the national interest the Key deer and other wildlife resources in the Florida Keys." 71 Stat. 412, dated Aug. 22, 1957.

"... to conserve (A) fish or wildlife which are listed as endangered species or threatened species .... or (B) plants ..." 16 U.S.C. 1534 (Endangered Species Act of 1973).

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

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

"... conservation, management, and … restoration of the fish, wildlife, and plant resources and their habitats … for the benefit of present and future generations of Americans..." 16 U.S.C. 668dd(a)(2) (National Wildlife Refuge System Administration Act).

Key West National Wildlife Refuge

"... a preserve and breeding ground for native birds." Executive Order 923 dated August 8, 1908.

"... particular value in carrying out the national migratory bird management program." 16 U.S.C. 667b (An Act Authorizing the Transfer of Certain Real Property for Wildlife, or other purposes).

to provide protection of these areas... and to ensure"...the preservation of their wilderness character..." Wilderness Act of 1964 (Public Law 88-577)

Great White Heron National Wildlife Refuge

"... as a refuge and breeding ground for great white herons [white phase of the great blue heron], other migratory birds and other wildlife." Executive Order 7993, dated October 27, 1938.

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

"... to conserve (A) fish or wildlife which are listed as endangered species or threatened species .... or (B) plants ..." 16 U.S.C. 1534 (Endangered Species Act of 1973).

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

National Wildlife Refuge System Mission:

The mission of the System, as defined by the National Wildlife Refuge System Improvement Act of 1977, 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:

Compatibility determinations for each description listed were considered separately. Although 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 apart from the comprehensive conservation plan.

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 (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, U.S.C.668dd)
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

Compatibility determinations for each description listed were considered separately. Although for brevity, the preceding sections from “Uses” through “Other Applicable Laws, Regulations and Policies” and the succeeding sections, “Literature Cited,” “Public Review,” and the “Approval of Compatibility Determinations” are only written once in the CCP, they are part of each descriptive use and become part of that compatibility determination if considered outside of the CCP.

Description of Use:
Environmental Education and Interpretation

Environmental education and interpretation comprise a variety of activities, mediums, and facilities that seek to increase the public’s knowledge and understanding of wildlife and to promote wildlife conservation. These are tools used to inform the public of resource values and issues. Examples of environmental education activities include staff or teacher-led events, student and teacher workshops and nature studies. Interpretive programs and facilities include special events, visitor center displays, interpretive trails, visitor contact stations, brochures and signs. Most activities, programs, and facilities are located on National Key Deer Refuge.

Availability of Resources: Facilities, such as visitor centers, trails and kiosks require funding to build and staff to operate and maintain, but they are a necessary expense to carry-out the refuges’ mission. The management of a volunteer program is essential to implement the environmental education and interpretive programs. A full-time refuge ranger position is allocated to this and the other visitor services tasks.

Anticipated Impacts of the Use: The use of the refuges for on-site, hands-on, action-oriented activities by groups to accomplish environmental education objectives may impose short-term impacts on the sites used for the activities. Impacts include trampling of vegetation and temporary disturbance to wildlife species in the immediate use area. Group activities would not be done where impacts would be permanent or long-lasting. Most of the interpretive activities occur on hardened surfaces and existing trails and pose a minimal threat to wildlife and habitat.

Public Review Comment: Public meetings were held on June 9 and 10, 2008 in Monroe County, Florida. The public review and comment period for the compatibility determinations coincided with the review of the Draft Comprehensive Conservation Plan and Environmental Assessment for the Lower Florida Keys Refuges as they were included in Appendix F. Comments were accepted for a month-long period ending June 23, 2008.

Determination (check one below):

___ Use is Not Compatible
_X_ Use is Compatible with Following Stipulations

Stipulations Necessary to Ensure Compatibility: Activities should be held on hardened sites where minimal impact will occur. Periodic evaluation of the sites and program activities should be done to assess whether the program objectives are being met and whether resources are being degraded. If adverse impacts become evident, environmental education and interpretive activities may need to be rotated, moved, reduced, or eliminated. Certain areas of the refuge may be restricted seasonally to avoid disturbance of breeding or nesting wildlife or to protect sensitive habitat.

Justification: Environmental education and interpretation are priority public uses under the National Wildlife Refuge System Improvement Act. The refuge uses environmental education and interpretation to motivate citizens of all ages to support and practice wildlife and wild lands stewardship. Environmental education and interpretation can have positive outcomes, such as instilling a land preservation ethic in visitors, developing support for the refuge, and lessening vandalism, poaching and littering. Through these combined activities, the refuge reaches a diverse group of more than 90,000 visits annually, primarily at NKDR. Refuge outreach also occurs on Key West and Great White Heron refuges through occasional public contacts in the field, at public events, and through the Florida Keys EcoDiscovery Center in Key West.

Mandatory 15-year Re-evaluation Date: 09/14/2024

Description of Use:
Hiking/daypacking, jogging and walking (NKDR)

Refuge roads, firebreaks, and developed trails on the mainline islands of National Key Deer Refuge are commonly used by local residents and visitors for walking, hiking, daypacking, jogging, and bicycling. This evaluation addresses specifically foot traffic only by individuals and small groups (bicycling is evaluated separately).

Availability of Resources: The roads, firebreaks, and trails are maintained for refuge purposes and therefore do not constitute additional cost for these public activities. All are maintained by a combination of volunteers and refuge staff.

Anticipated Impacts of the Use: Impacts from these activities could include wildlife disturbance, collecting, poaching, plant removal, littering, and vandalism.

Public Review Comment: Public meetings were held on June 9 and 10, 2008 in Monroe County, Florida. The public review and comment period for the compatibility determinations coincided with the review of the Draft Comprehensive Conservation Plan and Environmental Assessment for the Lower Florida Keys Refuges as they were included in Appendix F. Comments were accepted for a month-long period ending June 23, 2008.

Determination (check one below):

___ Use is Not Compatible
_X_ Use is Compatible with Following Stipulations

Stipulations Necessary to Ensure Compatibility: Hiking, jogging, and walking are restricted to daylight hours, specifically 1/2-hour before sunrise and 1/2-hour after sunset. Non-refuge-sponsored groups must apply for a special use permit. Athletic races and other non-wildlife dependent organized events are prohibited. Certain areas of the refuge may be restricted seasonally to avoid disturbance of breeding or nesting wildlife or to protect sensitive habitat. All trash must be packed out and properly disposed off-site. Pets must be kept on a leash at all times. These activities are prohibited in all posted closed areas, including (but not limited to) Watson Hammock and Cactus Hammock on Big Pine Key and the wetland area on Ohio Key.

Justification: These activities are low impact and considered to be wildlife-oriented. Observation of wildlife is enhanced by using the many trails offered at the refuge.

Mandatory 10-year Re-evaluation Date: 09/14/2019

Description of Use:
Bicycling (National Key Deer Refuge)

Refuge roads, firebreaks, and trails on the mainline islands of National Key Deer Refuge are often used by local residents and visitors for bicycling.

Availability of Resources: The roads, firebreaks, and trails are maintained for refuge purposes and do not incur any additional costs for allowing bicycling.

Anticipated Impacts of the Use: Minor impacts may occur, such as wildlife disturbance, collecting, poaching, soil compaction, vegetation trampling, littering, and vandalism. Bicyclists may occasionally compete for trail use with other visitors traveling on foot or horseback. Refuge law enforcement officers patrol regularly and volunteers and refuge staff regularly pick-up litter.

Public Review Comment: Public meetings were held on June 9 and 10, 2008 in Monroe County, Florida. The public review and comment period for the compatibility determinations coincided with the review of the Draft Comprehensive Conservation Plan and Environmental Assessment for the Lower Florida Keys Refuges as they were included in Appendix F. Comments were accepted for a month-long period ending June 23, 2008.

Determination (check one below):

___ Use is Not Compatible
_X_ Use is Compatible with Following Stipulations

Stipulations Necessary to Ensure Compatibility: Bicycling is not allowed in Great White Heron or Key West NWRs. Bicycling is restricted to refuge-maintained roads, firebreaks, and trails on the mainline islands of National Key Deer Refuge, with the exception of the Blue Hole, Watson, and Mannillo interpretive trails on Big Pine. Bicycling is prohibited in all posted closed areas, including (but not limited to) Watson Hammock and Cactus Hammock on Big Pine Key and the wetland area on Ohio Key. Off-road and off-trail biking is prohibited. Non-refuge sponsored groups of more than 10 cyclists must apply for a special use permit. Athletic and competitive (e.g., extreme sport) events are prohibited. Bicycling is restricted to the following hours: 1/2-hour before sunrise and 1/2-hour after sunset. Certain areas of the refuge may be restricted seasonally to avoid disturbance of breeding or nesting wildlife or to protect sensitive habitat. All trash must be packed out and properly disposed off-site. Pets must be kept on a leash at all times.

Justification: Bicycling on refuge-maintained roads and trails is considered a low impact, wildlife-oriented use. Some parts of the refuge, such as Upper and Lower Sugarloaf Keys, are more easily accessed by bicycle since distances are too great for access by foot for some persons.

Mandatory 10-year Re-evaluation Date: 09/14/2019

Description of Use:
Wildlife observation and photography

Wildlife observation is the viewing of fish, wildlife, plants, or their habitats by refuge visitors. Photography is defined as refuge visitation for the purpose of photographing refuge natural or cultural resources or public uses of those resources for personal use. Photography conducted for commercial, news, or educational purposes is allowed only as authorized in a special use permit. Non-consumptive wildlife observation uses include bird watching and nature photography by walking or using motorized vehicles, boats, bicycles, or horses. Foot travel is generally allowed on refuge roads, firebreaks, and trails.

Availability of Resources: Trails are maintained and patrolled for refuge purposes and recreational use and require no additional maintenance costs for wildlife observation and photography. Additional platforms, photography blinds, or towers to encourage these uses on the refuge would involve new construction and maintenance costs.

Anticipated Impacts of the Use: Some violations of refuge regulations are anticipated, such as wildlife disturbance, collecting, poaching, plant removal, littering, and vandalism.

Public Review Comment: Public meetings were held on June 9 and 10, 2008 in Monroe County, Florida. The public review and comment period for the compatibility determinations coincided with the review of the Draft Comprehensive Conservation Plan and Environmental Assessment for the Lower Florida Keys Refuges as they were included in Appendix F. Comments were accepted for a month-long period ending June 23, 2008.

Determination (check one below):

___ Use is Not Compatible
_X_ Use is Compatible with Following Stipulations

Stipulations Necessary to Ensure Compatibility: Law enforcement patrol of public use areas should continue to minimize violations of refuge regulations. The refuge is closed overnight. Some areas may be closed to the public seasonally to protect wildlife from disturbance or to protect habitat. Public use is prohibited in all posted closed areas, including (but not limited to) Watson Hammock and Cactus Hammock on Big Pine Key, the wetland area on Ohio Key, and designated beaches and whole islands in Key West and Great White Heron NWRs. Refuge access is restricted to ½ hour before sunrise to ½ hour after sunset. All trash must be packed out and properly disposed off-site. Pets must be kept on a leash at all times. A special use permit would be required for after-hours use or for commercial photography.

Justification: Wildlife observation and photography are priority public uses under the National Wildlife Refuge System Improvement Act.

Mandatory 15-year Re-evaluation Date: 09/14/2024

Description of Use:
Fishing

Fishing refers to traditional, recreational, and fishing with a hook and line. Saltwater fishing occurs in state-managed waters on all three refuges. Key West and Great White Heron NWRs have huge expanses state-managed marine waters that support sport and commercial saltwater fishing, and some fishing occurs from the shorelines of refuge islands. At National Key Deer Refuge, there are two areas with accessible shoreline at Ohio Key and Long Beach trail. Fishing is prohibited in the Blue Hole and other freshwater managed areas of National Key Deer Refuge.

Availability of Resources: Staff resources are adequate for allowing this use. This is an established part of law enforcement officer duties in coordination with Florida Fish and Wildlife Conservation Commission officers. Litter control is handled by refuge staff and volunteers.

Anticipated Impacts of the Use: The primary impacts of this use are disturbance to and the taking of non-target wildlife species, littering, vegetation and dune trampling, and water pollution from boat motors. Secondary impacts may include wildlife injury or death by entanglement or ingestion of discarded fishing line and hooks.

Public Review Comment: Public meetings were held on June 9 and 10, 2008 in Monroe County, Florida. The public review and comment period for the compatibility determinations coincided with the review of the Draft Comprehensive Conservation Plan and Environmental Assessment for the Lower Florida Keys Refuges as they were included in Appendix F. Comments were accepted for a month-long period ending June 23, 2008.

Determination (check one below):

___ Use is Not Compatible
_X_ Use is Compatible with Following Stipulations

Stipulations Necessary to Ensure Compatibility: All fishing activities must adhere to state fishing laws and regulations. Fishing from shorelines on the refuge is restricted to refuge hours (i.e., daylight use). No improvements to fishing areas, such as docks and piers, will be developed.
Justification: Fishing is a priority public use under the National Wildlife Refuge System Improvement Act and a wildlife-dependent activity that is compatible with refuge purposes.

Mandatory 15-year Re-evaluation Date: 09/14/2024

Description of Use:
Beach Use (Picnicking, Sunbathing, Shelling, Swimming, Snorkeling) (National Key Deer Refuge)

There are currently no designated picnic sites within the National Key Deer Refuge; however, informal picnicking and sunbathing is allowed on the beaches. Entry to and from the water for shelling, swimming, and snorkeling is allowed from the shoreline, except in posted closed areas. In 1975, Wilderness designation (Public Law 93-632) was conferred on many islands in National Key Deer Refuge. This designation applied only to the islands themselves, not the state sovereign submerged lands and waters surrounding them. Because nearly all wilderness islands are dominated by mangrove forests, they afford no opportunity for public use and are closed to public entry.

Availability of Resources: The beaches are maintained by refuge staff and volunteers.

Anticipated Impacts of the Use: No significant impacts are anticipated from limited beach use. Some littering, vandalism, plant removal, and feeding/disturbance of wildlife may occur. Violations would be infrequent and confined to the small areas. Litter is controlled through the waste pickup by refuge and contracted staff and by volunteers. Informal picnicking at other non-designated sites should have only minor impacts.

Public Review Comment: Public meetings were held on June 9 and 10, 2008 in Monroe County, Florida. The public review and comment period for the compatibility determinations coincided with the review of the Draft Comprehensive Conservation Plan and Environmental Assessment for the Lower Florida Keys Refuges as they were included in Appendix F. Comments were accepted for a month-long period ending June 23, 2008.

Determination (check one below):

___ Use is Not Compatible
_X_ Use is Compatible with Following Stipulations

Stipulations Necessary to Ensure Compatibility: All beach use is confined to the following hours: 1/2-hour before sunrise and 1/2-hour after sunset yearly. Law enforcement patrol of the beach areas should minimize any violations of refuge regulations. The following activities are not appropriate for a wildlife refuge and are consequently prohibited on refuge beaches open to public access: beach games (e.g., volleyball, frisbee, badminton, football, and catch); blaring of

radios, stereos, music players or excessive noise (e.g., screaming and yelling); use of grills, barbecues, smokers, or fire pits; campfires and camping; use of portable generators; and littering or dumping of trash. Umbrellas, tents, and chairs may not be set-up, left behind, or used. All trash must be packed-out and properly disposed of off-site. Pets must be kept on a leash at all times to avoid disturbance to wildlife. The public is prohibited from entering all posted closed areas, including the islands designated as Wilderness.

Justification: While none of these uses are wildlife-dependent, the beaches give refuge visitors a place to walk, swim from shore, or rest and observe wildlife with minimal disturbance. There are many other public beaches managed by the state, county, or local municipalities specifically for recreation that provide adequate opportunities to conduct those activities that are prohibited on refuge beaches.

Mandatory 10-year Re-evaluation Date: 09/14/2019

Description of Use:
Beach Use (Picnicking, Sunbathing, Shelling, Swimming, Snorkeling) (Key West NWR)

In 1975, Wilderness designation (Public Law 93-632) was conferred on all islands in Key West NWR. This designation applied only to the islands themselves, not the state sovereign submerged lands and waters surrounding them. Because nearly all wilderness islands are dominated by mangrove forests, they afford no opportunity for public use and are closed to public entry. The exceptions are the seven, distinct beaches on the Marquesas Keys and the beaches on Woman and Boca Grande Keys. This compatibility determination applies only to the island beaches of these three keys.

The islands are remote; the nearest, Woman Key, is about 16 km west of Key West and the most distant, the Marquesas Keys, is about 40 km from this town. One-half of the beaches on Woman and Boca Grande Keys, islands harboring threatened piping plovers, were closed to human visitation in 1992 to protect wildlife from human-caused disturbance. All refuge beaches are narrow and inundated at high tide. With the exception of the northwest part of Boca Grande Key, all are bordered by extensive tidal flats, including substantial seagrass beds. During high use periods, typical beach use on Boca Grande Key includes partying, sunbathing, and picnicking.

Availability of Resources: Two refuge law enforcement officers are charged with patrolling land and water areas in the four distinct refuges comprising the Lower Florida Keys NWR Complex. One of the officers has been designated for patrol in the backcountry areas of the Key West NWR.

Anticipated Impacts of the Use: Dune vegetation is fragile and sensitive to trampling by humans (McConnel 1981). On Boca Grande Key and three islands in the Marquesas Keys (Bradley 1999 a,b,c,d), the vegetation includes the endangered Garber's spurge. Landward of the narrow beaches are intricate networks of dunes and salt tolerant shrubs. Plants adapted to the dune environment form a fragile network holding the sand in place (McDonnell 1981, Carter et al. 1990a). Dune cohesion is increased by plant roots, without which undercutting of the dune can be continuous during storms (Carter et al. 1990b). Erosion can be so severe as to remove the protective beach, scarp the dune, and completely shift the dune crest (Carter et al. 1990a).

On some summer weekends—especially the Memorial Day weekend—acute overcrowding has been a long-term problem on Boca Grande Key on the island's northwest side, which has the only deep water access to the beach. During some peak-use weekends, scores of boats and hundreds of people are concentrated in a 600-foot-long area, where the beach is either very narrow or fully inundated by tides. As a result, dune vegetation is damaged, destabilizing the beach and fostering erosion. Signs informing visitors not to enter the dunes are often ignored when visitor numbers are high. Some visitors ascend dune-bordered scarps and further destabilize these highly erosion-prone areas. The endangered Garber's spurge can be damaged or killed by visitors entering the dunes. When this and other species of dune vegetation are damaged, the disturbed conditions may spur the invasion of non-native grasses or forbs, which may then displace native species.

Two trust species may be adversely affected by public use of the islands - green sea turtles and Miami blue butterflies. All green turtle nesting since 1990 on Boca Grande Key has occurred on the island's northwest side, nearly always in the dune vegetation. The dune's width has been progressively shrinking; its now-extreme narrowness looms increasingly as a threat to successful turtle nesting. Inadvertent walking above sea turtle nests can cause collapse and kill hatchlings (Dutton et al. 1994); compaction of sand from foot traffic can preclude the emergence of hatchlings (Mann 1977); pedestrian tracks and litter can impede movements by hatchlings (Hosier et al. 1981; Dutton et al. 1994). Sun umbrellas, chairs, towels, and other beach accessories—all observed on refuge beaches—can cause shading of nests and alter incubation temperatures (Arianoutsou 1988). Protection of nesting beaches is considered one of the highest priorities for perpetuation of sea turtles (Dodd 1988; Dodd 1992; Ehrhart 1992; NMFS and USFWS 1991a,b; Meylan et al. 1995; McClenachan et al. 2006).

Boca Grande Key and five islands in the Marquesas Keys harbor the state-endangered Miami blue butterfly. Once thought to be extinct in the United States, only a tiny population (<100 individuals) occurs outside the refuge. The refuge population numbered more than 1,000 individuals during recent surveys (November 2006—April 2007), where it was found only in dunes and low shrubs bordering refuge beaches. During the surveys, damage to beach vegetation by human visitors was documented on Boca Grande Key and three of the Marquesas beaches. Negative impacts to the habitat of the Miami blue butterfly and threatened and endangered nesting sea turtles would occur if the recommended restrictions are not implemented.

Conflicts among user groups are inevitable when large numbers of visitors are present in a confined area. Those seeking wildlife-dependent recreational activities are stymied in their pursuit because of the sheer density of people. Alcohol consumption is prevalent on holiday weekends, escalating the risk of violent behavior. In 2006, a fight among a number of visitors on Boca Grande Key required multiple agency law enforcement intervention to curtail the problem. Because the beaches on Boca Grande and Woman Keys are extremely narrow, visitors walking on the beach pass within mere feet of other visitors on the island. The presence of a large number of people on such a tiny island deprives all visitors of any opportunity for, as stated in the Wilderness Act of 1964, "...opportunities for solitude or a primitive or unconfined type of recreation."

Natural areas are influenced by both the extent and concentration of human activities (Jacobson and Lopez 1994). The concept of visitor carrying capacity, defined here as the threshold where public use degrades the resource base and excessive visitor numbers debase the wilderness experience, is a relevant concept to the problem of overcrowding on wilderness islands. The Service recognizes that public use of wilderness areas may lead to serious damage of the wilderness resource (6 RM 8.9A). Specific reference is made to public use in sensitive areas or tracts of small size (6 RM 8.9A), both of which would be applicable to the beaches in Key West NWR: "Excessive public use of sensitive areas or

small units, particularly those located in populated areas, may warrant special regulations to limit the number of visitors or the duration of visits." Further, “Wilderness areas may be closed to all public use if such use is determined to be incompatible with refuge purposes” (6 RM 8.9A).

Although visitor carrying capacity in protected areas is a subjective matter (see Moore and Polley 2007), it is inherently very low on refuge beaches because: (1) the stabilizing dune vegetation is easily damaged by trampling; (2) the beaches are short and extremely narrow, thereby concentrating visitors; (3) all refuge beaches are designated as federal wilderness—overcrowding is contrary to federal wilderness management guidelines; (4) overcrowding ruins the experience of visitors seeking a wilderness experience in a site designated for that purpose; (5) Miami blue butterfly nesting and foraging areas and sea turtle nesting habitat can be degraded by visitors walking on the dune vegetation; and (6) access to some beaches is limited by shallow water, thereby concentrating arriving visitors at deeper water access points.

Key West NWR was established as “a preserve and breeding ground for native birds and other wildlife. ”To meet this mandate, and the mandates of preserving wilderness character (Wilderness Act of 1964) and promoting wildlife dependent public uses (National Wildlife Refuge System Improvement Act of 1997), it is necessary to establish and enforce carrying capacities for visitor use on all refuge beaches, particularly during holiday weekends. Carrying capacities would reflect known differences among beaches and dunes, including access to boaters, public use patterns, wildlife populations, and habitat concerns. During holiday weekends, on Boca Grande Key, it may prove necessary to close this beach in its entirety. This action may lead to severe overcrowding on Woman Key (although this area has poor beach access), or have the highly undesirable effect of shunting visitors to the more distant and pristine islands in the Marquesas Keys. Currently, enforcement personnel are inadequate to enforce carrying capacities or a holiday beach closure at Boca Grande Key. If instituted, these measures would demand careful scrutiny to ensure that intended purposes are achieved, with changes instituted to achieve the referenced refuge mandates.

Public Review Comment: Public meetings were held on June 9 and 10, 2008 in Monroe County, Florida. The public review and comment period for the compatibility determinations coincided with the review of the Draft Comprehensive Conservation Plan and Environmental Assessment for the Lower Florida Keys Refuges as they were included in Appendix F. Comments were accepted for a month-long period ending June 23, 2008.

Determination (check one below)
___ Use is Not Compatible
_X_ Use is Compatible with the Following Stipulations

Stipulations Necessary to Ensure Compatibility: Beach use should be deemed compatible only if damage by visitors to adjacent dune vegetation is curtailed. A cogent, persistent message to the public should be purveyed about the necessity of not walking on dune vegetation. Given that all beaches are under water at high tide, visitors must be urged to remain in their boats at such time to avoid trampling of the dune vegetation. Damaged areas should be placed off limits and a wooden dune fence erected to effect habitat restoration.

The impact of beach visitors on Boca Grande Key must be monitored, particularly on the northwest side of the island. If dune habitat integrity cannot be maintained by setting and enforcing visitor carrying capacities in this area, as well as in other refuge beach/dune areas, and by implementing a holiday beach closure, then it should be closed to protect the dwindling nesting habitat for the endangered green sea turtle and the Miami blue butterfly.

Without setting carrying capacities or instituting beach closures, as circumstances dictate, beach and associated dune areas in the refuge may be subjected to levels of visitor use that are contrary to stated mandates for the refuge. In such areas, use may be precluded.

Law enforcement patrol of the beach areas should minimize any violations of refuge regulations. Shelling is restricted to the collection of uninhabited shells. No taking of shells with live animals (e.g., mollusks or hermit crabs) is allowed. The following are prohibited on refuge beaches in Key West NWR: all pets, beach games (e.g., volleyball, frisbee, badminton, football, and catch); blaring of radios, stereos, music players, or excessive noise (e.g., screaming and yelling); use of grills, barbecues, smokers, or fire pits; campfires and camping; use of portable generators; and littering or dumping of trash. Trash must be carried out. Umbrellas, tents, and chairs may not be set-up, used, or left behind. Beach use is restricted to the following hours: 1/2-hour before sunrise and 1/2-hour after sunset year-round.

Justification: While not a priority public use or wildlife-dependent use, beach use is popular among residents and tourists alike and, as sand beaches are rare in the Florida Keys, demand is high. Beaches are a major attraction for Monroe County's tourism-based economy. The refuge will accommodate passive beach uses that encourage wildlife viewing with minimal impacts and disturbance to habitat and wildlife in Key West NWR, unless additional restrictions become warranted to protect trust resources.

Mandatory 10-year Re-evaluation Date: 09/14/2019

Description of Use:
Research and monitoring

This includes scientific research, baseline inventory, long-term monitoring, and scientific collecting conducted by non-refuge personnel on refuge lands. Research and monitoring are used to help increase knowledge and understanding of animals, plants, habitats, and ecosystem processes found on the refuge. This activity will allow both short- and long-term research projects by other resource agencies, universities, non-profit organizations, and other research entities. Results of research and monitoring allow refuge managers to evaluate management activities and adapt those activities to be more effective. All researchers shall be required to obtain special use permits from the refuge. The research is very wide-ranging in nature and includes activities such as animal radio tracking, biological studies, vegetation surveys, animal trapping, and disease monitoring.

Availability of Resources: Other than administration of associated special use permits, no refuge resources above general operational costs are required for this use. Researchers typically provide all the materials needed and, depending on the project, the refuge may provide support with office space, housing (bunkhouse), boats, and/or vehicles.

Anticipated Impacts of the Use: Generally, impacts from research and monitoring are minimal. There may be some slight or temporary disturbance to wildlife or habitats, such as minor trampling of vegetation or flushing of birds. These impacts are not significant or permanent. A small number of individual plants or animals might be collected for further scientific study, but these collections are anticipated to have minimal impact on the populations from which they came. The collection or monitoring of field data during a research project may cause mortality to some target species. Minor

habitat and temporary wildlife disturbance may also occur. Research project impacts are minimized by applying stipulations on research activities under the special use permit by refuge personnel. Interim and final reports are required under the special use permits.

Public Review Comment: Public meetings were held on June 9 and 10, 2008 in Monroe County, Florida. The public review and comment period for the compatibility determinations coincided with the review of the Draft Comprehensive Conservation Plan and Environmental Assessment for the Lower Florida Keys Refuges as they were included in Appendix F. Comments were accepted for a month-long period ending June 23, 2008.

Determination (check one below):

___ Use is Not Compatible
_X_ Use is Compatible with Following Stipulations

Stipulations Necessary to Ensure Compatibility:

Special use permits will stipulate any specific restrictions that apply to the study, proposed methods, or study area. These are done on a case-by-case basis. Interim and final reports are required. In applying for special use permits, researchers are required to show proof that they have fulfilled all other applicable permitting requirements, such as state collecting permits and endangered species permits.

Justification: Research and monitoring can provide important benefits to the refuge and the natural resources supported by the refuge. Research conducted on the refuge can lead to new discoveries, new facts, verified information, and better management decisions. Research and monitoring is vital for furthering knowledge and understanding of refuge resources. The refuge is the largest landowner in the Lower Florida Keys and, in conjunction with refuge-managed state and county lands, provides the most available research opportunities.

Mandatory 10-year Re-evaluation Date: 09/14/2019

Description of Use:
Mosquito Control Operations (National Key Deer Refuge and Great White Heron NWR)

The Florida Keys Mosquito Control District (District) conducts a program to monitor, research, and control mosquito populations on the National Key Deer Refuge and Great White Heron NWR. Due to the diversity of the mosquito fauna in the Keys, the subtropical climate, and the proximity of the Keys to the Caribbean, where active transmission of several disease organisms is ongoing, the District believes that a potential exists for the transmission and spread of mosquito-borne diseases. These diseases include malaria, St. Louis encephalitis, eastern equine encephalitis, and West Nile virus. The District's work is performed under a refuge-issued special use permit.

The District and the refuges have developed an integrated pest management program that includes the use of both larvicide (*Bacillus thuringiensis israelensis* or BTI) and adulticide (Naled) to control mosquitoes. BTI is a selective microbial insecticide targeting mosquito larvae and some other non-target dipterans, with minimal impact to other non-target species. By treating mosquito breeding areas on the backcountry keys with BTI, the District has demonstrated that it can dramatically reduce the need to use broad-spectrum adulticides on the mainline keys to control mosquitoes. Refuge sites

to be treated with larvicide include all areas within the National Key Deer Refuge and Great White Heron NWR that are serviced by primary and secondary roads. In addition, islands not connected by roads (e.g., Annette, Mayo, Porpoise, Johnson, Horseshoe, Howe, Raccoon, Pumpkin, Johnston, Little Pine Keys, Johnson Keys, and Water Keys) may be aerially treated with BTI.

Naled has been used as a mosquito adulticide in the Keys for more than 30 years. Refuge lands are interspersed with private property and development, making it impossible to develop separate mosquito spraying programs for both public and private lands. Control of mosquitoes in developed areas of the Keys requires that some refuge lands be treated. Areas to be treated will consist of all refuge lands adjacent to and interspersed within existing human development and serviced by primary and secondary roads. This includes refuge lands on Big Pine, No Name, Middle Torch, and Big Torch Keys, consisting of 6,000 acres; however, Naled will not be applied in the Watson Hammock or Cactus Hammock areas on Big Pine Key or on the southern half of No Name Key. On more isolated refuge lands of Cudjoe, Sugarloaf, and Boca Chica Keys, as well as the Saddlebunch Keys, only privately owned and developed areas will be sprayed; therefore, refuge properties on these Keys will not be affected by mosquito spraying.

The District and Service continue to collaboratively assess the effectiveness of mosquito control activities and evaluate impacts on priority species; consequently, operations will continue to be reviewed and adjusted as necessary.

Availability of Resources: All aspects of this mosquito spraying program will be financed and administered by the District. Refuge and Ecological Services' staffs will participate in the annual review and evaluation of mosquito control operations and special use permit compliance, and oversee field studies on biological impacts of mosquito spraying on non-target species.

Anticipated Impacts of the Use: Naled is a broad-spectrum adulticide that can kill a wide variety of insects, fish, and wildlife. Naled is characterized as highly toxic to bees and aquatic invertebrates, moderately to highly toxic to fish, moderately to highly toxic to birds, and moderately toxic to mammals; however, the Environmental Protection Agency has determined that Naled used in mosquito control programs according to label directions does not pose unreasonable risks to wildlife or the environment. With the exception of the Stock Island tree snail (*Orthalicus reses reses*), the South Florida Multi-Species Recovery Plan does not list mosquito spraying as an identified threat to any federally listed threatened or endangered species in the Lower Keys.

Environmental risk assessments conducted on the Key deer, silver rice rat, eastern indigo snake, and Lower Keys marsh rabbit suggest that Naled is not likely to cause acute or chronic poisoning given the application rates and application frequencies proposed by the District with stipulations under the refuge special use permit. Because the Level of Concern standards for endangered species are much higher than those set for other wildlife, it can be assumed that the aerial application of Naled is not likely to result in acute or chronic toxicity in other resident and nonresident wildlife species. As a result of pesticide drift, some Naled may inadvertently contaminate aquatic environments; however, aerially applied Naled will reach the water surface at reduced concentrations and degrade rapidly, thus posing little or no risk to fish populations in the Keys.

Laboratory studies have shown that Naled is highly toxic to bees and estuarine/marine invertebrates. It can be assumed that terrestrial invertebrates, including butterflies and tree snails, are also highly susceptible to Naled poisoning. Any adverse effects of Naled to vertebrate and invertebrate communities would be minimized through the application of the pesticide in concert with an expanded use of BTI throughout the Lower Keys. Reduced application frequencies would minimize the numbers of invertebrates directly poisoned by Naled. Reduced

applications would also result in applications being spaced farther apart in time. This would allow unaffected eggs, larvae, pupae, and adult's time to complete their life cycles, allowing for a rapid buildup of invertebrate populations to pre-application levels.

BTI is a microbial larvicide that is applied to aquatic habitats where mosquito larvae occur since it must be ingested to be effective. Because it must be ingested by the mosquito larvae, it is largely species-specific and poses a minimal threat to non-target vertebrate and invertebrate species. This bacterium produces a crystal-containing spore that causes fragment toxicity when ingested by the mosquito larvae. It is species-specific and affects the larvae of mosquitoes, black flies, and midges. Of these, only mosquitoes are found in the Keys in any numbers. Experimental testing has shown no demonstrated effect against other aquatic insects, including dragonflies, damselflies, mayflies, stoneflies, caddis flies, and water beetles. Other invertebrates, such as Daphnia, cyclops, rotifers and crustaceans, are also not susceptible to BTI. A summary review of mammalian toxicity studies has revealed no known mammalian health effects resulting from BTI. It is not a phytotoxic and has shown no effect on seed germination or plant vigor.

Public Review Comment: Public meetings were held on June 9 and 10, 2008 in Monroe County, Florida. The public review and comment period for the compatibility determinations coincided with the review of the Draft Comprehensive Conservation Plan and Environmental Assessment for the Lower Florida Keys Refuges as they were included in Appendix F. Comments were accepted for a month-long period ending June 23, 2008.

Determination (check one below):

___ Use is Not Compatible
_X_ Use is Compatible with Following Stipulations

Stipulations Necessary to Ensure Compatibility:

- Areas to be treated with Naled will be limited to refuge lands on Big Pine, No Name, Middle Torch, and Big Torch Keys.
- Naled will be aerially applied at rates of 0.0785 pounds active ingredient/acre or less.
- Naled will be applied at the optimal droplet size of 22-29 microns using ultra-light volume spray equipment.
- All applications of Naled will be made during favorable weather conditions for maximum effectiveness against mosquitoes and to avoid drift.
- The application of Naled is prohibited in Watson Hammock and Cactus Hammock on Big Pine Key, as well as all areas on No Name Key south of Watson Boulevard.
- Naled will be applied in concert with the expanded use of BTI to reduce the number of applications of Naled to nine per season with applications spaced no closer than 5 days apart. This will minimize the adverse effects to invertebrates from this broad-spectrum adulticide.
- Refuge sites to be treated with BTI include all areas within the National Key Deer Refuge and Great White Heron NWR serviced by primary and secondary roads. Treatment of backcountry islands with BTI will be limited to Annette, Mayo, Porpoise, Horseshoe, Howe, Raccoon, Pumpkin, Johnston, and Little Pine Keys, Water Keys, and Johnson Keys.

Justification: Refuge lands are tightly interspersed with private property and residential and commercial development, making it impossible to separate mosquito control programs for the two areas. Controlling mosquitoes in developed areas of the Keys requires that some refuge lands also be treated. It is the desire of the refuges to ensure that the required control of mosquitoes be

conducted with as little use of the adulticide Naled as possible. The District believes much of the Naled applied on refuge lands is the result of mosquitoes migrating from large hatches on adjacent backcountry islands; therefore, the Service has agreed to allow larvicide application on backcountry wilderness islands for an anticipated reduction in the overall application of Naled.

Mosquito control is necessary to protect the general public from the threat of mosquito-borne diseases in the Florida Keys. Furthermore, a mosquito control program which reduces nuisance pests is vital in supporting the ability of the Florida Keys to remain a tourist destination, as well as maintaining a comfortable environment for both residents and tourists alike. The Service must strive to be a good neighbor and develop management programs that not only protect its trust resources but that also do not adversely affect the communities that surround them.

Mandatory 10-year Re-evaluation Date: 09/14/2019

Description of Use:
Horseback Riding (National Key Deer Refuge)

Horseback riding is an existing use on National Key Deer Refuge that facilitates wildlife observation. As proposed, horseback riding would occur only on refuge roads and firebreak trails. There is no designated parking for horse trailers, which limits use on the refuge mainly to nearby residential users. Use is light and sporadic, occurring mostly by local residents.

Availability of Resources: Based on existing refuge expenditures for managing visitor use, funding is adequate to ensure compatibility and to administer and manage the recreational use listed.

Anticipated Impacts of Use: A literature review was conducted to evaluate the potential effects of horseback riding on wildlife, habitat, human health, cultural resources, and other refuge uses. Although wildlife disturbance from horseback riding is not well-documented, some studies suggest that many wildlife species are habituated to livestock and that horseback wildlife observers can approach wildlife at closer distances than by other forms of travel. Any form of approach is expected to cause some disturbance, which will vary according to the species affected and the type, level, frequency, and duration of disturbance, as well as the time of day or year that it occurs.

Horseback riding has both direct and indirect effects on habitat. Trampling causes mortality of plant and animal species. Indirect effects result when soil is compacted and plants cannot re-establish. Grazing can reduce vegetation. There is a debate over whether horse hair or feces can spread exotic weed seed. Any trail or road can be a conduit for the introduction of exotic plants, since exposed soil and abundant sunlight provide favorable conditions for establishment.

Compacting and loosening of soils occur from stock riding, more so in moist or wet soils. Therefore, trails should be established in well-drained, upland sites. Roads and trails for public access affect hydrologic drainage patterns.

While it is possible for horses to transmit parasitic diseases, particularly *Cryptosporidium parvum* and *Giardia duodenalis*, to humans via the water supply, these diseases are usually spread by pregnant mares and foals under 6 months old, not through adult horse guts. Horse manure is not harmful to human health, although it can cause conflicts with other trail users since it can be odorous, unaesthetic, and a nuisance.

While there can be user group conflicts or safety issues resulting from hikers, cyclists, and horseback riders using the same roads and trails, there have not been such conflicts or issues, nor are they anticipated effects due to the current levels of use. Horseback travel on the designated roads and fire breaks is considered safe under current conditions and levels of use.

Public Review Comment: Public meetings were held on June 9 and 10, 2008 in Monroe County, Florida. The public review and comment period for the compatibility determinations coincided with the review of the Draft Comprehensive Conservation Plan and Environmental Assessment for the Lower Florida Keys Refuges as they were included in Appendix F. Comments were accepted for a month-long period ending June 23, 2008.

Determination (check one below):

___ Use is Not Compatible
_X_ Use is Compatible with the Following Stipulations

Stipulations Necessary to Ensure Compatibility: Horseback travel is allowed only on National Key Deer Refuge. It is restricted to hardened trails and firebreaks on Big Pine, No Name, Cudjoe and Upper Sugarloaf Keys, incluging Crane Boulevard on Upper Sugarloaf Key. Horses are not allowed on foot or interpretive trails, such as the nature trails at Blue Hole, Watson and Mannillo Nature Trails and Watson Hammock. Riding is only allowed on the refuge during the following hours: one-half hour before sunrise and one-half hour after sunset. Group size is limited to a maximum of six riders who travel no more than two abreast. All roads will be monitored annually to determine if they meet the compatibility criteria. Monitoring will be designed to assess the long-term effects of horse riding on refuge resources and visitor use. Law enforcement patrols will be conducted throughout the year. The patrols will promote compliance with refuge regulations, monitor public use patterns and public safety, and document visitor interactions. Some areas may be closed seasonally or as needed to all visitor use, including horseback riding, to prevent wildlife disturbance or habitat impacts. No commercial ventures involving horseback riding are permitted.

Justification: While not listed as a primary, wildlife-dependent recreational use under the National Wildlife Refuge System Improvement Act, horseback riding by a small number of local residents occurred for decades. If limited to present-day levels of use, horseback riding is believed to be a compatible public use under the stipulations outlined in this compatibility determination. Primary reasons for this determination include the following: wildlife observation can be an element of horseback riding; horseback riding allows us to reach a target audience we would not otherwise reach; horseback riders are potential partners and a potential source of support for the wildlife refuge; and impacts associated with horseback riding are not believed to exceed impacts already caused by other public use activities. This non-priority public use is being allowed since it is a minimal amount of use by a small number of local riders. It will be curtailed if impacts are discovered to wildlife or habitat or if problems occur due to littering or trampling. No trail or facility improvements will be made on the refuge to encourage use over present-day levels or as a tourist attraction. Trail maintenance will take lesser priority than interpretive and walking trails, which are smaller and easier to maintain with a limited number of maintenance staff and volunteers.

Mandatory 10-year Re-evaluation Date: 09/14/2019

Other Uses - The Management Agreement for Submerged Lands within Boundaries of the Key West and Great White Heron NWRs prohibits the use of airboats, personal watercraft, and air-cushioned hovercraft from State of Florida waters and restricts motorboat access in certain areas designated around refuge islands to minimize wildlife disturbance.

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Approval of Compatibility Determinations:

The signature of approval covers all the compatibility determinations considered within the Comprehensive Conservation Plan (CCP) for National Key Deer Refuge and Great White Heron and Key West National Wildlife Refuges. If one of the described uses is considered for compatibility outside of the CCP, the approval signature becomes part of that determination.

Refuge Manager: _____ 7-27-09
(Signature/Date)

Regional Compatibility Coordinator: _____ 8-6-09
(Signature/Date)

Refuge Supervisor: _____ 8/13/09
(Signature/Date)

Regional Chief, National Wildlife Refuge System, Southeast Region: _____ 8/14/09
(Signature/Date)

Appendix G. Intra-Service Section 7 Biological Evaluation

United States Department of the Interior

FISH AND WILDLIFE SERVICE
South Florida Ecological Services Office
1339 20th Street
Vero Beach, Florida 32960

December 12, 2007

Memorandum

To: Anne Morkill, Refuge Manager, Florida Keys National Wildlife Refuge Complex

From: Paul Souza, Field Supervisor, South Florida Ecological Services Office

Subject: Intra-Service Section 7 Consultation on "Draft Comprehensive Conservation Plan and Environmental Assessment for the Lower Florida Keys National Wildlife Refuges"

Attached is our signed concurrence with your intra-Service section 7 Biological Evaluation for the project referenced above. Thank you for coordinating this project with us. If you have any questions, please contact Mark Salvato at 772-562-3909, extension 340.

Attachment

TAKE PRIDE IN AMERICA

INTRA-SERVICE SECTION 7 BIOLOGICAL EVALUATION FORM

Originating Person: Anne Morkill, Project Leader
Telephone Number: (305)872-2239
E-Mail: Anne_Morkill@fws.gov
Date: September 28, 2007

PROJECT NAME:

I. **Service Program:**
___ **Ecological Services**
___ **Federal Aid**
___ **Clean Vessel Act**
___ **Coastal Wetlands**
___ **Endangered Species Section 6**
___ **Partners for Fish and Wildlife**
___ **Sport Fish Restoration**
___ **Wildlife Restoration**
___ **Fisheries**
_X_ **Refuges/Wildlife**

II. **State/Agency:** Florida/U.S. Fish and Wildlife Service

III. **Station Name:** National Key Deer Refuge (complex headquarters)

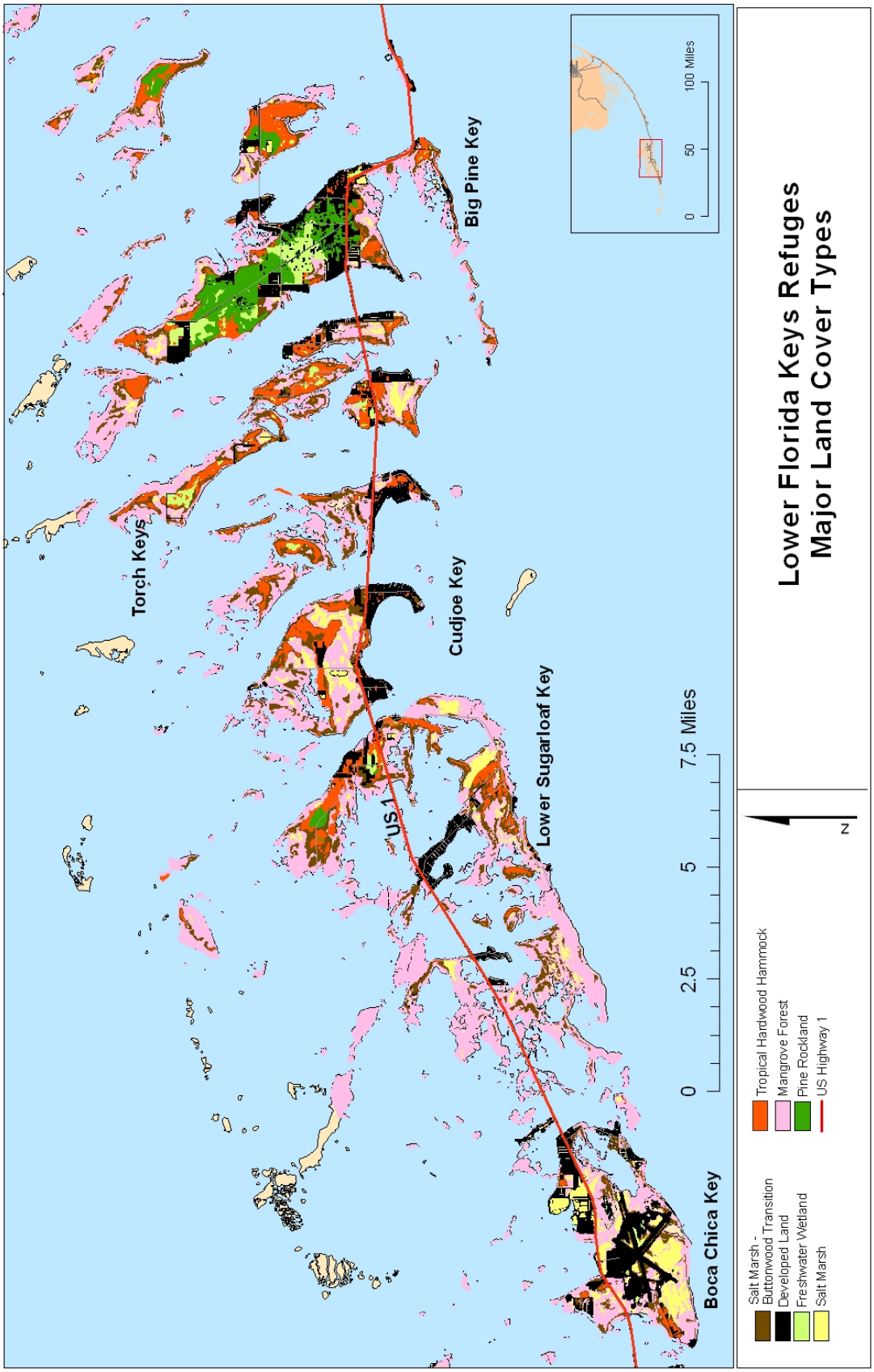
IV. **Description of Proposed Action**

The proposed action would result in the approval and implementation of the preferred alternative in the Comprehensive Conservation Plan (CCP) and Environmental Assessment (EA) for the following refuges: National Key Deer Refuge, Great White Heron and Key West National Wildlife Refuges. This plan would direct management actions on these refuges for the next 15 years. Prior to implementation of identified management actions that affect listed species, the refuge will consult with Ecological Services.

The preferred alternative identified in the plan outlines proposed actions to improve refuge management. It supports the purposes for which the refuges were established and the mission of the National Wildlife Refuge System. It identifies 7 broad goals for habitat, wildlife, imperiled species, visitor services, cultural resources, wilderness, and administration. Specific objectives and strategies for achieving these goals are detailed. The goals, objectives and strategies were developed to support international, national, regional and local conservation plans and initiatives in partnership with other agencies and organizations.

V. **Pertinent Species and Habitat:**

A. **Include species/habitat occurrence map:** Maps are not available for most species. A land cover map is attached.



Source: FL. Dept. Transportation, 2007; U.S Census Bureau, 2000; FL. Fish Wildlife Conservation Commission (FWC), FL. Marine Research Institute, Coastal and Marine Resource Assessment (CAMRA), 1996

VI. Location (see attached map):

A. Ecoregion Number and Name: 52 South Florida

B. County and State: Monroe County, Florida

C. Section, township, and range (or latitude and longitude): 24°41'25.650", 81°22'53.075"

D. Distance (miles) and direction to nearest town: Marathon is 20 miles driving distance and only a few miles from the approved acquisition boundaries of Great White Heron National Wildlife Refuge and National Key Deer Refuge. Key West is waterward several miles east of Key West National Wildlife Refuge.

E. Species/habitat occurrence:

LISTED SPECIES HABITATS FOR LOWER KEYS REFUGES

MAMMALS

Key Deer (E) – A variety of habitats in close proximity to fresh water, pine rocklands and tropical hardwood hammocks. Buttonwood and mangrove swamps provide a small, but essential part of this animal's annual habitat needs. Recently burned areas provide nutrient-rich forage.

Lower Keys marsh rabbit (E) – Higher elevations within saltmarsh or freshwater marsh. Occasionally uses mangrove communities and shrubby edges to wetlands, but depends on herbaceous plants for food and cover.

Rice Rat (E) (CH) – Transition from upland to marine and freshwater marsh communities, including buttonwoods and black mangroves, coastal strand, saltgrass flats and other communities within this zone that have moderate to abundant herbaceous cover.

West Indian Manatee (E) (CH) – coastal waters, sheltered coves for feeding, nursing, resting

BIRDS

Kirtland's Warbler (E) – This rare bird has been documented in Canada, Michigan, Wisconsin and South Carolina. Habitat in the mid-west is very specific to jack-pine forests. The wintering locations of the bird include the Bahamas, Turks, Caicos and Hispanola Islands.

Piping plover (T) (CH) - open, sandy beaches and tidal mudflats, sandflats

Roseate tern (T) – Nest sites include bare limestone, sand-shell beaches, newly-deposited rock and marl fill, dredge material, and heaps of broken coral deposited by storms. Also nests on roof tops. Forages for small, schooling fish in open water over sandbars, reefs and tide channels.

red knot (C) – marine habitats, especially near coastal inlets, estuaries and bay

REPTILES

American alligator (T) (S/A) – Most permanent bodies of fresh water including marshes, swamps, lakes and rivers. Occasionally wanders into salt or brackish water, but rarely remains there.

American crocodile (E) (CH) – Coastal estuarine mashes, tidal swamps and creeks along edges of mainland and islands. Usually associated with mangroves. Nests on beaches, stream banks and levees.

eastern Indigo snake (T) – In the Lower Florida Keys these snakes are broad habitat generalists inland potentially inhabiting all terrestrial habitats.

green sea turtle (E) (CH) – inhabit marine coastal and oceanic waters and nest on sand beaches. Hatchlings use offshore floating sargassum mats; juveniles frequent coastal bays, inlets, lagoons, and offshore worm reefs.

Hawksbill sea turtle (E) (CH) – Marine and oceanic waters, commonly associated with coral reefs, keys, and mangroves. Nests on coastal sand beaches, often in vegetation.

Kemp's ridley sea turtle (E) – shallow coastal and estuarine waters often in association with subtropical shorelines of red mangroves

leatherback sea turtle (E) (CH) – oceanic waters; nests on coastal sand beaches

loggerhead sea turtle (T) – marine coastal and oceanic waters, nest on sand beaches. Hatchlings use offshore floating sargassum mats; juveniles frequent coastal bays, inlets and lagoons.

INVERTEBRATES

Bartram's hairstreak (C) -- pine rocklands. Extirpated throughout most of its native range, this butterfly is now restricted to Big Pine Key, where it is found primarily in pine rockland areas that harbor its sole host plant, pineland croton.

Florida Leafwing (C) -- pine rocklands. Extirpated throughout most of its native range, this butterfly is now restricted to Big Pine Key, where it is found primarily in pine rockland areas that harbor its sole host plant, pineland croton.

Miami blue butterfly (C) -- primarily coastal scrub hammocks containing its host plants: gray nickerbean, blackbead and balloon vine. Forages on both woody and herbaceous flowering plants. Thought to be extirpated, a small population was rediscovered in 1999 at Bahia Honda State Park. Refuge-wide surveys in 2006-2007 revealed eight additional populations collectively numbering more than 1,000 individuals in KWNWR where blackbead was the sole host plant.

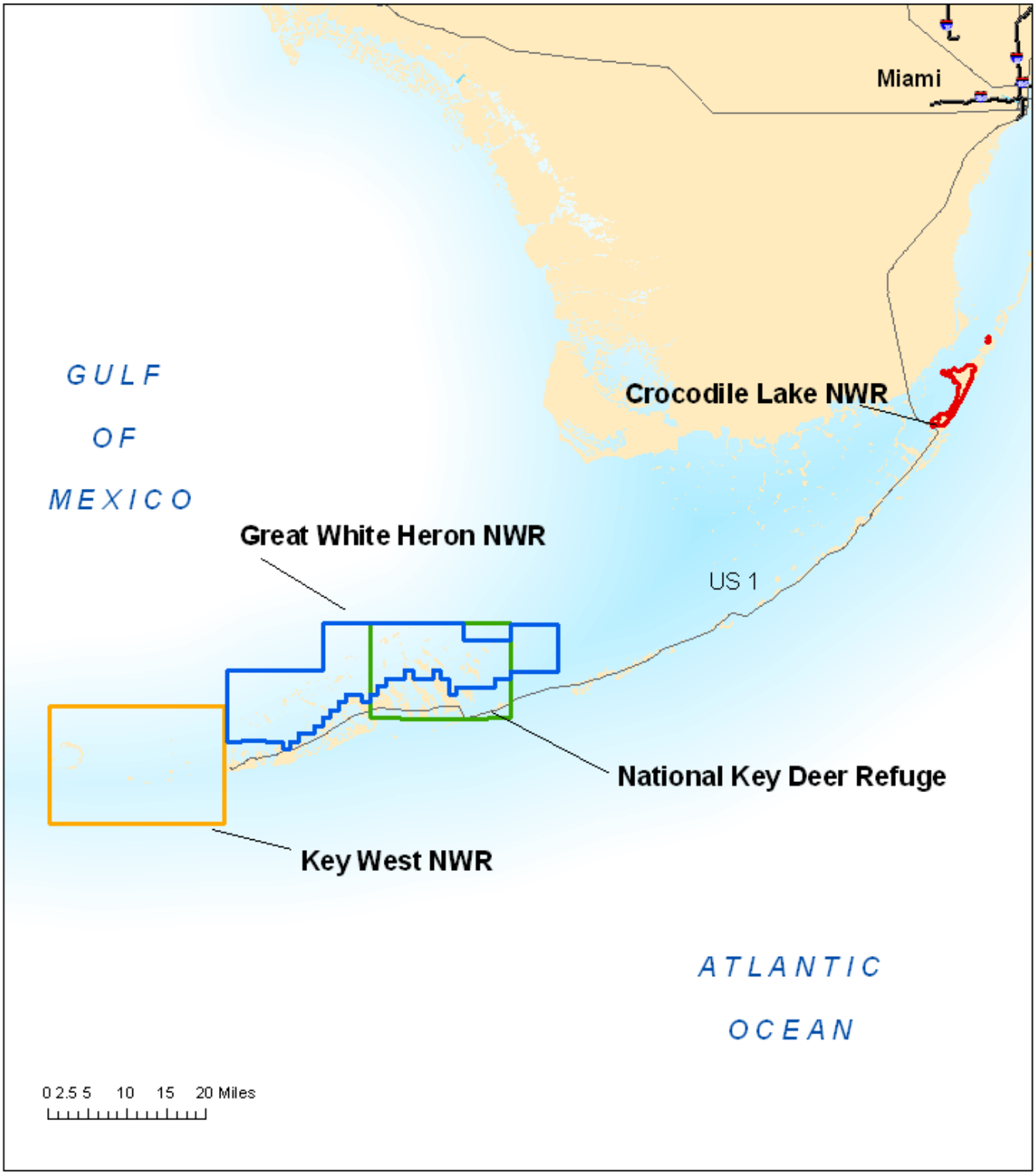
Stock Island tree snail (T) – tropical hardwood hammock (rockland hammock). Host trees are gumbo limbo, strangler fig, stoppers, pigeon plum, Jamaican dogwood, poisonwood, and other smooth-barked trees.

staghorn coral (T) – shallow to intermediate depths between 10 and 60 feet in clear, calm water. Most colonies are on reefs but may grow on open, clean areas of sand. Areas of surge on fore reefs located between 2 and 12 feet of water are ideal.

elkhorn coral (T) – Most common between 1 to 35 feet of water. Shallow areas where wave action causes constant water movement are ideal habitat.

FISH

smalltooth sawfish (E) – Inhabit shallow coastal waters very close to shore over bottoms. They prefer sheltered bays and shallow banks.



National Key Deer Refuge
Great White Heron NWR
Crocodile Lake NWR
Key West NWR
Water
Roads
N

Florida Keys National Wildlife Refuges

Source: FL. Dept. Transportation, 2007; U.S Census Bureau, 2000

PLANTS

Garber's spurge (T) – sandy soils over limestone in pine rocklands, hammock edges, coastal rock barrens, grass prairies, sandflats, beach ridges and swales.

Key tree cactus (E) – Openings in hardwood hammocks, cactus hammocks, and thorn scrub, over oolitic limestone.

Big Pine partridge pea (C) -- open understory in pine rocklands.

Blodgett's silverbush (C) -- open, sunny areas in pine rocklands, edges of rockland hammock, edges of coastal berm, and sometimes disturbed areas at the edges of natural areas.

Cape Sable thoroughwort (C) -- rock barrens and edges of tropical hardwood hammocks. Within the refuge, it is present only on Boca Grande Key.

Florida Sempaphore Cactus (C) -- grows close to salt water on bare rock with a minimum of humus-soil cover in or along the edges of hammocks near sea level.

sand Flax (C) -- pine rockland, marl prairie, and disturbed areas on limestone.

wedge spurge (C) -- bare limestone rock in pine rockllands.

VII. Determination of Effects:

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

Authorization of the Lower Florida Keys Refuges CCP and selection of the preferred alternative will have no effect on endangered, threatened and candidate species. Endangered species Act consultation will be initiated separately for implementation of any management actions that may affect any of the endangered, threatened, or candidate species listed below.

SPECIES/ CRITICAL HABITAT	IMPACTS TO SPECIES/CRITICAL HABITAT
Key deer	The project is not likely to adversely affect the species.
Lower Keys marsh rabbit	The project is not likely to adversely affect the species.
silver rice rat	The project is not likely to adversely affect the species.
West Indian manatee	The project is not likely to adversely affect the species.
Kirtland's Warbler	The project is not likely to adversely affect the species.

Piping plover	The project is not likely to adversely affect the species.
roseate tern	The project is not likely to adversely affect the species.
red knot	The project is not likely to adversely affect the species.
American alligator	The project is not likely to adversely affect the species.
American crocodile	The project is not likely to adversely affect the species.
eastern indigo snake	The project is not likely to adversely affect the species.
green sea turtle	The project is not likely to adversely affect the species.
hawksbill sea turtle	The project is not likely to adversely affect the species.
leatherback turtle	The project is not likely to adversely affect the species.
loggerhead sea turtle	The project is not likely to adversely affect the species.
Kemp's ridley sea turtle	The project is not likely to adversely affect the species.
Stock Island tree snail	The project is not likely to adversely affect the species.
staghhorn coral	The project is not likely to adversely affect the species.
elkhorn coral	The project is not likely to adversely affect the species.
smalltooth sawfish	The project is not likely to adversely affect the species.
Big Pine partridge pea	The project is not likely to adversely affect the species.
Blodgett's silverbush	The project is not likely to adversely affect the species.
Cape Sable thoroughwort	The project is not likely to adversely affect the species.
Florida semaphore cactus	The project is not likely to adversely affect the species.
Garber's spurge	The project is not likely to adversely affect the species.
Key tree cactus	The project is not likely to adversely affect the species.
sand flax	The project is not likely to adversely affect the species.
wedge spurge	The project is not likely to adversely affect the species.
Bartram's hairstreak	The project is not likely to adversely affect the species.
Florida leafwing	The project is not likely to adversely affect the species.

Miami blue butterfly	The project is not likely to adversely affect the species.

Prescribed burning, mechanical removal and/or hardwood fuel reduction may benefit the Key deer, Lower Keys marsh rabbit, silver rice rats, and eastern indigo snakes throughout their range by improving understory conditions of pine rocklands, freshwater wetlands, and coastal saltmarshes. These habitat management actions would perpetuate these habitats in the long-term. Potential adverse effects could occur during burning or maintenance of fire lines to these listed species: Lower Keys marsh rabbit, silver rice rat, eastern indigo snake. Candidate species, such as the Bartram's hairstreak and Florida leafwing butterflies and the following plants--Blodgett's Silverbush, Big Pine Key partridge pea, sand flax, and wedge spurge-- could also be impacted during burning or maintenance of fire lines. For the referenced butterfly species, burning would likely encourage the growth of pineland croton, the butterflies' sole host plant. For the referenced plant species, any impacts associated with burning would likely be temporary and more than offset by the benefits conferred since each plant is fire-dependent and adapted to an open pineland understory. Implementation of prescribed fire is likely to increase deer numbers, which may exacerbate documented impacts to species that are preferred browse for deer. Herd management to reduce deer densities in areas where the population is above carrying capacity will reduce or mitigate impacts to species already reduced and may facilitate their recovery by providing additional food sources, fawning and resting areas.

Measures to control exotic animal species, particularly feral cats, are proposed. Beneficial effects are expected for lower Keys marsh rabbits and silver rice rats, but will also likely benefit the eastern indigo snake and all native wildlife.

Propagation and translocation of Key tree cactus to suitable habitat that is less vulnerable to coastal flooding than that occupied by the extant refuge population will prevent the probable extirpation of this species. Maintaining a captive population and establishing the species over as wide an area in the refuge as possible will reduce the threat of a single event (e.g., hurricane, disease, poaching) from extinguishing the refuge population.

Frequent monitoring for and treatment of invasive exotic pest plants (IEEP) will ensure that native vegetation will not be displaced, benefiting all listed terrestrial wildlife and plant species. Maintaining native dune vegetation and curtailing the spread of non-native plant species will buffer the effects of coastal erosion and storms, prevent the accelerated loss of nesting habitat for sea turtles, and preserve the foraging and breeding areas of the Miami blue butterfly. IEEP will be treated only with herbicides that have been approved through the Service's Pesticide Use Proposal review process, with strict adherence to application rates and Service guidelines. Adherence to these guidelines will ensure that no negative effects on listed species will occur.

Increased law enforcement will afford additional protection to listed terrestrial mammals and plants, such as the Key tree cactus. On backcountry islands, increased enforcement will benefit piping plovers and roseate terns by reducing trespass and human-induced disturbance. This action will aid nesting sea turtles by reducing nocturnal human disturbance and poaching on nesting beaches. The American crocodile occurs irregularly in the Lower Florida Keys as a transient, but does not nest there. Poaching of Key deer, Lower Keys marsh rabbit, and eastern indigo snakes (for pet trade) is rare.

Augmented law enforcement would provide an additional measure of protection for all species.

Restricting public access to selected beaches to reduce resulting damage to dune vegetation will benefit nesting sea turtles and Miami blue butterflies by preserving the integrity of their nesting habitat. This action will foster beach occupancy by piping plovers, a species that is intolerant of the high level of public use that now occurs on northwest Boca Grande Key.

Garber's spurge occurs most frequently in plant communities in the early stages of succession. Thus, it will likely benefit from prescribed burning in areas where fire has been suppressed.

The Stock Island tree snail is not endemic to the refuge, but release by collectors has resulted in the establishment of a small population that persists in at least one tropical hardwood hammock on the refuge. No management is proposed for the latter habitat.

Kirtland's warblers are extremely rare in the Florida Keys. Lott et al. (2005) did not record Kirtland's warbler during 5 migration seasons in Upper and Lower Florida Keys study sites over a two-year period (26,785 trap hours). Its occurrence here is likely limited to a rare vagrant or a possible fall-out of migrants during severe weather. Nothing in the project would adversely affect the species.

Staghorn and elkhorn corals and the smalltooth sawfish occur within the refuges' administrative boundaries, but they occur in waters under the jurisdiction of the State of Florida and the Florida Keys National Marine Sanctuary. Representatives of both agencies and the National Marine Fisheries Service will be reviewing this document within the CCP/EA.

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

Project modification ideas may be found in the recovery plans. Although Section 7 of the Endangered Species Act prohibits only those actions by Federal agencies which are likely to jeopardize listed species or adversely modify critical habitat, the Service has a commitment to recovering listed species and trying to prevent the need to list additional species.

SPECIES/CRITICAL HABITAT	ACTIONS TO MITIGATE/MINIMIZE IMPACTS
Key deer	No actions are needed or planned.
Lower Keys marsh rabbit	Actions to minimize/mitigate impacts are discussed below.
silver rice rat	Actions to minimize/mitigate impacts are discussed below.
West Indian manatee	No actions are needed or planned.
Kirtland's Warbler	No actions are needed or planned.
piping plover	No actions are needed or planned.
roseate tern	No actions are needed or planned.
red knot	No actions are needed or planned.
American alligator	No actions are needed or planned.
American crocodile	No actions are needed or planned.

eastern indigo snake	Actions to minimize/mitigate impacts are discussed below.
green sea turtle	No actions are needed or planned.
hawksbill sea turtle	No actions are needed or planned.
leatherback turtle	No actions are needed or planned.
loggerhead sea turtle	No actions are needed or planned.
Kemp's ridley sea turtle	No actions are needed or planned.
Stock Island tree snail	No actions are needed or planned.
staghhorn coral	No actions are needed or planned.
elkhorn coral	No actions are needed or planned.
smalltooth sawfish	No actions are needed or planned.
Big Pine partridge pea	No actions are needed or planned.
Blodgett's silverbush	No actions are needed or planned.
Cape Sable thoroughwort	No actions are needed or planned.
Florida semaphore cactus	No actions are needed or planned.
Garber's spurge	No actions are needed or planned.
Key tree cactus	No actions are needed or planned.
sand flax	Actions to minimize/mitigate impacts are discussed below.
wedge spurge	No actions are needed or planned.
Bartram's hairstreak	Actions to minimize/mitigate impacts are discussed below.
Florida leafwing	Actions to minimize/mitigate impacts are discussed below.
Miami blue butterfly	No actions are needed or planned.

VII B. continued

Lower Keys marsh rabbit and silver rice rats – During fireline maintenance and prescribed burning, visual searches will be conducted to flush individuals from the area. Implementation of habitat management will be scheduled to avoid peak nesting periods. The use of heavy machinery will be minimized in habitats suitable to both species to avoid injury or death to individuals.

eastern indigo snakes – Eastern indigo snakes are believed to be locally extirpated from Lower Florida and are not likely to be impacted by proposed activities. Visual searches will be conducted prior to habitat management to ensure no individuals are in the area. In the unlikely event that an individual is observed, the individual will be temporarily removed from the area or activities will be postponed.

Garber's spurge - The relationship between Garber's spurge and fire is poorly understood. The species occurs in a variety of coastal habitats that are clearly not fire dependent plant communities, such as the populations on Boca Grande and Marquesas Keys. Garber's spurge may be present in refuge areas slated for prescribed burning. Fire may directly kill existing plants. Due to the plant's current rarity, a pre-burn search for this species will be made. If found, plants on site will be protected. If warranted, an experimental design may be applied to evaluate the use of fire on small test sites incorporating pre-and post-burn monitoring of the test sites.

sand flax– .Due to the plant's extreme rarity, a pre-burn search for this species will be made. If found, plants on site will be protected. Possible measures include pre-burn mechanical fuel reduction in the vicinity of the plants to allow post-burn pioneering into burned areas.

Bartam's hairstreak-- Prescribed fire would generate the early plant successional stage that favors this species host plant, pineland croton -- which is currently rare in the refuge -- and ultimately favor the butterfly. Burning, however, could kill pineland croton as well as hairstreak larvae. It could displace adult butterflies. Given the rarity of this butterfly and pineland croton, a search for both species will be undertaken prior to a prescribed burn. If significant numbers of either species are found, measures to preserve them (e.g., pre-burn black-lining or mechanical fuel reduction) will be considered to allow pioneering into burned areas.

Florida leafwing-- Prescribed fire would generate the early plant successional stage that favors this species host plant, pineland croton-- which is currently rare in the refuge -- and ultimately the butterfly. Burning, however, could kill this plant species, as well as hairstreak larvae, and displace adults. Given the rarity of this butterfly and pineland croton, a search for both species will be undertaken prior to a prescribed burn. If significant numbers of either species are found, measures to preserve them (e.g., pre-burn black-lining or mechanical fuel reduction) will be considered to allow pioneering into burned areas.

VIII. Effect Determination and Response Requested:

SPECIES/CRITICAL HABITAT	DETERMINATION[1]			REQUESTED
	NE	NA	AA	
Key deer		X		Concurrence
Lower Keys marsh rabbit		X		Concurrence
silver rice rat		X		Concurrence
West Indian manatee		X		Concurrence
Kirtland's Warbler		X		Concurrence
piping plover		X		Concurrence
roseate tern		X		Concurrence
red knot		X		Concurrence
American alligator		X		Concurrence
American crocodile		X		Concurrence
eastern indigo snake		X		Concurrence
green sea turtle		X		Concurrence
hawksbill sea turtle		X		Concurrence
leatherback turtle		X		Concurrence
loggerhead sea turtle		X		Concurrence
Kemp's ridley sea turtle		X		Concurrence
Stock Island tree snail		X		Concurrence
staghorn coral		X		Concurrence

elkhorn coral		X		Concurrence
smalltooth sawfish		X		Concurrence
Garber's spurge		X		Concurrence
Blodgett's silverbush		X		Concurrence
Big Pine partridge pea		X		Concurrence
wedge spurge		X		Concurrence
Cape Sable thoroughwort		X		Concurrence
sand flax		X		Concurrence
Florida semaphore cactus		X		Concurrence
Key tree cactus		X		Concurrence
Bartram's hairstreak		X		Concurrence
Florida leafwing		X		Concurrence
Miami blue butterfly		X		Concurrence

[1]DETERMINATION/ RESPONSE REQUESTED:
NE = no effect. This determination is appropriate when the proposed action will not directly, indirectly, or cumulatively impact, either positively or negatively, any listed, proposed, candidate species or designated/proposed critical habitat. Response Requested is optional but a "Concurrence" is recommended for a complete Administrative Record.

NA = not likely to adversely affect. This determination is appropriate when the proposed action is not likely to adversely impact any listed, proposed, candidate species or designated/proposed critical habitat or there may be beneficial effects to these resources. Response Requested is a" Concurrence".

AA = likely to adversely affect. This determination is appropriate when the proposed action is likely to adversely impact any listed, proposed, candidate species or designated/proposed critical habitat. Response Requested for listed species is "Formal Consultation". Response requested for proposed and candidate species is "Conference".

Anne E. Morkill — 27 Sept. 2007

Signature (originating station) — **Date**

Refuge Manager

Title

IX. Reviewing Ecological Services Office Evaluation:

A. Concurrence ✓ **Non-concurrence** _____

B. Formal consultation required _____

C. Conference required _____

D. Informal conference required _____

E. Remarks (attach additional pages as needed):

Signature	12-18-07 Date
AS Title	SFESO Office

Appendix H. Wilderness Review

Wilderness Review for the Lower Florida Keys Refuges - August 21, 2006

The project leader and staff met at National Key Deer Refuge on August 21, 2006, to gather information and discuss the wilderness review. The review team included:

Anne Morkill, Project Leader;
Mary Morris, CCP Planning Team Leader;
Tom Wilmers, Wildlife Biologist;
Lester Pulley, Lead Law Enforcement Officer;
James Bell, Park Ranger; and
Paige Schmidt, SCEP biologist trainee.

The wilderness review is a required component of the CCP. The Wilderness Act defines a wilderness area as an area of federal land retaining its primeval character and influence, without permanent improvements or human habitation, which is managed so as to preserve its natural conditions and (1) generally appears to have been affected primarily by the forces of nature, with the imprint of man's work substantially unnoticeable; (2) has outstanding opportunities for solitude or primitive and unconfined type of recreation; (3) has at least 5,000 contiguous roadless acres or is of sufficient size to make practicable its preservation and use in an unimpaired condition; (4) does not substantially exhibit the effects of logging, farming, grazing, or other extensive development or alteration of the landscape, or its wilderness character could be restored through appropriate management, at the time of review; (5) is a roadless island; and (6) may contain ecological, geological, or other features of scientific, education, scenic, or historic value.

During the inventory phase of the wilderness review, the emphasis is on an assessment of wilderness character within the inventory unit. Special values (i.e., ecological, geological, scenic, and historical) should be identified. The determination to recommend (or not recommend) a wilderness study area to Congress for wilderness designation will be made through the CCP decision-making process.

The areas designated as wilderness are described in Section A, Chapter II, and portrayed in Figure 5. Since all of the refuge-owned islands within Key West National Wildlife Refuge are designated as wilderness, this refuge was not included in the discussion. Likewise, those parts of Great White Heron NWR (west part) and parts of National Key Deer Refuge that are designated as wilderness were also omitted from the discussion.

Wilderness Management

The wilderness management policy and regulations allow motorized access and use of mechanized equipment for administrative purposes only if such uses are the minimum necessary to accomplish wilderness objectives. For the purpose of analysis in this CCP, managers should assume that authorization of such uses would be temporary and rare in a wilderness area. If such restrictions would significantly limit the Service's ability to accomplish other resource management objectives, these impacts should be fully described in the EA, Chapter IV, and would obviously be a factor for consideration in selecting a preferred alternative.

Resource Management Issues

Fire Management
Prescribed burning is implemented primarily on the mainline islands of Big Pine, No Name, Cudjoe, and Upper Sugarloaf Keys for habitat management and restoration purposes and to reduce fuel loads. Unintentional wildfires are suppressed on all mainline islands to minimize risk to human safety and property.

Endangered Species
There are 21 federally listed species on these islands and 10 candidate species. See the CCP, Chapter II for a listing (Table 1) and description of selected species.

Public Use
All mangrove islands are closed to public use. Visitors are permitted only on three islands, all containing beaches: Marquesas, Boca Grande, and Woman Keys. One-half of the beaches on Woman and Boca Grande Keys are closed to allow an undisturbed area for wildlife. Shallow waters border all or parts of some beaches, limiting direct access by larger boats. Acute overcrowding, particularly during peak use periods, such as the Memorial Day weekend, has been a recurring problem for years on Boca Grande Key and to a lesser extent on Woman Key. Non-wildlife-dependent activities prevail during such periods and a party atmosphere pervades the sites. Waters adjacent to refuge beaches are used for fishing, swimming, and diving.

Navigable Waters
All of the inventory units are bounded by navigable waters of the Gulf of Mexico and the Florida Bay. All navigable waters and submerged lands within the refuges' boundaries are owned by the State of Florida. Under a management agreement with the State of Florida, in-water buffer zones (i.e., idle speed, no motor, or no access) have been created around some refuge islands to reduce boater disturbance to wildlife.

Summary of Wilderness Inventory Findings

No new lands will be proposed as wilderness study areas as part of the comprehensive conservation planning process. The wilderness review inventory team looked at mainline islands (i.e., those linked by the Overseas Highway and islands within the refuges acquisition boundary) that were not already designated as wilderness. Because the mainline islands are not roadless and they are bisected by a highway, they do not meet the criterion for naturalness. There are no real opportunities for solitude. Therefore, they were not considered for further study as wilderness study areas.

In National Key Deer Refuge and Great White Heron NWR, there are several refuge-owned islands that have not been designated as wilderness. No areas were considered suitable for further study as wilderness study areas. All of the islands met the criterion for a wilderness study area of being a roadless island of any size. However, they could not be practicably managed as wilderness because of their location. Being proximal to suburban areas and to heavy motor boating activity, opportunities for solitude are not likely. As undeveloped islands, while they have a primitive nature, the lights and structures from the developed islands and the Overseas Highway are visible. Some of the islands are in shallow waters, which prohibit or greatly limit access. The dense mangrove forests dominating these islands are not conducive to visitation by most people. Further, human visitation would disturb nesting birds, particularly colonial wading birds. The heavy public use of motor-boating in the waters around the islands, combined with the small size of some of the islands, limits the opportunities for individuals to enjoy solitude or a primitive and unconfined recreational experience.

Appendix I. Refuge Biota

Legend for Lower Florida Keys Bird List- June 2006:

SP	**Spring, March – May**	**a = abundant (a common species which is very numerous)**
S	**Summer, June – August**	**c = common (certain to be seen in suitable habitat)**
F	**Fall, September – November**	**u = uncommon (present but not certain to be seen)**
W	**Winter, December – February**	**o = occasional (seen only a few times during a season)**
		r = rare (seen at intervals of 2 to 5 years)

** = known or suspected to have nested on the refuges or known to nest locally*

	SP	*S*	*F*	*W*
Loons				
___Red-throated Loon	o		o	o
___Common Loon	u		u	u
Grebes				
___Least Grebe			o	
___Pied-billed Grebe *	u	u	u	u
___Horned Grebe	o			o
Shearwaters and Petrels				
___Greater Shearwater		o		
___Sooty Shearwater	o			o
___Audubon's Shearwater		o		o
___Wilson's Storm-Petrel		o		
___Band-rumped Storm-Petrel			o	
Tropicbirds				
___White-tailed Tropicbird	o			
Boobies and Gannets				
___Masked Booby	o		o	o
___Brown Booby	r	r	r	r
___Northern Gannet	r	r	r	u
Pelicans				
___American White Pelican		r	r	r
___Brown Pelican *	c	c	c	c
Darters and Cormorants				
___Double-crested Cormorant *	c	c	c	c
___Anhinga	u	r	u	u
Frigatebirds				
___Magnificent Frigatebird	c	c	c	c
Bitterns, Herons, Egrets and Their Allies				
___American Bittern	o			
___Least Bittern *	r	r	r	r
___Great Blue Heron *	c	c	c	c
___Great Egret *	c	c	c	c
___Snowy Egret *	u	u	u	u
___Little Blue Heron *	u	u	u	u
___Tricolored Heron *	c	u	c	u
___Reddish Egret *	c	c	c	c
___Cattle Egret	c	c	c	c
___Green Heron *	c	c	c	c
___Black-crowned Night-Heron	r		r	r
___Yellow-crowned Night-Heron *	c	c	c	c

	SP	*S*	*F*	*W*
Falcons				
___American Kestrel	c		c	c
___Merlin	u		c	u
___Peregrine Falcon	u		c	u
Rails, Gallinules, Coots				
___Black Rail	u	u	u	u
___Clapper Rail *	u	u	u	u
___Virginia Rail	o		o	o
___Sora Rail	r		r	r
___Purple Gallinule *	r	r	r	r
___Common Moorhen *	u	u	u	u
___American Coot *	c	r	c	c
Limpkins				
___Limpkin	r	r	r	r
Plovers				
___Black-bellied Plover	c	u	c	c
___Lesser Golden-Plover	r		r	r
___Snowy Plover	o			o
___Wilson's Plover *	c	c	c	c
___Semipalmated Plover	c		c	c
___Piping Plover	r		r	r
___Killdeer *	u	r	u	u
___Mountain Plover				o
Oystercatchers				
___American Oystercatcher	o		o	
Stilts and Avocets				
___Black-necked Stilt *	u	u	u	
___American Avocet	o		o	o
Sandpipers and Phalaropes				
___Greater Yellowlegs	u		u	u
___Lesser Yellowlegs	u		u	u
___Solitary Sandpiper	u		r	
___Willet *	c		c	c
___Spotted Sandpiper	u		u	u
___Upland Sandpiper	r		r	
___Whimbrel	r		r	c
___Ruddy Turnstone	c	u	c	c
___Red Knot	u	r	u	r
___Sanderling	c	r	c	c
___Semipalmated Sandpiper	r	r	r	r
___Western Sandpiper	c	r	c	c
___Least Sandpiper	c	r	c	c
___White-rumped Sandpiper	u			
___Pectoral Sandpiper	r	r	r	
___Purple Sandpiper				r
___Dunlin	u		c	u
___Stilt Sandpiper	r		r	r

	SP	S	F	W
___Short-billed Dowitcher	c	u	c	c
___Common Snipe			r	r
___Wilson's Phalarope	o		o	o
___Red-necked Phalarope		o		
Jaegers, Gulls, Terns, and Skimmers				
___Pomarine Jaeger	o		o	o
___Parasitic Jaeger	o		o	o
___Laughing Gull *	c	c	c	c
___Bonaparte's Gull	r		r	r
___Ringed-billed Gull	c	r	c	c
___Herring Gull	u	r	c	c
___Lesser Black-backed Gull			r	r
___Great Black-backed Gull	r		r	r
___Black-legged Kittiwake (specimen)				o
___Gull billed Tern	o			
___Caspian Tern	u		u	c
___Royal Tern	c	c	c	c
___Roseate Tern*		u		
___Sandwich Tern *	u		u	u
___Common Tern	u		u	u
___Forster's Tern	u		c	c
___Least Tern *	u	c	c	
___Bridled Tern	r	r	r	
___Sooty Tern	r	r	r	
___Black Tern	r	r		
___Brown Noddy	o	o		
___Black Skimmer				u
Alcids				
___Dovekie				o
Pigeons and Doves				
___Rock Dove *	c	c	c	c
___White-crowned Pigeon *	u	c	u	u
___Eurasian collared Dove *	c	c	c	c
___White-winged Dove *	u	u	u	u
___Mourning Dove *	c	c	c	c
___Common Ground-Dove *	u	u	u	u
___Inca Dove (nested 1963-80, Key West, probably extirpated)				
___Ruddy Quail-Dove (1 captured, Key West)	o			
___Key West Quail Dove			o	
Cuckoos and Anis				
___Blacked-billed Cuckoo	r		r	
___Yellow-billed Cuckoo *	u	u	u	
___Mangrove Cuckoo *	u	u	r	r
___Smooth-billed Ani	r	r	r	r

	SP	S	F	W
Ibises and Spoonbills				
___White Ibis *	c	c	c	c
___Glossy Ibis	o	o	o	o
___Roseate Spoonbill	u	u	r	r
Storks				
___Wood Stork			o	o
Flamingos				
___Greater Flamingo	o		o	o
Ducks, Geese, Swans				
___Fulvous Whistling-Duck	o		o	o
___Canada Goose				o
___Snow Goose			o	o
___Wood Duck			o	
___Green-winged Teal	r		r	r
___White-cheeked Pintail	o			o
___Northern Pintail	u		u	u
___Blue-winged Teal	c		c	c
___Northern Shoveler	u		u	u
___Gadwall				o
___American Wigeon	c		c	c
___Ring-necked Duck	u		u	u
___Lesser Scaup	u		u	u
___Longtailed duck			o	
___Black Scoter			o	o
___Hooded Merganser				o
___Common Merganser			o	o
___Red-breasted Merganser	u	r	c	c
___Masked Duck	o			
Vultures				
___Black Vulture		o	o	o
___Turkey Vulture *	c	c	c	c
Osprey, Kites, Eagles, and Harriers				
___Osprey *	c	c	c	c
___Swallow-tailed Kite	r	r	r	r
___Mississippi Kite			o	o
___Bald Eagle *	u	u	u	u
___Northern Harrier	u		u	u
___Sharp-shinned Hawk	c		c	c
___Cooper's Hawk	u		u	u
___Red-Shouldered Hawk *	u	u	u	u
___Broad-winged Hawk	c		c	c
___Short-tailed Hawk	r		c	u
___Swainson's Hawk	r		c	r
___Red-tailed Hawk	r		r	r
___Zone-tailed Hawk			o	o

	SP	S	F	W
Owls				
___Eastern Screech Owl	o			
___Burrowing Owl	o		o	o
___Barred Owl		o		
___Long-eared Owl			o	
___Short-eared Owl	r	u	r	r
Barn Owls				
___Barn owls	r	r	r	r
Goatsuckers				
___Common Nighthawk *	c	c	c	
___Antillean Nighhawk *	c	c	c	
___Chuck-will's Widow	u	u	u	r
___Whip-poor-will	r			r
Swifts				
___Chimney Swift	r		u	
___Antillean Palm Swift		o		
Hummingbirds				
Black-chinned Hummingbird	o			
Ruby-throated Hummingbird	u	r	u	u
Kingfishers				
___Belted Kingfisher	c	u	c	c
Woodpeckers				
___Red-bellied Woodpecker *	c	c	c	c
___Yellow-bellied Sapsucker	u		u	u
___Northern Flicker			o	o
Tyrant Flycatchers				
___Olive-sided Flycatcher				o
___Eastern Wood-Pewee	r	u	u	
___Eastern Phoebe	r	r	r	r
___LaSagra's Flycatcher		o	o	
___Brown-crested Flycatcher	o			o
___Loggerhead Kingbird	o			
___Western Kingbird	u		u	u
___Eastern Kingbird	c	c	c	
___Gray Kingbird *	c	c	c	u
___Scissor-tailed Flycatcher	u		u	u
Swallows				
___Purple Martin	c	c	c	
___Cuban Martin	o			
___Southern Martin		o		
___Tree Swallow	c		c	u
___Northern Rough-winged Swallow	r		r	r
___Bahama Swallow	o	o		o
___Bank Swallow	r		r	r
___Cave Swallow	o			
___Barn Swallow	c	c	c	r
___Cliff Swallow				o
Jays and Crows				
___Blue Jay	o	o		
___American Crow	o	o	o	o
___Fish Crow	r		r	r
Wrens				
___Carolina Wren			o	
___House Wren	r		r	r
Old World Warblers				
___Ruby-crowned Kinglet				o
___Blue-gray Gnatcatcher	c	u	c	c
___Veery	r			
Thrushes				
___Gray-checked Thrush	r		r	
___Swainson's Thrush	r		u	
___Hermit Thrush				o
___Wood Thrush	r		r	
___American Robin	r		r	r
Mockingbirds & Thrashers				
___Gray Catbird	c		c	c
___Northern Mockingbird *	c	c	c	c
___Bahama Mockingbird	o	o	o	
___Brown Thrasher *	u	u	u	u
Pipits				
___American Pipit	o			o
Waxwings				
___Cedar Waxwing	c		c	c
Shrikes				
___Loggerhead Shrike				r
Starling & Allies				
___European Starling *	u	u	u	u
Vireos				
___White-eyed Vireo *	c	c	c	c
___Bell's Vireo			o	
___Blue-headed Vireo	u		r	r
___Philadelphia Vireo	o		o	
___Yellow-throated Vireo	u		u	u
___Red-eyed Vireo	c		c	
___Black-whiskered Vireo *	c	c	r	
___Thick-billed Vireo			o	u

	SP	*S*	*F*	*W*
Wood Warblers				
___Blue-winged Warbler	r		r	r
___Golden-winged Warbler	o		o	
___Tennessee Warbler	u		u	r
___Orange-crowned Warbler	u	r	u	
___Nashville Warbler	o		o	
___Northern Parula Warbler	c		c	c
___Yellow Warbler Cuban subspecies *	u	u	u	u
___Chestnut-sided Warbler	r		r	
___Magnolia Warbler	u		u	r
___Cape May Warbler	u		u	u
___Black-throated Blue Warbler	c		c	
___Yellow-rumped Warbler	c		c	c
___Black-throated Green Warbler	u		c	u
___Blackburnian Warbler	u		u	
___Yellow-throated Warbler	c		c	c
___Pine Warbler	o		o	o
___Prairie Warbler *	c	c	c	c
___Palm Warbler	c		c	c
___Bay-breasted Warbler	r		r	
___Blackpoll Warbler	c		r	
___Cerulean Warbler	r		r	
___Black-and-white Warbler	c		c	c
___American Redstart	c		c	u
___Prothonotary Warbler	u		u	
___Worm-eating Warbler	u		u	r
___Swainson's Warbler	u		u	o
___Ovenbird	c		c	u
___Norther Waterthrush	c		c	u
___Louisiana Waterthrush	r		r	
___Kentucky Warbler	u		u	
___Connecticut Warbler	r		r	
___Common Yellowthroat	c		c	c
___Hooded Warbler	u		u	
___Wilson's Warbler	r		r	
___Yellow-breasted Chat				o
Tanagers				
___Summer Tanager	u	u	r	
___Scarlet Tanager	u		u	
Cardinals and Buntings				
___Northern Cardinal	c	c	c	c
___Rose-breasted Grosbeak	u		u	
___Blue Grosbeak	u		u	
___Indigo Bunting	u		c	r
___Painted Bunting	u		u	u
___Dickcissel	r		r	r
Sparrows				
___Eastern Towhee				o
___Chipping Sparrow			o	o

	SP	*S*	*F*	*W*
___Clay colored Sparrow			o	o
___Vesper Sparrow	o			o
___Lark Sparrow			o	o
___Savannah Sparrow	u		u	u
___Grasshopper Sparrow	r		r	r
___LeConte's Sparrow				o
___Nelson's Sharp-tailed Sparrow				o
___Swamp Sparrow			r	r
___White-crowned Sparrow				o
___Dark-eyed Junco	o			o
Blackbirds and Orioles				
___Bobolink	u		u	
___Red-winged Blackbird *	c	c	c	c
___Tawny-shouldered Blackbird				o
___Yellow-headed Blackbird			o	o
___Brewer's Blackbird			o	
___Common Grackle *	c	c	r	r
___Shiny Cowbird	u			
___Brown-headed Cowbird		o	o	o
___Orchard Oriole	c		c	
___Baltimore Oriole	c		c	u
Finches				
___Pine Siskin (irruptive)	r		r	r
___American Goldfinch			c	u
Old World Sparrows				
___House Sparrow*	u	u	u	u

Final IR Draft Subtropical Florida Bird Conservation Table

Priority Birds in need of conservation attention for Subtropical Florida Physiographic Area (BCR 31).*

Immediate Management											
Mangroves/ Tropical Hardwoods	**Forested Wetlands/ Hammocks**	**Open Pine Woodlands/ Rocklands**	**Shrub-scrub**	**Transient Landbirds**	**Grassland, Prairie, Savanna, Pasture**	**Emergent Wetlands**	**Colonial Waders and Pelicans**	**Colonial gulls, terns, skimmers**	**Shorebirds (beaches)**	**Shorebirds (mudflats)**	**Open Water**
Swallow-tailed Kite (I b)	Swallow-tailed Kite (I b)	Red-cockaded Woodpecker (I a)	Florida Scrub-Jay (I a)	Bicknell's Thrush (I a)	Bachman's Sparrow (I a)	Yellow Rail (I a; w)	Great White Heron (I a)	Gull-billed Tern (I b)	Snowy Plover (I a)	Marbled Godwit (James Bay pop.; I b; w)	Black-capped Petrel (I a; nb)
Short-tailed Hawk (Florida pops.; II b)	Short-tailed Hawk (Florida pops.; II b)	Bachman's Sparrow (I a)	Painted Bunting (I b; w)		Henslow's Sparrow (I a; w)	Black Rail (I a; w)	Magnificent Frigatebird (I c)	Roseate Tern (I b)	Piping Plover (I a; w)	Buff-breasted Sandpiper (I c; t)	Audubon's Shearwater (I b; nb)
		Henslow's Sparrow (I a; w)	Smooth-billed Ani (II b)		Swallow-tailed Kite (I b)	King Rail (I a)	Reddish Egret (I c)	Least Tern (I b)	American Oyster-catcher (I b)		
		Red-headed Woodpecker (I b)			Grass-hopper Sparrow (Florida subsp.; II b)	Mottled Duck (FL subsp.; I c)	Wood Stork (southeast U.S. breeding pop. II a)	Black Skimmer (I b)	Red Knot (I c; w)		
		Brown-headed Nuthatch (I b)				Seaside Sparrow (Cape Sable subsp.; I c)					
		Carolina Chickadee (II a)				Snail Kite (Everglade s pop.; II b)					
		American Kestrel (Southeaster n subsp.; II b)									
		Summer Tanager (II b)									

Management Attention

Mangroves/ Tropical Hardwoods	Forested Wetlands/ Hammocks	Open Pine Woodlands/ Rocklands	Shrub-scrub	Transient Landbirds	Grassland, Prairie, Savanna, Pasture	Emergent Wetlands	Colonial Waders and Pelicans	Colonial gulls, terns, skimmers	Shorebirds (beaches)	Shorebirds (mudflats)	Open Water
White-crowned Pigeon (I b)	Prothonotary Warbler (I b)	Northern Bobwhite (II a)	American Woodcock (I b; w)	Bay-breasted Warbler (I b; t)	Short-eared Owl (Greater Antillean subsp; I b; nb)	Wilson's Snipe (I b; w)	Little Blue Heron (I b)	Masked Booby (I b; LR)	Sanderling (I b; nb)	American Golden-Plover (I b; t)	Horned Grebe (I b; w)
Mangrove Cuckoo (I b)	Rusty Blackbird (I b; w)	Chuck-will's-widow (II a)	Brown Thrasher (II a)	Mississippi Kite (II a; t)	Northern Harrier (II a; w)	Pied-billed Grebe (breeding pops.; II a)	Great Blue Heron (II a)	Bridled Tern (I c; LR)	Wilson's Plover (I c)	American Avocet (I b; nb)	Greater Shearwater (I b; nb)
Prairie Warbler (Florida subsp.; I b)	Limpkin (Florida pops.; II a)	Northern Flicker (II a)	Eastern Towhee (II a)	Connecticut Warbler (II a)	Northern Bobwhite (II a)	Least Bittern (II a)	Great Egret (II a)		Ruddy Turnstone (II a; nb)	Lesser Yellowlegs (I b, nb)	Band-rumped Storm-Petrel (I b; nb)
Clapper Rail (II a)	Yellow-billed Cuckoo (II a)	Bald Eagle (II b)			Common Nighthawk (II a)	American Bittern (II a; w)	Tricolored Heron (II a)			Solitary Sandpiper (I b; t)	Red Phalarope (I b; t)
Black-whiskered Vireo (II a)	Chimney Swift (II a)				Loggerhead Shrike (II a)	American Coot (breeding pops.; II a)	Green Heron (II a)			Upland Sandpiper (I b; t)	Cory's Shearwater (I c; nb)
Bald Eagle (II b)	Bald Eagle (II b)				Field Sparrow (II a)	Limpkin (Florida pops.; II a)	Black-crowned Night-Heron (II a)			Whimbrel (I b; nb)	Bridled Tern (I c; nb)
Yellow Warbler (Cuban subsp.; II b)					Vesper Sparrow (II a)	Purple Gallinule (II b)	White Ibis (II a)			Semi-palmated Sandpiper (I b; nb)	Sooty Shearwater (II a; nb)
					Grasshopper (eastern subsp.; II a; w)		Glossy Ibis (II a)			Western Sandpiper (I b; nb)	Northern Pintail (II a; w)

Mangroves/ Tropical Hardwoods	Forested Wetlands/ Hammocks	Open Pine Woodlands/ Rocklands	Shrub-scrub	Transient Landbirds	Grassland, Prairie, Savanna, Pasture	Emergent Wetlands	Colonial Waders and Pelicans	Colonial gulls, terns, skimmers	Shorebirds (beaches)	Shorebirds (mudflats)	Open Water
					Le Conte's Sparrow (II a; w)		Roseate Spoonbill (II a)			Dunlin (I b; w)	Canvas-back (II a; w)
					Bobolink (II a; t)		Yellow-crowned Night-Heron (II b)			Stilt Sandpiper (I b; nb)	Redhead (II a; w)
					Eastern Meadow-lark (II a)		Greater Flamingo (II b, nb)			Short-billed Dowitcher (I b; w)	Common Tern (II a; t)
					Barn Owl (II b)					Wilson's Phalarope (I b; t)	Black Tern (II a; t)
					Burrowing Owl (II b)					Black-bellied Plover (II a; nb)	Common Loon (II b; w)
					Sedge Wren (II b; w)					Least Sandpiper (II a; nb)	Northern Gannet (II b; w)
Planning and Responsibility											
Gray Kingbird (II c)	Wood Duck (II c)	Pine Warbler (II c)	White-eyed Vireo (II c)	Cape May Warbler (II c; nb)	Antillean Nighthawk (I c)	Nelson's Sharp-tailed Sparrow (I c; w)	Brown Pelican (II c)	Royal Tern (II c)	Willet (II a)	Greater Yellowlegs (II a; nb)	American White Pelican (Tier II c; w)
	Northern Parula (II c)			Black-throated Warbler (II c; nb)	Sandhill Crane (Florida subsp.; II c)			Sandwich Tern (II c)		Black-necked Stilt (II c)	Bonaparte's Gull (II c; w)
	Yellow-throated Warbler (II c)			Blackpoll Warbler (II c; t)				Sooty Tern (II c)		Pectoral Sandpiper (II c)	Forster's Tern (II c; w)
								Brown Noody (Tier II c)		Long-billed Dowitcher (II c)	

** Immediate Management = needed to reverse or stabilize significant, long-term population declines in species with small populations, or to protect species with the smallest populations for which trends are poorly known. Lack of action may lead to extirpations or extinction.*

Management Attention = on-the-ground conservation actions needed to reverse or stabilize significant, long-term population declines in species that are still relatively abundant.

Planning and Responsibility = long-term Planning and Responsibility needed for species to ensure that sustainable populations are maintained for species for which a region has high responsibility for that species.

w=winter, nb=non-breeding, t=transient; otherwise species are breeding (seasonal as well as resident species); LR (low responsibility for Tier I species, see below)

All species receive total scores (TOT), i.e., sum of all seven factors (max.=35) used , along with Action Level and Tier to help folks to determine where each species best fits for conservation planning at Planning Region/Bird Conservation Region/Physiographic Area., and in the West Indies islands or groups of islands

Tier I. *Continental Conservation Concern (Continental WatchList):*

(a) Species with multiple causes for concern across their entire range;

(b) Moderately abundant or widespread species with declines or high threats, and

(c) Species with restricted distributions or low population size.

For Regional and smaller scales, species for which local relative density to the best of our understanding has always been low (i.e, AI =2, with PT$\leq$3) are identified as of "low responsibility" when compared to species with AI$\geq$3 ("high responsibility") for the area of interest (this would not apply to species with AI=2, with PT$\geq$ 4 and TB and/or TN $\geq$ 4 as this indicates former higher relative densities and therefore former higher responsibility).

WatchList *score used for Continental Scoring (PIF Approach); species with WL SUBTOT combined scores of (1) 15 or more, (2) 14 with Tmax+PT $\geq$5 {used only in the West Indies for now, also may become important when including Mexico, but has no effect on species presently covered in the CPlan for Continental U.S. and Canada}, or (3) with 13 with PT=5 are identified using formula:*

Combined Score = PT + PS + maximum of (BD or ND) + maximum of (TB or TN)

Species with multiple causes for concern across their entire range: These species are considered by many to be of highest continental concern and of highest priority for conservation actions at national and international scales. A majority of these are legally listed as Endangered or Threatened in either the U.S. or Canada, and as such have recovery plans in place. Notable in this group, however, are several species without legal status, including Bicknell's Thrush and Saltmarsh Sharp-tailed Sparrow.

Moderately abundant or widespread species with declines or high threats: These species are on the Watch List primarily because they are declining and/or threatened throughout their range, though still fairly widespread or with moderately large populations. Many of these species still number in the millions (e.g. Dickcissel, Wood Thrush), but are threatened with serious reductions in population or geographic range in the future. Several other species (e.g. Swallow-tailed Kite, Mangrove Cuckoo, Elegant Trogon) are fairly widespread outside the U.S. and Canada, but are threatened in the U.S. portion of their range. Five species are afforded U.S. federal legal status in part of their range or for a particular recognized subspecies. This group also includes four resident game bird species with seriously declining populations.

Species with restricted distributions or low population size: These species are on the Watch List because they are restricted to a small range or have small global populations (often both). Many of these species are not known to be declining or seriously threatened at present, but many others are, (e.g. Spotted Owl, Montezuma Quail, Bendire's Thrasher, Rufous-winged Sparrow, Audubon's Oriole). We recognize that these species with small populations and restricted range are particularly vulnerable to relatively minor changes from current conditions, whether or not their populations are currently in decline.

Tier II. *Regional Conservation Interest (non-WatchList; TOT≥19, AI≥2):*

(a) high regional concern with TOT ≥22 not otherwise identified in Tier I and TOT=19-21 with(AI+PT≥8);*

(b) high regional threats (TB+TN≥7, or TB or TN=5), including taxa (subspecies and populations) of regional conservation interest regardless of total score (but previously identified), not otherwise included in categories above;

(c) high regional responsibility (as measured by percent of global, continental, or regional populations).

Vertebrate List – source: Phillip Hughes, Ecological Services 2-16-07

Common Name (*Latin Name*)	Value
Greenhouse Frog (*Eleutherodactylus planirostris planirostris*)	Non-Native
Narrow-mouthed Toad (*Gastrophrynae carolinensis*)	Native
Green Treefrog (*Hyla cinerea*)	Native
Squirrel Treefrog (*Hyla squirella*)	Native
Cuban Treefrog (*Osteopilus septentrionalis*)	Non-Native
Southern Leopard Frog (*Rana spenocephala*)	Native
Eastern Spadefoot Toad (*Scaphiopus holbrooki holbrooki*)	Native
Giant Toad (*Bufo marinus*)	Exotic, established
Oak Toad (*Bufo quercicus*)	Native
Southern Toad (*Bufo terrestris*)	Native
American Alligator (*Alligator mississippiensis*)	Native
American Crocodile (*Crocodylus acutus*)	Native
Yellowhead Gecko (*Gonatodes albogularis fuscus*)	Exotic, established
Ocellated Gecko (*Sphaerodactylus argus argus*)	Exotic, established
Indo-Pacific Gecko (*Hemidactylus garnotii*)	Exotic, established
Green Bark Anole (An*olis distichus dominicensis*)	Exotic, established
Green Anole (*Anolis carolinensis carolinensis*)	Native
Brown Anole (*Anolis sagrei*)	Non-Native
Six-lined Racerunner (*Cnemidophorus sexlineatus sexlineatus*)	Native
Keys Mole Skink (*Eumeces egregius egreguis*)	Native
Southeastern Five-lined Skink (*Eumeces inexpectatus*)	Native
Mediterranean Gecko (Hemidactylus turcicus turcicus)	Non-Native
Florida Reef Gecko (*Sphaerodactylus notatus notatus*)	Native
Ashy Gecko (*Sphaerodactylus elegans*)	Non-Native
Crested Anole (*Anolis cristatellus*)	Non-Native
Ground Skink (*Scincella lateralis*)	Native

Common Name (*Latin Name*)	Value
Atlantic Loggerhead (*Caretta caretta caretta*)	Native
Atlantic Green Turtle (*Chelonia mydas mydas*)	Native
Atlantic Leatherback (*Dermochelys coriacea coriacea*)	Native
Atlantic Ridley (*Lepidochelys kempii*)	Native
Atlantic Hawksbill (*Eretmochelys imbricata imbricata*)	Native
Southern Black Racer (*Coluber constrictor priapus*)	Native
Eastern Diamondback Rattlesnake	Native
Key Ringneck Snake (*Diadophis punctatus acricus*)	Native
Eastern Indigo Snake (*Drymarchon corais couperi*)	Native
Corn Snake (*Elaphe guttata guttata*)	Native
Rosy Rat Snake (*Elaphe guttata rosacea*)	Native
Mangrove Water Snake (*Nerodia fasciata compressicauda*)	Native
Rough Green Snake (*Opheodrys aestivus*)	Native
Florida Brown Snake (*Storeria dekayi victa*)	Native
Peninsula Ribbon Snake (*Thamnophis sauritus sackeni*)	Native
Scarlet Kingsnake (*Lampropeltis triangulum elapsoides*)	Status "not confirmed" potential range expansion
Florida Cottonmouth (*Agkistrodon piscivorus conanti*)	Status "not confirmed" potential range expansion
Mangrove Terrapin (*Malaclemys terrapin rhizophorarum*)	Native
Chicken Turtle (Deirochelys reticularia)	Native, potential range expansion or release
Snapping Turtle (Chelydra serpentina)	Native, potential range expansion or release
Peninsula Cooter (Pseudemys floridana peninsularis)	Native, potential range expansion or release

Common Name (*Latin Name*)	Value
Key Mud Turtle (Kinosternon baurii baurii)	Native
Florida Box Turtle (Terrapene carolina bauri)	Native
Florida Water Rat (Neofiber alleni)	Status "not confirmed"
Key Deer (Odocoileus virginianus clavium)	Native
Keys Raccoon (Procyon lotor auspicatus)	Native
Florida Pipistrelle (*Pipistrellus subflavus floridanus*)	Native
Free-tailed Bat (*Tadarida brasiliensis*)	Native
Evening Bat (*Nycticeius humeralis*)	Status "not confirmed"
Marsh Rabbit (*Sylvilagus palustris paludicola*)	Native
Silver Rice Rat (*Oryzomys argentatus*)	Native
Lower Keys Cotton Rat (*Sigmodon hispidus exsputus*)	Native
Black Rat (*Ratttus rattus*)	Non-Native
Norway Rat (*Rattus norvigicus*)	Non-Native
House Mouse (*Mus musculus*)	Non-Native
Eastern Woodrat (*Neotoma floridana*)	Status "not confirmed"
West Indian Manatee (*Trichechus manatus*)	Native
Opossum (*Didelphis marsupialis*)	Status "not confirmed"

Butterflies List – Source: compiled by Phillip Hughes, Ecological Services and circulated to others for review 2-16-07.

Butterflies and Moths of Monroe County, Florida

Brush-footed Butterflies (*Nymphalidae*)
Admirals and Relatives (*Limenitidinae*)
Antillean Daggerwing (*Marpesia eleuchea*)
Cramer's Eighty-eight (*Diaethria clymena*)
Dingy Purplewing (*Eunica monima*)
Florida Purplewing (*Eunica tatila*)
Many-banded Daggerwing (*Marpesia chiron*)
Pale Cracker (*Hamadryas amphichloe*)
Ruddy Daggerwing (*Marpesia petreus*)
Viceroy (*Limenitis archippus*)

Emperors (*Apaturinae*)
Tawny Emperor (*Asterocampa clyton*)

Leafwings (*Charaxinae*)
Florida Leafwing (*Anaea troglodyta floridalis*)

Longwings (*Heliconiinae*)
Banded Orange Heliconian (*Dryadula phaetusa*)
Gulf Fritillary (*Agraulis vanillae*)
Julia Heliconian (*Dryas iulia*)
Variegated Fritillary (*Euptoieta claudia*)
Zebra Heliconian (*Heliconius charithonia*)

Milkweed Butterflies (*Danainae*)
Monarch (*Danaus plexippus*)
Queen (*Danaus gilippus*)
Soldier (*Danaus eresimus*)

Satyrs and Wood-Nymphs (*Satyrinae*)
Carolina Satyr (*Hermeuptychia sosybius*)
Georgia Satyr (*Neonympha areolatus*)

Snouts (*Libytheinae*)
American Snout (*Libytheana carinenta*)

True Brushfoots (*Nymphalinae*)
American Lady (*Vanessa virginiensis*)
Caribbean Peacock (*Anartia chrysopelea*)
Common Buckeye (*Junonia coenia*)
Cuban Crescent (*Anthanassa frisia*)
Malachite (*Siproeta stelenes*)
Mangrove Buckeye (*Junonia evarete*)
Mimic (*Hypolimnas misippus*)
Painted Lady (*Vanessa cardui*)
Pearl Crescent (*Phyciodes tharos*)
Phaon Crescent (*Phyciodes phaon*)

Red Admiral (*Vanessa atalanta*)
Tropical Buckeye (*Junonia genoveva*)
White Peacock (*Anartia jatrophae*)

Gossamer-wing Butterflies (*Lycaenidae*)
Blues (*Polyommatinae*)
Cassius Blue (*Leptotes cassius*)
Ceraunus Blue (*Hemiargus ceraunus*)
Eastern Pygmy-Blue (*Brephidium pseudofea*)
Miami Blue (*Cyclargus thomasi*)
Nickerbean Blue (*Cyclargus ammon*)

Hairstreaks (*Theclinae*)
Amethyst Hairstreak (*Chlorostrymon maesites*)
Atala (*Eumaeus atala*)
Bartram's Scrub-Hairstreak (*Strymon acis*)
Disguised Scrub-Hairstreak (*Strymon limenia*)
Fulvous Hairstreak (*Electrostrymon angelia*)
Gray Hairstreak (*Strymon melinus*)
Gray Ministreak (*Ministrymon azia*)
Mallow Scrub-Hairstreak (*Strymon istapa*)
Martial Scrub-Hairstreak (*Strymon martialis*)
Red-banded Hairstreak (*Calycopis cecrops*)
Ruddy Hairstreak (*Electrostrymon sangala*)
Silver-banded Hairstreak (*Chlorostrymon simaethis*)
Southern Hairstreak (*Satyrium favonius*)

Metalmarks (*Riodinidae*)
Little Metalmark (*Calephelis virginiensis*)

Parnassians and Swallowtails (*Papilionidae*)

Swallowtails (*Papilioninae*)
Bahaman Swallowtail (*Papilio andraemon*)
Black Swallowtail (*Papilio polyxenes*)
Eastern Tiger Swallowtail (*Papilio glaucus*)
Giant Swallowtail (*Papilio cresphontes*)
Palamedes Swallowtail (*Papilio palamedes*)
Pipevine Swallowtail (*Battus philenor*)
Polydamas Swallowtail (*Battus polydamas*)
Schaus' Swallowtail (*Papilio aristodemus*)
Spicebush Swallowtail (*Papilio troilus*)
Zebra Swallowtail (*Eurytides marcellus*)

Prominents (*Notodontidae*)
Nystalea indiana (*Nystalea indiana*)
Nystalea ebalea (*Nystalea ebalea*)
Litodonta hydromeli (Litodonta hydromeli)
Heterocampa cubana (*Heterocampa cubana*)
Heterocampa zayasi (*Heterocampa zayasi*)
Unicorn Caterpillar Moth (*Schizura unicornis*)

Skippers (*Hesperiidae*)
Grass Skippers (*Hesperiinae*)
Aaron's Skipper (*Poanes aaroni*)
Baracoa Skipper (*Polites baracoa*)
Berry's Skipper (*Euphyes berryi*)
Brazilian Skipper (*Calpodes ethlius*)
Byssus Skipper (*Problema byssus*)
Clouded Skipper (*Lerema accius*)
Delaware Skipper (*Anatrytone logan*)
Eufala Skipper (*Lerodea eufala*)
Fiery Skipper (*Hylephila phyleus*)
Meske's Skipper (*Hesperia meskei*)
Monk (*Asbolis capucinus*)
Neamathla Skipper (*Nastra neamathla*)
Obscure Skipper (*Panoquina panoquinoides*)
Ocola Skipper (*Panoquina ocola*)
Palatka Skipper (*Euphyes pilatka*)
Palmetto Skipper (*Euphyes arpa*)
Sachem (*Atalopedes campestris*)
Salt Marsh Skipper (*Panoquina panoquin*)
Southern Broken-Dash (*Wallengrenia otho*)
Southern Skipperling (*Copaeodes minima*)
Swarthy Skipper (*Nastra lherminier*)
Tawny-edged Skipper (*Polites themistocles*)
Three-spotted Skipper (*Cymaenes tripunctus*)
Twin-spot Skipper (*Oligoria maculata*)
Violet-banded Skipper (*Nyctelius nyctelius*)
Whirlabout (*Polites vibex*)

Spread-wing Skippers (*Pyrginae*)
Common Checkered-Skipper (*Pyrgus communis*)
Dorantes Longtail (*Urbanus dorantes*)
Florida Duskywing (*Ephyriades brunnea*)
Funereal Duskywing (*Erynnis funeralis*)
Hammock Skipper (*Polygonus leo*)
Hayhurst's Scallopwing (*Staphylus hayhurstii*)
Long-tailed Skipper (*Urbanus proteus*)
Mangrove Skipper (*Phocides pigmalion*)
Manuel's Skipper (*Polygonus savigny*)
Silver-spotted Skipper (*Epargyreus clarus*)
Tropical Checkered-Skipper (*Pyrgus oileus*)
Zarucco Duskywing (*Erynnis zarucco*)
Zestos Skipper (*Epargyreus zestos*)

Sphinx Moths, Hawkmoths (*Sphingidae*)
Macroglossinae (*Macroglossinae*)
Achemon sphinx (*Eumorpha achemon*)
Alope sphinx (*Erinnyis alope*)
Banded sphinx (*Eumorpha fasciatus*)
Cramer's sphinx (*Erinnyis crameri*)
Ello sphinx (*Erinnyis ello*)

False-windowed sphinx (*Madoryx pseudothyreus*)
Fig sphinx (*Pachylia ficus*)
Gaudy sphinx (*Eumorpha labruscae*)
Grote's sphinx (*Cautethia grotei*)
Nessus sphinx (*Amphion floridensis*)
Obscure sphinx (*Erinnyis obscura*)
Pluto sphinx (Xylophanes pluto)
Tantalus sphinx (*Aellopos tantalus*)
Tersa sphinx (*Xylophanes tersa*)
Tetrio sphinx (*Pseudosphinx tetrio*)
Vine sphinx (*Eumorpha vitis*)
White-lined sphinx (*Hyles lineata*)

Sphinginae (*Sphinginae*)
Carolina sphinx (*Manduca sexta*)
Carter's sphinx (*Protambulyx carteri*)
Giant sphinx (*Cocytius antaeus*)
Occult sphinx (*Manduca occulta*)
Pink-spotted hawkmoth (*Agrius cingulata*)
Streaked sphinx (*Protambulyx strigilis*)

Tiger Moths and Lichen Moths (*Arctiidae*)
Lichen Moths (*Lithosiinae*)
Neoplynes eudora (*Neoplynes eudora*)
Mouse-Colored Lichen Moth (*Pagara simplex*)
Subject Lichen Moth (*Cisthene subjecta*)

Pericopine Moths (*Pericopinae*)
Faithful Beauty (*Composia fidelissima*)

Syntomine Moths (*Syntominae*)
Edwards' Wasp Moth (*Lymire edwardsii*)
Lesser Wasp Moth (*Pseudocharis minima*)
Polka-Dot Wasp Moth (*Syntomeida epilais*)

Tiger Moths (*Arctiinae*)
Streaked Calidota (*Calidota laqueata*)
Yellow-Winged Pareuchaetes (*Pareuchaetes insulata*)

Whites and Sulphurs (*Pieridae*)
Sulphurs (*Coliadinae*)
Barred Yellow (*Eurema daira*)
Boisduval's Yellow (*Eurema boisduvaliana*)
Cloudless Sulphur (*Phoebis sennae*)
Dainty Sulphur (*Nathalis iole*)
Dina Yellow (*Pyrisitia dina*)
Large Orange Sulphur (*Phoebis agarithe*)
Little Yellow (*Pyrisitia lisa*)
Lyside Sulphur (*Kricogonia lyside*)
Mimosa Yellow (*Pyrisitia nise*)
Orange Sulphur (*Colias eurytheme*)

Orange-barred Sulphur (*Phoebis philea*)
Orbed Sulphur (*Aphrissa orbis*)
Sleepy Orange (*Abaeis nicippe*)
Southern Dogface (*Zerene cesonia*)
Statira Sulphur (*Aphrissa statira*)
Yellow Angled-Sulphur (*Anteos maerula*)

Whites (*Pierinae*)
Cabbage White (*Pieris rapae*)
Checkered White (*Pontia protodice*)
Florida White (*Appias drusilla*)
Great Southern White (*Ascia monuste*)

Wild Silk Moths (*Saturniidae*)
Buck and Io Moths (*Hemileucinae*)
Io moth (*Automeris io*)

Royal Moths (*Citheroniinae*)
Consular oakworm moth (*Anisota consularis*)
Imperial moth (*Eacles imperialis*)
Pink-striped oakworm moth (*Anisota virginiensis*)

Plants of Lower Keys National Wildlife Refuges

Source: The Institute for Regional Conservation (IRC), Floristic Inventory of South Florida database

February 12, 2007

Gann, G.D., K.A. Bradley and S.W. Woodmansee. 2001-2007.
The Floristic Inventory of South Florida Database Online.
The Institute for Regional Conservation, Miami.

Legend:
Superscript (**I or II**) in scientific name column: FLEPPC *(Florida Exotic Pest Plant Council)* **=** Category I or II
Native Status: **N =** Native**, NN =** Not Native**, NA =** Naturalized**, CO =** Cultivated Only
IRC Status: **CI =** Critically Imperiled**, E =** Extirpated
State Status: **T =** Threatened**, E =** Endangered**, C =** Species of special concern
Federal Status: **T =** Threatened**, E =** Endangered**, C =** Candidate species
Refuges: **KD =** Key Deer**, KW =** Key West**, GWH =** Great White Heron

Scientific Name	Common Name	Native Status	IRC Status	State Status	Federal Status	Refuges
Abelmoschus esculentus	**Okra**	NN, NA				KD
Abildgaardia ovata	**Flatspike sedge**	N				KD
Abutilon permolle	**Coastal Indian mallow**	N				KD
Acacia farnesiana	**Sweet acacia**	N				KD, KW
Acacia pinetorum	**Pineland acacia**	N				KD
Acalypha chamaedrifolia	**Three-seeded mercury, Bastard copperleaf**	N				KD
Acanthocereus tetragonus	**Barbwire cactus, Dildoe cactus**	N		T		KD, KW, GWH
Acrostichum aureum	**Golden leather fern**	N		T		KD
Acrostichum danaeifolium	**Giant leather fern**	N				KD
Agalinis fasciculata	**Beach false foxglove**	N	CI			KD
Agalinis maritima	**Saltmarsh false foxglove**	N				KD
Agalinis obtusifolia	**Tenlobe false foxglove**	N	CI			KD
Agave americana	**Century plant**	NN, NA				KD
Agave decipiens	**False-sisal**	N				KD, KW, GWH
Agave sisalana [II]	**Sisal-hemp**	NN, NA				KD, KW, GWH
Ageratum littorale	**Keys ageratum, Cape Sable Whiteweed**	N		E		KD
Albizia lebbeck [I]	**Woman's tongue, Rattlepod**	NN, NA				KD

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Aletris bracteata	**White colic-root, bracted colic-root**	N		E		KD
Aloe vera	**Aloe**	NN, CO				KD, KW
Alternanthera flavescens	**Yellow joyweed**	N				KD, KW, GWH
Alternanthera maritima	**Seaside joyweed**	N				KW
Amaranthus hybridus	**Common pigweed, slim amaranth**	NN, NA				KD
Amaranthus spinosus	**Spiny amaranth**	NN, NA				KD
Ambrosia artemisiifolia	**Common ragweed**	N				KD, KW
Ambrosia hispida	**Beach ragweed, Coastal ragweed**	N				KD, KW
Ammannia latifolia	**Pink redstem, Toothcup**	N				
Amyris elemifera	**Common torchwood, Sea torchwood**	N				KD, KW, GWH
Andropogon glomeratus var. pumilus	**Common bushy bluestem**	N				KD, KW
Andropogon longiberbis	**Hairy bluestem**	N				KD
Andropogon ternarius	**Splitbeard bluestem**	N				KD
Andropogon virginicus	**Broomsedge bluestem**	N				KD
Anemia adiantifolia	**Pine fern, Maidenhair pineland fern**	N				KD
Angadenia berteroi	**Pineland-allamanda, Pineland golden trumpet**	N		T		KD
Annona glabra	**Pond-apple**	N				KD
Ardisia escallonioides	**Marlberry**	N				KD, GWH
Argusia gnaphalodes	**Sea-lavender, Sea-rosemary**	N		E		KD, KW
Argythamnia blodgettii	**Blodgett's silverbush**	N		E	C	KD
Aristida purpurascens	**Arrowfeather threeawn**	N				KD, KW
Arundo donax	**Giant reed**	NN, CO				KD
Asclepias viridis	**Green antelopehorn**	N				KD
Asparagus densiflorus [1]	**Sprenger's asparagus-fern**	NN, NA				KD
Asparagus officinalis	**Garden asparagus**	NN, CO				KD
Asparagus setaceus	**Common asparagus-fern**	NN, NA				KD

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Aster adnatus	**Clasping aster, Scaleleaf aster**	N				KD
Aster bracei	**Brace's aster**	N				KD, KW
Aster concolor	**Eastern silver aster**	N				KD
Aster dumosus	**Rice button aster**	N				KD
Aster subulatus	**Annual saltmarsh aster**	N				KD
Atriplex pentandra	**Beach orach, Crested saltbush**	N				KD, KW, GWH
Avicennia germinans	**Black mangrove**	N				KD, KW, GWH
Ayenia euphrasiifolia	**Eyebright ayenia**	N				KD
Baccharis angustifolia	**Narrowleaved groundsel, Saltwater Falsewillow**	N				KD
Baccharis halimifolia	**Saltbush, Groundsel tree, Sea-myrtle**	N				KD, GWH
Bacopa monnieri	**Water hyssop, Herb-of-grace**	N				KD
Basiphyllaea corallicola	**Carter's orchid**	N	CI	E		KD
Batis maritima	**Saltwort, Turtleweed**	N				KD, KW, GWH
Bidens alba var. radiata	**Spanish-needles**	N				KD, KW, GWH
Blechum pyramidatum [II]	**Green shrimpplant, Browne's blechum**	NN, NA				GWH
Bletia purpurea	**Pinepink**	N		T		KD
Blutaparon vermiculare	**Samphire, Silverhead**	N				KD, KW, GWH
Boerhavia diffusa	**Red spiderling, wineflower**	N				KD, KW, GWH
Boerhavia erecta	**Erect spiderling**	N				KD
Borrichia arborescens	**Green sea-oxeye-daisy, Tree seaside oxeye**	N				KD, KW, GWH
Borrichia frutescens	**Silver sea-oxeye-daisy, Bushy seaside oxeye**	N				KD, KW, GWH
Borrichia xcubana	**Cuban sea-oxeye-daisy**	N				KD
Bothriochloa pertusa	**Pitted bluestem, Pitted beardgrass**	NN, NA				KD
Bourreria cassinifolia	**Pineland strongback**	N	CI	E		KD
Bourreria succulenta	**Smooth strongback, Bahama strongbark**	N		E		KD

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Buchnera americana	**American bluehearts**	N				KD
Bursera simaruba	**Gumbo-limbo**	N				KD, KW, GWH
Byrsonima lucida	**Locustberry**	N		T		KD, KW, GWH
Caesalpinia bonduc	**Gray nicker-bean**	N				KD, KW, GWH
Caesalpinia major	**Yellow nicker-bean**	N	CI	E		GWH
Caesalpinia pauciflora	**Fewflower holdback**	N	CI	E		KD
Cajanus cajan	**Pigeonpea**	NN, NA				KD
Cakile lanceolata	**Coastal searocket**	N				KD, KW
Callisia fragrans [II]	**Basketplant**	NN, NA				GWH
Callisia repens	**Basket plant, Creeping inchplant**	NN, NA				GWH
Calyptranthes pallens	**Spicewood, Pale lidflower**	N		T		KD
Canavalia rosea	**Beach-bean, Baybean, Seaside jackbean**	N				KD, KW, GWH
Canella winterana	**Cinnamon bark, Pepper cinnamon**	N		E		KD, GWH
Capparis cynophallophora	**Jamaica caper-tree**	N				KD, KW, GWH
Capparis flexuosa	**Limber caper, Bayleaf capertree**	N				KD, KW, GWH
Capraria biflora	**Goatweed**	N				KD, KW
Capsicum annuum var. glabriusculum	**Bird pepper, Cayenne pepper**	N				KD
Carica papaya	**Papaya**	NN, NA				KD, KW
Carissa macrocarpa	**Natal-plum**	NN, NA				KD
Cassytha filiformis	**Lovevine, Devil's gut**	N				KD
Casuarina equisetifolia [I]	**Australian-pine, Horsetail casuarina**	NN, NA				KD, KW, GWH
Catesbaea parviflora	**Smallflower lilythorn**	NN	CI	E		KD
Catharanthus roseus	**Madagascar-periwinkle**	NN, NA				KD
Cenchrus echinatus	**Southern sandbur**	N				KD, KW, GWH
Cenchrus gracillimus	**Slender sandbur**	N				KD
Cenchrus incertus	**Coastal sandbur**	N				KD, KW
Cenchrus tribuloides	**Sanddune sandbur**	N				KW, GWH
Centella asiatica	**Coinwort, Spadeleaf**	N				KD

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Centrosema virginianum	**Spurred butterfly-pea**	N				KD, KW
Ceratophyllum muricatum subsp. australe	**Prickly hornwort**	N, E	E			KD
Chamaecrista lineata var. keyensis	**Big Pine partridge pea**	N		E	C	KD, KW, GWH
Chamaecrista nictitans var. aspera	**Hairy sensitive-pea, Hairy partridge-pea**	N				KD, KW
Chamaesyce blodgettii	**Limestone sandmat**	N				KD, KW
Chamaesyce conferta	**Everglades key sandmat**	N				KD
Chamaesyce cordifolia	**Heartleaf sandmat**	N				KD
Chamaesyce deltoidea spp. serpyllum	**wedge spur**	N	CI	E	C	KD
Chamaesyce garberi	**Garber's sandmat**	N		E	T	KD, KW
Chamaesyce hirta	**Hairy spurge, Pillpod sandmat**	N				KD
Chamaesyce hypericifolia	**Eyebane, Graceful sandmat**	N				KD, KW, GWH
Chamaesyce hyssopifolia	**Eyebane, Hyssopleaf sandmat**	N				KD
Chamaesyce mesembrianthemifolia	**Seaside spurge, Coastal beach sandmat**	N				KD, KW, GWH
Chamaesyce pergamena	**Southern Florida sandmat**	N		T		KD
Chamaesyce porteriana	**Porter's sandmat**	N		E		KD
Chiococca alba	**Common snowberry, Milkberry**	N				KD
Chiococca parvifolia	**Pineland snowberry**	N				KD, GWH
Chromolaena frustrata	**Cape Sable thoroughwort**	N	CI	E	C	KW
Chromolaena odorata	**Jack-in-the-bush**	N				KD
Chrysobalanus icaco	**Coco-plum**	N				KD
Chrysophyllum oliviforme	**Satinleaf**	N		T		KD
Cirsium horridulum	**Purple thistle**	N				KD
Cissus trifoliata	**Marinevine, Sorrelvine**	N				KD
Citharexylum spinosum	**Florida fiddlewood**	N				KD, KW
Citrus aurantifolia	**Key lime**	NN, NA				KD

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Cladium jamaicense	**Saw-grass, Jamaica swamp sawgrass**	N				KD, GWH
Clitoria ternatea	**Asian pigeonwings**	NN, NA				KD
Clusia rosea	**Pitch-apple**	NN, NA				KD
Cnidoscolus stimulosus	**Tread-softly, Finger-rot, 7-minute-itch**	N				KD
Coccoloba diversifolia	**Pigeonplum, Tietongue**	N				KD, KW, GWH
Coccoloba uvifera	**Seagrape**	N				KD, KW, GWH
Coccothrinax argentata	**Florida silver palm**	N		T		KD, KW, GWH
Cocos nucifera	**Coconut palm**	NN, NA				KD, KW, GWH
Colubrina arborescens	**Coffee colubrina, Greenheart**	N		E		KD, KW
Colubrina asiatica [1]	**Latherleaf, Asian nakedwood**	NN, NA				KD, KW, GWH
Commelina erecta	**Whitemouth dayflower**	N				KD, KW, GWH
Conocarpus erectus	**Buttonwood**	N				KD, KW, GWH
Conoclinium coelestinum	**Blue mistflower**	N				KD
Consolea coralicola	**Florida Semaphore cactus**	N	CI	E	C	KD
Conyza canadensis var. pusilla	**Dwarf Canadian horseweed**	N				KD, KW
Cordia globosa	**Butterflybush, Curacao bush**	N		E		KD
Cordia sebestena	**Orange geigertree, Largeleaf geigertree**	NN, NA				KD, KW, GWH
Coreopsis leavenworthii	**Leavenworth's tickseed**	N				KD
Crossopetalum ilicifolium	**Quailberry, Christmasberry**	N		T		KD
Crossopetalum rhacoma	**Rhacoma, Maidenberry**	N		T		KD, GWH
Crotalaria incana	**Shakeshake**	NN, NA				KD
Crotalaria pumila	**Low rattlebox**	N				KD
Crotalaria rotundifolia	**Rabbitbells**	N				KD
Croton linearis	**Pineland croton, Grannybush**	N				KD
Cupania glabra	**American toadwood**	N	CI	E		KD, GWH
Cynanchum angustifolium	**Vine milkweed, Gulf Coast swallowwort**	N				KD, KW, GWH

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Cynanchum blodgettii	**Blodgett's swallowwort**	N		T		KD
Cynanchum northropiae	**Vine milkweed, Fragrant swallowwort**	N				KD, KW, GWH
Cynanchum scoparium	**Hairnetvine, Leafless swallowwort**	N				KD
Cynodon dactylon	**Bermuda grass**	NN, NA				KD, KW, GWH
Cyperus compressus	**Poorland flatsedge**	N				KD
Cyperus elegans	**Royal flatsedge**	N				KD
Cyperus fuligineus	**Limestone flatsedge**	N	CI	E		KD
Cyperus ligularis	**Swamp flatsedge**	N				KD
Cyperus odoratus	**Fragrant flatsedge**	N				KD
Cyperus planifolius	**Flatleaf flatsedge**	N				KD, KW, GWH
Cyperus polystachyos	**Manyspike flatsedge**	N				KD
Cyperus retrorsus	**Pinebarren flatsedge**	N				KD
Cyperus squarrosus	**Bearded flatsedge**	N	CI			KD
Cyperus tetragonus	**Fourangle flatsedge**	N				KD
Dactyloctenium aegyptium	**Crow's-foot grass, Durban crowfootgrass**	NN, NA				KD, KW, GWH
Dalbergia ecastaphyllum	**Coinvine**	N				GWH
Delonix regia	**Royal poinciana, Flamboyant**	NN, NA				KD
Desmanthus virgatus	**Wild tantan**	N				KD, KW
Desmodium incanum	**Beggar's-ticks**	N				KD, GWH
Desmodium tortuosum	**Dixie ticktrefoil**	NN, NA				KD
Desmodium triflorum	**Threeflower ticktrefoil**	NN, NA				KD
Dichanthelium dichotomum	**Cypress witchgrass**	N				KD
Dicliptera sexangularis	**False-mint, Sixangle foldwing**	N				KD, KW
Digitaria bicornis	**Asia crabgrass**	NN, NA				KD, KW, GWH
Digitaria ciliaris	**Southern crabgrass**	N				KD, KW, GWH
Digitaria filiformis var. dolichophylla	**Caribbean crabgrass**	N		T		KD
Digitaria insularis	**Sourgrass**	N				KD

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Diospyros virginiana	**Persimmon, Common persimmon**	N				KD
Distichlis spicata	**Saltgrass**	N				KD, KW, GWH
Dodonaea elaeagnoides	**Smallfruit varnishleaf**	N		E		KD
Drypetes diversifolia	**Milkbark, Whitewood**	N		E		KD, GWH
Drypetes lateriflora	**Guiana-plum**	N		T		KD
Dyschoriste angusta	**Rockland twinflower, Pineland snakeherb**	N				KD
Echites umbellata	**Devil's-potato, Rubbervine**	N				KD, GWH
Eleocharis cellulosa	**Gulf Coast spikerush**	N				KD
Eleocharis geniculata	**Canada spikerush**	N				KD
Eleusine indica	**Indian goose grass**	NN, NA				KD
Emilia fosbergii	**Florida tasselflower**	NN, NA				KD
Encyclia tampensis	**Florida butterfly orchid**	N		C		KD, KW, GWH
Eragrostis amabilis	**Feather love grass**	NN, NA				KD
Eragrostis ciliaris	**Gophertail love grass**	NN, NA				KD, KW
Eragrostis elliottii	**Elliott's love grass**	N				KD
Eriochloa michauxii	**Longleaf cup grass, Michaux's cup grass**	N				KD
Erithalis fruticosa	**Blacktorch**	N		T		KD, KW, GWH
Ernodea littoralis	**Beach-creeper, Golden-creeper, Coughbush**	N				KD, KW, GWH
Erythrina herbacea	**Coralbean, Cherokee bean**	N				KD, KW
Eugenia axillaris	**White stopper**	N				KD, KW, GWH
Eugenia foetida	**Spanish stopper, Boxleaf stopper**	N				KD, KW, GWH
Eupatorium capillifolium	**Dog-fennel**	N				KD
Euphorbia lactea	**Mottled spurge**	NN, CO				KD
Euphorbia tirucalli	**Pencil-cactus, Pencil tree, Indian tree spurg**	NN, CO				KD
Euphorbia trichotoma	**Sanddune spurge**	N				KW
Eustachys glauca	**Prairie fingergrass, Saltmarsh fingergrass**	N				KD, KW

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Eustachys petraea	**Common fingergrass, Pinewoods fingergrass**	N				KD, KW, GWH
Eustoma exaltatum	**Seaside gentian, Marshgentian**	N				KD, KW, GWH
Evolvulus alsinoides	**Slender dwarf morningglory**	NN, NA				KD, KW
Evolvulus convolvuloides	**Bindweed dwarf morningglory**	N		E		KD
Evolvulus grisebachii	**Grisebach's Dwarf morningglory**	N	CI	E		KD
Evolvulus sericeus	**Silver dwarf morningglory**	N				KD
Exostema caribaeum	**Caribbean princewood**	N	CI	E		KD
Exothea paniculata	**Inkwood, Butterbough**	N				KD, GWH
Ficus aurea	**Strangler fig, Golden fig**	N				KD, KW, GWH
Ficus citrifolia	**Short-leaf fig, Wild banyan tree**	N				KD, KW
Fimbristylis cymosa	**Hurricane sedge, Hurricanegrass**	NN,NA				KD, KW, GWH
Fimbristylis spadicea	**Marsh fimbry**	N				KD, KW
Flaveria linearis	**Narrowleaf yellowtops**	N				KD, KW
Flaveria trinervia	**Annual yellowtops, Clustered yellowtops**	N				KD
Forestiera segregata	**Florida privet, Florida swampprivet**	N				KD
Gaillardia pulchella	**Blanketflower, Firewheel**	NN,NA				KD
Galactia striata	**Florida hammock milkpea**	N				KD, KW, GWH
Galactia volubilis	**Downy milkpea**	N				KD, KW, GWH
Galium hispidulum	**Coastal bedstraw**	N				KD
Gaura angustifolia	**Southern gaura, Southern beeblossum**	N				KD
Genipa clusiifolia	**Sevenyear apple**	N				KD, KW, GWH
Gossypium hirsutum	**Wild cotton, Upland cotton**	N		E		KD, KW, GWH
Guapira discolor	**Blolly, Beeftree**	N				KD, KW, GWH

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Guettarda elliptica	**Everglades velvetseed, Hammock velvetseed**	N				KD
Guettarda scabra	**Rough velvetseed**	N				KD, GWH
Gyminda latifolia	**West Indian false boxwood**	N		E		KD, KW
Gymnanthes lucida	**Crabwood, Oysterwood**	N				KD, KW, GWH
Habenaria quinqueseta	**Longhorn false reinorchid**	N				KD
Halodule wrightii	**Shoal-grass, Shoalweed**	N				KD, KW
Hamelia patens	**Firebush**	N				KD
Harrisia simpsonii	**Simpson's pricklyapples, Simpson's applecactus**	N		E		KD
Hedyotis nigricans var. floridana	**Florida diamond flowers**	NN				KD
Helianthus annuus	**Annual sunflower, Common sunflower**	NN,NA				KD
Heliotropium angiospermum	**Scorpionstail**	N				KD, KW, GWH
Heliotropium curassavicum	**Seaside heliotrope, Salt heliotrope**	N				KD, KW, GWH
Heliotropium polyphyllum	**Pineland heliotrope**	N				KD
Herissantia crispa	**Bladdermallow**	N				KD, KW, GWH
Hibiscus poeppigii	**Poeppig's rosemallow**	N		E		KD
Hibiscus rosa-sinensis	**Garden rosemallow, Shoe-back-plant**	NN, NA				KD
Hibiscus tiliaceus [II]	**Seaside mahoe, Sea hibiscus, mahoe**	NN, NA				KD
Hippomane mancinella	**Manchineel**	N		E		KD
Hymenocallis latifolia	**Mangrove spiderlily, Perfumed spiderlily**	N				KD, KW, GWH
Hypelate trifoliata	**White-ironwood, Inkwood**	N	CI	E		KD
Hypoxis wrightii	**Bristleseed yellow stargrass**	N				KD
Indigofera miniata var. florida	**Florida coastal indigo**	N				KD
Indigofera tinctoria	**True indigo**	NN, NA				KD

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Ipomoea alba	**Common moonflowers, Moonflowers**	N				KD, KW
Ipomoea batatas	**Sweetpotato**	NN, NA				KD
Ipomoea indica var. acuminata	**Ocean-blue morningglory**	N				KD, KW, GWH
Ipomoea pes-caprae subsp. brasiliensis	**Railroadvine, Bayhops**	N				KD, KW, GWH
Ipomoea sagittata	**Everglades morningglory**	N				KD
Ipomoea triloba	**Three-lobed morningglory, Littlebell**	NN, NA				KD, GWH
Ipomoea violacea	**Coastal morningglory**	N				KD, KW, GWH
Iresine diffusa	**Bloodleaf, Juba's bush**	N				KD
Iva imbricata	**Beach-elder, Seacoast marshelder**	N				KD, KW, GWH
Jacquemontia pentanthos	**Skyblue clustervine**	N		E		KD
Jacquinia keyensis	**Joewood**	N		T		KD, KW, GWH
Juncus roemerianus	**Black needle rush, Needle rush, Black rush**	N				KD
Kalanchoe daigremontiana	**Devil's-backbone**	NN, NA				KD, KW
Kalanchoe tubiflora	**Chandelier plant**	NN, NA				KD
Kosteletzkya virginica	**Virginia saltmarsh mallow**	N				KW
Krugiodendron ferreum	**Black ironwood**	N				KD, KW
Laguncularia racemosa	**White mangrove**	N				KD, KW, GWH
Lantana camara [1]	**Shrubverbena**	NN, NA				KD
Lantana involucrata	**Wild-sage, Buttonsage**	N				KD, KW, GWH
Lasiacis divaricata	**Smallcane, Florida tibisee, Wild-bamboo**	N				KD, KW, GWH
Launaea intybacea	**Achicoria azul**	NN, NA				KD
Lepidium virginicum	**Poor-man's-pepper, Virginia pepperweed**	N				KD
Leptochloa dubia	**Green spangletop, Green sprangletop**	N				KD, GWH
Leptochloa fascicularis	**Bearded spangletop, Bearded sprangletop**	N				KD

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Leucaena leucocephala [II]	**White leadtree**	NN, NA				KD, KW
Liatris tenuifolia	**Shortleaf gayfeather**	N				KD
Licania michauxii	**Gopher-apple**	N				KD
Limonium carolinianum	**Saltmarsh-rosemary, Carolina sealavender**	N				KD, KW
Linum arenicola	**Sand flax**	N		E	C	KD
Livistona chinensis [II]	**Chinese fan palm**	NN, NA				KD
Lobelia glandulosa	**Glade lobelia**	N				KD
Ludwigia curtissii	**Curtiss's primrosewillow**	N				KD
Ludwigia microcarpa	**Smallfruit primrosewillow**	N				KD
Ludwigia repens	**Creeping primrosewillow**	N				KD
Lycium carolinianum	**Christmasberry, Carolina desertthorn**	N				KD, KW, GWH
Lycopersicon esculentum	**Tomato, Garden tomato**	NN, NA				KD
Lysiloma latisiliquum	**Wild-tamarind, False tamarind**	N				KD, KW
Lythrum lineare	**Wand loosestrife**	N				KD
Macroptilium lathyroides	**Wild-bean, Wild bushbean**	NN, NA				KD
Malvastrum corchorifolium	**False mallow**	N				KD
Malvaviscus arboreus var. drummondii	**Texas waxmallow**	NN, NA				KD
Manilkara jaimiqui subsp. emarginata	**Wild dilly**	N		T		KD, KW, GWH
Manilkara zapota [I]	**Sapodilla**	NN, NA				KD, KW
Maytenus phyllanthoides	**Florida mayten**	N		T		KD, KW, GWH
Mecardonia acuminata subsp. peninsularis	**Axilflower**	N				KD
Melaleuca quinquenervia [I]	**Punktree**	NN, NA				KD
Melanthera nivea	**Snow squarestem**	N				KD, KW, GWH
Melanthera parvifolia	**Pineland blackanthers**	N		T		KD
Melia azedarach [II]	**Chinaberrytree**	NN, NA				KD
Melicoccus bijugatus	**Spanish lime**	NN, NA				KD

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Melothria pendula	**Creeping-cucumber**	N				KD
Metopium toxiferum	**Poisonwood, Florida poisontree**	N				KD, KW, GWH
Mikania scandens	**Climbing hempweed, Climbing hempvine**	N				KD
Mitreola petiolata	**Miterwort, Lax hornpod**	N				KD
Mitreola sessilifolia	**Mitrewort, Swamp hornpod**	N				KD
Momordica charantia	**Wild balsam-apple, Balsampear**	NN, NA				KD
Monanthochloe littoralis	**Shoregrass, Keygrass**	N				KD, KW, GWH
Morinda royoc	**Yellowroot, Redgal, Mouse's pineapple**	N				KD, KW, GWH
Muhlenbergia capillaris	**Muhlygrass, Hairawnmuhly**	N				KD
Musa x paradisiaca	**Common banana**	NN, NA				KD
Myrica cerifera	**Wax myrtle, Southern Bayberry**	N				KD
Nephrolepis exaltata	**Wild Boston fern**	N				KD
Neptunia pubescens	**Tropical-puff**	N				KD
Nerium oleander	**Oleander**	NN, NA				KD
Nicotiana tabacum	**Tobacco, Cultivated tobacco**	NN, NA				KD
Ocimum campechianum	**Wild basil, Wild sweet basil**	N		E		KD
Odontosoria clavata	**Wedgelet fern**	N		E		KD
Opuntia cubensis	**Bullsuckers**	N	CI			KD
Opuntia humifusa	**Pricklypear**	N				KD
Opuntia stricta	**Erect pricklypear**	N		T		KD, KW, GWH
Opuntia triacanthos	**Jumping cactus**	N	CI	E		KD
Panicum amarum	**Beachgrass, Bitter panicgrass**	N				KD, KW
Panicum dichotomiflorum var. bartowense	**Hairy fall panic grass**	N				KD
Panicum maximum [II]	**Guineagrass**	NN, NA				KD, KW
Panicum rigidulum	**Redtop panicum**	N				KD
Panicum virgatum	**Switchgrass**	N				KD

Scientific Name	Common Name	Native Status	IRC Status	State Status	Federal Status	Refuges
Parietaria floridana	**Florida pellitory**	N				KD
Parkinsonia aculeata	**Mexican palo verde, Jerusalam thorn**	NN, NA				KD
Parthenocissus quinquefolia	**Virginia-creeper, Woodbine**	N				KD
Paspalidium chapmanii	**Coral panicum**	N		E		KD, KW
Paspalum blodgettii	**Coral paspalum, Blodgett's crowngrass**	N				KW
Paspalum caespitosum	**Blue paspalum, Blue crowngrass**	N				KD, KW
Paspalum distichum	**Knot grass**	N				KD, KW
Paspalum laxum	**Coconut paspalum**	N				KD
Paspalum monostachyum	**Gulfdune paspalum**	N				KD
Paspalum notatum	**Bahia grass**	NN, NA				KD
Paspalum setaceum	**Thin paspalum**	N				KD, KW, GWH
Paspalum vaginatum	**Seashore paspalum**	N				KD, KW, GWH
Passiflora suberosa	**Corkystem passionflower**	N				KD, KW, GWH
Pectis glaucescens	**Tea-blinkum, Sanddune cinchweed**	N				KD, KW
Pedilanthus tithymaloides subsp. smallii	**Jacob's ladder, Devil's backbone**	NN, NA				KW
Pentalinon luteum	**Wild-allamanda, Hammock viperstail**	N				KD, KW, GWH
Persea americana	**Avocado**	NN, NA				KD
Persea palustris	**Swamp bay**	N				KD
Phlebodium aureum	**Golden polypody**	N				KD
Phoenix dactylifera	**Commercial date palm, Date**	NN, NA				KD, KW
Phoenix reclinata [II]	**Senegal date palm**	NN, NA				KD, KW
Phyla nodiflora	**Frogfruit, Turkey tangle fogfruit, Capeweed**	N				KD, GWH
Phyllanthus amarus	**Gale-of-wind, Carry-me-seed**	NN, NA				KD
Phyllanthus pentaphyllus var. floridanus	**Florida five-petalled leafflower**	N				KD
Physalis angulata	**Cutleaf groundcherry**	N				KD

Scientific Name	Common Name	Native Status	IRC Status	State Status	Federal Status	Refuges
Physalis angustifolia	**Coastal groundcherry**	N				KD
Physalis pubescens	**Husk tomato**	N				KD
Physalis walteri	**Walter's groundcherry**	N				GWH
Pilea herniarioides	**Caribbean clearweed**	N				KD
Pilea microphylla	**Artillery plant, Rockweed**	N				KD
Pilosocereus robinii	**Key tree cactus**	N	CI	E	E	KD
Pinguicula pumila	**Small butterwort**	N				KD
Pinus elliottii var. densa	**South Florida slash pine**	N				KD, GWH
Piriqueta caroliniana	**Pitted stripeseed**	N				KD
Piscidia piscipula	**Jamaica-dogwood, Florida fishpoison tree**	N				KD, KW, GWH
Pisonia aculeata	**Devil's claws, Pullback**	N				KD, KW, GWH
Pisonia rotundata	**Smooth devilsclaws, Blolly**	N		E		KD
Pithecellobium keyense	**Florida Keys blackbead**	N		T		KD, KW, GWH
Pithecellobium unguis-cati	**Cat's-claw, Catclaw blackbead**	N				KD, KW
Pityopsis graminifolia	**Narrowleaf silkgrass**	N				KD
Pityrogramma trifoliata	**Goldenrod fern**	N				KD
Pleopeltis polypodioides var. michauxiana	**Resurrection fern**	N				KD
Pluchea carolinensis	**Cure-for-all**	N				KD
Pluchea odorata	**Sweetscent**	N				KD
Pluchea rosea	**Rosy camphorweed**	N				KD
Poinsettia cyathophora	**Paintedleaf, Fire-on-the-mountain**	N				KD, KW, GWH
Poinsettia heterophylla	**Fiddler's spurge, Mexican fireplant**	N				KD, KW
Poinsettia pinetorum	**Pineland poinsettia, Pineland spurge**	N		E		KD, KW
Polygala balduinii	**Baldwin's milkwort**	N				KD
Polygala boykinii	**Boykin's milkwort**	N				KD

Scientific Name	Common Name	Native Status	IRC Status	State Status	Federal Status	Refuges
Polygala grandiflora	**Candyweed, Showy milkwort**	N				KD
Polypremum procumbens	**Rustweed, Juniperleaf**	N				KD
Portulaca oleracea	**Purslane, Little hogweed**	N				KD, KW, GWH
Portulaca rubricaulis	**Stalked purslane, Redstem purslane**	N				KD, KW
Proserpinaca palustris	**Mermaid weed, Marsh mermaidweed**	N				KD
Psidium guajava [I]	**Guava**	NN, NA				KD
Psidium longipes	**Longstalked-stopper**	N		T		KD, GWH
Psilotum nudum	**Whisk-fern**	N				KD
Psychotria nervosa	**Shiny-leaved wild coffee**	N				KD
Pteridium aquilinum var. caudatum	**Lacy bracken fern**	N				KD, GWH
Pteris bahamensis	**Bahama ladder brake**	N		T		KD
Pteris vittata [II]	**China brake**	NN, NA				KD
Pterocaulon pycnostachyum	**Blackroot**	N				KD
Punica granatum	**Pomegranate**	NN, CO				KD
Randia aculeata	**White indigoberry**	N				KD, KW, GWH
Rapanea punctata	**Myrsine, Colicwood**	N				KD, KW, GWH
Rayjacksonia phyllocephala	**Camphor daisy**	N				KD, GWH
Reynosia septentrionalis	**Darlingplum**	N		T		KD, KW, GWH
Rhabdadenia biflora	**Mangrove rubbervine, Mangrovevine**	N				KD
Rhizophora mangle	**Red mangrove**	N				KD, KW, GWH
Rhus copallinum	**Winged sumac**	N				KD
Rhynchelytrum repens [I]	**Rose Natalgrass**	NN, NA				KD
Rhynchosia cinerea	**Brownhair snoutbean**	N				KD
Rhynchosia minima	**Least snoutbean**	N				KD
Rhynchosia parvifolia	**Small-leaf snoutbean**	N		T		KD
Rhynchospora colorata	**Starrush whitetop**	N				KD

Scientific Name	Common Name	Native Status	IRC Status	State Status	Federal Status	Refuges
Rhynchospora divergens	**Spreading beaksedge**	N				KD
Rhynchospora floridensis	**Florida whitetop**	N				KD
Rhynchospora microcarpa	**Southern beaksedge**	N				KD
Ricinus communis [II]	**Castor-bean**	NN, NA				KD
Rivina humilis	**Rougeplant**	N				KD, KW, GWH
Roystonea regia	**Royal palm, Florida royal palm**	N		E		KW
Ruellia ciliatiflora	**Hairyflower wild petunia**	NN, NA				KD
Ruellia succulenta	**Thickleaf wild petunia**	N				KD
Ruppia maritima	**Wigeon-grass**	N				KD
Sabal palmetto	**Cabbage palm**	N				KD, KW
Sabatia stellaris	**Rose-of-Plymouth**	N				KD
Saccharum officinarum	**Sugarcane**	NN, NA				KD
Sachsia polycephala	**Bahama sachsia**	N		T		KD
Sagittaria lancifolia	**Bulltongue arrowhead, lance-leaved arrowhead**	N				KD
Salicornia bigelovii	**Annual glasswort**	N				KD, GWH
Salicornia perennis	**Perennial glasswort**	N				KD, KW, GWH
Salvia serotina	**Sage, Littlewoman**	N				KW
Samolus ebracteatus	**Water pimpernel, Limewater brookweed**	N				KD
Samolus valerandi subsp. parviflorus	**Pineland pimpernel, Seaside brookweed**	N				KD
Sansevieria hyacinthoides [II]	**Bowstring-hemp, Mother-in-laws tongue**	NN, NA				KD, KW, GWH
Sarcostemma clausum	**Whitevine, White twinevine**	N				KD, KW, GWH
Savia bahamensis	**Maidenbush, Bahama maidenbush**	N		E		KD, GWH
Scaevola plumieri	**Inkberry, Beachberry, Gullfeed**	N		T		KW
Scaevola sericea [I]	**Beach napuka**	NN, NA				KW
Schinus terebinthifolius [I]	**Brazilian-pepper**	NN, NA				KD, KW, GWH
Schizachyrium gracile	**Wire bluestem**	N				KD, KW

Scientific Name	Common Name	Native Status	IRC Status	State Status	Federal Status	Refuges
Schizachyrium rhizomatum	**Rhizomatous bluestem**	N				KD
Schizachyrium sanguineum	**Crimson bluestem**	N				KD, KW
Schoenus nigricans	**Black sedge, Black bogrush**	N				KD
Scleria lithosperma	**Florida Keys nutrush**	N		E		KD, KW
Scleria verticillata	**Low nutrush**	N				KD
Scutellaria havanensis	**Havana skullcap**	N		E		KD
Senna ligustrina	**Privet senna, Privet wild sensitive plant**	N				KD
Senna mexicana var. chapmanii	**Bahama senna, Chapman's wild sensitive plant**	N		T		KD
Serenoa repens	**Saw palmetto**	N				KD, KW
Sesbania herbacea	**Danglepod**	N				KD
Sesbania sericea	**Silky sesban**	NN, NA				KD
Sesuvium maritimum	**Annual sea-purslane, Slender seapurslane**	N				KD
Sesuvium portulacastrum	**Perennial sea-purslane, Shoreline seapurslane**	N				KD, KW, GWH
Setaria macrosperma	**Coastal foxtail, Coral bristlegrass**	N				KD, KW, GWH
Setaria magna	**Giant bristlegrass**	N				KD
Setaria parviflora	**Knotroot foxtail, Yellow bristlegrass**	N				KD, KW
Setaria pumila	**Yellow bristlegrass, Yellow foxtail**	NN, NA				KD
Sida abutifolia	**Spreading fanpetals**	N				KD
Sida acuta	**Common wireweed, Common fanpetals**	N				KD, GWH
Sida ciliaris	**Bracted fanpetals, Fringed fanpetals**	N				KD, KW, GWH
Sida elliottii	**Elliott's fanpetals**	N				KD
Sida rhombifolia	**Cuban jute, Indian hemp**	N				KD
Sideroxylon celastrinum	**Saffronplum**	N				KD, KW, GWH
Sideroxylon reclinatum	**Recline Florida bully**	N				KD
Sideroxylon salicifolium	**Willow-bustic, White bully**	N				KD, GWH

Scientific Name	Common Name	Native Status	IRC Status	State Status	Federal Status	Refuges
Simarouba glauca	**Paradisetree**	N				KD, KW, GWH
Sisyrinchium angustifolium	**Narroleaf blueeyed-grass**	N				KD
Smilax auriculata	**Earleaf greenbrier**	N				KD
Smilax havanensis	**Havana greenbrier, Everglades greenbrier**	N		T		KD, KW, GWH
Solanum americanum	**Common nightshade, American black nightshade**	N				KD, GWH
Solanum bahamense	**Bahama nightshade**	N				KD, KW, GWH
Solanum donianum	**Mullein nightshade**	N		T		KD, KW
Solanum erianthum	**Potatotree**	N				KD
Solidago stricta	**Narrow-leaved goldenrod, Wand goldenrod**	N				KD
Sonchus oleraceus	**Common sowthistle**	NN, NA				KD
Sophora tomentosa var. truncata	**Yellow necklacepod**	N				KD, KW
Sorghastrum secundum	**Lopsided Indian grass**	N				KD
Spartina bakeri	**Sand cordgrass**	N				KD
Spartina patens	**Marshhay cordgrass, Saltmeadow cordgrass**	N				KD, KW, GWH
Spartina spartinae	**Gulf cordgrass**	N				KD, KW
Spermacoce floridana	**Florida false buttonweed**	N				KD
Spermacoce prostrata	**Prostrate false buttonweed**	N				KD
Spermacoce terminalis	**Everglades Keys false buttonweed**	N		T		KD
Spermacoce tetraquetra	**Pineland false buttonweed**	N				KD
Spermacoce verticillata	**Shrubby false buttonweed**	NN, NA				KD
Spigelia anthelmia	**West Indian pinkroot**	N				KD
Spiranthes torta	**Southern lady's-tresses**	N	CI	E		KD
Sporobolus domingensis	**Coral dropseed**	N				KD, KW, GWH

Scientific Name	Common Name	Native Status	IRC Status	State Status	Federal Status	Refuges
Sporobolus indicus var. pyramidalis	**West Indian dropseed**	NN, NA				KD
Sporobolus virginicus	**Seashore dropseed**	N				KD, KW, GWH
Stachytarpheta jamaicensis	**Blue porterweed, Joee**	N				KD
Stenotaphrum secundatum	**St. Augustine grass**	NN, NA				KD, GWH
Strumpfia maritima	**Pride-of-Big-Pine**	N	CI	E		KD
Stylosanthes calcicola	**Everglades key pencilflower**	N		E		KD
Stylosanthes hamata	**Pencilflower, Cheesytoes**	N				KD
Suaeda linearis	**Sea-blite, Annual seepweed**	N				KD, KW, GWH
Suriana maritima	**Baycedar**	N				KD, KW, GWH
Swietenia mahagoni	**West Indian mahogany**	N		T		KD
Syringodium filiforme	**Manatee-grass**	N				KD, KW, GWH
Tamarindus indica	**Tamarind**	NN, NA				KD, GWH
Terminalia catappa [II]	**Tropical-almond, West Indian-almond**	NN, NA				KD
Thalassia testudinum	**Turtle-grass**	N				KD, KW, GWH
Thelypteris kunthii	**Southern shield fern**	N				KD
Thespesia populnea [I]	**Portiatree**	NN, NA				KD, KW, GWH
Thrinax morrisii	**Silver thatch palm, Brittle thatch palm**	N		E		KD, KW, GWH
Thrinax radiata	**Green thatch palm, Florida thatch palm**	N		E		KD, KW, GWH
Tillandsia balbisiana	**Reflexed wild-pine, Northern needleleaf**	N		T		KD
Tillandsia fasciculata var. densispica	**Stiff-leaved wild-pine, Cardinal airplant**	N		E		KD, GWH
Tillandsia flexuosa	**Banded wild-pine, Twisted airplant**	N		T		KD, KW
Tillandsia paucifolia	**Twisted wild-pine, Potbelly airplant**	N				KD, KW, GWH
Tillandsia recurvata	**Ball-moss**	N				KD
Tillandsia usneoides	**Spanish-moss**	N				KD
Tillandsia utriculata	**Giant wild-pine, Giant airplant**	N		E		KD

Scientific Name	Common Name	Native Status	IRC Status	State Status	Federal Status	Refuges
Tournefortia volubilis	**Twining soldierbush**	N				KD
Toxicodendron radicans	**Eastern poison-ivy**	N				KD
Tradescantia spathacea [I]	**Oysterplant, Moses-in-the-cradle, Boatlily**	NN, NA				GWH
Tragia saxicola	**Florida Keys noseburn**	N		T		KD
Trema micranthum	**Florida trema, Nettletree**	N				KD
Trianthema portulacastrum	**Desert horsepurslane**	N				KD
Tribulus cistoides [II]	**Puncture weed, Burrnut, Jamaican feverplant**	NN, NA				KD
Tridax procumbens	**Brittleweed, Coatbuttons**	NN, NA				KD
Tripsacum floridanum	**Florida gamagrass**	N		T		KD
Turnera ulmifolia	**Yellow alder, Ramgoat dashalong**	NN, NA				KD
Typha domingensis	**Southern cat-tail**	N				KD
Uniola paniculata	**Sea-oats**	N				KD, KW, GWH
Urochloa adspersa	**Dominican signalgrass**	N				KD
Urochloa fasciculata var. reticulata	**Browntop signalgrass**	NN, NA				KD
Vallesia antillana	**Pearlberry, Tearshrub**	N	CI	E		KD
Vanilla barbellata	**Wormvine orchid**	N		E		KD
Vernonia blodgettii	**Florida ironweed**	N				KD
Vigna luteola	**Cow-pea, Hairypod cowpea**	N				KD
Vitis rotundifolia	**Muscadine, Muscadine grape**	N				KD
Vittaria lineata	**Shoestring fern**	N				KD
Waltheria indica	**Sleepy morning**	N				KD, KW, GWH
Washingtonia robusta [II]	**Desert palm, Washington fan palm**	Not Native, Naturalized				KD
Ximenia americana	**Hog-plum, Tallowwood**	N				KD, KW, GWH
Youngia japonica	**Rocketweed, Oriental false hawksbeard**	Not Native, Naturalized				KD
Yucca aloifolia	**Spanish-bayonet, Aloe yucca**	N				KW

Scientific Name	Common Name	Native Status	IRC Status	State Status	Federal Status	Refuges
Zanthoxylum fagara	**Wild-lime, Lime prickly-ash**	N				KD
Zanthoxylum flavum	**West Indian satinwood, Yellowwood**	N	CI	E		KW
Zeuxine strateumatica	**Soldier's orchid, Lawn orchid**	Not Native, Naturalized				KD

Appendix J. Budget Requests

REFUGE OPERATING NEEDS SYSTEM (RONS)

RONS Project Number	CCP Project Description Number(s)	Project Title (see CCP Ch. 5 for project descriptions)	Cost Estimate (2009 U.S. dollars)
Fish and Wildlife Populations			
RONS FY08-5041	1,3,4,8	Gather critical data on habitat and wildlife in response to climate change	239,000
RONS FY08-5042	5,6,7, 14	Ensure population viability of threatened and endangered species	730,000
RONS FY08-4812	4,11	Support refuge biological program and habitat management (Biological Technician)	99,000
RONS FY08-5077	10, 14	Conserve rare and listed plants (Botanist)	99,000
RONS FY08-4864	4,12, 14	Enhance biological capability in response to climate change (Wildlife Biologist)	99,000
RONS FY08-5040	9,12	Provide monitoring capability for threatened and endangered species	120,000
Habitat Management			
RONS FY08-4700	2, 10	Exotic vegetation removal, habitat restoration and monitoring	81,000
RONS FY08-5071	2, 10	Support exotic vegetation removal and habitat restoration (Biological Technician)	81,000
RONS FY08-4856	1,5,7	Support refuge habitat management for endangered species recovery (marsh rabbit, silver rice rat) (Wildlife Biologist)	81,000
RONS FY08-5073	2, 10	Restore hardwood hammock on Sawyer Key (GWHNWR)	81,000
RONS FY08-4867	9,13	Coordinate habitat conservation in the marine environment (Marine Biologist)	120,000
RONS FY08-4870	1,4,9	Support habitat restoration and wildlife population surveys (Biological Technician)	62,000

Resource Protection			
RONS FY08-4544	13	Enhance management capability of refuge lands (Refuge Operations Specialist)	120,000
RONS FY08-4960	13	Protect ecologically fragile backcountry islands (Refuge Law Enforcement Officer)	90,000
Visitor Services			
RONS FY08-4989	18	Improve coordination of volunteer activities (Volunteer Coordinator)	81,000
RONS FY08-4697	16,18,19	Improve public outreach and education (Refuge Ranger)	81,000
RONS FY08-4865	16,17,19	Enhance visitor experience and environmental education (Interpretive Specialist)	35,000
RONS FY08-4863	9,12,16	Provide monitoring of public use impacts on wildlife species (Refuge Ranger)	81,000
RONS FY08-4868	16,18	Coordinate visitor services programs (Supervisory Park Ranger)	99,000
RONS FY08-5082	17	Expand environmental education (Education Specialist)	81,000
Refuge Administration			
RONS FY08-4967	15	Provide support for refuge operations (Administrative Officer)	81,000
RONS FY08-4702	1,2,4,10,13	Develop Geographic Information System for refuge resources (GIS Specialist)	99,000
RONS FY08-4515	13	Ensure protection of refuge wilderness (Assistant Refuge Manager)	120,000
RONS FY08-5086	1,2,4,10,13	Support data management needs (Information Technology Specialist)	81,000

Appendix K. List of Preparers

PLANNING TEAM

The Comprehensive Conservation Plan Team (aka Planning Team) met regularly between August 2006 and July 2007 and was comprised of the following staff, former staff and regional staff. Except as noted, all team members are based at Florida Keys NWR Complex headquarters:

Mary Morris, Natural Resources Planner and Planning Team Leader, St. Marks NWR
Anne Morkill, Project Leader
Jim Wigginton, Deputy Refuge Manager
Thomas Wilmers, Wildlife Biologist
Lester Pulley, Zone Officer, former Lead Refuge Law Enforcement Officer
Steven Berger, Law Enforcement Officer
James Bell, Park Ranger/Visitor Services
Paige Schmidt, former Wildlife Biologist Trainee
Phillip Hughes, Endangered Species Biologist, FWS Ecological Services
Paul Stevko, former Forestry Technician.

Mary Morris developed the document based on the input of the team, technical advisors, reviewers, and public comment. Primary contributors of text included Mary Morris, Thomas Wilmers, Paige Schmidt, James Bell, Phillip Hughes, and Anne Morkill. Mary Morris edited the document through all drafts. Evelyn Nelson of the Regional Office (RO) edited the Draft and Final CCP documents. Randy Musgraves (RO) formatted the images and document for printing.

BIOLOGICAL REVIEW

A biological review was conducted in 2005. It consisted of Service and state employees and invited research experts. The team provided recommendations for management actions based on the most current knowledge of refuge resources. Members of the team included:

Phillip Hughes, Endangered Species Biologist, USFWS, Big Pine Key
Chuck Hunter, Chief, Division of Planning and Resource Management, FWS, Region 4
Dean Demarest, former Assistant Migratory Birds Coordinator, FWS, Region 4
Steve Earsom, former Regional Refuge Ecologist, FWS, Region 4
Ken Meyer, Ph.D., Researcher, Avian Research and Conservation Institute, Gainesville, FL
Phil Frank, Ph.D., former Project Leader, Florida Keys NWR Complex
Van Fischer, former Natural Resources Planner, Florida Keys NWR Complex
Randy Grau, Manager, Florida Keys Wildlife and Environmental Areas, Florida FWC
Chris Bergh, Director, Florida Keys Program of The Nature Conservancy
William Miller, former Deputy Refuge Manager, Florida Keys NWR Complex
Tom Wilmers, Wildlife Biologist, Florida Keys NWR Complex
Neil Perry, graduate student, Texas Agricultural and Mechanical University
David Brownlie, Regional Fire Ecologist, Regional Fire Ecology Field Office, Tallahassee, FL.

VISITOR SERVICES AND PUBLIC USE REVIEW

A visitor services and public use review was conducted in 2003. The team consisted of staff from the Service's Regional Office and current and former field staff:

Garry Tucker, Visitor Services Coordinator, FWS, Region 4
Dorn Whitmore, Assistant Refuge Manager, Merritt Island NWR
Jane Whaley, former Park Ranger, Peidmont NWR
James Bell, Park Ranger/Visitor Services, Florida Keys NWR Complex
Phil Frank, Ph.D., former Project Leader, Florida Keys NWR Complex
Van Fischer, former Natural Resources Planner, Florida Keys NWR Complex.

WILDERNESS REVIEW

A review of the refuges' wilderness areas and potential wilderness study areas was conducted by the CCP planning team on August 21, 2006 and included the following team members:

Mary Morris, Natural Resources Planner, Region 4, St. Marks NWR
Anne Morkill, Project Leader, Florida Keys NWR Complex
Lester Pulley, Zone Officer, former Lead Refuge Law Enforcement Officer, Florida Keys NWR Complex
James Bell, Park Ranger/Visitor Services, Florida Keys NWR Complex
Thomas Wilmers, Wildlife Biologist, Florida Keys NWR Complex
Paige Schmidt, Wildlife Biologist Trainee, Florida Keys NWR Complex.

FIRE MANAGEMENT PROGRAM REVIEW

In February 2007 an interagency team was convened to discuss the Services' fire management program for National Key Deer Refuge. The following persons attended:

Thomas Wilmers, Wildlife Biologist, Florida Keys NWR Complex
David Brownlie, Regional Fire Ecologist, FWS, Region 4 - Tallahassee
Kathy O'Reilly-Doyle, Partners for Fish and Wildlife, FWS, Florida Panther NWR
Jim Durwachter, former Fire Management Officer, FWS
Jon Wallace, Prescribed Fire Specialist, FWS, Loxahatchee NWR
Josh O'Conner, Forestry Fire Technician, FWS, Florida Panther NWR
Mary Morris, Natural Resources Planner, St. Marks NWR
Anne Morkill, Project Leader, Florida Keys NWR Complex
Paige Schmidt, Wildlife Biologist Trainee, Florida Keys NWR Complex
Phillip Hughes, Endangered Species Biologist, FWS, Ecological Services Office.

Appendix L. List of Partnerships

EXISTING PARTNERSHIPS

Federal Agencies:

National Oceanic and Atmospheric Administration (NOAA)
- Florida Keys National Marine Sanctuary (FKNMS) and Eco-Discovery Center
- National Marine Fisheries Service

United States Department of Agriculture
- Animal and Plant Health Inspection Service, Wildlife Services
- Forest Service

United States Department of Defense
- Naval Air Station Key West
- Army Corps of Engineers

United States Department of Homeland Security
- Immigration and Customs Enforcement
- United States Coast Guard, Key West Sector
- United States Coast Guard Auxilliary
- United States Customs and Border Protection

United States Department of Interior
- National Park Service
  - Everglades, Biscayne Bay, and Dry Tortugas National Parks
  - Archaeological Center
- United States Geological Survey
  - Florida Integrated Science Center
  - National Wildlife Health Center

United States Department of Justice
- U.S. Marshals Service

State Agencies:

Florida Department of Agriculture
- Division of Forestry

Florida Department of Environmental Protection (DEP)
- Division of State Lands
  - Bureau of Invasive Plant Management
- Division of Parks and Recreation
  - Florida Park Service
- Office of Coastal and Aquatic Managed Areas (CAMA)

Florida Department of Highway Safety and Motor Vehicles

Florida Highway Patrol

Florida Department of Transportation

Florida Fish and Wildlife Conservation Commission (FWC)
- Division of Habitat and Species Conservation
- Division of Law Enforcement
- Wildlife and Environmental Areas

South Florida Water Management District (Regional Office)

Local Government Agencies:

Monroe County
- Division of Growth Management
  - Department of Planning and Environmental Services
  - Department of Marine Resources
- Division of Community Services (Animal Control)
- Land Authority
- Mosquito Control District
- Sheriff's Office
- Florida Keys Scenic Highway

Regional Agencies, Events or Programs:

Earth Day, Bahia Honda State Park
Florida Keys Birding and Wildlife Festival, Inc.
Florida Keys Exotic Species Task Force

Other Organizations and Academia:

Avian Research and Conservation Institute
Big Pine Key Civic Association
Dolphin Research Center
Fairchild Tropical Botanic Garden
Florida Keys Exotic Species Task Force
Florida Keys National Marine Sanctuary Advisory Council
Florida Keys National Marine Sanctuary Water Quality Protection Program Steering Committee
Florida International University
Friends and Volunteer of Refuges (FAVOR)
Institute for Regional Conservation
Inwater Research Group
Key Deer Protection Alliance (KDPA)
Key West Tropical Forest and Botanical Garden
Lower Keys Chamber of Commerce
Lower Keys Wildfire Hazard Reduction Initiative
Monroe County Environmental Education Advisory Council
National Audubon Society
- Coral Reef Initiative
- Keys Environmental Restoration Fund
- Tavenier Science Center
- Florida Keys Chapter of National Audubon Society

Seagrass Outreach Partnership
South Florida Ecosystem Restoration Task Force Land Acquisition Task Team
South Florida Pine Rockland Working Group
Texas Agricultural and Mechanical University
Texas State University, San Marcos
The Nature Conservancy
University of Georgia, Southeast Cooperative Wildlife Disease Study (SECDS)
University of Tennessee

POTENTIAL PARTNERSHIPS

Ducks Unlimited
Florida Guides Association
Florida Keys Commercial Fishermens Association
Green Living and Energy Education (Florida Keys GLEE)
Key West and Lower Keys Fishing Guides
Marathon Guides Association
National Association for Interpretation
North American Association of Environmental Educators (NAAEE)
Reef Relief
USA National Phenology Network

Appendix M. Inventorying and Monitoring Efforts by Refuge Staff and Partners

This appendix outlines a list of biological inventorying and monitoring efforts occurring between 2006 and 2008 or currently in progress at the National Key Deer, Great White Heron and/or Key West National Wildlife Refuges. The list contains inventory and monitoring activities conducted by refuge staff and/or by partners.

Legend for Refuge Wildlife and Habitat Surveys:
c - currently ongoing
s - ongoing, but sporadic effort applied
d - conducted within past three years, but presently discontinued

Refuge Wildlife Surveys:

Marsh Rabbit Patch Occupancy Survey (**c** - annually)
Great White Herons Nesting Survey (**c** - annually)
White-crowned Pigeon Nesting Survey (**c** - annually)
Reddish Egret Nesting Survey (**s**)
Sea Turtle Nesting Survey (**c** - annually)
Brown Pelican Nesting Survey (**c** -annually)
Piping Plover and Other Shorebirds Survey (**c** - annually)
Bald Eagle Nest Survey (**c** - annually)
Least and Roseate Tern Nest Survey (**c** - annually)
Key Deer Roadside Counts (**c** - monthly)
Key Deer Herd Health Monitoring (**s**)
Inventory of Amphibians and Reptiles (**d**)
Invasive Exotic Animal Early Detection and Rapid Response (**c**)

Refuge Habitat Surveys:

Invasive Exotic Plant Species Monitoring and Control (**c**)
Prescribed Fire Fuel and Fire Effects Monitoring (**s**)
Dune Erosion Monitoring (**s**)

Research and Monitoring by Partners:

Principal Investigator: William Anderson, Florida International University
Project Description: Dendro-isotope investigation of pine forests from the Florida Keys: understanding the interaction of precipitation, sea-level rise, and tropical cyclones

Principal Investigator: Rob Bergstresser, Carbon County Environmental Education Center
Project Description: Avian survey with emphasis on the mangrove cuckoo, white-crowned pigeon, and West Indian migrants

Principal Investigator: Keith Bradley, Institute for Regional Conservation
Project Description: Determination of population size and distribution of three Federal candidate plant species: Big Pine partridge pea, deltoid spurge, and sand flax

Principal Investigator: Steve Collins
Project Description: Inventory of dragonflies

Principal Investigator: Aaron Dossey, University of Florida
Project Description: Survey for walking sticks (*Aplopus mayeri*) and collection of their defensive secretions

Principal Investigator: Alan Franck, University of South Florida
Project Description: Conservation genetics of three endangered Florida endemic *Harrisia* cacti

Principal Investigator: Ed Fussell, Florida Keys Mosquito Control District
Project Description: Surveillance and monitoring activities on refuge lands to determine the distribution and abundance of mosquitoes

Principal Investigator: Steven Green, Institute for Regional Conservation
Project Description: Status survey of the federally threatened Garber's spurge (*Chamaesyce garberi*)

Principal Investigator: Patrick Griffith, Montgomery Botanical Center
Project Description: Collection of samples of leaf tissue from the Key thatch palm (*Thrinax morrisii*) for genetic analysis to evaluate ex-situ conservation strategies

Principal Investigator: Tom Heitmuller, U.S. Geological Survey
Project Description: Ecological assessment of coastal wetlands across the Gulf of Mexico region

Principal Investigator: Stephen Hodges, Key West Tropical Forest and Botanical Garden
Project Description: Collection of *Argythamnia blodgettii, Chamaecrista lineate* var. *keyensis, Indigofera mucronata* var. *keyensis,* and *Linum arenicola*

Principal Investigator: Sally Horn, University of Tennessee
Project Description: Sediment records of fire and vegetation history from solution holes

Principal Investigator: Suzanne Koptur, Florida International University
Project Description: Survey pine rocklands and hammocks for activity and abundance of three plant-associated arthropods: ants, pollinators, and herbivores (primarily Lepidoptera)

Principal Investigator: Brian Lapointe, Harbor Branch Oceanographic Institution
Project Description: Resample groundwater wells installed on public lands in the 1980s to measure trends in water quality parameters

Principal Investigator: Jeffrey Marcus, Western Kentucky University
Project Description: Genetic structure of populations of *Junonia evarete, Junonia coenia,* and *Junonia genoveva* butterflies in Florida

Principal Investigator: Joyce Maschinski, Fairchild Tropical Botanic Garden
Project Description: Continuing recovery efforts for the endangered Key Tree Cactus (*Pilosocereus robinii*)

Principal Investigator: Ken Meyer, Avian Research and Conservation Institute
Project Description: Long-term study of the annual movements, habitat use, and nest site selection by short-tailed hawks through trapping and radio-tagging

Principal Investigator: Elizabeth Mihalcik, Florida Agricultural and Mechanical University
Project Description: Geographic distribution of the Stock Island tree snail, *Orthalicus reses reses*, in the Florida Keys

Principal Investigator: Marc Minno, Eco-Cognizant, Inc.
Project Description: Monitoring study of the rockland grass skipper butterfly (*Hesperia meskei pinocayo*) and Zestos skipper butterfly (*Epargyreus zestos*)

Principal Investigator: Corrie Moreau, Chicago Field Museum of Natural History
Project Description: Ants of the Florida Keys: understanding community interactions

Principal Investigator: Richard Pierce, Mote Marine Laboratory
Project Description: Determine direct and indirect effects of mosquito control pesticides on listed species inhabiting refuge managed lands in the Florida Keys

Principal Investigator: Michael Ross, Florida International University
Project Description: Development of a Lower Florida Keys digital terrain model and vegetation analysis to evaluate landscape changes from hurricanes and sea level rise

Principal Investigator: Mark Salvato
Project Description: Monitoring study of the Florida leafwing (*Anaea troglodyta floridalis*) and Bartram's hairstreak (*Strymon acis bartrami*) butterflies

Principal Investigator: Roger Santer, University of Nebraska
Project Description: Investigating the role of nervous system specializations in the natural behavior of amblypygid spiders

Principal Investigator: Petra Sierwald, Chicago Field Museum of Natural History
Project Description: Florida biodiversity of the mega-diverse, micro-distributed spider family Oonopidae (Goblin spiders), with sampling of soil arachnids and myriapods

Principal Investigator: James Snyder, U.S. Geological Survey Integrated Science Center
Project Description: Resampling of permanent pine rockland vegetation burn plots

Principal Investigators: Liza Soliz, Texas Agricultural and Mechanical University
Project Description: Comparing Key deer demographics on outer islands to core population demographic information, genetic and herd health evaluations

Principal Investigator: Brian Stacy, University of Florida
Project Description: Blood flukes, major pathogens of sea turtles: life cycle studies in coastal Florida

Principal Investigator: Gary Steck, U.S. Department of Agriculture
Project Description: Collect two specimens of a possible new species of gall midge for laboratory identification and species confirmation

Principal Investigator: Mary Truglio, Florida Fish and Wildlife Conservation Commission
Project Description: Population survey for Bartram's hairstreak butterfly (*Strymon acis bartrami*) and the Florida leafwing butterfly (*Anaea troglodyta floridalis*)

Principal Investigator: Peggy VanArman, Palm Beach Atlantic University

Project Description: Follow-up investigation of the presence of native crayfish populations, and crayfish species identification in the Florida Keys, with special emphasis on Big Pine Key

Principal Investigator: Ya Yang, University of Michigan
Project Description: Phylogenetic analysis of *Chamaesyce deltoidea*, an endangered species complex of spurges in southeastern Florida

Principal Investigator: Margo Zdravkovic, Coastal Bird Conservation Program
Project Description: Annual abundance, distribution, and habitat use of Wilson's plovers (*Charadrius wilsonia*) of the Florida Keys

Principal Investigator: John Lloyd, Ecostudies Institute
Project Description: An inventory and status assessment of breeding-season mangrove landbirds in southern Florida

Principal Investigator: Joseph Boyer, Florida International University
Project Description: Long-term monitoring of water quality in the marine waters within the Florida Keys National Wildlife Refuges Complex to contribute information to the water quality protection program of the FKNMS

Principal Investigator: Jim Fourquren, Florida International University
Project Description: Long-term monitoring of seagrass communities the marine waters within the Florida Keys National Wildlife Refuges Complex to contribute information to the water quality protection program of the FKNMS

Principal Investigator: FWC Fish and Wildlife Research Institute
Project Description: Long-term monitoring of coral communities the marine waters within the Florida Keys National Wildlife Refuges Complex to contribute information to the water quality protection program of the FKNMS

Principal Investigator: Michael Bresette, Inwater Research Group
Project Description: Sea turtle distribution and abundance in the Key West National Wildlife Refuge and waters of the Marquesas Keys

Principal Investigator: Paula Cannon
Project Description: Distribution and abundance of the Miami blue butterfly (*Cyclargus thomasi bethunebakeri*) on islands in the Florida Keys National Wildlife Refuges

Principal Investigator: Jaret Daniels, University of Florida
Project Description: Population monitoring and genetic sampling of the State-endangered Miami blue butterfly (*Cyclargus thomasi bethunebakeri*) on islands in the Florida Keys National Wildlife Refuges

Principal Investigator: Theodore Papenfuss, California Museum of Vertebrate Zoology
Project Description: Ecology of diamondback terrapins (*Malaclemys terrapin rhizophorarum*) in the Key West National Wildlife Refuge

Principal Investigator: Eileen Hebets, University of Nebraska School of Biological Sciences
Project Description: Investigating the role of an amblypygid's (*Phrynus marginemaculatus*) giant sensory interneurons in stereotyped aggressive behaviors

Principal Investigator: Danielle Ogurcak, Florida International University

Project Description: Plant community response to interactions between disturbance regimes, sea-level rise, and hydrology on Big Pine Key, Florida

Principal Investigator: Jeanette Hobbs, Keys Environmental Restoration Fund
Project Description: Monitoring recovery of water quality and wildlife use of restored wetland habitats

Principal Investigator: Keith Bradley, Institute for Regional Conservation
Project Description: Post-hurricane responses of rare plant species and vegetation of pine rocklands in the Lower Florida Keys

Principal Investigator: Eric Hoffman, University of Central Florida
Project Description: Determine fundamental aspects of genetic diversity of Lower Keys marsh rabbits to identify options and improve capacities to ensure long-term viability of the species

Principal Investigator: Kirsten Hines, Institute for Regional Conservation
Project Description: Assessment of the status and distribution of the endemic rimrock crowned snake (*Tantilla oolitica*) in Miami-Dade and Monroe Counties, Florida

Principal Investigator: Jonathon Clough, Warren Pinnacle Consulting, Inc.
Project Description: Application of the Sea-Level Affecting Marshes Model (SLAMM 5.0) to National Key Deer Refuge

Appendix N. Environmental Assessment

I. Background

PURPOSE AND NEED

As directed by the National Wildlife System Improvement Act of 1997, Comprehensive Conservation Plans (CCPs) are to be adopted for all national wildlife refuges by 2012. These CCPs identify the role individual refuges will have in support of the mission of the National Wildlife Refuge System. CCPs provide long-term guidance regarding the refuges' management direction and operations. A Comprehensive Conservation Plan (CCP) for the Lower Florida Keys Refuges has been developed to address important natural and cultural resources, wildlife-dependent recreation, and administrative and law enforcement needs.

The purpose of the proposed action is to establish and implement a management direction for the Lower Florida Keys Refuges for the next 15 years. The action is needed because adequate, long-term, comprehensive planning does not exist. Management is currently guided by general policies, federal mandates, and a limited number of specific step-down action plans, the latter which are in need of drafting or revision. The action is needed to address current priority management issues.

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 partnering agencies. For a description of the priority resource issues, refer to Chapter III of the CCP. To address these issues and concerns, the Service's planning team devised three alternatives, evaluated the consequences of implementing each alternative, and selected Alternative B as the proposed management action.

PROPOSED ACTION

Based on the environmental effects analysis of the proposed action, also known as Alternative B or the proposed alternative, and public comments concerning the significance of these effects, the Service must decide whether or not the proposed action would significantly impact the environment. If so, then an Environmental Impact Statement would be prepared. If the proposed action is not found to be significant, then a Finding of No Significant Impact (FONSI) would be issued.

The FONSI and CCP were prepared based on agency and public comments. In response to public comments on the Draft CCP and EA for the Lower Florida Keys Refuges, the EA was revised and is contained herein as an appendix to the CCP.

II. Affected Environment

For a description of the affected environment, see Chapter II, Refuges Overview, of the CCP.

III. Description of Alternatives

FORMULATION AND DESCRIPTION OF ALTERNATIVES

Alternatives are different approaches or combinations of management objectives and strategies designed to achieve the refuges' purposes and vision and the seven goals identified in Chapter IV of the CCP. Each alternative is designed to achieve the priorities and goals of the Fish and Wildlife Service, South Florida Ecosystem Team, and the mission of the National Wildlife Refuge System.

The three alternatives represent moderately different approaches for managing and operating the Lower Florida Keys Refuges over a 15-year time frame. All alternatives would provide protection, restoration, and management of the refuges' fish, wildlife, plants, habitats, and other resources, as well as provide appropriate and compatible wildlife-dependent uses. Each alternative was evaluated based on how it would address the priority resource issues identified by the Service and the public during public scoping as detailed in Chapter III of the CCP. A summary of each alternative is given. Table 8 follows the summary. It presents a comparison of how each alternative addresses the priority resource issues. The table is grouped by each of the seven goals as outlined in Chapter IV of the CCP.

ALTERNATIVE A - (CURRENT MANAGEMENT - NO ACTION)

The Lower Florida Keys Refuges have a high diversity of community types and endemic species, with many threatened, endangered, candidate, and other imperiled species. The primary mission of these refuges is to provide habitat for wildlife. The refuges currently have a small staff and funding source for the inventorying and monitoring of natural resources. Much effort has been put into some resources, such as Key deer and their habitat (pine rocklands), as a result of cooperative partnerships with academic and other research organizations. Certain species, such as great white herons, white-crowned pigeons, and sea turtles, have been studied over time by refuge biological staff. Under this alternative, these studies would continue.

Baseline data has yet to be established for some protected species, species suites, habitats, and cultural resources. The effects of natural catastrophic disturbances (e.g., Hurricane Wilma in 2005) on the refuges' resources have not been fully assessed and the effect of climate change (e.g., sea level rise) is not known.

Threatened and endangered species are protected through a variety of management tools, such as area closures, law enforcement, exotic plant control, etc. Limited research and monitoring of focal species, such as Key deer, Lower Keys marsh rabbit, and some migratory birds would continue with existing refuge staff and partnerships. The National Key Deer Refuge's prescribed fire management program would continue with the objectives to reduce fuels and to sustain the pine rockland ecosystem for the benefit of Key deer.

As funding and willing sellers are available, the Service would continue habitat conservation through land acquisition within the approved acquisition boundary and through lease agreements with other agencies for non-refuge lands that support the refuges' missions. Partnerships exist to promote land conservation. Exotic plant control to protect and maintain current habitat would occur at existing levels by relying on partnerships with the Nature Conservancy, the Florida Fish and Wildlife Conservation Commission, and Monroe County. A predator management program is currently under development on National Key Deer Refuge to reduce the effects of feral cat predation on the endangered Lower Keys marsh rabbit.

Most ecologically sensitive areas and living resources are protected from disturbance or degradation through the use of closure areas, law enforcement, and the implementation of the Management Agreement for Submerged Lands within the Key West and Great White Heron NWRs. Impacts from concentrated, non-wildlife dependent uses threaten a limited number of sites, particularly islands with accessible sand beaches. The effects of commercial activities and public uses (both wildlife-dependent and non-wildlife-dependent) have not been fully evaluated and visitor carrying capacities have not been quantified.

The Service has an active volunteer program to assist in all facets of refuge management. Partnerships for these purposes and for research are encouraged and maintained. Under this alternative, the existing level of administrative resources (staffing, facilities and assets, funding, and partnerships) would be maintained. This means some positions may not be filled when vacated if funds need to be reallocated to meet rising costs or new priorities.

ALTERNATIVE B - (PROPOSED ALTERNATIVE)

This alternative assumes a slow-to-moderate growth of refuge resources over the 15-year implementation period of the CCP. It proposes a proactive and adaptive ecosystem-management approach for the enhancement of wildlife populations. It would promote a natural diversity and abundance of habitats for native plants and animals, especially Keys' endemic, trust, and keystone imperiled species. Many of the objectives and strategies are designed to maintain and restore native communities. Active management strategies would be applied particularly within the globally imperiled pine rockland, salt marsh transition, and freshwater wetland habitats, and island beach berm communities. Research and long-term monitoring will be initiated to expand the collection of baseline data and measure variables of ecosystem health. Cooperative studies to monitor and model the immediate and/or long-term effects of natural catastrophic events (e.g., hurricanes, wildfire) and global climate change, particularly sea level rise, would be promoted.

Current ongoing and proposed programs and efforts focus on threatened, endangered, and candidate species of plants and animals. The need for more comprehensive inventorying and long-term monitoring is addressed in this alternative, particularly for priority imperiled species and their habitats within the refuges. The feasibility of managing the core population of Key deer to minimize the effects of overbrowsing on native plants would be considered in accordance with the Endangered Species Act.

Habitat enhancement for critically imperiled species, such as the Lower Keys marsh rabbit and Key tree cactus, would occur to ensure the long-term sustainability of these species. Opportunities for land acquisition would focus more strategically on protecting environmentally sensitive habitat by contacting specific property owners to determine their willingness to sell, with a particular emphasis on enhancing habitat connectivity and protecting marsh rabbit habitat. Off-refuge nursery propagation of the Key tree cactus would be implemented for later translocation to suitable refuge habitats. Cooperative partnerships with nurseries and botanical gardens would be developed to secure seed and plant material of rare and endemic plant species to ensure genetically viable sources for future restoration needs. Research would be initiated to identify causal reasons for the marked, long-term decline in the great white heron nesting population and to evaluate the potential impacts of sea level rise on the ecology of wading birds.

Since a primary purpose of the refuges is to provide sanctuary for nesting and migratory birds, greater protection from human disturbance would be provided, particularly at colonial nesting bird rookeries and at beach habitats in the backcountry islands. Additional limitations to public use may be implemented in sensitive beach areas important for shorebirds, terns, sea turtles, and butterflies.

Strategies are proposed to enhance the biological diversity and resiliency of the fire-dependent pine rocklands and also to enhance fire-adapted habitat features in salt marsh transition and freshwater wetlands that benefit priority species in the National Key Deer Refuge. Prescribed fire and mechanical or manual vegetation treatments would be used as habitat management tools to reduce wildland fuels and restore desirable habitat features where appropriate. Predictive modeling and fire effects monitoring would be used on all prescribed-fire treatments in an adaptive management approach to develop site-specific burn prescriptions and to determine whether objectives were met. Research on fire behavior, fuels response, and fire history will be conducted. The fire management step-down plan would be revised and implemented accordingly in conjunction with the development of a habitat management step-down plan.

Exotic plant control would continue as an ongoing operation within the refuges to maintain native habitats and prevent new infestations. Cooperative efforts would be sought with private property owners and homeowners associations to control seed sources from private lands. Existing partnerships would be reinforced to increase coordinated mapping and monitoring of treated areas with known infestations and ongoing control needs. Management of non-native exotic predators would be implemented as directed by the South Florida Multi-Species Recovery Plan for the benefit of threatened and endangered species. An early detection and rapid response program would be implemented in cooperation with county, state and federal authorities to address the increasing invasion by and potential establishment of exotic snakes, lizards and other non-native animals in the Florida Keys.

A primary focus of the visitor services program, as proposed, is to enhance environmental education and outreach efforts substantially to reach larger numbers of residents, students, educators, and visitors. This alternative also focuses on increasing public awareness, understanding, and support for the refuges' conservation mission. It places priority on wildlife-dependent uses, such as photography and wildlife observation; the details of these allowable uses are specified in appropriate use and compatibility determinations (Appendices E and F). A new visitor center on U.S. Highway 1 on Big Pine Key and enhanced visitor facilities at existing sites (e.g. Blue Hole and Watson-Mannillo NatureTrails) are proposed. Non-wildlife dependent forms of recreation would be limited or restricted in sensitive areas and awareness efforts would be stepped-up to inform visitors about protecting wilderness areas. A Visitor Services step-down plan will specify program details consistent with the Service's visitor service program standards.

The basic administrative and operational needs of the refuges have been addressed. Essential new staffing is proposed through the addition and funding of five permanent, full-time employees. Daily operation of the refuge would be guided by the CCP and the development and implementation of 19 projects and 11 step-down management plans. Wilderness and cultural resource protection objectives and strategies would be incorporated within the appropriate step-down management plans. The modest growth in administrative resources would be used for wildlife monitoring and habitat enhancement to better serve the refuges' purposes and the CCP's vision. With the exception of a new Visitor Center that is proposed, the existing number of facilities would be maintained. Energy efficiency standards will be applied wherever feasible during facility maintenance, repair or renovation projects. Existing vehicles will be replaced with alternative fuel vehicles to increase fuel efficiency and reduce carbon emissions.

ALTERNATIVE C

This alternative assumes a moderate-to-substantial growth of refuge resources from internal or external sources. It would more fully realize the refuges' missions and address the large number of threatened, endangered and candidate species along with other imperiled species and habitat types. While Alternative C contains many of the provisions to protect and restore habitats similar to

Alternative B, it emphasizes a broader suite of priority species, assuming the addition of several new staff positions and increased funding. The long-term inventorying and monitoring plan would be expanded to cover more species and species suites. Additional studies on some species would be undertaken and additional biological staffing would be required. The use of captive, off-refuge sources of some species facing potential extirpation (e.g., Lower Keys marsh rabbit) would be explored for reintroduction after a natural catastrophe, such as a major hurricane. In certain habitats, some alternative habitat management techniques would be studied and applied. Fire management efforts would emphasize fire suppression and the reduction of hazardous fuels by mechanical or manual means to protect private properties, and the use of prescribed fire would be reduced or eliminated. Under this alternative, the CCP anticipates shifts in the Visitor Services program in order to increase visitation and public use. A refuge ranger position is proposed to coordinate and enhance volunteerism, to foster expanded relationships with FAVOR, and to establish new partnerships for environmental education and outreach programs.

Resource protection and visitor safety would be greatly enhanced through this alternative with the addition of two law enforcement officers. This would allow for more patrol and enforcement of closure and sensitive area protection, especially of wilderness areas or cultural resource sites. New areas of the backcountry would be closed to public access to protect wildlife resources. The Service would seek expanded management authority to regulate public and commercial activities in nearshore waters and submerged lands under the Backcountry Management Agreement with the State. A cultural resources field investigation and inventory would be conducted.

Implementation of Alternative C would also occur through the development of 11 step-down management plans. New staffing is proposed through the addition of six permanent, full-time employees. The positions would be in addition to the five full-time positions proposed in Alternative B, for a total of eleven full-time positions in Alternative C. New maintenance and government housing facilities are proposed along with new vehicles and boats to accommodate the staff increases for a total of 11 new positions. While Alternative C would promote the vision of the Service for these refuges, the resources available to implement it are not likely to be forthcoming in the current economic environment as compared to when first proposed. Therefore, Alternative B appears to be the best choice alternative for the planning time frame of the next 15 years.

FEATURES COMMON TO ALL ALTERNATIVES

Although the alternatives differ in many ways, there are some similarities among them. All three alternatives maintain existing partnerships and increase others with academia, other government and non-governmental organizations, private institutions, and the public for the following activities: inventorying and monitoring; public land protection; and outreach and environmental education. The use of volunteers to supplement existing staff and resources is proposed for many facets of refuge operation and maintenance, with special emphasis on the visitor services programs. All alternatives are based on the best available and professionally sound science, Endangered Species Act requirements, and compliance with all Service laws, policies, directives, and guidelines.

Table 8. Comparison of alternatives by management issues for the Lower Florida Keys Refuges

Priority Issues	Alternative A (Current Management- No Action Alternative)	Alternative B (Proposed Alternative)	Alternative C
OVERARCHING ISSUE			
1. Climate Change			
Catastrophic events	Continue to map pine kills resulting from storm surge events and record burned acreages due to wildfires. Continue to assess hurricane effects on priority species.	Obtain baseline information on ecosystem health to evaluate immediate and long-term effects of catastrophic storm and wildfire events with emphasis on synergistic and cumulative effects of multiple events or conditions, for example, a hurricane followed by a severe drought and/or wildfire. Partner with plant ecologists to gauge the long-term effects of Hurricane Wilma (or future hurricanes) on refuge habitats. Formulate a response plan that accounts for changes wrought by natural catastrophes.	Same as Alternative B.

Priority Issues	Alternative A (Current Management- No Action Alternative)	Alternative B (Proposed Alternative)	Alternative C
Climate change	Continue consulting with academic partners on a study of sea level rise effects on globally imperiled pine rocklands.	Obtain data to monitor and detect environmental changes due to global climate change, such as sea level rise. Work with ecologists, climate specialists and hydrologists to create a model of projected sea level rise and its areal coverage on refuge habitats. Focus habitat management, species conservation, and land acquisition accordingly. Participate in local, regional and national partnerships to develop adaptive management strategies and implement mitigation measures.	Same as Alternative B.
FISH AND WILDLIFE POPULATION MANAGEMENT			
2. Limited Inventorying and monitoring			
Wildlife surveys, inventorying and monitoring	As biological staff and outside researchers are available, continue wildlife and plant surveys on a few priority species.	Through partnerships, new staff and the use of existing staff, conduct more extensive monitoring of priority, endemic plant (e.g., Garber's spurge) and animal (e.g., reddish egrets) species and species groups (e.g. butterflies) and habitats. Write long-term, ecological inventory and monitoring step-down plan to support a proactive and adaptive ecosystem management approach.	Same as Alternative A. Also, add to biological staff to increase monitoring of priority habitats, and plant, mammal, and bird species.

Priority Issues	Alternative A (Current Management- No Action Alternative)	Alternative B (Proposed Alternative)	Alternative C
3. Recovery of Imperiled Species			
Key deer - Species habitat relationships	Continue population monitoring efforts of Key deer. Continue partnerships with universities to understand Key deer population dynamics and ecology, and browsing effects on native plant communities.	Evaluate the feasibility of population management strategies compatible with protection of Key deer under the Endangered Species Act to maintain herd health and habitat quality. Increase education and outreach efforts to foster an understanding of Key deer ecology. Curtail public feeding of deer.	Allow a natural decline in deer population resulting from natural disasters (e.g., hurricanes, drought, and disease).
Potential extinction of the Lower Keys marsh rabbit (LKMR)	Monitor the extant population. Continue to translocate LKMRs to suitable, uninhabited refuge islands free of feral cat predation. Reduce abundance of free-roaming and feral cats in LKMR habitat as resources allow.	Same as Alternative A. Also, maintain, restore and enhance occupied and potentially suitable LKMR habitat. Maximize connectivity among suitable habitats. Consider establishing a genetically diverse LKMR population of 100 animals on the Florida mainland as a source for reintroduction in the event of a catastrophic hurricane. Implement the Integrated Predator Management Plan.	Establish a genetically diverse LKMR population of 100 animals on the Florida mainland as a source for reintroduction in the event of a catastrophic hurricane. Explore the feasibility of instituting in situ breeding to develop a source population for translocations.

Priority Issues	Alternative A (Current Management- No Action Alternative)	Alternative B (Proposed Alternative)	Alternative C
Extirpation of the Key tree cactus	Maintain closed areas to protect extant Key tree cactus population on refuge lands. Continue partnerships to establish a nursery-grown population as a source for reintroduction or translocation to refuge lands identified as suitable release sites.	Same as Alternative A. Also restore or create suitable habitat for nursery-grown tree cactus.	Same as Alternative B.
Potential listing of candidate species, such as Florida leafwing butterfly and Big Pine partridge pea	Continue to monitor the status of candidate species.	Same as Alternative A. Also evaluate the effectiveness of habitat management actions by monitoring targeted candidate species and ensuring their persistence to avoid species listing. Encourage research and captive propagation of candidate species by partners.	Same as Alternative B. Also, expand partnerships with botanical gardens to increase captive populations and seed banks of candidate species to provide for reintroductions in the future.
4. Controlling Injurious, Invasive and Exotic Species			
Exotic and invasive plants	Continue cooperative efforts with Monroe County, TNC, and the State to re-treat areas with known invasive species problems.	Same as Alternative A. Also expand cooperative efforts to increase mapping and monitoring of areas with known infestations, particularly on private lands and public rights-of-way, which serve as seed sources for refuge lands.	Use existing infestation and treatment data to seek and obtain a permanent funding source for a refuge-based exotics treatment program.

Priority Issues	Alternative A (Current Management- No Action Alternative)	Alternative B (Proposed Alternative)	Alternative C
Exotic and invasive animals	Reduce abundance of free-roaming and feral cats in LKMR habitat as resources allow. Monitor other exotic species and remove individuals if problematic.	Implement an integrated predator management program in cooperation with Monroe County and other stakeholders to reduce the abundance of feral and free-roaming cats and dogs on the refuges, including trapping and removal, and public education. Establish a rapid response protocol to detect and remove new exotic animals.	Same as Alternative B. Also, evaluate the ecological effects of green iguanas and other invasive species and manage accordingly.
HABITAT AND WILDLIFE POPULATION MANAGEMENT			
5. Habitat Loss and Fragmentation			
Habitat loss and fragmentation	Continue protection of the Lower Florida Keys Refuges and county and state lands managed by the Service.	Complete priority land acquisitions to ensure conservation of quality habitats in the Lower Florida Keys in perpetuity. Work with partners in administering jointly managed areas. Expand wetland and upland restoration to mitigate habitat loss.	Same as Alternative B. Also, secure permanent funding source for the management of county and state lands under the management authority of the refuges.

Priority Issues	Alternative A (Current Management- No Action Alternative)	Alternative B (Proposed Alternative)	Alternative C
6. Fire Management			
Prescribed fire and fire effects management	Continue to use prescribed fire primarily for fuel reduction and to benefit Key deer. The refuge fire management program is currently under review.	Use prescribed fire for maintaining and restoring fire-dependent pine rockland habitats and fire-adapted habitats. Clearly define habitat management objectives to reflect management for a variety of imperiled species, as well as fuel reduction. Use inventory and monitoring plan to determine areas suitable for prescribed fire, define objectives, and evaluate the use of prescribed fire. Implement adaptive management and revise burning operations accordingly. Expand education and outreach efforts on the use of prescribed fire as a habitat management tool.	Use mechanical and hand-clearing of vegetation to mimic the effects of prescribed fire in fire-adapted habitats. Reduce or eliminate the use of prescribed fire. Use inventory and monitoring data to determine areas suitable for alternative management strategies. Use information to implement adaptive management. Expand education and outreach efforts on the use of alternative strategies as habitat management tools.

Priority Issues	Alternative A (Current Management- No Action Alternative)	Alternative B (Proposed Alternative)	Alternative C
Wildland-urban interface (WUI)/fuel loads	Continue cooperative efforts with Monroe County, TNC, and the Florida Division of Forestry to identify and treat refuge-owned and managed lands with elevated fuel levels that pose a threat to lives, property and habitat from catastrophic wildfires.	Same as Alternative A. Also, use prescribed fire and mechanical methods to reduce the fuel load in the WUI. Work with the National Fire Lab to develop fuel models and burn prescriptions specific to National Key Deer Refuge for proper application of fire to achieve fuel reduction and habitat management goals. Expand education and outreach efforts on the role of prescribed fire for habitat management and promote FireWise practices among homeowners.	Suppress all fires, and reduce or eliminate the use of prescribed fire, relying on mechanical or manual treatments to reduce hazardous fuel loads. Emphasis private homeowners' responsibilities to protect properties and provide technical assistance in the implementation of FireWise practices.
VISITOR SERVICES			
7. Changing Public Use Attitudes, Needs, and Demands			
Public perception of the Service's role in endangered species management.	Maintain current level of outreach efforts to keep the public and media informed about imperiled species management and to encourage activities to enhance species and their habitat.	With a second park ranger position, expand outreach and partnership efforts and create exhibits in the new visitor center to address this issue.	More effort will be placed on the partnership with FAVOR and the Ecological Service's Office to address this issue.

Priority Issues	Alternative A (Current Management-No Action Alternative)	Alternative B (Proposed Alternative)	Alternative C
Visitor Services – maintaining wildlife dependent public uses and preventing degradation and disturbance to resources from overuse by public and commercial use.	Maintain existing wildlife-dependent activities and opportunities where appropriate and compatible.	Research the impact of visitor use on resources and determine a carrying capacity for sensitive areas or resources. Take corrective actions to prevent resource degradation and overuse problems. Maintain current levels of appropriate and compatible wildlife-dependent public use activities and opportunities on the refuges in areas that are not resource sensitive (e.g., environmental education programs on and off the refuges). Develop a Visitor Services step-down plan.	Same as Alternative B. Also, increase visitation and public awareness through increased number of visitor services staff and volunteers.
Visitor Services – Address demand for non-priority public uses from the public and commercial vendors.	Continue to allow some historic non-wildlife-dependent public uses that do not cause disturbance to wildlife and are not detrimental to their habitat and natural resources. Revise and implement the 1997 Draft Commercial Use Management Plan.	Same as Alternative A.	Consider additional area closures on islands in the backcountry, and seek expanded authority to regulate public and commercial activities in nearshore waters and submerged lands under the Backcountry Management Agreement with the State.

Priority Issues	Alternative A (Current Management- No Action Alternative)	Alternative B (Proposed Alternative)	Alternative C
Cultural resources	Some areas are permanently closed to visitors because they are ecologically sensitive. Some cultural sites (unknown) may benefit from this policy. Address cultural resource protection in all applicable step-down plans.	Same as Alternative A. Also, provide general, interpretive information on cultural resource themes at the visitor center.	Same as Alternative A. Also, inventory cultural sites on the refuges. If warranted, consider closure of some areas if deemed culturally sensitive and not appropriate for public use. Increase law enforcement (LE) patrol.
RESOURCE PROTECTION			
8. Violation			
Illegal activities – law enforcement	With two LE officers, continue to manage for illegal activities with the existing level of visitor activity and access restrictions.	Undertake a study of refuge resources to assess impacts from recreational refuge users. Determine which changes in the visitor services program should be implemented to curtail any illegal activity(ies).	Increase refuge patrol and presence to enforce closure areas (and special details) to support this effort. Consider the use of a volunteer community workforce (e.g., boat captains, pilots) to observe and monitor refuge areas.

Priority Issues	Alternative A (Current Management- No Action Alternative)	Alternative B (Proposed Alternative)	Alternative C
Marine debris	Encourage current efforts by FAVOR, FKNMS, and Monroe County to address removal of marine debris from refuge lands on an opportunistic basis.	Work cooperatively with FAVOR, FKNMS, and Monroe County to remove marine debris from refuge lands on a regular basis. Increase level of partnerships with other government organizations and private entities to address root causes of marine debris and implement a coordinated public outreach campaign.	Same as Alternative B.
Impacts of visitor use on wilderness/backcountry Islands	Monitor and patrol the wilderness as LE and biological staff are available.	Evaluate the need and feasibility of limiting public access to islands in the Marquesas Keys to protect its unique wilderness and ecological values. Incorporate wilderness protection measures in all applicable step-down management plans. Update the management agreement as needed.	Same as Alternative B. Also, research the impacts of visitor use and carrying capacity, determine problem areas, and take corrective action. Marginally allow for an increase of appropriate and compatible wildlife-dependent uses in areas that are not resource sensitive.
Controlling public access in important migratory bird areas	Enforce current area closures through LE patrols.	Increase LE patrol and presence to prevent trespass and minimize disturbance. Seek supplemental assistance from local, state, and other federal agencies.	Increase LE patrol and presence to prevent trespass and minimize disturbance.

Priority Issues	Alternative A (Current Management- No Action Alternative)	Alternative B (Proposed Alternative)	Alternative C
Illegal activities and controlling public access	Enforce current area closures through LE patrols. Two full-time officers currently patrol three refuges spread over a great expanse of water.	With assistance from state and other federal agencies, supplement current refuge enforcement of area closures.	Increase refuge patrol and presence to enforce closure areas (and special details) to support this effort. Consider the use of a volunteer workforce (e.g., pilots) to supplement observation.
REFUGE ADMINISTRATION			
9. Managing a Complex of Islands			
Changes in land use	Purchase priority lands within the approved acquisition boundaries as money is appropriated by Congress. Continue to accept management responsibility for state- and county-owned lands that fulfill the mission and purposes of the refuges.	Same as Alternative A. Also, work cooperatively with state, county, and private organizations to strategically identify existing conservation lands outside the current acquisition boundaries that are critical to the management of the refuges resources or protected (trust) species.	Shift emphasis from land acquisition to management and restoration of existing refuge lands.
Jurisdiction – Existing agreements add responsibility to LE staff to cover more areas than refuge lands	Maintain current management agreements at existing level and review as required.	Institute any new agreement(s) that support the Visitor Services' program. Conserve and protect critical habitat through land and water lease agreements with local and state agencies.	Same as Alternative B.

Priority Issues	Alternative A (Current Management-No Action Alternative)	Alternative B (Proposed Alternative)	Alternative C
10. Administrative Resources			
Staffing	Maintain existing staff positions. Fulfill mandatory staff training requirements.	Hire five permanent, full-time employees and use operational funds to hire seasonal staff to enhance capability to achieve priority refuge objectives for habitat protection, biological inventorying and monitoring, marine resource management, adaptive management, species recovery, and public outreach.	Same as Alternative B. Also hire an additional six permanent, full-time employees (11 total) to increase resource protection and visitor safety, improve the capability to conduct environmental education and outreach, promote volunteerism, enhance the fire management program, and to study and document climate and catastrophic weather impacts and assist in managing refuge operations.
Facility and asset needs	Maintain existing assets—five employee quarters, administrative headquarters, boats and heavy equipment to support refuge operations; and manage the bunkhouse and trailer as itinerant quarters for seasonal staff, volunteers, and researchers.	Same as Alternative A. Also construct new visitor center on U.S. Highway 1.	Same as Alternative B, except expand the vehicle fleet and develop affordable housing quarters to support additional staff. Also, construct a maintenance shop.

Priority Issues	Alternative A (Current Management- No Action Alternative)	Alternative B (Proposed Alternative)	Alternative C
Funding	Expend annual operations and maintenance funds as allocated.	Expend annual operations and maintenance funds as allocated, and actively pursue non-traditional funding sources through partnerships and grant writing to expand capacity to accomplish refuge objectives.	Same as Alternative B.
Partnerships	Maintain existing partnerships.	Foster internal (Service) and external partnerships with local, state, and federal agencies; conservation organizations; and non-profit groups and support FAVOR and volunteers.	Same as Alternative B.
Partnerships for ecological studies	Continue cooperative research agreements with universities that address priority species on refuge lands.	Same as Alternative A. Greatly expand cooperative collaboration to examine ecological processes of the refuge lands as a whole. Pursue challenge cost-share grants to achieve this.	Initiate cooperative efforts with private, university, and public agency researchers to expand research efforts of individual or groups of priority species.
Partnerships for visitor services programs	Maintain existing partnerships and cooperative efforts in the Visitor Services' program.	Strengthen current partnerships that will enhance priority wildlife-dependent public uses and institute new partnerships where there are none.	Same as Alternative B.

Priority Issues	Alternative A (Current Management- No Action Alternative)	Alternative B (Proposed Alternative)	Alternative C
Partnerships for cultural resource assessment	While there has been no comprehensive inventory of cultural resources, use available data and existing compliance mechanisms to best manage for cultural resources protection.	The regional archaeologist will prepare a cultural resources overview of the refuges and obtain state mapped site data. All applicable step-down plans will include provisions for protection of cultural resource sites.	Conduct a refuge-wide cultural resources inventory and map sites. The refuge and regional archaeologist will identify potential partnerships on archaeological and historic investigations and will promote interdisciplinary research.

IV. Environmental Consequences

OVERVIEW

This section analyzes and discusses the potential environmental effects or consequences that can be reasonably expected by the implementation of each of the three alternatives described in Chapter III. Conclusions are based on best available scientific information, internal consultation, peer review, and professional judgement of the CCP planning team members. Appendix B of the CCP provides an extensive list of references that were reviewed in preparation of the CCP and EA.

The CCP is a programmatic document intended to analyze proposed actions over a 15 year-time frame on a conceptual level to guide management direction and priorities. It should be noted that these are anticipated effects. Due to the conceptual nature of projects proposed in this plan, actual effects will be detailed later in any step-down management plan or project proposal, which would involve federal, state, regional and/or local consultation and NEPA compliance. Environmental Assessments will be developed in particular for the revised Fire Management Plan, and the new Integrated Predator Management Plan, Mosquito Management Plan, and Visitor Services Plan (which will include design and construction of the the new visitor center).

Refuge management is also required to consult with the Ecological Services Office prior to implementation of any plans or actions identified in the CCP, due to the potential to affect federally listed and candidate species. Specifically, section 7(a)(2) of the ESA requires all federal agencies to consult with the Service to ensure that actions they fund, authorize, permit, or otherwise carry out, will not jeopardize the continued existence of any listed species or adversely modify designated critical habitats. Section 7(a)(1) of the ESA charges federal agencies to aid in the conservation of listed species. Refuge construction projects must also comply with provisions of the Habitat Conservation Plan for Big Pine and No Name Keys, and will be consistent with provisions of the Monroe County Comprehensive Land Use Plan. The Service will consult with county, state and federal agencies that have shared management interest and/or jurisdictional authority over affected resources. All applicable federal laws, regulations and policies will be adhered to and reiterated further under specific step-down management plans.

DIRECT AND INDIRECT EFFECTS

Direct effects are caused by an action and occur at the same time as the action. Indirect effects are caused by an action, but are manifested later in time or further removed in distance, but are still reasonably foreseeable. The actions proposed for implementation under the proposed alternative include the development of a visitor center; wildlife and population management; habitat management; resource protection; public use; and the operation of the refuge (administrative programs). These actions could likely lead to both direct and indirect effects. Facility development, for example, could lead to increased public use in certain areas, which might have potential indirect effects, such as increased traffic, noise or littering.

Other indirect effects that may result from implementing the proposed action include minor impacts from siltation and ground disturbance during construction of the visitor center, elevated observation tower, and photography blind. A discussion of the effects of all three alternatives on the refuges' physical, biological, and socio-economic environments follows. None of the direct or indirect impacts are anticipated to be significant.

EFFECTS ON THE PHYSICAL ENVIRONMENT

To assist in this analysis, the impacts on the physical environment were divided into the categories of soils, hydrology, water quality, air quality, noise, aesthetics, and facilities.

SOILS

Under Alternative A, there are no proposed actions that would significantly degrade soils anywhere in the refuges. Soils within the fire-dependent pine rocklands are very thin or absent; burning removes vegetative litter and exposes the bare oolitic caprock which is a dominant natural feature of pine rocklands as a function of fire. With a limited fire management program as currently exists, the exclusion or suppression of fires in some pine rockland areas allows for a build-up of soil-building materials, and slow-moving or intense fires under undesirable environmental conditions may increase pine mortality by cooking tree roots. Prescribed fires conducted under carefully selected environmental conditions would be managed to move quickly through the forest to reduce fine fuels and minimize pine mortality.

Under Alternative B, in addition to effects of conducting prescribed burning in pine rockland described above, burning in salt marsh transition and freshwater wetlands is advocated to enhance Lower Keys marsh rabbit habitat. The historic and ecological role of fire in this habitat is currently being studied. Prescribed burns would be carefully managed in limited areas to reduce overstory vegetation and enhance ground cover. Temporary changes in soil characteristics may occur after a fire, but would be negligible and more than offset by potential benefits conferred on marsh rabbit habitat. The development of a new visitor services center is not expected to affect any soils because it will be constructed on an already scarified and gravel-filled commercial site. The modification of the viewing platform on the Watson Nature Trail into an elevated platform will have short-term minor impacts to soils during the construction. Equipment will be restricted to the existing trail and platform area, and precautionary measures will be taken to limit impacts surrounding the site to only foot traffic that will be necessary for surveying and setting platform pilings. A more detailed environmental assessment will be completed based on specific site plans developed for the proposed visitor center and elevated viewing platform prior to construction.

Under Alternative C, mechanical and hand clearing is proposed as the primary tool to achieve the fuel reduction to mimic effects of prescribed burning in pine rocklands. Mechanical equipment displaces and compacts soils. Foot traffic may cause minor rutting and compaction of soils. With the possible construction of a new shop and employee quarters, construction could affect soils unless construction is restricted to an existing gravel-filled site.

HYDROLOGY

Under Alternatives A and B, wetland restoration would continue to occur as funds and cooperative mitigation projects allow. Alternative B proposes a hydrological study and associated work to restore altered areas to a more natural hydrology. Under all alternatives, procurement of additional lands from willing sellers would confer protection in perpetuity to acquired wetlands, would enhance the protection of the freshwater lenses underlying Big Pine Key, and, in the case of upland acquisitions, would serve as a buffer for adjacent wetlands. These acquisitions would have a beneficial effect on hydrological resources. Expansion of wetland restoration efforts would allow restorative work to be expedited, rather than delayed. Under Alternative C, securing a permanent funding source for management of county and state-owned lands under refuge management would facilitate restorative efforts that would benefit natural wetland processes.

WATER QUALITY

Under all alternatives, the effects of long-term herbicide use for exotic plant control could result in a slight decrease in water quality in localized areas With proper application under EPA-approved label instructions, no leaching of chemicals into water bodies would be expected. Under all alternatives, since exotic plant infestation areas would be discovered and treated while still relatively small, a reduced amount of herbicide would be needed for treatment, lessening the impact of herbicides and mechanical treatment that may affect local water quality.

Alternative B would allow baseline information to be obtained on the long-term effects of catastrophic hurricanes and storm surges on water quality, as well as monitor the consequences of gradual climatological changes, such as sea level rise, on freshwater resources. It would confer the additional advantage of working with partners to develop predictive models to guide management strategies in light of existing and predicted changes in baseline data.

AIR QUALITY

Under Alternatives A and B, impacts to air quality and visibility may be caused from smoke emissions associated with prescribed fires. All fire management activities must comply with the national air ambient air quality standards established under the Clean Air Act to protect public health and the environment, and require authorization by the Florida Division of Forestry. Air quality impacts will be temporary and minimal due to careful planning of prescribed burning operations when environmental conditions (e.g. wind speed and direction, humidity, fuel moistures) are most optimal to minimize smoke production and movement. Wildfires tend to consume considerably more biomass per acre and occur under weather conditions outside the planning window of fire managers; therefore, air quality impacts are expected to be greater, though only temporary as all wildfires will be suppressed under all alternatives. Alternative C may have a greater impact on air quality as only mechanical and manual means are proposed to maintain fuel loads, resulting in greater biomass per acre compared to fire-maintained units and the potential for catastrophic wildfires to occur.

Effects on air quality from vehicular use with associated carbon emissions is likely to continue under all three alternatives due to a growing local and regional population and refuge visitation. However, this might be offset by reduced vehicle or residential emissions that could result from protecting existing or purchasing new lands that might otherwise have been developed. Compared to other land uses, all of the alternatives for the refuges would provide greater protection against degradation of daily ambient air quality over the long term. Under Alternative B, the Service will transition its vehicle fleet to alternative fuel models, and incorporate energy conservation measures into renovated and new facilities to reduce emissions and conserve resources, with an expected beneficial impact on local air quality.

NOISE POLLUTION

Under all alternatives, temporary noise and minor traffic increases would be by-products of wildfire suppression and prescribed burning activities where a helicopter, mechanized machinery, or fire trucks were used. Exotic plant species control typically involves the use of hand chainsaws and a mechanized chipper to cut and mulch vegetation, which would generate temporary increases in noise for all alternatives.

Visitors to refuge beach areas may experience noise pollution from non-wildlife dependent recreational activities, particularly due to overcrowding and use of radios. On some weekends, high numbers of visitors to Boca Grande Key, and to a lesser extent, Woman Key, create a serious noise

pollution problem. Under Alternative A, noise pollution would continue to be a problem at such periods on both islands. Under Alternative B, Boca Grande Key would be closed during holiday weekends to prevent overcrowding. Under Alternative C, carrying capacities would be set for these islands to reduce overcrowding and noise pollution, which may necessitate additional enforcement or beach closures.

AESTHETICS

Under all alternatives, aesthetics are expected to be positively impacted through the acquisition or other protection of adjacent lands from urban and suburban fringe development. Prescribed fire may have a temporary, negative aesthetic impact to people who dislike seeing burned vegetation until new green growth appears. Over the longer term, negative impacts would be offset under Alternative B as more refuge pine rockland areas are brought into an uneven-aged condition, resulting in greater plant diversity in the understory and a more visually appealing forest.

Exotic plant control would have temporary negative aesthetic impacts with easily observable dead and dying vegetation along roadsides in high use areas in particular. However, under all alternatives, these actions would result in a net benefit to aesthetics by preventing establishment of exotic plant monocultures and restoring native plant diversity. Planting native species following exotic plant removal will also reduce the impacts on aesthetics.

Under Alternatives B and C, construction of a new visitor center would have a temporary negative effect on aesthetics during the construction stages. However, since the facility would be sited on U.S. Highway 1 on an already developed site within a commercial zone, the completed facility would complement, rather than degrade, the aesthetics. The center would be built to Service standards, conform to local building codes, and be compatible with architectural and landscaping standards desired by the local community.

FACILITIES

Under Alternative A, there would be no change to the current facilities. Under Alternatives B and C, construction of a new visitor center is proposed. Because the new Visitor Center would be sited on lands previously developed, there would be no or minimal loss of native habitat.

EFFECTS ON THE BIOLOGICAL ENVIRONMENT

NATIVE HABITATS AFFECTED BY THE PLAN

Pine Rocklands

Under Alternative A, pine rockland habitats will continue to be lost due to numerous extrinsic threats, including habitat succession towards hammock from the lack of prescribed fire, and potentially catastrophic wildfires from the associated elevation in fuel loads. Rare hardwoods will continue being impacted by the endangered Key deer herd where it is currently believed to be at high density on Big Pine and No Name Keys. The impacts of non-native herbivores, such as the green iguana, are not known, but these could likely be detrimental. Continued land acquisition of priority uplands sites will provide additional protection.

Under Alternative B, an inventorying and monitoring plan would establish baseline data on the extent and health of the pine rockland ecosystem and top-priority species associated with this habitat type. Prescribed fire would be implemented as an adaptive habitat-management tool with emphasis on top

priority species. The fire management step-down plan would be revised to include all appropriate fuel treatments to enhance habitat diversity and benefit priority species. Prescribed fire activities will have a short-term negative impact on candidate plant species such as Big Pine partridge pea by potentially top-killing individual plants, but the overall long-term impact will be beneficial as burning reduces the overstory vegetation and opens the canopy to promote the growth of candidate plants. Agency and academic partnerships would be expanded to explore the impacts of sea-level rise on this globally imperiled ecosystem and to develop appropriate adaptive strategies. Data obtained from fire management and sea-level rise studies would be used to prioritize protection and restoration efforts. Impacts to pine rocklands from Key deer browsing would be reduced by appropriate herd management. Establishing a seed bank or nursery to restore the pine rocklands' flora lost due to sea-level rise, storm surges, and catastrophic wildfires would be evaluated.

Under Alternative C, mechanical management would be implemented to mimic prescribed fire and to determine impacts of fire suppression and increased fuel loads. Mechanical and hand-clearing treatments may reduce or slow successional processes; however, fire-dependent plants and associated fauna may ultimately be lost. All priority species associated with pine rocklands would be addressed in the inventorying and monitoring plan and associated step-down plans.

Hardwood Hammock

Tropical hardwood hammocks are considered to be a climax ecosystem and therefore, do not require active management with the exception of exotic species control and wildfire suppression, which would continue under all alternatives. Two federally listed species are located within hardwood hammocks on refuge lands, the Key tree cactus and Stock Island tree snail. Under Alternative A, both would continue to be protected from damage or illicit collection by visitors through closure of Watson and Cactus Hammocks. Mosquito-control spraying of adulticides is prohibited in both areas. The lack of prescribed fire in pine rocklands would likely increase the amount of hardwood hammock due to successional processes. Rare hardwood species would continue to be impacted by over-browsing by the endangered Key deer herd where densities are high on Big Pine and No Name Keys. Native orchids and air plants may be negatively impacted by non-native herbivores, such as the green iguana.

Under Alternative B, an inventorying and monitoring plan would establish baseline data on the extent and health of the hardwood hammock ecosystem and top-priority species associated with this habitat type. Impacts to hardwood hammock species from Key deer browsing would be reduced by appropriate herd management. Establishing a seed bank or nursery to restore the hardwood hammock flora lost due to over-browsing, sea-level rise, wind storms, and storm surges would be evaluated. The impacts of sea level rise on this habitat type would be documented.

Under Alternative C, more of the priority species associated with hardwood hammocks would be addressed in the inventorying and monitoring plan and associated step-down plans. The reduction or elimination of prescribed fire under this alternative would increase the amount of hardwood hammock due to successional processes as encroaching hardwood species become dominant features in pine rocklands, salt marsh transition, and freshwater wetland habitats.

Freshwater wetlands

Under Alternative A, freshwater wetlands would continue to be impacted by fire suppression, storm surges and sea-level rise and by hydrological changes due to roads, canals, mosquito ditches, and the use of fill to elevate existing areas. Continued loss of freshwater wetlands will decrease the long-term persistence of Lower Keys marsh rabbits on refuge lands.

Under Alternative B, an inventorying and monitoring plan would establish baseline data on the extent and health of the freshwater wetland ecosystem and focal species associated with this habitat type. Research on freshwater resources, including water quality and quantity and impacts of landscape alterations, would be conducted. Freshwater habitats would be restored and protected accordingly. The use of prescribed fire would be implemented and evaluated as a habitat management strategy for maintaining vegetation structure of freshwater wetlands favored by Lower Keys marsh rabbits. The impacts of sea level rise on this habitat type would be documented.

The environmental consequences associated would Alternative B would be the same for Alternative C; however, more of the priority species associated with freshwater wetlands would be addressed in the inventorying and monitoring plan and associated step-down plans. The reduction or elimination of prescribed fire under this alternative would allow for hardwood species to encroach on wetland habitats and become dominant features in the overstory. The use of mechanical and hand-clearing of vegetation would be evaluated as a habitat management strategy to maintain freshwater wetlands in the absence of prescribed fire.

Salt marsh transition

Under Alternative A, salt marsh transition would continue to be impacted by hurricanes, storm surges, and sea-level rise. The role of prescribed fire as a management tool to mimic the effect of natural disturbance regimes on maintaining coastal salt marsh transition would not be evaluated. Continued loss of salt marsh transitions would greatly decrease the long-term persistence of Lower Keys marsh rabbits on refuge lands.

Under Alternatives B and C, an inventorying and monitoring plan would establish baseline data on the extent and health of saltmarshes and top priority species associated with this habitat type. The use of prescribed fire would be implemented and evaluated as a habitat management strategy for maintaining vegetation structure of salt marsh transition habitats favored by Lower Keys marsh rabbits. The impacts of sea level rise on this habitat type would be documented.

Under Alternative C, the reduction or elimination of prescribed fire under this alternative would allow for hardwood species to encroach on transitional habitats and become dominant features in the overstory. The use of mechanical and hand-clearing of encroaching over-story vegetation would be evaluated as a habitat management strategy to maintain coastal saltmarshes in the absence of prescribed fire.

WILDLIFE AND PROTECTED SPECIES

Under all alternatives, population monitoring of certain priority wildlife species would continue. Feral and free-roaming cats would be trapped and removed from refuge lands to lessen the impact of this non-native predator on the endangered Lower Keys marsh rabbit and other native wildlife. Monitoring and translocation of Key deer would continue as warranted. Invasive exotic plants would be eradicated or controlled to protect native plant and animal communities. The application of herbicides to control exotic plants may have a short-term negative impact on candidate plants; however, proper application measures should be implemented to minimize impacts to non-target plants. Additionally, exotic plant control will have a long-term beneficial impact on candidate plant species by reducing competition and enhancing habitat quality. The acquisition and protection of additional lands would provide important habitat for a diverse array of plant and animal species, including rare butterflies, Key deer, and reptiles. With an extremely limited land base and continued loss of habitat to development, this measure is critical for the long-term welfare of wildlife and plant species.

Under Alternative A, the endangered Key tree cactus would remain in only a tiny area of the refuge that was severely flooded by storm surges from two recent hurricanes. The critically endangered Lower Keys marsh rabbit population would remain suppressed at an extremely low level, with extirpation likely on Big Pine Key without direct intervention. Assessment of the health and nutritional plane of the Key deer herd would be performed only irregularly and be insufficient to prevent or detect the spread of a disease outbreak. No measures would be taken to manage high Key deer densities on Big Pine and No Name Key, which are affecting plant communities and thwarting natural ecological processes. Wildlife surveys would continue to be limited to only a few priority vertebrate species, thus knowledge of the biological community as a whole would remain limited. Assessment of the long-range impacts of sea level rise and the recent and future impacts of hurricanes on wildlife and their habitats would be limited. Partnerships with academic, private, and government entities would continue at current levels.

Under Alternative B, wildlife populations are expected to benefit from increased integration of their habitat needs into a proactive and adaptive management approach using the best available science and implementing research, monitoring, and evaluation. Wetland and upland restoration would be increased and priority lands would be acquired from willing sellers. On No Name and Big Pine Keys, the management of Key deer numbers using proven immuno-contraceptive practices would be evaluated. This would foster natural plant community processes, increase plant diversity, and allow plant communities to recover from the adverse effects of the recurring high deer density of the past ten years. Nutritional indices would be monitored year-round by field necropsies of dead deer, with annual herd health checks by wildlife disease specialists. Blood serum samples from selected dead and live deer would be collected for laboratory analyses.

Key tree cactus habitat would be created in widely separated upland areas on Big Pine Key that are less vulnerable to flooding than that of the extant refuge population. Cactus would be propagated and planted in these sites to increase population size and distribution. Removal of encroaching buttonwood and prescribed burning would be implemented to enhance Lower Keys marsh rabbit habitat and maximize connectivity among restored habitats. These measures would be monitored to evaluate their effectiveness for increasing marsh rabbit numbers and to assess possible impacts on other wildlife species, as well as allow for adaptive management to occur.

Prescribed burning in pine rockland tracts would be conducted according to a fire management plan for National Key Deer Refuge, with pre- and post-burn monitoring performed to gauge plant and animal responses, particularly candidate plant and rare butterfly species. Specific measures to protect species from fire-induced mortality, for example, will be included in step-down Fire Management Plan and its associated Environmental Assessment and IntraService Section 7 Biological Consultation. Short-term negative effects to listed and candidate species can be expected during fire management activities, such as installation of fire breaks, mechanical treatment, implementation of prescribed fire, etc. However, long-term beneficial impacts from restoring and maintaining pine rockland habitat with prescribed fire will be conferred upon candidate plant and butterfly species that have evolved in this fire-dependent habitat. Attempts would be made to locate and flush or remove certain species, such as box turtles, from the burn areas prior to igniting a prescribed fire.

The aerial application of mosquito control adulticides negatively affect lepidopterans, such as the Bartram's hairstreak and Florida leafwing, with potential effects on insect-pollinated plants, such as the Big Pine partridge pea and other candidate plants. A new Mosquito Management Plan will be completed under Alternative B, which will limit mosquito control practices conducted by the Florida Keys Mosquito Control District on refuge lands to reduce or eliminate negative impacts to refuge resources based on field research and ecological risk assessments.

Under Alternatives B and C, the expanded monitoring of target species would provide important feedback to identify habitat needs and evaluate and improve management actions. Partnerships with academic, private, and government researchers would be expanded to further understand species, communities, and their interrelationships throughout the landscape. Obtaining baseline information on ecosystem health would allow immediate and long-term effects of catastrophic events, such as hurricanes, to be more fully understood. Completion of an extensive biological inventory and monitoring plan would allow adaptive management processes to be practiced to benefit communities of plants and animals. Partnerships with private, academic, and other government agencies would increase under both alternatives. These partnerships would serve to advance the application of strategic conservation planning, interdisciplinary approaches to addressing resource issues, and implementation of models and adaptive management to support decision making in a changing landscape.

Under Alternative C, a permanent funding source would be sought for management of state- and county-owned lands managed by the refuge to reduce the labor force and monetary burdens on limited refuge resources. Currently, such lands cannot reach their management potential. As with Alternative A, the Key deer population would be regulated only by natural processes, such as diseases and hurricanes. As a result, plant communities would be adversely affected where deer densities remain high. Through a contractual partnership, a genetically diverse Lower Key marsh rabbit population numbering 100 or more animals would be established outside the Florida Keys to serve as a source for reintroduction in the wake of a catastrophic hurricane in the refuge.

RESEARCH AND MONITORING

As discussed in the previous section, research and monitoring provides information needed to conduct effective management of refuge habitats for the benefit of a diverse array of associated wildlife. Under Alternative A, little monitoring and almost no refuge-sponsored research would take place, thus providing little data to evaluate and improve management actions.

Alternative B provides for monitoring of priority species and species groups, thus providing the critical element to evaluate and improve management actions under a proactive and adaptive ecosystem management approach. As a result, the populations of key species and species groups should respond positively, assuming adequate habitat is available on the refuges. Research and monitoring efforts will also focus on the potential impacts of global climate change on wildlife and their habitats in the Florida Keys, and provide the Service with new and updated information to develop adaptive management strategies and mitigate climate change impacts accordingly.

Under Alternative C, additional biological positions and contracts would greatly increase the monitoring of wildlife, especially mammals and priority birds not monitored under Alternative B.

EFFECTS ON WILDERNESS

Under all alternatives, non-native plant species would continue to be controlled year-round. Incompatible uses in wilderness have been addressed through the proposed revisions to the compatibility determinations (Appendix F).

Under Alternative A, overcrowding, non-wildlife dependent uses, and loss of wilderness character would continue to be a serious problem on certain backcountry islands, particularly Boca Grande Key. Over time, this would likely worsen and increase at other beach sites in Key West NWR. With no limits set on visitation, trampling and degradation of dune vegetation would continue to occur--and likely increase--promoting death or displacement of native species, including the

endangered Garber's spurge, by non-native grasses and forbs. Such damage would impact sea turtle nesting habitat and Miami blue butterfly foraging and nesting areas.

Under Alternative B, during peak use times (e.g., Memorial and Labor Days, July 4th) overcrowding on Boca Grande Key would be curtailed by closure of the beach. At other periods, at this and other refuge beaches in Key West NWR, carrying capacities would be established to curtail overcrowding and loss of wilderness character. If these measures prove ineffective or unfeasible to enforce, more stringent measures (seasonal or year-round closure) would be considered on a beach-by-beach basis as a necessary measure to protect the sensitive dune areas, reduce disturbance to wildlife, and preserve wilderness character.

Environmental education outreach efforts would be increased under Alternatives B and C to target wilderness area users and inform them about the importance and fragility of dune vegetation and to convey the tenets of responsible visitation to wilderness areas.

Without inventories of natural resources, specific management strategies for threatened and imperiled species in wilderness areas cannot take place. Alternatives B and C would increase the refuges' capability to protect and manage biological, wilderness, and cultural resources through increased inventorying and monitoring of habitats, species, and species groups. Increased law enforcement presence under Alternative C would be a deterrent to resource violations.

EFFECTS ON THE SOCIO-ECONOMIC ENVIRONMENT

PUBLIC USE, ACCESS, AND RECREATION

Fishing

Under all alternatives, the Service would promote resource protection by providing information on proper boating safety and fishing etiquette, and through promotion and enforcement of the State's saltwater fishing regulations. Fishing in freshwater habitats is not allowed under any alternatives. Fishing guides and guide associations would become active partners in this effort.

Wildlife Observantion and Photography

Under Alternative A, current visitor facilities would be maintained. Under Alternative B, an elevated wildlife observation platform would replace the current ground-level platform on the Watson Nature Trail to enhance wildlife observation and photography. Under all alternatives, additional restrictions on beach access would be instituted in Key West NWR to protect turtle nesting areas, to reduce beach loss, to reduce conflicts among beach users, and to ensure that public use conforms to wilderness laws and policies. Such resource protection strategies should maintain or enhance opportunities for wildlife observation and photography.

Environmental Education and Interpretation

Under Alternative A, current environmental education and interpretation efforts would be maintained. Under Alternatives B and C, the new visitor center proposed to be located on U.S. Highway 1 would enhance the Service's capabilities to educate residents, students, educators and visitors to the uniqueness and sensitivity of the wildlife and habitats of the Florida Keys. Additional interpretive signs would be installed at existing visitor sites in order to increase the public's understanding of refuge resources and public use provisions. New kiosks at existing sites, as well as brochures and maps, will emphasize the sensitivity of wildlife to human disturbance and

encourage proper wildlife viewing etiquette, resulting in long-term beneficial impacts to refuge resources. Expanded partnerships will be sought to educate businesses and their customers about appropriate and compatible wildlife-dependent recreational uses and also to promote public awareness of closed areas and prohibited uses. Such partnerships would enhance stewardship of the refuges' natural resources.

Other Permitted Activities

Several non-wildlife dependent public uses will be allowed to continue at existing or reduced levels on the refuges opened to public use. At National Key Deer Refuge, all alternatives allow for the continued uses of horseback riding, walking, day hiking, rollerblading, and jogging. At Key West NWR, opportunities for beach use activities (sunbathing, fishing, and walking on the beaches) would be reduced slightly due to new restrictions on use during peak use times. There are no new trails proposed under any alternative. Public access will be maintained at existing visitor facilities.

ECOTOURISM

Visitors to national wildlife refuges bring substantial benefits to the local economy. Ecotourism generates millions of dollars from expenditures on lodging, meals, gasoline, boat rentals, and ancillary purchases. Increases in ecotourism related to visitation to the Lower Florida Keys Refuges will likely create more revenue for local businesses, including the FAVOR Key Deer book store. The Service does not deliberatively attempt to attract new visitors through advertising or promotional materials, but it must be prepared to meet current and future demands for use of the Lower Florida Keys Refuges where compatible and appropriate for wildlife and habitat. Under Alternatives B and C, the Service assumes that a new visitor center on U.S. Highway 1 will capture visitors at a similar level to what is presently visiting the current visitor center located in the Winn Dixie Shopping Plaza, plus incidental drive-by tourists already traveling on the highway that see the new facility, resulting in a moderate increase in visitation. Without a detailed visitor use survey, it would be very difficult to predict the number or percent increase in annual visitation beyond a general upward trend, based on trends observed in tourism throughout the Florida Keys. There could be some increase in visitation to the Blue Hole and Watson-Mannilo Nature Trails concurrent with projected increases in tourism in the Florida Keys that will occur regardless of proposed management actions taken by the Service. The use level would be monitored to ensure refuge resources and visitation experiences are not degraded. Area closures, either permanent or seasonal, can be enacted to protect refuge resources as necessary.

TAX REVENUE

Tax revenue is generated by FAVOR's Key Deer bookstore located at the Florida Keys National Wildlife Refuge Complex's visitor center. The non-profit organization sells t-shirts, hats, books, and art work focused on the natural and cultural history of the Florida Keys. During 2008, $1,712 in state sales revenue was generated from bookstore sales. Under Alternative A, sales and state tax revenue would likely remain the same. Under Alternatives B and C, a new visitor center would likely generate increases in sales and state tax revenue from local residents and visitors.

EFFECTS COMMON TO ALL ALTERNATIVES

A few potential effects will be the same under each alternative and are summarized under these categories: regulatory, environmental justice, cultural resources, and refuge revenue sharing.

HEALTH AND SAFETY

Wildfires could have a negative effect on human health and safety. There is a chance of increased health effects associated with smoke and the conducting of prescribed fire under Alternatives A and B. Any increase in time in the field would increase the possibility of injuries to fire an biological staff. With regular training and safety precautions, field operation hazards will be minimized.

REGULATORY

As indicated in the Final CCP, the Service must comply with a number of federal laws, executive and administrative orders, and policies in the development and implementation of management actions and programs. All alternatives would be in furtherance of these laws and orders.

ENVIRONMENTAL JUSTICE

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

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

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 be caused by the construction of new facilities (Alternatives B and C) if they were inadvertently sited at a historic or archaeologic site. This is unlikely; however, since these management actions require review by the Service's Regional Archaeologist in consultation with the State of Florida's Historic Preservation Office, as mandated by Section 106 of the National Historic Preservation Act. The Service will also coordinate with the Seminole Tribe of Florida, the Seminole Nation of Oklahoma, the Muscogee (Creek) Nation of Oklahoma, the Poarch Band of Creek Indians of Alabama, and the Miccosukee Indian Tribe for information on and input into the management of important cultural and sacred sites located within the refuges. Therefore, the determination of whether a particular action within an alternative has the potential to affect cultural resources is an on-going process that would occur during the planning stages of every project.

Service acquisition of land with known or potential archaeological or historical sites provides two major types of protection for these resources: protection from damage by federal activity and protection from vandalism or theft. The National Historic Preservation Act requires that any actions by a Federal agency which may affect archaeological or historical resources be reviewed by the State

Historic Preservation Office, and that the identified effects must be avoided or mitigated. The Service's policy is to preserve these cultural, historic, and archaeological resources in the public trust, and avoid any adverse effects wherever possible.

REVENUE SHARING

All refuge lands are within Monroe County, Florida. Federal lands are not subject to state or local taxes or assessments; however, under the Revenue Sharing Act (16 USC 715s), the Service makes annual payments to counties to offset the loss of property tax revenues. In 2007, the Revenue Sharing check issued to Monroe County totaled $64,419 for 8,968 acres in National Key Deer Refuge and $14,447 for 5,768 acres in Great White Heron NWR. Lands within the Key West NWR are not included in the generation of revenue sharing fees. Under all alternatives, continued land acquisition activities will increase the acreage that is considered in calculating annual payments under the Revenue Sharing Act.

CUMULATIVE IMPACTS

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

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

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

EFFECTS ON THE PHYSICAL ENVIRONMENT

Alternatives B and C provide for habitat restoration and enhancement projects and all alternatives provide for land acquisition. Collectively, over time, and in working with other conservation partners, these actions will improve the refuges native habitats, particularly on mainline islands (NKDR).

The construction of a visitor center on U.S. Highway 1 will require detailed study, analysis and planning. The Service will coordinate with the County to insure any new construction or enhancements to visitor facilities that may increase traffic levels or reduce native habitat are consistent with the Big Pine Key and No Name Key Habitat Conservation Plan. A traffic study and environmental assessment will be done with site design planning for the new visitor center. The

traffic study will address the location and timing of traffic increases which could affect the Key deer. Where possible, avoidance and minimization measures will be employed. Traffic reduction measures will be assessed and implemented where practicable.

EFFECTS ON THE BIOLOGICAL ENVIRONMENT

Although the degree of habitat quality and improvement differs under the three alternatives, all are intended to improve fish and wildlife habitat and populations. For species that are threatened, endangered, candidate, rare or have declining populations, this improvement is important to their overall population and genetic diversity.

Under all alternatives, the effects of long-term herbicide use for exotic plant control could result in a slight decrease in water quality in localized areas, specifically in wetland areas prone to exotic plant infestation. With proper application, negligible leaching of chemicals into water bodies would be expected. Under all alternatives, since exotic plant infestation areas would be discovered and treated while still relatively small, a reduced amount of herbicide would be needed for treatment, lessening the impact of herbicides and mechanical treatment that may affect local water quality.

Negative cumulative effects of prescribed burning are anticipated to be minimal. The use of relatively small-scale prescribed burns conducted in accordance with agency policies and under an approved Fire Management Plan would help maintain local air quality at acceptable levels and ensure that mitigation and planning are done to preserve and protect imperiled species. These managed burns reduce fuel loads and help prevent catastrophic wildfires that have the potential to cause serious reductions in short-term air quality, threaten lives and property and damage native habitats.

The proposed predator management activities will seek to minimize the effects of predation by non-native species, such as feral cats and exotic snakes, on the Lower Keys marsh rabbit and other native wildlife. Careful assessment of the range and numbers of native predators will be done to ensure that the proposed action poses only negligible impacts on non-target species (such as raccoons).

The proposed exotic plant control activities are not expected to have significant, adverse cumulative effects. Currently, several agencies are working in partnership across the Keys landscape (mainline islands) to coordinate efforts and preserve the integrity of the remaining natural areas. These activities involve mechanical removal, application of approved (permitted) pesticides, and prescribed burning, or a combination of these activities. Herbicides used for exotic plant control are used and managed to target specific exotic plants or infestations. They are approved for use in natural areas to control exotic and invasive plants. They generally do not have long-lasting, residual effects to the environment as their chemical nature provides for relatively quick break-down of the product upon application. The use of herbicides is done under EPA regulations. It is limited to label rates and application practices, which are regulated across the State of Florida. Pesticide Use Proposals are completed annually and approved at the regional or national level as required by Service policy. All exotic plant chemical applications would be conducted in accordance with Service policy.

An Environmental Assessment will be prepared once site design and location are established for a new visitors center to minimize any impacts due to construction and placement of a facility. The use of an existing, scarified site with a minor construction footprint would minimize any cumulative effects.

Alternatives B and C emphasize maintaining the integrity of the refuges' natural resources. Working closely in partnership with neighboring entities and other conservation agencies, the Service actions will have a positive effect on the remaining natural environment of the Lower Keys, as well as on restoring certain degraded areas. Habitat improvements are expected to benefit rare and declining

species along with listed and candidate species. The strong biological monitoring components of these alternatives should aid in providing increased information for decision making that benefits fish and wildlife on the refuges, but adds to the body of knowledge collected by other agencies which can affect resource decision-making over a broader landscape.

EFFECTS ON THE SOCIO-ECONOMIC ENVIRONMENT

Regarding public uses, the negative cumulative impacts of increased visitation are anticipated to be minimal. New visitation will be directed to three locations, including two existing central areas, the Blue Hole and Watson-Mannilo trail as well as the newly proposed visitors center. Since visitation to the Florida Keys may be expected to increase over time, it is the Services' position that it is better to educate visitors and inform them about refuge resources and ways to minimize visitor use impacts. A new and more accessible visitor center could reduce native impacts of visitation on refuge resources by providing a full interpretive and educational experience for most visitors and thus potentially diminish their desire to travel elsewhere on Big Pine and No Name Keys. Therefore, the proposal is to concentrate public use activities in areas which can be monitored and assessed over time for any disturbance or degredation of the refuges resources. The location of a facility on U.S. Highway 1 will capture existing traffic transitting the islands. A traffic study will be done to ensure safety to both visitors and imperiled species. The new visitors center and associated friends bookstore is expected to generate some income to the local economy.

Overall coordination and communication with the general public should improve under Alternatives B and C due to new staff positions dealing with public use and public information. Since some may oppose changes in one or more of the alternative, or likewise support them, the cumulative impact on public perception of the refuges and Fish and Wildlife Service could be positive or negative. More emphasis on public and environmental education in Alternatives B and C should foster more understanding and appreciation of resource issues and needs. This could lead to increased political support, which would positively affect fish and wildlife resources on the Lower Florida Keys Refuges. Increased outreach of these alternatives could also positively impact land use decisions outside of the Services property by local governments, partners and private landowners. This could lead to increased protection and conservation of fish and wildlife populations over a broader area than that within Service jurisdiction.

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

UNAVOIDABLE ADVERSE EFFECTS

As discussed in previous sections, some of the habitat and facility projects in the alternatives have a certain level of unavoidable effects, especially during the construction phase. These effects will be more thoroughly evaluated in step-down planning and project design and permitting, all of which will include public involvement under NEPA. The negative effects are mitigated to some degree by the use of best management practices and precautions that safeguard water quality and avoid sensitive or irreplaceable habitats. Actions may be timed to avoid or minimize impacts to wildlife. Adverse effects are generally short-term and more than offset by the long-term gains in habitat quality and resulting wildlife and plant productivity and diversity. The process for dealing with these impacts is on a case-by-case basis.

Land acquisition entails unavoidable impacts to local governments as tax revenue on a property is reduced under public ownership. Payments made to Monroe County under the Refuge Revenue Sharing Act are only a portion of what would otherwise have been generated had the lands been retained in private ownership.

MITIGATION MEASURES

The following are proposed to mitigate and minimize potential adverse effects resulting from the implementation of the proposed action:

USER GROUP CONFLICTS

Compatibility determinations are proposed for all compatible wildlife-dependent uses (Appendix F). As public use increases, unanticipated conflicts between different user groups could occur. If this should happen, the Service will adjust its programs, as needed, to eliminate or minimize any public use issues. The refuge will use methods that have proven to be effective in reducing or eliminating public use conflicts. These methods include establishing permit-only use areas, refuge-guided activities, separate use areas, different use periods, and limits on the numbers of users in order to provide safe, quality, appropriate, and compatible wildlife-dependent recreational opportunities.

WATER QUALITY FROM SOIL DISTURBANCE AND USE OF HERBICIDES

Soil disturbance and siltation due to road and trail maintenance; and the construction of an elevated viewing platform and a visitor center are expected to be minor and of short duration. To further reduce potential impacts, the Service will use best management practices to minimize the erosion of soils into water bodies.

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

VEGETATION DISTURBANCE

Negative impacts could result from the use and maintenance of trails, firebreaks and roads that require the clearing or cutting of non-sensitive vegetation along their length. This is expected to be a minor, short-term impact.

Visitor use may increase the potential for the introduction of new exotic species into areas when visitors do not stay on trails. The Service will minimize this impact by installing informational signs that request users to stay on the trails.

WILDLIFE DISTURBANCE

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

The known and anticipated levels of disturbance from the proposed alternative are not considered to be significant. Nevertheless, the refuge will manage management activities and public use activities to minimize the potential for negative impacts. General wildlife observation may result in minimal disturbance to wildlife. If the refuge determines that impacts from the expected additional visitor uses are above the levels that are anticipated, those uses will be discontinued, restricted, or rerouted to other, less-sensitive areas.

EFFECTS ON ADJACENT LANDOWNERS

Implementation of the proposed alternative is not expected to negatively affect the owners of private lands adjacent to the refuge. Positive impacts that would be expected include reduced risk of wildfire, less intrusion of invasive exotic plants, and increased opportunities for viewing more diverse wildlife.

However, some negative impacts that may occur include a higher frequency of trespass onto adjacent private lands, and noise associated with increased traffic. To minimize these potential impacts, the Service will provide informational signs that clearly mark refuge boundaries, maintain the refuge's existing parking facilities, enhance law enforcement patrols, and provide increased educational and outreach efforts at the visitor center and through presentations for volunteer groups, civic organizations, and homeowners associations.

LAND OWNERSHIP

Land acquisition efforts by the Service could lead to changes in land use and recreational use patterns. However, most of the non-Service-owned lands within the refuge's approved acquisition boundary are currently undeveloped. If these lands are acquired as additions to the refuge, they would be maintained in a natural state, managed for native wildlife populations, and opened to wildlife-compatible public uses, where feasible. The Service provides modest revenue to local governments for lands it acquires and holds under Service jurisdiction. The maintenance of conservation lands by the federal government could offset some local costs if the lands were in local government ownership.

SITE DEVELOPMENT

Potential development of the buildings and other improvements could lead to minor short-term negative impacts on plants, soil, and some wildlife species. New construction will use recycled and environmentally sensitive materials as much as possible, be energy efficient and a "green building." The new visitor center and proposed wildlife observation platform will be constructed with materials that fit into the local architectural scheme and do well in the elements. All construction will conform to applicable federal, state, regional and local laws and ordinances. Section 7 consultation would be sought for the development of the visitor center and an Environmental Assessment will be prepared once a site plan and design are developed.

SHORT-TERM USES VERSUS LONG-TERM PRODUCTIVITY

The habitat protection and management actions proposed under the proposed alternative often involve short-term negative impacts to ensure the long-term productivity of refuge habitats. The benefits of this plan for long-term productivity far outweigh any impacts from short-term actions, such as the construction of observation platform and a visitor center. While these activities could cause short-term, negative effects, the educational values and associated public support gained from the improved visitor experience would produce long-term benefits for the refuges' entire ecosystem.

Protecting the refuges' long-term productivity requires that the nature and extent of public uses are limited to the degree that they do not degrade or interfere with natural resources. The proposed alternative has been carefully conceived to ensure that such thresholds are not exceeded. Therefore, implementing the proposed alternative would lead to long-term benefits for wildlife protection and land conservation that far outweigh any short-term negative effects.

SUMMARY STATEMENT

The management activities in the proposed action are anticipated to maintain or improve the refuges' biological resources, protecting the biological integrity of the three refuges. Benefits are expected for endangered, threatened, candidate and imperiled species, native wildlife and habitat diversity. Benefits are also expected for cultural and wilderness resources, as well as for the local economy. Beneficial, but no significant adverse effects, are expected for the three refuges' resources with the implementation of the proposed alternative.

The citations used to develop this EA are included in Appendix B. A description of the coordination and consultation regarding the CCP and EA is included in Appendix D.

Appendix O. Finding of No Significant Impact

Introduction
The U.S. Fish and Wildlife Service proposes to protect and manage certain fish and wildlife populations and their habitats in Monroe County on the Key West National Wildlife Refuge, Great White Heron National Wildlife Refuge, and National Key Deer Refuge (collectively the Lower Florida Keys Refuges). An Environmental Assessment (EA) has been prepared to inform the public of the possible environmental consequences of implementing the Comprehensive Conservation Plan (CCP) for the Lower Florida Keys Refuges. A description of the alternatives, the rational for selecting the preferred alternative, the environmental effects of the preferred alternative, the potential adverse effects of the action, and a declaration concerning the factors determining the significance of effects, in compliance with the National Environmental Policy Act of 1969, are outlined below. The supporting information can be found in the Environmental Assessment, which is Appendix N of the CCP for the Lower Florida Keys Refuges.

Alternatives
In developing the Comprehensive Conservation Plan for the Lower Florida Keys Refuges, the Fish and Wildlife Service evaluated three alternatives. The Service adopted Alternative B, the "Preferred Alternative," as the plan for guiding the direction of the refuges for the next 15 years. The overriding concern reflected in this plan is that wildlife conservation assumes first priority in refuge management. A description of the three alternatives follows.

ALTERNATIVE A - (CURRENT MANAGEMENT - NO ACTION)

The Lower Florida Keys Refuges have a high diversity of community types and endemic species, with many threatened, endangered, candidate, and other imperiled species. The primary mission of these refuges is to provide habitat for wildlife. The refuges currently have a small staff and funding source for the inventorying and monitoring of natural resources. Much effort has been put into some resources, such as Key deer and their habitat (pine rocklands), as a result of cooperative partnerships with academic and other research organizations. Certain species, such as great white herons, white-crowned pigeons, and sea turtles, have been studied over time by refuge biological staff. Under this alternative, these studies would continue.

Baseline data has yet to be established for some protected species, species suites, habitats, and cultural resources. The effects of natural catastrophic disturbances (e.g., Hurricane Wilma in 2005) on the refuges' resources have not been fully assessed and the effect of climate change (e.g., sea level rise) is not known.

Threatened and endangered species are protected through a variety of management tools, such as area closures, law enforcement, exotic plant control, etc. Limited research and monitoring of focal species, such as Key deer, Lower Keys marsh rabbit, and some migratory birds would continue with existing refuge staff and partnerships. The National Key Deer Refuge's prescribed fire management program would continue with the objectives to reduce fuels and to sustain the pine rockland ecosystem for the benefit of Key deer.

The Service would continue habitat conservation through land acquisition when funds allow and willing sellers offer lands within the approved acquisition boundary and through lease agreements with other agencies for non-refuge lands that support the refuges' missions. Partnerships exist to promote land conservation. Exotic plant control to protect and maintain current habitat would occur at

existing levels by relying on partnerships with the Nature Conservancy, the Florida Fish and Wildlife Conservation Commission, and Monroe County. A predator management program is currently under development on National Key Deer Refuge to reduce the effects of feral cat predation on the endangered Lower Keys marsh rabbit.

Most ecologically sensitive areas and living resources are protected from disturbance or degradation through the use of closure areas, law enforcement, and the implementation of the Management Agreement for Submerged Lands within the Key West and Great White Heron NWRs. Impacts from concentrated non-wildlife dependent uses threaten a limited number of sites, particularly islands with accessible sand beaches. The effects of commercial activities and public uses (both wildlife-dependent and non-wildlife-dependent) have not been fully evaluated and visitor carrying capacities have not been quantified.

The Service has an active volunteer program to assist in all facets of refuge management. Partnerships for these purposes and for research are encouraged and maintained. Under this alternative, the existing level of administrative resources (staffing, facilities and assets, funding, and partnerships) would be maintained. This means some positions may not be filled when vacated if funds need to be reallocated to meet rising costs or new priorities.

ALTERNATIVE B - (PREFERRED ALTERNATIVE)

This alternative assumes a slow-to-moderate growth of refuge resources over the 15-year implementation period of the CCP. It proposes a proactive and adaptive ecosystem-management approach for the enhancement of wildlife populations. It would promote a natural diversity and abundance of habitats for native plants and animals, especially Keys' endemic, trust, and keystone imperiled species. Many of the objectives and strategies are designed to maintain and restore native communities. Active management strategies would be applied particularly within the globally imperiled pine rockland, salt marsh transition, and freshwater wetland habitats and the island beach berm communities. Research and long-term monitoring would be initiated to expand the collection of baseline data and measure variables of ecosystem health. Cooperative studies to monitor and model the immediate and/or long-term effects of natural catastrophic events (e.g., hurricanes, wildfire) and global climate change, particularly sea level rise, would be promoted.

Current ongoing and proposed programs and efforts focus on threatened, endangered, and candidate species of plants and animals. The need for more comprehensive inventorying and long-term monitoring is addressed in this alternative, particularly for priority imperiled species and their habitats within the refuges. The feasibility of managing the core population of Key deer to minimize the effects of overbrowsing on native plants would be considered in accordance with the Endangered Species Act.

Habitat enhancement for critically imperiled species, such as the Lower Keys marsh rabbit and Key tree cactus, would occur to ensure the long-term sustainability of these species. Opportunities for land acquisition would focus more strategically on protecting environmentally sensitive habitat by contacting specific property owners to determine their willingness to sell, with a particular emphasis on enhancing habitat connectivity and protecting marsh rabbit habitat.
Off-refuge nursery propagation of the Key tree cactus would be implemented for later translocation to suitable refuge habitats. Cooperative partnerships with nurseries and botanical gardens would be developed to secure seed and plant material of rare and endemic plant species to ensure genetically viable sources for future restoration needs. Research would be initiated to identify causal reasons for the marked, long-term decline in the great white heron nesting population and to evaluate the potential impacts of sea level rise on the ecology of wading birds.

Since a primary purpose of the refuges is to provide sanctuary for nesting and migrating birds, greater protection from human disturbance would be provided, particularly at colonial nesting bird rookeries and at beach habitats in the backcountry islands. Additional limitations to public use may be implemented in sensitive beach areas important for shorebirds, terns, sea turtles, and butterflies.

Strategies are proposed to enhance the biological diversity and resiliency of the fire-dependent pine rocklands and also to enhance fire-adapted habitat features in salt marsh transition and freshwater wetlands that benefit priority species in the National Key Deer Refuge. Prescribed fire and mechanical or manual vegetation treatments would be used as habitat management tools to reduce wildland fuels and restore desirable habitat features where appropriate. Predictive modeling and fire effects monitoring would be used on all prescribed-fire treatments in an adaptive management approach to develop site-specific burn prescriptions and to determine whether objectives were met. Research on fire behavior, fuels response, and fire history would be conducted. The fire management step-down plan would be revised and implemented accordingly in conjunction with the development of a habitat management step-down plan.

Exotic plant control would continue as an ongoing operation within the refuges to maintain native habitats and prevent new infestations. Cooperative efforts would be sought with private property owners and homeowners associations to control seed sources from private lands. Existing partnerships would be reinforced to increase coordinated mapping and monitoring of treated areas with known infestations and ongoing control needs. Management of non-native exotic predators would be implemented as directed by the South Florida Multi-Species Recovery Plan for the benefit of threatened and endangered species. An early detection and rapid response program would be implemented in cooperation with county, state, and federal authorities to address the increasing invasion by and potential establishment of exotic snakes, lizards, and other non-native animals in the Florida Keys.

A primary focus of the visitor services program, as proposed, is to enhance environmental education and outreach efforts substantially to reach larger numbers of residents, students, educators, and visitors. This alternative also focuses on increasing public awareness, understanding, and support for the refuges' conservation mission. It places priority on wildlife-dependent uses, such as photography and wildlife observation; the details of these allowable uses are specified in appropriate use and compatibility determinations (Appendices E and F). A new visitor center on U.S. Highway 1 on Big Pine Key and enhanced visitor facilities at existing sites (e.g. Blue Hole and Watson-Mannillo NatureTrails) are proposed. Non-wildlife dependent forms of recreation would be limited or restricted in sensitive areas and awareness efforts would be stepped-up to inform visitors about protecting wilderness areas. A visitor services step-down plan would specify program details consistent with the Service's visitor services program standards.

The basic administrative and operational needs of the refuges have been addressed. Essential new staffing is proposed through the addition and funding of 5 permanent, full-time employees. Daily operation of the refuge would be guided by the CCP and the development and implementation of 19 projects and 11 step-down management plans. Wilderness and cultural resource protection objectives and strategies would be incorporated within the appropriate step-down management plans. The modest growth in administrative resources would be used for wildlife monitoring and habitat enhancement to better serve the refuges' purposes and the CCP's vision. With the exception of a new visitor center that is proposed, the existing number of facilities would be maintained. Energy efficiency standards would be applied wherever feasible during facility maintenance, repair or renovation projects. Existing vehicles would be replaced with alternative fuel vehicles to increase fuel efficiency and reduce carbon emissions.

ALTERNATIVE C

This alternative assumes a moderate-to-substantial growth of refuge resources from internal or external sources. It would more fully realize the refuges' missions and address the large number of threatened, endangered, and candidate species along with other imperiled species and habitat types. While Alternative C contains many of the provisions to protect and restore habitats similar to Alternative B, it emphasizes a broader suite of priority species, assuming the addition of several new staff positions and increased funding. The long-term inventorying and monitoring plan would be expanded to cover more species and species suites. Additional studies on some species would be undertaken and additional biological staffing would be required. The use of captive, off-refuge sources of some species facing potential extirpation (e.g., Lower Keys marsh rabbit) would be explored for reintroduction after a natural catastrophe, such as a major hurricane. In certain habitats, some alternative habitat management techniques would be studied and applied. Fire management efforts would emphasize fire suppression and the reduction of hazardous fuels by mechanical or manual means to protect private properties, and the use of prescribed fire would be reduced or eliminated. Under this alternative, the CCP anticipates shifts in the visitor services program in order to increase visitation and public use. Positions are proposed to add another refuge ranger position to coordinate and enhance volunteerism, to foster expanded relationships with FAVOR, and to establish new partnerships for environmental education and outreach programs.

Resource protection and visitor safety would be greatly enhanced through this alternative with the addition of two law enforcement officers. This would allow for more patrol and enforcement of closure and sensitive area protection, especially of wilderness areas or cultural resource sites. New areas of the backcountry would be closed to public access to protect wildlife resources. The Service would seek expanded management authority to regulate public and commercial activities in nearshore waters and submerged lands under the backcountry management agreement with the state. A cultural resources field investigation and inventory would be conducted.

Implementation of Alternative C would also occur through the development of 11 step-down management plans. New staffing is proposed through the addition of 6 permanent, full-time employees. The positions would be in addition to the 5 full-time positions proposed in Alternative B, for a total of 11 full-time positions in Alternative C. New maintenance and government housing facilities are proposed along with new vehicles and boats to accommodate the staff increases. While Alternative C would promote the vision of the Service for these refuges, the resources available to implement it are not likely to be forthcoming in the current economic environment as compared to when planning on this project started. Therefore, Alternative B appears to be the best choice alternative for the planning time frame of the next 15 years.

Selection Rationale

Alternative B is selected for implementation because it guides the development of programs that best achieve the refuges' vision to protect, enhance, and restore the natural diversity and integrity of the ecological landscapes of the Lower Florida Keys Refuges, and provide unique opportunities for research and compatible wildlife-dependent recreational uses in cooperation with our partners. It emphasizes the restoration and maintenance of habitats to support the recovery of several federally endangered, threatened, and candidate species; provides for the scientific research and long-term monitoring of habitat and wildlife data; and promotes an adaptive management approach to evaluate and prepare for future challenges in the face of climate change. At the same time, these management actions provide balanced levels of compatible public use opportunities with a focus on wildlife-dependent activities, consistent with existing laws, Service policies, and sound biological principles.

Under Alternative B, all lands within the current boundaries of the three refuges will be protected and maintained, as well as restored and enhanced where appropriate. Additional lands within the refuges' approved acquisition boundaries will be prioritized for land protection through acquisition or cooperative management. This alternative positively addresses priority concerns and issues expressed by the public.

Environmental Effects
Implementation of the Service's management action is expected to result in environmental (physical and biological), social and economic effects as outlined in the Environmental Assessment, Chapter IV (Appendix N). Habitat management, fish and wildlife population management, visitor services, and resource protection activities on the Lower Florida Keys Refuges will result in habitat restoration, recovery of threatened and endangered species, enhanced native wildlife populations and plant communities, and improved opportunities for wildlife-dependent recreation and environmental education. These effects are detailed as follows:

1. Wildlife populations are expected to benefit from increased integration of their habitat needs into management strategies.

2. Migratory bird production will be enhanced through additional research and monitoring efforts, and managing public uses to minimize human disturbance during critical periods of their life cycle.

3. In the forested habitats, regular inventories and prescriptions would occur and provide for the appropriate management responses to maintain healthy plant communities. The monitoring of target species would provide important feedback to identify habitat needs and evaluate and improve management actions. Additional research and monitoring of habitats and associated wildlife will further improve management both on and off the refuge.

4. The protection of additional lands would provide important habitat for many species, including the endangered Key deer and Lower Keys marsh rabbit.

5. Other effects to wildlife under this alternative include the evaluation of human disturbance on wildlife and the implementation of measures to reduce those impacts, and the increased control of feral cats and other invasive exotic animals and their damage to populations of native wildlife and plants.

6. Habitats of threatened, endangered, candidate, and other imperiled species will be conserved, restored, and enhanced. Baseline inventoryinh and long-term monitoring of priority species will be undertaken to detect changes in population abundance and distribution due to current and emerging threats such as climate change.

7. Habitat restoration and management, along with a focus on accessibility and facility developments, will result in improved wildlife-dependent recreational opportunities. Public use may result in some minimal, short-term adverse effects on wildlife and user conflicts may occur at certain times of year, but these effects are minimized by site and trail design, time zoning, and the enforcement of refuge regulations. The effects of public use on wildlife and habitat will be monitored and assessed.

8. Exotic plants on the refuge fee title lands and managed properties would be aggressively controlled to achieve effective removal of most exotic species listed by the State of Florida within 15 years. This would result in a cumulative positive impact on native vegetation and wildlife that utilize the treated habitats.

Potential Adverse Effects and Mitigation Measures

Wildlife Disturbance

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

As currently proposed, the known and anticipated levels of disturbance of the management action are considered minimal and well within the tolerance level of known wildlife species and populations present in the area. Implementation of the public use program would take place through carefully controlled time and space zoning, and establishment of protection zones around key sites, such as rookeries and eagle nests. Monitoring activities though wildlife inventories and assessments of public use levels and activities would be used and public use programs would be adjusted as needed to limit disturbance.

Land Ownership and Site Development

Land acquisition will occur within the approved acquisition boundary of each refuge only on a willing-seller basis at fair market values. Land ownership by the Service precludes any future economic development by the private sector. The effect of removing federal land from the local tax rolls on the fiscal revenue of Monroe County will be offset by annual contributions from the Service's Revenue Sharing Program.

Potential development of visitor services facilities could lead to some minor short-term negative effects on plants or wildlife species. When site development is proposed, each activity will be given the appropriate National Environmental Policy Act consideration during pre-construction planning, as well as consultation requirements under Section 7 of the Endangered Species Act. Attempts will be made to avoid or minimize the level of adverse impacts to the environment and to protect fish and wildlife resources.

User Group Conflicts

Compatibility determinations are proposed for all compatible wildlife-dependent uses (Appendix F). As public use increases, unanticipated conflicts between different user groups could occur. If this should happen, the Service will adjust its programs, as needed, to eliminate or minimize any public use issues. The Service will use methods that have proven to be effective in reducing or eliminating public use conflicts. These methods include establishing permit-only use areas, refuge-guided activities, separate use areas, different use periods, and limits on the numbers of users in order to provide safe, quality, appropriate, and compatible wildlife-dependent recreational opportunities.

Water Quality from Soil Disturbance and Use of Herbicides

Soil disturbance and siltation due to road and trail maintenance and the construction of an elevated viewing platform and a visitor center are expected to be minor and of short duration. To further reduce potential impacts, the Service will use best management practices to minimize the erosion of soils into water bodies.

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

Vegetation Disturbance
Negative impacts could result from the use and maintenance of trails, firebreaks, and roads that require the clearing or cutting of non-sensitive vegetation along their length. This is expected to be a minor, short-term impact. Visitor use may increase the potential for the introduction of new exotic species into areas when visitors do not stay on trails. The Service will minimize this impact by installing informational signs that request users to stay on the trails.

Effects on Adjacent Landowners
Implementation of the proposed alternative is not expected to negatively affect the owners of private lands adjacent to the refuge. Positive impacts that would be expected include reduced risk of wildfire, less intrusion of invasive exotic plants, and increased opportunities for viewing more diverse wildlife.

However, some negative impacts that may occur include a higher frequency of trespass onto adjacent private lands, and noise associated with increased traffic. To minimize these potential impacts, the Service will provide informational signs that clearly mark refuge boundaries, maintain the refuge's existing parking facilities, enhance law enforcement patrols, and provide increased educational and outreach efforts at the visitor center and through presentations for volunteer groups, civic organizations, and homeowners associations.

Coordination
The management action has been coordinated with all interested or affected parties including: Florida and United States Congressional representatives, the Florida State Clearinghouse, the State Historic Preservation Officer, local community and government officials, conservation organizations, and interested citizens and refuge neighbors.

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

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

2. The actions will not have a significant effect on public health and safety. (Environmental Assessment, Chapter IV)

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

4. The effects on the quality of the human environment are not likely to be highly controversial. (Environmental Assessment, Chapter IV)

5. The actions do not involve highly uncertain, unique, or unknown environmental risks to the human environment. (Environmental Assessment, Chapter IV)

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

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

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

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

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

Supporting References

U. S. Fish and Wildlife Service. 2009. Final Comprehensive Conservation Plan and Environmental Assessment for the Lower Florida Keys Refuges. U. S. Department of Interior, Fish and Wildlife Service, Southeast Region.

Document Availability

The Environmental Assessment is Appendix N of the Comprehensive Conservation Plan. Copies may be found at local libraries, the refuge, and the following website: http://www.fws.gov/nationalkeydeer.

Acting Regional Director, Southeast Region

Date: 9-14-9