CROCODILE LAKE NATIONAL WILDLIFE REFUGE

DRAFT COMPREHENSIVE CONSERVATION PLAN

AND

ENVIRONMENTAL ASSESSMENT

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SECTION A. DRAFT COMPREHENSIVE CONSERVATION PLAN

I. Background

INTRODUCTION

Crocodile Lake National Wildlife Refuge, operating as a satellite of the National Key Deer Refuge, is on upper Key Largo in Monroe County, Florida, and was established under the Endangered Species Act of 1973 (as amended) and the Land and Water Conservation Fund Act of 1965 (as amended in 1976). The refuge was established in April 1980 and currently covers 6,700 acres, including 650 acres of open water. It contains a mosaic of habitat types including tropical hardwood hammock, mangrove forest, and salt marsh. These habitats are vital for hundreds of plants and animals, including six federally listed species.

Crocodile Lake Refuge is unusual in that not all of the critical habitat areas are in a pristine, undisturbed condition. A large portion of the refuge was slated to become a residential development, complete with canals for boating access. The organic peat dredge-spoil from the canal system was piled up in berms on the banks of the canals and became an important nesting area for the federally listed American crocodile. American crocodiles are fairly widespread throughout the tropics; however, in the United States crocodiles are only found in south Florida and the Keys.

The refuge protects one of the largest remaining tracts of tropical hardwood hammock, which is a globally threatened habitat type. These diverse forests are home to hundreds of plants and animals, including the federally listed Key Largo woodrat, Key Largo cotton mouse, Schaus swallowtail butterfly, Stock Island tree snail, and eastern indigo snake. These species require hammocks in order to survive. Unfortunately, most of the hammocks in Key Largo have been eliminated by development, which has led to considerable population declines in these already imperiled species.

Management initiatives on the refuge include exotic plant removal and habitat protection. The refuge is closed to public access to protect critical habitat. A casual visitor might think that Key Largo is little more than a highly developed, tourist-oriented island. However, much of north Key Largo has been set aside as a natural area for the protection of threatened and endangered species and their habitats. Acre for acre, few places on earth harbor more threatened and endangered plants and animals than Crocodile Lake Refuge and the adjacent Dagny Johnson Key Largo Hammock Botanical State Park.

The mix of pristine natural areas and disturbed areas on the refuge creates many management challenges. Natural areas are important to a multitude of species, as are the disturbed areas. Typically, habitat management strives to restore disturbed habitats to a pre-disturbance state. At the refuge, federally listed species, such as the American crocodile and the Key Largo woodrat, thrive in disturbed areas. Thus, management of the refuge must undertake actions that seem contradictory to the maintenance of ecological integrity.

This Draft Comprehensive Conservation Plan and integrated Habitat Management Plan for Crocodile Lake National Wildlife Refuge were prepared to guide refuge management. A planning team developed a range of alternatives that best met the goals and objectives of the refuge. Following a public review and comment period on this draft plan, a final decision will be made by the Fish and Wildlife Service that will guide refuge management programs and projects over a 15-year planning period.

PURPOSE AND NEED FOR PLAN

The National Wildlife Refuge System Improvement Act of 1997 established a clear legislative mission of wildlife conservation for the National Wildlife Refuge System. Activities were initiated in 1997 to complement the direction of this new legislation, including an effort to complete 15-year management plans (i.e., comprehensive conservation plans) for all refuges. These plans, which are conducted with full public involvement, help guide the management of refuges, including providing management direction for natural resources, as well as recreation and education programs.

The Act states that each refuge shall be managed to:

- fulfill the mission of the Refuge System;
- fulfill the individual purposes of each refuge;
- consider the needs of fish and wildlife first;
- fulfill the requirement of developing a comprehensive conservation plan for each unit of the Refuge System and fully involve the public in the preparation of these plans;
- maintain the biological integrity, diversity, and environmental health (cumulatively referred to as "ecological integrity") of the Refuge System; and
- recognize that wildlife-dependent recreation activities, including hunting, fishing, wildlife observation, wildlife photography, and environmental education and interpretation are legitimate and priority public uses of national wildlife refuges.

The purpose of this plan is to identify the role the refuge will play in support of the mission of the National Wildlife Refuge System, and to provide guidance for managing the refuge through the next 15 years. This plan is designed to fulfill the following:

- provide a clear statement of the desired future condition of the refuge;
- provide refuge neighbors, visitors, and partners with a clear understanding of the reasons for management actions on and around the refuge;
- ensure that management of the refuge is consistent with mandates of the National Wildlife Refuge System;
- ensure that refuge management is consistent with other federal, state, and county plans;
- provide long-term guidance and continuity for refuge management; and
- provide a basis for operation, maintenance, and capital improvement budget requests.

U.S. FISH AND WILDLIFE SERVICE

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

The mission of the Service is:

> "Working with others, to conserve, protect, and enhance fish, wildlife, and plants and their habitats for the continuing benefit of the American people."

NATIONAL WILDLIFE REFUGE SYSTEM

As part of its mission, the Service administers the National Wildlife Refuge System, a national network of lands and waters for the management and protection of these resources. To date, the Refuge System encompasses more than 540 national wildlife refuges and more than 3,000 small waterfowl breeding and nesting sites that protect upwards of 95 million acres. It is the world's largest collection of lands and waters specifically managed for conservation of fish and wildlife. The majority of these lands, 77 million acres, is in Alaska. The remaining acres are spread across the other 49 states and several island U.S. territories.

The mission of the 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."
>
> *--National Wildlife Refuge System Improvement Act of 1997*

The wildlife and habitat vision for national wildlife refuges stresses that wildlife come first; that ecosystems, biodiversity, and wilderness are vital concepts in refuge management; that the ecological integrity of refuges is maintained; that the growth of refuges and the Refuge System must be strategic; and that the Refuge System serves as a model for habitat management with broad participation from others. This broad participation includes local, state, and federal government partners; organizations; the local business communities; individuals; and volunteers. Volunteers continue to be a major contributor to the success of the Refuge System. In 2004, 6,349 volunteers supported 125 stations and contributed 293,937 hours with a value of more than five million dollars in the Southeast Region.

The National Wildlife Refuge System hosts over 35 million annual visitors. Economists estimate that these refuge visitors contribute more than $400 million annually to local economies. In 2001, on conservation lands throughout the nation, approximately 37.8 million people participated in wildlife-related activities, most to observe wildlife in their natural habitats. These visitors represent nearly 40 percent of the country's adults who spent $108 billion on wildlife-related pursuits in 2001, according to the National Survey of Fishing, Hunting, and Wildlife-Associated Recreation (U.S. Department of Interior, Fish and Wildlife Service and U.S. Department of Commerce, U.S. Census Bureau 2002). As visitation continues to grow on conservation lands and waters in general, and specifically on refuges, adjacent local communities are realizing significant economic benefits.

LEGAL POLICY CONTEXT

The administration of national wildlife refuges is guided by the mission and goals of the National Wildlife Refuge System, Congressional legislation, Presidential executive orders, and international treaties. Policies for management options of refuges are further refined by administrative guidelines established by the Secretary of the Interior and by policy guidelines established by the Director of the Fish and Wildlife Service. Management options are guided by a refuge's establishing authorities; Public Law 104, Stat. 2957 (§108, H.R. 3338); and the National Wildlife Refuge System Improvement Act of 1997 (see Appendix III for more information on legal and policy guidance for the operation of national wildlife refuges).

Key guidance and direction can be found in:

- National Wildlife Refuge System Administration Act of 1966;
- Refuge Recreation Act of 1962;
- Title 50 of the Code of Federal Regulations;
- U.S. Fish and Wildlife Service Manual; and
- National Wildlife Refuge System Improvement Act of 1997.

Since refuges must be managed for wildlife first, the lands and waters within the National Wildlife Refuge System are closed to public uses unless specifically and legally opened under specified conditions allowing compatibility with the purposes of the refuges. All programs and uses of a refuge must be evaluated based on mandates set forth in the National Wildlife Refuge System Improvement Act, including those that:

- contribute to ecosystem goals, as well as to refuge purpose(s) and goals;
- conserve, manage, and restore fish, wildlife, and plant resources and their habitats;
- monitor the trends of fish, wildlife, and plants;
- maintain ecological integrity;
- manage and ensure compatible wildlife-dependent visitor uses as those uses which benefit the conservation of fish and wildlife resources and which contribute to the enjoyment of the public (these uses include hunting, fishing, observing wildlife, photographing wildlife, and participating in environmental education and interpretation); and
- ensure that visitor activities are compatible with refuge purpose(s).

RELATIONSHIP TO STATE PARTNERS

The U.S. Fish and Wildlife Service is committed to encouraging and maintaining partnerships with others to improve the environmental health of ecosystems and the National Wildlife Refuge System. Partnerships are recognized by the Service as vital to fulfill our mission and help share our advocacy for fish and wildlife resources. Some of our current partners include federal and state agencies, environmental organizations, outdoor sporting groups, industry, local governments, and private landowners.

A provision of the National Wildlife Refuge System Improvement Act of 1997 and subsequent agency policy provide that the Service shall ensure timely and effective cooperation and collaboration with other federal agencies and state fish and wildlife agencies during the course of acquiring and managing refuges. For Crocodile Lake Refuge, state fish and wildlife management is administered by the Florida Fish and Wildlife Conservation Commission (http://www.myfwc.com/) and the Florida Department of Environmental Protection (http://www.dep.state.fl.us/). These state agencies are charged with enforcement responsibilities relating to migratory birds, trust species, and fisheries, as well as with management of the state's natural resources. Both the Florida Fish and Wildlife Conservation Commission and the Florida Department of Environmental Protection manage state lands and waters. The Florida Fish and Wildlife Conservation Commission manages 4.3 million acres of public lands and 220,000 acres of private lands for recreation and conservation purposes. The Florida Department of Environmental Protection manages 150 state parks covering nearly 600,000 acres and 57 coastal and aquatic managed areas totaling over 5 million acres of submerged lands and coastal uplands.

Various agencies within the state government have also participated in a mix of refuge projects, including the planning process to develop a 15-year management plan for the refuge. The State of Florida's participation and contribution throughout this comprehensive conservation planning process provide for ongoing opportunities and open dialogue to improve the ecological conservation of fish and wildlife in Florida. An integral part of the comprehensive conservation planning process is integrating common mission objectives, where appropriate.

ECOSYSTEM CONTEXT

Comprising one of 52 ecosystems around the country, the Fish and Wildlife Service's South Florida Ecosystem encompasses more than 26,000 square miles, 19 southern Florida counties, and more than 7 million people. The South Florida Ecosystem has undergone numerous human disturbances, ranging from alteration of hydroperiods, fire history, and drainage patterns. Developing and dredging the Everglades canal system and expanding agricultural operations have eliminated and diminished natural systems. Exotic species such as Australian pine, Brazilian pepper, and lead tree are further contributing to wildlife population and habitat declines. Over the last 50 years, the South Florida Ecosystem has undergone dramatic changes, which are largely attributed to various human activities and economic growth.

Despite the ongoing landscape alteration and rapidly growing economy, the scrub, hardwood hammocks, cypress swamps, salt marshes, mangrove islands, coral reefs, and seagrass beds of south Florida support one of the most ecologically diverse systems on the planet. The majority of the remaining wildlife and habitats of the South Florida Ecosystem are found on national interest lands, including sixteen national wildlife refuges, three national parks, one national preserve, and one national marine sanctuary. Despite tremendous economic development, the South Florida Ecosystem supports more than 600 rare or imperiled species, where 68 are federally listed as threatened or endangered, including 8 mammals, 13 birds, 10 reptiles, 2 invertebrates, and 35 plants.

ECOLOGICAL THREATS AND PROBLEMS

The following threats were identified by the South Florida Ecosystem Team and published in the Team's plan in 1998. Not all of these threats and problems affect Crocodile Lake Refuge; however, they affect the South Florida Ecosystem as a whole, and are included here as a frame of reference. The threat topics are taken directly from the 1999 South Florida Ecosystem Team's Ecosystem Plan section on Florida Keys issues, and all do not necessarily apply to the refuge.

EXOTICS

Exotic (non-native) species of concern include Brazilian pepper, Old-world climbing fern, Australian pine, *Asiatic colubrina,* lead tree, knickerbean, and non-native grasses. In both Great White Heron and Key West Refuges, much of the affected area is on offshore islands where treatment is difficult. Much of the exotic vegetation on the highway connecting the Keys lies on private property, which makes treatment problematic. Past survey efforts concluded that roughly 500 acres of Crocodile Lake Refuge, National Key Deer Refuge, Great White Heron Refuge, and Key West Refuge lands were infested with exotic vegetation. Feral cats are the primary predators of the endangered Lower Keys marsh rabbit and may be impacting the Key Largo woodrat and cotton mouse. Imported fire ants attack young sea turtles and endangered endemic rodents. Black rats may eat the young of endangered rodents and outcompete them for habitat.

PUBLIC USE

The public use carrying capacity of specific areas needs to be addressed. The high level of public use throughout all of the Keys (uplands, Florida Bay, reef tract) is the source of many other critical issues. Many problems are associated with illegal uses and commercial use, particularly in the lower Keys backcountry islands. Beach use causes disturbance to shorebirds and damages their loafing and feeding areas. Personal watercraft use, recreational fishing, parasailing, diving, and snorkeling continue to be increasing problems. Crocodile Lake Refuge, however, has always been a closed refuge and does not have problems with illegal public uses. The public uses mentioned above are primarily of concern elsewhere in the Keys.

WETLAND PROTECTION

There has been substantial restoration of wetlands, such as the Harrison Tract on Crocodile Lake Refuge and Port Pine Heights Mitigation Project within the National Key Deer Refuge. The potential for these areas to be hydrologically flushed needs to be restored. Freshwater areas are critical for mammal species. Saltwater wetlands are important nursery areas for reef fish, as well as feeding and roosting areas for wading birds. Although restoration of some areas is underway, much more is needed, such as filling of mosquito ditches and unused canals. Water wells associated with residential development are lowering the freshwater lens on Big Pine Key, making this water unavailable to wildlife and subject to saltwater intrusion.

WATER QUALITY

This area is affected by nearshore water quality issues of Florida Bay and the Keys reef tract. Alterations of historic water flow through this subregion create water quality problems ranging from loss of seagrass in Florida Bay to coral die-off in the sensitive reef tract. Hydrologic flushing of this area needs to be restored. Nearshore water quality is impacted by nutrient loading from upstream and local sources. Sewage treatment plants, septic tanks, cesspits, and live-aboard vessels represent the most common and widespread sources of pollution and water quality degradation in the Florida Keys. Boaters in shallow waters and divers stir up the sediments.

CONTAMINANTS

Mosquito spraying is not allowed on Crocodile Lake Refuge but it may be harming invertebrate populations in North Key Largo, such as the endangered Schaus swallowtail butterfly and Stock Island tree snail. Possible water table contamination from a landfill inholding at Crocodile Lake Refuge may be a problem. Lead from firearm ranges is also a known contaminant.

HABITAT LOSS

The primary threats to upland habitats in the Florida Keys are economic development, fragmentation by infrastructure, and invasion of exotic vegetation. Wetland restoration is helping to reverse existing habitat loss. At Crocodile Lake Refuge, loss of adjacent tropical hardwood hammock habitat for residential purposes is the largest problem. Losses of seagrass in Florida Bay and coral die-off in the reef tract are also problems associated with commercial and public uses.

COASTAL IMPACTS

Some natural erosion has been exacerbated by human use and boat wakes, particularly on backcountry islands. Sea level rise could eventually affect wetlands and mangrove forests by altering tidal and hydrologic cycles.

LACK OF KNOWLEDGE

More information is needed on the public use carrying capacity for the Florida Keys, particularly for commercial use. Information is also needed on the extent of exotic plant invasions and the role of fire in pine rocklands in the lower Keys. Baseline data for water quality and faunal and floral inventories are also needed.

AIR QUALITY

This is not believed to be an issue as there are no major industries.

LAND USE

The primary problem is increased human population growth, with its subsequent residential and associated commercial development and landfill activities. In the backcountry waters and coral reef communities, a primary problem is increased competition for support and space between species, including humans, and the resulting damage and problems.

LAW ENFORCEMENT

The full scope of law enforcement activities should be performed to eliminate the unlawful take of migratory birds, threatened and endangered species, and other native wildlife and plants. Traffic enforcement and prevention of illegal feeding of Key deer are critical to the survival of this species.

CONSERVATION PRIORITIES

The South Florida Ecosystem Team's plan identified seven goals. Each goal was established by ecosystem team members to accomplish the tasks identified by the Interagency Task Force. The goals recognize refuges and other national interest lands as cornerstones of an ecosystem approach to resource conservation and management. Refuge land managers will consider landscapes beyond their respective boundaries and focus on the overall environmental health and biological integrity of the ecosystem. The conservation priorities for the South Florida Ecosystem are reflected in the following seven goals:

1. Protect and manage units of the National Wildlife Refuge System and other national interest lands.

2. Protect migratory birds and protect, restore, and manage their habitats.

3. Protect, restore, and manage candidate, threatened, and endangered species and their habitats.

4. Protect, restore, and manage wetlands and other freshwater habitats.

5. Protect, manage, and restore fish and other aquatic species and their habitats.

6. Protect, restore, and enhance coastal and estuarine habitats.
7. Protect, restore, and manage for biodiversity.

II. Refuge Description

INTRODUCTION

Crocodile Lake National Wildlife Refuge was established in April 1980 to protect and preserve critical habitat for the American crocodile. The refuge is also home to five other indigenous species that are federally listed as threatened and endangered. The refuge and surrounding waters are habitat for more than 80 other wildlife and plant species that are listed by federal, state, or county agencies as threatened, endangered, candidate, or otherwise protected. The refuge was established under the authorities of the Land and Water Conservation Fund Act of 1965, as amended in 1976 (Public Law 94-422) and the Endangered Species Act of 1973 (Public Law 93-295, 87 Stat. 884), as amended.

The refuge was established in 1980 with an initial purchase of 85 acres at a cost of $41,250. Subsequent land purchases did not begin again until February 1981, at which time purchases proceeded at a steady pace until 1994 and resulted in an additional 6,475 acres being acquired. Also in 1994, the Service entered into a 99-year lease agreement with the State of Florida for approximately 125 acres that exist within the refuge acquisition boundaries. The last purchases, encompassing almost 2 acres, occurred in 1998, and put the total lands under refuge control at 6,688 acres.

The refuge serves as a satellite refuge of National Key Deer Refuge and was not staffed until 1997, when a refuge manager was hired. Over the years, refuge administration and management have been supplemented by staff from the National Key Deer Refuge, as well as interns, university researchers, and volunteers.

REFUGE LOCATION

Crocodile Lake National Wildlife Refuge is on North Key Largo in Monroe County, Florida, approximately 40 miles southwest of Miami (Figure 1). The refuge is a satellite of National Key Deer Refuge located 70 miles southwest on Big Pine Key. It is bordered on the east by County Road 905 and on the south by U.S. Highway 1. Card Sound, Barnes Sound, and North Lake Surprise border the western shoreline of the refuge. The refuge is part of a complex of environmentally protected areas which include Everglades National Park to the northwest, Key Largo Hammock Botanical State Park to the east, and Card Sound Aquatic Preserve and Biscayne National Park to the north.

REFUGE PURPOSES

Crocodile Lake National Wildlife Refuge was established under authority of the Endangered Species Act of 1973 and the Fish and Wildlife Act of 1956. The refuge was created specifically to protect critical habitat for federally listed species. The primary purposes from the enabling legislation are as follows:

> "... 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)."

> "... 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)."

ROLE OF CROCODILE LAKE NATIONAL WILDLIFE REFUGE

Crocodile Lake National Wildlife Refuge protects breeding and nesting habitat for the endangered American crocodile and other wildlife. The refuge is located in north Key Largo and is currently comprised of 6,700 acres including 650 acres of open water. It contains a mosaic of habitat types including tropical hardwood hammock, mangrove forest, and salt marsh. These habitats are critical for hundreds of plants and animals including six federally listed species.

The refuge, in conjunction with adjacent state lands, protects the last large areas of habitat in north Key Largo. Several hundred acres of habitat could have been lost to economic development if the refuge was not established. Crocodile Lake Refuge is unique in that it is truly a refuge for wildlife.

REFUGE ENVIRONMENT

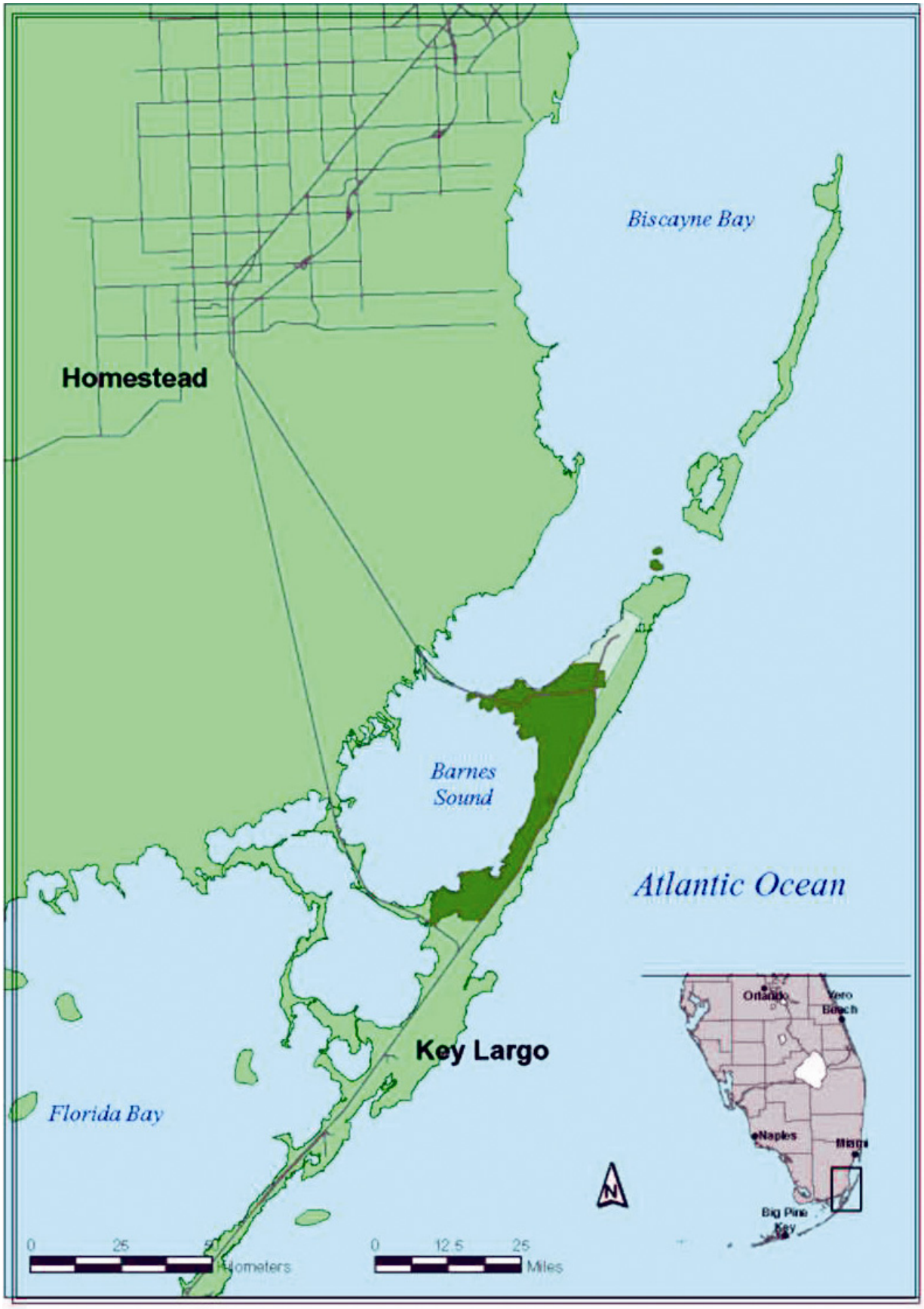
FISH AND WILDLIFE POPULATIONS, INCLUDING FEDERALLY LISTED SPECIES

Crocodile Lake Refuge is an important ecological niche for the conservation of several threatened and endangered species and their habitats. The refuge provides habitat for six federally listed threatened and endangered species, including the American crocodile, Key Largo woodrat, Key Largo cotton mouse, Schaus swallowtail butterfly, Stock Island tree snail, and eastern indigo snake. The refuge supports nearly 25 percent of the existing American crocodile population and is one of only three areas in the United States that provides nesting habitat for the species. Approximately 40 percent of the Key Largo woodrat and Key Largo cotton mouse reside on the refuge, with the remaining populations confined to the adjacent Key Largo Hammock Botanical State Park. The inshore waters and mangrove creeks in and around the refuge provide habitat for the federally endangered West Indian manatee and five species of federally listed threatened and endangered sea turtles. The refuge is also a seasonal home to American bald eagles, white-crowned pigeons, and other migratory birds. More than 34 state-listed wildlife species also call the refuge home.

The refuge is comprised of two globally endangered ecosystems: mangrove wetlands and tropical hardwood forests. Within the continental United States, these habitat types are found only in extreme south Florida and the Florida Keys. The tropical hardwood forests contain more than 120 native trees and shrubs, making this ecosystem one of the most diverse in the world. Nearly 80 percent of the plant species on the refuge are of West Indian origin. Many of the plant species are listed as threatened or endangered by the State of Florida, and are also protected by Monroe County.

The mosaic of habitats at Crocodile Lake Refuge supports the federally threatened eastern indigo snake, as well as state-listed species including the mangrove terrapin, rim rock crowned snake, and Florida Keys mole skink. The terrapin and mole skink are subspecies restricted in distribution to the Florida Keys, while the rim rock crowned snake is a species that also occurs in the southern reaches of Dade County. These four species are found in several major habitat types, including mangroves (terrapin and indigo snake); hammock (mole skink, indigo snake, and rim rock crowned snake); and driftwood and tidal wrack along the shorelines and islands (mole skink).

Figure 1. Crocodile Lake National Wildlife Refuge location.



The refuge's mangrove wetlands serve as important nursery areas for a diversity of fish and shellfish, with many having recreational and commercial importance. The mangrove wetlands and hardwood forests of the refuge also support a large number of migratory bird species, including wading and water birds, shorebirds, waterfowl, and neotropical migratory songbirds.

TOPOGRAPHY

The refuge is part of the geographic region of high coral keys with maximum elevations of 10 to 12 feet above mean sea level. The intertidal, tidal, and submerged areas of this tract are less than 2 feet below mean sea level. Natural solution holes, created by the dissolution of the limestone by rainfall, form depressions in the limestone and can be more than 5 feet in depth. Some of the topography of the upland and submerged areas has been altered by human activity, such as dredging of deep canals and basins, filling wetlands and uplands to create adequate elevations for residential construction, and installation of roads.

GEOLOGY

The geologic formation of the refuge is Key Largo limestone. Built by coral polyps of ancient reef formations, these remains are similar to the present living coral reefs offshore. Sea level has fluctuated over time and the land mass of south Florida has been both exposed and submerged by water. Approximately 120,000 years ago, the sea level dropped close to its present level, exposing the coral and allowing for the formation of the islands of the Florida Keys. The ancient coral reefs were very large, as evidenced by Key Largo limestone as much as 145 feet thick in some areas of the Upper Keys.

SOILS

Five soil types have been identified on the refuge. They are Pennekamp gravelly muck, Rock Outcrop-Tavernier complex, Islamorada muck, Key Largo muck, and Udorthents-Urban land complex.

Pennekamp gravelly muck is found in the upland hammock areas typically at the highest elevations. It is characterized by a thin layer of organic debris and leaf layer over the limestone rock. Soil in this unit is well drained. In the low intertidal area, the soil unit is Rock Outcrop-Tavernier complex. In this soil unit, the mangrove tidal swamps are subject to daily flooding by tides causing the soil to be poorly drained. The exposed limestone rock has weathered into smooth caprock pitted with solution holes filled with accumulated marl soil. The submerged shallow bottom in Dispatch Slough consists of fine mud of organic particles and calcareous sediments known as Islamorada muck. In addition to the Rock Outcrop-Tavernier complex, both Islamorada muck and Key Largo muck are associated with mangrove tidal swamps. The Udorthents-Urban land complex includes constructed upland areas where the land has been altered by dredging and filling for development.

MINERALS

Other than Key Largo limestone, there are no minerals on the refuge.

HYDROLOGY

Rain is the primary natural source of fresh water in the Florida Keys. Historically, early settlers collected rain water in cisterns or used water from wells and solution holes that tapped the small, shallow freshwater lenses. These lenses form from fresh water held in the ground above sea level during the rainy season. Until recently, nearshore freshwater upwelling, an extension of the Biscayne

Aquifer, occurred in at least one location on northern Key Largo. Drainage of the Everglades and subsequent canalization of southeast Florida (including canals in the Florida Keys) resulted in saltwater intrusion into the Biscayne Aquifer and changed the regional hydrology. The Key Largo islands are composed of limestone that is very porous and does not lead to freshwater lens formation. However, the lower Key islands (e.g., Big Pine Key) are composed of oolite that is much less porous and retains rain water and forms freshwater lenses.

AIR AND WATER QUALITY

Air pollutants of major concern in Florida are carbon monoxide, lead, nitrogen dioxide, ozone, particulate matter and sulfur dioxide (Florida Dept. of Environmental Protection 1999a). The primary sources of these pollutants are vehicle emissions, power plants, and industrial activities. In 1999, all areas of Florida were air quality attainment areas (Florida Dept. of Environmental Protection 1999a). There are no major industrial operations in the Florida Keys and air quality is consistently good. On occasion, air quality is reduced briefly by smoke from wildfires in the Everglades.

Water quality is generally good in the Florida Keys. However, near shore water quality is affected by storm water runoff and wastewater. On-site septic systems are abundant in the Keys and older systems do not effectively remove nitrogen and phosphorus from effluent, which leads to eutrophication of near shore waters. Similarly, storm water runoff contributes to near shore water quality degradation by flushing fertilizers, pesticides, contaminants, and pet waste into the water during rain events. Most of these negative contributions are directly associated with economic development. Crocodile Lake NWR has an overall beneficial effect for near shore water quality in north Key Largo because it protects land from economic development and the natural vegetation effectively traps nutrients and contaminants.

HABITATS

The refuge contains the following distinct habitat types (Figure 2), along with ruderal and developed areas:

Tropical Hardwood Hammock

The rockland forests of the refuge are part of the largest West Indian hardwood hammock in the continental United States. Despite disturbance from development, early settlers, and the construction of County Road 905 which bisects north Key Largo and separates Key Largo Hammock Botanical State Park from the refuge, the majority of the hammock is in relatively good condition. Diversity is high as a result of many successional stages. Mature wild tamarind *(Lysiloma latisiliqua),* mahogany *(Swietenia mahagoni),* gumbo limbo *(Bursera simaruba),* poisonwood *(Metopium toxiferum),* and strangler fig *(Ficus aurea)* trees dominate the canopy. Understory trees include two rare species of stoppers: red stopper *(Eugenia rhombea)* and redberry stopper *(Eugenia confusa),* as well as white stopper *(Eugenia axillaris),* Spanish stopper *(Eugenia foetida),* milkbark *(Drypetes diversifolia),* wild coffee *(Psychotria nervosa),* soldierwood *(Colubrina elliptica),* lignum vitae *(Guaiacum sanctum),* and torchwood *(Amyris elemifera).* Several species of bromeliads and orchids, including dollar orchid *(Encyclia boothiana),* butterfly orchid *(Encyclia tampensis),* common wild pine *(Tillandsia fasciculata),* twisted air plant *(Tillandsia flexousa),* silvery wild pine *(Tillandsia paucifolia),* reddish wild pine *(Tillandsia polystachia),* Spanish moss *(Tillandsia usneoides),* and giant wild pine *(Tillandsia utriculata)* can be found on mature trees throughout the hammock.

A number of solution holes in the hammock retain fresh water except under conditions of drought. These areas support moisture loving plants such as cabbage palm *(Sabal palmetto),* pond apple

(Annona glabra), and ferns, including leather fern *(Acrostichum aureum).* The hammock grades into a narrow strand of transition vegetation found along the hammock margins in areas of lesser elevation. The hardwood forests in the refuge are host to several endangered animal species including the Key Largo woodrat *(Neotoma floridana smalli),* Key Largo cotton mouse *(Peromyscus gossypinus allapaticola),* Schaus swallowtail butterfly *(Papilio aristodemus ponceanus),* eastern indigo snake *(Drymarchon corais couperi),* and the threatened Stock Island tree snail *(Orthalicus reses reses).* Hammock areas also provide important habitat for the state threatened white-crowned pigeon *(Columba leucocephala).*

Coastal Rock Barren

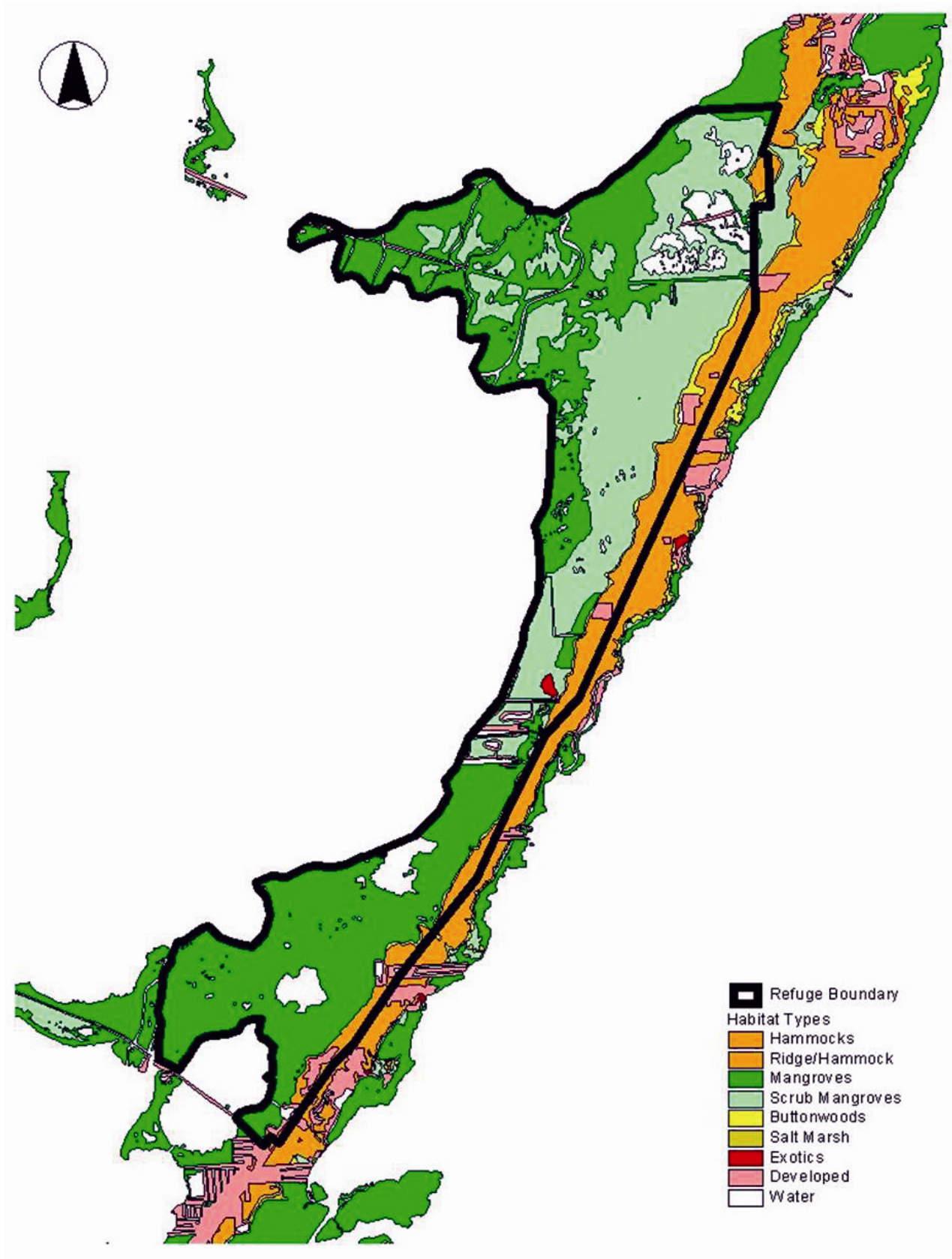
Coastal rock barren is a very rare community, occurring in scattered patches along a few shorelines in the Florida Keys. On the refuge, the coastal rock barren is in good to excellent condition and occurs between the rockland hammock and the coastal berm/marine tidal swamp. The substrate is exposed cap rock pitted with small solution holes.

The coastal rock barren forms a zone of varying width on the Gulf side of the rockland hammock. Prior to refuge acquisition, more land was cleared at the southern end of the park for proposed development. As a result, the northern end of the refuge has a better developed coastal rock barren community. However, it occurs in areas that are closer to the marine tidal swamp, and therefore, during the extreme high tides in October, has been inundated with as much as 6 inches of water. This periodic inundation does not seem to adversely affect the plant species, which are adapted to harsh conditions. Plant species found in this community include: joewood *(Jacquinia keyensis),* black torch *(Erithalis fruticosa),* saltwort *(Batis maritima),* black mangrove *(Avicennia germinans),* white mangrove *(Laguncularia racemosa),* saffron plum *(Bumelia celastrina),* Key thatch palm *(Thrinax morrisii),* Florida thatch palm *(Thrinax radiata),* wild dilly *(Manilkara bahamensis),* sea lavender *(Limonium carolinianum* var. *angustatum),* Christmas berry *(Lycium carolinianum),* prickly pear cactus *(Opuntia stricta),* limber caper *(Capparis flexuosa),* and buttonwood *(Conocarpus erectus).* Exposed branches of shrubs and small trees are covered with orchids and bromeliads, including dollar orchid *(Encyclia boothiana),* butterfly orchid *(Encyclia tampensis),* reflexed wild pine *(Tillandsia balbisiana),* common wild pine *(Tillandsia fasciculata),* and silvery wild pine *(Tillandsia paucifolia).* The coastal rock barren at Key Largo Hammocks needs to be protected from development, the invasion of exotic species, and poaching of both plant material and driftwood.

Coastal Berm

A narrow coastal berm parallels the fringe of red mangroves along portions of the shoreline of the Port Bougainville Tract. This berm is characterized by a ridge of storm-deposited debris that is subjected to an accumulation of flotsam. The substrate is coarse calcareous sand which has accumulated to an elevation of 1 to 2 feet. A variety of plant associations develop on this ridge and include dense thickets of large shrubs, small trees, or sparse shrubby vegetation. Such species include: blackbead *(Pithecellobium guadalupense),* prickly pear cactus, Spanish stopper, poisonwood, sea oxeye *(Borrichia arborescens),* manchineel *(Hippomane mancinella),* and indigo berry *(Randia aculeata).* Unfortunately, this area has been invaded both in historical times and in recent times by exotic species, particularly seaside portia *(Thespesia populnea)* and lather leaf *(Colubrina asiatica).*

Figure 2. Crocodile Lake National Wildlife Refuge habitat.



In the areas where the coastal berm occurs, the berm grades into coastal rock barren and marine tidal swamp. Because the coastal rock barren is an ecotonal community, plant species found in that community may also be present in the coastal berm community.

Mangrove Forest

Mangrove forests at the refuge are in excellent condition. Red mangroves are established along the shoreline with their prop-roots submerged in the water. Typical species found attached to or living near the red mangrove prop-roots include: snapper *(Lutjanus* sp.*),* mosquitofish *(Gambusia affinis),* oysters *(Isognomon alatus),* barnacles *(Lepas anatifera),* mangrove crabs *(Cardisoma guanhumi),* and fiddler crabs *(Uca pugilator).* Black mangroves are landward of red mangroves in the intertidal zone which is subject to tidal movement. To cope with saltwater inundation and salinity fluctuations, black mangroves extend pneumatophores above the surface of the soil to aid in gas exchange. White mangroves are often found in association with black mangroves, but prefer slightly higher ground that is not inundated by daily tides.

Mangrove wetlands support many species of wading birds, such as wood stork *(Mycteria americana),* white ibis *(Eudocimus albus),* white pelican *(Pelecanus erythrorhynchos),* and roseate spoonbill *(Ajaia ajaja),* which frequent the area, particularly in winter months. Several species of raptors, particularly osprey *(Pandion haliaetus),* red-shouldered hawk *(Buteo lineatus),* red-tailed hawk *(Buteo jamaicensis),* and an occasional bald eagle *(Haliaeetus leucocephalus),* are seasonally observed over the wetlands, some of which nest in adjacent high hammock trees.

Ruderal and Developed Areas

Ruderal and developed areas can be found throughout the refuge. Ruderal areas include the abandoned Nike Missile Facility and the old Card Sound Road bed. Some development had taken place prior to the closure of the property, including a marina with docks, remnants of a fire station and a maintenance building, a helicopter pad, and several roads.

INVASIVE SPECIES

Florida Keys habitats are continually affected by invasive exotic species. Brazilian pepper, Australian pine, and lead tree are of particular concern since these plants are fast-growing and crowd out native vegetation. Many of the dense stands of exotics have been removed from the refuge, but controlling reestablishment is an ongoing management requirement.

CULTURAL RESOURCES

North Key Largo, which includes the refuge, has been a rich environment for both pre-historic peoples and early settlers. Prehistoric sites tend to be located near the water, and are chiefly composed of shell middens. Historical remains are somewhat more widely distributed and more diverse. The refuge does not have any identified archaeological sites. North Key Largo has been populated by diverse ethnic groups, including the Timucuan culture, the Caloosa, and settlers from the Bahamas prior to the influx of Europeans. The early history of north Key Largo shows that Native Americans inhabited the area between 1600 BC and 1200 AD. They capitalized on the rich seaside environment. Activities continued in the area until the mid-18th century, which corresponds to the arrival of the first European settlers. Cultural remains from the prehistoric period consist chiefly of Glades II and Glades III artifacts, indicating that this was the period of heaviest activity.

Early formal references to north Key Largo include Bernard Romans, an English cartographer who visited the area in 1776. He commented on an apparent link of Key Largo to the mainland of Florida, and tried unsuccessfully to find a passage behind Key Largo into Florida Bay.

Shipwrecks were a common occurrence in Key Largo since ships had to navigate treacherous waters through the dangerous coral reef line. A lightship was placed out at Carysfort Reef and became one of the most important navigational lights between St. Augustine and Key West. The lightship master, Captain John Walton, kept a farm house and a small garden with fruit trees at Garden Cove. Another early settler was Edward Bell, who operated the Carysfort Lighthouse which replaced the lightship. He purchased 700 acres near Basin Hills on north Key Largo. There he maintained crops that included pineapple, sapodilla, and Key lime, as well as other tropical fruits. A hurricane in 1876 destroyed Bell's plantation and others in the area. Today old cisterns, foundations, and remnants of the old fruit tree orchards are scattered throughout the hammock. Exotic vegetation, including species grown primarily for fiber such as sisal hemp *(Agave sisalana)* and bowstring hemp, is evidence of earlier settlement.

PARTNERSHIPS AND COORDINATION

The refuge has a 99-year lease to manage 125 acres of hardwood forests, mangrove wetlands, and disturbed areas owned by the Florida Department of Environmental Protection and located within the boundaries of the refuge. The tract is managed in accordance with all applicable Florida statutes and administrative rules, as well as federal regulations governing management of national wildlife refuges.

While the refuge does not have any other formal agreements or partnerships with any other agency or private organization, it does work closely with many federal, state, and local agencies, as well as private organizations and groups to address refuge goals and objectives. For example, research on refuge wildlife is routinely conducted by the University of Florida which helps further the Service's knowledge of the refuge. Additionally, many projects are conducted in conjunction with the state park across Route 905 since the landscape level of the habitats crosses jurisdictional boundaries.

RECREATIONAL AND COMMERCIAL USE ON THE REFUGE

The Florida Keys receives 3 to 4 million visitors a year, making it one of the most popular tourist destinations in the United States. Visitors are attracted to the warm weather and beauty of the natural resources in the Keys. Crocodile Lake Refuge is a closed refuge due to the extreme sensitivity of the endangered animals and habitats. However, an interpretive butterfly garden was completed in 2001 adjacent to the refuge headquarters to provide limited public use and environmental interpretation and education. The butterfly garden serves as an outdoor classroom for local elementary schools as part of a Monroe County 4-H Butterfly Garden School Program developed by the refuge and refuge volunteers.

CURRENT MANAGEMENT PRACTICES

The refuge was established to preserve, protect, and manage habitat for a wide diversity of endangered species. Even though most available habitat critical for endangered species is now in public ownership, some endangered species including the Key Largo woodrat and Key Largo cotton mouse continue to decline for unknown reasons. To ensure the long-term survival of these important species, the refuge has implemented programs to reverse habitat loss and degradation through aggressive habitat restoration, protection, and enhancement and to reduce the secondary effects of fire ants, exotic plants, introduced black rats, and free-roaming cats. The South Florida Multi-Species Recovery Plan is used as a guide to develop management programs for the refuge. While

management focuses on listed species, recovery actions and activities also benefit other wildlife and fish species.

Major wildlife management programs and projects completed on the refuge since 1997 include:

- Annual population surveys for the American crocodile, Key Largo woodrat, Key Largo cotton mouse, Schaus swallowtail butterfly, and Stock Island tree snail.

- The Service and the Florida Department of Environmental Protection purchased the last remaining tracts of land within the acquisition boundaries of the refuge that could be subject to development under existing Monroe County Land Use Regulations. These sites consist of approximately 3 acres and include the abandoned cockfighting arena (Corney Tract), the Gulfstream Trailer Park, and the Intus property.

- Approximately ¾-mile of Old Card Sound Road located on the refuge was removed; the area was restored to mangrove wetland; and two sand berms were constructed in the old road bed to serve as nesting habitat for American crocodiles.

- Over 1,000 wild lime trees, an important larvae host plant for the Schaus swallowtail butterfly, were planted on the refuge and Key Largo Hammock Botanical State Park to enhance habitat for this endangered species. The project is ongoing in cooperation with the University of Florida and Dr. Tom Emmel.

- All mobile homes, structures, and debris were removed from the Gulfstream Trailer Park, with more than half of the area being restored to hardwood forest. The remaining cleared area is the site of the refuge headquarters, a shop/equipment area, and interpretive butterfly garden.

- The crocodile barrier fence was removed along approximately 1 mile of Card Sound Road and C-905, and wing fences were installed at each of the crocodile culvert crossings. Due to the design of the barrier fence, crocodile road kills were a larger problem than before along these roads. The wing fences were installed to help direct crocodiles to the crossing culverts and appear to be working.

- An interpretive butterfly garden was constructed adjacent to the refuge headquarters to provide limited public use and environmental education and interpretation. The garden includes an access path for the disabled, park benches, interpretive signs, and a display pond and waterfall. The garden is also used as an outdoor classroom for local elementary schools in the area.

- The abandoned cockfighting arena was demolished and removed, thus allowing approximately 1 acre of hardwood hammock to recover.

- Remnants of seven small support buildings were demolished and the debris pushed into piles to serve as nesting sites for woodrats.

- The population of the Stock Island tree snail and its range were expanded through the establishment of four new populations on refuge and state lands in Key Largo and Plantation Key.

- The three missile storage buildings and associated launch pads at the abandoned NIKE missile site were demolished and removed as part of an effort to restore the entire facility to hardwood forest. Removal of the three buildings will result in restoration of approximately 5 acres of hardwood forest.

FACILITIES AND STRUCTURES

The refuge has limited support facilities to carry out daily operations. A double-wide, 3-bedroom trailer serves as the refuge office. Equipment, tools and supplies are kept in a secure fenced shop and equipment yard adjacent to the office. Within this fenced-in yard is the refuge's intern/research facility consisting of a 2-bedroom mobile home with small office. All these structures are confined to less than ½-acre of the old Gulfstream Trailer Park.

Several abandoned structures exist throughout the refuge. On the Port Bougainville Tract, which the refuge leases from the Florida Department of Environmental Protection, stands the remnants of a 2-bay maintenance facility, a 15-foot high concrete helicopter pad, and a boat basin with degrading boat docks. At the abandoned NIKE missile site, a missile maintenance building is still standing.

Monroe County maintains a waste transfer station within the refuge acquisition boundary. This facility is located on the site of the old Key Largo Dump which was closed in 1983. The Department of Environmental Protection monitors several test wells on the site for any contamination. Due to the presence of trash and other debris, the waste transfer station attracts black rats, feral cats, fire ants, and exotic plants, all of which are detrimental to native wildlife populations on the refuge.

WILDERNESS REVIEW

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

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

2. has outstanding opportunities for solitude or primitive and unconfined 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 unimpeded condition, or is a roadless island regardless of size;

4. does not substantially exhibit the effects of logging, farming, grazing, or other extensive development or alteration of the landscape, or its wilderness character could be restored through appropriate management at the time of review; and

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

The lands within Crocodile Lake National Wildlife Refuge were reviewed for their suitability in meeting the criteria for wilderness, as defined by the Wilderness Act of 1964. No lands in the refuge were found to meet these criteria. Therefore, the suitability of refuge lands for wilderness designation is not further analyzed in this plan.

III. Plan Development

PUBLIC INVOLVEMENT AND THE PLANNING PROCESS

Preplanning activities for the Crocodile Lake National Wildlife Refuge Comprehensive Conservation Plan began in January 2003, with activities such as gathering data and information, meeting with refuge staff, meeting with intergovernmental partners, visioning, and preparing for the public scoping phase. The core planning team identified items such as existing and needed data, refuge resources, issues, concerns, affected members of the public, vision ideas, and public participation issues. As a group, the team prioritized the most critical issues to be addressed by the refuge over the 15-year life of the plan.

The core planning team, comprised of Service employees and a state Fish and Wildlife Conservation Commission representative, was assembled and meetings were held in preparation for conducting the planning effort in advance of public scoping. A notice announcing that the planning process had begun was published in the *Federal Register* on May 9, 2003. A public scoping meeting was held on September 3, 2003, at the Key Largo Public Library, and was successful for gathering input from the dozen members of the public in attendance. Additional information about the comprehensive conservation plan and public scoping was provided through informational flyers, a planning update, articles in the local newspapers, and postings on Fish and Wildlife Service websites.

A letter that invited participation in the planning process through a variety of means, including public meetings, letters, faxes, telephone calls, e-mail messages, and personal visits, was mailed to individuals and organizations on the refuge mailing list. The invitation announced the time and location of the public scoping meeting, provided other information, and described the purposes of the refuge. After the public meeting was held, a refuge planning update newsletter was sent to mailing list recipients and meeting participants, and was also made available at the refuge headquarters.

Members of the Service's core planning team met periodically to review public comments, data, and information collected to write the draft plan. Professional reviews of the refuge were conducted to determine the status, trends, and conditions of refuge resources and facilities. Experts from the Service, State of Florida (including Fish and Wildlife Conservation Commission and Department of Environmental Protection), Everglades National Park, and University of Florida participated in a biological review of the refuge. The information garnered from this review helped the planning team analyze and develop recommendations for this draft plan and environmental assessment.

The Service will seek comments on the draft plan as the next stage of public involvement. Adjustments will be made to the draft plan accordingly, in preparation for the final plan.

ISSUES AND CONCERNS

During the preplanning and public scoping phases of plan development, a myriad of issues, concerns, and opportunities were raised by the public, the Service, and other public agencies. Issue identification is a major factor in determining management goals and objectives, and which projects the refuge will adopt. In addition to the general public scoping meeting, a series of meetings were conducted with federal, state, and local governmental agencies. Coordination with governmental partners and the public is essential to ensure support for the plan and identified projects. While some of the issues and concerns raised during scoping are significant to the future of the refuge, many are not within the Service's management jurisdiction or authority, and some are completely outside of its control. Several opportunities raised during scoping are addressed by the Service in this draft plan.

A Service planning team evaluated the list of issues raised, identified the most significant issues to be addressed over the next 15 years, evaluated steps to rectify these issues and resource needs, and measured the impact of plan implementation. The core planning team then developed a list of goals, objectives, and strategies to shape the management of the refuge for the 15-year life of the plan.

The significant issues are divided into four categories: wildlife and habitat conservation; land protection and conservation; education and visitor services; and refuge administration. The following list summarizes the comments and suggestions provided by the public at the scoping meeting and other public comments that were received:

WILDLIFE AND HABITAT CONSERVATION

- Needs of threatened and endangered species should be top priority.
- Control of invasive exotic plants is essential.
- Control of fire ants and feral cats is essential.
- Restoration of habitats should be strengthened.
- Consider habitat manipulation experiments to benefit wildlife.
- Maintain closed status of the refuge.
- Coordinate recovery activities with Service's South Florida Ecological Services Office.

LAND PROTECTION AND CONSERVATION

- Purchase remaining land inholdings within acquisition boundary.
- Investigate a "land swap" with the State of Florida to trade land within each agency's respective boundaries.
- Work with Florida Department of Transportation to minimize environmental impacts from proposed hurricane evacuation road project.

EDUCATION AND VISITOR SERVICES

- Request assistance from Florida Department of Transportation to provide a recreation path along Route 905.
- Allow only staff-led tours of the refuge, if any at all.
- Investigate the possibility of additional public use at the refuge's headquarters.

REFUGE ADMINISTRATION

- Add an additional full-time biological technician position.
- Continue and increase volunteer workers to assist with refuge projects.

IV. Management Direction

INTRODUCTION

The Service manages fish and wildlife habitats with the primary focus being conservation of habitat and wildlife. Crocodile Lake National Wildlife Refuge was created for the purpose of protecting habitat for federally listed species. The American crocodile was the impetus; however, the refuge also harbors the Key Largo woodrat, Key Largo cotton mouse, Schaus swallowtail butterfly, Stock Island tree snail, and eastern indigo snake. Habitats are managed with these species in mind, as well as other wildlife species including migratory birds, wading birds, snakes, and butterflies.

The Florida Keys is a global biodiversity hotspot and Crocodile Lake Refuge contains a diverse array of plant and animal species found nowhere else in the continental United States. This plan is intended to help guide management for the next 15 years in order to maintain and enhance refuge resources for continued vigor in the years to come. The goals and objectives in this plan provide a framework from which future management actions will be based. Conservation of federally listed species is the overriding priority of all management actions.

All of the goals, objectives, and strategies are in keeping with the purposes of the refuge, and aim to ensure long-term viability of the fish and wildlife resources.

VISION

Crocodile Lake is an important area in north Key Largo for biodiversity of the Florida Keys and North America. The sensitive nature of the habitats and wildlife warrants keeping the refuge closed to general public use amidst a growing urban landscape. The refuge will be managed to be a true oasis of protected habitat in an area that has lost much of the habitats that once existed.

Crocodile Lake National Wildlife Refuge will be a model refuge that exemplifies habitat management of hardwood hammocks, mangrove wetlands, and open water (unique habitats of the Florida Keys) for the benefit of federally listed threatened and endangered species. Focal species are the American crocodile, Key Largo woodrat, Key Largo cotton mouse, Stock Island tree snail, and Schaus swallowtail butterfly. Further, hundreds of other wildlife and plant species will benefit from refuge habitat conservation and restoration.

MANAGEMENT PLAN SUMMARY

Three goals were developed based on comments from the public and various non-profit and governmental agencies. Under the following goals, the objectives and strategies outline approaches to habitat management, exotics control, and coordination of efforts:

1. Provide high quality habitat including nesting, resting, foraging, and nursery areas for the long-term survival of threatened and endangered species, migratory birds, and other wildlife.

2. Expand on the existing knowledge and database regarding the ecology, biology, and behavior of threatened and endangered species and those factors affecting their status and long-term survival.

3. Develop and implement a comprehensive refuge program that includes providing sufficient staff, facilities, equipment, and volunteers to protect and manage the natural resources of the refuge.

GOALS, OBJECTIVES, AND STRATEGIES

The goals, objectives, and strategies presented in this plan are based on issues, concerns, and needs expressed by the planning team, refuge staff, and public. The intent is to achieve the mandates of the National Wildlife Refuge System Improvement Act, the mission of the National Wildlife Refuge System, and the establishment purposes of Crocodile Lake National Wildlife Refuge.

GOAL 1

Provide high quality habitat including nesting, resting, foraging, and nursery areas for the long-term survival of threatened and endangered species, migratory birds, and other wildlife.

Objective 1.1
Maintain, restore, and enhance existing American crocodile nesting habitat.

Discussion: Crocodile Lake Refuge provides for one of three major breeding sites for American crocodiles in south Florida, the other two sites being Turkey Point Power Plant and along the southern edge of Everglades National Park. The highest priority for Crocodile Lake Refuge is to restore and manage nesting habitat that has become less suitable in recent years. Another priority is to monitor the population by tracking road kills and vital data. However, these kills are considered to be of such low frequency that there is no need for extraordinary efforts, such as fencing, at this time.

Strategies:

- Control invasive vegetation on existing nesting berms to increase available nesting habitat.
- Treat approximately 3 miles of nesting levee at the Harrison Tract with herbicide to control invasive vegetation. Herbaceous vegetation will be treated with Roundup Pro, or equivalent, and those plants with invasive roots or rhizomes will be tilled to make the substrate more pliable for nesting crocodiles. Woody vegetation will be treated with Garlon 4, or equivalent, through basal bark application and left standing to decompose naturally. Approximately ½-mile of nesting levee will be controlled for exotics per year, with the entire nesting levee to be completed within 6 years of plan adoption.
- Elevate low-lying areas on the existing nesting berms with supplemental nesting material to prevent saltwater intrusion and flooding of nests.
- Construct 10 elevated nesting mounds along the nesting levee at the Harrison Tract. Mounds measuring 50′x30′x2′ high will be constructed of suitable nesting material to be determined by area crocodile biologists. Due to the inaccessibility of the nesting levees, suitable nesting material will be airlifted to the site by helicopter. Construction of the 10 nesting mounds will be completed within 5 years of plan adoption. Once constructed, the elevated mounds will be treated each year with herbicide to control invasive vegetation. Yearly monitoring of the sites for nesting activity will be conducted to evaluate the success of the program.
- As part of future wetland restoration projects, create additional nesting habitat in restored wetland areas.

Objective 1.2
Restore suitable wetland habitat for American crocodiles.

Strategies:

- Remove fill from disturbed areas such as abandoned roads and fill pads, and restore these sites to historic wetland elevations where they can recover naturally.
- Remove the remaining portion of the Old Card Sound Road located on the refuge south of the Card Sound Bridge. Restore the old road bed to historic wetland elevation and allow to vegetate naturally. This would not only restore the wetland but would eliminate the site from being used as a launch area for personal watercraft that may disturb crocodiles in the area. Set a target date of 10 years to complete this project.
- Coordinate and cooperate with the Florida Keys Mosquito Control District to initiate, implement, and complete the Jewfish Creek Restoration Project on property it owns near Jewfish Creek. This project would involve the removal of approximately 1 mile of old abandoned road that traverses mangrove wetlands. The road bed and all associated fill would be removed and the area restored to historic wetland elevation. A nesting berm would be placed in the road bed near a tidal creek to serve as a possible nest site for American crocodiles. A target date of 5 years would be set to complete this project.
- Coordinate and cooperate with other governmental agencies, environmental organizations, and local landowners to purchase and restore 12 acres of filled and disturbed wetlands located north of Lake Surprise as part of the Lake Surprise Restoration Project. This project would involve removing the majority of fill and restoring the area to historic wetland elevation and creating additional habitat for crocodiles. A portion of the fill, approximately 2,000′x100′, would remain to serve as a base for the construction of nesting sites for American crocodiles and to support an access road to these sites. A target date of 10 years would be set to complete this project.
- Create a sand/gravel nesting berm within the proposed Jewfish Creek Wetland Restoration Project. The nesting berm should be 50′x25′x3′ high and constructed of suitable nesting material to be determined by area crocodile biologists.
- Create a nesting berm within the proposed Lake Surprise Wetland Restoration Project. The nesting levee should be 2,000′x50′x3′ high and constructed of suitable nesting material on existing fill within the project area.

Objective 1.3
Within 6 years of plan adoption, develop a nesting, nest production, population trend, and road mortality monitoring plan for the American crocodile.

Strategies:

- Coordinate with cooperative agencies, organizations, and groups, such as the Florida Fish and Wildlife Conservation Commission and the University of Florida, to develop and conduct population surveys of the American crocodile to determine distribution, abundance, and trends, as well as to determine the effectiveness of management programs and actions.
- Continue to coordinate with Florida Fish and Wildlife Conservation Commission to complete nesting and hatchling surveys on the refuge each year. The Commission has conducted nest and hatchling surveys on the refuge for the past 27 years and maintains the database for all information. It will continue to take the lead in this program as long as its resources will allow.

- Continue to coordinate with the University of Florida to expand crocodile surveys on the refuge. This would include expanded surveys of the Harrison Tract, Crocodile Lake area, and the refuge shoreline of Lake Surprise, Barnes Sound, and Card Sound. The refuge would assist with this program by providing staff to help with the surveys both on- and off-refuge. The University would provide all other needed equipment and supplies.
- Surveys of American crocodiles should include, but not be limited to, nest counts, hatchling surveys, and overall population censuses and should include all suitable habitats on the refuge, as well as portions of the Biscayne Bay Estuary such as Lake Surprise, Barnes Sound, and Card Sound.
- Continue yearly crocodile nest surveys on the Harrison Tract and Card Sound Road Restoration area, as well as any new nesting areas created as part of future wetland restoration projects. These surveys provide important information on nest site preference and nesting success.
- Continue yearly hatchling surveys within areas of the refuge where nesting has been documented. Attempts would be made to catch and mark each hatchling observed and to collect important data including length, weight, location of capture, etc. The data collected would provide important insights in recruitment, age class distribution, and movement patterns of crocodile populations on the refuge and surrounding areas.
- Continue to assist the University of Florida with its quarterly crocodile surveys conducted along the refuge shoreline adjacent to Lake Surprise, Barnes Sound, and Card Sound. These quarterly surveys provide important information on population size/trends, recruitment, and movement patterns of crocodiles within the refuge.
- With the assistance of the University of Florida, expand the monitoring program for crocodiles on the refuge to include quarterly surveys of the Harrison Tract and Crocodile Lakes area.
- Continue to monitor and document crocodile road kills on U.S. Highway 1 and Card Sound Road in the Key Largo area. Collect data on each road kill including total length, snout/vent length, weight (if possible), location hit, date, marked or unmarked crocodile, and general condition of the animal. This would provide important information on movement patterns and population size/trends, as well as overall health of the population. All information would be provided to appropriate agencies.
- Establish a standard protocol for data collection on crocodiles hit by vehicles.

Objective 1.4
Actively manage Key Largo woodrat habitat including nesting, resting, and foraging areas for the long-term survival of the species.

Discussion: Crocodile Lake Refuge contains some of the last remaining tropical hardwood hammocks in Key Largo. The woodrat once ranged throughout Key Largo but is now restricted to the refuge and adjacent state lands due to loss of habitat. Recent sampling efforts revealed a drastic drop in the woodrat population. This led the Service's South Florida Ecological Services Office to initiate a captive breeding program in order to prevent immediate extinction. The refuge role is to maintain and enhance habitat and assist the Ecological Services' office with the ultimate release of captive-bred woodrats.

Strategies:

- Create artificial nest sites from coral rubble and other debris and place them in suitable woodrat habitat.

- Use large concrete rubble or limestone boulders to create artificial nest structures in open areas of the refuge. Rubble piles should be a minimum of 6′ tall x 15′ wide so as to provide ample sources of possible nest sites. To avoid damage to existing hardwood forests, the rubble piles would be placed in disturbed areas of the refuge, such as the Port Bougainville Tract and the NIKE missile site. Twenty nesting structures would be constructed within the next 5 years.
- Restore hardwood forests. Remove abandoned buildings and other structures at the Port Bougainville Tract and NIKE missile site and allow natural revegetation.
- Demolish the maintenance building and concrete helicopter pad at the Port Bougainville Tract, and the missile maintenance building at the NIKE missile site. The construction rubble would remain on-site and be pushed into piles to serve as nesting sites for the endangered Key Largo woodrat. The restoration would result in approximately 1 acre of tropical hardwood forest to serve as important habitat for the Key Largo woodrat. Demolition of existing structures would be completed within 5 years.
- Create hammock habitat by filling areas within historic hardwood forests that were dredged or mined.
- Fill the 1.5-acre Keystone Pit and restore the area to its historic elevation. Fill can include concrete/concrete block, crusted limestone (marl), or any other suitable soil substrate. Due to the size of this project, it is expected to take 15 years to restore the Keystone Pit.
- Restore and enhance habitat by controlling invasive exotic plants within the refuge and along public rights-of-way and easements. Coordinate with adjacent landowners to control exotic plants on non-refuge lands that may serve as habitat for woodrats, or those that may serve as a possible seed source for re-infestation of refuge lands.
- Control exotic plants mechanically (pulled by hand) or chemically with the appropriate herbicide. Woody vegetation would be treated with Garlon 4, either as a basal bark application or cut stump application. Herbaceous vegetation would be treated with Roundup Pro, or other appropriate herbicide. In most cases the vegetation would remain on site to decompose naturally.
- Continue follow-up control of exotic plants in problem areas including Port Bougainville Tract, Whiskey Bottle Pit/Keystone Tract, County auto salvage site, and the NIKE missile site. This would be done yearly until all exotics and associated seed sources are depleted (5-6 years).
- Continue yearly maintenance control of exotics along County Road 905 and Card Sound Road rights-of-way that transect the refuge. These easements have been treated yearly since 1999, and require minimal control to keep them exotic-free.
- Coordinate and cooperate with the Florida Keys Electric Cooperative to control invasive exotic plants along its power line easement adjacent to the refuge. The refuge would provide staff time to assist the Cooperative in pulling or treating exotics within the easement. The Cooperative would provide the herbicide used for the treatments.
- Survey and control exotics along the transitional upland corridor of the refuge (hardwood forest/wetland interface). Exotics identified in this area would be pulled by hand or treated with a basal bark application of Garlon 4. Initial application would be completed within 2 years.
- Enhance habitat by controlling fire ants within the refuge and along adjacent public rights-of-way and easements.
- Continue with feral and free-roaming cat control.
- Continue to investigate the effectiveness of controlling fire ants along County Road 905 using long-lasting broadcast baits such as Extinguish. Currently, the refuge is treating 9 miles of County Road 905 twice a year with Extinguish fire ant bait and initial results look promising. If Extinguish or other fire ant controls are effective, expand the control program to other areas that exhibit fire ant infestation.

- Expand fire ant surveys to include abandoned roads and other open areas to determine extent of fire ant infestation on the refuge. Areas on which to focus include Port Bougainville, Keystone/Whiskey Bottle area, County auto salvage site, and NIKE missile site.

Objective 1.5
Within 5 years of plan adoption, develop a nesting, nest production, and population trend monitoring plan for the Key Largo woodrat.

Strategies:

- Assist the Service's South Florida Ecological Services Field Office with development and implementation of population surveys of the Key Largo woodrat to determine distribution, abundance, trends, and habitat preferences, as well as to determine the effectiveness of management programs and actions. The Ecological Services' office has taken the lead on this program and, where practical, the refuge would provide support (e.g., supplies, equipment, housing, limited staff, and technical assistance) to help fulfill monitoring responsibilities.
- Coordinate with Ecological Services to monitor the effects of habitat management programs and activities on woodrats.
- Integrate extensive woodrat surveys developed and initiated by Ecological Services. This would include conducting woodrat surveys in conjunction with management programs such as fire ant/cat eradication, woodrat nesting structure development, and habitat modification/alteration in an effort to determine the most effective method to safeguard and improve habitat conditions for woodrats.

Objective 1.6
Actively manage Key Largo cotton mouse habitat including nesting, resting, and foraging areas for the long-term survival of the species.

Discussion: The cotton mouse once ranged throughout Key Largo but is now restricted to the refuge and adjacent state lands due to loss of habitat. The cotton mouse inhabits tropical hardwood hammock but has broader requirements than the Key Largo woodrat and thus the population is steady. The refuge aims to manage habitats for the long-term survival of the species.

Strategies:

- Restore hardwood forests. Remove abandoned buildings and other structures at the Port Bougainville Tract and NIKE missile site and allow natural revegetation.
- Demolish the maintenance building and concrete helicopter pad at the Port Bougainville Tract and the missile maintenance building at the NIKE site. The construction rubble would remain and be pushed into piles to serve as nesting sites for the endangered Key Largo cotton mouse. The restoration would result in approximately 1 acre of tropical hardwood forest to serve as important habitat for the Key Largo cotton mouse. Demolition of existing structures would be completed within 5 years.
- Create hammock habitat by filling areas within historic hardwood forests that were dredged or mined.
- Fill the 1.5-acre Keystone Pit and restore the area to historic elevation. Fill can include concrete/concrete block, crusted limestone (marl) or any other suitable soil substrate. Due to the size of this project, it is expected to take 15 years to restore the pit.

- Restore and enhance habitat by controlling invasive exotic plants within the refuge and along public rights-of-way and easements. Also coordinate with adjacent landowners to control exotic plants on non-refuge lands that may serve as habitat for cotton mice, or that may serve as a possible seed source for re-infestation of refuge lands.
- Exotic plants would be controlled mechanically (pulled by hand) or chemically with the appropriate herbicide. Woody vegetation would be treated with Garlon 4, either as a basal bark application or cut stump application. Herbaceous vegetation would be treated with Roundup Pro, or other appropriate herbicide. In most cases the vegetation would remain on site to decompose naturally.
- Continue follow-up control of exotic plants in problem areas including Port Bougainville Tract, Whiskey Bottle Pit/Keystone Tract, County auto salvage site, and the NIKE missile site. This would be done yearly for a period of 5-6 years until all exotics and associated seed sources are extirpated.
- Continue yearly maintenance control of exotics along the County Road 905 and Card Sound Road rights-of-way that transect the refuge. These easements have been treated yearly since 1999 and require minimal control to keep them exotic-free.
- Coordinate and cooperate with the Florida Keys Electric Cooperative to control invasive exotic plants along its power line easement adjacent to the refuge. The refuge would provide staff time to assist the Cooperative in pulling or treating exotics within the easement. The Cooperative would provide the herbicide used for the treatments.
- Survey and control exotics along the transitional upland corridor of the refuge (hardwood forest/wetland interface). Exotics identified in this area would be pulled by hand or treated with a basal bark application of Garlon 4. Initial application would be completed within 2 years.
- Enhance habitat by controlling fire ants within the refuge and along adjacent public rights-of-way and easements.
- Continue to investigate the effectiveness of controlling fire ants along County Road 905 using long-lasting broadcast baits such as Extinguish. Currently, the refuge is treating 9 miles of County Road 905 twice a year with Extinguish fire ant bait and initial results look promising. If Extinguish or other fire ant controls are effective, the program would be expanded to other areas that exhibit fire ant infestation.
- Expand fire ant surveys to include abandoned roads and other open areas to determine extent of fire ant infestation on the refuge. Areas to focus on include Port Bougainville Tract, Whiskey Bottle/Keystone Tract, County auto salvage site, and NIKE missile site.

Objective 1.7
Within 5 years of plan adoption, develop a nesting, nest production, and population trend monitoring plan of the Key Largo cotton mouse.

Strategies:

- Assist the Service's South Florida Ecological Services Field Office with the development and implementation of population surveys of the Key Largo cotton mouse to determine distribution, abundance, trends, and habitat preferences, as well as to determine the effectiveness of management programs and actions. Ecological Services would take the lead on this program and, where practical, the refuge would provide assistance (e.g., supplies, equipment, housing, limited staff, and technical assistance).

Objective 1.8
Actively manage Schaus swallowtail butterfly habitat including nesting, resting, and foraging areas in order to increase the population size and ensure long-term survival of the species.

Discussion: The Schaus swallowtail butterfly is a large dark brown and yellow butterfly that historically occurred in hardwood hammocks from south Miami to Lower Matecumbe Key, Florida. The loss of habitat to development has drastically restricted the current range to north Key Largo and south Miami. Schaus swallowtails are exclusively found in hardwood hammocks which contain plants essential for reproduction and feeding. Crocodile Lake Refuge is important since it protects one of the last large hammocks in the Keys and south Florida. Managing the refuge for this species also benefits other butterfly species such as Miami blue, hairsteaks, and skippers. Strategies for habitat restoration activities that are specifically defined for the Key Largo woodrat and cotton mouse are the same for Schaus swallowtail butterflies. Please refer to the aforementioned habitat strategies for more details about restoration of forests and control of exotics.

Strategies:

- Continue to prohibit the use of broad spectrum adulticides by the Florida Keys Mosquito Control District to control mosquitoes on the refuge.
- Cooperate with the Florida Keys Mosquito Control District in developing improved methods of mosquito control that reduce the need for broad spectrum adulticides and minimizes impacts to natural resources of the area.
- Enhance habitat for the Schaus swallowtail butterfly by planting the larvae host plants of the butterfly.
- Continue to plant wild lime and torchwood, two important larvae host plants for the Schaus swallowtail butterfly, along abandoned roads and other disturbed areas adjacent to suitable butterfly habitat. Sites to consider for future plantings include Port Bougainville Tract, the County auto salvage site, and the NIKE missile site.
- Continue to coordinate plantings with the University of Florida which will provide wild lime trees and the labor needed to plant and establish the trees on the refuge. Set a target of 50-100 trees established per year on the refuge for the next 5 years.

Objective 1.9
Within 10 years of plan adoption, develop a nesting, nest production, and population trend monitoring plan for the Schaus swallowtail butterfly.

Strategies:

- Coordinate with the University of Florida, cooperative agencies, organizations, and groups to develop and conduct population surveys of the Schaus swallowtail butterfly to determine distribution, abundance, and trends, and to determine the effectiveness of management programs and actions.
- Continue to coordinate with the University of Florida to complete Schaus swallowtail butterfly surveys on the refuge each year. The University has conducted these surveys on the refuge since the early 1990s and maintains the database for all information. The University will continue to take the lead in this program as long as its resources will allow.
- The refuge will expand surveys on the refuge for the Schaus swallowtail butterfly that will enhance and complement the work presently being done by the University of Florida. Areas to survey would include the Port Bougainville Tract, Harrison Tract, County auto salvage site, and NIKE missile site.

- Surveys should include adult flight counts and egg/larvae surveys on suitable habitat throughout North Key Largo, including Key Largo Hammock Botanical State Park.
- Both flight counts and egg/larvae surveys will be conducted along abandoned roads and disturbed areas of the refuge where wild lime trees have been planted. The lime trees not only attract female Schaus butterflies looking for host plants, but serve as important survey sites to monitor egg and larvae abundance.

Objective 1.10
Actively manage Stock Island tree snail habitat including nesting, resting, and foraging areas for the long-term survival of the species.

Discussion: The Stock Island tree snail is an arboreal snail found in hardwood hammocks in the Florida Keys. The snail historically occurred on Stock Island and Key West where it has been virtually extirpated. Habitat loss and a significant 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. Crocodile Lake Refuge contains one of the last established populations of the Stock Island tree snail. Strategies for habitat restoration activities that are specifically defined for the Key Largo woodrat and cotton mouse are the same for Stock Island tree snails. Please refer to the aforementioned habitat strategies for more details about restoration of forests and control of exotics.

Strategies:

- Continue to prohibit the use of broad spectrum adulticides by the Florida Keys Mosquito Control District to control mosquitoes on the refuge.
- Cooperate with the Florida Keys Mosquito Control District in developing improved methods of mosquito control that reduce the need for broad spectrum adulticides and minimizes impacts to natural resources of the area.

Objective 1.11
Within 10 years of plan adoption, develop a nesting, nest production, and population trend monitoring plan for the Stock Island tree snail.

Strategies:

- Coordinate with other cooperative agencies, organizations, and groups to develop and conduct population surveys of the Stock Island tree snail to determine distribution, abundance, and trends, and to determine the effectiveness of management programs and actions.
- Continue to coordinate and cooperate with the Florida Keys Electric Cooperative in the identification of Stock Island tree snails found during routine power line corridor maintenance. The Cooperative is knowledgeable in the identification of Stock Island tree snails and notifies the refuge immediately upon discovery of snails that have been displaced by their maintenance activities. The Cooperative also has expertise in the proper protocol for transplanting of displaced snails to adjacent trees.
- Coordinate and cooperate with the Florida Fish and Wildlife Conservation Commission in developing and implementing snail surveys for those populations relocated in 2000 on their Dove Creek and Snake Creek Management Areas located in Key Largo and Plantation Key. Due to the time needed for these populations to increase to a size large enough to be readily detected by surveys, this monitoring will not be initiated until 2005.

- Continue refuge surveys of Stock Island tree snails in the two locations where they are known to occur on the refuge. Continue to conduct exploratory surveys on other areas of the refuge that contain suitable tree snail habitat.
- Surveys should include summer snail counts on areas of the refuge supporting known populations of Stock Island tree snails, and should be coordinated with Ecological Services to complete surveys of known tree snail populations off-refuge, including introduced populations on Key Largo and Plantation Key.
- Snail surveys will be conducted each year during the summer months with emphasis on August-September, the wettest months of the year, when snails are most active and easiest to survey.

Objective 1.12
Actively manage eastern indigo snake habitat including nesting, resting, and foraging areas for the long-term survival of the species. Strategies for habitat restoration activities that are specifically defined for the Key Largo woodrat and cotton mouse are the same for eastern indigo snakes. Please refer to the aforementioned habitat strategies for more details about restoration of forests and control of exotics.

Discussion: The eastern indigo snake is a large, black, non-venomous snake found in the southeastern United States and throughout Florida. It is believed that in Key Largo the snakes are restricted to north Key Largo hammocks, which are primarily found at Crocodile Lake Refuge and the state botanical park. Confirmed sightings of the snakes are rare and occur every 5 to 10 years. Refuge management and restoration of hardwood hammocks benefit this species since it is exclusive to hammocks.

Objective 1.13
Within 10 years of plan adoption, develop a nesting, nest production, and population trend monitoring plan for the eastern indigo snake.

Strategies:

- Due to the small population size of this species on the refuge and the difficulty in surveying snakes, no formal monitoring program will be developed for the eastern indigo snake.
- Presence/absence data will be collected by documenting any road kills along public roads and through observations made by staff and other persons during routine refuge operations.
- Coordinate with staff of the Key Largo Hammocks Botanical State Park and the Monroe County road maintenance crew to receive any reports on road kills of eastern indigo snakes along County Road 905 and Card Sound Road. The state park conducts road kill surveys along these roads and the county's road crew conducts regular maintenance of these roads, making these two entities the ones most likely to discover and document road kills.

Objective 1.14
Coordinate habitat management activities with the Service's South Florida Ecological Services Office to support threatened and endangered species recovery efforts.

Strategies:

- Coordinate and cooperate with Ecological Services in the review of refuge habitat management programs and actions to ensure compliance with federal, state, and local regulations, and to ensure that these programs and projects contribute to the health and long-term survival of threatened and endangered species.
- Submit all habitat management plans and actions to Ecological Services for review to ensure compliance with the Endangered Species Act and other Service regulations. Consult with the Army Corps of Engineers, the Florida Department of Environmental Protection, and the Florida Fish and Wildlife Conservation Commission to ensure all management activities are in accordance with applicable federal and state regulations.
- Where practical, provide assistance to Ecological Services in the form of supplies, equipment, housing, and staff support needed to identify and complete recovery actions for listed species.

Objective 1.15
Gather data and information necessary for ensuring sustainable white-crowned pigeon populations in and around the refuge in north Key Largo by 2010.
Strategies:

- Determine nesting sites and evaluate their protective status with respect to access by predators and disturbance from recreationists.
- Evaluate response of fruit-producing species and pigeon foraging to experimental habitat manipulations on Key Largo.

Objective 1.16
Acquire remaining privately owned lands within the refuge acquisition boundary (Figure 3).

Strategies:

- Within 2 years of plan adoption, identify privately owned parcels within the refuge acquisition boundary and work with refuge partners to secure funding to acquire those parcels.
- Develop a GIS database and related maps of all privately owned parcels within the refuge's boundary. The database should include the names of the property owners, including addresses and phone numbers, parcel sizes, and habitat types found on the property.
- Identify possible environmental foundations and organizations that might be sources of funding for future land acquisitions. Also, identify private citizens who might be sources of funding for future land acquisitions.

GOAL 2

Expand on the existing knowledge and database regarding the ecology, biology, and behavior of threatened and endangered species and those factors affecting their status and long-term survival.

Objective 2.1
Encourage research on the biology and life history of threatened and endangered species, including aspects of reproductive success, productivity, dispersal, and movement patterns.

Strategies:

- Coordinate with Ecological Services to conduct research on these species utilizing Service biologists, universities, and/or independent researchers.
- Provide logistic support for research efforts by supplying equipment, supplies, housing, and limited staff, whenever possible.

Objective 2.2
Encourage research on habitat requirements and preferences of threatened and endangered species.

Strategies:

- Coordinate with Ecological Services to conduct research on wildlife habitats utilizing Service biologists, universities, and/or independent researchers.
- Provide logistic support for research efforts by supplying equipment, supplies, housing, and limited staff, whenever possible.
- Coordinate research with proposed habitat management programs and activities to determine impacts on threatened and endangered species.

Objective 2.3
Encourage research on captive breeding of Key Largo woodrats to improve the success of existing and future breeding efforts.

Strategies:

- Coordinate with Ecological Services to conduct research on woodrat husbandry utilizing Service biologists, universities, and/or independent researchers.
- Provide logistic support for research efforts by supplying equipment, supplies, housing, and limited staff, whenever possible.

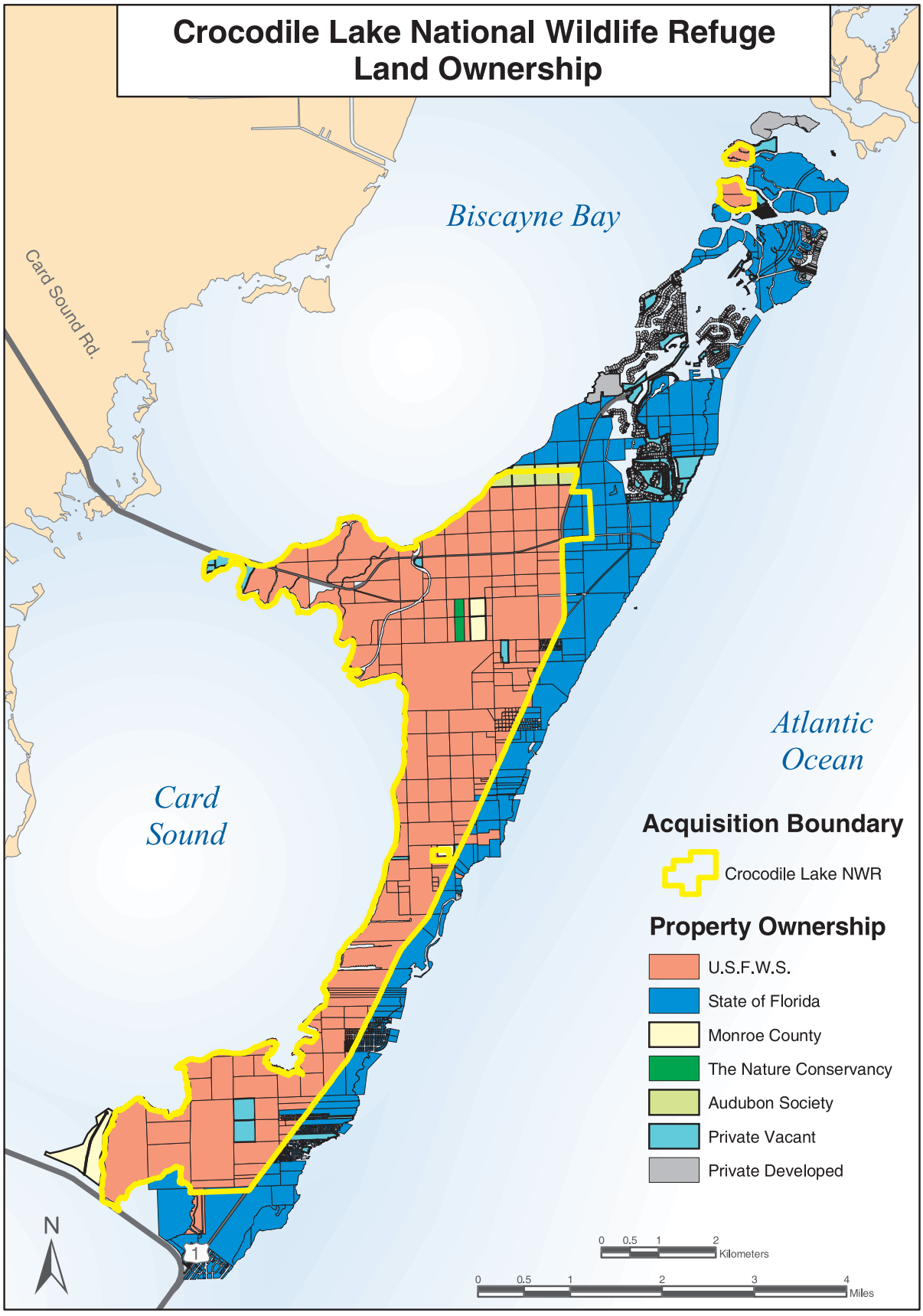
GOAL 3

Develop and implement a comprehensive refuge program that includes providing sufficient staff, facilities, equipment, and volunteers to protect and manage the natural resources of the refuge.

Discussion: The refuge requires few staff since it is closed to public use and contains minimal infrastructure to maintain. The refuge is a satellite of the National Key Deer Refuge and receives maintenance and staff support on an as-needed basis. However, a full-time biological technician is necessary to assist with annual wildlife surveys, censuses, and habitat management.

Objective 3.1
Staff the refuge with a full-time manager, a full-time biologist, a full-time biological technician, and a seasonal biological technician to implement refuge programs and activities needed to fulfill the goals and objectives of the refuge.

Figure 3. Crocodile Lake National Wildlife Refuge land ownership.



Strategies:

- Secure refuge funding for a full-time biologist and a seasonal biological technician.

Provide part-time and seasonal staff to assist with the completion of important refuge programs and activities

Objective 3.2
Develop and maintain an active volunteer program on the refuge.

Strategies:

- Continue to work with the refuge friend's group, FAVOR, to provide assistance in the management and growth of the volunteer organization.
- Develop and implement volunteer projects and activities that not only help fulfill refuge goals and objectives but also instill in the volunteers a sense of pride, accomplishment, and stewardship.

V. Plan Implementation

INTRODUCTION

As required by the National Wildlife Refuge System Improvement Act of 1997, the Service will manage all refuges in accordance with an approved comprehensive conservation plan, which, when implemented, will achieve refuge purposes; help fulfill the National Wildlife Refuge System mission; maintain and, where appropriate, restore the biological integrity, diversity, and environmental health of the refuge; and meet other mandates.

PROPOSED PROJECTS

The proposed projects reflect the basic needs identified by Service staff, the public, and planning team members for the management of fish and wildlife populations, habitats, visitor services, general administration, land protection, and conservation. Among these projects is a list of step-down plans to be developed. The refuge operates under a number of step-down plans which are individual and specific management plans. Some specific plans may need revisions, while others will need to be developed.

Eleven projects were developed based on the strategies designed to achieve plan objectives. These projects are subject to revision at least every 15 years, but may be amended earlier based on updated information. Estimated costs of the projects have been included (Table 1).

PROJECT 1: INVASIVE EXOTIC PLANT CONTROL

The refuge has aggressively targeted invasive exotic plants for the past several years and has reached a general maintenance level. However, there is an ongoing need to monitor and remove exotics. Key Largo has a considerable seed source of Brazilian pepper, lead tree, and Australian pine that is continuously distributed by birds and raccoons. Further, exotic swamp fern needs to be periodically eradicated from crocodile nesting berms since it prevents successful nesting. The estimated recurring cost for this activity is $15,000 per year.

PROJECT 2: INVASIVE EXOTIC PEST CONTROL

Fire ants are an aggressive ant species introduced from South America that raid woodrat and cotton mouse nests and kill newborns. Nesting occurs along County Road 905 which runs through the refuge. Fire ant control is an ongoing management action that requires the use of an approved insecticide. Several treatments a year are required along approximately 12 miles of road on both sides. The estimated recurring cost for this activity is $5,000 per year.

PROJECT 3: FERAL AND FREE-ROAMING CAT CONTROL

Feral and free-roaming cats are of considerable concern on the refuge, since they prey on woodrats and cotton mice. Control efforts involve live-trapping and taking the cats to animal shelters. The refuge does not kill any cats. There are a few known hotspots for cat activity on the refuge and trapping efforts are undertaken when needed. The South Florida Ecological Services' Field Office is the lead in this effort since the South Florida Multi-Species Recovery Plan (1999) requires this activity for the successful recovery of the Key Largo woodrat. Estimated recurring cost for this activity is $15,000 per year.

PROJECT 4: CROCODILE NESTING BERM REPLENISHMENT

Nesting berms for crocodiles consist of organic peat that naturally decomposes over time. Currently, many of the berms have become unsuitable for nesting and require replenishment of the peat. Access to the berms is only available by water in shallow-draft boats. This makes transport of large quantities of peat extremely difficult. Using a helicopter with a transport bucket would be the most effective method to bring new peat to the berms. The estimated one-time cost is $75,000 with a recurring cost of $1,000 per year for maintenance.

PROJECT 5: HABITAT RESTORATION

The refuge has several areas that consist of cleared and disturbed habitats. Old roads, borrow pits, and the NIKE missile site are in need of restoration. Funding is typically the factor that delays restoration projects, since removal of fill and debris is expensive and labor-intensive. The refuge has accomplished a considerable amount of restoration but is not yet finished and plans to complete all restoration areas within 10 years of plan adoption. The estimated cost to complete all restoration is $500,000 with a recurring cost of $1,000 per year for 5 years after completion.

PROJECT 6: WOODRAT ARTIFICIAL NEST SITES

The Key Largo woodrat is a ground-nesting species that prefers to nest in rubble or brush piles. Woodrats also heavily utilize illegally dumped trash (e.g., cars, refrigerators, and washing machines) for nesting. However, once the thin metal cases of these items rust away the woodrats abandon the sites. The refuge has removed almost all of the dumped trash and plans to create artificial nesting sites for the woodrat using natural materials, such as coral rocks. The estimated initial cost is $50,000 with a recurring cost of $1,000 per year.

PROJECT 7: SCHAUS SWALLOWTAIL BUTTERFLY PLANTS

The Schaus swallowtail butterfly requires specific plants for food and for egg laying. The refuge wants to plant more of these plant species in order to increase the butterfly population. These plantings will also benefit other butterflies on the refuge and assist with some restoration areas. The estimated initial cost is $30,000 with an estimated recurring cost of $1,000 per year.

PROJECT 8: MONITORING AND POPULATION SURVEYS

A systematic survey of the refuge's threatened and endangered species will be conducted on a recurring basis in order to determine status and trends of the species. Periodic surveys of other species will also occur in order to determine if habitat management changes are needed. Monitoring and surveys are ongoing needs that warrant a dedicated biological technician for the refuge. The estimated recurring cost is $5,000 per year.

PROJECT 9: LAND ACQUISITION

A few land inholdings remain within the refuge acquisition boundary (Figure 3). The refuge would like to acquire these inholdings in order to complete the refuge and protect the lands from development. Land values change rapidly in the Keys, thus the estimated costs will change constantly. The faster the inholdings can be purchased, the lower the cost. The current estimated cost is $1,000,000 to $3,000,000 and increasing substantially each year.

PROJECT 10: VOLUNTEER PROGRAM

The refuge relies on volunteers for many of its annual management activities, such as crocodile nesting surveys, exotic control, and habitat management. The refuge wants to recruit more volunteers to assist with projects. Additional funding is needed to provide supplies for the volunteer program. The estimated recurring cost is $3,000 per year.

PROJECT 11: BUTTERFLY GARDEN AND INTERPRETIVE MATERIALS

Refuge volunteers developed a butterfly garden at the refuge headquarters to provide visitors with an interpretive experience. The garden is universally accessible and illustrates many of the plants found on the refuge. Additional interpretive signs and kiosks are needed to complete the project, and information needs to be updated periodically. The interpretive materials will help visitors understand why the refuge is closed to public access. The initial estimated cost is $5,000 with a recurring cost of $1,000.

Table 1. Cost summary of projects.

Project	Initial cost	Recurring costs per year
Invasive exotic plant control	15,000	5,000
Invasive exotic pest control	5,000	5,000
Feral cat control	15,000	10,000
Crocodile nesting berm replenishment	75,000	1,000
Habitat Restoration	500,000	1,000
Woodrat artificial nest sites	50,000	1,000
Schaus swallowtail butterfly plants	30,000	1,000
Monitoring and population surveys		5,000
Land Acquisition	1,000,000 to 3,000,000	
Volunteer program		3,000
Butterfly garden and interpretive materials	5,000	1,000
Full-time biologist (GS-11)	~80,000	60,000
Full-time biological technician (GS-9)	~70,000	50,000
Seasonal biological technician	~35,000	25,000
Full-time refuge manager (GS-12)		70,000
TOTAL	1,000,000 to 3,600,000 ($880,000 without land acquisition)	238,000

STAFFING NEEDS

Crocodile Lake National Wildlife Refuge is a satellite refuge of the National Key Deer Refuge with its headquarters on Big Pine Key. The refuge is staffed by a refuge manager who handles daily activities. To conduct large projects, National Key Deer Refuge staff travel to Crocodile Lake Refuge to provide assistance. However, since the refuges are 2 hours apart, it is not feasible to send staff on a daily basis. The addition of a full-time biologist, a biological technician, and a seasonal biological technician will be required for the refuge to achieve the goals and objectives outlined in this plan. The estimated cost for a full staff would be $205,000 per year.

STEP-DOWN PLANS

Service policy (Fish and Wildlife Service Manual, Chapter 602 FW 4, Step-Down Management Planning) requires that specific management plans be developed for each refuge. Some plans require annual revisions; others are revised on a 5- to 10-year schedule. Refuge staff will continue to seek public and professional input in the development, revision, and implementation of step-down plans. Some of these plans are already in place, while others need to be developed. Step-down plans that require development, some level of modification, or updating to implement this plan are listed below:

- Hurricane Evacuation Plan (2000)
- Public Use Plan (2000)
- Fire Management Plan (2000)
- Habitat Management plan (included in this plan)
- Law Enforcement Plan (2004)

PARTNERSHIP OPPORTUNITIES

To achieve the goals and objectives of this plan, maintaining existing partnerships and developing new ones with a variety of resource agencies, organizations, and individuals are essential. Partnerships help enable the refuge to fulfill plan objectives and reduce costs.

The Florida Department of Environmental Protection is a key refuge partner since there is a state park directly across County Road 905. The state park shares the same habitats as the refuge and is essential in helping the refuge manage species such as the Key Largo woodrat and cotton mouse.

Another major partner is the refuge friends group, FAVOR, which provides excellent volunteer help with numerous refuge projects. Without volunteer help, the refuge would struggle to complete refuge management projects.

MONITORING AND ADAPTIVE MANAGEMENT

Monitoring the Service's performance while implementing this plan will help ensure its success. Monitoring and evaluating allow the Service, other government agencies, the public, and partners to measure and progress. Following approval of the plan and public notification of the decision, the Service will begin implementing the outlined strategies. The Service will monitor, evaluate, and determine whether or not progress is being made towards achieving the refuge's purposes, vision, and goals. Monitoring will address habitat or population objectives and the effects of management activities. Through adaptive management, evaluation of monitoring and research results may indicate the need to modify refuge objectives or strategies.

The Service will review this plan annually to decide if it requires any revisions. The plan will be modified, along with associated management activities, whenever this review or other monitoring and evaluating determine that changes are needed to achieve planning unit purposes, vision, and goals. The Service will revise this plan when significant new information becomes available, or when there are changes in ecological conditions. At a minimum, plan revision will occur every 15 years. All plan revisions will follow the procedures outlined in current policy and will require compliance with the National Environmental Policy Act. The Service will continue to encourage public involvement regarding management of this refuge.

SECTION B. ENVIRONMENTAL ASSESSMENT

I. Background

INTRODUCTION

This Environmental Assessment for Crocodile Lake National Wildlife Refuge has been prepared in compliance with the National Environmental Policy Act. It discusses the purpose and need for a comprehensive conservation plan and provides an analysis of the expected impacts resulting from the proposed management actions. Ultimately, this analysis assists the Fish and Wildlife Service in determining if an Environmental Impact Statement or a Finding of No Significant Impact statement needs to be prepared.

The Fish and Wildlife Service is the nation's primary habitat and wildlife conservation and management agency. The Service administers the National Wildlife Refuge System which consists of more than 540 refuges encompassing over than 93 million acres. The focus is to manage resources for federally listed species, migratory birds, and plants. Crocodile Lake Refuge was created for protection of threatened and endangered species which is an emphasis for this draft plan.

PURPOSE AND NEED FOR PLAN

The purpose of the comprehensive conservation plan is to specify a management direction and provide long-term management guidance for Crocodile Lake National Wildlife Refuge. Management guidance and direction are described in detail through a set of goals, objectives, and strategies in the comprehensive conservation plan. This environmental assessment discusses the purpose and need for the plan and provides an analysis of the impacts that could be expected under each of the outlined management alternatives. Also, this plan is needed to fulfill legislative mandates of the National Wildlife Refuge System Improvement Act of 1997, which requires development of such plans for all national wildlife refuges.

An environmental assessment is needed to determine and evaluate a range of reasonable management alternatives. Each alternative was generated with the potential to be fully developed into a final comprehensive conservation plan. Descriptions of each alternative outline predicted biological, physical, social, and economical impacts of implementing each alternative. Following public review and comment, the Service will select an alternative to be fully developed for the refuge.

The Service identified issues, concerns, and needs through discussions with the public, conservation partners, and other agencies. The planning team evaluated the comments and suggestions received and identified a range of alternatives and evaluated possible consequences of implementing the alternatives. Alternative 2 was selected as the preferred alternative for managing the refuge over the next 15 years.

DECISIONS TO BE MADE

Based on the environmental assessment described in this document, the Service will (1) select an alternative that best serves the purposes of the refuge and the mission of the National Wildlife Refuge System, and (2) determine if the selected alternative is a major federal action significantly affecting the quality of the human environment, thus requiring preparation of an Environmental Impact Statement. Assuming no significant impacts are found, a Finding of No Significant Impact will be prepared and the plan will be implemented.

PLANNING STUDY AREA

Crocodile Lake National Wildlife Refuge is in Key Largo, Florida, approximately 30 miles south of Miami, Florida. The refuge currently manages about 6,700 acres and contains close to 400 acres of inholdings within the 7,100 approved acquisition boundary. The Service will continue to purchase inholdings when there is a willing seller. This environmental assessment identifies management actions that will only occur on refuge lands. The refuge has no legal jurisdiction for managing land that is not Service owned or officially managed through lease agreements.

PLANNING PROCESS AND ISSUES

Please refer to Section A, Chapter III, of the Draft Comprehensive Conservation Plan for a detailed summary of the planning process.

The draft plan was developed following guidelines of the National Environmental Policy Act. Public comments and suggestions are essential to the planning process and were used in developing the draft plan.

II. Alternatives

FORMULATION OF ALTERNATIVES

Alternatives are different approaches or combinations of management actions and activities designed to achieve the refuge purpose, vision, and goals identified in the comprehensive conservation plan; the mission of the National Wildlife Refuge System; and the mission of the Fish and Wildlife Service. Alternatives are formulated to address significant issues, concerns, and problems identified by the Service and public during the public scoping process.

The three alternatives identified and evaluated represent different approaches to provide permanent protection, restoration, and management of refuge resources with a focus on federally listed species. Crocodile Lake National Wildlife Refuge protects one of the largest remaining contiguous areas of habitat in Key Largo, which includes tropical hardwood hammocks, mangrove forests, and coastal wetlands. Many of the threatened and endangered species found on the refuge once had a larger range but are now restricted to the refuge because of habitat loss due to development. Fortunately, most of the lands adjacent to the refuge are owned by the State of Florida and are protected from development.

Refuge staff assessed biological conditions and analyzed external relationships affecting the refuge. This information contributed to the development of goals, objectives, and alternatives presented in this environmental assessment. Each alternative presents different objectives and strategies for attaining long-term goals. Each alternative was evaluated based on how much benefit it could provide and how it could address core habitat issues, problems, and concerns.

Crocodile Lake Refuge was established as a closed refuge because of the sensitivity to disturbance of the American crocodile and other wildlife. Public scoping revealed that the public felt the refuge should mostly remain closed to general public access. However, it was suggested that limited public use of the refuge be allowed with the development of a nature trail and guided tours conducted by refuge staff. Alternative 3 addresses limited public use on the refuge.

DESCRIPTION OF ALTERNATIVES

Serving as a basis for each alternative, a number of goals and sets of objectives and strategies were developed to help fulfill the purposes of the refuge and the mission of the National Wildlife Refuge System. Objectives are desired conditions or outcomes that are grouped into sets, and for this planning effort, consolidated into three alternatives. These alternatives represent different approaches to managing the refuge while still meeting the purposes and goals. Plans will be revised at least every 15 years, or earlier, if monitoring indicates management changes are warranted. Goals are common for each of the alternatives, with objectives and strategies differing. A comparison of each alternative follows the general descriptions.

ALTERNATIVE 1 - NO ACTION

Continuation of current refuge management that includes basic habitat management such as control of exotics and fundamental monitoring.

This alternative represents no change from current management of the refuge and is considered a baseline. Management emphasis would continue to focus on maintaining biological integrity of habitats found on the refuge. Primary management activities include invasive exotic plant control, pest management, habitat restoration, and basic monitoring of threatened and endangered species. Alternative 1 represents the anticipated conditions of the refuge for the next 15 years assuming current policies, programs, and activities continue. The other two alternatives are compared to this alternative in order to evaluate differences in future conditions compared to baseline management.

This alternative reflects actions that include supporting recovery efforts for federally listed species, restoring hammocks, restoring wetlands, and acquiring lands from willing sellers within the acquisition boundary. Monitoring of plants and animals would be limited due to staffing constraints and limited research interest. Habitat management actions are intended to benefit all wildlife by maintaining habitat integrity.

Management coordination would occur between the refuge and the adjacent state botanical preserve. Coordination would be limited because of staffing constraints and remain focused on invasive exotics control, habitat restoration, and threatened and endangered species. Since the refuge is closed to the public, visitors would continue to be directed to the state botanical preserve. The preserve has infrastructure to accommodate visitors who want to experience being in a hardwood hammock or mangrove forest.

The refuge would remain staffed with a refuge manager and periodic interns. Researchers would be accommodated when projects benefit the refuge. The refuge would remain closed to public and commercial access.

ALTERNATIVE 2 - PREFERRED ALTERNATIVE

Increase management actions that focus greater attention on actively managing habitats to provide increased habitat value.

This alternative is the preferred alternative for managing the refuge. Under this alternative, existing management activities would continue, and some activities would be expanded. This alternative proposes to add an additional full-time biological technician to allow for expansion of activities such as monitoring, exotics control, and restoration. The staff member would help support the additional activities proposed under this alternative.

Increasing efforts related to exotics control, pest management, and monitoring are characteristic of this alternative. The increased management actions would help to achieve the long-term goals and objectives in a timelier manner than under the “no action” alternative. This alternative would result in a more ecosystem based management approach that views the refuge as a single system rather than separate habitat types. Federally listed species would still be of primary concern, but needs of other resident and migratory wildlife would also be considered.

A more proactive approach to land acquisition would be taken in order to purchase remaining inholdings. The refuge would actively contact owners of inholdings and seek to acquire the parcels. There are roughly 400 acres of inholdings that the refuge wants to acquire in order to restore

disturbed habitats on those parcels. Acquiring inholdings will also ensure that connectivity of refuge habitats is maintained.

ALTERNATIVE 3 - LIMITED PUBLIC ACCESS

Open refuge to limited public use and access while increasing management actions that focus greater attention on actively managing habitats to provide increased habitat value.

This alternative is an expanded version of Alternative 2 in that it allows for opening the refuge to limited public use. The refuge was established as a closed refuge and the possibility of allowing public use was considered for this alternative. Restoration of habitats may provide an opportunity to incorporate nature trails that provide access to the refuge. These potential nature trails would need to be located in areas that would result in the no disturbance to wildlife since they would be located in areas that were disturbed. The trails would also provide interpretive signs to educate visitors about refuge resources.

In addition to the nature trails, there would be a strengthening of the refuge friends group in order to provide guided tours of the refuge. Refuge staff would train volunteers to conduct tours of areas that are only accessible with a guide. This approach would open the refuge and allow visitors to experience the refuge while minimizing disturbance to sensitive wildlife areas.

ALTERNATIVES CONSIDERED, BUT REJECTED

Opening the entire refuge to general public use and access was rejected because it would create too much disturbance to sensitive wildlife. Additionally, a full-time refuge ranger and law enforcement officer would need to be added to the staff to handle the influx of visitors. The Florida Keys receive approximately 4 million visitors per year and even a fraction of a percent of those visitors stopping at the refuge would cause impacts of unacceptable levels.

Active habitat manipulation to emulate natural disturbances (e.g., hurricane microbursts) was discussed at length during the biological review as a possible approach to increase preferred habitat for federally listed species. This alternative centered on clearing one to five acres of mature hardwood hammock to create disturbed areas. The planning team unanimously agreed that destroying intact hardwood hammock was too controversial to undertake. However, restoring existing disturbed areas (e.g., NIKE site) to a younger-aged hammock was agreed upon and incorporated into the preferred alternative.

COMPARISON OF ALTERNATIVES

Table 2 on the following pages provides a side-by-side comparison of the three alternatives. The intent is to make the differences between alternatives readily apparent. Many times there may be no difference or only a slight difference between the alternatives. However, it should be clear that each alternative has a slightly different management approach to achieving the proposed goals and objectives.

Table 2. Comparison of alternatives.

Alternative 1 (no action)	Alternative 2 (preferred)	Alternative 3
Goal 1. *Provide high quality habitat including nesting, resting, foraging, and nursery areas for the long-term survival of threatened and endangered species.*		
Objective 1.1 American crocodile nesting habitat		
Conduct annual maintenance of crocodile nesting berms.	Maintain, restore, and enhance existing American crocodile nesting habitat.	Maintain, restore, and enhance existing American crocodile nesting habitat.
Strategy: • Control invasive vegetation on existing nesting berms to increase nesting habitat.	*Strategies:* • Control invasive vegetation on existing nesting berms to increase nesting habitat. • Elevate low-lying areas on the existing nesting berms with supplemental nesting material to prevent saltwater intrusion and flooding of nests. • Augment existing nesting berms with additional peat. • As part of future wetland restoration projects, create additional nesting habitat in restored wetland areas.	*Strategies:* • Control invasive vegetation on existing nesting berms to increase nesting habitat. • Elevate low-lying areas on the existing nesting berms with supplemental nesting material to prevent saltwater intrusion and flooding of nests. • Augment existing nesting berms with additional peat. • As part of future wetland restoration projects, create additional nesting habitat in restored wetland areas.
Objective 1.2 American crocodile wetland habitat		
Restore wetland habitats for general wildlife use.	Restore suitable wetland habitat for American crocodiles.	Restore suitable wetland habitat for American crocodiles.
Strategy: • Remove fill from disturbed areas such as abandoned roads and fill pads, and restore these sites to historic wetland elevations where they can recover naturally.	*Strategies:* • Remove fill from disturbed areas such as abandoned roads and fill pads, and restore these sites to historic wetland elevations where they can recover naturally. • Where feasible, create berms of peat for additional crocodile nesting areas.	*Strategies:* • Remove fill from disturbed areas such as abandoned roads and fill pads, and restore these sites to historic wetland elevations where they can recover naturally. • Where feasible, create berms of peat for additional crocodile nesting areas.

Alternative 1 (no action)	Alternative 2 (preferred)	Alternative 3
Objective 1.3 American crocodile monitoring		
Continue with annual crocodile hatchling surveys conducted by University of Florida.	Within 2 years of plan adoption, develop a nesting, nest production, population trend, and road mortality monitoring plan for the American crocodile.	Within 2 years of plan adoption, develop a nesting, nest production, population trend, and road mortality monitoring plan for the American crocodile.
Strategy: • Coordinate with cooperative agencies, organizations, and groups (i.e., Florida Fish and Wildlife Conservation Commission and University of Florida) to develop and conduct hatchling surveys of the American crocodile.	*Strategies:* • Coordinate with cooperative agencies, organizations, and groups (i.e., Florida Fish and Wildlife Conservation and University of Florida) to develop and conduct population surveys of the American crocodile to determine distribution, abundance, and trends, as well as to determine the effectiveness of management programs and actions. • Surveys of American crocodiles should include, but not be limited to, nest counts, hatchling surveys, and overall population censuses and should include all suitable habitats on the refuge, as well as portions of the Biscayne Bay Estuary (i.e., Lake Surprise, Barnes Sound, and Card Sound). • Establish a standard protocol for data collection on crocodiles hit by vehicles.	*Strategies:* • Coordinate with cooperative agencies, organizations, and groups (i.e., Florida Fish and Wildlife Conservation and University of Florida) to develop and conduct population surveys of the American crocodile to determine distribution, abundance, and trends, as well as to determine the effectiveness of management programs and actions. • Surveys of American crocodiles should include, but not be limited to, nest counts, hatchling surveys, and overall population censuses and should include all suitable habitats on the refuge, as well as portions of the Biscayne Bay Estuary (i.e., Lake Surprise, Barnes Sound, and Card Sound). • Establish a standard protocol for data collection on crocodiles hit by vehicles.

Alternative 1 (no action)	Alternative 2 (preferred)	Alternative 3
Objective 1.4 Key Largo woodrat habitat		
Continue with hardwood hammock habitat management that targets invasive exotics.	Actively manage Key Largo woodrat habitat including nesting, resting, and foraging areas for the long-term survival of the species.	Actively manage Key Largo woodrat habitat including nesting, resting, and foraging areas for the long-term survival of the species, plus development of hammock nature trails.
Strategies: • Restore and enhance habitat by controlling invasive exotic plants within the refuge and along public rights-of-way and easements. Also coordinate with adjacent landowners to control exotic plants on non-refuge lands that may serve as habitat for woodrats, or that may serve as a possible seed source for re-infestation of refuge lands. • Enhance habitat by controlling fire ants within the refuge and along adjacent public rights-of-way and easements.	*Strategies:* • Create artificial nest sites from coral rubble and other debris and place them in suitable woodrat habitat. • Restore hardwood forests. Remove abandoned buildings and other structures at the Port Bougainville Tract and NIKE missile site and allow natural revegetation. • Create hammock habitat by filling areas within historic hardwood forests that were dredged or mined. • Restore and enhance habitat by controlling invasive exotic plants within the refuge and along public rights-of-way and easements. Also coordinate with adjacent landowners to control exotic plants on non-refuge lands that may serve as habitat for woodrats, or that may serve as a possible seed source for re-infestation of refuge lands. • Enhance habitat by controlling fire ants within the refuge and along adjacent public rights-of-way and easements.	*Strategies:* • Create artificial nest sites from coral rubble and other debris and place them in suitable woodrat habitat. • Restore hardwood forests. Remove abandoned buildings and other structures at the Port Bougainville Tract and NIKE missile site and allow natural revegetation. • Create hammock habitat by filling areas within historic hardwood forests that were dredged or mined. • Restore and enhance habitat by controlling invasive exotic plants within the refuge and along public rights-of-way and easements. Also coordinate with adjacent landowners to control exotic plants on non-refuge lands that may serve as habitat for woodrats, or that may serve as a possible seed source for re-infestation of refuge lands. • Enhance habitat by controlling fire ants within the refuge and along adjacent public rights-of-way and easements. • As part of hardwood hammock restoration, develop nature trails to include observation platforms.

Alternative 1 (no action)	Alternative 2 (preferred)	Alternative 3
Objective 1.5 Key Largo woodrat monitoring		
Continue to rely on periodic researchers to conduct monitoring.	Within 2 years of plan adoption, develop a nesting, nest production, and population trend monitoring plan for the Key Largo woodrat.	Within 2 years of plan adoption, develop a nesting, nest production, and population trend monitoring plan for the Key Largo woodrat.
Strategy: • Request through the Service's South Florida Ecological Services Field Office that monitoring of the woodrat population be conducted at least every 5 years.	*Strategies:* • Assist Ecological Services with development and implementation of population surveys of the Key Largo woodrat to determine distribution, abundance, trends, and habitat preferences, as well as to determine the effectiveness of management programs and actions. Ecological Services would take the lead on this program and, where practical, the refuge would provide support (e.g., supplies, equipment, housing, limited staff, and technical assistance) to help fulfill their monitoring responsibilities. • Coordinate with Ecological Services to monitor the effects of habitat management programs and activities on woodrats.	*Strategies:* • Assist Ecological Services with development and implementation of population surveys of the Key Largo woodrat to determine distribution, abundance, trends, and habitat preferences, as well as to determine the effectiveness of management programs and actions. Ecological Services would take the lead on this program and, where practical, the refuge would provide support (e.g., supplies, equipment, housing, limited staff, and technical assistance) to help fulfill their monitoring responsibilities. • Coordinate with Ecological Services to monitor the effects of habitat management programs and activities on woodrats.

Alternative 1 (no action)	Alternative 2 (preferred)	Alternative 3
Objective 1.6 Key Largo cotton mouse habitat		
Continue with hardwood hammock habitat management that targets invasive exotics.	Actively manage Key Largo cotton mouse habitat including nesting, resting, and foraging areas for the long-term survival of the species.	Actively manage Key Largo cotton mouse habitat including nesting, resting, and foraging areas for the long-term survival of the species, plus development of hammock nature trails.
Strategies: • Restore and enhance habitat by controlling invasive exotic plants within the refuge and along public rights-of-way and easements. Also coordinate with adjacent landowners to control exotic plans on non-refuge lands that may serve as habitat for cotton mice, or that may serve as a possible seed source for re-infestation of refuge lands. • Enhance habitat by controlling fire ants within the refuge and along adjacent public rights-of-way and easements.	*Strategies:* • Restore hardwood forests. Remove abandoned buildings and other structures at the Port Bougainville Tract and NIKE missile site and allow natural revegetation. • Create hammock habitat by filling areas within historic hardwood forests that were dredged or mined. • Restore and enhance habitat by controlling invasive exotic plants within the refuge and along public rights-of-way and easements. Also coordinate with adjacent landowners to control exotic plants on non-refuge lands that may serve as habitat for cotton mice, or that may serve as a possible seed source for re-infestation of refuge lands. • Enhance habitat by controlling fire ants within the refuge and along adjacent public rights-of-way and easements.	*Strategies:* • Restore hardwood forests. Remove abandoned buildings and other structures at the Port Bougainville Tract and NIKE missile site and allow natural revegetation. • Create hammock habitat by filling areas within historic hardwood forests that were dredged or mined. • Restore and enhance habitat by controlling invasive exotic plants within the refuge and along public rights-of-way and easements. Also coordinate with adjacent landowners to control exotic plants on non-refuge lands that may serve as habitat for cotton mice, or that may serve as a possible seed source for re-infestation of refuge lands. • Enhance habitat by controlling fire ants within the refuge and along adjacent public rights-of-way and easements. • As part of hardwood hammock restoration, develop nature trails to include observation platforms.

Alternative 1 (no action)	Alternative 2 (preferred)	Alternative 3
Objective 1.7 Key Largo cotton mouse monitoring		
Continue to rely on periodic researchers to conduct monitoring.	Within 2 years of plan adoption, develop a nesting, nest production, and population trend monitoring plan for the Key Largo cotton mouse.	Within 2 years of plan adoption, develop a nesting, nest production, and population trend monitoring plan for the Key Largo cotton mouse.
Strategy: • Request through Ecological Services that monitoring of the cotton mouse population be conducted at least every 5 years.	*Strategies:* • Assist Ecological Services with the development and implementation of population surveys of the Key Largo cotton mouse to determine distribution, abundance, trends, and habitat preferences, as well as to determine the effectiveness of management programs and actions. Ecological Services office would take the lead on this program and, where practical, the refuge would provide support (e.g., supplies, equipment, housing, limited staff, and technical support) to help fulfill their monitoring responsibilities. • Coordinate with Ecological Services to monitor the effects of habitat management programs and activities on cotton mice.	*Strategies:* • Assist Ecological Services with the development and implementation of population surveys of the Key Largo cotton mouse to determine distribution, abundance, trends, and habitat preferences, as well as to determine the effectiveness of management programs and actions. Ecological Services office would take the lead on this program and, where practical, the refuge would provide support (e.g., supplies, equipment, housing, limited staff, and technical support) to help fulfill their monitoring responsibilities. • Coordinate with Ecological Services to monitor the effects of habitat management programs and activities on cotton mice.

Alternative 1 (no action)	Alternative 2 (preferred)	Alternative 3
Objective 1.8 Schaus swallowtail butterfly habitat		
Plant tree species that are beneficial to Schaus swallowtail butterflies when funding and labor are available and prohibit adulticide spraying.	Actively manage Schaus swallowtail butterfly habitat including nesting, resting, and foraging areas for the long-term survival of the species.	Actively manage Schaus swallowtail butterfly habitat including nesting, resting, and foraging areas for the long-term survival of the species, plus development of an interpretive butterfly trail.
Strategies: • Enhance habitat for the Schaus swallowtail butterfly by planting the larvae host plants of the butterfly. • Continue to prohibit the use of broad spectrum adulticides by the Florida Keys Mosquito Control District to control mosquitoes on the refuge.	*Strategies:* • Create habitat by filling areas within historic hardwood forests that were dredged or mined. • Restore hardwood forests. Remove abandoned buildings and other structures at the Port Bougainville Tract and the NIKE missile site, and allow natural revegetation. • Restore and enhance habitat by controlling invasive exotic plants within the refuge and along public rights-of-way and easements. Also coordinate with adjacent landowners to control exotic plants on non-refuge lands that may serve as habitat for Schaus swallowtail butterflies or that may possibly serve as a seed source for re-infestation of refuge lands. • Enhance habitat by controlling fire ants within the refuge and along adjacent public rights-of-way and easements. • Cooperate with Florida Keys Mosquito Control District in developing methods of mosquito control that reduce the need for broad spectrum adulticides. • Enhance habitat for the Schaus swallowtail butterfly by planting the larvae host plants of the butterfly.	*Strategies:* • Create habitat by filling areas within historic hardwood forests that were dredged or mined. • Restore hardwood forests. Remove abandoned buildings and other structures at the Port Bougainville Tract and the NIKE missile site, and allow natural revegetation. • Restore and enhance habitat by controlling invasive exotic plants within the refuge and along public rights-of-way and easements. Also coordinate with adjacent landowners to control exotic plants on non-refuge lands that may serve as habitat for Schaus swallowtail butterflies or that may possibly serve as a seed source for re-infestation of refuge lands. • Enhance habitat by controlling fire ants within the refuge and along adjacent public rights-of-way and easements. • Cooperate with Florida Keys Mosquito Control District in developing methods of mosquito control that reduce the need for broad spectrum adulticides. • Enhance habitat for the Schaus swallowtail butterfly by planting the larvae host plants of the butterfly. • Create a nature trail that focuses on butterflies by placing the trail where host plants occur.

Alternative 1 (no action)	Alternative 2 (preferred)	Alternative 3
		• Plant host plants for the butterflies on the trail along with associated interpretive signs.
Objective 1.9 Schaus swallowtail butterfly monitoring		
Continue to rely on periodic researchers to conduct monitoring.	Within 2 years of plan adoption, develop a nesting, nest production, and population trend monitoring plan for the Schaus swallowtail butterfly.	Within 2 years of plan adoption, develop a nesting, nest production, and population trend monitoring plan for the Schaus swallowtail butterfly.
Strategies: • Request that Schaus swallowtail surveys be conducted by University of Florida and other universities.	*Strategies:* • Coordinate with the University of Florida, cooperative agencies, organizations, and groups to develop and conduct population surveys of the Schaus swallowtail butterfly to determine distribution, abundance, and trends and determine the effectiveness of management programs and actions. • Surveys should include adult flight counts and egg/larvae surveys on suitable habitat throughout North Key Largo, including Key Largo Hammock Botanical State Park.	*Strategies:* • Coordinate with the University of Florida, cooperative agencies, organizations, and groups to develop and conduct population surveys of the Schaus swallowtail butterfly to determine distribution, abundance, and trends and determine the effectiveness of management programs and actions. • Surveys should include adult flight counts and egg/larvae surveys on suitable habitat throughout North Key Largo, including Key Largo Hammock Botanical State Park.

Alternative 1 (no action)	Alternative 2 (preferred)	Alternative 3
Objective 1.10 Stock Island tree snail habitat		
Continue with hardwood hammock habitat management that targets invasive exotics and prohibits adulticide spraying.	Actively manage Stock Island tree snail habitat including nesting, resting, and foraging areas for the long-term survival of the species.	Actively manage Stock Island tree snail habitat including nesting, resting, and foraging areas for the long-term survival of the species.
Strategies: • Restore and enhance habitat by controlling invasive exotic plants within the refuge and along public rights-of-way and easements. Also coordinate with adjacent landowners to control exotic plants on non-refuge lands that may serve as habitat for Stock Island tree snails, or that may serve as a possible seed source for re-infestation of refuge lands. • Enhance habitat by controlling fire ants within the refuge and along adjacent public rights-of-way and easements. • Continue to prohibit the use of broad spectrum adulticides by the Florida Keys Mosquito Control District to control mosquitoes on the refuge.	*Strategies:* • Restore hardwood forests. Remove abandoned buildings and other structures at the Port Bougainville Tract and NIKE missile site, and allow natural revegetation. • Create habitat by filling areas within historic hardwood forests that were dredged or mined. • Restore and enhance habitat by controlling invasive exotic plants within the refuge and along public rights-of-way and easements. Also coordinate with adjacent landowners to control exotic plants on non-refuge lands that may serve as habitat for Stock Island tree snails, or that may serve as a possible seed source for re-infestation of refuge lands. • Enhance habitat by controlling fire ants within the refuge and along adjacent public right-of-way and easements. • Continue to prohibit the use of broad spectrum adulticides by the Florida Keys Mosquito Control District to control mosquitoes on the refuge.	*Strategies:* • Restore hardwood forests. Remove abandoned buildings and other structures at the Port Bougainville Tract and NIKE missile site, and allow natural revegetation. • Create habitat by filling areas within historic hardwood forests that were dredged or mined. • Restore and enhance habitat by controlling invasive exotic plants within the refuge and along public rights-of-way and easements. Also coordinate with adjacent landowners to control exotic plants on non-refuge lands that may serve as habitat for Stock Island tree snails, or that may serve as a possible seed source for re-infestation of refuge lands. • Enhance habitat by controlling fire ants within the refuge and along adjacent public right-of-way and easements. • Continue to prohibit the use of broad spectrum adulticides by the Florida Keys Mosquito Control District to control mosquitoes on the refuge.
Objective 1.11 Stock Island tree snail monitoring		
Conduct sight surveys every 3 years.	Within 2 years of plan adoption, develop a nesting, nest production, and population trend monitoring plan for the Stock Island tree snail.	Within 2 years of plan adoption, develop a nesting, nest production, and population trend monitoring plan for the Stock Island tree snail.

Alternative 1 (no action)	Alternative 2 (preferred)	Alternative 3
Strategy: • Coordinate with other cooperative agencies, organizations, and groups to develop and conduct sight surveys of the Stock Island tree snail.	*Strategy:* • Coordinate with other cooperative agencies, organizations, and groups to develop and conduct population surveys of the Stock Island tree snail to determine distribution, abundance, and trends, as well as to determine the effectiveness of management programs and actions.	*Strategy:* • Coordinate with other cooperative agencies, organizations, and groups to develop and conduct population surveys of the Stock Island tree snail to determine distribution, abundance, and trends, as well as to determine the effectiveness of management programs and actions.
Objective 1.12 Eastern indigo snake habitat		
Continue habitat management focusing on invasive exotics control.	Actively manage eastern indigo snake habitat including nesting, resting, and foraging areas for the long-term survival of the species.	Actively manage eastern indigo snake habitat including nesting, resting, and foraging areas for the long-term survival of the species.
Strategies: • Restore and enhance habitat by controlling invasive exotic plants within the refuge and along public rights-of-way and easements. Also coordinate with adjacent landowners to control exotic plants on non-refuge lands that may serve as habitat for eastern indigo snakes, or that may serve as a possible seed source for re-infestation of refuge lands. • Enhance habitat by controlling fire ants within the refuge and along adjacent public rights-of-way and easements.	*Strategies:* • Restore hardwood forests. Remove abandoned buildings and other structures at the Port Bougainville Tract and NIKE missile site and allow natural revegetation. • Create hammock habitat by filling areas within historic hardwood forests that were dredged or mined. • Restore and enhance habitat by controlling invasive exotic plants within the refuge and along public rights-of-way and easements. Also coordinate with adjacent landowners to control exotic plants on non-refuge lands that may serve as habitat for eastern indigo snakes, or that may serve as a possible seed source for re-infestation of refuge lands. • Enhance habitat by controlling fire ants within the refuge and along adjacent public rights-of-way and easements.	*Strategies:* • Restore hardwood forests. Remove abandoned buildings and other structures at the Port Bougainville Tract and NIKE missile site and allow natural revegetation. • Create hammock habitat by filling areas within historic hardwood forests that were dredged or mined. • Restore and enhance habitat by controlling invasive exotic plants within the refuge and along public rights-of-way and easements. Also coordinate with adjacent landowners to control exotic plants on non-refuge lands that may serve as habitat for eastern indigo snakes, or that may serve as a possible seed source for re-infestation of refuge lands. • Enhance habitat by controlling fire ants within the refuge and along adjacent public rights-of-way and easements.

Alternative 1 (no action)	Alternative 2 (preferred)	Alternative 3
Objective 1.13 Eastern indigo snake monitoring		
Continue to rely on confirmed sightings of the snake by researchers studying other species on the refuge, and by road kill data.	Within 2 years of plan adoption, develop a nesting, nest production, and population trend monitoring plan for the eastern indigo snake.	Within 2 years of plan adoption, develop a nesting, nest production, and population trend monitoring plan for the eastern indigo snake.
Strategies: • Due to the small population size of this species on the refuge, and the difficulty in surveying snakes, no formal monitoring program will be developed for the eastern indigo snake. • Presence/absence data will be collected by documenting any road kills along public roads, and through observations made by staff and other persons during routine refuge operations.	*Strategies:* • Coordinate with other cooperative agencies, organizations, and groups to develop and conduct population surveys of the eastern indigo snake to determine distribution, abundance, and trends, as well as to determine the effectiveness of management programs and actions. • Surveys should include counts on areas of the refuge where previous sightings occurred. • Coordinate with the Department of Environmental Protection to complete surveys of known snake locations in the state botanical site.	*Strategies:* • Coordinate with other cooperative agencies, organizations, and groups to develop and conduct population surveys of the eastern indigo snake to determine distribution, abundance, and trends, as well as to determine the effectiveness of management programs and actions. • Surveys should include counts on areas of the refuge where previous sightings occurred. • Coordinate with the Department of Environmental Protection to complete surveys of known snake locations in the state botanical site.
Objective 1.14 Threatened and endangered species recovery efforts		
Continue with refuge habitat management that focuses on invasive exotics.	Coordinate habitat management activities with the Service's South Florida Ecological Services Office to support threatened and endangered species recovery efforts.	Coordinate habitat management activities with the Service's South Florida Ecological Services Office to support threatened and endangered species recovery efforts.
Strategy: • Control invasive exotics on the refuge.	*Strategies:* • Coordinate and cooperate with Ecological Services in the review of refuge habitat management programs and actions to ensure compliance with federal, state, and local regulations, and to ensure that these programs and projects contribute to the health and long-term survival of threatened and endangered species.	*Strategies:* • Coordinate and cooperate with Ecological Services in the review of refuge habitat management programs and actions to ensure compliance with federal, state, and local regulations, and to ensure that these programs and projects contribute to the health and long-term survival of threatened and endangered species.

Alternative 1 (no action)	Alternative 2 (preferred)	Alternative 3
	• Where practical, the refuge would provide support (e.g., supplies, equipment, housing, and staff) needed to identify and complete recovery actions for listed species.	• Where practical, the refuge would provide support (e.g., supplies, equipment, housing, and staff) needed to identify and complete recovery actions for listed species.
Objective 1.15 White-crowned pigeon		
No management actions specific to white-crowned pigeons other than maintaining hardwood hammock.	Gather data and information necessary for ensuring sustainable white-crowned pigeon populations in and around the refuge in north Key Largo by 2010.	Gather data and information necessary for ensuring sustainable white-crowned pigeon populations in and around the refuge in north Key Largo by 2010.
Strategy: Control invasive exotics found in hardwood hammocks.	*Strategies:* • Determine nesting sites and evaluate their protective status with respect to access by predators and disturbance from recreationists. • Evaluate response of fruit-producing species and pigeon foraging to experimental habitat manipulations on Key Largo.	*Strategies:* • Determine nesting sites and evaluate their protective status with respect to access by predators and disturbance from recreationists. • Evaluate response of fruit-producing species and pigeon foraging to experimental habitat manipulations on Key Largo.
Objective 1.16 Land protection and conservation		
Consider acquiring inholdings if owners contact the refuge and are willing to sell.	Acquire remaining privately owned lands within the refuge acquisition boundary.	Acquire remaining privately owned lands within the refuge acquisition boundary.
Strategy: • Wait for owners of inholdings to contact refuge.	*Strategy:* • Within 2 years of plan adoption, identify privately owned parcels within the refuge acquisition boundary and work with refuge partners to secure funding to acquire those parcels.	*Strategy:* • Within 2 years of plan adoption, identify privately owned parcels within the refuge acquisition boundary and work with refuge partners to secure funding to acquire those parcels.

Alternative 1 (no action)	Alternative 2 (preferred)	Alternative 3
Goal 2. *Develop an education and visitor services program that will benefit refuge visitors and adjacent community school groups.*		
Objective 2.1 Education and visitor services		
The refuge was established as a closed refuge because of the sensitivity of the threatened and endangered species.	The refuge was established as a closed refuge because of the sensitivity of the threatened and endangered species.	By 2008, develop an outdoor informational kiosk and nature trail at the butterfly garden, a refuge general brochure and fact sheet, and two interpretive brochures to increase awareness of Crocodile Lake NWR.
Strategy: • Closed refuge.	*Strategy:* • Closed refuge.	*Strategies:* • Develop interpretive materials to install along nature trails as part of hammock restoration projects. • Maintain and enhance the existing interpretive butterfly garden. • Develop a three-panel kiosk with brochure rack on or off site for public viewing after hours. Panels will have mission specific descriptions about the refuge and the Service. • With assistance from an interpretive writer, develop a threatened and endangered species brochure unique to the refuge. • Develop a refuge specific brochure and fact sheet.

Alternative 1 (no action)	Alternative 2 (preferred)	Alternative 3
Objective 2.2 Education and Visitor Services		
The refuge was established as a closed refuge because of the sensitivity of the threatened and endangered species.	The refuge was established as a closed refuge because of the sensitivity of the threatened and endangered species.	By 2009, provide environmental education off-refuge to local civic groups, schools, and area organizations with existing staff, and by 2009, encourage the refuge friends group or volunteers to support environmental education programs
Strategy: • Closed refuge.	*Strategy:* • Closed refuge.	*Strategies:* • Increase involvement and update local public (School board, Chamber of Commerce) on refuge activities • Increase awareness of Crocodile Lake NWR and the importance of its endangered habitats • Offer educational classes on wildlife observation opportunities and unique features of the area to local communities and civic groups • Develop an exhibit at the nearest Welcome Center featuring Crocodile Lake NWR

Alternative 1 (no action)	Alternative 2 (preferred)	Alternative 3
Goal 3. *Expand on the existing knowledge and database regarding the ecology, biology, and behavior of threatened and endangered species and those factors affecting their status and long-term survival.*		
Objective 3.1 Research		
Allow research on the refuge provided it provides data beneficial to the refuge.	Encourage research on biology and life history of threatened and endangered species, including aspects of reproductive success, productivity, dispersal, and movement patterns.	Encourage research on biology and life history of threatened and endangered species, including aspects of reproductive success, productivity, dispersal, and movement patterns.
Strategy: • Allow research to be conducted on the refuge as long as requests provide data that are useful for refuge management.	*Strategies:* • Coordinate with researchers to conduct research on refuge species. • Provide logistic support for research efforts by supplying equipment, supplies, housing, and limited staff, whenever possible. • Actively solicit research that will fill data gaps about refuge species.	*Strategies:* • Coordinate with researchers to conduct research on refuge species. • Provide logistic support for research efforts by supplying equipment, supplies, housing, and limited staff, whenever possible. • Actively solicit research that will fill data gaps about refuge species.
Objective 3.2 Threatened and endangered species research		
Allow research of threatened and endangered species if beneficial to the refuge.	Encourage research on habitat requirements and preferences of threatened and endangered species.	Encourage research on habitat requirements and preferences of threatened and endangered species.
Strategy: • Allow research of threatened and endangered species to be conducted on the refuge if the research provides data that are useful for refuge management.	*Strategies:* • Coordinate with Ecological Services to conduct research on wildlife habitats utilizing Service biologists, universities, and/or independent researchers. • Provide logistic support for research efforts by supplying equipment, supplies, housing, and limited staff, whenever possible. • Coordinate research with proposed habitat management programs and activities to determine impacts on threatened and endangered species.	*Strategies:* • Coordinate with Ecological Services to conduct research on wildlife habitats utilizing Service biologists, universities, and/or independent researchers. • Provide logistic support for research efforts by supplying equipment, supplies, housing, and limited staff, whenever possible. • Coordinate research with proposed habitat management programs and activities to determine impacts on threatened and endangered species.

Alternative 1 (no action)	Alternative 2 (preferred)	Alternative 3
Objective 3.3 Key Largo woodrat captive breeding		
Currently, the refuge is not active with woodrat captive breeding.	Encourage research on captive breeding of Key Largo woodrats to improve the success of existing and future breeding efforts.	Encourage research on captive breeding of Key Largo woodrats to improve the success of existing and future breeding efforts.
Strategy: • Learn about captive breeding progress occasionally from Ecological Services' updates.	*Strategies:* • Coordinate with Ecological Services to conduct research on woodrat husbandry utilizing Service biologists, universities, and/or independent researchers. • Provide logistic support for research efforts by supplying equipment, supplies, housing, and limited staff, whenever possible.	*Strategies:* • Coordinate with Ecological Services to conduct research on woodrat husbandry utilizing Service biologists, universities, and/or independent researchers. • Provide logistic support for research efforts by supplying equipment, supplies, housing, and limited staff, whenever possible.
Goal 4. *Develop and implement a comprehensive refuge program that includes providing sufficient staff, facilities, equipment, and volunteers to protect and manage the natural resources of the refuge.*		
Objective 4.1 Refuge staffing		
Continue to staff refuge with a refuge manager and periodic interns.	Staff the refuge with a full-time manager, a fulltime biologist, a full-time biological technician, and a seasonal biological technician to implement refuge programs and activities needed to fulfill the goals and objectives of the refuge.	Staff the refuge with a full-time manager, a fulltime biologist, a full-time biological technician, and a seasonal biological technician to implement refuge programs and activities needed to fulfill the goals and objectives of the refuge, plus a visitor services specialist.
Strategy: • Maintain a refuge manager at the refuge.	*Strategies:* • Secure refuge funding for a full-time biologist and a seasonal biological technician. • Provide part-time and seasonal staff to assist with the completion of important refuge programs and activities.	*Strategies:* • Secure refuge funding for a full-time biologist and a seasonal biological technician. • Provide part-time and seasonal staff to assist with the completion of important refuge programs and activities. Secure funding for a full-time visitor services specialist to handle public use trails and interpretation.

Alternative 1 (no action)	Alternative 2 (preferred)	Alternative 3
Objective 4.2 Volunteer program		
Utilize refuge friend's group to help with refuge projects.	Develop and maintain an active volunteer program on the refuge.	Expand volunteer program to take the lead on creating and maintaining visitor use trails, interpretive signs, and visitor contact station.
Strategy: • Continue to work with the refuge friend's group, FAVOR, to provide assistance in managing the existing volunteer program.	*Strategies:* • Continue to work with the refuge friend's group, FAVOR, to provide assistance in the management and growth of the existing volunteer organization. • Develop and implement volunteer projects and activities that not only help fulfill refuge goals and objectives but also instill in the volunteers a sense of pride, accomplishment, and stewardship.	*Strategies:* • Expand the scope of the refuge friend's group to manage visitor services on the refuge. • Train volunteers to qualify them to represent the refuge to visitors. • Continue to work with the refuge friend's group, FAVOR, to provide assistance in the management and growth of the existing volunteer organization. • Develop and implement volunteer projects and activities that not only help fulfill refuge goals and objectives but also instill in the volunteers a sense of pride, accomplishment, and stewardship.

III. Affected Environment

Background information on Crocodile Lake National Wildlife Refuge and a description of the environment affected by the proposed management activities can be found in Section A, Chapter II of the Draft Comprehensive Conservation Plan.

IV. Environmental Consequences

OVERVIEW

Chapter II described three alternatives for achieving the vision, goals, and objectives of the refuge. Alternative 1 is a continuation of existing management; Alternative 2 proposes proactive habitat management; and Alternative 3 proposes to open the refuge to limited public access in addition to proactive management. This section discusses the environmental impacts expected to occur from the implementation of each alternative. Alternative 1 is used as a baseline to which the other two alternatives are compared.

ANTICIPATED IMPACTS

The planning team selected the following six impact topics to analyze based on refuge resources:

GEOLOGY AND SOILS

As described in Chapter II of the Draft Comprehensive Conservation Plan, the geologic formation of the refuge is Key Largo limestone, and the soils consist of five types. All three alternatives would have a neutral or positive impact on the refuge's geology and soils. Management actions center on restoration of habitats that includes grading or filling sites to the proper elevation for wetlands. Proper soil types are used for these actions. Hammock restoration would eventually lead to an increase in the depth of organic soil layers through decomposition of leaf and branch litter.

AIR QUALITY

The Department of the Interior requires agencies under its direction to consider potential air quality and climate change impacts as part of long-range planning. The increase of carbon within the earth's atmosphere has been linked to the gradual rise in surface temperature, commonly referred to as global warming. In relation to comprehensive conservation planning for national wildlife refuges, carbon sequestration constitutes the primary air quality and climate-related impact to be considered in planning. The Department of Energy defines carbon sequestration as "...the capture and secure storage of carbon that would otherwise be emitted to or remain in the atmosphere" (U.S. Department of Energy 1999). Vegetation is a tremendous force in carbon sequestration. Terrestrial biomes of all sorts (e.g., grasslands, wetlands, and forests) are effective in both preventing carbon emission and acting as a biological "scrubber" of atmospheric carbon monoxide. The Department of Energy's report noted that ecosystem protection is important to carbon sequestration and may reduce or prevent loss of carbon currently stored in the terrestrial biosphere.

Preserving natural habitat for fish and wildlife is the heart of any long-range plan for national wildlife refuges. The actions proposed in this plan and environmental assessment would preserve or restore land and water, and would thus enhance carbon sequestration and, subsequently, air quality. This, in turn, contributes positively to efforts to mitigate human-induced global climate changes.

BIOLOGICAL RESOURCES

Water Quality, Wetlands, and Flood Plains. All alternatives would be neutral or positive for water quality. Positive impacts are anticipated from restoring and maintaining wetland function that filters storm water runoff, retains sediment, and minimizes non-point source pollution. The proposed management alternatives are not anticipated to have any adverse effects on the area's wetlands and flood plains, pursuant to Executive Orders 11990 and 11988. Further, the refuge provides protection to lands and waters that would have been developed into commercial and residential uses had the refuge never been established.

Vegetation and Wildlife. All of the alternatives involve habitat enhancement, restoration, and maintenance. Habitats on the refuge would be maintained such that all wildlife would have the best possible habitats to utilize for shelter, foraging, and breeding. Hardwood hammocks are important for migratory birds and other wildlife, and management activities strive to benefit as many species as possible. Restoration projects will carefully consider wildlife needs to guide selection of the most important plant species to provide. Alternative 3 could have a minimal effect since parking areas would need to be made; however, the parking would be in already disturbed areas. Alternative 3 would impact vegetation and wildlife since developing trails would require parking areas and bring a continuing disturbance to birds and wildlife.

Threatened and Endangered Species. The refuge was established under the Endangered Species Act in order to provide habitat for federally listed species. Six threatened and endangered species rely on the refuge for survival. American crocodiles inhabit wetland habitat, while Key Largo woodrats, Key Largo cotton mice, Stock Island tree snails, Schaus swallowtail butterflies, and eastern indigo snakes rely on hardwood hammocks.

All of the alternatives consider the needs of threatened and endangered species above all else. The refuge is closed to public access to minimize disturbance to wildlife, and habitat management actions consider these species first. Alternative 3 is the only alternative that has the potential to impact listed species. Location of nature trails would be selected based on the least amount of impact and in locations that are part of restoration projects. Even though impacts to listed species would be minimal initially, the anticipated increase in tourism to the refuge ultimately could lead to unacceptable disturbance levels.

Research and monitoring of threatened and endangered species is integral to each alternative. In conjunction with the South Florida Ecological Services' Office, the refuge supports research and monitoring of these species. Based on the most recent findings, the refuge adapts management actions as necessary to provide maximum benefit to the species. For example, the proposed development of artificial nesting rubble piles for the Key Largo woodrat stems from recommendations of researchers (South Florida Multi-Species Recovery Plan 1999).

SOCIOECONOMIC ISSUES

The refuge is in north Key Largo, Florida, which is bordered to the north by the exclusive Ocean Reef Club and to the south by Key Largo. The refuge does not directly affect either group of residents because it currently does not have public access. Further, the refuge does not interfere with the public's day-to-day activities. In fact, most people are likely unaware that there is a neighboring refuge.

ENVIRONMENTAL JUSTICE

None of the management alternatives described in this environmental assessment will disproportionately place any adverse environmental, economic, social, or health impacts on minority or low-income populations. Implementation of any action alternative that includes public use and environmental education is anticipated to benefit minority and low-income citizens living in the vicinity of Crocodile Lake National Wildlife Refuge.

TRAFFIC CIRCULATION, VOLUME, AND PARKING

The refuge headquarters has a small parking area and a building that provides office space. There is also a small storage yard and a second trailer that provides housing for refuge interns and researchers. The location of these facilities used to be a trailer park that was barren of habitat. A small piece of the old park became headquarters while the rest of the site has been or is targeted for restoration. Since the refuge is closed to public access, there are not any other locations for parking.

The refuge is bounded by U.S. Highway 1, County Road 905, and Card Sound Road. The state and county maintain their roads and keep traffic flow at required levels. Alternative 3 could affect traffic circulation or volume during the peak tourist season.

Alternatives 1 and 2 would not require any additional parking. Alternative 3 proposes creating nature trails and would need to incorporate parking areas. Parking areas would be located in disturbed areas where possible and designed to reduce impacts. The anticipated result is that the additional parking would have a relatively small negative effect since habitat would be restored around the parking areas.

CUMULATIVE IMPACTS

Each alternative aims to maintain and improve refuge habitats. Cumulative impacts from development projects that existed on refuge lands prior to establishment are targeted to be reduced or eliminated. These included clearing of hardwood hammock and excavation of limestone that left large quarry pits. These areas had the cumulative effect of reducing available habitat in conjunction with other development in Key Largo. All the alternatives will focus management actions on ameliorating past impacts so that the refuge does not contribute to cumulative impacts.

V. Consultation and Coordination

INTRODUCTION

The Crocodile Lake National Wildlife Refuge comprehensive conservation planning process involved a wide variety of participants, including federal, state, university researchers; private non-profit groups; friends of the refuge; and local residents. The diversity and input of participants helped guide development of the plan and this environmental assessment. A core planning team led the planning process, and a biological review team helped develop habitat and wildlife needs.

CORE PLANNING TEAM

The core planning team involved staff from Crocodile Lake Refuge, National Key Deer Refuge, and the Florida Fish and Wildlife Conservation Commission. This team was the primary decision-making team for the comprehensive conservation plan. Key tasks of this group involved defining and refining the vision; identifying, reviewing, and filtering the issues; defining the goals; outlining the alternatives; and providing a reality check. The team members included:

- Phil Frank, Ph.D., Project Leader, National Key Deer Refuge
- Steve Klett, Refuge Manager, Crocodile Lake National Wildlife Refuge
- Van Fischer, Natural Resource Planner, National Key Deer Refuge
- Randy Grau, Manager, Florida Fish and Wildlife Conservation Commission, Florida Keys Wildlife and Environmental Areas

BIOLOGICAL REVIEW TEAM

The biological review team 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 biological review team included:

- Chuck Hunter, Biologist, Fish and Wildlife Service, Region 4
- Dean Demarest, Migratory Birds and State Programs, Fish and Wildlife Service, Region 4
- Laura Brandt, Biologist, A.R.M. Loxahatchee National Wildlife Refuge
- Britta Muiznieks, Biologist, Ecological Services, Fish and Wildlife Service
- Ken Meyer, Ph.D., Researcher, Avian Research and Conservation Institute
- Phil Frank, Ph.D., Project Leader, National Key Deer Refuge
- Steve Klett, Refuge Manager, Crocodile Lake National Wildlife Refuge
- Van Fischer, Natural Resource Planner, National Key Deer Refuge
- Randy Grau, Manager, Florida Fish and Wildlife Conservation Commission, Florida Keys Wildlife and Environmental Areas
- Tom Wilmers, Biologist, National Key Deer Refuge

SECTION C. APPENDICES

I. Glossary

Adaptive Management	A process in which projects are implemented within a framework of scientifically driven experiments to test predictions and assumptions outlined within the comprehensive conservation plan. The analysis of the outcome of project implementation helps managers determine whether current management should continue as is or whether it they should modify it to achieve desired conditions.
Alternative	Alternatives are different means of accomplishing refuge purposes, goals, and objectives and contributing to the National Wildlife Refuge System. An alternative is a reasonable way to fix the identified problem or satisfy the stated need.
Approved Acquisition Boundary	A project boundary that the Director of the Fish and Wildlife Service approves upon completion of the detailed planning and environmental compliance process.
Biological Diversity	The variety of life and its processes, including the variety of living organisms, the genetic differences among them, and the communities and ecosystems in which they occur. The National Wildlife Refuge System focus is on indigenous species, biotic communities, and ecological processes.
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.
Canopy	A layer of foliage; generally, the upper-most layer in a forest stand. It can 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).
Categorical Exclusion	A category of actions that do not individually or cumulatively have a significant effect on the human environment and have been found to have no such effect in procedures adopted by a federal agency pursuant to the National Environmental Policy Act of 1969.
CFR	Code of Federal Regulations.

Compatible Use	A wildlife-dependent recreational use or any other use of a refuge that, in the sound professional judgment of the Refuge Manager, will not materially interfere with, or detract from, the fulfillment of the mission or the purposes of the refuge. A compatibility determination supports the selection of compatible uses and identifies stipulations or limits necessary to ensure compatibility.
Comprehensive Conservation Plan	A document that describes the desired future conditions of the refuge; provides long-range guidance and management direction for the Refuge Manager to accomplish the purposes, goals, and objectives of the refuge; and contributes to the mission of the National Wildlife Refuge System and meet relevant mandates.
Conservation Easement	A legal document that provides specific land-use rights to a secondary party. A perpetual conservation easement usually grants conservation and management rights to a party in perpetuity.
Cooperative Agreement	A simple habitat protection action in which no property rights are acquired. An agreement is usually long-term and either party can modify it. Lands under a cooperative agreement do not necessarily become part of the National Wildlife Refuge System.
Corridor	A route that allows movement of individuals from one region or place to another.
Cover Type	The present vegetation of an area.
Cultural Resources	The remains of sites, structures, or objects used by people of the past.
Deciduous	Pertaining to perennial plants that are leafless for sometime during the year.
Ecological Succession	The orderly progression of an area through time in the absence of disturbance from one vegetative community to another.
Ecosystem	A dynamic and interrelating complex of plant and animal communities and their associated non-living environment.
Ecosystem Management	Management of natural resources using system-wide concepts to ensure that all plants and animals in ecosystems are maintained at viable levels in native habitats and basic ecosystem processes are perpetuated indefinitely.
Environmental Health	The composition, structure, and functioning of soil, water, air, and other abiotic features comparable with historic conditions, including the natural abiotic processes that shape the environment.

Endangered Species	A plant or animal species listed under the Endangered Species Act that is in danger of extinction throughout all or a significant portion of its range.
Endemic Species	Plants or animals that occur naturally in a certain region and whose distribution is relatively limited to a particular locality.
Environmental Assessment	A concise document, prepared in compliance with the National Environmental Policy Act, that briefly discusses the purpose and need for an action, alternatives to such action, and provides sufficient evidence and analysis of impacts to determine whether to prepare an environmental impact statement or finding of no significant impact.
Fauna	All the vertebrate or invertebrate animals of an area.
Federal Trust Species	All species where the Federal Government has primary jurisdiction including federally threatened or endangered species, migratory birds, anadromous fish, and certain marine mammals.
Fee-title	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, the seller may reserve certain rights or sell them, 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 seller's life).
Finding of No Significant Impact	A document prepared in compliance with the National Environmental Policy Act, supported by an environmental assessment, that briefly presents why a federal action will have no significant effect on the human environment and for which the agency will not prepare an environmental impact statement.
Fragmentation	The process of reducing the size and connectivity of habitat patches. The disruption of extensive habitats into isolated and small patches.
Goal	Descriptive, open-ended, and often broad statements of desired future conditions that convey a purpose but does not define measurable units.
Geographic Information System	A computer system capable of storing and manipulating spatial data.
Ground Story (flora)	Vascular plants less than one meter in height, excluding tree seedlings.

Habitat	The place where an organism lives. The existing environmental conditions required by an organism for survival and reproduction.
Hardwood Hammock	Forests comprised of hardwood plants of predominately West Indian origin. Species include gumbo limbo, mahogany, Spanish stopper, and Jamaica dogwood.
Herbaceous Wetland	Annually or seasonally inundated with vegetation consisting primarily of grasses, sedges, rushes, and cattail.
Historic Conditions	These are the composition, structure, and functioning of ecosystems resulting from natural processes that we believe, based on sound professional judgment, were present prior to substantial human related changes to the landscape.
Indicator Species	A species of plant or animals that is assumed to be sensitive to habitat changes and represents the needs of a larger group of species.
In-holding	Privately owned land inside the boundary of a national wildlife refuge.
Issue	Any unsettled matter that requires a management decision.
Migratory	The seasonal movement from one area to another and back.
Monitoring	The process of collecting information to track changes of selected parameters over time.
National Environmental Policy Act	Requires all agencies, including the Service, to examine the environmental impacts of their actions, incorporate environmental information, and use public participation in the planning and implementation of all actions. Federal agencies must integrate this Act with other planning requirements, and prepare appropriate policy documents to facilitate better environmental decision making.
National Wildlife Refuge	A designated area of land, water, or an interest in land or water within the National Wildlife Refuge System.
National Wildlife Refuge System	Various categories of areas administered by the Secretary of the Interior for the conservation of fish and wildlife, including species threatened with extinction, all lands, waters, and interests therein administered by the Secretary as wildlife refuges, wildlife ranges, game ranges, wildlife management areas, or waterfowl production areas.
Native Species	Species that normally live and thrive in a particular ecosystem.
Neotropical Migratory Bird	A bird species that breeds north of the United States/Mexican border and winters primarily south of that border.

Objective	An objective is a concise quantitative (where possible) target statement of what a plan will achieve. The planners derive objectives from goals and they provide the basis for determining management strategies. Objectives should be attainable and time-specific.
Planning Area	A planning area may include lands outside existing planning unit boundaries that are being studied for inclusion in the unit and/or partnership planning efforts. It may also include watersheds or ecosystems that affect the planning area.
Planning Team	A planning team prepares the comprehensive conservation plan. Planning teams are interdisciplinary in membership and function. A team generally consists of the a planning team leader; refuge manager and staff biologists; staff specialists or other representatives of Service programs, ecosystems or regional offices; and state partnering wildlife agencies as appropriate.
Preferred Alternative	The alternative determined by the decision-maker to best achieve the refuge purpose, vision, and goals; contributes to the refuge system mission, addresses the significant issues; and is consistent with principles of sound fish and wildlife management.
Purpose of the Refuge	The purpose of the refuge is specified in or derived from the law, proclamation, Executive Order, agreement, public land order, donation document, or administrative memorandum establishing, authorizing, or expanding a refuge and refuge unit.
Refuge Operating Needs System	A national database that contains the unfunded operational needs of each refuge. Projects included are those required to implement approved plans and meet goals, objectives, and legal mandates.
Refuge Purposes	The purposes specified in or derived from the law, proclamation, executive order, agreement, public land order, donation document, or administrative memorandum establishing, authorizing, or expanding a refuge, refuge unit, or refuge subunit.
Step-down Management Plans	Step-down management plans provide the details necessary to implement management strategies and projects identified in the comprehensive conservation plan.
Strategy	A specific action, tool, or technique or combination of actions, tools, and techniques used to meet unit objectives.
Threatened Species	Species listed under the Endangered Species Act that are likely to become endangered within the foreseeable future throughout all or a significant portion of their range.

Trust Species	Species for which the Fish and Wildlife Service has primary responsibility, including most federally listed threatened and endangered species, anadromous fish once they enter the inland coastal waterways, and migratory birds.
Understory	Any vegetation with canopy below or closer to the ground than canopies of other plants.
Wildlife Corridor	A landscape feature that facilitates the biologically effective transport of animals between larger patches of habitat dedicated to conservation functions. Such corridors may facilitate several kinds of traffic, including frequent foraging movement, seasonal migration, or the once in a lifetime dispersal of juvenile animals. These are transition habitats and need not contain all the habitat elements required by migrants for long-term survival or reproduction.
Wildlife-dependent Recreation	A use of a refuge involving hunting, fishing, wildlife observation, wildlife photography and environmental education and interpretation. The National Wildlife Refuge System Improvement Act of 1997 specifies that these are the six priority general public uses of the system.

II. References

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III. Relevant Legal Mandates

NATIONAL WILDLIFE REFUGE SYSTEM AUTHORITIES

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

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

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

KEY LEGISLATION/POLICIES FOR PLAN IMPLEMENTATION

The Crocodile Lake National Wildlife Refuge Comprehensive Conservation Plan describes and illustrates management-area projects with standards and guidelines for future decision-making, and may be adjusted through monitoring and evaluation as well as amendment and revision. The plan establishes conservation and land protection goals, objectives, and specific strategies for the refuge. This plan provides for systematic stepping down from the overall direction, as outlined, when making management decisions. This level involves site-specific analysis to meet National Environmental Policy Act requirements for decision-making.

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

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

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

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

Historic Sites, Buildings and Antiquities Act (16 U.S.C. 461-462, 464-467): The Act of August 21, 1935, (49 Stat. 666) popularly known as the Historic Sites Act, as amended by Public Law 89-249, approved October 9, 1965, (79 Stat. 971), declared it a national policy to preserve historic sites and objects of national significance, including those located on refuges. It provided procedures for designation, acquisition, administration and protection of such sites. Among other things, National Historic and Natural Landmarks are designated under authority of this Act. As of January 1989, 31 national wildlife refuges contained such sites.

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

Land and Water Conservation Fund Act of 1948: This act provides funding through receipts from the sale of surplus federal land, appropriations from oil and gas receipts from the outer continental shelf, and other sources of land acquisition under several authorities. Appropriations from the fund may be used for matching grants to states for outdoor recreation projects and for land acquisition by various federal agencies, including the Fish and Wildlife Service.

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

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

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

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

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

Refuge Recreation Act of 1962: This Act authorizes the Secretary of the Interior to administer refuges, hatcheries, and other conservation areas for recreational use, when such uses do not interfere with the area's primary purposes. It authorizes construction and maintenance of recreational facilities and the acquisition of land for incidental fish and wildlife oriented recreational development or protection of natural resources. It also authorizes the charging of fees for public uses.

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

National Historic Preservation Act of 1966 (16 U.S.C. 470-470b, 470c-470n): Public Law 89-665, approved October 15, 1966, (80 Stat. 915) and repeatedly amended, provided for preservation of significant historical features (buildings, objects and sites) through a grant-in-aid program to the states. It established a National Register of Historic Places and a program of matching grants under the existing National Trust for Historic Preservation (16 U.S.C. 468-468d). The Act established an Advisory Council on Historic Preservation, which was made a permanent independent agency in Public Law 94-422, approved September 28, 1976 (90 Stat. 1319). That Act also created the Historic Preservation Fund. Federal agencies are directed to take into account the effects of their actions on items or sites listed in, or eligible for listing in, the National Register of Historic Places. As of January 1989, 91 such sites on national wildlife refuges are listed in this Register.

National Wildlife Refuge System Administration Act of 1966 as amended by the National Wildlife Refuge System Improvement Act of 1997, 16 U.S.C. 668dd-668ee (Refuge Administration Act): Defines the National Wildlife Refuge System and authorizes the Secretary of the Interior to permit any use of a refuge provided such use is compatible with the major purposes for which the refuge was established. The Refuge Improvement Act clearly defines a unifying mission for the refuge system; establishes the legitimacy and appropriateness of the six priority public uses (hunting, fishing, wildlife observation, wildlife photography and environmental education and interpretation); establishes a formal process for determining compatibility; established the responsibilities of the Secretary of the Interior for managing and protecting the System; and requires a Comprehensive Conservation Plan for each refuge by the year 2012. This Act amended portions of the Refuge Recreation Act and National Wildlife Refuge System Administration Act of 1966.

National Environmental Policy Act (1969): Title I of the 1969 National Environmental Policy Act requires that all federal agencies prepare detailed environmental impact statements for “every recommendation or report on proposals for legislation and other major federal actions significantly affecting the quality of the human environment.” The 1969 statute stipulated the factors to be considered in environmental impact statements, and required that federal agencies employ an interdisciplinary approach in related decision-making and develop means to ensure that unquantified environmental values are given appropriate consideration, along with economic and technical considerations. Title II of this statute requires annual reports on environmental quality from the President to the Congress, and established a Council on Environmental Quality in the Executive Office of the President with specific duties and functions.

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

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

Executive Order 11988, Flood plain Management: The purpose of this Executive Order, signed May 24, 1977, is to prevent federal agencies from contributing to the "adverse impacts associated with occupancy and modification of floodplains" and the "direct or indirect support of flood plain development." In the course of fulfilling their respective authorities, federal agencies "shall take action to reduce the risk of flood loss, to minimize the impact of floods on human safety, health and welfare, and to restore and preserve the natural and beneficial values served by flood plains."

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

Fish and Wildlife Improvement Act of 1978: This Act was passed to improve the administration of fish and wildlife programs and amends several earlier laws, including the Refuge Recreation Act, the National Wildlife Refuge System Administration Act, and the Fish and Wildlife Act of 1956. It authorizes the Secretary of the Interior to accept gifts and bequests of real and personal property on behalf of the United States. It also authorizes the use of volunteers on Service projects and appropriations to carry out volunteer programs.

Archaeological Resources Protection Act (16 U.S.C. 470aa - 47011): Public Law 96-95, approved October 31, 1979, (93 Stat. 721) largely supplanted the resource protection provisions of the Antiquities Act for archaeological items. This Act established detailed requirements for issuance of permits for any excavation for or removal of archaeological resources from Federal and Indian lands.

It also established civil and criminal penalties for the unauthorized excavation, removal, or damage of any such resources; for any trafficking in such resources removed from Federal and Indian lands in violation of any provision of federal law; and for interstate and foreign commerce in such resources acquired, transported, or received in violation of any state or local law. Public Law 100-588, approved November 3, 1988, (102 Stat. 2983) lowered the threshold value of artifacts triggering the felony provisions of the Act from $5,000 to $500, made attempting to commit an action prohibited by the Act a violation, and required the land managing agencies to establish public awareness programs regarding the value of archaeological resources to the nation.

Emergency Wetland Resources Act of 1986: This Act authorized the purchase of wetlands from the Land and Water Conservation Fund, removing a prior prohibition on such acquisitions. The Act also requires the Secretary of the Interior to establish a National Wetlands Priority Conservation Plan, requires states to include wetlands in their Comprehensive Outdoor Recreation Plans, and transfers to the Migratory Bird Conservation Fund an amount equal to import duties on arms and ammunition. Executive Order 12996, Management and General Public Use of the National Wildlife Refuge System (1996): Defines the mission, purpose, and priority public uses of the National Wildlife Refuge System. It also presents four principles to guide management of the system.

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

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

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

Americans with Disabilities Act (1991): Prohibits discrimination in public accommodations and services.

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

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

IV. Public Involvement

PUBLIC SCOPING

A public scoping meeting was held on September 3, 2003, to solicit comments from the public regarding Crocodile Lake NWR. The meeting provided information about current refuge management and the CCP planning process. The meeting was well attended and many comments were received in the following weeks.

Comment forms were made available at the scoping meeting and at the refuge headquarters. An October 2003 refuge planning update newsletter was also sent to individuals on the refuge mailing list that provided another opportunity for submitting comments. Comments were received via email, facsimile, and traditional mail.

Comments received are summarized below. On the whole, comments were supportive of the refuge and management actions. These comments were used by the planning team to help guide development of the goals, objectives, and strategies found in the comprehensive conservation plan.

- The needs of threatened and endangered species should get first priority.
- Continue invasive exotic plant control.
- Continue fire ant control.
- Continue feral cat control on the refuge.
- Acquire the remaining private land within the refuge acquisition boundary.
- Keep refuge closed to public use
- Add a staff position for habitat management and restoration.
- Seek additional funding for refuge restoration projects.
- Maintain a good working relationship with the State of Florida.
- Strengthen the volunteer program to assist with refuge projects.
- Prevent extinction of endangered species.
- Continue and increase monitoring of refuge wildlife.
- Is it time to start a captive breeding program for the Key Largo cotton mouse?

V. Compatibility Determinations

DRAFT CROCODILE LAKE COMPATIBILITY DETERMINATIONS

Introduction

A compatibility determination documents the formal procedure used to determine if existing and proposed uses of national wildlife refuges are compatible with the purpose of each refuge and the mission of the National Wildlife Refuge System. Under the National Wildlife Refuge System Administration Act of 1966, the Refuge Recreation Act of 1962, and the National Wildlife Refuge System Improvement Act of 1997, the Service may not permit public recreational uses on national wildlife refuges unless the uses are determined to be compatible.

All lands of the National Wildlife Refuge System will be managed in accordance with an approved comprehensive conservation plan that guides management by identifying goals, objectives, and strategies that will ultimately achieve refuge purposes. Crocodile Lake NWR was established as a closed refuge because of the sensitivity to disturbance of the threatened and endangered species inhabiting the area. Thus, general public access to the refuge is not allowed except for the butterfly garden located at the refuge headquarters. Research of refuge resources is an ongoing priority and is allowed when it furthers knowledge of the refuge.

The compatibility determinations that follow adhere to the Fish and Wildlife Service Manual for evaluating uses (Standard Exhibit 2, 603 FW 2).

Refuge Name: Crocodile Lake National Wildlife Refuge

Establishing and Acquisition Authorities: Endangered Species Act of 1973 (Public Law 93-205, 87 Stat. 884) as amended, Land and Water Conservation Act as amended in 1976 (Public Law 94-422), and the Fish and Wildlife Act of 1956.

Refuge Purposes: ... 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).

... 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)

Refuge Uses: Crocodile Lake NWR has researched and collected data about refuge resources for many years. The refuge supports these activities and encourages long-term research studies. Research and monitoring is vital to the refuge and has negligible impacts to refuge resources.

An interpretive butterfly garden was created at the refuge headquarters to provide a glimpse of the refuge to visitors. The garden contains native plants that attract butterflies and illustrates many plants found in the surrounding hardwood hammock. The garden resulted in a gain of habitat by restoring a previously scarified area adjacent to the headquarters. Also, the garden provides educational materials and directs visitors to the neighboring state park that has several nature trails that traverse the same habitat types that are found in the refuge.

Public Review and Comment: A compatibility determination has been prepared for the following uses:

- Research and monitoring
- Environmental education and interpretation

Description of Use
Research and Monitoring

This use would allow university researchers, non-governmental researchers, and government scientists access to the refuge to conduct both short- and long-term research projects. Efforts would be made to expand partnerships to increase research associated with recovery of threatened and endangered species. All scientific research and monitoring on the refuge would be covered by this use.

Availability of Resources
No additional fiscal resources would be needed to conduct this use. The existing refuge manager can administer permits and monitor use as part of routine management duties.

Anticipated Impacts of Use
The outcome of research uses of the refuge would result in an increased knowledge and understanding of refuge resources. New information and current data would help guide management actions to adapt to changing conditions and needs of the resources. The anticipated impacts are minimal and should not adversely affect any species or habitats as a whole. Research projects are designed to minimize disturbance to organisms and the surrounding environment while addressing management needs. The increase of knowledge and continuation of long-term status and trends data are important and benefits the refuge.

Determination (Check One Below)
___ Use is Not Compatible
_X_ Use is Compatible with following stipulations

Stipulations Necessary to Ensure Compatibility
Scientific research and monitoring would be evaluated and modifications to proposals would be made, when needed, prior to issuance of a special use permit to prevent of minimize disturbance to wildlife. The final decision to issue a permit to conduct research and monitoring should be left to the discretion of the project leader and refuge manager.

Research projects involving federally-listed species would be critically reviewed prior to issuance of a special use permit. A Section 7 Biological Evaluation would be conducted through USFWS Ecological Services to review the proposed research and determine effects on listed species. Permits from Ecological Services would be required prior to starting research.

Justification
Scientific research and monitoring have been conducted on refuges since the inception of the National Wildlife Refuge System. Annually, three to five projects are conducted at Crocodile Lake NWR with no long-term impacts to the species studied or associated habitats. The basis for most refuge habitat management practices is distilled from research, and long-term monitoring of many species is necessary to evaluate status and trends. The refuge protects unique habitats that allow for studies of plants and animals that could not be conducted elsewhere. Conservation and management of many organisms on the refuge and elsewhere will depend upon future research and monitoring.

Mandatory 10-15-year re-evaluation_____

Description of Use
Environmental Education and Interpretation

Environmental education and interpretation would include activities that seek to increase public knowledge and understanding of wildlife and contribute to wildlife conservation. The butterfly garden provides an opportunity to educate people about refuge resources and the National Wildlife Refuge System while causing negligible disturbance to the refuge. Students would also be able to use the garden for field-trips and outdoor learning experiences.

Availability of Resources
The butterfly garden is maintained by the refuge friend's group and the refuge manager. The garden requires general upkeep that has minimal associated costs. Updates to interpretive materials would occur as budget funding and educational grants are obtained.

Anticipated Impacts of Use
The butterfly garden is located adjacent to the refuge headquarters and parking area. The location was a scarified area that had no habitat value prior to the planting of the garden. As such, the garden has created habitat that is used by many species of butterflies and other insects. Given the location of the garden, the occasional visitors and student groups do not adversely impact the refuge any more than the existing headquarters and parking area. The creation of the garden was actually a benefit to the area.

Determination (Check One Below)
___ Use is Not Compatible
_X_ Use is Compatible with Following Stipulations

Stipulations Necessary to Ensure Compatibility
The only area of the refuge open to general public use would be the butterfly garden located at the refuge headquarters. Access to other parts of the refuge may be allowed only with refuge staff conducting a tour. Any staff-led tours would be conducted to minimize disturbance to habitats and wildlife.

Justification
Crocodile Lake NWR is a closed refuge that exists in the very busy tourist destination of the Florida Keys. Even though the refuge is closed, there are visitors each year who arrive and want to learn more about the refuge. The butterfly garden was developed to fill the need for education and interpretation about the refuge to interested visitors. The garden has had a positive response from the local community too as evidenced by a greater understanding of the refuge and the habitats it protects.

Mandatory 10-15-year re-evaluation_____

Approval of Compatibility Determinations

This approval is for the preceding compatibility determinations considered within the comprehensive conservation plan for Crocodile Lake NWR.

Project Leader:	_____ Signature	_____ Date
Refuge Manager:	_____ Signature	_____ Date
Regional Compatibility Coordinator:	_____ Signature	_____ Date
Refuge Supervisor:	_____ Signature	_____ Date
Regional Chief:	_____ Signature	_____ Date

VI. Section 7 Intra-Service Consultation

INTRA-SERVICE SECTION 7 BIOLOGICAL EVALUATION FORM

Originating Person: Dr. Phil Frank, PhD, Project Leader, Florida Keys National Wildlife Refuges

Telephone Number: 305-872-2239 **E-Mail:** phil_frank@fws.gov

Date: April 7, 2005

PROJECT NAME (Grant Title/Number): Crocodile Lake National Wildlife Refuge Comprehensive Conservation Plan

I. Service Program:

___ Ecological Services

___ Federal Aid

___ Clean Vessel Act

___ Coastal Wetlands

___ Endangered Species Section 6

___ Partners for Fish and Wildlife

___ Sport Fish Restoration

___ Wildlife Restoration

___ Fisheries

_X_ Refuges/Wildlife

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

III. Station Name: Crocodile Lake National Wildlife Refuge

IV. Description of Proposed Action (attach additional pages as needed): Authorization of the Comprehensive Conservation Plan for Crocodile Lake National Wildlife Refuge by adopting the preferred alternative. Prior to implementation of identified management actions that affect listed species, the refuge will consult with Ecological Services. The Crocodile Lake CCP is intended to serve as a guidance document for future management of the refuge.

V. Pertinent Species and Habitat:

A. Include species/habitat occurrence map: American crocodile, Key Largo woodrat, Key Largo cotton mouse, Schaus swallowtail butterfly, Stock Island tree snail, Eastern indigo snake.

B. Complete the following table:

Species/Critical Habitat	Status[1]
American crocodile	E
Key Largo woodrat	E
Key Largo cotton mouse	E
Schaus swallowtail butterfly	E
Stock Island tree snail	T
Eastern indigo snake	T

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

VI. Location (attach map):

A. Ecoregion Number and Name: South Florida Ecosystem

B. County and State: Monroe County, Florida

C. Section, township, and range (or latitude and longitude): Sections T 58 S, T 59 S, and T 60 S; Ranges R 39 E, R 40 E, and R 41 E.

D. Distance (miles) and direction to nearest town:

E. Species/habitat occurrence:

VII. Determination of Effects:

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

Species/Critical Habitat	Impacts to Species/Critical Habitat
American Crocodile	Authorization of the CCP and selection of the preferred alternative will have no effect on T&E species. ESA consultation will be initiated separately for implementation of any management actions that may affect T&E species.
Key Largo woodrat	Authorization of the CCP and selection of the preferred alternative will have no effect on T&E species. ESA consultation will be initiated separately for implementation of any management actions that may affect T&E species.
Key Largo cotton mouse	Authorization of the CCP and selection of the preferred alternative will have no effect on T&E species. ESA consultation will be initiated separately for implementation of any management actions that may affect T&E species.
Schaus swallowtail butterfly	Authorization of the CCP and selection of the preferred alternative will have no effect on T&E species. ESA consultation will be initiated separately for implementation of any management actions that may affect T&E species.
Stock Island tree snail	Authorization of the CCP and selection of the preferred alternative will have no effect on T&E species. ESA consultation will be initiated separately for implementation of any management actions that may affect T&E species.
Eastern indigo snake	Authorization of the CCP and selection of the preferred alternative will have no effect on T&E species. ESA consultation will be initiated separately for implementation of any management actions that may affect T&E species.

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

Species/Critical Habitat	Actions to mitigate/minimize impacts
American Crocodile Key Largo woodrat Key Largo cotton mouse Schaus swallowtail butterfly Stock Island tree snail Eastern indigo snake	No mitigation is required at this stage of the CCP since authorization of the CCP will not affect T&E species. Prior to implementing CCP actions that may affect T&E species, ESA consultation will occur.

VIII. Effect Determination and Response Requested:

Species/Critical Habitat	Determination[1]			Response Requested[1]
	NE	NA	AA	
American Crocodile	X			Concurrence
Key Largo woodrat	X			Concurrence
Key Largo cotton mouse	X			Concurrence
Schaus swallowtail butterfly	X			Concurrence
Stock Island tree snail	X			Concurrence
Eastern indigo snake	X			Concurrence

[1]DETERMINATION/RESPONSE REQUESTED:

NE = no effect. This determination is appropriate when the proposed action will not directly, indirectly, or cumulatively impact, either positively or negatively, any listed, proposed, candidate species or designated/proposed critical habitat. Response Requested is optional, but a "Concurrence" is recommended for a complete Administrative Record.

NA = not likely to adversely affect. This determination is appropriate when the proposed action is not likely to adversely impact any listed, proposed, candidate species or designated/proposed critical habitat or there may be beneficial effects to these resources. Response Requested is a "Concurrence."

AA = likely to adversely affect. This determination is appropriate when the proposed action is likely to adversely impact any listed, proposed, candidate species or designated/proposed critical habitat. Response Requested for listed species is "Formal Consultation." Response requested for proposed and candidate species is "Conference."

_____ _____

Signature (originating station) **Date**

_____

Title

IX. Reviewing Ecological Services Office Evaluation:

A. Concurrence _____ Non-concurrence _____

B. Formal consultation required _____

C. Conference required _____

D. Informal conference required _____

E. Remarks (attach additional pages as needed):

_____ _____

Signature **Date**

_____ _____

Title **Office**

VII. Refuge Biota

FLORIDA KEYS NWR BIRD LIST

Seasonal appearance:
Spring - March to May
Summer - June to August
Fall - September to November
Winter - December to February

Seasonal abundance:
c - common: commonly observed in proper habitat
u - uncommon: uncommonly observed in proper habitat
r - rare: rarely observed
o - occasional: observed fewer than ten times
* - confirmed breeding in checklist area

Species	Spring	Summer	Fall	Winter
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 (Key West Specimen)	-	-	o	-
TROPICBIRDS				
White-tailed Tropicbird	o	-	-	-
BOOBIES AND GANNETS				
Masked Booby	o	-	o	o
Brown Booby	r	r	r	r
Northern Gannet	r	-	r	u
PELICANS				
American White Pelican	-	r	r	r
Brown Pelican*	c	c	c	C
DARTERS AND CORMORANTS				

Species	Spring	Summer	Fall	Winter
Double-crested Cormorant*	c	c	c	c
Anhinga	u	r	u	u
FRIGATEBIRDS				
Magnificent Frigatebird	c	c	c	c
BITTERNS, HERONS, EGRETS AND ALLIES				
American Bittern	o	-	-	-
Least Bittern*	r	r	r	r
Great Blue Heron (dark morph)*	c	c	c	c
Great Blue Heron (light morph)*	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
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

Species	Spring	Summer	Fall	Winter
Ring-necked Duck	u	-	u	u
Lesser Scaup	u	-	u	u
Oldsquaw	-	-	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	r	-	r	r
Red-shouldered Hawk*	u	u	u	u
Broad-winged Hawk	c	-	c	c
Short-tailed Hawk	r	-	c	r
Swainson's Hawk	r	-	c	r
Red-tailed Hawk	r	-	r	r
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	o	o	o	O
PLOVERS				
Black-bellied Plover	c	u	c	c
American Golden Plover	r	-	r	r

Species	Spring	Summer	Fall	Winter
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	-
STILT 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
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
Ring-billed Gull	c	r	c	c
Herring Gull	u	r	c	c

Species	Spring	Summer	Fall	Winter
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*	c	-	c	c
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	-	-	-	c
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*	c	c	c	c
Inca Dove (nested 1963-80, Key West, probably extirpated)	o	-	-	-
Ruddy Quail-Dove (1 captured, Key West)	o	-	-	-
Scaly-naped Pigeon (2 specimens, Key West)	o	-	o	-
CUCKOOS AND ANIS				
Black-billed Cuckoo	r	-	r	-
Yellow-billed Cuckoo*	u	u	u	-
Mangrove Cuckoo*	u	u	r	r
Smooth-billed Ani	r	r	r	r
OWLS				
Barn Owl	-	-	o	o
Eastern Screech-Owl	o	-	-	-
Burrowing Owl	o	-	o	o
Barred Owl	-	o	-	-

Species	Spring	Summer	Fall	Winter
Long-eared Owl	-	-	o	-
Short-eared Owl	-	o	-	-
GOATSUCKERS				
Common Nighthawk*	c	c	c	-
Antillean Nighthawk*	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
Great Crested Flycatcher*	u	u	u	u
LaSagra's Flycatcher	-	o	-	-
Brown-crested Flycatcher	o	-	-	o
Loggerhead Kingbird	o	-	-	-
Western Kingbird	u	-	u	u
Eastern Kingbird	c	c	c	-
Gray Kingbird*	c	c	c	c
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
SWALLOWS (continued)				
Bank Swallow	r	-	r	r
Cave Swallow	o	-	-	-

Species	Spring	Summer	Fall	Winter
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 AND THRUSHES				
Ruby-crowned Kinglet	-	-	-	o
Blue-gray Gnatcatcher	c	u	c	c
Veery	r	u	-	-
Gray-cheecked Thrush	r	r	-	-
Swainson's Thrush	r	u	-	-
Hermit Thrush	-	-	-	o
Wood Thrush	r	-	r	-
American Robin	r	-	r	r
MOCKINGBIRDS AND 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	-	-	-	o
STARLINGS				
European Starling*	c	c	c	c
VIREOS				
White-eyed Vireo	c	c	c	c
Bell's Vireo	-	-	o	-
Solitary 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	-
WOOD WARBLERS				
Blue-winged Warbler	r	-	r	r

Species	Spring	Summer	Fall	Winter
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 Race)*	u	u	u	u
Chestnut-sided Warbler	o	-	o	-
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	o	c
Palm Warbler	o	-	o	o
Bay-breasted Warbler	o	-	o	-
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	o	-	o	o
Ovenbird	c	-	c	u
Northern 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	-

Species	Spring	Summer	Fall	Winter
Indigo Bunting	u	-	c	r
Painted Bunting	u	-	u	u
Dickcissel	o	-	o	o
SPARROWS				
Rufous-sided Towhee	-	-	-	o
Chipping Sparrow	-	-	o	o
Clay-colored Sparrow	-	-	o	o
Vesper Sparrow	o	-	-	o
Lark Sparrow	-	-	o	o
Savannah Sparrow	u	-	u	u
Grasshopper Sparrow	r	-	r	r
Le Conte's Sparrow	-	-	-	o
Sharp-tailed Sparrow	-	-	-	o
Swamp Sparrow	-	-	r	r
White-crowned Sparrow	-	-	-	o
Dark-eyed Junco	o	-	-	o
BLACKBIRDS AND ORIOLES				
Bobolink	c	-	c	-
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	-
Northern Oriole (bred once, Key West)	c	-	c	u
FINCHES				
Pine Siskin (irruptive)	r	-	r	r
American Goldfinch	-	-	c	u
WEAVERS				
House Sparrow*	c	c	c	c

LIST OF LEGALLY PROTECTED ANIMAL SPECIES IN THE FLORIDA KEYS

Taxon/Common Name	Scientific Name	State Status[a]	Federal Status[a]
Fish			
Key silverside	*Menidia conchorum*	T	
Rivulus	*Rivulus marmoratus*	SSC	

Taxon/Common Name	Scientific Name	State Status[a]	Federal Status[a]
Key blenny	*Starksia starcki*	SSC	
Amphibians and Reptiles			
American crocodile	*Crocodylus acutus*	E	E
American alligator	*Alligator mississippiensis*	SSC	T(S/A)
Atlantic loggerhead turtle	*Caretta caretta caretta*	T	T
Atlantic green turtle	*Chelonia mydas mydas*	E	E
Atlantic hawksbill turtle	*Eretmochelys imbricata imbricata*	E	E
Leatherback turtle	*Dermochelys coriacea*	E	E
Atlantic ridley turtle	*Lepidochelys kempi*	E	E
Key striped mud turtle	*Kinosternon bauri bauri*	E	
Eastern indigo snake	*Drymarchon corais couperi*	T	T
Big Pine Key ringneck snake	*Diadophis punctatus acricus*	T	
Florida brown snake	*Storeria dekayi victa*	T*	
Florida ribbon snake	*Thamnophis sauritus sackeni*	T*	
Miami black-headed snake	*Tantilla oolitica*	T	
Red rat snake	*Elaphe guttata guttata*	SSC*	
Florida Keys mole skink	*Eumeces egregius egregius*	SSC	
Birds			
Roseate spoonbill	*Ajaia ajaja*	SSC	
Burrowing owl	*Speotyto cunicularia*	SSC	
Southeastern snowy plover	*Charadrius alexandrinus tenuirostric*	T	
Piping plover	*Charadrius melodus*	T	UR1
White-crowned pigeon	*Columba leucocephala*	T	
Little blue heron	*Egretta caerulea*	SSC	
Birds (continued)			
Reddish egret	*Egretta rufescens*	SSC	
Snowy egret	*Egretta thula*	SSC	
Tricolored heron	*Egretta tricolor*	SSC	
Wood stork	*Mycteria americana*	E	E
Brown pelican	*Pelecanus occidentalis*	SSC	

Taxon/Common Name	Scientific Name	State Status[a]	Federal Status[a]
Least tern	*Sterna antillarum*	T	
Roseate tern	*Sterna dougallii*	T	
Black skimmer	*Rynchops niger*	SSC	
White ibis	*Eudocimus albus*	SSC	
Southeastern American kestrel	*Falco sparverius paulus*	T	
Bald eagle	*Haliaeetus leucocephalus*	T	E
Arctic peregrine falcon	*Falco peregrinus tundrius*	E	T
Mammals			
Key deer	*Odocoileus virginianus clavium*	E	E
Lower Keys marsh rabbit	*Sylvilagus palustris hefneri*	E	E
Silver rice rat	*Oryzomys argentatus*	E	
Key Largo woodrat	*Neotoma floridana smalli*	E	E
Key Largo cotton mouse	*Peromyscus gossypinus allapaticola*	E	E
West Indian manatee	*Trichechus manatus latirostris*	E	E
Invertebrates[b]			
Schaus' swallowtail butterfly	*Heraclides aristodemus ponceanus*	E	E
Florida tree snail	*Liguus fasciatus*	SSC	
Stock Island tree snail	*Orthalicus reses reses*	E	T

[a] E = endangered; T = threatened; T(S/A) = threatened due to similarity of appearance; SSC = species of special concern.
Note: an asterisk (*) indicates that the listing only is applicable to the Lower Keys.
[b] Excludes corals.

TERRESTRIAL INDICATOR SPECIES OF THE FLORIDA KEYS

Terrestrial Indicator Species: Species were identified as candidates for monitoring because they are (1) indicator species for good habitat quality in the major Keys habitat types, (2) occur in habitats subjected to development, (3) are legally protected, (4) exhibit a functional response to development activities, and (5) are *reasonably* easy to monitor.

Species/Status	Range/Habitat	Response
Key Deer *Odocoileus virginianus clavium* Endangered	All habitat types on Big Pine Key, No Name Key, Torch Keys, Ramrod Key, and adjacent offshore islands. Can be transient on adjacent islands.	Vulnerable to habitat loss, vehicle mortality, habitat fragmentation via barriers to movement, predation by free-ranging dogs, and density-dependent disease.
Lower Keys marsh rabbit *Sylvilagus palustris hefneri* Endangered	High salt marsh, patchy distribution, Big Pine Key, Lower Sugarloaf Key, Saddlebunch Keys, Boca Chica Key.	Vulnerable to habitat loss, habitat fragmentation, and predation by free-ranging domestic cats. Fire ants may impact nestling survival.
Silver Rice Rat *Oryzomys argentatus* Endangered	Mangroves and salt marsh, Torch Keys, Summerland Key, Cudjoe Key, Sugarloaf Keys, Saddlebunch Keys, some backcountry islands.	Species appears to require large, contiguous wetland tracts, vulnerable to habitat loss, habitat fragmentation, and predation by free-ranging domestic cats. Fire ants may impact nestling survival. Black rats may be competitors.
Key Largo Woodrat *Neotoma floridana smalli* Endangered	Hardwood hammocks on North Key Largo.	Vulnerable to habitat loss, habitat fragmentation, and predation by free-ranging domestic cats. Fire ants may impact nestling survival. Black rats may be competitors.
American alligator *Alligator mississippiensis* Species of Special Concern	Fresh and brackish wetlands, primarily in the Lower Keys (can be wide-ranging in marine habitats).	Vulnerable to habitat loss, habitat fragmentation, nest disturbance, poaching, and vehicle mortality. Fire ants may impact nestling survival.
Lower Keys Striped Mud Turtle *Kinosternon bauri bauri* Endangered	Freshwater marshes, ponds, mosquito ditches, brackish impoundments, and adjacent upland habitats throughout the Lower Keys.	Vulnerable to habitat loss, habitat fragmentation, hydrological alterations, fire ant predation, and collecting. Fire ants may impact egg/nestling survival.

Species/Status	Range/Habitat	Response
Atlantic loggerhead turtle *Caretta caretta caretta* Endangered	Nests on sandy beaches throughout the Keys.	Vulnerable to habitat loss, habitat degradation, nest disturbance, pollution, hatchling disorientation, and poaching.
Wading Bird Complex (Herons, Egrets, Ibises, Pelicans) Various Listings	Keys-wide in marine habitats; nest primarily on offshore mangrove islands.	Vulnerable to human disturbance, marine pollution, and water quality (forage).
White-crowned pigeon *Columba leucocephala* Threatened	Nests on offshore mangrove islands, forages in hardwood hammock, Keys-wide from Biscayne Bay west through the Marquesa Keys.	Vulnerable to habitat loss, habitat fragmentation, disturbance to nesting colonies, predation by free-ranging domestic cats.
Florida Tree Snail *Liguus fasciatus* Species of Special Concern	Hardwood hammocks from North Key Largo west to Torch Keys. Patchily distributed in remaining hammocks of larger size.	Vulnerable to habitat loss, habitat fragmentation, mosquito spraying, fire ant predation, and collecting.
Schaus' swallowtail butterfly *Heraclides aristodemus ponceanus* Endangered	Hardwood hammocks in Biscayne Bay and North Key Largo.	Vulnerable to habitat loss, habitat fragmentation, mosquito spraying, fire ant predation, and collecting.

NATIVE PLANTS – FLORIDA KEYS

Scientific Name	Common Name	Family
Abildgaardia ovata	Flatspike Sedge	CYPERACEAE
Abutilon permolle	Coastal Indian Mallow	MALVACEAE
Acacia choriophylla	Cinnecord; Tamarindillo	FABACEAE
Acacia farnesiana	Sweet Acacia	FABACEAE
Acacia macracantha	Porknut	FABACEAE
Acacia pinetorum	Pineland Acacia	FABACEAE
Acalypha chamaedrifolia	Bastard Copperleaf	EUPHORBIACEAE
Acanthocereus tetragonus	Triangle Cactus; Dildoe Cactus; Barbed-Wire Cactus	CACTACEAE
Acrostichum aureum	Golden Leather Fern	PTERIDACEAE
Acrostichum danaeifolium	Giant Leather Fern	PTERIDACEAE
Agalinis fasciculata	Beach False Foxglove	OROBANCHACEAE
Agalinis filifolia	Seminole False Foxglove	OROBANCHACEAE
Agalinis harperi	Harper's False Foxglove	OROBANCHACEAE
Agalinis maritima	Saltmarsh False Foxglove	OROBANCHACEAE
Agalinis obtusifolia	Tenlobe False Foxglove	OROBANCHACEAE
Agalinis purpurea	Purple False Foxglove	OROBANCHACEAE
Agave decipiens	False Sisal	AGAVACEAE
Ageratum maritimum	Cape Sable Whiteweed	ASTERACEAE
Aletris bracteata	Bracted Colicroot	NARTHECIACEAE
Alternanthera maritima	Seaside Joyweed	AMARANTHACEAE
Amaranthus australis	Southern Amaranth	AMARANTHACEAE
Amaranthus floridanus	Florida Amaranth	AMARANTHACEAE
Ambrosia hispida	Coastal Ragweed	ASTERACEAE
Ammannia coccinea	Valley Redstem; Scarlet Ammannia	LYTHRACEAE
Ammannia latifolia	Pink Redstem; Toothcup	LYTHRACEAE
Amyris balsamifera	Balsam Torchwood	RUTACEAE
Amyris elemifera	Sea Torchwood	RUTACEAE
Andropogon glomeratus var. *pumilus*	Bushy Bluestem	POACEAE
Andropogon longiberbis	Hairy Bluestem	POACEAE
Andropogon tenarius	Splitbeard Bluestem	POACEAE

Scientific Name	Common Name	Family
Andropogon virginicus	Broomsedge Bluestem	POACEAE
Anemia adiantifolia	Maidenhair Pineland Fern	SCHIZAEACEAE
Angadenia berteroi	Pineland Golden Trumpet	APOCYNACEAE
Annona glabra	Pond Apple	ANNONACEAE
Ardisia escallonioides	Marlberry	MYRSINACEAE
Argemone mexicana	Mexican Pricklypoppy	PAPAVERACEAE
Argusia gnaphalodes	Sea Rosemary; Sea Lavender	BORAGINACEAE
Argythamnia blodgettii	Blodgett's Silverbush; Blodgett's Wild Mercury	EUPHORBIACEAE
Aristida floridana	Key West Threeawn	POACEAE
Aristida purpurascens	Arrowfeather Threeawn	POACEAE
Aristida purpurascens var. *tenuispica*	Hillsboro Threeawn	POACEAE
Aristolochia pentandra	Marsh's Dutchman's-Pipe	ARISTOLOCHIACEAE
Aristolochia serpentaria	Virginia Snakeroot	ARISTOLOCHIACEAE
Asclepias viridis	Green Antelopehorn	APOCYNACEAE
Atriplex cristata	Crested Saltbush	AMARANTHACEAE
Avicennia germinans	Black Mangrove	AVICENNIACEAE
Ayenia euphrasiifolia	Eyebright Ayenia	MALVACEAE
Baccharis angustifolia	Saltwater Falsewillow	ASTERACEAE
Baccharis halimifolia	Groundsel Tree; Sea Myrtle	ASTERACEAE
Bacopa monnieri	Herb-Of-Grace	VERONICACEAE
Basiphyllaea corallicola	Carter's Orchid	ORCHIDACEAE
Batis maritima	Saltwort; Turtleweed	BATACEAE
Bidens alba var. *radiata*	Beggarticks; Romerillo	ASTERACEAE
Bletia purpurea	Pinepink	ORCHIDACEAE
Blutaparon vermiculare	Samphire; Silverhead	AMARANTHACEAE
Boerhavia diffusa	Red Spiderling; Wineflower	NYCTAGINACEAE
Boerhavia erecta	Erect Spiderling	NYCTAGINACEAE
Borrichia arborescens	Tree Seaside Oxeye	ASTERACEAE
Borrichia frutescens	Bushy Seaside Oxeye	ASTERACEAE
Borrichia x cubana		ASTERACEAE
Bourreria cassinifolia	Smooth Strongbark; Little Strongbark	BORAGINACEAE
Bourreria radula	Rough Strongbark	BORAGINACEAE

Scientific Name	Common Name	Family
Bourreria succulenta	Bahama Strongbark; Bodywood	BORAGINACEAE
Buchnera americana	American Bluehearts	OROBANCHACEAE
Bursera simaruba	Gumbo-Limbo	BURSERACEAE
Byrsonima lucida	Long Key Locustberry	MALPIGHIACEAE
Caesalpinia bonduc	Gray Nicker	FABACEAE
Caesalpinia major	Hawaii Pearls; Yellow Nicker	FABACEAE
Caesalpinia pauciflora	Fewflower Holdback	FABACEAE
Cakile lanceolata	Coastal Searocket	BRASSICACEAE
Callicarpa americana	American Beautyberry	LAMIACEAE
Calyptranthes pallens	Pale Lidflower; Spicewood	MYRTACEAE
Calyptranthes zuzygium	Myrtle-Of-The-River	MYRTACEAE
Calystegia sepium subsp. *limnophila*	Hedge False Bindweed	CONVOLVULACEAE
Campyloneurum phyllitidis	Long Strap Fern	POLYPODIACEAE
Canavalia rosea	Baybean; Seaside Jackbean	FABACEAE
Canella winterana	Pepper Cinnamon; Cinnamon Bark; Wild Cinnamon	CANELLACEAE
Caperonia castaneifolia	Chestnutleaf Falsecroton	EUPHORBIACEAE
Capparis cynophallophora	Jamaican Capertree	BRASSICACEAE
Capparis flexuosa	Bayleaf Capertree	BRASSICACEAE
Capraria biflora	Goatweed	VERONICACEAE
Capsicum annuum var. *glabriusculum*	Bird Pepper	SOLANACEAE
Capsicum frutescens	Tabasco Pepper	SOLANACEAE
Cardiospermum corindum	Faux Persil	SAPINDACEAE
Cardiospermum microcarpum	Heartseed	SAPINDACEAE
Cassytha filiformis	Love Vine; Devil's Gut	LAURACEAE
Catesbaea parviflora	Smallflower Lilythorn; Dune Lilythorn	RUBIACEAE
Celosia nitida	West Indian Cock's Comb	AMARANTHACEAE
Cenchrus brownii	Slimbristle Sandbur	POACEAE
Cenchrus echinatus	Southern Sandbur	POACEAE
Cenchrus gracillimus	Slender Sandbur	POACEAE
Cenchrus myosuroides	Big Sandbur	POACEAE
Cenchrus spinifex	Coastal Sandbur	POACEAE

Scientific Name	Common Name	Family
Centella asiatica	Spadeleaf	ARALIACEAE
Centrosema virginianum	Spurred Butterfly Pea	FABACEAE
Chamaecrista lineata var. *keyensis*	Narrowpod Sensitive Pea; Key Cassia	FABACEAE
Chamaecrista nictitans var. *aspera*	Sensitive Pea	FABACEAE
Chamaesyce blodgettii	Limestone Sandmat	EUPHORBIACEAE
Chamaesyce bombensis	Dixie Sandmat	EUPHORBIACEAE
Chamaesyce conferta	Everglades Key Sandmat	EUPHORBIACEAE
Chamaesyce deltoidea subsp. *serpyllum*	Wedge Sandmat	EUPHORBIACEAE
Chamaesyce garberi	Garber's Sandmat; Garber's Spurge	EUPHORBIACEAE
Chamaesyce hirta	Pillpod Sandmat	EUPHORBIACEAE
Chamaesyce hypericifolia	Graceful Sandmat	EUPHORBIACEAE
Chamaesyce hyssopifolia	Hyssopleaf Sandmat	EUPHORBIACEAE
Chamaesyce maculata	Spotted Sandmat	EUPHORBIACEAE
Chamaesyce mesembrianthemifolia	Coastal Beach Sandmat	EUPHORBIACEAE
Chamaesyce ophthalmica	Florida Hammock Sandmat	EUPHORBIACEAE
Chamaesyce pergamena	Southern Florida Sandmat; Rocklands Spurge	EUPHORBIACEAE
Chamaesyce porteriana	Porter's Sandmat; Porter's Spurge	EUPHORBIACEAE
Chamaesyce prostrata	Prostrate Sandmat	EUPHORBIACEAE
Chenopodium berlandieri	Pitseed Goosefoot	AMARANTHACEAE
Chiococca alba	Snowberry; Milkberry	RUBIACEAE
Chloris elata	Tall Windmillgrass; Manyspike Fingergrass	POACEAE
Chromolaena frustrata	Cape Sable Thoroughwort	ASTERACEAE
Chromolaena odorata	Jack-In-The-Bush	ASTERACEAE
Chrysobalanus icaco	Coco Plum	CHRYSOBALANACEAE
Chrysophyllum oliviforme	Satinleaf	SAPOTACEAE
Cienfuegosia yucatanensis	Yucatan Flymallow; Yellow-Hibiscus	MALVACEAE
Cirsium horridulum	Purple Thistle	ASTERACEAE
Cissus trifoliata	Sorrelvine; Marinevine	VITACEAE
Cissus verticillata	Seasonvine; Possum Grape	VITACEAE
Citharexylum spinosum	Florida Fiddlewood	VERBENACEAE
Cladium jamaicense	Jamaica Swamp Sawgrass	CYPERACEAE

Scientific Name	Common Name	Family
Clusia rosea	Pitchapple	CLUSIACEAE
Cnidoscolus stimulosus	Tread-Softly; Finger-Rot	EUPHORBIACEAE
Coccoloba diversifolia	Tietongue; Pigeon Plum	POLYGONACEAE
Coccoloba uvifera	Seagrape	POLYGONACEAE
Coccothrinax argentata	Florida Silver Palm	ARECACEAE
Coelorachis rugosa	Wrinkled Jointtailgrass	POACEAE
Colubrina arborescens	Greenheart	RHAMNACEAE
Colubrina cubensis var. *floridana*	Cuban Nakedwood	RHAMNACEAE
Colubrina elliptica	Soldierwood	RHAMNACEAE
Conocarpus erectus	Buttonwood	COMBRETACEAE
Conoclinium coelestinum	Blue Mistflower	ASTERACEAE
Conyza canadensis var. *pusilla*	Dwarf Canadian Horseweed	ASTERACEAE
Corchorus siliquosus	Slippery Burr	MALVACEAE
Cordia globosa	Curacao Bush	BORAGINACEAE
Coreopsis leavenworthii	Leavenworth's Tickseed	ASTERACEAE
Crossopetalum ilicifolium	Christmasberry	CELASTRACEAE
Crossopetalum rhacoma	Maidenberry; Rhacoma	CELASTRACEAE
Crotalaria pumila	Low Rattlebox	FABACEAE
Crotalaria rotundifolia	Rabbitbells	FABACEAE
Croton glandulosus	Vente Conmigo	EUPHORBIACEAE
Croton humilis	Pepperbush	EUPHORBIACEAE
Croton linearis	Pineland Croton; Grannybush	EUPHORBIACEAE
Cupania glabra	American Toadwood; Cupania	SAPINDACEAE
Cuscuta americana	American Dodder	CONVOLVULACEAE
Cuscuta umbellata	Flatglobe Dodder	CONVOLVULACEAE
Cynanchum angustifolium	Gulf Coast Swallowwort	APOCYNACEAE
Cynanchum blodgettii	Blodgett's Swallowwort	APOCYNACEAE
Cynanchum northropiae	Fragrant Swallowwort	APOCYNACEAE
Cynanchum scoparium	Leafless Swallowwort	APOCYNACEAE
Cyperus croceus	Baldwin's Flatsedge	CYPERACEAE
Cyperus cuspidatus	Coastalplain Flatsedge	CYPERACEAE
Cyperus elegans	Royal Flatsedge	CYPERACEAE
Cyperus floridanus	Florida Flatsedge	CYPERACEAE

Scientific Name	Common Name	Family
Cyperus fuligineus	Limestone Flatsedge	CYPERACEAE
Cyperus ligularis	Swamp Flatsedge	CYPERACEAE
Cyperus odoratus	Fragrant Flatsedge	CYPERACEAE
Cyperus planifolius	Flatleaf Flatsedge	CYPERACEAE
Cyperus polystachyos	Manyspike Flatssedge	CYPERACEAE
Cyperus retrorsus	Pinebarren Flatsedge	CYPERACEAE
Cyperus squarrosus	Bearded Flatsedge	CYPERACEAE
Cyperus surinamensis	Tropical Flatsedge	CYPERACEAE
Cyrtopodium punctatum	Cowhorn Orchid; Cigar Orchid	ORCHIDACEAE
Dalbergia brownei	Browne's Indian Rosewood	FABACEAE
Dalbergia ecastaphyllum	Coinvine	FABACEAE
Dichanthelium aciculare	Needleleaf Witchgrass	POACEAE
Dichanthelium dichotomum	Cypress Witchgrass	POACEAE
Dicliptera sexangularis	Sixangle Foldwing	ACANTHACEAE
Digitaria ciliaris	Southern Crabgrass	POACEAE
Digitaria filiformis var. *dolichophylla*	Caribbean Crabgrass	POACEAE
Digitaria insularis	Sourgrass	POACEAE
Digitaria serotina	Blanket Crabgrass; Dwarf Crabgrass	POACEAE
Distichlis spicata	Saltgrass	POACEAE
Dodonaea elaeagnoides	Smallfruit Varnishleaf; Keys Hopbush	SAPINDACEAE
Dodonaea viscosa	Varnishleaf; Florida Hopbush	SAPINDACEAE
Drypetes diversifolia	Whitewood; Milkbark	EUPHORBIACEAE
Drypetes lateriflora	Guiana Plum	EUPHORBIACEAE
Dyschoriste angusta	Pineland Twinflower; Pineland Snakeherb	ACANTHACEAE
Echinochloa paludigena	Florida Cockspur	POACEAE
Echinodorus berteroi	Upright Burrhead	ALISMATACEAE
Echites umbellata	Devil's Potato; Rubbervine	APOCYNACEAE
Eclipta prostrata	False Daisy	ASTERACEAE
Eleocharis cellulosa	Gulf Coast Spikerush	CYPERACEAE
Eleocharis geniculata	Canada Spikerush	CYPERACEAE
Encyclia tampensis	Florida Butterfly Orchid	ORCHIDACEAE
Eragrostis elliottii	Elliott's Lovegrass	POACEAE

Scientific Name	Common Name	Family
Eriochloa michauxii	Michaux's Cupgrass	POACEAE
Eriochloa michauxii var. *simpsonii*	Simpson's Cupgrass	POACEAE
Erithalis fruticosa	Blacktorch	RUBIACEAE
Ernodea cokeri	Coker's Beach Creeper; One-Nerved Ernodea	RUBIACEAE
Ernodea littoralis	Beach Creeper; Coughbush	RUBIACEAE
Erythrina herbacea	Coralbean; Cherokee Bean	FABACEAE
Eugenia axillaris	White Stopper	MYRTACEAE
Eugenia confusa	Redberry Stopper; Redberry Eugenia	MYRTACEAE
Eugenia foetida	Spanish Stopper; Boxleaf Stopper	MYRTACEAE
Eugenia rhombea	Red Stopper	MYRTACEAE
Eupatorium capillifolium	Dogfennel	ASTERACEAE
Eupatorium serotinum	Lateflowering Thoroughwort	ASTERACEAE
Euphorbia trichotoma	Sanddune Spurge	EUPHORBIACEAE
Eustachys petraea	Pinewoods Fingergrass	POACEAE
Eustoma exaltatum	Marshgentian; Catchfly Prairie-Gentian	GENTIANACEAE
Evolvulus alsinoides	Slender Dwarf Morning-Glory	CONVOLVULACEAE
Evolvulus grisebachii	Grisebach's Dwarf Morning-Glory; Grisebach's Bindweed	CONVOLVULACEAE
Evolvulus sericeus	Silver Dwarf Morning-Glory	CONVOLVULACEAE
Exostema caribaeum	Caribbean Princewood	RUBIACEAE
Exothea paniculata	Inkwood; Butterbough	SAPINDACEAE
Ficus aurea	Strangler Fig; Golden Fig	MORACEAE
Ficus citrifolia	Wild Banyan Tree	MORACEAE
Fimbristylis caroliniana	Carolina Fimbry	CYPERACEAE
Fimbristylis cymosa	Hurricanegrass	CYPERACEAE
Fimbristylis puberula	Hairy Fimbry	CYPERACEAE
Fimbristylis spadicea	Marsh Fimbry	CYPERACEAE
Flaveria linearis	Narrowleaf Yellowtops	ASTERACEAE
Flaveria trinervia	Clustered Yellowtops	ASTERACEAE
Forestiera segregata	Florida Swampprivet	OLEACEAE
Gaillardia pulchella	Firewheel	ASTERACEAE
Galactia elliottii	Elliott's Milkpea	FABACEAE

Scientific Name	Common Name	Family
Galactia regularis	Eastern Milkpea	FABACEAE
Galactia striata	Florida Hammock Milkpea	FABACEAE
Galactia volubilis	Downy Milkpea	FABACEAE
Gamochaeta antillana	Caribbean Purple Everlasting	ASTERACEAE
Gaura angustifolia	Southern Beeblossom	ONAGRACEAE
Genipa clusiifolia	Sevenyear Apple	RUBIACEAE
Glandularia maritima	Coastal Mock Vervain	VERBENACEAE
Gossypium hirsutum	Upland Cotton; Wild Cotton	MALVACEAE
Gouania lupuloides	Chewstick; Whiteroot	RHAMNACEAE
Guaiacum sanctum	Holywood Lignumvitae	ZYGOPHYLLACEAE
Guapira discolor	Beeftree; Blolly	NYCTAGINACEAE
Guapira obtusata	Broadleaf Blolly	NYCTAGINACEAE
Guettarda elliptica	Hammock Velvetseed	RUBIACEAE
Guettarda scabra	Rough Velvetseed	RUBIACEAE
Gyminda latifolia	West Indian False Boxwood	CELASTRACEAE
Gymnanthes lucida	Crabwood; Oysterwood	EUPHORBIACEAE
Habenaria quinqueseta	Longhorn False Reinorchid; Michaux's Orchid	ORCHIDACEAE
Halodule wrightii	Shoalweed	CYMODOCEACEAE
Halophila decipiens	Caribbean Seagrass	HYDROCHARITACEAE
Halophila engelmannii	Engelmann's Seagrass	HYDROCHARITACEAE
Hamelia patens	Firebush	RUBIACEAE
Harrisia simpsonii	Simpson's Applecactus	CACTACEAE
Helianthus debilis	East Coast Dune Sunflower	ASTERACEAE
Heliotropium angiospermum	Scorpionstail	BORAGINACEAE
Heliotropium curassavicum	Seaside Heliotrope; Salt Heliotrope	BORAGINACEAE
Heliotropium fruticosum	Key West Heliotrope	BORAGINACEAE
Heliotropium polyphyllum	Pineland Heliotrope	BORAGINACEAE
Herissantia crispa	Bladdermallow	MALVACEAE
Heteropogon contortus	Tanglehead	POACEAE
Hibiscus poeppigii	Poeppig's Rosemallow	MALVACEAE
Hippocratea volubilis	Medicine Vine	CELASTRACEAE
Hippomane mancinella	Manchineel	EUPHORBIACEAE

Scientific Name	Common Name	Family
Hymenocallis latifolia	Mangrove Spiderlily; Perfumed Spiderlily	AMARYLLIDACEAE
Hypelate trifoliata	White Ironwood	SAPINDACEAE
Hypolepis repens	Creeping Bramble Fern	DENNSTAEDTIACEAE
Hypoxis wrightii	Bristleseed Yellow Stargrass	HYPOXIDACEAE
Imperata brasiliensis	Brazilian Satintail	POACEAE
Indigofera miniata var. *florida*	Florida Coastal Indigo	FABACEAE
Indigofera trita subsp. *scabra*	Florida Keys Indigo	FABACEAE
Ipomoea alba	Moonflowers; Tropical White Morning-Glory	CONVOLVULACEAE
Ipomoea cordatotriloba	Tievine	CONVOLVULACEAE
Ipomoea indica var. *acuminata*	Oceanblue Morning-Glory	CONVOLVULACEAE
Ipomoea pes-caprae subsp. *brasiliensis*	Railroad Vine; Bayhops	CONVOLVULACEAE
Ipomoea sagittata	Saltmarsh Morning-Glory	CONVOLVULACEAE
Ipomoea violacea	Heavenlyblue Morning-Glory	CONVOLVULACEAE
Iresine diffusa	Juba's Bush	AMARANTHACEAE
Iva imbricata	Seacoast Marshelder	ASTERACEAE
Jacquemontia havanensis	Havana Clustervine	CONVOLVULACEAE
Jacquemontia pentanthos	Skyblue Clustervine	CONVOLVULACEAE
Jacquinia keyensis	Joewood	THEOPHRASTACEAE
Juncus marginatus	Shore Rush; Grassleaf Rush	JUNCACEAE
Kallstroemia maxima	Big Caltrop	ZYGOPHYLLACEAE
Krugiodendron ferreum	Black Ironwood; Leadwood	RHAMNACEAE
Laguncularia racemosa	White Mangrove	COMBRETACEAE
Lantana involucrata	Buttonsage	VERBENACEAE
Lasiacis divaricata	Smallcane; Florida Tibisee	POACEAE
Leersia monandra	Bunch Cutgrass	POACEAE
Lepidium virginicum	Virginia Pepperweed	BRASSICACEAE
Leptochloa dubia	Green Sprangletop	POACEAE
Leptochloa virgata	Tropical Sprangletop	POACEAE
Liatris tenuifolia var. *quadriflora*	Shortleaf Gayfeather	ASTERACEAE
Licania michauxii	Gopher Apple	CHRYSOBALANACEAE
Limonium carolinianum	Carolina Sealavender	PLUMBAGINACEAE

Scientific Name	Common Name	Family
Linum arenicola	Sand Flax	LINACEAE
Linum medium var. *texanum*	Stiff Yellow Flax	LINACEAE
Lobelia glandulosa	Glade Lobelia	CAMPANULACEAE
Ludwigia curtissii	Curtiss' Primrosewillow	ONAGRACEAE
Ludwigia microcarpa	Smallfruit Primrosewillow	ONAGRACEAE
Ludwigia octovalvis	Mexican Primrosewillow	ONAGRACEAE
Lycium carolinianum	Christmasberry; Carolina Desert-Thorn	SOLANACEAE
Lysiloma latisiliquum	False Tamarind	FABACEAE
Malvastrum corchorifolium	False Mallow	MALVACEAE
Manilkara jaimiqui subsp. *emarginata*	Wild Dilly	SAPOTACEAE
Maytenus phyllanthoides	Florida Mayten	CELASTRACEAE
Mecardonia acuminata subsp. *peninsularis*	Axilflower	VERONICACEAE
Mecardonia procumbens	Baby Jumpup	VERONICACEAE
Melanthera nivea	Snow Squarestem	ASTERACEAE
Melochia pyramidata	Pyramidflower	MALVACEAE
Melothria pendula	Creeping Cucumber	CUCURBITACEAE
Mentzelia floridana	Poorman's Patch; Stickleaf	LOASACEAE
Metopium toxiferum	Florida Poisontree; Poisonwood	ANACARDIACEAE
Microgramma heterophylla	Climbing Vine Fern	POLYPODIACEAE
Mikania scandens	Climbing Hempvine	ASTERACEAE
Mitreola petiolata	Lax Hornpod	LOGANIACEAE
Mitreola sessilifolia	Swamp Hornpod	LOGANIACEAE
Monanthochloe littoralis	Shoregrass; Keygrass	POACEAE
Morinda royoc	Redgal	RUBIACEAE
Mosiera longipes	Mangroveberry	MYRTACEAE
Muhlenbergia capillaris	Hairawn Muhly	POACEAE
Muhlenbergia capillaris var. *filipes*	Gulf Hairawn Muhle	POACEAE
Myrcianthes fragrans	Twinberry; Simpson's Stopper	MYRTACEAE
Myrica cerifera	Southern Bayberry; Wax Myrtle	MYRICACEAE
Najas guadalupensis	Southern Waternymph	HYDROCHARITACEAE
Neptunia pubescens	Tropical Puff	FABACEAE
Nevrodium lanceolatum	Ribbon Fern	POLYPODIACEAE

Scientific Name	Common Name	Family
Ocimum campechianum	Wild Sweet Basil; Wild Mosquitoplant; Ocimum	LAMIACEAE
Ocotea coriacea	Lancewood	LAURACEAE
Odontosoria clavata	Wedgelet Fern	DENNSTAEDTIACEAE
Oenothera laciniata	Cutleaf Eveningprimrose	ONAGRACEAE
Opuntia corallicola	Semaphore Pricklypear; Semaphore Cactus	CACTACEAE
Opuntia cubensis	Bullsuckers	CACTACEAE
Opuntia humifusa	Pricklypear	CACTACEAE
Opuntia stricta	Erect Pricklypear; Shell-Mound Pricklypear	CACTACEAE
Opuntia triacanthos	Spanish Lady; Keys Joe-Jumper	CACTACEAE
Oxalis corniculata	Common Yellow Woodsorrel; Creeping Woodsorrel	OXALIDACEAE
Panicum amarum	Bitter Panicgrass	POACEAE
Panicum dichotomiflorum var. *bartowense*	Fall Panicgrass	POACEAE
Panicum rigidulum	Redtop Panicum	POACEAE
Panicum virgatum	Switchgrass	POACEAE
Parietaria floridana	Florida Pellitory	URTICACEAE
Parthenocissus quinquefolia	Virginia Creeper; Woodbine	VITACEAE
Paspalidium chapmanii	Coral Panicum; Coral Panicgrass	POACEAE
Paspalum blodgettii	Coral Paspalum; Blodgett's Crowngrass	POACEAE
Paspalum caespitosum	Blue Crowngrass	POACEAE
Paspalum laxum	Coconut Paspalum	POACEAE
Paspalum monostachyum	Gulfdune Paspalum	POACEAE
Paspalum setaceum	Thin Paspalum	POACEAE
Paspalum vaginatum	Seashore Paspalum	POACEAE
Passiflora multiflora	Whiteflower Passionflower; White-Flowered Passionvine	PASSIFLORACEAE
Passiflora suberosa	Corkystem Passionflower	PASSIFLORACEAE
Pecluma dispersa	Widespread Polypody	POLYPODIACEAE
Pecluma plumula	Plume Polypody	POLYPODIACEAE

Scientific Name	Common Name	Family
Pecluma ptilodon var. *caespitosa*	Comb Polypody; Swamp Plume Polypody	POLYPODIACEAE
Pectis glaucescens	Sanddune Cinchweed	ASTERACEAE
Pectis prostrata	Spreading Cinchweed	ASTERACEAE
Pectis x floridana		ASTERACEAE
Pentalinon luteum	Wild Allamanda; Hammock Viperstail	APOCYNACEAE
Persea borbonia	Red Bay	LAURACEAE
Persea palustris	Swamp Bay	LAURACEAE
Petiveria alliacea	Guinea Hen Weed	PETIVERIACEAE
Phoradendron rubrum	Mahogany Mistletoe	VISCACEAE
Phyla nodiflora	Turkey Tangle Fogfruit; Capeweed	VERBENACEAE
Phyllanthus abnormis	Drummond's Leafflower	EUPHORBIACEAE
Phyllanthus caroliniensis subsp. *saxicola*	Rock Carolina Leafflower	EUPHORBIACEAE
Phyllanthus pentaphyllus var. *floridanus*	Fivepetal Leafflower	EUPHORBIACEAE
Physalis angulata	Cutleaf Groundcherry	SOLANACEAE
Physalis angustifolia	Coastal Groundcherry	SOLANACEAE
Physalis pubescens	Husk Tomato	SOLANACEAE
Physalis walteri	Walter's Groundcherry	SOLANACEAE
Physostegia purpurea	Eastern False Dragonhead	LAMIACEAE
Phytolacca americana	American Pokeweed	PHYTOLACCACEAE
Pilea herniarioides	Caribbean Clearweed	URTICACEAE
Pilea microphylla	Artillery Plant; Rockweed	URTICACEAE
Pilosocereus polygonus	Key Tree Cactus	CACTACEAE
Pinguicula pumila	Small Butterwort	LENTIBULARIACEAE
Pinus elliottii	Slash Pine	PINACEAE
Piriqueta cistoides subsp. *caroliniana*	Pitted Stripeseed	TURNERACEAE
Piscidia piscipula	Florida Fishpoison Tree; Jamaican Dogwood	FABACEAE
Pisonia aculeata	Devil's Claws; Pullback	NYCTAGINACEAE
Pisonia rotundata	Smooth Devil's Claws; Cockspur	NYCTAGINACEAE
Pithecellobium keyense	Florida Keys Blackbead	FABACEAE
Pithecellobium unguis-cati	Catclaw Blackbead	FABACEAE

Scientific Name	Common Name	Family
Pityopsis graminifolia	Narrowleaf Silkgrass	ASTERACEAE
Pityrogramma trifoliata	Goldenrod Fern	PTERIDACEAE
Platythelys latifolia	Jug Orchid	ORCHIDACEAE
Pluchea carolinensis	Cure-For-All	ASTERACEAE
Pluchea foetida	Stinking Camphorweed	ASTERACEAE
Pluchea odorata	Sweetscent	ASTERACEAE
Pluchea rosea	Rosy Camphorweed	ASTERACEAE
Plumbago scandens	Doctorbush	PLUMBAGINACEAE
Poinsettia cyathophora	Paintedleaf; Fire-On-The-Mountain	EUPHORBIACEAE
Poinsettia heterophylla	Fiddler's Spurge; Mexican Fireplant	EUPHORBIACEAE
Poinsettia pinetorum	Pineland Spurge; Everglades Poinsettia	EUPHORBIACEAE
Polygala balduinii	Baldwin's Milkwort	POLYGALACEAE
Polygala boykinii	Boykin's Milkwort	POLYGALACEAE
Polygala incarnata	Procession Flower	POLYGALACEAE
Polygala violacea	Showy Milkwort	POLYGALACEAE
Polypremum procumbens	Rustweed; Juniperleaf	TETRACHONDRACEAE
Pontederia cordata	Pickerelweed	PONTEDERIACEAE
Portulaca rubricaulis	Redstem Purslane	PORTULACACEAE
Priva lappulacea	Catstongue; Velvetburr	VERBENACEAE
Proserpinaca palustris	Marsh Mermaidweed	HALORAGACEAE
Prosthechea boothiana var. *erythronioides*	Dollar Orchid	ORCHIDACEAE
Pseudophoenix sargentii	Sargent's Cherry Palm	ARECACEAE
Psychotria ligustrifolia	Bahama Wild Coffee	RUBIACEAE
Psychotria nervosa	Wild Coffee	RUBIACEAE
Pteridium aquilinum var. *caudatum*	Lacy Bracken	DENNSTAEDTIACEAE
Pteris bahamensis	Bahama Ladder Brake	PTERIDACEAE
Pteris x delchampsii	Delchamps' Ladder Brake	PTERIDACEAE
Pterocaulon pycnostachyum	Blackroot	ASTERACEAE
Quercus virginiana	Live Oak	FAGACEAE
Randia aculeata	White Indigoberry	RUBIACEAE
Rapanea punctata	Myrsine; Colicwood	MYRSINACEAE
Rayjacksonia phyllocephala	Camphor Daisy	ASTERACEAE

Scientific Name	Common Name	Family
Reynosia septentrionalis	Darlingplum	RHAMNACEAE
Rhabdadenia biflora	Rubbervine; Mangrovevine	APOCYNACEAE
Rhizophora mangle	Red Mangrove	RHIZOPHORACEAE
Rhus copallinum	Winged Sumac	ANACARDIACEAE
Rhynchosia cinerea	Brownhair Snoutbean	FABACEAE
Rhynchosia minima	Least Snoutbean	FABACEAE
Rhynchosia parvifolia	Small-Leaf Snoutbean	FABACEAE
Rhynchosia swartzii	Swartz's Snoutbean	FABACEAE
Rhynchospora colorata	Starrush Whitetop	CYPERACEAE
Rhynchospora divergens	Spreading Beaksedge	CYPERACEAE
Rhynchospora floridensis	Florida Whitetop	CYPERACEAE
Rhynchospora microcarpa	Southern Beaksedge	CYPERACEAE
Rivina humilis	Rougeplant	PETIVERIACEAE
Ruellia succulenta	Thickleaf Wild Petunia	ACANTHACEAE
Ruppia maritima	Wigeongrass	RUPPIACEAE
Sabal palmetto	Cabbage Palm	ARECACEAE
Sabatia grandiflora	Largeflower Rosegentian	GENTIANACEAE
Sabatia stellaris	Rose-Of-Plymouth	GENTIANACEAE
Sachsia polycephala	Bahama Sachsia	ASTERACEAE
Sagittaria lancifolia	Bulltongue Arrowhead	ALISMATACEAE
Salicornia bigelovii	Annual Glasswort; Dwarf Glasswort	AMARANTHACEAE
Salvia micrantha	Yucatan Sage	LAMIACEAE
Salvia serotina	Littlewoman	LAMIACEAE
Samolus ebracteatus	Water Pimpernel; Limewater Brookweed	PRIMULACEAE
Sapindus saponaria	Soapberry	SAPINDACEAE
Sarcocornia perennis	Perennial Glasswort; Virginia Glasswort	AMARANTHACEAE
Sarcostemma clausum	White Twinevine	APOCYNACEAE
Savia bahamensis	Bahama Maidenbush	EUPHORBIACEAE
Scaevola plumieri	Beachberry; Inkberry; Gullfeed	GOODENIACEAE
Schaefferia frutescens	Florida Boxwood	CELASTRACEAE
Schizachyrium gracile	Wire Bluestem	POACEAE
Schizachyrium sanguineum	Crimson Bluestem	POACEAE

Scientific Name	Common Name	Family
Schizachyrium scoparium	Little Bluestem	POACEAE
Schizachyrium sericatum	Silky Bluestem	POACEAE
Schoenus nigricans	Black Bogrush	CYPERACEAE
Schoepfia chrysophylloides	Graytwig	OLACACEAE
Scleria lithosperma	Florida Keys Nutrush	CYPERACEAE
Scleria verticillata	Low Nutrush	CYPERACEAE
Scutellaria havanensis	Havana Skullcap	LAMIACEAE
Senna ligustrina	Privet Wild Sensitive Plant	FABACEAE
Senna mexicana var. *chapmanii*	Chapman's Wild Sensitive Plant	FABACEAE
Serenoa repens	Saw Palmetto	ARECACEAE
Sesbania herbacea	Danglepod	FABACEAE
Sesuvium maritimum	Slender Seapurslane	AIZOACEAE
Sesuvium portulacastrum	Shoreline Seapurslane	AIZOACEAE
Setaria macrosperma	Coral Bristlegrass; Coral Foxtail	POACEAE
Setaria parviflora	Yellow Bristlegrass; Knotroot Foxtail	POACEAE
Sida abutifolia	Spreading Fanpetals	MALVACEAE
Sida acuta	Common Wireweed; Common Fanpetals	MALVACEAE
Sida antillensis	Antilles Fanpetals	MALVACEAE
Sida ciliaris	Bracted Fanpetals; Fringed Fanpetals	MALVACEAE
Sida elliottii	Elliott's Fanpetals	MALVACEAE
Sida rhombifolia	Cuban Jute; Indian Hemp	MALVACEAE
Sideroxylon celastrinum	Saffron Plum	SAPOTACEAE
Sideroxylon foetidissimum	False Mastic	SAPOTACEAE
Sideroxylon reclinatum	Florida Bully	SAPOTACEAE
Sideroxylon salicifolium	Willow Bustic; White Bully	SAPOTACEAE
Simarouba glauca	Paradisetree	SIMAROUBACEAE
Sisyrinchium angustifolium	Narrowleaf Blue-Eyed Grass	IRIDACEAE
Sisyrinchium nashii	Nash's Blue-Eyed Grass	IRIDACEAE
Smilax bona-nox	Saw Greenbrier	SMILACACEAE
Smilax havanensis	Everglades Greenbrier	SMILACACEAE
Solanum americanum	American Black Nightshade	SOLANACEAE
Solanum bahamense	Bahama Nightshade; Cankerberry	SOLANACEAE

Scientific Name	Common Name	Family
Solanum chenopodioides	Black Nightshade	SOLANACEAE
Solanum donianum	Mullein Nightshade	SOLANACEAE
Solanum erianthum	Potatotree	SOLANACEAE
Solidago stricta	Wand Goldenrod	ASTERACEAE
Sophora tomentosa var. *truncata*	Yellow Necklacepod	FABACEAE
Sorghastrum secundum	Lopsided Indiangrass	POACEAE
Spartina alterniflora	Saltmarsh Cordgrass; Smooth Cordgrass	POACEAE
Spartina bakeri	Sand Cordgrass	POACEAE
Spartina patens	Marshhay Cordgras; Saltmeadow Cordgrass	POACEAE
Spartina spartinae	Gulf Cordgrass	POACEAE
Spermacoce keyensis	Florida False Buttonweed	RUBIACEAE
Spermacoce terminalis	Everglades Key False Buttonweed	RUBIACEAE
Spermacoce tetraquetra	Pineland False Buttonweed	RUBIACEAE
Spigelia anthelmia	West Indian Pinkroot	STRYCHNACEAE
Spiranthes torta	Southern Ladiestresses	ORCHIDACEAE
Spiranthes vernalis	Spring Ladiestresses	ORCHIDACEAE
Sporobolus domingensis	Coral Dropseed	POACEAE
Sporobolus pyramidatus	Whorled Dropseed	POACEAE
Sporobolus virginicus	Seashore Dropseed	POACEAE
Stachytarpheta jamaicensis	Blue Porterweed; Joee	VERBENACEAE
Stenaria nigricans var. *floridana*	Florida Diamondflowers	RUBIACEAE
Stenotaphrum secundatum	St. Augustinegrass	POACEAE
Strumpfia maritima	Pride-Of-Big-Pine	RUBIACEAE
Stylosanthes calcicola	Everglades Key Pencilflower	FABACEAE
Suaeda linearis	Sea Blite; Annual Seepweed	AMARANTHACEAE
Suriana maritima	Bay Cedar	SURIANACEAE
Swietenia mahagoni	West Indian Mahogany	MELIACEAE
Symphyotrichum bracei	Brace's Aster	ASTERACEAE
Symphyotrichum concolor	Eastern Silver Aster	ASTERACEAE
Symphyotrichum dumosum	Rice Button Aster	ASTERACEAE
Symphyotrichum subulatum	Annual Saltmarsh Aster	ASTERACEAE

Scientific Name	Common Name	Family
Syringodium filiforme	Manateegrass	CYMODOCEACEAE
Thalassia testudinum	Turtlegrass	HYDROCHARITACEAE
Thelypteris augescens	Abrupt-Tip Maiden Fern	THELYPTERIDACEAE
Thelypteris kunthii	Widespread Maiden Fern; Southern Shield Fern	THELYPTERIDACEAE
Thrinax morrisii	Brittle Thatch Palm; Key Thatch Palm	ARECACEAE
Thrinax radiata	Florida Thatch Palm	ARECACEAE
Tillandsia balbisiana	Northern Needleleaf; Inflated & Reflexed Wild Pine	BROMELIACEAE
Tillandsia fasciculata var. *clavispica*	Cardinal Airplant; Common Wild Pine; Stiff-Leaved Wild Pine	BROMELIACEAE
Tillandsia fasciculata var. *densispica*	Cardinal Airplant; Common Wild Pine; Stiff-Leaved Wild Pine	BROMELIACEAE
Tillandsia flexuosa	Twisted Airplant; Banded Airplant	BROMELIACEAE
Tillandsia paucifolia	Potbelly Airplant	BROMELIACEAE
Tillandsia recurvata	Ballmoss	BROMELIACEAE
Tillandsia setacea	Southern Needleleaf	BROMELIACEAE
Tillandsia usneoides	Spanish Moss	BROMELIACEAE
Tillandsia utriculata	Giant Airplant; Giant Wild Pine	BROMELIACEAE
Tillandsia variabilis	Leatherleaf Airplant; Soft-Leaved Wild Pine	BROMELIACEAE
Tournefortia hirsutissima	Chiggery Grapes	BORAGINACEAE
Tournefortia volubilis	Twining Soldierbush	BORAGINACEAE
Toxicodendron radicans	Eastern Poison Ivy	ANACARDIACEAE
Tragia saxicola	Florida Keys Noseburn; Rocklands Noseburn	EUPHORBIACEAE
Trema lamarckianum	Pain-In-The-Back; West Indian Trema; Lamarck's Trema	CELTIDACEAE
Trema micranthum	Nettletree	CELTIDACEAE
Trianthema portulacastrum	Desert Horsepurslane	AIZOACEAE
Trichostigma octandrum	Hoopvine	PETIVERIACEAE
Tridens eragrostoides	Lovegrass Tridens	POACEAE
Tripsacum floridanum	Florida Mock Gamagrass; Florida Tripsacum	POACEAE
Typha domingensis	Southern Cattail	TYPHACEAE

Scientific Name	Common Name	Family
Uniola paniculata	Seaoats	POACEAE
Urochloa adspersa	Dominican Signalgrass	POACEAE
Utricularia gibba	Humped Bladderwort	LENTIBULARIACEAE
Vallesia antillana	Tearshrub	APOCYNACEAE
Vanilla barbellata	Wormvine Orchid	ORCHIDACEAE
Vernonia blodgettii	Florida Ironweed; Blodgett's Ironweed	ASTERACEAE
Vigna luteola	Hairypod Cowpea	FABACEAE
Vitis rotundifolia	Muscadine	VITACEAE
Voyria parasitica	Parasitic Ghostplant	GENTIANACEAE
Waltheria indica	Sleepy Morning	MALVACEAE
Ximenia americana	Tallow Wood; Hog Plum	OLACACEAE
Xyris caroliniana	Carolina Yelloweyed Grass	XYRIDACEAE
Yucca aloifolia	Spanish Bayonet; Aloe Yucca	AGAVACEAE
Zamia pumila	Florida Arrowroot; Coontie	ZAMIACEAE
Zanthoxylum fagara	Wild Lime; Lime Pricklyash	RUTACEAE
Zanthoxylum flavum	West Indian Satinwood; Yellowwood; Yellowheart	RUTACEAE

ENDEMIC FLORIDA KEYS PLANTS

Scientific Name	Common Name	Family
Agave decipiens	False Sisal	AGAVACEAE
Amaranthus floridanus	Florida Amaranth	AMARANTHACEAE
Argythamnia blodgettii	Blodgett's Silverbush; Blodgett's Wild Mercury	EUPHORBIACEAE
Chamaecrista lineata var. *keyensis*	Narrowpod Sensitive Pea; Key Cassia	FABACEAE
Chamaesyce conferta	Everglades Key Sandmat	EUPHORBIACEAE
Chamaesyce deltoidea subsp. *serpyllum*	Wedge Sandmat	EUPHORBIACEAE
Chamaesyce garberi	Garber's Sandmat; Garber's Spurge	EUPHORBIACEAE
Chamaesyce porteriana	Porter's Sandmat; Porter's Spurge	EUPHORBIACEAE
Chromolaena frustrata	Cape Sable Thoroughwort	ASTERACEAE
Coreopsis leavenworthii	Leavenworth's Tickseed	ASTERACEAE
Echinochloa paludigena	Florida Cockspur	POACEAE
Eriochloa michauxii var. *simpsonii*	Simpson's Cupgrass	POACEAE
Glandularia maritima	Coastal Mock Vervain	VERBENACEAE
Harrisia simpsonii	Simpson's Applecactus	CACTACEAE
Indigofera miniata var. *florida*	Florida Coastal Indigo	FABACEAE
Liatris tenuifolia var. *quadriflora*	Shortleaf Gayfeather	ASTERACEAE
Linum arenicola	Sand Flax	LINACEAE
Mecardonia acuminata subsp. *peninsularis*	Axilflower	VERONICACEAE
Opuntia corallicola	Semaphore Pricklypear; Semaphore Cactus	CACTACEAE
Phyllanthus pentaphyllus var. *floridanus*	Fivepetal Leafflower	EUPHORBIACEAE
Poinsettia pinetorum	Pineland Spurge; Everglades Poinsettia	EUPHORBIACEAE
Rhynchosia cinerea	Brownhair Snoutbean	FABACEAE
Ruellia succulenta	Thickleaf Wild Petunia	ACANTHACEAE
Schizachyrium sericatum	Silky Bluestem	POACEAE
Spermacoce terminalis	Everglades Key False Buttonweed	RUBIACEAE
Tragia saxicola	Florida Keys Noseburn; Rocklands Noseburn	EUPHORBIACEAE

STATE OF FLORIDA LISTED PLANTS - FLORIDA KEYS

Scientific Name	Common Name	Family
Acacia choriophylla	Cinnecord; Tamarindillo	FABACEAE
Acanthocereus tetragonus	Triangle Cactus; Dildoe Cactus; Barbed-Wire Cactus	CACTACEAE
Acrostichum aureum	Golden Leather Fern	PTERIDACEAE
Ageratum maritimum	Cape Sable Whiteweed	ASTERACEAE
Aletris bracteata	Bracted Colicroot	NARTHECIACEAE
Angadenia berteroi	Pineland Golden Trumpet	APOCYNACEAE
Argusia gnaphalodes	Sea Rosemary; Sea Lavender	BORAGINACEAE
Argythamnia blodgettii	Blodgett's Silverbush; Blodgett's Wild Mercury	EUPHORBIACEAE
Aristolochia pentandra	Marsh's Dutchman's-Pipe	ARISTOLOCHIACEAE
Basiphyllaea corallicola	Carter's Orchid	ORCHIDACEAE
Bletia purpurea	Pinepink	ORCHIDACEAE
Bourreria cassinifolia	Smooth Strongbark; Little Strongbark	BORAGINACEAE
Bourreria radula	Rough Strongbark	BORAGINACEAE
Bourreria succulenta	Bahama Strongbark; Bodywood	BORAGINACEAE
Byrsonima lucida	Long Key Locustberry	MALPIGHIACEAE
Caesalpinia major	Hawaii Pearls; Yellow Nicker	FABACEAE
Caesalpinia pauciflora	Fewflower Holdback	FABACEAE
Calyptranthes pallens	Pale Lidflower; Spicewood	MYRTACEAE
Calyptranthes zuzygium	Myrtle-Of-The-River	MYRTACEAE
Canella winterana	Pepper Cinnamon; Cinnamon Bark; Wild Cinnamon	CANELLACEAE
Catesbaea parviflora	Smallflower Lilythorn; Dune Lilythorn	RUBIACEAE
Celosia nitida	West Indian Cock's Comb	AMARANTHACEAE
Chamaecrista lineata var. *keyensis*	Narrowpod Sensitive Pea; Key Cassia	FABACEAE
Chamaesyce deltoidea subsp. *Serpyllum*	Wedge Sandmat	EUPHORBIACEAE
Chamaesyce garberi	Garber's Sandmat; Garber's Spurge	EUPHORBIACEAE
Chamaesyce pergamena	Southern Florida Sandmat; Rocklands Spurge	EUPHORBIACEAE

Scientific Name	Common Name	Family
Chamaesyce porteriana	Porter's Sandmat; Porter's Spurge	EUPHORBIACEAE
Chromolaena frustrata	Cape Sable Thoroughwort	ASTERACEAE
Chrysophyllum oliviforme	Satinleaf	SAPOTACEAE
Cienfuegosia yucatanensis	Yucatan Flymallow; Yellow-Hibiscus	MALVACEAE
Coccothrinax argentata	Florida Silver Palm	ARECACEAE
Colubrina arborescens	Greenheart	RHAMNACEAE
Colubrina cubensis var. *floridana*	Cuban Nakedwood	RHAMNACEAE
Colubrina elliptica	Soldierwood	RHAMNACEAE
Cordia globosa	Curacao Bush	BORAGINACEAE
Crossopetalum ilicifolium	Christmasberry	CELASTRACEAE
Crossopetalum rhacoma	Maidenberry; Rhacoma	CELASTRACEAE
Croton humilis	Pepperbush	EUPHORBIACEAE
Cupania glabra	American Toadwood; Cupania	SAPINDACEAE
Cynanchum blodgettii	Blodgett's Swallowwort	APOCYNACEAE
Cyperus floridanus	Florida Flatsedge	CYPERACEAE
Cyperus fuligineus	Limestone Flatsedge	CYPERACEAE
Cyrtopodium punctatum	Cowhorn Orchid; Cigar Orchid	ORCHIDACEAE
Dalbergia brownei	Browne's Indian Rosewood	FABACEAE
Digitaria filiformis var. *dolichophylla*	Caribbean Crabgrass	POACEAE
Dodonaea elaeagnoides	Smallfruit Varnishleaf; Keys Hopbush	SAPINDACEAE
Drypetes diversifolia	Whitewood; Milkbark	EUPHORBIACEAE
Drypetes lateriflora	Guiana Plum	EUPHORBIACEAE
Erithalis fruticosa	Blacktorch	RUBIACEAE
Ernodea cokeri	Coker's Beach Creeper; One-Nerved Ernodea	RUBIACEAE
Eugenia confusa	Redberry Stopper; Redberry Eugenia	MYRTACEAE
Eugenia rhombea	Red Stopper	MYRTACEAE
Evolvulus grisebachii	Grisebach's Dwarf Morning-Glory; Grisebach's Bindweed	CONVOLVULACEAE
Exostema caribaeum	Caribbean Princewood	RUBIACEAE
Glandularia maritima	Coastal Mock Vervain	VERBENACEAE
Gossypium hirsutum	Upland Cotton; Wild Cotton	MALVACEAE

Scientific Name	Common Name	Family
Guaiacum sanctum	Holywood Lignumvitae	ZYGOPHYLLACEAE
Gyminda latifolia	West Indian False Boxwood	CELASTRACEAE
Harrisia simpsonii	Simpson's Applecactus	CACTACEAE
Hibiscus poeppigii	Poeppig's Rosemallow	MALVACEAE
Hippomane mancinella	Manchineel	EUPHORBIACEAE
Hypelate trifoliata	White Ironwood	SAPINDACEAE
Indigofera trita subsp. *scabra*	Florida Keys Indigo	FABACEAE
Jacquemontia havanensis	Havana Clustervine	CONVOLVULACEAE
Jacquemontia pentanthos	Skyblue Clustervine	CONVOLVULACEAE
Jacquinia keyensis	Joewood	THEOPHRASTACEAE
Linum arenicola	Sand Flax	LINACEAE
Manilkara jaimiqui subsp. *emarginata*	Wild Dilly	SAPOTACEAE
Maytenus phyllanthoides	Florida Mayten	CELASTRACEAE
Microgramma heterophylla	Climbing Vine Fern	POLYPODIACEAE
Mosiera longipes	Mangroveberry	MYRTACEAE
Myrcianthes fragrans	Twinberry; Simpson's Stopper	MYRTACEAE
Nevrodium lanceolatum	Ribbon Fern	POLYPODIACEAE
Odontosoria clavata	Wedgelet Fern	DENNSTAEDTIACEAE
Opuntia corallicola	Semaphore Pricklypear; Semaphore Cactus	CACTACEAE
Opuntia stricta	Erect Pricklypear; Shell-Mound Pricklypear	CACTACEAE
Opuntia triacanthos	Spanish Lady; Keys Joe-Jumper	CACTACEAE
Paspalidium chapmanii	Coral Panicum; Coral Panicgrass	POACEAE
Passiflora multiflora	Whiteflower Passionflower; White-Flowered Passionvine	PASSIFLORACEAE
Pecluma dispersa	Widespread Polypody	POLYPODIACEAE
Pecluma plumula	Plume Polypody	POLYPODIACEAE
Pecluma ptilodon var. *caespitosa*	Comb Polypody; Swamp Plume Polypody	POLYPODIACEAE
Phoradendron rubrum	Mahogany Mistletoe	VISCACEAE
Pilosocereus polygonus	Key Tree Cactus	CACTACEAE
Pisonia rotundata	Smooth Devil's Claws; Cockspur	NYCTAGINACEAE

Scientific Name	Common Name	Family
Pithecellobium keyense	Florida Keys Blackbead	FABACEAE
Poinsettia pinetorum	Pineland Spurge; Everglades Poinsettia	EUPHORBIACEAE
Prosthechea boothiana var. *erythronioides*	Dollar Orchid	ORCHIDACEAE
Pseudophoenix sargentii	Sargent's Cherry Palm	ARECACEAE
Psychotria ligustrifolia	Bahama Wild Coffee	RUBIACEAE
Pteris bahamensis	Bahama Ladder Brake	PTERIDACEAE
Reynosia septentrionalis	Darlingplum	RHAMNACEAE
Rhynchosia parvifolia	Small-Leaf Snoutbean	FABACEAE
Rhynchosia swartzii	Swartz's Snoutbean	FABACEAE
Sachsia polycephala	Bahama Sachsia	ASTERACEAE
Savia bahamensis	Bahama Maidenbush	EUPHORBIACEAE
Scaevola plumieri	Beachberry; Inkberry; Gullfeed	GOODENIACEAE
Schaefferia frutescens	Florida Boxwood	CELASTRACEAE
Schizachyrium sericatum	Silky Bluestem	POACEAE
Scleria lithosperma	Florida Keys Nutrush	CYPERACEAE
Scutellaria havanensis	Havana Skullcap	LAMIACEAE
Senna mexicana var. *chapmanii*	Chapman's Wild Sensitive Plant	FABACEAE
Smilax havanensis	Everglades Greenbrier	SMILACACEAE
Solanum donianum	Mullein Nightshade	SOLANACEAE
Spermacoce terminalis	Everglades Key False Buttonweed	RUBIACEAE
Spiranthes torta	Southern Ladiestresses	ORCHIDACEAE
Strumpfia maritima	Pride-Of-Big-Pine	RUBIACEAE
Stylosanthes calcicola	Everglades Key Pencilflower	FABACEAE
Swietenia mahagoni	West Indian Mahogany	MELIACEAE
Thelypteris augescens	Abrupt-Tip Maiden Fern	THELYPTERIDACEAE
Thrinax morrisii	Brittle Thatch Palm; Key Thatch Palm	ARECACEAE
Thrinax radiata	Florida Thatch Palm	ARECACEAE
Tillandsia balbisiana	Northern Needleleaf; Inflated & Reflexed Wild Pine	BROMELIACEAE
Tillandsia fasciculata var. *clavispica*	Cardinal Airplant; Common Wild Pine; Stiff-Leaved Wild Pine	BROMELIACEAE

Scientific Name	Common Name	Family
Tillandsia fasciculata var. *densispica*	Cardinal Airplant; Common Wild Pine; Stiff-Leaved Wild Pine	BROMELIACEAE
Tillandsia flexuosa	Twisted Airplant; Banded Airplant	BROMELIACEAE
Tillandsia utriculata	Giant Airplant; Giant Wild Pine	BROMELIACEAE
Tillandsia variabilis	Leatherleaf Airplant; Soft-Leaved Wild Pine	BROMELIACEAE
Tournefortia hirsutissima	Chiggery Grapes	BORAGINACEAE
Tragia saxicola	Florida Keys Noseburn; Rocklands Noseburn	EUPHORBIACEAE
Trema lamarckianum	Pain-In-The-Back; West Indian Trema; Lamarck's Trema	CELTIDACEAE
Tripsacum floridanum	Florida Mock Gamagrass; Florida Tripsacum	POACEAE
Vallesia antillana	Tearshrub	APOCYNACEAE
Vanilla barbellata	Wormvine Orchid	ORCHIDACEAE
Voyria parasitica	Parasitic Ghostplant	GENTIANACEAE
Zanthoxylum flavum	West Indian Satinwood; Yellowwood; Yellowheart	RUTACEAE

NON-NATIVE PLANTS – FLORIDA KEYS

Scientific Name	Common Name	Family
Abelmoschus esculentus	Okra	MALVACEAE
Abrus precatorius	Rosary Pea; Blackeyed Susan	FABACEAE
Abutilon hirtum	Florida Keys Indian Mallow	MALVACEAE
Acacia auriculiformis	Earleaf Acacia	FABACEAE
Acacia retinodes	Water Wattle	FABACEAE
Acalypha amentacea subsp. *wilkesiana*	Wilkes' Copperleaf	EUPHORBIACEAE
Achyranthes aspera	Devil's Horsewhip	AMARANTHACEAE
Adenanthera pavonina	Red Beadtree; Red Sandalwood	FABACEAE
Agave sisalana	Sisal Hemp	AGAVACEAE
Agdestis clematidea	Rockroot	AGDESTIDACEAE
Aloe vera	Aloe	ASPHODELACEAE
Alternanthera flavescens	Yellow Joyweed	AMARANTHACEAE
Alternanthera paronichyoides	Smooth Joyweed	AMARANTHACEAE
Alysicarpus vaginalis	White Moneywort	FABACEAE
Amaranthus blitum subsp. *emarginatus*	Purple Amaranth	AMARANTHACEAE
Amaranthus crassipes	Spreading Amaranth	AMARANTHACEAE
Amaranthus dubius	Spleen Amaranth	AMARANTHACEAE
Amaranthus hybridus	Slim Amaranth; Pigweed	AMARANTHACEAE
Amaranthus polygonoides	Tropical Amaranth	AMARANTHACEAE
Amaranthus viridis	Slender Amaranth	AMARANTHACEAE
Anagallis arvensis	Scarlet Pimpernel	PRIMULACEAE
Annona squamosa	Sugar Apple	ANNONACEAE
Anredera vesicaria	Texas Madeiravine	BASELLACEAE
Antigonon leptopus	Coral Vine; Queen's Jewels	POLYGONACEAE
Ardisia elliptica	Shoebutton	MYRSINACEAE
Asparagus aethiopicus	Sprenger's Asparagus-Fern	ASPARAGACEAE
Asparagus officinalis	Garden Asparagus	ASPARAGACEAE
Asystasia gangetica	Chinese Violet	ACANTHACEAE
Avena fatua var. *sativa*	Common Oat	POACEAE
Barleria lupulina	Hophead Philippine Violet	ACANTHACEAE
Blechum pyramidatum	Browne’s Blechum	ACANTHACEAE
Bothriochloa pertusa	Pitted Beardgrass	POACEAE
Brosimum alicastrum	Breadnut	MORACEAE
Bucida buceras	Black Olive	COMBRETACEAE
Caesalpinia pulcherrima	Pride-Of-Barbados; Dwarf Poinciana	FABACEAE
Cajanus cajan	Pigeonpea	FABACEAE
Calophyllum antillanum	Santa Maria; Galba	CLUSIACEAE

Scientific Name	Common Name	Family
Cannabis sativa	Hemp; Marijuana	CANNABACEAE
Cardiospermum halicacabum	Love-In-A-Puff	SAPINDACEAE
Carica papaya	Papaya	CARICACEAE
Carissa macrocarpa	Natal Plum	APOCYNACEAE
Casuarina cunninghamiana	River Sheoak	CASUARINACEAE
Casuarina equisetifolia	Australian-Pine; Horsetail Casuarina	CASUARINACEAE
Casuarina glauca	Gray Sheoak; Suckering Australian-Pine	CASUARINACEAE
Catharanthus roseus	Madagascar Periwinkle	APOCYNACEAE
Ceratophyllum muricatum subsp. *Australe*	Prickly Hornwort	CERATOPHYLLACEAE
Cestrum diurnum	Dayflowering Jessamine	SOLANACEAE
Cestrum nocturnum	Nightflowering Jessamine	SOLANACEAE
Chamaedorea seifrizii	Bamboo Palm	ARECACEAE
Chamaesyce mendezii	Mendez's Sandmat	EUPHORBIACEAE
Chenopodium murale	Nettleleaf Goosefoot	AMARANTHACEAE
Chloris barbata	Swollen Fingergrass	POACEAE
Citrullus lanatus	Watermelon; Citron	CUCURBITACEAE
Citrus x aurantiifolia	Key Lime	RUTACEAE
Citrus x jambhiri	Mandarin Lime; Rough Lemon	RUTACEAE
Clerodendrum speciosissimum	Javanese Glorybower	LAMIACEAE
Clitoria ternatea	Asian Pigeonwings	FABACEAE
Cocos nucifera	Coconut Palm	ARECACEAE
Colocasia esculenta	Wild Taro; Dasheen; Coco Yam	ARACEAE
Colubrina asiatica	Latherleaf; Asian Nakedwood	RHAMNACEAE
Commelina diffusa	Common Dayflower	COMMELINACEAE
Cordia sebestena	Largeleaf Geigertree	BORAGINACEAE
Cosmos caudatus	Wild Cosmos	ASTERACEAE
Crescentia cujete	Calabash	BIGNONIACEAE
Crotalaria pallida var. *obovata*	Smooth Rattlebox	FABACEAE
Crotalaria retusa	Rattleweed	FABACEAE
Cryptostegia grandiflora	Palay Rubbervine	APOCYNACEAE
Cryptostegia madagascariensis	Madagascar Rubbervine	APOCYNACEAE
Cyanthillium cinereum	Little Ironweed	ASTERACEAE
Cyclospermum leptophyllum	Marsh Parsley	APIACEAE
Cynodon dactylon	Bermudagrass	POACEAE
Cyperus esculentus	Yellow Nutgrass; Chufa Flatsedge	CYPERACEAE
Cyperus involucratus	Umbrella Plant	CYPERACEAE
Cyperus iria	Ricefield Flatsedge	CYPERACEAE
Cyperus lentiginosus	Latin American Flatsedge	CYPERACEAE
Cyperus rotundus	Nutgrass	CYPERACEAE
Dactyloctenium aegyptium	Durban Crowfootgrass	POACEAE
Dalbergia sissoo	Indian Rosewood	FABACEAE

Scientific Name	Common Name	Family
Delonix regia	Royal Poinciana	FABACEAE
Desmanthus virgatus	Wild Tantan	FABACEAE
Desmodium incanum	Zarzabacoa Comun	FABACEAE
Desmodium scorpiurus	Scorpion Ticktrefoil	FABACEAE
Desmodium tortuosum	Dixie Ticktrefoil	FABACEAE
Dichrostachys cinerea subsp. *africana*	Aroma	FABACEAE
Digitaria bicornis	Asia Crabgrass	POACEAE
Dioscorea bulbifera	Air-Potato	DIOSCOREACEAE
Diplotaxis muralis	Annual Wallrocket	BRASSICACEAE
Duranta erecta	Golden Dewdrops	VERBENACEAE
Eleusine indica	Indian Goosegrass	POACEAE
Emilia fosbergii	Florida Tasselflower	ASTERACEAE
Eragrostis amabilis	Feather Lovegrass	POACEAE
Eragrostis ciliaris	Gophertail Lovegrass	POACEAE
Eragrostis prolifera	Dominican Lovegrass	POACEAE
Erucastrum gallicum	Common Dogmustard	BRASSICACEAE
Eucalyptus robusta	Swampmahogany	MYRTACEAE
Eugenia uniflora	Surinam Cherry	MYRTACEAE
Euphorbia graminea	Grassleaf Spurge	EUPHORBIACEAE
Euphorbia lactea	Mottled Spurge	EUPHORBIACEAE
Evolvulus convolvuloides	Bindweed Dwarf Morning-Glory; Dwarf Bindweed	CONVOLVULACEAE
Evolvulus glomeratus subsp. *grandiflorus*	Blue Daze	CONVOLVULACEAE
Fatoua villosa	Hairy Crabweed	MORACEAE
Ficus benjamina	Weeping Fig	MORACEAE
Ficus microcarpa	Indian Laurel	MORACEAE
Ficus religiosa	Bo Tree; Sacred Fig	MORACEAE
Fimbristylis schoenoides	Ditch Fimbry	CYPERACEAE
Gliricidia sepium	Quickstick	FABACEAE
Glycosmis parviflora	Flower Axistree	RUTACEAE
Gomphrena serrata	Arrasa Con Todo	AMARANTHACEAE
Helianthus annuus	Common Sunflower	ASTERACEAE
Hordeum vulgare	Common Barley	POACEAE
Hura crepitans	Sandboxtree	EUPHORBIACEAE
Indigofera spicata	Trailing Indigo	FABACEAE
Indigofera tinctoria	True Indigo	FABACEAE
Ipomoea batatas	Sweetpotato	CONVOLVULACEAE
Ipomoea cairica	Mile-A-Minute Vine	CONVOLVULACEAE
Ipomoea carnea subsp. *fistulosa*	Bush Morning-Glory	CONVOLVULACEAE
Ipomoea triloba	Littlebell	CONVOLVULACEAE
Jacquinia arborea	Braceletwood	THEOPHRASTACEAE
Jasminum dichotomum	Gold Coast Jasmine	OLEACEAE
Jasminum fluminense	Brazilian Jasmine;	OLEACEAE

Scientific Name	Common Name	Family
	Jazmin De Trapo	
Jasminum sambac	Arabian Jasmine	OLEACEAE
Jatropha integerrima	Peregrina	EUPHORBIACEAE
Kalanchoe daigremontiana	Devil's Backbone	CRASSULACEAE
Kalanchoe delagoensis	Chandelier Plant	CRASSULACEAE
Kalanchoe laciniata	Christmastree Plant	CRASSULACEAE
Kalanchoe pinnata	Cathedral Bells; Life Plant	CRASSULACEAE
Kyllinga brevifolia	Shortleaf Spikesedge	CYPERACEAE
Lablab purpureus	Hyacinthbean	FABACEAE
Lagenaria siceraria	Bottle Gourd	CUCURBITACEAE
Lantana camara	Lantana; Shrubverbena	VERBENACEAE
Launaea intybacea	Achicoria Azul	ASTERACEAE
Leonotis nepetifolia	Lion's-Ear; Christmas Candlestick	LAMIACEAE
Leucaena leucocephala	White Leadtree	FABACEAE
Lippia alba	Bushy Matgrass	VERBENACEAE
Lonchocarpus punctatus	Dotted Lancepod	FABACEAE
Macroptilium atropurpureum	Purple Bushbean	FABACEAE
Macroptilium lathyroides	Wild Bushbean	FABACEAE
Malvaviscus arboreus var. *drummondii*	Texas Waxmallow	MALVACEAE
Malvaviscus penduliflorus	Mazapan; Turkscap Mallow	MALVACEAE
Manihot esculenta	Tapioca	EUPHORBIACEAE
Manilkara zapota	Sapodilla	SAPOTACEAE
Melia azedarach	Chinaberrytree	MELIACEAE
Melicoccus bijugatus	Spanish Lime	SAPINDACEAE
Merremia tuberosa	Spanish Arborvine; Yellow Morning-Glory	CONVOLVULACEAE
Merremia umbellata	Hogvine	CONVOLVULACEAE
Mirabilis jalapa	Four-O'clock; Marvel-Of-Peru	NYCTAGINACEAE
Momordica charantia	Balsampear	CUCURBITACEAE
Morinda citrifolia	Indian Mulberry	RUBIACEAE
Mucuna pruriens	Cowitch; Velvetbean	FABACEAE
Muntingia calabura	Strawberrytree	MUNTINGIACEAE
Murraya paniculata	Orange Jessamine	RUTACEAE
Musa acuminata	Dwarf Banana	MUSACEAE
Musa x paradisiaca	Common Banana	MUSACEAE
Nama jamaicensis	Jamaicanweed	HYDROPHYLLACEAE
Nerium oleander	Oleander	APOCYNACEAE
Nicotiana plumbaginifolia	Tex-Mex Tobacco	SOLANACEAE
Nicotiana tabacum	Cultivated Tobacco	SOLANACEAE
Ochrosia elliptica	Elliptic Yellowwood	APOCYNACEAE
Oeceoclades maculata	Monk Orchid	ORCHIDACEAE
Oldenlandia corymbosa	Flattop Mille Graines	RUBIACEAE
Opuntia cochenillifera	Cochineal Cactus	CACTACEAE
Panicum maximum	Guineagrass	POACEAE

Scientific Name	Common Name	Family
Panicum repens	Torpedograss	POACEAE
Parkinsonia aculeata	Mexican Palo Verde; Jerusalem Thorn	FABACEAE
Parthenium hysterophorus	Santa Maria Feverfew	ASTERACEAE
Paspalum fimbriatum	Winged Paspalum; Panama Crowngrass	POACEAE
Passiflora x pfordtii		PASSIFLORACEAE
Peltophorum pterocarpum	Yellow Poinciana	FABACEAE
Pennisetum setaceum	Fountaingrass	POACEAE
Phaseolus lunatus	Lima Bean	FABACEAE
Phyllanthus amarus	Gale-Of-Wind; Carry-Me-Seed	EUPHORBIACEAE
Phyllanthus angustifolius	Foliage Flower; Swordbush	EUPHORBIACEAE
Phyllanthus tenellus	Mascarene Island Leafflower	EUPHORBIACEAE
Plumeria obtusa	Frangipani	APOCYNACEAE
Polyscias guilfoylei	Frosted Aralia	ARALIACEAE
Portulaca oleracea	Little Hogweed	PORTULACACEAE
Pouteria campechiana	Egg Fruit; Canistel	SAPOTACEAE
Psidium guajava	Guava	MYRTACEAE
Psychotria punctata	Dotted Wild Coffee	RUBIACEAE
Pteris vittata	Chinese Ladder Brake	PTERIDACEAE
Rhynchelytrum repens	Rose Natalgrass	POACEAE
Ricinus communis	Castorbean	EUPHORBIACEAE
Rottboellia cochinchinensis	Itchgrass	POACEAE
Ruellia malacosperma	Softweed Wild Petunia	ACANTHACEAE
Russelia equisetiformis	Fountainbush; Firecracker Plant	VERONICACEAE
Scaevola taccada	Beach Naupaka	GOODENIACEAE
Scaevola taccada var. *sericea*	Beach Naupaka	GOODENIACEAE
Schefflera actinophylla	Australian Umbrella Tree; Octopus Tree	ARALIACEAE
Schinus terebinthifolius	Brazilian Pepper	ANACARDIACEAE
Senna occidentalis	Septicweed	FABACEAE
Senna pendula var. *glabrata*	Valamuerto	FABACEAE
Senna surattensis	Glossy Shower	FABACEAE
Sesbania grandiflora	Vegetable Hummingbird	FABACEAE
Sesbania sericea	Silky Sesban	FABACEAE
Setaria rariflora	Brazilian Bristlegrass	POACEAE
Setaria setosa	West Indian Bristlegrass	POACEAE
Sida cordifolia	Llima	MALVACEAE
Sida spinosa	Prickly Fanpetals	MALVACEAE
Solanum elaeagnifolium	Silverleaf Nightshade; White Horsenettle	SOLANACEAE
Solanum lycopersicum	Garden Tomato	SOLANACEAE
Solanum tampicense	Aquatic Soda Apple	SOLANACEAE
Sonchus oleraceus	Common Sowthistle	ASTERACEAE
Spermacoce verticillata	Shrubby False Buttonweed	RUBIACEAE
Sphagneticola trilobata	Creeping Oxeye	ASTERACEAE
Spondias purpurea	Purple Mombin	ANACARDIACEAE
Sporobolus indicus	Smutgrass	POACEAE

Scientific Name	Common Name	Family
Sporobolus indicus var. *pyramidalis*	West Indian Dropseed	POACEAE
Stictocardia tiliifolia	Spottedheart	CONVOLVULACEAE
Stylosanthes hamata	Cheesytoes	FABACEAE
Synedrella nodiflora	Nodeweed	ASTERACEAE
Syngonium podophyllum	American Evergreen	ARACEAE
Tabebuia heterophylla	White Cedar	BIGNONIACEAE
Talinum fruticosum	Verdolaga-Francesa	PORTULACACEAE
Talipariti tiliaceum	Sea Hibiscus; Mahoe	MALVACEAE
Talipariti tiliaceum var. *pernambucense*	Yellow Mahoe	MALVACEAE
Tamarindus indica	Tamarind	FABACEAE
Tecoma stans	Yellow Elder; Yellow Trumpetbush	BIGNONIACEAE
Terminalia catappa	West Indian Almond	COMBRETACEAE
Thespesia populnea	Portia Tree	MALVACEAE
Tribulus cistoides	Burrnut; Jamaican Feverplant	ZYGOPHYLLACEAE
Tridax procumbens	Coatbuttons	ASTERACEAE
Triphasia trifolia	Limeberry	RUTACEAE
Turbina corymbosa	Christmasvine	CONVOLVULACEAE
Turnera ulmifolia	Yellow Alder; Ramgoat Dashalong	TURNERACEAE
Urochloa distachya	Tropical Signalgrass	POACEAE
Verbesina encelioides	Golden Crownbeard; Skunk Daisy	ASTERACEAE
Vitex trifolia	Simpleleaf Chastetree	LAMIACEAE
Youngia japonica	Oriental False Hawksbeard	ASTERACEAE
Zeuxine strateumatica	Soldier's Orchid; Lawn Orchid	ORCHIDACEAE
Zoysia matrella	Manila Templegrass; Manilagrass	POACEAE
Zoysia tenuifolia	Manila Templegrass; Mascarenegrass	POACEAE

VIII. List of Preparers

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