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APPENDIX A

SUMMARY OF LEGISLATION AND OTHER FEDERAL MANDATES RELEVANT TO THE VITAL SIGNS MONITORING PROGRAM

SFCN Staff
2005

APPENDIX A. Summary of Legislation and other federal mandates relevant to the Vital Signs Monitoring Program.

Legislation	Summary Content
National Park Service Organic Act of 1916 *16 USC 1*	This Act created the National Park Service within the U.S. Department of the Interior and gave it jurisdiction over parks, monuments, and reservations acquired by the U.S. government for the purpose of wilderness conservation and public enjoyment. "The service thus established shall promote and regulate the use of the Federal areas known as national parks, monuments, and reservations hereinafter specified by such means and measures as conform to the fundamental purposes of the said parks, monuments, and measures as conform to the fundamental purposes of the said parks, monuments, and reservations, which purpose is to conserve the scenery and the natural and historic objects and the wildlife therein and to provide for the enjoyment of the same in such manner and by such means as will leave them unimpaired for the enjoyment of future generations."
Fish and Wildlife Coordination Act of 1958 and 1980	The Fish and Wildlife Coordination Act requires federal agencies to consult with the US Fish and Wildlife Service (USF&W), or National Marine Fisheries Service, and with parallel state agencies, whenever water resource development plans result in alteration of a body of water. The Secretary of the Interior is authorized to assist and cooperate with federal agencies to "provide that wildlife conservation shall receive equal consideration and be coordinated with other features of water-resource development programs."
Wilderness Act of 1964 *16 U.S.C. 1131 et seq. (1988), 78 Stat. 890, Pub. L. 88-577*	The Wilderness Act of 1964 established the National Wilderness Preservation System, composed of federal lands designated as Wilderness Areas. Wilderness Areas are to be administered "…for the use and enjoyment of the American people in such manner as will leave them unimpaired for future use and enjoyment as wilderness, so as to provide for the …preservation of their wilderness character…" NPS policy mandates that any proposed wilderness areas be managed as *de facto* wilderness until a final determination regarding wilderness designation has been made by Congress. (NPS Management Policies 2001).
National Historic Preservation Act of 1966, as amended (16 USC 470 et seq.)	Congress set forth in NHPA includes preserving 'the historical and cultural foundations of the Nation' and preserving irreplaceable examples important to our national heritage to maintain 'cultural, educational, aesthetic, inspirational, economic, and energy benefits.' NHPA established the National Register of Historic Places composed of places and objects 'significant in American history, architecture, archeology, engineering, and culture.' NHPA requires federal agencies to account for effects of actions on historic (state and federal) properties.
National Environmental Policy Act of 1969	The National Environmental Policy Act (NEPA) is the fundamental national charter for environmental protection. "NEPA is intended to help public officials to: (1) make decisions that are based on an understanding of environmental consequences; and (2) take actions that protect, restore, and enhance the environment." (National Park Service, 1990c). The National Environmental Policy Act states that the federal government will "preserve important historic, cultural, and natural aspects of our national heritage." It directs that all practicable means be used to improve federal functions so that the nation may "...attain the widest range of beneficial uses of the environment without degradation, risk to health or safety, or other undesirable and unintended consequences..." Specifically, NEPA requires that an environmental impact statement (EIS) be prepared for major actions by federal government agencies. The primary purpose of an EIS is to evaluate the environmental impacts of proposed projects and facilitate public review. An environmental assessment may be prepared to determine if an EIS is required. An environmental assessment is not required as part of the WRMP because the plan provides a general management direction for the Recreation Area. Specific actions recommended in this WRMP may be implemented depending on funding and staff availability. Compliance with NEPA will be completed when specific actions are likely to be initiated.
General Authorities Act of 1970	The General Authorities Act reinforces the National Park Service Organic Act by uniting all areas administered by the National Park Service into one National Park System. This was done in recognition of the growing variety of National Park Service units (e.g. national recreation areas, national seashores). The act assures a common preservation purpose for all units, regardless of title or designation. Hence, the fundamental duty of Recreation Area managers is to protect park resources, unless specifically exempted by Congress. Managers of all National Park Service units are accountable to the National Park Service Organic Act, related legislation and to National Park Service policies and guidelines.
Environmental Quality Improvement Act of 1970 (42 U.S.C. 56 § 4371)	Directs all Federal agencies, whose activities may affect the environment, to implement policies established under existing law to protect the environment.
Federal Water Pollution Control Act of 1972 (Clean Water Act)	This Act protects the biological, chemical, and physical nature of the Nation's waters through the elimination of pollutants and the creation of wastewater treatment plants. *"It is the policy of the Congress to recognize, preserve, and protect the primary responsibilities and rights of States to prevent, reduce, and eliminate pollution, to plan the development and use (including restoration, preservation, and enhancement) of land and water resources…"*

Legislation	Summary Content
Marine Protection, Research, and Sanctuaries Act of 1972 (16 U.S.C. 32 § 1431)	Recognizes that the United States has historically protected "Special areas of its public domain, but (that) these efforts have been directed almost exclusively to land areas above the high-water mark." For this reason congress elected to recognize and protect "Certain areas of the marine environment possess(ing) conservation, recreational, ecological, historical, scientific, educational, cultural, archeological, or esthetic qualities which give them special national, and in some cases international, significance." Specifically this law intends to "Improve the conservation, understanding, management, and wise and sustainable use of marine resources; (to) enhance public awareness, understanding, and appreciation of the marine environment; and (to) maintain for future generations the habitat, and ecological services, of the natural assemblage of living resources that inhabit these areas.
Coastal Zone Management Act of 1972 (16 U.S.C. 33 § 1452)	"Congress finds and declares that it is the national policy - to preserve, protect, develop, and where possible, to restore or enhance, the resources of the Nation's coastal zone for this and succeeding generations."
Federal Advisory Committee Act of 1972 (FACA) (Public Law 92-463, 5 U.S.C.)	Creates a formal process for federal agencies to seek advice and assistance from citizens. Any council, panel, conference, task force or similar group used by federal officials to obtain consensus advice or recommendations on issues or policies fall under the purview of FACA.
Endangered Species Act of 1973	The Endangered Species Act was enacted in 1973 and amended in 1978, 1982 and 1988. It provides for the conservation, protection, restoration, propagation and recovery of species of native fish and wildlife (including plants) that are listed as being threatened with extinction. All entities using federal funding must consult with the Secretary of the Interior (through authority delegated to the US Fish and Wildlife Service) on activities that potentially affect endangered or threatened flora and fauna.
Migratory Bird Treaty Act of 1974 *16 U.S.C. §703-711*	On January 10, 2001, the President signed Executive Order 13186, directing Federal agencies to minimize their negative impacts on migratory birds, to enter into an MOU with the U.S. Fish and Wildlife Service, and to carry out certain actions to further the implementation of the Migratory Bird Treaty Act. In addition, the Executive Order calls on Federal agencies to take reasonable steps that include restoring and enhancing habitat, incorporating migratory bird conservation into planning processes, promoting research and information exchange, providing training and visitor education, and developing partnerships beyond agency boundaries. The Migratory Bird Treaty Act (MBTA), signed in 1918 and amended in 1936, 1974 and 1989, is the domestic law that implements the United States' commitment to four international conventions (with Canada, Mexico, Japan and Russia) for the protection of migratory birds. The species protected by the MBTA are listed at 50 CFR § 10.13. In 2000, a Federal Court ruled that Federal agencies, like private citizens, are subject to MBTA regulations regarding take of migratory birds. An MOU between the National Park Service and the U.S. Fish and Wildlife Service is currently being drafted to address this issue, as required by the Executive Order.
Forest and Rangeland Renewable Resources Planning Act of 1974 (16 U.S.C. 36 § 1642	Mandates that the Secretary of Agriculture inventory and monitor renewable natural resources in National Forests, and has been cited as congressional authorization for the inventory and monitoring of natural resources on all federal lands. While this is not specifically directed in the act it is perhaps indicative of a national will to account for and manage the nations natural heritage in manner that sustains these resources in perpetuity.
Safe Drinking Water Act of 1974	The Safe Drinking Water Act was enacted in 1974 and amended in 1986. This act, implemented by the states, sets national minimum drinking water quality standards and requires regular testing of public drinking water supplies. The National Park Service must comply with state regulations regarding the construction, operation, and monitoring of its public water supplies.
Surface Mining Control and Reclamation Act of 1977	The Surface Mining Control and Reclamation Act establishes a nationwide program to protect the environment from adverse effects of surface coal mining operations, establishes minimum national standards for regulating surface coal mining, assists states in developing and implementing regulatory programs, and promotes reclamation of previously mined areas with inadequate reclamation. Under the Act, the Secretary of the Interior is directed to regulate the conduct of surface coal mining throughout the United States for both federally and non-federally owned rights. The Act establishes the Abandoned Mine Reclamation Fund, which is for the reclamation of land and water affected by coal mining. Eligibility for reclamation under this program requires that the land or water had been mined for coal, or affected by coal mining, and had been inadequately reclaimed prior to the enactment of this act in 1977. Both public and private lands are eligible for funding. Sections 522(e)(1) and 533(e)(3) of the act specifically prohibit surface mining within the National Park Service, National Wildlife Refuge System, National System of Trails, National Wilderness Preservation System, or Wild and Scenic Rivers System. The act also prohibits surface mining that adversely impacts any publicly-owned park or place included in the National Register of Historic Sites. These prohibitions are subject to valid existing rights at the time of the Act, the exact definition of which remains the subject of administrative and legal action. How valid existing rights are ultimately defined will affect the ability of mineral owners to mine in the Recreation Area.

Legislation	Summary Content
Redwood National Park Act of 1978	The Redwood National Park Act amends the General Authorities Act of 1970, and reasserts the system-wide standard of protection prescribed in the original Organic Act. This Act strengthens the Secretary of the Interior's ability to protect park resources, yet qualifies that park protection will "not be exercised in derogation of the values and purposes for which these various areas have been established." Thus, specific provisions in a park's enabling legislation allow park managers to permit certain activities, such as hunting or grazing.
Clean Air Act of 1990 *42 U.S.C. Sec. 7401(c).*	The Clean Air Act provides a legal framework for the National Park Service to preserve and protect parks' air quality related values (AQRV's) from pollution sources emanating from within and outside park boundaries. Because of a perceived need for national and regional air quality research to support state programs, Congress passed its first federal air quality initiative in 1955. In response to increasing harm to public health and welfare and to inadequate controls and enforcement, Congress has slowly but steadily expanded and refined the law, now known as the Clean Air Act, to cover more types of pollutants and emitters; i.e., stationary and mobile sources of pollution. These efforts have culminated in the 1990 amendments to the Clean Air Act, which represent the most comprehensive and detailed set of measures to date to both prevent and curtail air pollution. The declaration of purpose as revised in 1990 states, "A primary goal of this Act is to encourage or otherwise promote reasonable Federal, State, and local government actions, consistent with the provisions of the Act, for pollution prevention."
Government Performance and Results Act of 1993	Passed in 1993, GPRA establishes a performance management system to set goals and track accomplishments within Federal Agencies. In accordance, Park Service-wide strategic plans, annual performance plans, and annual performance reports are prepared and analyzed for management accountability. The strategic plans, developed and updated at all organizational levels, drive budgeting and resource allocation decisions. The superintendent of each park, as well as other program managers, is required to prepare a 5-year strategic plan, an annual performance plan and an annual performance report. The strategic plan and annual performance plan reflect NPS policies and goals stated in the Service-wide Strategic Plan. Annual performance reports for parks and programs show accomplishments or results toward stated goals to evaluate organizational and individual performance. NPS GPRA goals must be consistent with National Park Service Management Policies (2001).
National Parks Omnibus Management Act of 1998	The Omnibus Act is the precursor to the Natural Resource Challenge, the prime directive guiding the NPS I&M Program. The goal of the act is to use state-of-the-art methods of scientific research to improve management decisions within the NPS. This act also made the superintendents of each park unit responsible for the care and condition of the resources within the parks. "The Secretary shall undertake a program of inventory and monitoring of National Park System resources to establish baseline information and to provide information on the long-term trends in the condition of the National Park System." In addition, the act created the Natural Resources Challenge, which provides the funding for the I&M Program and doubles the natural resources staff within the NPS. "The Committee applauds the Service for recognizing that the preservation of the diverse natural elements and the great scenic beauty of America's national parks and other units should be as high a priority in the Service as providing visitor services. A major part of protecting those resources is knowing what they are, where they are, how they interact with their environment and what condition they are in. This involves a serious commitment from the leadership of the National Park Service to insist that the superintendents carry out a systematic, consistent, professional inventory and monitoring program, along with other scientific activities, that is regularly updated to ensure that the Service makes sound resource decisions based on sound scientific data."

Appendix A Continued: Executive Orders

Executive Order	Summary Content
Exotic Organisms *E.O. 11987*	This Order states that government agencies will restrict the introduction of exotic species into natural areas. *"Executive agencies shall, to the extent permitted by law, restrict the introduction of exotic species into the natural ecosystems on lands and waters which they own, lease, or hold for purposes of administration; and, shall encourage the States, local governments, and private citizens to prevent the introduction of exotic species into natural ecosystems of the United States."*
Floodplain Management *E.O. 11988*	Requires all federal agencies to *"reduce the risk of flood loss,... minimize the impacts of floods on human safety, health and welfare, and ... restore and preserve the natural and beneficial values served by flood plains."* To the extent possible, park facilities, such as campgrounds and rest areas, should be located outside floodplain areas. Executive Order 11988 is implemented in the National Park Service through the *Floodplain Management Guidelines* (National Park Service, 1993b). It is the policy of the National Park Service to 1) restore and preserve natural floodplain values; 2) to the extent possible, avoid environmental impacts to the floodplain by discouraging floodplain development; 3) minimize the risks to life and property when structures and facilities must be located on a floodplain; and, 4) encourage nonstructural over structural methods of flood hazard mitigation.
Off-Road Vehicle Use *E.O. 11989*	If the enabling legislation allows the use of off-road vehicles, NPS is required to designate specific areas for off-road vehicle use. These areas must be *"located to minimize damage to soil, watershed, vegetation, or other resources"* (Section (3)(a)(1)). If it is determined that such use is adverse to resources, the NPS is to immediately close such areas or trails until the impacts have been corrected.
Protection of Wetlands *E.O. 11990*	Requires all federal agencies to *"minimize the destruction, loss, or degradation of wetlands, and preserve and enhance the natural and beneficial values of wetlands".* Unless no practical alternative exists, federal agencies must avoid any activities that have the potential to adversely affect wetland ecosystem integrity. NPS guidance pertaining to this Executive Order is stated in *Floodplain and Wetland Protection Guidelines* (National Park Service, 1980).
Federal Compliance with Pollution Control Standards *E.O. 12088*	Requires all federal agencies to prevent, control, and abate environmental pollution from federal facilities and activities and to comply with all applicable pollution control standards, including the Federal Water Pollution Control Act.
Coral Reef Protection *E.O. 13089*	To preserve and protect the biodiversity, health, heritage, and social and economic value of U.S. coral reef ecosystems and the marine environment by coral reef mapping and monitoring; research; conservation, mitigation, and restoration; and international cooperation.
Invasive Species Management *E.O. 13112*	Goal is to prevent the introduction of invasive species and provide for their control and to minimize the economic, ecological, and human health impacts that invasive species cause. Among other things, this Executive Order It established the National Invasive Species Council and required the preparation of a National Invasive Species Management Plan to recommend specific, performance-oriented goals and objectives and specific measures of success for Federal agency efforts concerning invasive species.
Protection of Migratory Birds *E.O. 13186*	This Order provides additional protection for migratory birds, such that Federal agencies should "design migratory bird habitat and population conservation principles, measures, and practices, into agency plans and planning processes (natural resource, land management, and environmental quality planning, including, but not limited to, forest and rangeland planning, coastal management planning, watershed planning, etc.) as practicable, and coordinate with other agencies and nonfederal partners in planning efforts."

Appendix A Continued: NPS Polices and Guidance

NPS Policy/Guidance	Summary Content
NPS Management Policies 2001 (NPS Directives System)	This is the basic NPS servicewide policy document. It is the highest of three levels of guidance documents in the NPS Directives System. The Directives System is designed to provide NPS management and sta. with clear and continuously updated information on NPS policy and required and/or recommended actions, as well as any other information that will help them manage parks and programs effectively.
NPS Directors Orders	Second level of NPS Directives System. Directors Orders serve as a vehicle to clarify or supplement Management Policies to meet the needs of NPS managers. Relevant Directors Orders: DO-2.1 Resource Management Planning DO-12 Environmental Impact Assessment DO-14 Resource Damage Assessment & Restoration DO-24 Museum Collections Management DO-41 Wilderness Preservation & Management DO-47 Sound Preservation & Noise Management DO-77 Natural Resource Protection
NPS Handbooks and Reference Manuals	This is the third tier in the NPS Directives System. These documents are issued by Associate Directors. These documents provide NPS field employees with a compilation of legal references, operating policies, standards, procedures, general information, recommendations and examples to assist them in carrying out Management Policies and Director's Orders. Level 3 documents may not impose any new servicewide requirements, unless the Director has specifically authorized them to do so. Relevant Handbooks and Reference Manuals: NPS-75 Natural Resources Inventory & Monitoring NPS-77 Natural Resources Management Guidelines NPS Guide to Fed. Advisory Committee Act Website: Monitoring Natural Resources in our National Parks, http://science.nature.nps.gov/im/

Park	Summary Content
Big Cypress National Preserve	*Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,* That in order to assure the preservation, conservation, and protection of the natural, scenic, hydrologic, floral and faunal, and recreational values of the Big Cypress Watershed in the State of Florida and to provide for the enhancement and public enjoyment thereof, the Big Cypress National Preserve is hereby established.
Biscayne National Park	In order to preserve and protect for the education, inspiration, recreation, and enjoyment of present and future generations a rare combination of terrestrial, marine, and amphibious life in a tropical setting of great natural beauty, there is hereby established the Biscayne National Park in the State of Florida.
Buck Island National Park	WHEREAS Buck Island and Its adjoining shoals, rocks, and undersea coral reef formations possess one at the finest marine gardens In the Caribbean Sea; and WHEREAS these lands and their related features are of great scientific interest and educational value to students of the sea and to the public; and WHEREAS this unique natural area and the rare marine life which are dependent upon it are subject to constant threat of commercial exploitation and destruction; and WHEREAS the Advisory Board on National Parks. Historic Sites. Buildings and Monuments, established pursuant to the act of August 21, 1935, 49 Stat. see (15 U.S-C-4g3). Impressed by the caliber and scientific importance of the coral reefs of Buck Island, had urged their prompt protection to prevent further despoliation;
Dry Tortugas National Park	In order to preserve and protect for the education, inspiration, and enjoyment of present and future generations nationally significant natural, historic, scenic, marine, and scientific values in South Florida, there is hereby established the Dry Tortugas National Park.
Everglades National Park	When title to all the lands within boundaries to be determined by the Secretary of the Interior within the area of approximately two thousand square miles in the region of the Everglades of Dade, Monroe, and Collier Counties, in the State of Florida, recommended by said Secretary, in his report to Congress of December 3, 1930, pursuant to the Act of March 1, 1929 (45 Stat. 1443), shall have been vested in the United States, said lands shall be, and are, established, dedicated, and set apart as a public park for the benefit and enjoyment of the people and shall be known as the Everglades National Park
Salt River Bay National Historical Park and Ecological Preserve	In order to preserve, protect, and interpret for the benefit of present and future generations certain nationally significant historical, cultural, and natural sites and resources in the Virgin Islands, there is established the Salt River Bay National Historical Park and Ecological Preserve at St. Croix, Virgin Islands.
Virgin Islands National Park	A portion of the Virgin Islands of the United States, containing outstanding scenic and other features of national significance, shall be established, as prescribed in section 398a of this title, as the "Virgin Islands National Park".

APPENDIX B

GPRA GOALS

SFCN Staff
2005

APPENDIX B. GPRA Goals

GPRA Goal	Park Code	Park Goal Details
1a0 – Other	Natural and cultural resources and associated values are protected, restored and maintained in good condition and managed within their broader ecosystem and cultural context.	
	BISC	By September 30, 2005, Disturbed mangroves and Bay bottom lands on 2% of affected acres of park land (1 of 50acres)are restored.
	BISC	By September, 30, 2005, damaged coral on 10% of affected acres of parkland (1 of 10 acres) will be restored.
1a01A –	This goal provides parks an opportunity to plan/report all efforts spent in restoring lands not covered by goal Ia1A.	
	EVER	By September 30, 2005, 109,506 acres in the East Everglades addition are potected through acquisition.
	VIIS	By September 30, 2005, restore 2 acres (66%) of Lameshur wetlands at Virgin Islands National Park, disturbed by hurricane damage.
1a01B – Exotic species	Restoring or containing Exotic Species Not Covered by Goal Ia1B including Exotic Animal Species.	
	BICY	By September 30, 2005 119,000 acres, 100% of Big Cypress National Preserve's land impacted by Melaleuca will be retreated.
	BUIS	By September 30, 2005 176 acres (100%) of 176 acres of Buck Island Reef National Monument targeted land impacted by exotic animals (Rattus rattus) as of Fy 1999, are contained.
	VIIS	By September 30, 2005, 35 acres of an estimated 3000 acres of Virgin Islands National Park targeted lands impacted by exotic vegetation, as of FY 1999, are contained.
1a02– Other	None listed	
	DRTO	By September 30,2005, 9 species (fish & avian populations, including breeding populations of sooty & noddy terns, brown pelicans, boobies & frigate birds, lobster & conch populations and coral reef & other benthic-type communities) remain stable.
	VIIS	By September 30, 2005, 1 (50%) of Virgin Islands National Park's 2 identified federally listed threatened and endangered species without critical habitat or recovery plans have a stable status. These species are the St. Thomas Lidflower and the Roseate Tern.
1a04 – Water Quality	This goal provides parks an opportunity to plan/report all efforts spent in managing water quality issues not covered by Ia4.	
	BISC	By September 30, 2005, 4 of 7 (60%) of Biscayne National Park water quality parameters will be improved. Seven water quality parameters (temp., specific conductivity, salinity, dissolved oxygen, ph, turbidity, and depth) will be managed towards improved conditions.
	EVER	By September 30, 2005, phosphorus levels entering the park are 8ppb in the Shark River Slough and 6 ppb in the Taylor/Slough/Coastal Water Basin.
1a1A – Disturbed Land	By September 30, 2005, 10.1% of targeted parklands, disturbed by development or agriculture, as of 1999 (22,500 of 222,300 acres), are restored.	
	BICY	By Sept. 30, 2005 4015 (10%) of the 40,151 acres of Big Cypress National Preserve targeted lands disturbed by prior development, ORV and agricultural use identified in FY 1999 are restored.
	DRTO	Goal entered but no park long term goal listed
	EVER	By September 30, 2005, 1000 acres in the Hold in the Donut are restored.
	VIIS	By September 30, 2005, 10.1% of targeted parklands, disturbed by development or agriculture, as of 1999, are restored.

GPRA Goal	Park Code	Park Goal Details
1a1B – Exotic Veg.	By September 30, 2005: Exotic vegetation on 6.3% of targeted acres of parkland (167,500 of 2,656,700 acres) is contained.	
	BISC	By September 30, 2005, exotic vegetation on 100% of targeted acres of parkland (10,880 of 172,900 acres)is contained.
	BUIS	By September 30, 2005, 50 (30%) acres of Buck Island Reef NM's lands impacted by exotic vegetation targeted by September 30,1999, are contained.
	DRTO	By September 30, 2005, 40 acres of disturbed park land are restored.
	EVER	By September 30, 2005, 21,000 acres of disturbed park lands are restored
1a2 – Other	None stated	
	BISC	6 of 13 targeted t & e species will have an improved status in accordance with NPS guidelines and fish and wildlife recovery plans by improving degraded habitats
	BICY	100% of the 1999 identified Preserve populations of federally listed threatened and endangered species with critical habitat in Big Cypress National Preserve or requiring NPS recovery actions continue to have improved status.
	BUIS	By September 30, 2005, 4 (80%) of Buck Island Reef NM's 5 Threatened & Endangered populations will have improved status
	DRTO	By September 30, 2005 breeding populations of loggerhead & green sea turtles increase.
	EVER	By September 30, 2005, 2 of the 14 threatened and endangered species populations in the park (including Cape Sable Seaside Sparrow, crocodile, eagle, panther, manatee & osprey) improve and 5 remain stable.
	VIIS	By September 30, 2005, 3 (50%) of Virgin Islands National Park's identified populations of federally listed threatened and endangered species with critical habitat on park lands or requiring NPS recovery actions have improved status. These species are: Leather Back Turtles, Hawksbill Turtle, Green Turtle, Prickly Ash, Brown Pelican, and Peregrine
1a3 – Air Quality	By September 30, 2005, Air quality in 70% of reporting park areas has remained stable or improved.	
	VIIS	By September 30, 2005, air quality in Virgin Islands National Park has remained stable or improved.
1a4 – Water Quality	75% of Park units will have unimpaired water quality	
	BICY	By September, 2005,Big Cypress National Preserve has unimpaired water quality
	VIIS	By September 30, 2005, Virgin Islands National Park has unimpaired water quality at all marine water sites.
1a6 – Museum Collections	72.3% of preservation and protection standards for park museum collections are met.	
	EVER	By September 30, 2005, 90 of the 120 standards for storage and protection of museum collections are met.
	VIIS	By September 30, 2005, 85 (50%) of 170 applicable preservation and protection standards for Virgin Islands National Park museum collections are met
1b0 – NR Management	The National Park Service contributes to knowledge about natural and cultural resources and associated values; management decisions about resources and visitors are based on adequate scholarly and scientific information.	
	BISC	By September 30, 2005, Biscayne National Park contributes to knowledge about cultural and natural resources and associated values. PROVIDE INFORMATION TO DETERMINE THE STATUS AND TRENDS OF THE PARK'S FOUR PRIMARY BIOLOGIC COMMUNITIES (MANGROVE SHORELINE, ESTUARINE BAY, ISLANDS, AND CORAL REEFS).
	BISC	By September 30, 2005, 77,891 of the park's museum collections will be catalogued.
1b01 – NR Plan/Report	This goal provides parks an opportunity to plan/report all efforts spent in acquiring or developing outstanding data sets or other natural or cultural resource information	
	BICY	Big Cypress National Preserve contributes to knowledge about natural and cultural resources and associated values: management decisions about resources and visitors are based on adequate scholarly and scientific information by maintaining 7 sets of data.
	BUIS	By September 30, 2005, acquire 90% of the outstanding data sets identified in 1999 of the BUIS Natural Resource Inventories
	EVER	By September 30,2005, 8 of the natural resource data sets related to South Florida ecosystem are acquired/developed.

1b1 – NR Data Sets	Acquire or develop 87% (2,203) of the 2,527 outstanding data sets identified in 1999 of basic natural resource inventories for all parks. [Only the Natural Resource Stewardship and Science Division reports to this goal – Parks report to Ib01]	
	VIIS	By September 30, 2005, 2 of the park's 5 data sets are identified -- vertebrate and vascular plants. The park's five data sets include: birds, vascular plants, mammals, fish and amphibians.
1b2D – Museum Objects	Museum objects cataloged are increased by 34.3% (from FY 1999 baseline of 37.3 million to 50.1 million).	
	BUIS	By September 30, 2005, the number of Buck Island Reef NM museum objects cataloged submitted to the National Catalog is increased from 0 in FY 1999 to 720 (100% increase).
	VIIS	By September 30, 2005, the number of Virgin Islands National Park museum objects cataloged into the National Park Service Automated National Catalog System (ANCS+) and submitted to the National Catalog is increased from 28,581 in FY1999 to 32,862 (15% increase).
1b3 – Vital Signs	80% (216) of 270 parks with significant natural resources have identified their vital signs for natural resource monitoring.	
	BUIS	By September 30, 2005, Buck Island Reef NM will have identified its vital signs for Natural Resource Monitoring.

APPENDIX C

AIR QUALITY MONITORING CONSIDERATIONS

FOR THE SOUTH FLORIDA/CARIBBEAN NETWORK

Tonnie Maniero
NER Air Quality Ecological Effects Coordinator
August 2005

Appendix C

AIR QUALITY MONITORING CONSIDERATIONS FOR THE SOUTH FLORIDA/CARIBBEAN NETWORK

Tonnie Maniero
NER Air Quality Ecological Effects Coordinator
August 2005

Introduction

As part of the National Park Service (NPS) Inventory and Monitoring (I&M) Program's Vital Signs scoping process, the South Florida/Caribbean Network (SFCN) will evaluate the need for ambient air quality and air pollution effects monitoring in Network parks. This report contains background and summary air quality information to assist Network staff in that effort. On-site and nearby off-site ambient air quality data were used in conjunction with park-specific resource information to evaluate the following relative to the SFCN: 1) the need for additional ambient air quality monitoring at any Network park, i.e., wet deposition, dry deposition, visibility, and/or ozone monitoring, and 2) the need for air quality effects-related monitoring at any Network park.

The evaluation for SFCN parks relied on data collected through a number of Federal- and state-sponsored ambient air quality monitoring programs. Monitor locations, site numbers, and distances from SFCN parks are provided in Tables 1 and 2. Maps displaying monitor locations and graphics summarizing monitoring data are provided in a separate PowerPoint file as an addendum to this report.

The evaluation used products developed by the NPS Air Resources Division (ARD) specifically for the I&M Program. In 2004, the ARD finalized an Air Quality Inventory for I&M parks. The Air Quality Inventory consists of GIS-based maps and associated look-up tables that provide baseline values for a set of air quality parameters for all I&M parks. The values are based on averaged 1995 to 1999 data. Air Quality Inventory products are in the NPS Air Atlas (http://www2.nature.nps.gov/air/maps/airatlas/). NPS Air Atlas estimates for select air quality parameters for SFCN parks are provided in Appendix 1 of this report, and a description of those parameters is provided in Appendix 2. Because ozone is a regional pollutant, in most cases the estimates are likely representative of ozone concentrations in a park. Greater variability, and uncertainty, may exist for deposition and visibility values, since those pollutants are more likely to be influenced by meteorological differences.

In another project, completed in October 2004, ARD contracted with an ozone effects expert to assess the risk of ozone-induced foliar injury on sensitive vegetation in I&M parks. The risk assessments are based on NPS Air Atlas ozone values, the Palmer Z Drought Index and park vascular plant lists. The assessment for the SFCN is attached as Appendix 3.

Wet Deposition

The National Atmospheric Deposition Program/National Trends Network (NADP/NTN) is a nationwide network of precipitation monitoring sites. The network is a cooperative effort between many different groups, including the U.S. Environmental Protection Agency (EPA), U.S. Geological Survey (USGS), U.S. Department of Agriculture, and private entities. The NPS is a major participant in NADP/NTN, and the ARD recommends that any new wet deposition site installed in a park meet NADP/NTN siting criteria and follow NADP/NTN monitoring protocols. There are currently more than 200 NADP/NTN sites spanning the continental U.S., Alaska, Puerto Rico, and the Virgin Islands (http://nadp.sws.uiuc.edu/).

The purpose of the NADP/NTN network is to collect data on the chemistry of precipitation in order to monitor geographical and temporal long-term trends. The precipitation at each station is collected weekly according to strict clean-handling procedures. It is then sent to the Central Analytical Laboratory in Illinois where it is analyzed for hydrogen (acidity as pH), sulfate (SO_4), nitrate (NO_3), ammonium (NH_4), chloride, and base cations (such as calcium, magnesium, potassium and sodium). NADP/NTN's excellent quality assurance programs ensure that the data remain accurate and precise.

The NADP/NTN has also expanded its sampling to include the Mercury Deposition Network (MDN), which currently has over 85 sites in North America. The MDN was formed in 1995 to collect weekly samples of precipitation, which are analyzed for total mercury. The objective of the MDN is to monitor the amount of mercury in precipitation on a regional basis (http://nadp.sws.uiuc.edu/mdn/).

Deposition varies with the amount of annual on-site precipitation, and is useful because it gives an indication of the total annual pollutant loading at the site. Concentration is independent of precipitation amount, therefore, it provides a better indication of whether ambient pollutant levels are increasing or decreasing over the years. In general, annual average wet deposition and concentration of SO_4, NO_3, and NH_4 are higher in the eastern than in the western U.S. At many NADP/NTN sites across the U.S., concentration and deposition of SO_4 have declined in recent years as sulfur dioxide emissions have decreased. Trends have been variable for NO_3 and NH_4, with concentration and deposition at different sites increasing, decreasing, or showing no overall change. MDN deposition maps show that, similar to SO_4 and NO_3, wet mercury deposition is higher in the eastern U.S. than in the western U.S. Highest wet mercury deposition values are consistently reported for sites in Florida and along the Gulf of Mexico. The MDN program has not yet performed trend analyses for mercury deposition data due to the relatively short time the monitors have been in operation.

Everglades National Park (NP) has both NADP/NTN and MDN monitors on-site and Virgin Islands NP has an on-site NADP/NTN monitor. Big Cypress National Preserve (NPres) and Biscayne NP are within 38 and 30 km, respectively, of the Everglades NP monitors, while Buck Island Reef National Monument (NM) is about 85 km south of the Virgin Islands NP monitor. There are no NADP/NTN or MDN monitors near Dry Tortugas NP. The average 1995 through 1999 Air Atlas wet deposition values for SFCN parks in Florida were 3.49 to 4.63 kilograms per hectare per year (kg/ha/yr) for sulfur (S) and 2.97 to 3.93 kg/ha/yr for nitrogen (N). The 1999 deposition values at Virgin Islands NP were 2.67 kg/ha for S and 0.99 kg/ha for N, comparable to amounts recorded at the park in 2003. Further information on the Everglades and Virgin Islands NP wet deposition monitors is provided below.

Everglades NP

The NADP/NTN monitor was installed at the park Research Center in 1980 (site FL11). NADP/NTN trend analyses indicate no change in SO_4 concentration or wet deposition, no trend in NO_3 or NH_4 concentration, and slight increases in NO_3 and NH_4 wet deposition. The MDN monitor was installed at the Research Center in 1995 (site FL11). Mercury concentration and wet deposition were substantially higher in 2003 than in previous years.

Virgin Islands NP

A NADP/NTN monitor was installed at the park in 1998 (site VI01). Because the data have not met the program's completeness criteria for most years, NADP/NTN has not performed a trend analysis for the site.

Dry Deposition

The Clean Air Status and Trends Network (CASTNet) is the nation's primary source for atmospheric data to estimate dry acidic deposition (http://www.epa.gov/castnet/). Established in 1987, CASTNet now comprises about 95 monitoring sites across the U.S. The majority of the monitoring stations are operated by EPA; however, approximately 30 stations are operated by the NPS in cooperation with EPA. Each CASTNet dry deposition station measures weekly average atmospheric concentrations of SO_4, NO_3, NH_4, sulfur dioxide, and nitric acid; hourly concentrations of ambient ozone; and some meteorological parameters. Dry deposition rates are calculated using atmospheric pollutant concentrations, meteorological data, and information on land use, vegetation, and surface conditions. CASTNet complements the database compiled by NADP/NTN; therefore, CASTNet sites are located at or near NADP/NTN sites. Dry deposition monitoring is more difficult, and more expensive, than wet deposition monitoring; consequently, there are fewer CASTNet than NADP/NTN sites nationwide. Because CASTNet calculates dry deposition based on estimated deposition velocities, there is greater uncertainty in the reported values than in the values measured by NADP/NTN. CASTNet recently developed ambient concentration isopleth maps (http://www.epa.gov/castnet/mapindex.html), but has not produced similar maps for dry deposition.

Both Everglades and Virgin Islands NPs have/had a CASTNet monitor on-site; data summaries and trend analyses for the sites are provided below. There are no sites near Dry Tortugas NP.

Everglades NP

The Everglades NP CASTNet site was installed at the Research Center in 2000 (site EVE419). 2000 through 2003 data showed no trends in either dry S deposition or dry N deposition. Total S deposition at Everglades NP was composed of 17 percent dry deposition and 83 percent wet deposition, while total N deposition was 18 percent dry and 82 percent wet.

Virgin Islands NP

The CASTNet site was installed at Lind Point in 1993 and discontinued in 2004 (site VII423). 1999 through 2003 data showed no trends in either dry S deposition or dry N deposition. Total S deposition at the site consisted of 15 percent dry and 85 percent wet deposition, while total N deposition was 18 percent dry and 82 percent wet.

Chemical Analyses of Surface Water, Sediments and Biota

It is generally accepted that surface waters with a pH below 6.0 and an acid neutralizing capacity (ANC) below 100 microequivalents per liter (μeq/l) are sensitive to acidification from atmospheric deposition. The NPS Water Resources Division's *Baseline Water Quality Data Inventory and Analysis* reports were reviewed for all SFCN parks except Dry Tortugas NP, for which a report was not available. In addition, state agency and the NPS Research Permit and Reporting System (RPRS) websites were reviewed for reports of any additional, relevant surface water or sediment chemistry data. The websites were also reviewed for information pertaining to any chemical analyses conducted on biota in the park. The results are summarized below.

Acidification due to atmospheric deposition does not appear to be a threat to surface waters of any SFCN parks. Eutrophication from nitrogen deposition is a concern in many coastal areas, and may be an issue for the SFCN, particularly in Biscayne and Everglades NPs. Florida has fish consumption advisories to limit ingestion of mercury from fish. Advisories are in effect for water bodies in Collier, Monroe and Miami-Dade counties, which encompass Big Cypress NPres, Biscayne NP and Everglades NP (http://www.doh.state.fl.us/environment/community/fishconsumptionadvisories/index.html). It does not appear that Virgin Islands has issued any fish consumption advisories (http://www.dpnr.gov.vi/dep/home.htm). A number of studies relative to mercury and other pollutants have been conducted in SFCN parks.

The U.S. Department of Agriculture (USDA) collected weekly ambient air, rain and surface water samples in 2002-2003 to determine whether pesticides are entering south Florida waters through atmospheric deposition. A number of pesticides were detected in the samples. Higher concentrations were found in air, rain and surface water during harvest (March) than during the planting season (November). Pesticide concentrations were lower in samples collected at Biscayne NP than in those from Everglades NP. (Kathleen Hapeman, USDA, 301-504-6511)

The Science Museum of Minnesota collected sediment cores from Florida lakes, and used ^{210}Pb-dating to try to evaluate changes in atmospheric mercury deposition over time and to distinguish mercury deposition resulting from local versus global sources. They were not successful in obtaining a core from Deep Lake in Big Cypress NPres, but they did get a core from Nine-Mile Pond in Everglades NP and from three other Florida lakes. Mercury concentrations and deposition varied between sites. A core from a central Florida lake indicated a decrease in mercury deposition over time, while cores from south Florida lakes showed no change in deposition. (Dan Engstrom, The Science Museum of Minnesota, 651-433-5953)

The USGS collected sediment cores at Big Cypress NPres and Everglades NP in 2002-2003 to examine mercury, S and nutrient cycling. Results were not provided on the RPRS website. (Ben McPherson, USGS, 813-975-8620)

The South Florida Water Management District collected water and sediment samples from Everglades NP in 2000-2001 and analyzed them for total and methylmercury. They found a pattern of elevated concentrations of methylmercury where runoff mixed with saline bay waters. This indicated a local source of methylmercury formation. (Darren Rumbold, South Florida Water Management District, 561-682-2132)

Long-term monitoring of mercury concentrations in largemouth bass and other fish has taken place in Everglades NP and peninsular Florida. Sampling began in Everglades NP in 1989. Fish mercury concentrations appear to increase from north to south in the park. Fish from North Prong Creek in Everglades NP and from Big Lostmans/Indian Camp Creek in the drainage basin of Big Cypress NPres exceeded Florida's "no consumption" threshold in 2001, 2002 and 2003. Results from earlier years were not reported on the RPRS website. (Ted Lange, 352-742-6461)

The South Florida Water Management District evaluated mercury concentrations in mosquitofish, sunfish and largemouth bass collected at Everglades NP in 2002-2004. While increased concentrations were observed between 2002 and 2003, the reason for, and significance of, the change is unknown. 2004 results were not provided on the RPRS website. (Nicole Niemeyer, South Florida Water Management District, 561-753-2400)

The USGS collected pig frogs (*Rana grylio*) in Everglades NP in 2001 and measured total mercury concentrations in frog leg muscle. They reported a maximum concentration of 2.3 mg/l (wet mass). (Kenneth Rice, USGS, 954-577-6305)

A researcher collected blood samples from eaglets and osprey nestlings at Everglades NP in 2003 to determine mercury levels in serum. No results were provided on the RPRS website. (Brian Mealey, 305-975-0200)

P.E.A.K. Research quantitatively evaluated pre-1992 and 2002 risks of chronic dietary mercury exposure to panthers in the Everglades. They determined that pre-1992, there was a 46 percent probability of exceeding chronic dietary thresholds for methylmercury. The 2002 risk was a 4 percent probability of exceedances. P.E.A.K. Research concluded that past mercury exposures likely adversely affected panthers in the Everglades, but that current risks from mercury are low. (Barron, M.G., S.E. Duvall, and K.J. Barron. 2004. Retrospective and current risks of mercury to panthers in the Florida Everglades. **Ecotoxicology** 13:223-229)

The Academy of Natural Sciences and others investigated factors that control aquatic cycling of mercury in the Everglades. Using a process-oriented, multidisciplinary approach that involved a number of intensively-studied sites in the Everglades, the investigators determined that: 1) mercury methylation in the Everglades is mediated by sulfate-reducing bacteria in the soil, 2) methylmercury bioaccumulation occurs primarily through the benthic food web, 3) S has the largest impact on methylmercury production, but the magnitude and direction of the impact vary with S concentration, and 4) phosphate and NO_3 have no direct effect on methylmercury production rates in sediment cores. (Cynthia Gilmour, The Academy of Natural Sciences, 410-586-9713)

The Florida Department of Environmental Protection (FDEP) used emissions, deposition and fish and wildlife data to show that a decline in local mercury emissions resulted in reduced mercury concentrations in Everglades wildlife. There was a significant reduction in mercury emissions in Dade, Broward and Palm Beach counties in about 1990. Analysis of lake cores showed a mercury reduction at about the same time. Mercury concentrations in egret feathers decreased between 1994 and 2003, approaching pre-1980 levels. Mercury concentrations in largemouth bass and mosquitofish also declined in the 1990s. The FDEP concluded a decline in local atmospheric mercury emissions resulted in a 75 percent decline in mercury concentrations in fish and wildlife in less than 15 years from peak deposition. They further concluded that atmospheric deposition drives the Everglades mercury problem. (Tom Atkeson, FDEP, 850-245-8305)

Particulate Matter

Small or "fine" particles in the air, typically those less than 2.5 microns in diameter, $PM_{2.5}$, are a leading cause of human respiratory illness. Particles are present everywhere, but high concentrations and/or specific types have been found to present a serious danger to human health. Fine particles in the air are also the main contributor to human-caused visibility impairment. The particles not only decrease the distance one can see; they also reduce the colors and clarity of scenic vistas.

The pre-existing human-health based National Ambient Air Quality Standards (NAAQS) for particulate matter (set by the EPA) are for particles 10 microns or less in diameter (PM_{10}). Areas where air quality exceeds the NAAQS are designated "nonattainment" for that pollutant. Only Buck Island Reef NM and Everglades NP have nearby PM_{10} monitors. In 1997, EPA finalized an additional, stricter NAAQS for particulate matter based on $PM_{2.5}$. Nationwide $PM_{2.5}$ monitoring was initiated in 1999. $PM_{2.5}$ monitors are located near all SFCN parks except Big Cypress NPres and Dry Tortugas NP. Neither Florida nor Virgin Islands have designated PM_{10} or $PM_{2.5}$ nonattainment areas (http://www.epa.gov/air/data/index.html).

In 2001, the USGS began investigating potential ecological effects in the Caribbean due to dust storms that originate in Africa. Air samples taken during dust storms at Dry Tortugas and Virgin Islands NPs contained bacteria, fungi, heavy metals and persistent organic pollutants. Laboratory studies indicate the dust could be toxic to some marine organisms. (Virginia Garrison and Dale Griffin, USGS, 727-803-8747)

Visibility

In 1985, in response to the mandates of the Clean Air Act, Federal and regional/state organizations established the Interagency Monitoring of Protected Visual Environments (IMPROVE) program to protect visibility in Class I air quality areas. Class I areas are national parks greater than 5,000 acres and wilderness areas greater than 6,000 acres, that were established prior to August 7, 1977. All other NPS areas are designated Class II. Everglades and Virgin Islands NPs are Class I areas. The objectives of the IMPROVE program are to: establish current visibility conditions in all Class I areas, identify pollutants (particles and gases) and emission sources responsible for existing man-made visibility impairment, and document long-term trends in visibility. The IMPROVE network is designed to assess regional visibility; standard operation does not identify individual sources that impair visibility at a monitoring site.

In 1999, there were 30 official IMPROVE sites and 40 protocol sites. Because of recently enacted Regional Haze regulations that require improving visibility in Class I areas, the number of visibility monitors has increased. Protocol sites were upgraded to full IMPROVE sites and 80 new sites were added to the IMPROVE network. While the IMPROVE program has focused on Class I air quality areas, a great deal of visibility monitoring has been conducted in Class II areas. Installation and annual operating costs for a full IMPROVE site are expensive. The ARD is currently developing a monitoring protocol for less-expensive view monitoring using a digital camera. While this type of monitoring would not be adequate for regulatory purposes, it is useful for documenting visibility conditions and trends and presents an excellent means of sharing that information with the public.

IMPROVE provides maps of visibility conditions, pie charts of the pollutants that contribute to visibility impairment, and trend data for sites that have been operating 10 years or longer (http://vista.cira.colostate.edu/views/). One measurement used to report visibility is light extinction, or b_{ext}, reported in inverse megameters (Mm^{-1}). Light extinction occurs when particles in the air scatter or absorb light; extinction generally increases as particle concentrations in the air increase. Therefore, the higher the

b_{ext}, the worse the visibility. The Regional Haze regulations require improvements in visibility on both the best (clearest), and the worst (haziest), days. In general, visibility is much better in the western, than in the eastern, U.S.

Everglades and Virgin Islands NPs have on-site IMPROVE monitors. The Everglades site, EVER1, has been operating since 1988 while the Virgin Islands site, VIIS1, has been operating since 1998. No monitors are located near Dry Tortugas NP.

The average 1995 to 1999 estimates provided in the NPS Air Atlas indicate values at Florida SFCN parks of 38 to 39 Mm^{-1} on the best visibility days and 151 to 155 Mm^{-1} on the worst visibility days. 2003 IMPROVE data indicated b_{ext} at Florida SFCN parks on the best visibility days ranged from 23 to 27 Mm^{-1}. On the worst visibility days, b_{ext} at south Florida parks ranged from 72 to 90 Mm^{-1}. Everglades NP 2003 IMPROVE data show that on the clearest days, impairment was due to ammonium sulfate (52 percent), organic carbon (17 percent) and ammonium nitrate (12 percent). On the haziest days, impairment was due mostly to organic carbon (49 percent) and ammonium sulfate (38 percent). Sources of ammonium sulfate include coal combustion and oil refineries; sources of ammonium nitrate are coal and natural gas combustion and automobiles; and sources of organic carbon include automobiles. The other constituents that contribute to visibility impairment are elemental carbon (from wood burning) and coarse mass (source unknown). 1990 through 2003 trend analyses for Everglades NP show improvements on both the clearest and haziest days through 2002, but substantial deterioration in 2003.

Ozone

Ozone is created by a chemical reaction between oxides of nitrogen and volatile organic compounds in the presence of heat and sunlight. Some major sources of ozone-forming chemicals are motor vehicle exhaust and industrial emissions, gasoline vapors, and chemical solvents. High ozone concentrations cause respiratory problems in humans, and are a particular concern for those who are engaging in strenuous aerobic activity, such as hiking. Ozone also damages sensitive plant species. It injures plant leaves by causing a visible spotting or "stipple" on the upper surface of the leaves. Ozone can affect plant physiology by reducing growth, increasing susceptibility to disease, and increasing senescence.

Everglades and Virgin Islands NPs have an ozone monitor on-site; Buck Island Reef NM and Dry Tortugas NP have no nearby monitors (http://www.epa.gov/air/data/index.html). EPA recently established a new NAAQS for ozone which is based on an 8-hour ozone concentration. The previous, less-stringent, NAAQS was based on a 1-hour concentration. There are no 1-hour or 8-hour ozone nonattainment areas in either Florida or Virgin Islands (http://www.epa.gov/ttn/naaqs/ozone/index.html).

The NPS focuses on plant sensitivity to ozone for a couple of reasons. First, ozone is a regional pollutant and is, therefore, more likely to affect park resources than other gaseous pollutants such as sulfur dioxide and nitrogen oxide which quickly convert to other compounds. Second, the literature on ozone sensitivity is more recent and more reliable than that for other pollutants. The ARD contracted with an ozone effects expert from Cornell University to perform ozone injury risk assessments for all parks in the NPS I&M program. The risk assessments relied on the ozone concentration data provided in Air Atlas, vascular plant lists contained in NPSpecies, a master list of ozone-sensitive vascular plant species developed at a 2003 expert workshop convened by the ARD (http://www2.nature.nps.gov/air/Pubs/index.htm), and the Palmer Z Index, which is used to indicate soil moisture status. Note that the ARD workshop report provides a general guide to ozone sensitivity. Differences in plant genetics, weather conditions, soil water availability, and ozone concentrations will affect whether or not a species exhibits injury in a park. In particular, studies have shown that plants will not take up ozone unless there is sufficient soil moisture. The risk assessments for the SFCN parks are in Appendix 3. An assessment could not be performed for Dry Tortugas NP due to the lack of ambient ozone data. For the remaining SFCN parks, there is a low risk of ozone-induced foliar injury of sensitive vegetation.

Conclusions

Except for Dry Tortugas NP, all SFCN parks have both wet and dry deposition monitors on-site or nearby. Given the remoteness of Dry Tortugas and lack of acid-sensitive surface waters, monitoring deposition at

the park is not warranted. Only the south Florida SFCN parks have an on-site or nearby MDN monitor. Installation of additional MDN monitors is not recommended at this time.

Data indicate surface waters in SFCN parks are not susceptible to acidification from atmospheric deposition; however, atmospherically-deposited N could be a concern from an eutrophication standpoint. Atmospherically-deposited mercury is a significant concern in south Florida, as numerous studies have shown elevated methylmercury concentrations in fish and other biota. While reductions in mercury emissions have led to substantial reductions in mercury deposition and tissue methylmercury levels since 1990, continued monitoring of mercury levels in biota is recommended.

$PM_{2.5}$ and/or PM_{10} are monitored near all SFCN parks except Big Cypress NPres and Dry Tortugas NP. All parks except Dry Tortugas have on-site or nearby IMPROVE monitoring. Because of the remoteness of the area, monitoring particulates at Dry Tortugas NP is not warranted. If visibility impairment is of particular interest for any Network park, the SFCN may want to consider installing a digital camera to record and interpret visibility conditions. Given concerns about African dust storms, the Network may want to consider ambient monitoring of dust events for toxic pollutants and/or biological agents.

Except for Buck Island Reef NM and Dry Tortugas NP, all SFCN parks have an on-site or nearby ozone monitor. Given the low ozone values recorded at, or estimated for, the other Network parks, monitoring ozone at Buck Island Reef and Dry Tortugas is not warranted at this time. The ozone injury risk assessments indicate a low risk of ozone injury of sensitive vegetation in SFCN parks. Therefore, foliar injury surveys are not recommended for Network parks.

APPENDIX D

Geologic Resource Management Issues
Scoping Summaries

D.1 Big Cypress National Preserve
D.2 Biscayne National Park
D.3 Buck Island Reef National Monument
D.4 Dry Tortugas National Park
D.5 Everglades National Park
D.6 Salt River National Historic Park and Ecological Preserve
D.7 Virgin Islands National Park and Coral Reef National Monument.

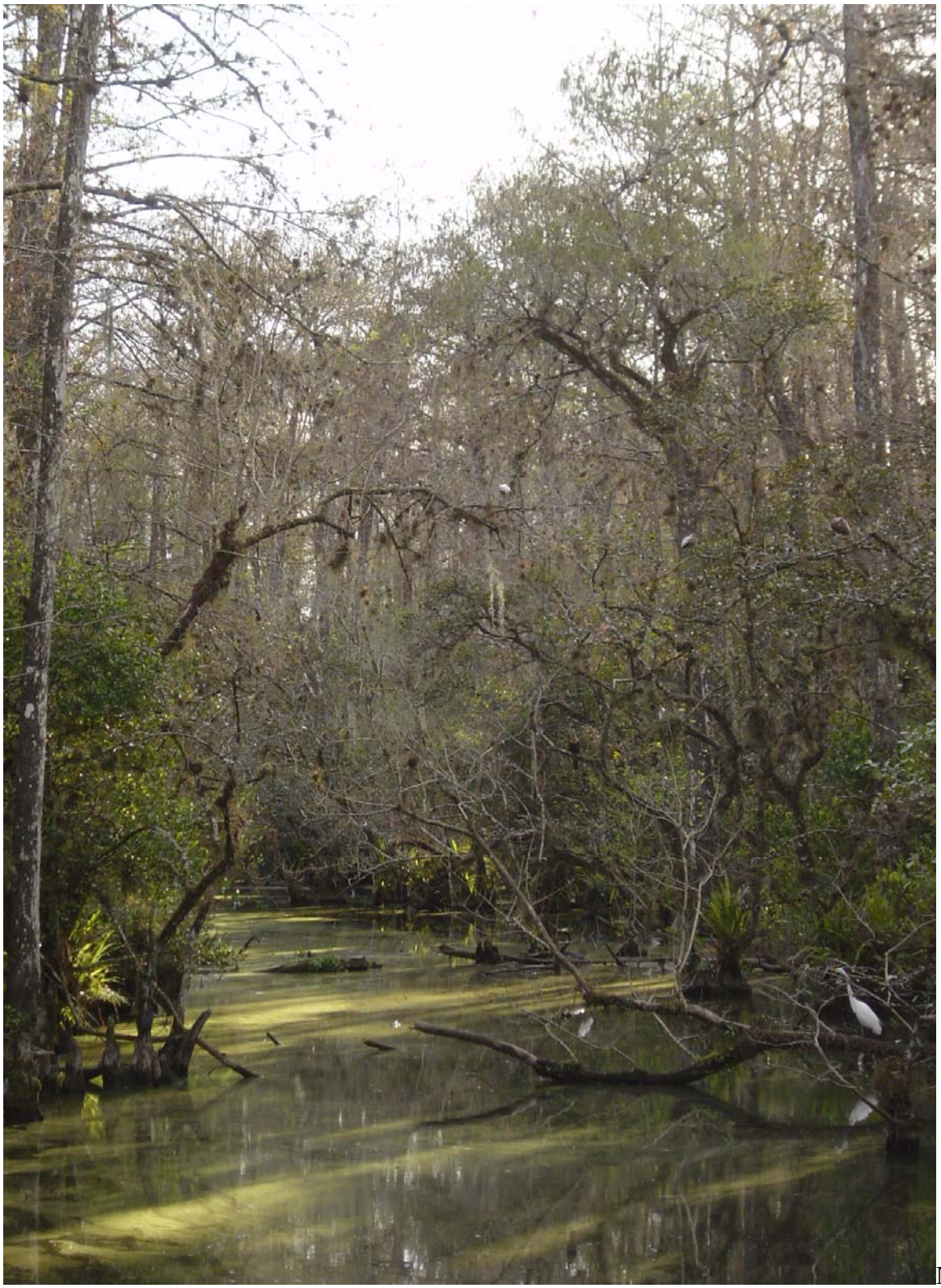
APPENDIX D.1

BIG CYPRESS NATIONAL PRESERVE

GEOLOGIC RESOURCE MANAGEMENT ISSUES

SCOPING SUMMARY

Trista L. Thornberry-Ehrlich
Colorado State University – Geologic Resource Evaluation
February 13, 2005



Near Sweetwater Strand in Big Cypress National Preserve. Photograph by Trista L. Thornberry-Ehrlich (Colorado State University).

Executive Summary

Followed by a field trip on January 28, 2005, a Geologic Resources Evaluation scoping meeting took place at the preserve headquarters on January 27, 2005. The scoping meeting participants identified the following list of geologic resource management issues.

1. The hydrogeologic system at Big Cypress is a western extension of the Everglades. Surface water flows over the low relief landscape through sloughs and marshes. This flow has been altered by roads, canals, and levees at the preserve.

2. Geologic and topographic mapping when combined with flow patterns would help resource management determine which areas to focus on for restoration.

3. Soils and bedrock depth surveys and measurements are needed at the preserve. This in addition to soil recovery research would help resource management deal with ORV damage remediation.

4. Disturbed lands at the preserve include borrow pits and canals dug during the construction of roads and pads for oil and gas drilling. These features disrupt the flow of water and need to be remediated.

5. ORV management is an ongoing process at the park. Implementation of the 2001 ORV Plan is a major management goal. The preserve is trying to designate 644 km (400 miles) of trails to lessen ORV environmental impact.

6. Oil and gas issues include regulating the eight producing wells located within the preserve. Land/mineral ownership rights differ between the surface and subsurface and responsibility for clean-up and remediation is often mislaid.

Introduction

The National Park Service held a Geologic Resource Evaluation scoping meeting for Big Cypress National Preserve at the park headquarters near Everglades City, Florida on Thursday, January 27, 2005. Following this meeting was a field trip on January 28, 2005. The purpose of the meeting was to discuss the status of geologic mapping in the preserve, the associated bibliography, and the geologic issues in the preserve. The products to be derived from the scoping meeting are: (1) Digitized geologic maps covering the preserve; (2) An updated and verified bibliography; (3) Scoping summary (this report); and (4) A Geologic Resource Evaluation Report which brings together all of these products.

Big Cypress National Preserve was established during Gerald Ford's administration on October 11, 1974. Big Cypress covers 720,567 acres of the southwestern corner of Florida. Big Cypress National Preserve was the first national preserve incorporated into the National Park Service. This preserve features incredible biodiversity. The environments protected at the preserve range from sawgrass prairies, mangrove forests, cypress stands and domes, hardwood tree islands, to slow flowing sloughs and marshes. The area covers a large portion of the "western Everglades". The preserve is heavily recreated and contains some of the most productive oil and gas fields in south Florida.

Big Cypress National Preserve identified 37 quadrangles of interest. However, additional coverage of 30 more quadrangles (to the north and west) would add considerably to resource management's understanding of the landscape and watershed at the preserve. The Florida State Geologic Survey (FGS) has digitized a geologic map covering the state from individual county maps at a small scale (~ 1:750,000). This map only displays 5 separate geologic units (Holocene sediments, Pleistocene - Holocene undifferentiated, Miami Limestone, Shell-bearing sediments, Tamiami Formation) for inside the boundaries of the park.

Other geologic maps covering portions of the quadrangles of interest include the FGS MS6/19, MS 6/20, MS 6/21, MS 6/22, MS 6/24, and MS 6/25 (1:24,000, 2000), Geological Society of America (GSA) Memoir 147 (1:79,000, 1977), the FGS OFMS 67 (1:26,720, Dade County), 66/01 (1:126,720, Monroe County), 62 (1:126,720 , Hendry County), 63 and Series 120 (1:126,720, Collier County), 64 (1:126,720, Broward County), 65 (1:126,720, Palm Beach County), USGS 84-4068 and 86-4126 (1:134,000 and 1:136,000, 1985 and 1986, respectively). Additional mapping at a smaller scale will be more helpful for preserve management.

Physiography

South Florida in the area of the Big Cypress is divided into 5 physiographic provinces. The Big Cypress Swamp province defines the western boundary of the Everglades. This area is slightly higher in elevation than the Everglades basin because it is underlain primarily by the coral-rich limestones of the Pliocene Tamiami Formation (3-4 Ma). This formation is exposed in large areas of Big Cypress. Drainage in the province is primarily to the south and southwest.

The Everglades province forms a south dipping, spoon-shaped low-lying area between the Atlantic Coastal Ridge to the east, the Big Cypress Swamp to the west, and the Sandy Flatlands area to the north. The basin has very low relief. The elevation change is only 3.6 to 4.3 m (12-14 ft) from the maximum near Lake Okeechobee to sea level. Prior to anthropogenic alteration, this drainage system flowed slowly from north to south.

Bounding the Everglades province on the east is the Atlantic Coastal Ridge. It is comprised of Pleistocene marine limestones covered by thin quartz sand sheets. The province ranges in elevation from 1.5 to 6 m (5 to 20 ft) in the southernmost portions. The width of the ridge ranges from 16 km (10 miles) in southern Miami-Dade County and narrows to 5 to 8 km (3 – 5 miles) further north. Periodically breaching the southern portions of the ridge are sloughs (transverse glades) oriented perpendicular to the trend of the ridge.

The southern reaches of the Everglades and Big Cypress Swamp provinces transition into the Coastal Marshes and Mangrove Swamp physiographic province. The province covers an area from the northeastern part of Florida Bay, around the southern Florida peninsula, and west, into the Gulf of Mexico up to the Ten Thousand Island region never Everglades City. Bands of swamps and brackish marshes sitting just above sea level characterize this province. Freshwater runoff and tidal fluxes cause the salinity to change dramatically. This is why the mangrove, capable of enduring such salinity changes, thrives in this area.

Geologic History of South Florida

Sediment cores indicate that South Florida has been predominantly an area of carbonate accumulation since the Mesozoic.

Late Paleozoic Era – During the Mississippian, the landmass that would underlie the grand carbonate platform of Florida today was not attached to the North American Craton. It is speculated that it was attached to the northwest portion of the African continent (Condie and Sloan, 1998). However, marine carbonates were being deposited over large portions of the area atop a Paleozoic age crystalline basement high, the Peninsular Arch (Pollastro *et al.*, 2000). In the Pennsylvanian, a collision event, known as the Ouachita orogeny sutured the Florida landmass to the continent as Gondwanaland and North America collided eventually forming the supercontinent Pangaea. The land was still submerged and south Florida was located at the junction of the North American, South American, and African plates. Through the Permian, Pangaea remained intact (Condie and Sloan, 1998).

Early Mesozoic Era – No sooner had Pangaea formed than it began to break up. During the late Triassic, South and Central America and Africa began to rift away from North America. This established the long-standing passive margin of the eastern seaboard that persists today. The Florida and Cuba blocks detached from northwest Africa and the Gulf of Mexico opened (Condie and Sloan, 1998).

Accompanying the rifting of Pangaea was the widespread extrusion of volcanic rocks consistent with mantle plume upwelling due to crustal tension (Heatherington and Mueller, 1991). This continental rifting also opened the Atlantic Ocean basin.

Middle Mesozoic Era - Underlying the south Florida basin are igneous rhyolitic - basaltic rocks (Thomas et al., 1989). These rocks were subaerially exposed and eroded during the late Triassic to middle Jurassic. This caused the formation of redbeds locally. As the Atlantic Ocean continued to develop, deltaic and shallow marine sediments were deposited in the late Jurassic. Restriction of marine circulation at this time resulted in periodic accumulations of evaporites and marine carbonates (Cunningham, 2005). Deposition of Jurassic and Cretaceous sediments was controlled by the south-southeast plunging axis of the Peninsular Arch. Basal sediments onlap and pinch out against the arch (Pollastro *et al.*, 2000).

Late Mesozoic Era – As marine transgression proceeded during the early Cretaceous, the Florida Platform was the site of more widespread deposition of marine limestones and reefs. Further transgression and global warming during the Late Cretaceous established an open marine accumulation of carbonates over the entire Florida Peninsula.

Cenozoic Era – Cenozoic development of the Florida Platform included additional deposition of marine carbonates and deposition of siliciclastics (grains of silicate minerals such as quartz in lieu of carbonates) from northwestern highlands sources and long shore oceanic currents. Tertiary faulting occurred south of Florida as the Cuban block collided with the Antilles arc and carbonate accumulation continued in Florida (Condie and Sloan, 1998). In southern Florida, the open marine setting continued during the Paleocene as more restricted flow to the north resulted

in deposits of mixed carbonates and evaporites. Eocene and Oligocene deposition is marked by shallow water carbonates. Intermittent with this deposition were subaerial exposures associated with local oceanic regressions.

Deposition in south Florida during the Miocene changed with the introduction of more widespread siliciclastics from a fluvio-deltaic system prograding down the peninsula. Phosphates and the carbonate ramp of the Arcadia Formation were deposited during the Miocene in south Florida. A Pliocene lowstand caused many of the previous deposits to be reworked and/or eroded. The Tamiami Formation is a Pliocene marine unit comprising a wide range of rock types. These are predominantly fossiliferous sands and clays with limestone.

The Pleistocene era resulted in the conversion from siliciclastic deposition mixed with carbonate accumulation to more widespread carbonate sedimentation (Cunningham, 2005). Global sea-level changes during the intermittent ice ages of the Pleistocene controlled the rate and distribution of carbonate units. At 120 Ka, the last major sea level fall occurred as the mixed carbonate-siliciclastic sediments formed the Fort Thompson Formation. This unit interfingers with the surficial geologic units, the Miami and Key Largo Limestones, and the Anastasia Formation (~130 Ka) (Cunningham, 2005).

At 15-16 Ka sea level began to rise rapidly and flood southern Florida around 7 or 6 Ka (Shinn *et al.*, 1997). Sea level has continued to rise. Holocene geologic activity in the Big Cypress area consists of the dissolution of carbonate units, the accumulation of carbonate muds, freshwater marls, sand and swamp (organic peat and muck) deposits.

Stratigraphy

Cores drilled in the oil and gas exploration operations help constrain the stratigraphy underlying the preserve. In the oil producing area of Big Cypress, the sedimentary section is 4,572 to 5,182 m (15,000 – 17,000 ft) thick. The first 2,134 to 2,743 m (7,000 – 9,000 ft) are Late Jurassic through Early Cretaceous rocks, the next 914 m (3,000 ft) are Late Cretaceous age rocks, and the remaining 1,676 m (5,500 ft) are of Tertiary age to the present (Pollastro *et al.,* 2000). These rocks fill the South Florida Basin, the center of which is located northwest of the Florida Keys. The basin is bounded on the east by the Paleozoic Peninsular Arch (trending northwest – southeast), the Florida escarpment to the west, the Tampa – Sarasota Arch (trending northeast – southwest) to the north, and the Pine Key arch to the south.

Jurassic age basaltic-rhyolitic rocks underlie all of south Florida. Since the Jurassic, sedimentation has kept pace with overall basin subsidence. Deposition has included carbonates, clastics and evaporites (Pollastro *et al.,* 2000). The earliest sediments, of the Wood River Formation are continental clastics overlain by salt, limestone, anhydrite and brown dolomite. Between the Wood River and the oil producing Sunniland Formation lie the predominantly carbonate-evaporite Bone Island and Pumpkin Bay Formations, and the Glades Group of shales, dolomites, and anhydrites (Faulkner and Applegate, 1986). The Sunniland Formation of Lower Cretaceous age is comprised of anhydrites, thin limestone layers, and dolomites. The Sunniland, along with the anhydrite and limestone of the Lake Trafford Formation and the dolomite, limestone and anhydrite of the Rattlesnake Hammock Formation, comprise the Ocean Reef Group.

The Big Cypress Group and Naples Bay Group overlie the Ocean Reef Group. These are largely dolomites and anhydrites beneath Big Cypress. The Upper Cretaceous Pine Key Formation is composed of chalky limestone and dolomite. It is approximately 914 m (3,000 ft) thick. The Paleocene to present day sedimentary layers lie atop the Pine Key Formation at Big Cypress (Faulkner and Applegate, 1986). Relatively uninterrupted Tertiary deposition amassed the grand carbonate platform of South Florida. These sediments reach great thicknesses of approximately 1,676 m (5,500 ft).

Cores drilled in nearby Everglades National Park help determine the upper stratigraphy at Big Cypress. Eocene to late Oligocene deposition consists of marine carbonates of the Avon Park Formation, the Suwannee Limestone and the Ocala Group, and the Arcadia Formation of ramp setting carbonates with scant quartz contents increasing northward (Cunningham, 2005). A major disconformity marks the boundary between the Arcadia Formation and the overlying Peace River Formation. In other areas of Florida, the Hawthorn Group is between the Arcadia and Peace River Formations. The Peace River Formation contains two distinct units: a lower diatomaceous mudstone, and an upper fine-grained quartz muddy sandstone (Cunningham *et al.,* 1998). Deposited atop the Peace River Formation is the Tertiary age Tamiami Formation. This unit comprises much of the surface outcrop at Big Cypress.

Shallow water limestone of the Fort Thompson Formation underlies the surficial Miami Limestone. This limestone is probably combined with the capping unit of the Miami Limestone.

The Fort Thompson is mostly lagoonal facies carbonate with abundant bivalve fossils and some quartz sand. The Miami Limestone is ~125 – 130 Ka and represented deposition during an interglacial period. Two facies exist for the Miami Limestone. The western portion of the unit contains predominantly the bryozoan facies, the unit then becomes more oolitic eastward (Hoffmeister *et al.*, 1974; Cunningham, 2005).

Overlying the Miami Limestone bedrock are surficial units of freshwater peat and organic muck, freshwater marls, and cyanobacteria mats in the swampy marsh at Big Cypress. The peat and muck typically occurs in low-lying sloughs and solution holes and are dark and fine-grained. During the standing water phase of the wet season, extracellular precipitation of calcium carbonate by cyanobacteria forms fresh limestone marls (Cunningham, 2005).

Significant Geologic Resource Management Issues at Big Cypress National Preserve

1. Hydrogeologic system at Big Cypress

The Big Cypress is really a western extension on the Everglades system. Water is flowing on the surface in marshes and sloughs and below ground in slow flowing aquifers through porous substrate. The present topographic and hydrogeologic information is too coarse and/or inadequate for resource management. More modeling is necessary to understand the true water budget of the preserve.

The flow of water through the preserve has been drastically altered and diverted by the construction of roads, trails, pads, canals, and levees. The state and local pumping policies control a vast portion of water input to Big Cypress. Pumping can control basin dynamics. A major goal of the preserve is the restoration of the original flow ways as best as possible. A focus area is the 9 to 12 m (30 – 40 ft) wide Turner River basin in-channel construction near U.S. Highway 41. Restoration efforts include reconnection flows through canals and roads (building causeways). The Bear Island area is another area to focus restoration efforts. Cooperation is necessary between resource management and local water volume management agencies to coordinate and organize the timing responses of gates and pumps.

Regional models achieve varying degrees of success at Big Cypress. The South Florida Water Management Model (SFWMM) ignores roads and uses an outdated climate. The Natural Systems Model (NSM) uses vegetation patterns to predict an improved pseudotopography. The Across Trophic-Level System Simulation (ATLSS) correlates species with hydrology, hydroperiod, and vegetation. The Everglades Landscape Model (ELM) covers the hydrology of bounded systems of canals and structural control with rain-driven triggers. The Interim Structural and Operational Model (ISOP), which is 2-3 years from implementation, is probably the closest to the concerted water budget management the preserve needs, but still uses core data from the SFWMM model. Cell size and vertical precision vary on these models from 3.2 km (2 miles) to 30 m (100 ft) and 15 to 3 cm (6 to 1 inches), respectively. LIDAR would improve the vertical precision.

Research and monitoring questions and suggestions include: Study how rainfall controls the hydrologic system. Does the depth to bedrock measurement have a significant control on the system? Compare natural and anthropogenic caused hydraulic changes. Monitor hydrologic response to storm events. Try to get LIDAR mapping of sloughs for fine-scale topographic changes. Obtain more hydrologic sampling and install hydrologic monitoring stations in key locations. Determine more stage level measurement points. Monitor stage level. Attempt to align with CERP efforts (Big Cypress is largely overlooked in favor of Everglades restoration). Cooperate with federal, state, and local agencies to monitor and clean up ground and surface water; examples of pollution include creosote (from Copeland sawmill in the 1960s), agricultural runoff (including pesticides from tomato farms). Deep Lake (27 m 90 ft deep) is the southernmost sinkhole in Florida, why? Focus geologic studies on processes rather than just

features. Categorize, describe, and model the near-surface, mid- and deep aquifers below Big Cypress National Preserve.

2. Geologic and topographic mapping

The relief at Big Cypress is approximately 6 cm/km (2 inches/mile) or 4.6 m over 145 km (15 ft over 90 miles). This incredibly low relief is the reason the sloughs, swamps, and marshes thrive at Big Cypress. Water slowly trickles down to the sea from central Florida. High-resolution topographic mapping, when combined with flow patterns would help resource management determine which areas to focus on for restoration.

Research and monitoring questions and suggestions include: Relate small-scale topographic differences with the locations of hammacks and pinelands at the preserve. Map the locations where the Tamiami Limestone is exposed. Focus topography and cross section production on key areas (coordinate with the original flow way restoration efforts). Map karst features in addition to canals and rock pits on maps. Cooperate with slough mapping project through the Audubon Society. Expand upon the Tamiami type section located within the preserve. Are strands and paleochannels related? Why is the boundary between Big Cypress and the Everglades so dramatic? What is the nature of the boundaries between strands? Map rock outcrops at different scales and determine if they have a controlling influence on the location of Cypress stands. Greg Desmond with the USGS is conducting a High-Accuracy Elevation Project with an Airborne Height Finger (AHF), which creates DEMs; support him to obtain better data. Determine original flow ways with DEMs. Suggest more USGS/BLM/NRCS/SFWMD/FLDOT cooperative geologic/mapping projects.

3. Soils and bedrock depth

Soils were identified as an ORV Plan ROD information need. A soil survey is needed at the park as well as research on recovery science. Several unique soil units, such as “deep muck” and “cypress strand” exist in the preserve and should be type localities.

Research and monitoring questions and suggestions: What is the depth of the soils at Big Cypress? Map soil types and depths. Study resiliency of soils. Research possible options to restore damaged soils. Research historical fire data and correlate with soil types. Relate near surface limestone (marine or freshwater) and/or peat with soil distributions.

4. Disturbed lands

Disturbed lands besides the oil and gas exploration affected areas, include borrow pits excavated for the construction of the oil and gas pads and roads built to access remote sites.

Research and monitoring questions and suggestions: Quantitatively identify disturbed sites and explore remediation to restore natural water flow. Remove Bear Islands closed oilfield roads. Work on finding ways to build bridges and reculvert established road areas to improve flow focusing on roads directly perpendicular to flow first.

5. ORV management

More than 409,262 visitors came to the preserve in 2003. These visitors enjoyed the incredible recreational opportunities at Big Cypress. Activities include camping, kayaking, hiking, bird watching, canoeing, hunting, ORV use, and airboat access. The preserve is attempting to concentrate visitor access to reduce environmental impact.

Raised roadbeds across south Florida have dammed the natural, low relief, slow moving sheet-flow from Lake Okeechobee to Florida Bay. ORV use at Big Cypress has caused major damage to the hydrology and soils. Soil resiliency at the preserve is not well understood. Buggies and other ORVs destroy algae (terraphytes) populations in the soils. The entire ecosystem is based on these microorganisms that lie dormant in dry conditions. When they are churned up and buried, the landscape resembles a soil desert. An ORV management plan, completed in 2001, calls for a designation of 644 km (400 miles) of trails in the preserve. It is estimated that at least 22,000 miles of trails currently exist. For a park the size of the state of Rhode Island, the ranger on duty has difficulty patrolling the ORV activity. Unauthorized airboat use is also a resource management issue affecting water quality, noise levels, and soils.

Research and monitoring questions and suggestions include: Determine the best sites for a designated trails system. Perform a preserve-wide soils survey to establish baseline conditions for trail planning.

6. Oil and gas issues

Oil and gas exploration began in the Big Cypress area in 1923. Most of the active drilling was in the mid 1970's. The main producing geologic unit is the Sunniland Formation. Approximately 450 wells have been drilled along the northwest – southeast oriented Sunniland Trend. Oil and gas activity in the preserve is rapidly declining. As of September 2004, there are 18 wells producing from only eight fields. Eight of these producing wells are located within the preserve. The oil and gas reservoir rocks are porous (10-30% porosity). They are composed of carbonate grainstones and dolomites sealed by evaporites and/or nonporous carbonates. Based on 2D seismic surveys, gravity and magnetics data, the overall drilling success rate has been about 3% (Norby, 2005).

Most of the oil and gas rights under the preserve are of private ownership, established prior to the designation of the preserve. Ninety-nine percent of the land at the preserve is "split estate" meaning the surface and subsurface ownership is different. The pads and roads left behind when a well is closed leave a large scar on the landscape and affect the hydrologic system at Big Cypress. Roads are built of borrow pit material 1.2 m (4 ft) higher than the surrounding drainage. Culverts are thinly spaced and many are falling into rusty disrepair. The responsibility for monitoring, compliance with regulations, restoration and remediation is often unclear and pipes, wells, and structures are still at abandoned pads.

Research and monitoring questions and suggestions: Explore making a depth to bedrock measurement mandatory per shot hole for oil and gas exploration. Obtain seismic information per township on a grid pattern. Use road and pad fill for trail construction and other remediation

work. Work with corers to obtain more stratigraphic data. Attempt to update the Minerals Management Plan to have stronger surficial protection regulations.

Scoping Meeting Participants

NAME	AFFILIATION	PHONE	EMAIL
Ron Clark	NPS, BICY	239-695-1106	
Sid Covington	NPS, Geologic Resources Division	(303) 969-2154	sid_covington@nps.gov
Don Hargrove	NPS, BICY	239-695-1150	
Melanie Harris	USGS, CCWS	727-803-8747 x3023	mharris@usgs.gov
Carrie Karl	NPS, BICY	239-695-1201	
Lisa Norby	NPS-GRD	303-969-2318	
Frank Partridge	NPS, BICY	239-695-1162	
Matt Patterson	NPS, SFCN	305-224-4211	
Anne Poole	NPS, Geologic Resources Division	303-987-6954	anne_poole@nps.gov
Pedro Ramos	NPS, BICY	239-695-1103	
Bob Sobczak	NPS, BICY	239-695-1150	
Trista Thornberry-Ehrlich	Colorado State University	757-222-7639	tthorn@cnr.colostate.edu

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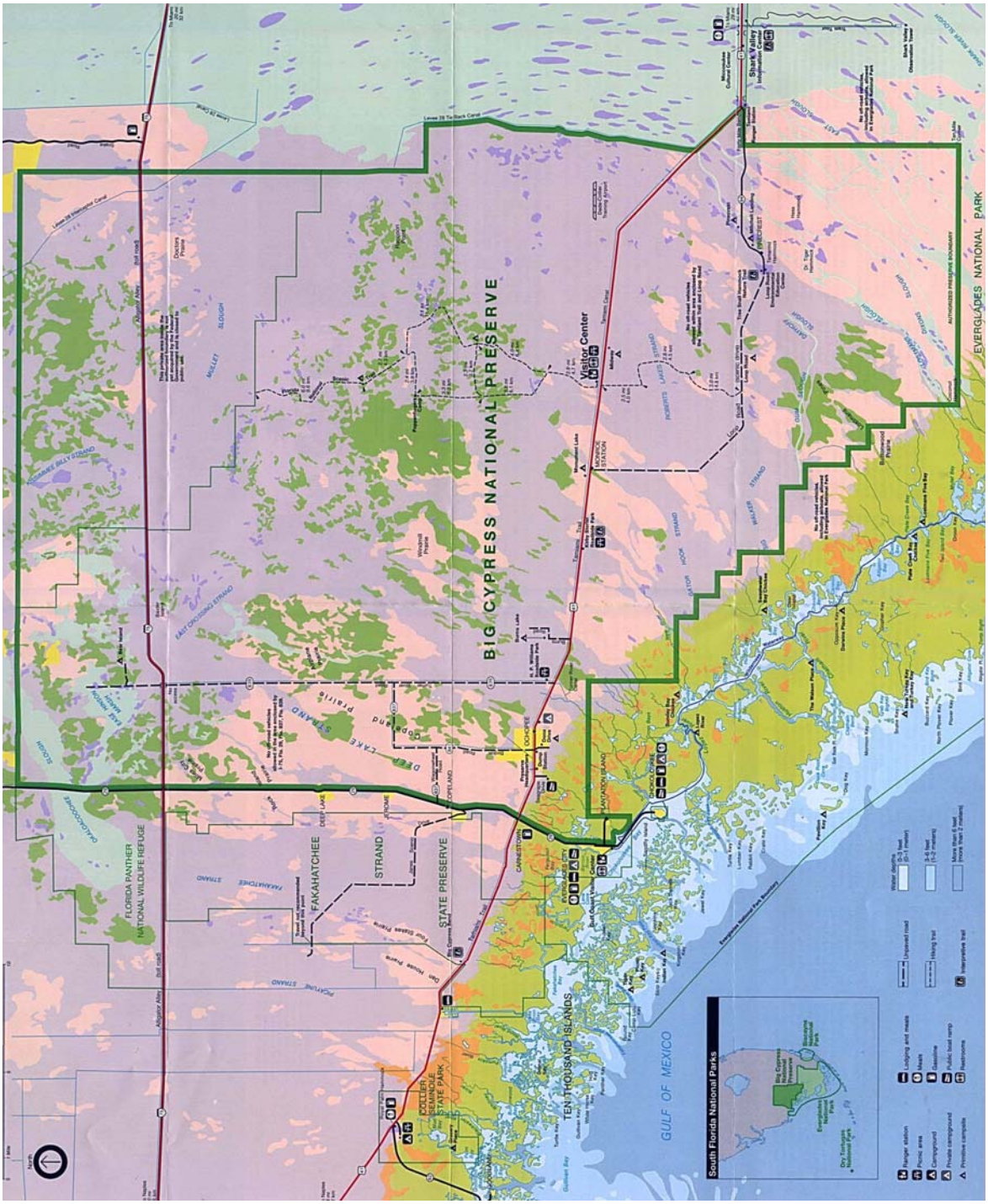
Map of Big Cypress National Preserve



APPENDIX D.2

BISCAYNE NATIONAL PARK

GEOLOGIC RESOURCE MANAGEMENT ISSUES

SCOPING SUMMARY

Trista L. Thornberry-Ehrlich
Colorado State University – Geologic Resource Evaluation
February 9, 2005

Microkarst on Elliot Key's eastern shore, in Biscayne National Park. Photograph by Trista L. Thornberry-Ehrlich (Colorado State University).

Executive Summary

Following a field trip on January 25, 2005, a Geologic Resources Evaluation scoping meeting took place at the park headquarters on January 26, 2005. The scoping meeting participants identified the following list of geologic resource management issues. These topics are discussed in detail on pages 11 - 18.

1. Hydrogeologic system of Biscayne Bay
2. Benthic habitats at Biscayne National Park
3. Inundation history and paleoconditions
4. Sediment transport and erosion
5. Karst activity
6. Sea level rise
7. Disturbed lands
8. Active reefs and coral mapping
9. Recreation demands and resource restoration
10. Sediment thickness
11. Urban development concerns
12. Soil characterization
13. Paleontologic inventory

Introduction

The National Park Service held a Geologic Resource Evaluation scoping meeting for Biscayne National Park at the park headquarters near Homestead, Florida on Wednesday, January 26, 2005. This meeting followed a field trip on January 25, 2005. The purpose of the meeting was to discuss the status of geologic mapping in the park, the associated bibliography, and the geologic issues in the park. The products to be derived from the scoping meeting are: (1) Digitized geologic maps covering the park; (2) An updated and verified bibliography; (3) Scoping summary (this report); and (4) A Geologic Resource Evaluation Report which brings together all of these products.

Biscayne National Monument was established during Lyndon B. Johnson's administration on October 18, 1968. The boundaries were expanded in 1974 to include Swan and Gold Keys. On June 28, 1980, Biscayne was redesignated as a national park. Biscayne covers 172,924 acres along the southeastern Florida coast, 95% of which is underwater (72,000 acres of coral reefs). Biscayne National Park is the largest marine park in North America. The environments protected at the park vary from mangrove forest to the shallow waters of Biscayne Bay, from the northern most islands of the Florida Keys chain to the beginning of the third-largest coral reef tract in the world. The area covers a large portion of the Intercoastal Waterway, a large boating channel running along the Florida coast. The park contains some of the most pristine and unique marine habitat in the continental United States.

Biscayne National Park identified 19 quadrangles of interest. The Florida State Geologic Survey (FGS) has digitized a geologic map covering the state from individual county maps at a small scale (~ 1:750,000). This map only displays 3 separate geologic units (Holocene sediments, Key Largo Limestone, Miami Limestone) for inside the boundaries of the park.

Other geologic maps covering portions of the quadrangles of interest include the USGS I-2505 (1:24,000, 1997), the benthic habitat map published by NOAA CSC (1:48,000, 1999), Geological Society of America (GSA) Memoir 147 (1:79,000, 1977), the FGS OFMS 83/01-07 (1:100,000, 1995), 83/08-12 (1:100,000, 1996), USGS OF-97-526 (1:120,000, 1997),), FGS OFMS 83/08-12 (1:100,000, 1995), 67 (1:126,720, Dade County), 66/01 and 66/02 (1:126,720, Monroe County), USGS OF 97-526 (1:120,000, 1997) and 86-4126 (1:136,000, 1986). Additional mapping at a smaller scale will be more helpful for park management. For Biscayne National Park, where most of the park is underwater, mapping needs extend beyond the shoreline.

Physiography

South Florida in the area of the Biscayne is divided into 5 physiographic provinces. These are called the Atlantic Coastal Ridge, Coastal Marshes and Mangrove Swamp, Everglades, Big Cypress Swamp, and Sandy Flatlands provinces. The Everglades province forms the central south dipping, spoon-shaped low-lying area between the Atlantic Coastal Ridge to the east, the Big Cypress Swamp to the west, the Coastal Marshes and Mangrove Swamp to the south, and the Sandy Flatlands area to the north.

Part of Biscayne National Park lies within the Atlantic Coastal Ridge province. It is comprised of Pleistocene marine limestones covered by thin quartz sand sheets. The province ranges in elevation from 1.5 to 6 m (5 to 20 ft) in the southernmost portions. The width of the ridge ranges from 16 km (10 miles) in southern Miami-Dade County and narrows to 5 to 8 km (3 – 5 miles) further north. Periodically breaching the southern portions of the ridge are sloughs (transverse glades) oriented perpendicular to the trend of the ridge.

The rest of Biscayne National Park is composed of islands and marine/bay environments. The reefs of Biscayne National Park are part of a 241 km (150 miles) long chain of coral reefs extending roughly southwestward down through the lower Florida Keys and into the Caribbean. The Florida Keys are divided into three distinct sections: the upper. middle, and lower Keys. These divisions correspond to their orientation, morphology, water depth, and composition. The upper Keys (including Biscayne) are oriented almost north-south and buttress against the east-southeast winds. The middle Keys are oriented northeast-southwest and face directly into the east-southeast winds. The lower Keys are oriented nearly parallel to the winds and trend nearly east-west (Shinn et al., 1997).

Elliot Key in Biscayne National Park is the parks largest island and is considered the northernmost true coral rock Florida Key. There are 42 islands in Biscayne National Park, which form a protective barrier for Biscayne Bay and south Florida. These islands display the transition from coral rock keys from the south to the sand barrier islands in the north. The islands north of Elliott Key, from Sands Key to Soldier Key, are examples of transitional islands. A transitional island contains features of both hard rock coral keys and sand barrier islands.

Geologic History of South Florida

Sediment cores indicate that South Florida has been predominantly an area of carbonate accumulation since the Mesozoic.

Late Paleozoic Era – During the Mississippian, the landmass that would underlie the grand carbonate platform of Florida today was not attached to the North American Craton. It is speculated that it was attached to the northwest portion of the African continent (Condie and Sloan, 1998). However, marine carbonates were being deposited over large portions of the area atop a Paleozoic age crystalline basement high, the Peninsular Arch (Pollastro *et al.*, 2000). In the Pennsylvanian, a collision event, known as the Ouachita orogeny sutured the Florida landmass to the continent as Gondwanaland and North America collided eventually forming the supercontinent Pangaea. The land was still submerged and south Florida was located at the junction of the North American, South American, and African plates. Through the Permian, Pangaea remained intact (Condie and Sloan, 1998).

Early Mesozoic Era – No sooner had Pangaea formed than it began to break up. During the late Triassic, South and Central America and Africa began to rift away from North America. This established the long-standing passive margin of the eastern seaboard that persists today. The Florida and Cuba blocks detached from northwest Africa and the Gulf of Mexico opened (Condie and Sloan, 1998).

Accompanying the rifting of Pangaea was the widespread extrusion of volcanic rocks consistent with mantle plume upwelling due to crustal tension (Heatherington and Mueller, 1991). This continental rifting also opened the Atlantic Ocean basin.

Middle Mesozoic Era - Underlying the south Florida basin are igneous rhyolitic - basaltic rocks (Thomas et al., 1989). These rocks were subaerially exposed and eroded during the late Triassic to middle Jurassic. This caused the formation of redbeds locally. As the Atlantic Ocean continued to develop, deltaic and shallow marine sediments were deposited in the late Jurassic. Restriction of marine circulation at this time resulted in periodic accumulations of evaporites and marine carbonates (Cunningham, 2005). Deposition of Jurassic and Cretaceous sediments was controlled by the south-southeast plunging axis of the Peninsular Arch. Basal sediments onlap and pinch out against the arch (Pollastro *et al.*, 2000).

Late Mesozoic Era – As marine transgression proceeded during the early Cretaceous, the Florida Platform was the site of more widespread deposition of marine limestones and reefs. Further transgression and global warming during the Late Cretaceous established an open marine accumulation of carbonates over the entire Florida Peninsula.

Cenozoic Era – Cenozoic development of the Florida Platform included additional deposition of marine carbonates and deposition of siliciclastics (grains of silicate minerals such as quartz in lieu of carbonates) from northwestern highlands sources and long shore oceanic currents. Tertiary faulting occurred south of Florida as the Cuban block collided with the Antilles arc and carbonate accumulation continued in Florida (Condie and Sloan, 1998). In southern Florida, the

open marine setting continued during the Paleocene as more restricted flow to the north resulted in deposits of mixed carbonates and evaporites. Eocene and Oligocene deposition is marked by shallow water carbonates. Intermittent with this deposition were subaerial exposures associated with local oceanic regressions.

Deposition in south Florida during the Miocene changed with the introduction of more widespread siliciclastics from a fluvio-deltaic system prograding down the peninsula. Phosphates and the carbonate ramp of the Arcadia Formation were deposited during the Miocene in south Florida. A Pliocene lowstand caused many of the previous deposits to be reworked and/or eroded. The Florida Keys area was active as a thick pile of sand that was being transported south to eventually form the Long Key Formation (Guertin et al., 1999; Cunningham, 2005). Continued carbonate accumulation in the Florida Keys during the Pliocene built the Stock Island Formation (Cunningham et al., 1998).

The Pleistocene era resulted in the conversion from siliciclastic deposition mixed with carbonate accumulation to more widespread carbonate sedimentation (Cunningham, 2005). Global sea-level changes during the intermittent ice ages of the Pleistocene controlled the rate and distribution of carbonate units. At 120 Ka, the last major sea level fall occurred as the reefs and the oolite facies were accumulating to become the Miami and Key Largo Limestones. The Pleistocene Key Largo Limestone (130 Ka) underlies the Florida Keys to its northernmost extent at Soldier Key (Shinn *et al.*, 1997). The Miami Limestone (Upper Pleistocene oolite and bryozoan facies) underlies the southeastern portion of the Florida mainland including Biscayne Bay.

At 15-16 Ka sea levels began to rise rapidly and flood southern Florida around 7 or 6 Ka (Shinn *et al.*, 1997). Sea level has continued to rise. Holocene geologic activity at Biscayne area consists of the accumulation of coral reefs, sand deposits and carbonate muds. These deposits directly overlie the Pleistocene Key Largo and Miami Limestones. Reef distribution at Biscayne is controlled by geologic and climatic factors such as the timing and rate of sea level rise, sediment facies, and underlying bedrock. At present, anthropogenic activity is probably the most prevalent source of reef change in south Florida.

Stratigraphy

Cores such as the deep, continuous core near the Everglades National Park Research Center (W-17232), those of the South Florida Drilling Project (Florida Geological Survey, University of Miami, Florida Department of Transportation), and the USGS help constrain the stratigraphy at depth underlying the park.

The lowest unit penetrated by the core in the Everglades is the Arcadia Formation (top surface at 147 m, 482 ft). This formation consists of ramp setting carbonates with scant quartz contents increasing northward (~20% quartz grains at W-17232) (Cunningham, 2005). A major disconformity marks the boundary between the Arcadia Formation and the overlying Peace River Formation. The Peace River Formation is absent south of the Everglades and pinches out west of Biscayne National Park.

Beneath Biscayne National Park, the Long Key Formation overlies the Arcadia Formation. This new unit, proposed by Cunningham *et al.* (1998) is composed of subsurface siliciclastics underlying the southernmost reaches Florida (from core W-17156 on Long Key). This unit is coeval with the Stock Island Formation of the lower Florida Keys (Guertin *et al.,* 1999). The top of the Long Key Formation beneath the park is ~145 m (475 ft) below the surface. The siliciclastics of the unit were deposited in at least 3 pulses (late Miocene, early Pliocene, and latest Pliocene/earliest Pleistocene). They are present in a channelized morphology of coarse-grained sands (>1mm) (Warzeski *et al.,* 1996).

The Miami Limestone is ~125 – 130 Ka and represented deposition during an interglacial period. Two facies, the oolitic facies and the bryozoan facies are more or less combined in most of the outcrops at east of Biscayne National Park (Hoffmeister *et al.,* 1974; Cunningham, 2005). Further east, towards Biscayne Bay and the upper Keys, the coralline Key Largo Limestone is exposed as far north as Soldier Key (Shinn *et al.,* 1997). The deposition of the Miami and Key Largo Limestones was contemporaneous.

Overlying the Miami and Key Largo Limestones bedrock are surficial units of sands and carbonate muds, coral rubble and reef, as well as local peat and organic material on the islands.

Significant Geologic Resource Management Issues in Biscayne National Park

1. Hydrogeologic system of Biscayne Bay

The resource managers need to understand how water is moving through the hydrogeologic system into, under, and from the park. Two aquifers, the Biscayne (upper) and Florida (lower) aquifers, plus an intermediate aquifer underlie the park. Knowledge is limited about the amount of flow and partitioning between them. Their depths are associated with the five unconformities (Q1 – Q5) in the Fort Thompson – Miami Limestone transition. Porosity is estimated at 40%, but little modeling exists for the system. The USGS has monitoring wells in the park including four seepage wells. These would be useful to perform a tracer study to see how quickly and in what direction water is moving through the system.

Management also needs to understand how the water table might change over time. The Biscayne aquifer is surficial in the Everglades and deepens towards the east. This aquifer provides water for the urban development stretching along the eastern Florida coast. Eight million gallons/day of waste are pumped into deep injection wells from Miami. This waste goes down gradient to the Florida Straights and washes up in the park. Because of Biscayne's location (jutting into the Florida Straights), an understanding of how the water currents and geology interact is vital to understanding contaminant flow through the park.

The interaction between groundwater flow and the overall fresh water and marine ecological quality must be quantitatively determined at Biscayne. Visitor uses and surrounding development are increasing the levels of certain substances in the water at the park. Nutrients from waste are causing algal blooms.

Research and monitoring questions and suggestions include: How many wells are necessary to model the hydrogeologic system at the park? Examine the salt wedge characteristics versus the surface water. How would an increase in hydraulic head affect the local spring activity? Characterize the groundwater interface between the salt and fresh water boundaries. Determine the fresh water discharge into Biscayne Bay. How does a change in hydraulic head affect fresh water discharge into the bay? To what extent does the substrate buffer contaminants in the water flowing into Biscayne Bay? Obtain more cores beneath the park to quantify the characteristics of the Biscayne aquifers location, permeability, porosity, etc. Relate tidal pumping to water movement in the park. Locate the drill log for a 457 m (1,500 ft) well in the center of Elliot Key and use for resource management (possibly located in Denver Service Center?). Access the Harold Hudson Collection of cores at the USGS in St. Petersburg, FL. Measure stable Sr isotopes in ground water as well as ephemeral salinity changes in the Bay to better understand water movement through the hydrogeologic system. Perform mass balance calculations and stable isotope measurements to determine the freshwater inputs and their proportions from rainfall, canal discharge, and groundwater. Map depressions to find freshwater discharge points. Is there a blue hole just outside the park associated with cave openings? Are upwellings in the bay tidal or hydraulic head driven?

2. Benthic habitats at Biscayne National Park

The features in the bay are strongly related to minute changes in elevation. Environments can change within centimeters of topographic relief. Given the coverage of mapping at the park, normal surficial maps are not sufficient for complex management decisions at Biscayne. An interdisciplinary approach to mapping is critical to producing a useful product for resource management. Anthropogenic, supratidal, intertidal, subtidal, and coastal features would all be helpful. This holistic ecosystem approach integrates biological, physical, cultural, and oceanographic variables.

LIDAR surveys in addition to satellite imagery, multibeam mapping, bathymetry data, water quality and circulation, shoreline change data, pre/post storm comparisons, oceanographic data (waves, tides, currents, turbidity, temperature salinity, sediment transport patterns, coral larvae and other species distributions), etc. are essential for resource management at Biscayne National Park. Research and monitoring questions and suggestions include: What is the minimum mapping unit relevant to resource management? What are the flow dynamics in the bay?

3. Inundation history and paleoconditions

Knowledge of the location and characteristics of paleoshorelines at Biscayne will deepen the understanding of the evolution of the landscape as well as increase predictability of future responses to changing sea level. Any paleoshoreline exposed in the park needs to be dated and mapped. In addition to understanding the paleoshorelines at the park, knowledge of the areas paleodrainages will connect with the archaeology of the area. Approximately 5,000-8,000 years ago, indigenous people were concentrated along shorelines, creeks and other drainages. Any anthropological sites should be protected, preserved, and/or excavated. These will add to the cultural value of the park. Knowledge of how the drainage and shoreline have changed through time should help with this process.

Research and monitoring questions and suggestions include: Use LIDAR (penetrates unconsolidated Holocene sediments) and DEMs to determine the paleotopography, locations of drowned reefs and paleochannels flooded off Elliot Key that lie atop Pleistocene bedrock.

4. Sediment transport and erosion

Biscayne National Park straddles the transition between barrier islands to the north and hard rock islands (keys) to the south. Longshore drift processes end at Key Biscayne and Soldier Key. The “Safety Valve” is a large sand bar that allows water in and out, lessening the effects of storm surges. This dynamic feature has been stable for 100 years.

Shifting muds and sands, and carbonate dissolution continually alter the shape and profile of the shoreline. Sand and mud erode from one beach and deposit elsewhere in the course of a single storm event. Focus also needs to be on understanding the sediment transport dynamics at the park. The hydrogeologic system in the area around the park was altered with the construction of canals, roads, and levees.

Research and monitoring questions and suggestions include: How much beach renourishment/degradation is occurring in the park? By what processes are beaches changing? What effect will rising seas have on the Safety Valve? Does longshore drift stabilize or destabilize the Safety Valve?

5. Karst activity

Karst features are not obvious on the landscape at Biscayne. Microkarst appears on the eastern shores of Elliot and other Keys and numerous holes and caves are located beneath the waters of Biscayne Bay. Their distribution, characteristics, depths, and interconnectedness need to be systematically mapped and described.

Research and monitoring questions and suggestions include: How are karst features affecting water quality at Biscayne? How do karst features affect the hydrogeologic regime including retention time, hydraulic head, and water storage? How much of the surface is karst-related collapsed features? What steps should be taken to model water flow in the park regarding karst features? Could aerial photography be used to map sinkholes? Map historic and active sinkholes and other karst features in the bay, especially where it might pose a geohazard to visitors. Relate karst topography with sea grass distribution.

6. Sea level rise

Sea level rise is affecting all of South Florida. Local levels of sea level rise are estimated at 23 cm/year (9 inches/year). Given the low relief of the 42 islands at Biscayne National Park, rising seas will quickly submerge the lower islands and shoals. While slowing the rate of sea level rise is beyond the resources of the park, monitoring sea level change and evaluating/predicting impacts on the park's landscape is a valid management issue. Increases in turbidity with rising seas are causing large seagrass dieoffs and increased carbonate material suspension. Baseline data and conditions are needed first, and then monitoring can proceed.

Research and monitoring questions and suggestions include: Is there any way to save the subaerial habitat from rising seas? What is the exact local rate of sea level rise? Looking at the affects of storm surges, how will the buttonwood/mangrove zones respond to the rising water? Monitor and measure the relationship between water level flux and elevations to determine an exposure/submergence index (i.e. 100% of the time exposed versus 0% of the time exposed). Quantitatively define the terms subtidal, supratidal, and intertidal units to use for future predictions and relate these to the local elevations and annual regime of water fluctuations. How fast will the park be submerged? How should facilities be sited in light of sea level rise? Determine the vulnerability index of the shorelines at Biscayne to sea level rise. Are coral growth rates keeping up with sea level rise?

7. Disturbed lands

Several oil and gas exploration wells are located within the quadrangles of interest for the park. These are all dry wells. In addition to these wells, canals (such as L31 canal), levees, and

quarries (18 m, 60 ft deep canal along Road 107) are disturbed lands in the Biscayne area. Five canals open to the bay within park boundaries.

Research and monitoring questions and suggestions include: Obtain GPS locations of quarry sites. How do quarries and canals affect groundwater flow?

8. Active reefs and coral mapping

Coral reefs are an essential resource to preserve and protect at Biscayne National Park. They are also one of the most fragile features of the park. At least forty-two different benthic types are present in the park. These are associated with small-scale topographic peaks and valleys. There are approximately six types of reefs in the park separated based on their morphology and relief. The reef character changes further north to become smaller and rounder. Older corals are concentrated on the northwest corner of the reef for unknown reasons.

The USGS is using spectral color imaging and LIDAR to produce high-resolution maps of coral reefs in the Biscayne area. This in addition to hand measurements and specific transects with acoustic arrays (measures roughness and hardness of substrate) greatly increases the understanding of the production and calcification of corals, and of the overall health of the benthic ecosystem.

The NOAA Coral Ecosystem Mapping Team is starting an initiative to form a coral reef task force of federal and state agencies to coordinate data rich programs. The desired products are high-resolution benthic maps that will be used to develop a hierarchical benthic habitat/structure classification scheme. Some of the information required for this project includes high-resolution imagery, LIDAR, GPS measurements, seafloor habitat characterization, and an agreed upon minimum mapping unit based on the technology and accuracy requirements. The National Park Service hopes to cooperate with this program to increase the understanding of the coral reefs at Biscayne National Park.

Research and monitoring questions and suggestions: Which reefs are part of an actual Pleistocene complex and which have been moved as chunks during storm events? Accurately map and characterize the reefs and the reef edge. Use LIDAR and DEMs to determine the locations of lagoonal patch reefs, storm blowouts, drowned reefs, and patch reef cores for resource management. What is the geologic connection with coral distribution? How many reefs are there at Biscayne? What are the controls on reef shape? Research alternatives to concrete for reef restoration (concrete does not dissolve enough). Why have reefs changed in the past (look at fossil record in the Key Largo Limestone)? Characterize reef structure. Determine which coral species is the reef builder (branching or stony corals). How quickly does reef form pavement? Should damaged areas of the reef be filled? If so, how long will it take to stabilize? What are the causes and nature of the barrier island - key transition?

9. Recreation demands and resource restoration

In 2003, Biscayne National Park hosted 490,178 recreation visits. This number does not include the thousands of boats that pass through Biscayne Bay every week. Primary visitor activities in

the park include recreational (and commercial) fishing, diving, snorkeling, camping, picnicking, and hiking. Visitors are placing increasing demands on the limited resources and fragile ecosystem of the park. The Sands Cut area (a shallow sand flat) attracts particular attention from boaters who pull up onto the flats to recreate.

Commercial fishing, spear fishing, lobster trapping, etc. all have profound effects on the resources at Biscayne. Vessel groundings can destroy a reef that took thousands of years to build. Shrimp trawlers crush baby corals. Storms toss traps around the sea floor, causing more damage to the bottom. More than 200 vessel groundings are reported per year at Biscayne National Park. Many more are assumed to occur by park management. Ninety percent of these groundings are in the shallow seagrass beds (~2 m, 6.5 ft deep), 9-10% are on coral reefs, and occasionally mangrove groundings occur.

Sea grasses grow in shoals and channels in the park. There are three levels of severity for groundings based on the depth of impact. Deeper cuts often fill with drift algae. Restoration options for the seagrass beds include resedimentation, sediment stabilization, transplanting, and bird stakes (fertilization and seed distribution from droppings). Groundings on reefs are also categorized by the severity of the damage. Results include a fractured substrate, altered topography, and rubble production. Restoration of the reefs can include natural recovery, seal/fill fractures, recolonizing the population, reattaching substrate, removing rubble, capping fractures, promoting natural deposition, and abating erosion.

Research and monitoring questions and suggestions: Are visitors affecting sediment transport and the hydrologic system at the park? Should visit limitations be instigated by the park to reduce anthropogenic erosion and sea grass dieoff? Are seagrasses successional species? How are visitors at Sand Cut affecting sediment thickness there? Develop an interpretive exhibit specific to the geology of the park for visitor information.

10. Sediment thickness

The sedimentary cover over the Pleistocene bedrock is only a thin veneer approximately 1.2 to 4.6 m (4 – 15 ft) thick. This veneer is easily disturbed by devegetation and vessel groundings. Understanding the distribution of sediment thickness is vital to determining viable habitat for sea grass. Storm events and hurricanes have a pronounced and often catastrophic effect on the landscape of south Florida. Baseline conditions must be determined and studied for the resource management to predict the environmental response.

Research and monitoring questions and suggestions include: Develop a response protocol in cooperation with other local agencies to determine the geochemical effects of storm surges. Establish baselines for comparison and prediction of future events. Map sedimentary thickness to see differences across the bay as well as solution haloes that form around islands because of organic acids produced by mangrove peats. Monitor changes in sediment distribution because of vessel groundings. How does the clay layer at depth under the sand waves affect sand ripples? How should this clay layer be managed?

11. Urban development concerns

Dominating the western skyline at Biscayne National Park are the Turkey Point nuclear power plant and the Dade County landfill (the highest point in south Florida). The U.S. Air Force Base at Homestead is growing and increasing the local population west of the park (18,000 new home permits in Homestead). Five canals enter the park and inevitably have an effect on overall water quality. Local agriculture increases the phosphorous and nitrate concentrations by more than 100 times the baseline levels.

The power plant has 217 km (135 miles) of cooling canals which prevent thoroughgoing groundwater movement. The fuel delivery channel to the power plant receives barges approximately 300 days/year (55,000 barrels/day). These barges commonly ground in the shallow water near Biscayne National Park. The potential for a toxic spill is high.

Surrounding canals, including the five that directly enter the park, affect sediment transport, increase turbidity, change water chemistry, and form sediment plumes. The Black Point sewage treatment plant, leachate from the Dade County landfill, as well as contaminated water injected into the Florida aquifer are threatening the water quality of the park. Plans are in place to deepen Miami harbor by 9 m (30 ft) which would cause huge amounts of toxic materials now trapped in sediments to be released. The Intercoastal Waterway that runs through the long axis of the park is on the verge of being dredged.

As local population increases, so does the number of vessel groundings at the park. Florida requires no special license to operate a boat, thus inexperienced boaters are often stranded on shoals, reefs, and sand bars. Buoys and low speed zones are an attempt to reduce the severity of the situation, but monitoring and patrolling boat activity (cooperation with the U.S. Coast Guard) is difficult in the large park. Markers also affect the viewshed of the park. Recovering costs of restoration from responsible parties is very difficult. Park staff needs to join forces with NOAA, FKNMS, DEP, and other state agencies to research the cumulative effects of this boating activity and help restore some of the damage caused by vessel groundings.

Research and monitoring questions and suggestions include: What contaminants are attached to sediments emanating from canals? How can the park cooperate with federal, state, and local agencies to remediate threats to water quality at Biscayne? Discuss alternatives to the fuel barge with the authorities of the Turkey Point nuclear power plant.

12. Soil characterization

Soils need to be mapped and characterized on the 42 islands at Biscayne. Locations of the fresh and saltwater peats in Biscayne Bay are of particular importance to determine the inundation history.

13. Paleontologic inventory

Biscayne National Park contains the fossil remnants of a great Pleistocene reef that forms the foundation for the Florida Keys. These fossilized remains have much to correlate with the modern system, but have to be inventoried, mapped, and described.

Research and monitoring questions and suggestions include: Inventory the Pleistocene fossil corals at Biscayne National Park. Attempt to locate and catalogue specimens previously removed from the park for public/private collections. Create an interpretive exhibit for the fossil resources on Winley Key.

Scoping Meeting Participants

NAME	AFFILIATION	PHONE	EMAIL
Andrea Atkinson	NPS, SFCN	305-224-4245	andrea_atkinson@nps.gov
Amanda Bourque	NPS, BISC	305-230-1144 x3013	amanda_bourque@nps.gov
Sid Covington	NPS, Geologic Resources Division	(303) 969-2154	sid_covington@nps.gov
Richard Curry	NPS, BISC	305-290-1144 x3006	richard_curry@nps.gov
Robert Ginsburg	University of Miami, RSMAS	305-421-4875	rginsburg@rsmas.miami.edu
Melanie Harris	USGS	727-803-8747 x3023	mharris@usgs.gov
Harley Means	Florida Geological Survey	850-488-9380	guy.means@dep.state.fl.us
Lisa Norby	NPS, Geologic Resources Division	303-969-2318	lisa_norby@nps.gov
Matt Patterson	NPS, SFCN	305-224-4211	matt_patterson@nps.gov
Anne Poole	NPS, Geologic Resources Division	303-987-6954	anne_poole@nps.gov
Jeremy Stalker	Florida International University	406-370-4571	jstalker@fiu.edu
Trista Thornberry-Ehrlich	Colorado State University	757-222-7639	tthorn@cnr.colostate.edu
Linda York	NPS, SERO	404-562-3113 x537	linda_york@nps.gov

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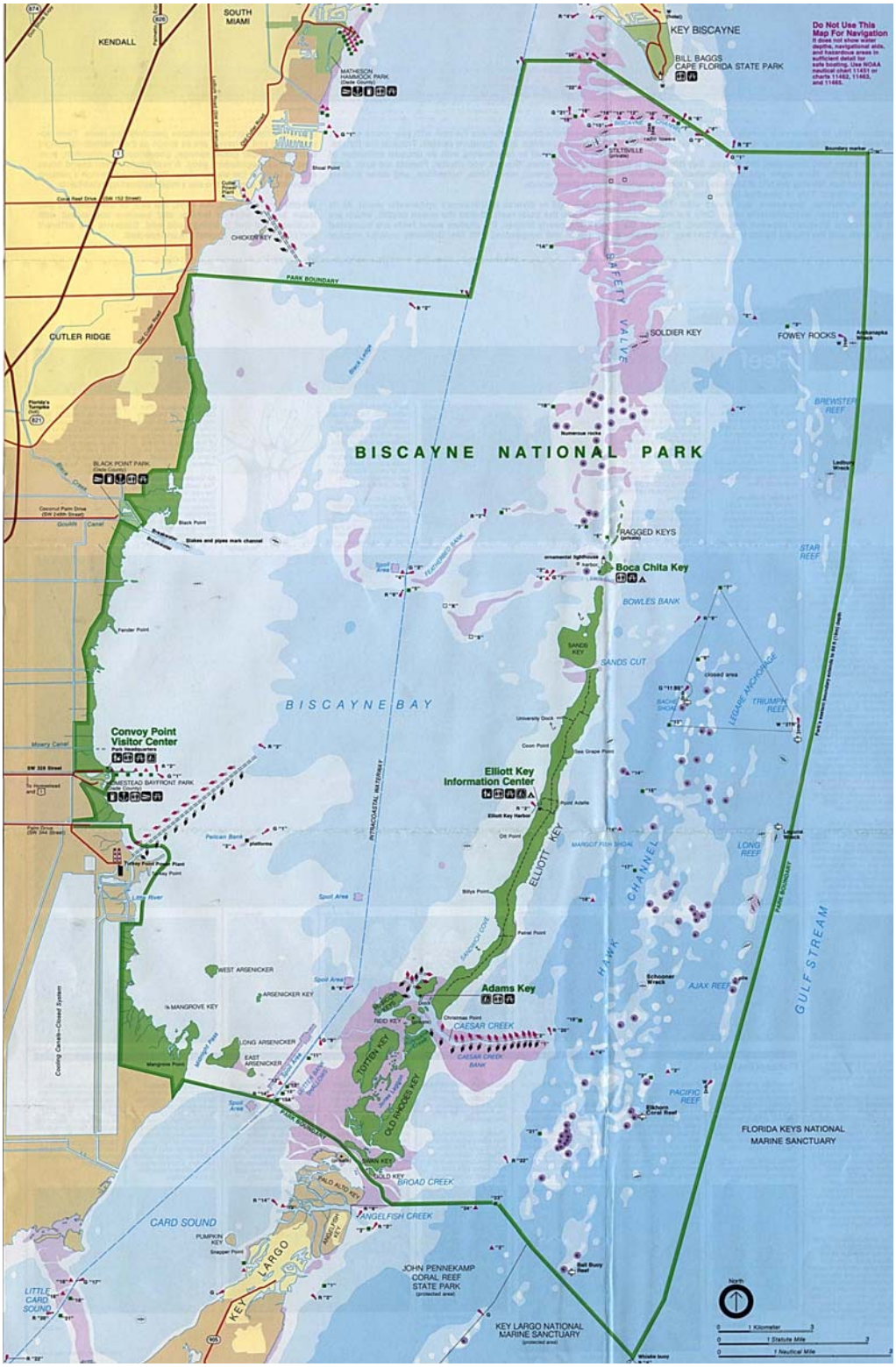
Map of Biscayne National Park



APPENDIX D.3

BUCK ISLAND REEF NATIONAL MONUMENT

GEOLOGIC RESOURCE MANAGEMENT ISSUES

SCOPING SUMMARY

K. N. Hall
Geologic Resource Evaluation
September 1, 2005

EXECUTIVE SUMMARY

A Geologic Resources Evaluation scoping meeting was held for Buck Island Reef National Monument (BUIS) on April 5, 2004. The scoping meeting participants identified the following as the most significant geologic resources management issues:

1. Inventory and monitor coastal and marine processes and resources such as sediment transport, sediment thickness, coral reef populations (i.e. health, location, species), and other benthic habitats.

2. Monitor BUIS hiking trails for a significant increase in erosion.

3. Investigate the possible effects of windblown particulates (i.e. Saharan dust, Montserrat dust) on park resources.

4. Monitor seismic activity in the Puerto Rico Trench and the Anegada Trough for earthquakes and tsunamis.

INTRODUCTION

The National Park Service conducted a Geologic Resources Evaluation scooping meeting at Buck Island Reef National Monument on April 5, 2004. The purpose of the meeting was to discuss the status of geologic mapping in the park, the associated bibliography, and the geologic issues in the park. The products to be derived from the scoping meeting are: (1) Digitized geologic maps covering the park; (2) An updated and verified bibliography; (3) Scoping summary; and (4) A Geologic Resource Evaluation Report which brings together all of these products.

Buck Island was originally designated a protected area by the Municipal Government of St. Croix in 1948. In 1961, Buck Island Reef National Monument was established by President Kennedy in order to protect and preserve "one of the finest marine gardens in the Caribbean Sea." The park included the 176- acre island and approximately 700 acres of submerged lands. In 2001, President Clinton expanded the park to include an additional 18,135 acres of submerged resources. To date, the park contains a total of 19,015 acres (FY2005).

BUIS MAPPING PRODUCTS

Buck Island Reef National Monument has “quadrangles of interest” (or “QOI’s”) at the 7.5’x7.5’- *(1:24,000)* scale. It is desired to obtain DIGITAL geologic map coverage for all identified 7.5’ qoi’s. (Figures 1,2 and 3).

While numerous “paper” maps at suitable scale have been published for this park, complete DIGITAL geologic map coverage is not available. It is hoped that through the scoping meetings and discussions with park staff , the USGS and state geological surveys that gaps in DIGITAL

coverage can be resolved for areas not currently known to have digitized geologic maps. These meetings lay the foundation for a plan to accomplish this task

The contents of this document reflect what is known regarding published geology as of September 6, 2005, from searches done by NPS-GRD staff as discerned from the USGS on-line geologic maps database found at: *http://ngmdb.usgs.gov/ngmdb/ngm_compsearch.html*

In short, it appears a few maps do give coverage for the island of Saint Croix as follows:

- NOAA Benthic Habitats map
- Whetten, J.T., 1966, Geology of St. Croix, U.S. Virgin Islands, Geological Society of America, Memoir 98, 1:31,680 scale

During the scoping sessions held in April 2004, for Buck Island Reef National Monument (BUIS), Salt River Bay National Historical Park and Ecological Preserve (SARI) and Christiansted National Historic Site (CHRI), it was decided that the Whetten map would be the best available source to give the bedrock geology of the island of Saint Croix, as it would also encompass all three NPS areas on the island of St. Croix (Figures 1 and 2) . NPS-GRE staff will acquire the original map and convert it into a digital, user-friendly GIS product.

The NOAA benthic habitat maps will accompany the bedrock map of the island and is already available digitally. NPS-GRE staff will incorporate it as well into a final geologic map of the island. A summary table follows along with explanatory graphics.

Extent of Coverage	**Published Map Citation**	**Paper**	***Digital***	***GRE Plan***
Entire island of Saint Croix	Whetten, J.T., 1966, Geology of St. Croix, U.S. Virgin Islands, Geological Society of America, Memoir 98, 1:31680 scale	yes	Unknown	Acquire paper copy and convert to digital
Entire island of Saint Croix	Kendall, M.S., M.E. Monaco, K.R. Buja, J.D. Christensen, C.R. Kruer, and M. Finkbeiner, R.A. Warner, 1999, Benthic Habitat Maps of the U.S. Virgin Islands-St. Croix; Prepared by Visual Interpretation from Remote Sensing Imagery Collected by NOAA in 1999, 1:6000 scale	Unknown	Yes, from NOAA	Convert NOAA digital version to NPS format

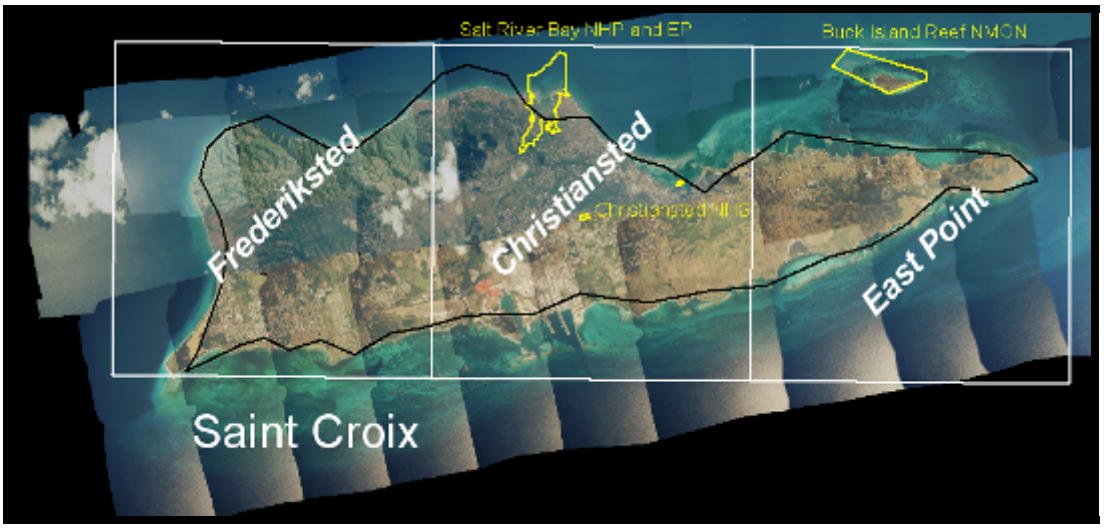


Figure 1: Quadrangles of Interest (QOI's) for BUIS, SARI, and CHRI (7.5' shown in white outline; park boundaries in yellow outline; MrSID image of Island of Saint Croix as background).

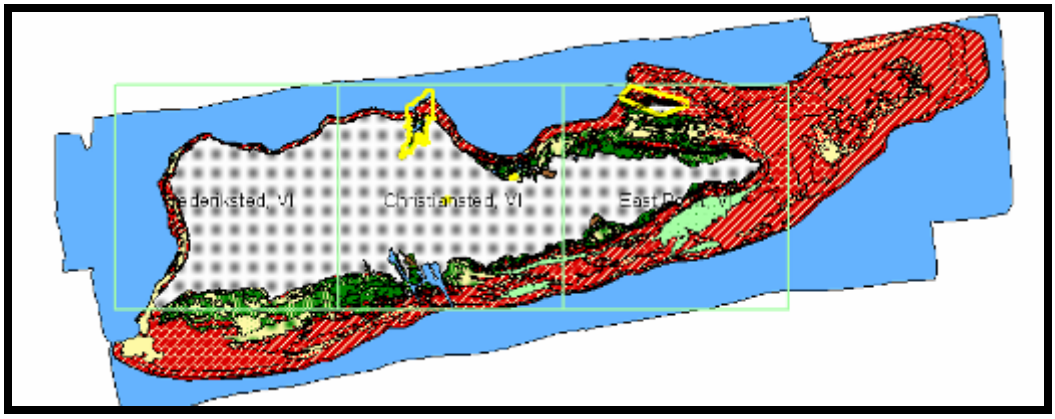


Figure 2: NOAA Benthic Habitats of Saint Croix Island

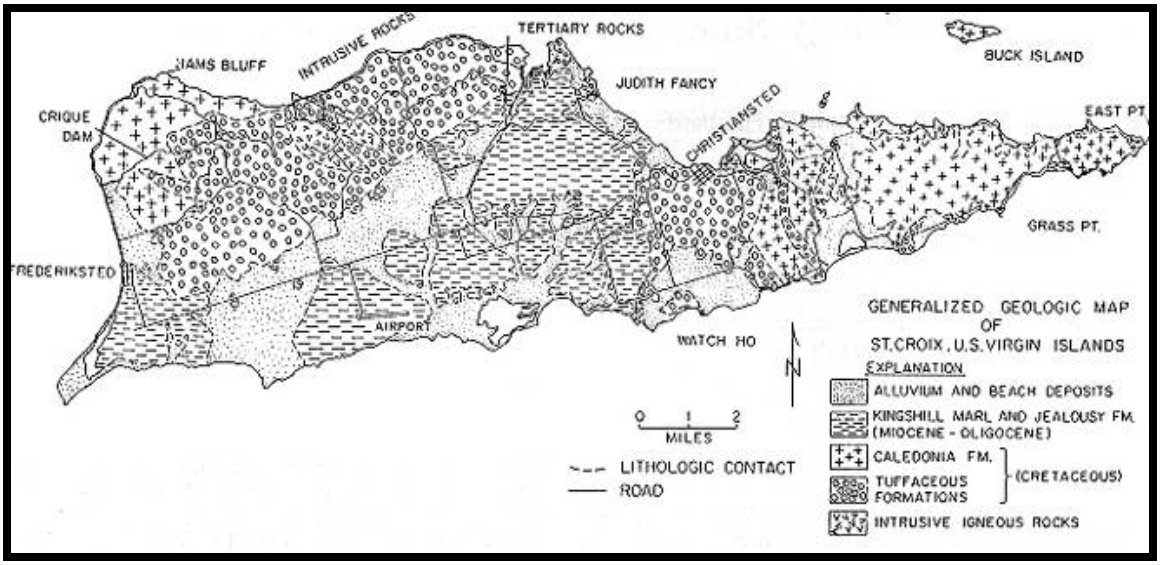


Figure 3: Scan of Generalized Geologic Map of Saint Croix (after Whetten 1974, in Hubbard SP8)

GEOLOGY OF BUCK ISLAND REEF NATIONAL MONUMENT

Taken from Bythell et al., 1989

Buck Island Reef National Monument lies approximately 2 km north of St. Croix. The park's modern carbonate environment is composed primarily of the elkhorn coral, *Acropora palmata*. The only non-carbonate exposures are found in a narrow band of Caledonia Formation volcaniclastics (~100 my). This band rings the island and is exposed on the entire shoreline of BUIS with the exception of the west shore. Holocene beachrock also fringes much of the island. (Whetten, 1966: Bythell et al. 1989)

The east end of Buck Island is encompassed by a massive bank barrier reef that encloses a 200-300 m. wide, and 2-4 m deep, lagoon. This bank-barrier reef trends from southeast to the northwest and represents one of the largest stands of elkhorn coral on St. Croix. The north side of the island is dominated by isolated patch reefs, both within the lagoon and seaward of the bank barrier reef. The seaward patch reefs, known as haystacks, are composed of almost 100% dead *Acropora palmata.*

Although many of the corals found at BUIS have been decimated by White Band disease, living stands of corals on the windward reefs may grow at the high rate of ~15 meters per 1000 years. This high growth rate, combined with high population densities, result in high levels of carbonate production for Buck Island Reef National Monument. (Gladfelter et al., 1977: Gladfelter and Gladfelter, 1979: Bythell et al., 1989)

SIGNIFICANT MANAGEMENT ISSUES

The scoping participants identified the following as the most significant geologic issues at Buck Island Reef National Monument:

1.Coastal and Marine Features and Processes

1. Sediment characteristics – sediment thickness, type, and grain size should be integrated into park maps. Available information on sediment distribution, budget, and sources and sinks should be available to park managers for a variety of reasons including, but not limited to, buoy placement and maintenance, boat anchoring, and erosion hotspots. An understanding of the system's sediment supply is critical for monitoring coastal areas and predicting shoreline change.

2. Boating Hazards – boat anchoring and vessel groundings may damage coral reefs. Although anchoring is permissible in certain areas, illegal anchoring and anchor dragging may destroy marine habitat throughout the park. In addition, vessel groundings due to inexperienced boating and storm events may critically damage large sections of coral reefs.

3. Oceanographic Variables – relative sea level rise, temperature and salinity patterns, currents, and tidal regimes should be monitored for Buck Island Reef National Monument. These variables may aid in identifying sediment transport patterns within

the park. In addition, knowledge of currents at headlands and in channels may reduce visitor injuries.

4. Benthic habitat mapping – Buck Island Reef National Monument is working in cooperation with NOAA to complete benthic habitat mapping for the park. Benthic habitats including coral reefs and submerged aquatic vegetation will be included in coastal mapping products. These features influence the hydrodynamic regimes within their localized areas, thereby determining sedimentation patterns. The location of marine habitats should be known in order to determine the impacts that coastal development and visitor use may have on their health and survival.

2.Recreational Impacts

Buck Island Reef National Monument is experiencing significant erosion on its hiking trails. Further studies are needed because even small increases in sedimentation can negatively affect adjacent marine habitats including coral reefs and seagrass beds.

3.Windblown Features and Processes

Currently, the park is investigating the effects of Saharan dust on park resources. It is believed that imported particulates could have harmful effects on fragile marine habitats such as coral reefs and seagrass beds, by carrying fungi and dust-borne pathogens. Dust from alternate sources such as the Montserrat eruption of 1995 could also have negative impacts on park resources.

4. Seismic Activity

The Virgin Islands are situated on an active plate boundary zone between the Caribbean Plate and the North American Plate. Periodic seismic activity, including earthquakes, submarine landslides, submarine volcanic eruptions, subaerial pyroclastic flows, and tsunamis are common throughout the region. The active fault zone lies approximately 100 miles north of Buck Island Reef National Monument in the Puerto Rico Trench. (Olcott, 1999) In addition, the Anegada Trough lies between St. Thomas and St. Croix. In 1867, a 7.5 magnitude earthquake generated two large tsunamis. These tsunamis produced waves in excess of 23 feet, causing loss of life and structural damage on St. Croix.

Currently, A U.S. Geological Survey (USGS) seismic station in Puerto Rico monitors earthquake activity in the U.S. Virgin Islands.

SCOPING MEETING PARTICIPANTS

Rebecca Beavers
Coastal Geologist
Geologic Resources Division
303-987-6945
Rebecca_beavers@nps.gov

Tim Connors
Geologist
Geologic Resource Division
303-969-2093
Tim_Connors@nps.gov

Melanie Harris
Geographer
U.S. Geologic Survey
727-803-8747
mharris@usgs.gov

Bruce Heise
Geologist
Geologic Resource Division
303-969-2017
Bruce_Heise@nps.gov

Zandy Hillis-Starr
Chief of Resource Management
NPS, Buck Island Reef National Monument
340-773-1460 x235
Zandy_Hillis-Starr@nps.gov

Matt Patterson
South Florida/Caribbean Network,
Inventory and Monitoring Coordinator
305-230-1144
matt_patterson@nps.gov

Kimberly Woody
Biologist
NPS, Buck Island Reef National Monument

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APPENDIX D.4

DRY TORTUGAS NATIONAL PARK

GEOLOGIC RESOURCE MANAGEMENT ISSUES

SCOPING SUMMARY

Trista L. Thornberry-Ehrlich
Colorado State University – Geologic Resource Evaluation
January 31, 2005

Fort Jefferson and moat at Dry Tortugas National Park. Photograph by Trista L. Thornberry-Ehrlich (Colorado State University).

Executive Summary

Following a field trip on January 23, 2005, a Geologic Resources Evaluation scoping meeting took place in Homestead, Florida on January 24, 2005. The scoping meeting participants identified the following geologic resource management issues.

1. Coral reef framework rehabilitation and restoration is needed in response to anthropogenic degradation and disease. Vessel groundings are of particular concern.

2. Sea level rise is a concern for all of South Florida. Further research and monitoring is needed to determine how the environments at Dry Tortugas will respond to rising seas.

3. Benthic ecosystems need to be mapped at a large scale in the park using a multidisciplinary approach for resource management.

4. Island geomorphic processes and stability of Fort Jefferson are closely linked. Resource management must understand the nature of the underlying sediments to attempt to stabilize the crumbling fort. Modeling of sediment transport patterns and rates will help to predict shoreline evolution.

5. Groundwater flow dynamics, dictated by the hydrogeologic system, need to be modeled to predict nutrient/contaminant flow paths and to monitor water quality at the park.

6. Recreation and other use (including commercial fishing boats) threaten the reefs and sea grass beds at the Dry Tortugas. Remediation of the anchorage at the park is being considered.

Introduction

Following a daylong field trip on January 23, 2005, the National Park Service held a Geologic Resource Evaluation scoping meeting for Dry Tortugas National Park at the Krome Center in Homestead, Florida on Monday, January 24, 2005. The purpose of the meeting was to discuss the status of geologic mapping in the park, the associated bibliography, and the geologic issues in the park. The products to be derived from the scoping meeting are: (1) Digitized geologic maps covering the park; (2) An updated and verified bibliography; (3) Scoping summary (this report); and (4) A Geologic Resource Evaluation Report which brings together all of these products.

Dry Tortugas National Monument was established under Franklin D. Roosevelt's administration on January 4, 1935. On October 26, 1992, the monument was redesignated a national park. Dry Tortugas covers 64,701 acres and is located 112.9 km (70 miles) west of Key West. Over 99% of the park is under water. Seven keys, (Loggerhead, Garden, Bush, Long, Hospital, Middle, and East Keys) comprise the only subaerial exposures. The area covers a large portion of the outermost Florida Keys, a long tract of paleoreefs that stretch from Biscayne National Park to Dry Tortugas, some 193 km (120 miles). The park contains some of the most pristine marine habitat in the continental United States. Its isolated location attracts nesting birds and turtles to its shores. The strategic location also attracted military attention leading to the construction of the defensive Fort Jefferson on Garden Key.

Dry Tortugas National Park is covered by four quadrangles of interest (Dry Tortugas OE, Dry Tortugas OE E, Dry Tortugas OE S, and Dry Tortugas OE SE). However, additional coverage is required for underwater mapping in surrounding quadrangles. The Florida State Geologic Survey has digitized a geologic map covering the state at a small scale (~ 1:750,000). This map only displays one geologic unit for the park. Additional mapping at a smaller scale will be more helpful for park management.

Physiography

The Florida Keys are divided into three distinct sections: the upper. middle, and lower Keys (including Dry Tortugas). These divisions correspond to their orientation, morphology, water depth, and composition. The upper Keys are oriented almost north-south and buttress against the east-southeast winds. The middle Keys are oriented northeast-southwest and face directly into the east-southeast winds. The upper and middle Keys are composed of coralline limestone. The lower Keys are oriented nearly parallel to the winds and trend nearly east-west and are composed of oolite (preserved tidal-bar deposits?). Water depth is at a maximum in the middle Keys. As a result, the coral reef development is greatest in the shallower waters of the upper and lower Keys (Shinn et al., 1997).

East of Dry Tortugas is an area of extensive sand waves that are current-swept into crests as high as 3 m (9 ft), called the Quicksands. Sand accumulations are as thick as 12 m (40 ft). The reefs at Dry Tortugas are thick, as much as 17 m (55 ft). They form an elevated atoll-like rim. The sand islands are located around the atoll and are as much as 14 m (45 ft) thick (Loggerhead Key). The Holocene sediments at Dry Tortugas are mostly uncemented and the mixture of paleocorals and sands proved an unstable foundation for the construction of Fort Jefferson on Garden Key.

Geologic History of South Florida

Sediment cores (southwest of the Marquesas Keys, penetrated 4,500 m (15,000 ft) indicate that South Florida has been predominantly an area of carbonate accumulation since the Mesozoic.

Late Paleozoic Era – During the Mississippian, the landmass that would underlie the grand carbonate platform of Florida today was not attached to the North American Craton. It is speculated that it was attached to the northwest portion of the African continent (Condie and Sloan, 1998). However, marine carbonates were being deposited over large portions of the area atop a Paleozoic age crystalline basement high, the Peninsular Arch (Pollastro *et al.*, 2000). In the Pennsylvanian, a collision event, known as the Ouachita orogeny sutured the Florida landmass to the continent as Gondwanaland and North America collided eventually forming the supercontinent Pangaea. The land was still submerged and south Florida was located at the junction of the North American, South American, and African plates. Through the Permian, Pangaea remained intact (Condie and Sloan, 1998).

Early Mesozoic Era – No sooner had Pangaea formed than it began to break up. During the late Triassic, South and Central America and Africa began to rift away from North America. This established the long-standing passive margin of the eastern seaboard that persists today. The Florida and Cuba blocks detached from northwest Africa and the Gulf of Mexico opened (Condie and Sloan, 1998).

Accompanying the rifting of Pangaea was the widespread extrusion of volcanic rocks consistent with mantle plume upwelling due to crustal tension (Heatherington and Mueller, 1991). This continental rifting also opened the Atlantic Ocean basin.

Middle Mesozoic Era - Underlying the south Florida basin are igneous rhyolitic - basaltic rocks (Thomas et al., 1989). These rocks were subaerially exposed and eroded during the late Triassic to middle Jurassic. This caused the formation of redbeds locally. As the Atlantic Ocean continued to develop, deltaic and shallow marine sediments were deposited in the late Jurassic. Restriction of marine circulation at this time resulted in periodic accumulations of evaporites and marine carbonates (Cunningham, 2005). Deposition of Jurassic and Cretaceous sediments was controlled by the south-southeast plunging axis of the Peninsular Arch. Basal sediments onlap and pinch out against the arch (Pollastro *et al.*, 2000).

Late Mesozoic Era – As marine transgression proceeded during the early Cretaceous, the Florida Platform was the site of more widespread deposition of marine limestones and reefs. Further transgression and global warming during the Late Cretaceous established an open marine accumulation of carbonates over the entire Florida Peninsula.

Cenozoic Era – Cenozoic development of the Florida Platform included additional deposition of marine carbonates and deposition of siliciclastics (grains of silicate minerals such as quartz in lieu of carbonates) from northwestern highlands sources and long shore oceanic currents. Tertiary faulting occurred south of Florida as the Cuban block collided with the Antilles arc and carbonate accumulation continued in Florida (Condie and Sloan, 1998). In southern Florida, the

open marine setting continued during the Paleocene as more restricted flow to the north resulted in deposits of mixed carbonates and evaporites. Eocene and Oligocene deposition is marked by shallow water carbonates. Intermittent with this deposition were subaerial exposures associated with local oceanic regressions.

Deposition in south Florida during the Miocene changed with the introduction of more widespread siliciclastics from a fluvio-deltaic system prograding down the peninsula. Phosphates and the carbonate ramp of the Arcadia Formation were deposited during the Miocene in south Florida. A Pliocene lowstand caused many of the previous deposits to be reworked and/or eroded. The Florida Keys area was active as a thick pile of sand that was being transported south to eventually form the Long Key Formation (Guertin et al., 1999; Cunningham, 2005). Continued carbonate accumulation in the Florida Keys during the Pliocene built the Stock Island Formation (Cunningham et al., 1998).

The Pleistocene era resulted in the conversion from siliciclastic deposition mixed with carbonate accumulation to more widespread carbonate sedimentation (Cunningham, 2005). Global sea-level changes during the intermittent ice ages of the Pleistocene controlled the rate and distribution of carbonate units. At 120 Ka, the last major sea level fall occurred as the reefs and the oolite facies were accumulating to become the Key Largo Limestone. Locally, the Pleistocene Key Largo Limestone (130 Ka) underlies the lower Keys including the Dry Tortugas. The Pleistocene section is south Florida is more than 61 m (200 ft) thick at Big Pine Key (Shinn *et al.,* 1997).

At 15-16 Ka sea level began to rise rapidly and flood southern Florida around 7 or 6 Ka (Shinn *et al.,* 1997). Sea level has continued to rise. Holocene geologic activity in the Dry Tortugas area consists of the accumulation of coral reefs, sand deposits and carbonate muds. These deposits directly overlie the Pleistocene Key Largo Limestone. Reef distribution at Dry Tortugas is controlled by geologic and climatic factors such as the timing and rate of sea level rise, sediment facies, oceanic currents, and underlying bedrock (topography).

Stratigraphy

The USGS has installed monitoring wells at Garden Key of Dry Tortugas National Park. Cores from these wells reveal the upper 1 m (3 ft) to consist of sand and other anthropogenic debris. *Halimeda* is the most abundant biogenic sediment grain (Davis, Jr., and O'Neill, 1979). In the core, the next 15 m (50 ft) is Holocene limestone including head corals and numerous sand pockets, below the Holocene units is the Pleistocene Key Largo Limestone (fossilized patch reef complex and oolites) that underlies much of the South Florida Keys (Shinn *et al.*, 1979).

The Pleistocene section is of varying thickness and may contain as many as five separate facies units. In the lower keys (Big Pine Key), the section is more than 18 m (60 ft) thick. A Pleistocene coral facies (*Montastraea annularis*) underlies modern Holocene reefs. Pleistocene biogenic (*Halimeda*) underlies Holocene carbonate sands (Shinn *et al.*, 1997). The mixed stratigraphy from the Holocene caused the initial subsidence of Fort Jefferson. Differential subsidence continues to this day between the unconsolidated sand pockets and the limestones.

Marine units at Dry Tortugas include sandy shoals, lagoons, algal mats, patch reefs, bank barrier/fringing reefs, staghorn reefs, beach rock, hard bottom, and bare sand and rubble (Davis, 1979; Meeder, 1979; Ginsburg, 1979).

Significant Geologic Resource Management Issues in Dry Tortugas National Park

1. Coral reef framework rehabilitation and restoration

Due in part to its isolated location, Dry Tortugas protects pristine and unique coral communities with pinnacles, staghorn and elkhorn corals. Historically, the shallow shoals and reefs have caused numerous shipwrecks (Windjammer, Little Africa, Brick, etc). Today, the reefs and accompanying sea grass beds are under constant threat of degradation from vessel groundings and overuse. Private and public vessels as well as those from the local fishing industry (shrimpers) are all permitted safe harbor at the park and the high traffic in the area increases the likelihood of groundings and damage.

Given that coral growth rates are very slow, restoring a coral bank after a vessel grounding is more than just a matter of patching a hole, care must be given to the type of material used (i.e. concrete, fossil corals) and the encouragement of regrowth. To protect the environment, the banks must be restored before restoring damaged sea grass beds. Monitoring and research questions include: What is the best way to encourage growth on the reefs? What affect does loss of sea grass beds have on the marine environment? Should the number of permitted boat moorings be limited? How?

2. Sea level rise

Sea level rise is affecting all of South Florida. While slowing the rate of sea level rise is beyond the resources of the park, monitoring sea level change and evaluating/predicting impacts on the park's landscape is a valid management issue. The seven islands of Dry Tortugas are under constant threat of inundation by the sea. Several of the islands disappear seasonally due to rising seas including Middle Key. Bird Key has disappeared altogether. Given the low relief of the islands, this rise will destroy the bird and turtle nesting habitats protected at the park. The USGS and NOAA are working to determine the coastal vulnerability index (CVI) of the park.

Park management must continually balance 1) the aim to let natural processes take their course at Dry Tortugas, with 2) the preservation/restoration of the cultural resources present (Fort Jefferson and Loggerhead Key Lighthouse). Research and monitoring questions include: What is the best way to preserve the structure of Fort Jefferson from rising seas? Is there any way to save the subaerial habitat from rising seas? Will coral growth rates be able to change in response? What is the local rate of sea level rise? Looking at the affects of storm surges, how will the islands respond to the rising water?

3. Island geomorphic processes and stability of Fort Jefferson

The very nature of the landscape at Dry Tortugas is one of change. Shifting sands continually alter the shape and profile of the islands. Sand erodes from one beach and is deposited elsewhere in the course of a single storm event (including two deposits in the fort's moat on the west and northeast sides). Focus also needs to be placed on understanding the sediment transport

dynamics at the park. A relatively deep channel separated Garden Key and Bush Key until a large storm event joined them with a sand bridge. This sand bridge widens and recedes, but remains a persistent feature of the landscape. The anchorage at the park, to the south of Garden Key is being filled in. This affects access to the park as well as the safe harbor provided by the park. Dredging this area could have devastating effects on the local ecosystem.

Fort Jefferson is the largest of the 19th century coastal fortifications in America. Construction began on Fort Jefferson in 1846, but was never finished due to uneven subsidence in the foundations on Garden Key. This subsidence was rapid at first and cracked the freshwater cisterns making it necessary to distill seawater or import water to the fort. Ongoing efforts are attempting to stabilize the fort and preserve this historical resource. Research and monitoring questions include: Should the channel between Garden and Bush Key be dredged to encourage circulation around the islands? Should the anchorage area be dredged? What effects would dredging have on the benthic/marine environments at the park? How will further stabilization of the fort affect the environment?

4. Benthic ecosystems

Benthic habitats comprise more than 99% of Dry Tortugas National Park. Environments can change within centimeters of topographic relief. Given the coverage of mapping at the park, normal surficial maps are not sufficient for complex management decisions at Dry Tortugas. An interdisciplinary approach to mapping is critical to producing a useful product for resource management. Anthropogenic, supratidal, intertidal, subtidal, and coastal features would all be helpful. This holistic ecosystem approach integrates biological, physical, cultural, and oceanographic variables.

USGS LIDAR surveys are adding detail to the elevation and geomorphic profiles at Dry Tortugas. These in addition to satellite imagery, multibeam mapping, bathymetry data, water quality and circulation, shoreline change data, pre/post storm comparisons, oceanographic data (waves, tides, currents, turbidity, temperature salinity, sediment transport patterns, coral larvae and other species distributions) are essential for resource management at Dry Tortugas National Park. Research and monitoring questions include: What is the minimum mapping unit relevant to resource management? Would banded maps of vulnerability patterns be useful? Could video be employed to monitor shoreline change at the park?

5. Groundwater flow dynamics

The interaction between groundwater flow and the overall marine ecological quality must be quantitatively determined at Dry Tortugas. Visitor uses as well as other boats are increasing the levels of certain substances in the water at the park. This is affecting corals, including the last stand of elkhorn coral near Bush and Long Keys). Nutrients from waste are causing algal blooms. The USGS has drilled a series of monitoring wells at the park, both inside and outside the fort to monitor water chemistry. A sand overflow into the fort's moat along the western wall from Hurricane Charlie in 2004 inundated one well.

Research and monitoring questions include: How many wells are necessary to model the hydrogeologic system at the park? What are the affects of the numerous boats moored in the anchorage of the park on water quality? How has the sediment transport affected groundwater flow patterns (i.e. the sand bridge between Garden and Bush Keys)?

6. Recreation and other use demands

In 2003, Dry Tortugas National Park hosted 74,576 recreation visits. These in addition to the boat moorings (public, private, and industry) are placing increasing demands on the limited resources and fragile ecosystems of the park. The most common visitor activities include snorkeling, the self-guided tour of the fort, camping, and swimming at the beach. Visitors access Dry Tortugas by Ferry (69%), seaplane (11%), commercial charter (10%), private sailboat (7%), private motor boat (2%), commercial dive boat (1%), and other (4%) (Ye and Littlejohn, 2003). These all have an impact on the parks benthic environments, viewshed, air and water quality, and noise levels.

Research and monitoring questions: Should the park restrict access to the islands? Would a guided boat tour decrease the environmental impact of visitation? Are visitors affecting sediment transport?

Scoping Meeting Participants

NAME	AFFILIATION	PHONE	EMAIL
Andrea Atkinson	NPS, SFCN	305-224-4245	andrea_atkinson@nps.gov
Sonny Bass	NPS, EVER	305-242-7833	sonny_bass@nps.gov
Sid Covington	NPS, Geologic Resources Division	(303) 969-2154	sid_covington@nps.gov
Kevin Cunningham	USGS		
Robert Ginsburg	University of Miami, RSMAS	305-421-4875	rginsburg@rsmas.miami.edu
Melanie Harris	USGS, CCWS	727-803-8747 x3023	mharris@usgs.gov
Fred Herling	NPS, EVER/DRTO	305-242-7704	fred_herling@nps.gov
Todd Hickey	USGS	727-803-8747 x3040	tdhickey@usgs.gov
Kelly Jackson	University of Miami, RSMAS	305-421-4811 x4	kjackson@rsmas.miami.edu
Bob Johnson	NPS, EVER/DRTO	305-224-4240	robert_johnson@nps.gov
Harley Means	Florida Geological Survey	850-488-9380	guy.means@dep.state.fl.us
Sherry Mitchell-Bruker	NPS, EVER	305-224-4286	sherry_mitchell@nps.gov
Doug Morrison	NPS, EVER/DRTO	305-852-0324 x0327	douglas_morrison@nps.gov
Lisa Norby	NPS, Geologic Resources Division	303-969-2318	lisa_norby@nps.gov
Matt Patterson	NPS, SFCN	305-224-4211	matt_patterson@nps.gov
Anne Poole	NPS, Geologic Resources Division	303-987-6954	anne_poole@nps.gov
Tom Schmidt	NPS, EVER	305-224-4269	tom_schmidt@nps.gov
Eugene Shinn	USGS	727-803-8747 x3030	eshinn@usgs.gov
Dewitt Smith	NPS, EVER	305-242-7818	dewitt_smith@nps.gov
Trista Thornberry-Ehrlich	Colorado State University	757-222-7639	tthorn@cnr.colostate.edu
Brigitte Vlaswinkel	University of Miami, RSMAS	305-421-4918	bvlaswinkel@rsmas.miami.edu
Harold Wanless	University of Miami, Geological Sci.	305-284-4253	hwanless@miami.edu
Britton Wilson	NPS, SFCN		britton_wilson@nps.gov
Linda York	NPS, SERO	404-562-3133 x537	linda_york@nps.gov

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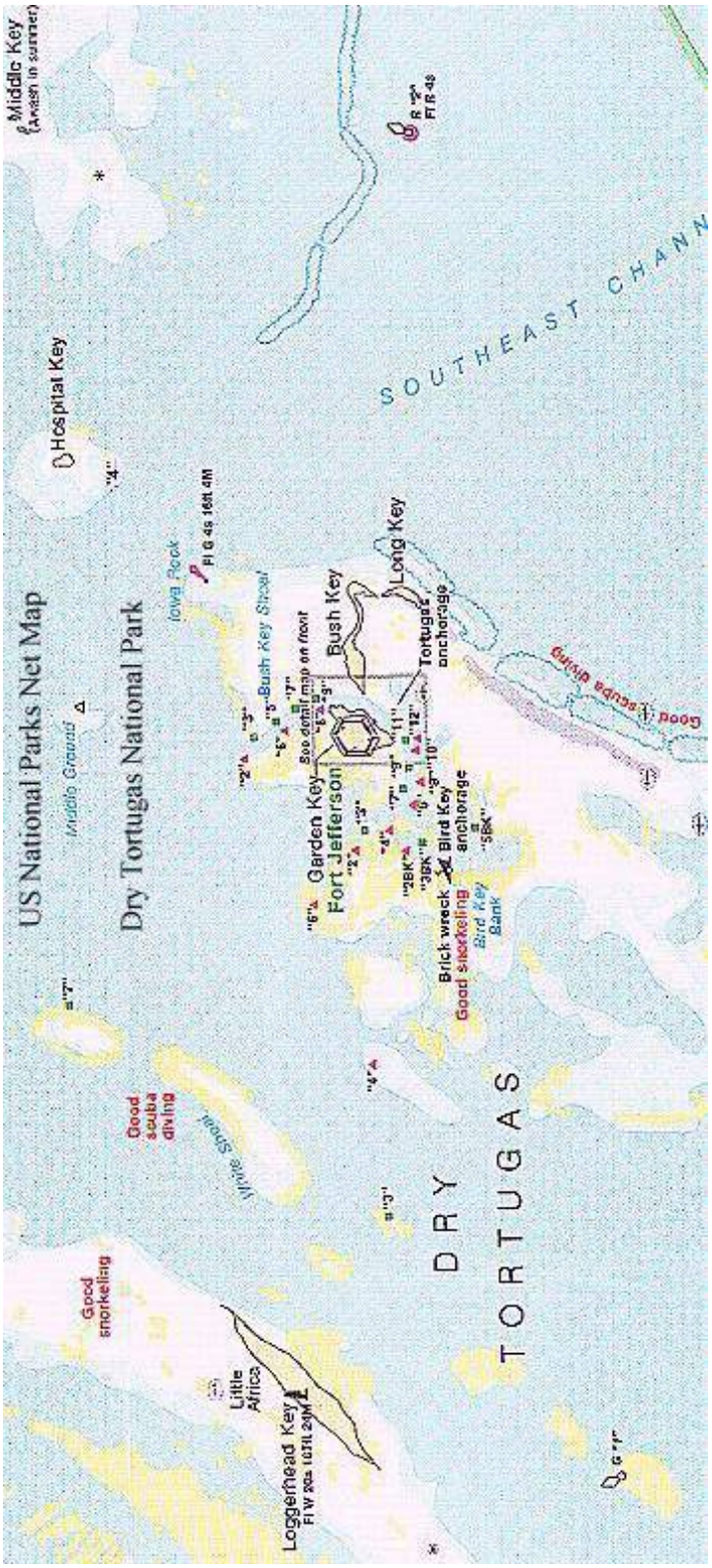

Map of Dry Tortugas National Park

APPENDIX D.5

EVERGLADES NATIONAL PARK

GEOLOGIC RESOURCE MANAGEMENT ISSUES

SCOPING SUMMARY

Trista L. Thornberry-Ehrlich
Colorado State University – Geologic Resource Evaluation
February 4, 2005

Rock Reef Pass in Everglades National Park. Photograph by Trista L. Thornberry-Ehrlich (Colorado State University).

Executive Summary

A Geologic Resources Evaluation scoping meeting took place in Homestead, Florida on January 24, 2005. The meeting was followed by a field trip on January 25, 2005. The scoping meeting participants identified the following list of geologic resource management issues. These topics are discussed in detail on pages 10 - 16.

1. The Florida Bay mud banks elevation and stability
2. Mangrove zone topography and buttonwood ridge height
3. Whitewater Bay and Gulf Coast estuaries
4. Solution holes
5. Aquifer characteristics and groundwater flow dynamics
6. Recreation and other use demands
7. Earthen and failed dams, canals, and sheet piling
8. Sediment transport and resuspension at Lake Ingraham
9. Sinkholes and karst features
10. Paleoclimates
11. Sea level rise
12. Geologic changes due to storms and hurricanes
13. Atmospheric deposition of African dust
14. "Lake Belt" management
15. Tree islands and hardwood hammacks
16. Archaeological sites

Introduction

The National Park Service held a Geologic Resource Evaluation scoping meeting for Everglades National Park at the Krome Center in Homestead, Florida on Monday, January 24, 2005, followed by a field trip the next day. The purpose of the meeting was to discuss the status of geologic mapping in the park, the associated bibliography, and the geologic issues in the park. The products to be derived from the scoping meeting are: (1) Digitized geologic maps covering the park; (2) An updated and verified bibliography; (3) Scoping summary (this report); and (4) A Geologic Resource Evaluation Report which brings together all of these products.

Everglades National Park was established under Harry S. Truman's administration on December 6, 1947. On October 26, 1976, the park was designated as an International Biosphere Reserve. The park attained its Wilderness Designation on November 10, 1978. It was made a world heritage site on October 24, 1979, and was named a Wetland of International Importance on June 4, 1987. Everglades covers 1,508,537 acres spanning the southern tip of the Florida peninsula and most of Florida Bay between the peninsula and the Florida Keys. The Everglades is the only subtropical preserve in North America. The environments at the park vary from mangrove and cypress swamps, marine and estuarine environments, pinelands and hardwood hammocks, sawgrass prairies and rock ridges. The area covers a large portion of the Florida Bay, a large carbonate mud bank. The park contains some of the most pristine and unique marshland habitat in the continental United States.

Everglades National Park identified 385 quadrangles of interest. The Florida State Geologic Survey (FGS) has digitized a geologic map covering the state from individual county maps at a small scale (~ 1:750,000). This map only displays 4 separate geologic units (Holocene sediments, Key Largo Limestone, Miami Limestone, Tamiami Formation) for inside the boundaries of the park. Located within the quadrangles of interest are 11 additional geologic map units.

Other geologic maps covering portions of the park itself include the FGS MS6/22 (1:24,000, 2000), the benthic habitat map published by NOAA CSC (1:48,000, 1999), Geological Society of America (GSA) Memoir 147 (1:79,000, 1977), the FGS OFMS 83/01-07 (1:100,000, 1996), 83/08-12 (1:100,000, 1995), 67 (1:26,720, Dade County), 66/01 (1:26,720, Monroe County), 63 and Series 120 (1:26,720, Collier County), USGS OF 97-526 (1:120,000, 1997) and 86-4126 (1:136,000, 1986).
Additional mapping at a smaller scale will be more helpful for park management.

Physiography

South Florida in the area of the Everglades is divided into 5 physiographic provinces. The Everglades province forms a south dipping, spoon-shaped low-lying area between the Atlantic Coastal Ridge to the east, the Big Cypress Swamp to the west, and the Sandy Flatlands area to the north. The basin has very low relief. The elevation change is only 3.6 to 4.3 m (12-14 ft) from the maximum near Lake Okeechobee to sea level. Prior to anthropogenic alteration, this drainage system flowed slowly from north to south.

Bounding the Everglades province on the east is the Atlantic Coastal Ridge. It is comprised of Pleistocene marine limestones covered by thin quartz sand sheets. The province ranges in elevation from 1.5 to 6 m (5 to 20 ft) in the southernmost portions. The width of the ridge ranges from 16 km (10 miles) in southern Miami-Dade County and narrows to 5 to 8 km (3 – 5 miles) further north. Periodically breaching the southern portions of the ridge are sloughs (transverse glades) oriented perpendicular to the trend of the ridge.

The southern reaches of the Everglades and Big Cypress Swamp provinces transition into the Coastal Marshes and Mangrove Swamp physiographic province. The province covers an area from the northeastern part of Florida Bay, around the southern Florida peninsula, and west, into the Gulf of Mexico up to the Ten Thousand Island region never Everglades City. Bands of swamps and brackish marshes sitting just above sea level characterize this province. Freshwater runoff and tidal fluxes cause the salinity to change dramatically. This is why the mangrove, capable of enduring such salinity changes, thrives in this area.

The Big Cypress Swamp province defines the western boundary of the Everglades. This area is slightly higher in elevation than the Everglades basin because it is underlain primarily by the coral-rich limestones of the Pliocene Tamiami Formation (3-4 Ma). This formation is exposed in large areas of Big Cypress. Drainage in the province is primarily to the south and southwest.

Geologic History of South Florida

Sediment cores indicate that South Florida has been predominantly an area of carbonate accumulation since the Mesozoic.

Late Paleozoic Era – During the Mississippian, the landmass that would underlie the grand carbonate platform of Florida today was not attached to the North American Craton. It is speculated that it was attached to the northwest portion of the African continent (Condie and Sloan, 1998). However, marine carbonates were being deposited over large portions of the area atop a Paleozoic age crystalline basement high, the Peninsular Arch (Pollastro *et al.*, 2000). In the Pennsylvanian, a collision event, known as the Ouachita orogeny sutured the Florida landmass to the continent as Gondwanaland and North America collided eventually forming the supercontinent Pangaea. The land was still submerged and south Florida was located at the junction of the North American, South American, and African plates. Through the Permian, Pangaea remained intact (Condie and Sloan, 1998).

Early Mesozoic Era – No sooner had Pangaea formed than it began to break up. During the late Triassic, South and Central America and Africa began to rift away from North America. This established the long-standing passive margin of the eastern seaboard that persists today. The Florida and Cuba blocks detached from northwest Africa and the Gulf of Mexico opened (Condie and Sloan, 1998).

Accompanying the rifting of Pangaea was the widespread extrusion of volcanic rocks consistent with mantle plume upwelling due to crustal tension (Heatherington and Mueller, 1991). This continental rifting also opened the Atlantic Ocean basin.

Middle Mesozoic Era - Underlying the south Florida basin are igneous rhyolitic - basaltic rocks (Thomas et al., 1989). These rocks were subaerially exposed and eroded during the late Triassic to middle Jurassic. This caused the formation of redbeds locally. As the Atlantic Ocean continued to develop, deltaic and shallow marine sediments were deposited in the late Jurassic. Restriction of marine circulation at this time resulted in periodic accumulations of evaporites and marine carbonates (Cunningham, 2005). Deposition of Jurassic and Cretaceous sediments was controlled by the south-southeast plunging axis of the Peninsular Arch. Basal sediments onlap and pinch out against the arch (Pollastro *et al.*, 2000).

Late Mesozoic Era – As marine transgression proceeded during the early Cretaceous, the Florida Platform was the site of more widespread deposition of marine limestones and reefs. Further transgression and global warming during the Late Cretaceous established an open marine accumulation of carbonates over the entire Florida Peninsula.

Cenozoic Era – Cenozoic development of the Florida Platform included additional deposition of marine carbonates and deposition of siliciclastics (grains of silicate minerals such as quartz in lieu of carbonates) from northwestern highlands sources and

long shore oceanic currents. Tertiary faulting occurred south of Florida as the Cuban block collided with the Antilles arc and carbonate accumulation continued in Florida (Condie and Sloan, 1998). In southern Florida, the open marine setting continued during the Paleocene as more restricted flow to the north resulted in deposits of mixed carbonates and evaporites. Eocene and Oligocene deposition is marked by shallow water carbonates. Intermittent with this deposition were subaerial exposures associated with local oceanic regressions.

Deposition in south Florida during the Miocene changed with the introduction of more widespread siliciclastics from a fluvio-deltaic system prograding down the peninsula. Phosphates and the carbonate ramp of the Arcadia Formation were deposited during the Miocene in south Florida. A Pliocene lowstand caused many of the previous deposits to be reworked and/or eroded. The Everglades area was the deposition area of a thick pile of sand that was being transported south to eventually form the Long Key Formation (Guertin et al., 1999; Cunningham, 2005).

The Pleistocene era resulted in the conversion from siliciclastic deposition mixed with carbonate accumulation to more widespread carbonate sedimentation (Cunningham, 2005). Global sea-level changes during the intermittent ice ages of the Pleistocene controlled the rate and distribution of carbonate units. At 120 Ka, the last major sea level fall occurred as the mixed carbonate-siliciclastic sediments formed the Fort Thompson Formation. This unit interfingers with the surficial geologic units, the Miami and Key Largo Limestones, and the Anastasia Formation (~130 Ka) (Cunningham, 2005).

At 15-16 Ka sea level began to rise rapidly and flood southern Florida around 7 or 6 Ka (Shinn *et al.*, 1997). Sea level has continued to rise. Holocene geologic activity in the Everglades area consists of the dissolution of carbonate units, the accumulation of carbonate muds, marine and freshwater marls, sand and swamp deposits.

Stratigraphy

Cores such as the deep, continuous core near the Everglades National Park Research Center (W-17232), those of the South Florida Drilling Project (Florida Geological Survey, University of Miami, Florida Department of Transportation), and the USGS help constrain the stratigraphy underlying the park.

The lowest unit penetrated by the core in the park is the Arcadia Formation (top surface at 147 m, 482 ft). This formation consists of ramp setting carbonates with scant quartz contents increasing northward (~20% quartz grains at W-17232) (Cunningham, 2005). A major disconformity marks the boundary between the Arcadia Formation and the overlying Peace River Formation. The Peace River Formation is absent south of the Everglades. It contains two distinct units: a lower diatomaceous mudstone, and an upper fine-grained quartz muddy sandstone (Cunningham *et al.,* 1998). The top of the Peace River Formation is 98.8 m (324 ft) below the surface at W-17232 (McNeill *et al.,* 1996).

Cunningham *et al*. (1998) proposed a new unit, the Long Key Formation, for subsurface siliciclastics underlying the southernmost reaches Florida (from core W-17156 on Long Key). This unit is coeval with the Stock Island Formation of the lower Florida Keys (Guertin *et al.,* 1999). The top of the Long Key Formation in the park is 17.4 m (57 ft) below the surface. The siliciclastics of the unit were deposited in at least three pulses (late Miocene, early Pliocene, and latest Pliocene/earliest Pleistocene). They are present in a channelized morphology of coarse-grained sands (>1mm) (Warzeski *et al.,* 1996).

Shallow water limestone of the Fort Thompson Formation comprises the uppermost 17 m of cored section in the Everglades. This limestone is probably combined with the capping unit of the Miami Limestone. The Fort Thompson is mostly lagoonal facies carbonate with abundant bivalve fossils and some quartz sand. The Miami Limestone is ~125 – 130 Ka and represented deposition during an interglacial period. Two facies, the oolitic facies and the bryozoan facies are more or less combined in most of the outcrops at Everglades National Park (Hoffmeister *et al.,* 1974; Cunningham, 2005).

Overlying the Miami Limestone bedrock are surficial units of freshwater peat and organic muck, freshwater and marine marls, and cyanobacteria mats. The peat and muck typically occurs in low-lying sloughs and solution holes and are dark and fine-grained. During the standing water phase of the wet season, extracellular precipitation of calcium carbonate by cyanobacteria forms fresh and marine limestone marls. The marine marls (Flamingo Marl) are dominated by aragonitic mud, and shell deposits that form a sort of coastal levee around the southern rim of the park (Cunningham, 2005).

Significant Geologic Resource Management Issues in Everglades National Park

1. The Florida Bay mud banks elevation and stability

The Florida Bay is covered by an extensive system of supra- and subtidal carbonate mud banks, coastal marl ridges, coastal carbonate mud ridges, mangrove peat deposits, and mollusk deposits. There is a strong resource management need to understand how water moves around the bay and what buttressing effect, if any, the mud and marl ridges have on the flow of water. Another concern is gaining an understanding of the nature of landscape evolution during late Holocene sea level rise (23 cm, 9 inches rise in sea level in 70 years). Many of the freshwater marshes behind the ridges are changing to super saline marine lagoons.

The features in the bay are strongly related to minute changes in elevation. Environments can change within centimeters of topographic relief. Given the coverage of mapping at the park, normal surficial maps are not sufficient for complex management decisions at the Everglades. An interdisciplinary approach to mapping is critical to producing a useful product for resource management. Anthropogenic, supratidal, intertidal, subtidal, and coastal features would all be helpful. This holistic ecosystem approach integrates biological, physical, cultural, and oceanographic variables.

LIDAR surveys in addition to satellite imagery, multibeam mapping, bathymetry data, water quality and circulation, shoreline change data, pre/post storm comparisons, oceanographic data (waves, tides, currents, turbidity, temperature salinity, sediment transport patterns, coral larvae and other species distributions), etc. are essential for resource management at Everglades National Park. Research and monitoring questions and suggestions include: What is the relationship between coastal marl and carbonate mud ridges and the buttonwood distribution? What is the minimum mapping unit relevant to resource management? What are the flow dynamics (especially related to salinity) in the bay? What controls the distribution of the mud banks? Is there any remediation possible for the hypersaline environment in the central portion of the bay? Why does the basin and bank character of the Florida Bay resemble hexagonal mudcracks?

2. Mangrove zone topography and buttonwood ridge height

The mangroves thrive in oscillating fresh-saline water conditions. In a sense, they define the water level. A baseline needs to be established regarding sea level rise to determine its effect on the mangrove areas. Detailed topography would help manage this resource. The scale of inches is important for the low banks and ridges where the tides and wind expose the entire western basins.

3. Whitewater Bay and Gulf Coast estuaries

Whitewater Bay sits behind Cape Sable and is fed by the Shark, Broad, and Harney Rivers. It is bound by a buttonwood embankment growing as a natural berm on a storm beach made of mud.

Research and monitoring questions and suggestions include: What is the relationship between the diversion of water through canals and the buttonwood distribution? What is the nature of the Shark Slough-Taylor Slough divide?

4. Solution holes

Solution holes are an element of the karst topography at the park. They provide essential habitat for fish and other wildlife during the dry winter months at the Everglades. Solution holes occur throughout the park (especially in the eastern half) and need to be systematically located, mapped, and described for resource management.

Research and monitoring questions and suggestions include: How are solution holes and other karst features affecting water quality at the Everglades? Are solution holes sources of phosphorus input? How do solution holes affect the hydrogeologic regime including retention time, hydraulic head, and water storage?

5. Aquifer characteristics and groundwater flow dynamics

The interaction between groundwater flow and the overall fresh water and marine ecological quality must be quantitatively determined at the Everglades. Visitor uses and surrounding development are increasing the levels of certain substances in the water at the park. Nutrients from waste are causing algal blooms. Salinity levels are dependent on seasonal freshwater input and tidal circulation in the Florida Bay.

Research and monitoring questions and suggestions include: How many wells are necessary to model the hydrogeologic system at the park? Model the porosity and permeability of the Fort Thompson layer. Examine the salt wedge characteristics versus the surface water. Is increasing the hydraulic head at the Everglades a good idea? How would an increase in hydraulic head affect the local spring activity?

6. Recreation and other use demands

In 2003, Everglades National Park hosted 1,031,888 recreation visits. These in are placing increasing demands on the limited resources and fragile ecosystem of the park. Motorized boat access and fishing motors are restricted in the wilderness areas of the park.

Research and monitoring questions and suggestions: Are visitors affecting sediment transport and the hydrologic system at the park?

7. Earthen and failed dams, canals, and sheet piling

Dams and other earth works in the park pose a serious threat to the safety of visitors and park resources. During the 1930's a series of canals and levees were constructed (including East Cape canal, Homestead canal, Slegel's ditch, Houseman's ditch, and Middle Cape canal) to divert the water away from the "prime" real estate around Cape Sable. The real estate venture failed and the land was later included in the park boundaries. The remediation of the canals and earth works is a park responsibility.

Canals throughout south Florida divert water away from the natural flow between Lake Okeechobee and the Everglades. Locally, near Cape Sable and Lake Ingraham, the flow is disrupted and sediment transport patterns have changed. Fresh water marshes behind the cape are being salinated due to the overall lack of fresh water input.

8. Sediment transport and resuspension at Cape Sable and Lake Ingraham

The very nature of the landscape at the Everglades is one of change. Shifting muds and sands continually alter the shape and profile of the shoreline. Sand and mud erode from one beach and are deposited elsewhere in the course of a single storm event. Focus also needs to be on understanding the sediment transport dynamics at the park. The hydrogeologic system in the area around Lake Ingraham was altered with the construction of canals, roads, and levees. As a result, sediments scouring through the canals are being deposited in the lake basin (6-30 cm/year, 2.4-11.8 inches/year) and the lake levels are very low and are often exposed at low tide. The delta emanating from the Middle Cape Canal is expanding and increasing the sediment influx for the Florida Bay. Salinity is increasing as 80 high tides a year are cresting the low marl ridges. Higher salinity waters are encroaching on the fresh water areas. This leads to a decline in marsh, mangrove, and prairie areas.

Research and monitoring questions and suggestions: Are declines in mangrove, marsh, and prairie areas due to the canal system or sea level rise around Lake Ingraham? USGS survey points are too far apart for proper monitoring of landscape response to sea level rise (~400 m, 1,312 ft apart). Can the number of these points be increased? Should fill dams be destroyed or reestablished? What remediation can be done on the eroded canal openings (erosion rate is 0.6-1.2 m/year, 2-4 ft/year)? What is the rate of change in sediment transport around Cape Sable? How much sediment is being lost through canal scouring? What would be the effects of replugging the Middle Cape Canal?

9. Sinkholes and karst features

The Fort Thompson limestone is a very permeable unit. Borrow pits and canals intersect this unit in many locations of the park. This is affecting water flow. Approximately 50 sinkholes have been located in the park. These serve as vital habitat during the dry season. However, their distribution, characteristics, depths, and interconnectedness need to be systematically mapped and described.

Research and monitoring questions and suggestions: What steps should be taken to model water flow in the park regarding karst features? Could aerial photography be used to map

sinkholes? What is the relationship, if any, between solution holes and other karst features and the distribution of hardwood hammacks and tree islands at the park?

10. Paleoclimates

Cores in Florida and Biscayne Bays, and numerous sloughs in the park show peat and pollen as indicators of past climates. The spatial coverage for the cores is not at an adequate resolution to determine the temporal relationships and make interpolations between points. Bioturbation and other ground disturbances (railroad infill effects) distort the subsurface features.

Research and monitoring questions and suggestions: Perform more coring operations to increase coverage at the park. Identify pollen species and correlate with paleoclimate.

11. Sea level rise

Sea level rise is affecting all of South Florida. While slowing the rate of sea level rise is beyond the resources of the park, monitoring sea level change and evaluating/predicting impacts on the park's landscape is a valid management issue. The fresh water marshes and brackish estuaries are under constant threat of inundation by the sea. Given the low relief of the park, this rise will destroy much of the marsh landscape protected at the park. Sea level rise is also causing beach erosion near Cape Sable and Lake Ingraham. Increases in turbidity with rising seas are causing large seagrass dieoffs and increased carbonate material suspension.

Research and monitoring questions and suggestions include: Is there any way to save the subaerial habitat from rising seas? What is the local rate of sea level rise? Looking at the affects of storm surges, how will the buttonwood/mangrove zones respond to the rising water? What direction should future planning proceed in light of the current restoration effort? Monitor and measure the relationship between water level flux and elevations to determine an exposure/submergence index (i.e. 100% of the time exposed versus 0% of the time exposed). Quantitatively define the terms subtidal, intertidal, and supratidal to use for future predictions and relate these to the local elevations and annual regime of water fluctuations.

12. Geologic changes due to storms and hurricanes

Storm events and hurricanes have a pronounced and often catastrophic effect on the landscape of south Florida. Baseline conditions must be determined and studied for the resource management to predict the environmental response. Hurricane Donna in 1960 evacuated water from the bay by about 1 m (3 ft), then the water rushed back in to a depth of 2.1 m (7 ft). This resulted in mud deposition on the south side of the mud ridges and a high-energy shell layer deposit on the north side. Hurricane Andrew blew the highland beach area near the Ross River away. Geochemical changes resulting from the influx of storm water went unmeasured in the panic and cleanup by local agencies.

Research and monitoring questions and suggestions include: Develop a response protocol in cooperation with other local agencies to determine the geochemical effects of storm surges. What are the recovery rates of mangroves after large storm events? Establish baselines for comparison and prediction of future events.

13. Atmospheric deposition of African dust

Dust has been blowing across the Atlantic Ocean and depositing in south Florida for thousands of years. Paleosols and reddish (oxidized) layers atop the Miami Limestone attest to these airborne inputs. The process continues today, but modern development has introduced nutrients, elements, microbes, pesticides, soot, organics, bacteria, viruses, and other contaminants to the dust. The dust diminishes air water visibility. A peak of dust fall in the 1980s coincided with a sea urchin disease and other benthic system killoffs. Lead, arsenic, phosphate, copper, iron, and mercury concentrations in the surface sediments in the middle of Florida Bay are highest in low tidal flux areas.

Research and monitoring questions and suggestions include: There are 9.1 m (30 ft) monitoring wells in the bay; these could be expanded and utilized (contact Gene Shinn). Did the combination of dust and hypersalinity kill sea grass and cause algal blooms in Florida Bay? Monitor dust levels and attempt to correlate with environmental responses. Are dieoffs caused by African dust or by the transport of sediments, nutrients, and organics transported out during rising seas and storms?

14. "Lake Belt" management

The term "Lake Belt" refers to a series of quarries near the park. These features are supposed to supply water to the park as part of a restoration effort. There is some concern about how these features are affecting groundwater movement. Some USGS monitoring wells are located near levees, but more wells would increase the understanding of the local hydrogeologic system. Local agriculture introduces sulphates, phosphorus, and other contaminants into the groundwater near these lakes that, given the permeable, conduit-rich bedrock, would easily contaminate the water in the quarries and affect the ecosystem of the park.

15. Tree islands and hardwood hammacks

Tree islands and hardwood hammacks are prevalent features at the Everglades. They dot the sawgrass prairies throughout the park. They appear to be oriented in linear trends. There is discussion as to whether the islands and hammacks are located in bedrock highs or lows. They could be located in peat depressions, or perhaps on a laminated duracrust formed by phosphorus from evaporites pulled up by the trees in the groundwater.

Rock ridges, such as that at Rock Reef Pass, are subtle, enigmatic linear features on the landscape at the Everglades. There are approximately 20 rock ridges in south Florida. The amount of relief associated with these ridges is small, approximately 0.9 to 1.5 m (3-5 ft), but the vegetation changes across them and makes them appear more pronounced.

Many theories abound as to why these features exist. Are they paleoshores, results of Pleistocene wrench faulting, developed fractures, concentrations of shells in oolite, paleo mudbanks, or the result of differential compaction and fracturing?

Research and monitoring questions and suggestions include: There are numerous theories as to why these features exist. Can hydrogeochemistry determine if the bedrock is a source of phosphorous for these trees? How did the tree islands and hardwood hammacks form? What is the geologic control on their distribution? Are their linear trends related to elongated paleoflows? Obtain more cores in a transect through a rock ridge to help determine why they exist. Core tree islands to bedrock to determine the nature of their formation. Install a monitoring well into the tree islands to look at differences in local groundwater chemistry.

16. Archaeological sites

There are several sites, approximately 12,000 years old, along ancient coastlines that contain artifacts from the local indigenous populations. Mapping and/or reconstructing these sites would add to the cultural value of the park and help reconstruct the paleoshoreline in the 10,000 lakes, and Cape Sable areas especially.

Scoping Meeting Participants

NAME	AFFILIATION	PHONE	EMAIL
Andrea Atkinson	NPS, SFCN	305-224-4245	andrea_atkinson@nps.gov
Sonny Bass	NPS, EVER	305-242-7833	sonny_bass@nps.gov
Sid Covington	NPS, Geologic Resources Division	(303) 969-2154	sid_covington@nps.gov
Kevin Cunningham	USGS		
Robert Ginsburg	University of Miami, RSMAS	305-421-4875	rginsburg@rsmas.miami.edu
Melanie Harris	USGS, CCWS	727-803-8747 x3023	mharris@usgs.gov
Fred Herling	NPS, EVER/DRTO	305-242-7704	fred_herling@nps.gov
Todd Hickey	USGS	727-803-8747 x3040	tdhickey@usgs.gov
Kelly Jackson	University of Miami, RSMAS	305-421-4811 x4	kjackson@rsmas.miami.edu
Bob Johnson	NPS, EVER/DRTO	305-224-4240	robert_johnson@nps.gov
Harley Means	Florida Geological Survey	850-488-9380	guy.means@dep.state.fl.us
Sherry Mitchell-Bruker	NPS, EVER	305-224-4286	sherry_mitchell@nps.gov
Doug Morrison	NPS, EVER/DRTO	305-852-0324 x0327	douglas_morrison@nps.gov
Lisa Norby	NPS, Geologic Resources Division	303-969-2318	lisa_norby@nps.gov
Matt Patterson	NPS, SFCN	305-224-4211	matt_patterson@nps.gov
Anne Poole	NPS, Geologic Resources Division	303-987-6954	anne_poole@nps.gov
Tom Schmidt	NPS, EVER	305-224-4269	tom_schmidt@nps.gov
Eugene Shinn	USGS	727-803-8747 x3030	eshinn@usgs.gov
Dewitt Smith	NPS, EVER	305-242-7818	dewitt_smith@nps.gov
Trista Thornberry-Ehrlich	Colorado State University	757-222-7639	tthorn@cnr.colostate.edu
Brigitte Vlaswinkel	University of Miami, RSMAS	305-421-4918	bvlaswinkel@rsmas.miami.edu
Harold Wanless	University of Miami, Geological Sci.	305-284-4253	hwanless@miami.edu
Britton Wilson	NPS, SFCN		britton_wilson@nps.gov
Linda York	NPS, SERO	404-562-3133 x537	linda_york@nps.gov

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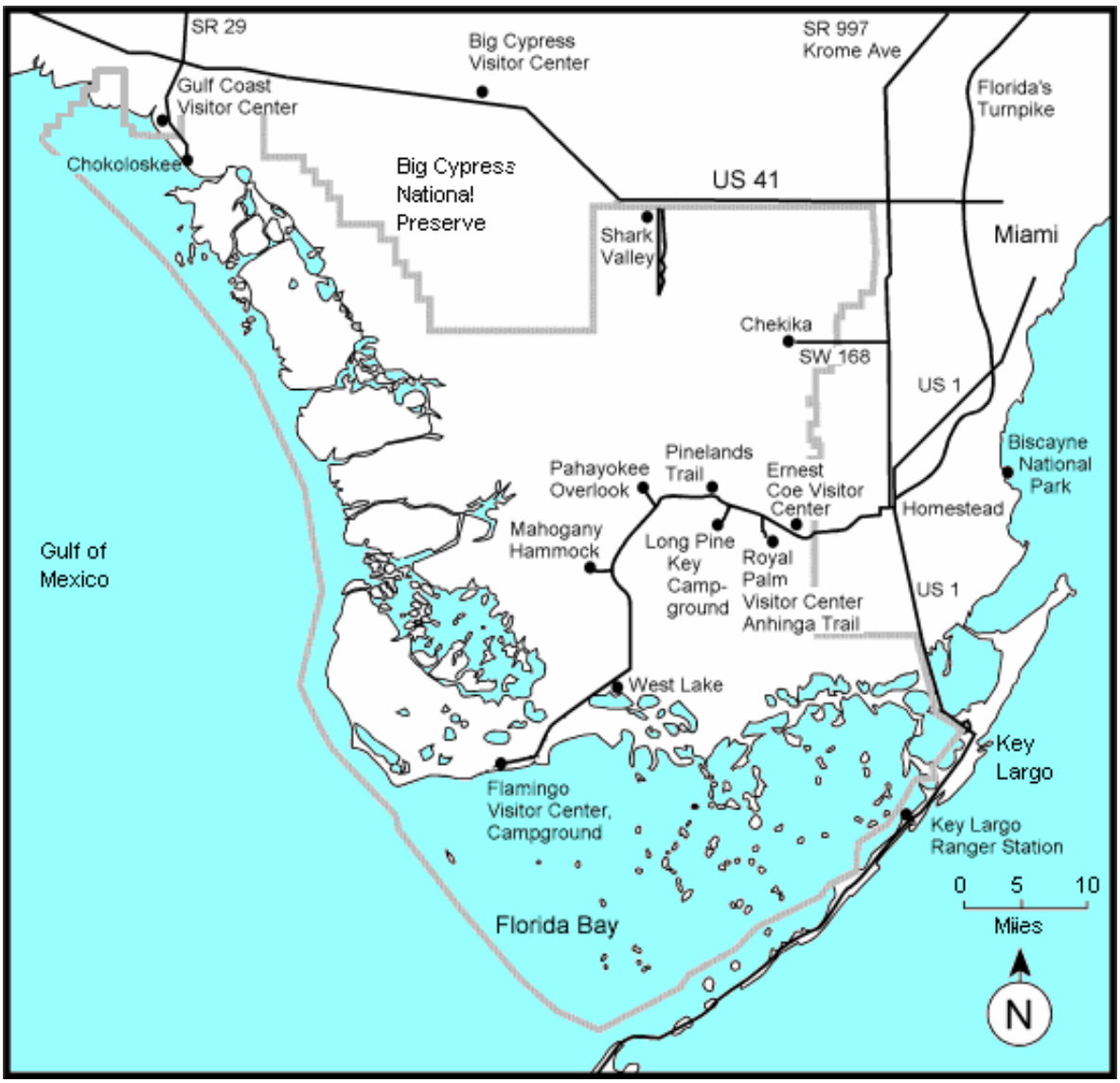
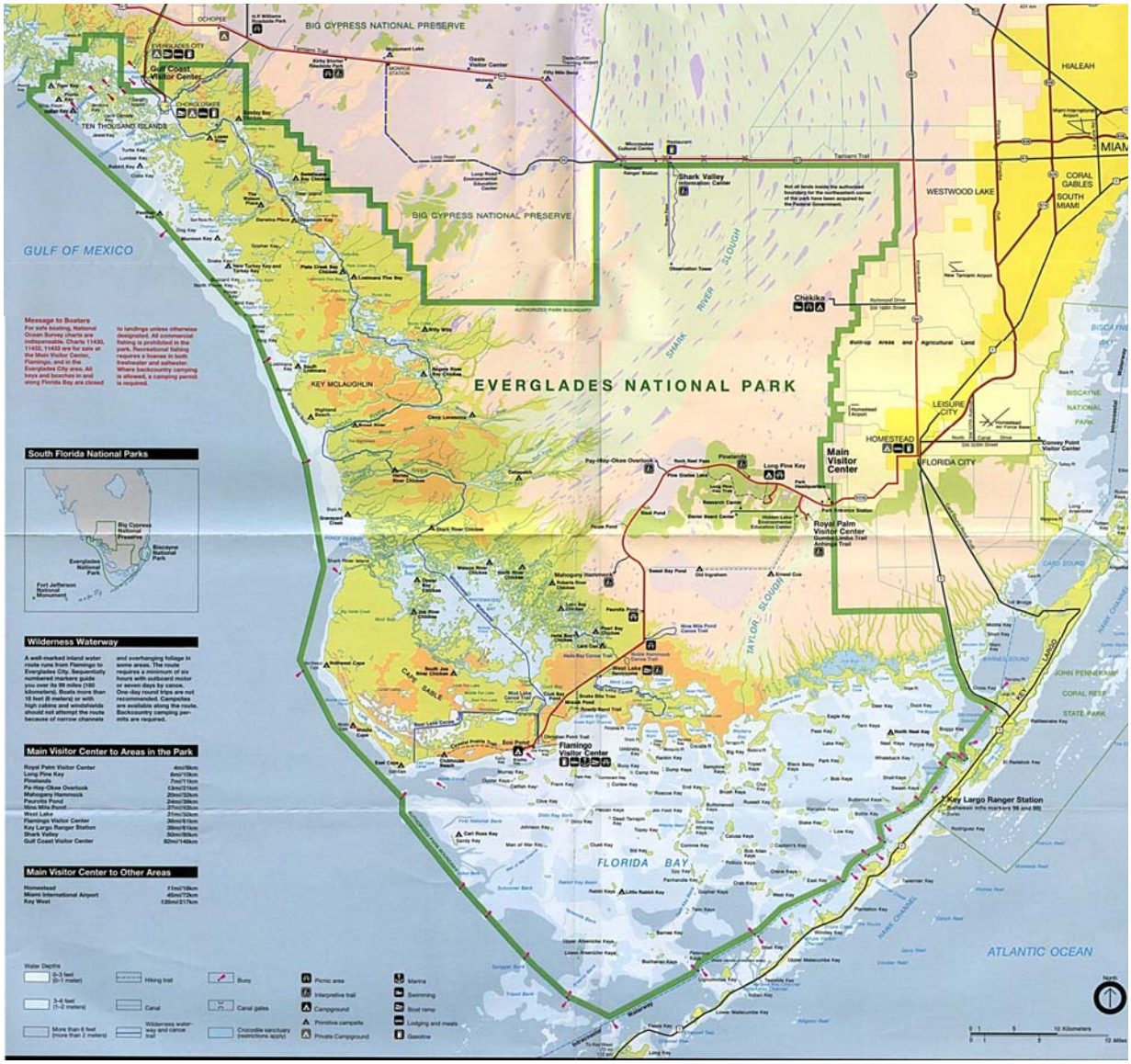
Maps of Everglades National Park




BIG CYPRESS NATIONAL PRESERVE
EVERGLADES NATIONAL PARK
GULF OF MEXICO
ATLANTIC OCEAN
FLORIDA BAY
TEN THOUSAND ISLANDS
KEY MCLAUGHLIN
HOMESTEAD
FLORIDA CITY
LEISURE CITY
WESTWOOD LAKE
HIALEAH
CORAL GABLES
SOUTH MIAMI
Gulf Coast Visitor Center
Shark Valley
Chekika
Main Visitor Center
Royal Palm Visitor Center
Flamingo Visitor Center
Key Largo Ranger Station
Convey Point Visitor Center
SHARK RIVER SLOUGH
TAYLOR SLOUGH
Message to Boaters
South Florida National Parks
Wilderness Waterway
Main Visitor Center to Areas in the Park
Main Visitor Center to Other Areas

APPENDIX D.6

SALT RIVER BAY NATIONAL HISTORIC PARK AND ECOLOGICAL PRESERVE

GEOLOGIC RESOURCE MANAGEMENT ISSUES

SCOPING SUMMARY

Kimberly N. Hall
Geologic Resource Evaluation
September 1, 2005

INTRODUCTION

The National Park Service conducted a Geologic Resources Evaluation scooping meeting at Salt River Bay National Historic Park and Ecological Preserve (SARI) on April 6, 2004. The purpose of the meeting was to discuss the status of geologic mapping in the park, the associated bibliography, and the geologic issues in the park. The products to be derived from the scoping meeting are: (1) Digitized geologic maps covering the park; (2) An updated and verified bibliography; (3) Scoping summary (this report); and (4) A Geologic Resource Evaluation Report which brings together all of these products.

Salt River Bay National Historic Park and Ecological Preserve (SARI) was established by Congress on February 24, 1992 to protect and preserve an astounding array of natural and cultural resources. The park includes fragile coral reefs, a submarine canyon, and the largest remaining mangrove forest found in the Virgin Islands. The National Park Service and the Government of the U.S. Virgin Islands jointly manage this 1,015 acre park and preserve.

Salt River Bay National Historic Park and Ecological Preserve is not identified as an inventory and monitoring park, and therefore, significant time was not spent addressing the geologic inventory and monitoring needs. However, the scoping meeting participants identified the following as the most significant geologic resources management issue at the park:

Complete structure and bedrock maps to compliment existing benthic habitat maps.

SARI MAPPING PRODUCTS

Salt River Bay National Historic Park and Ecological Preserve has "quadrangles of interest" (or "QOI's") at the 7.5'x7.5'- *(1:24,000) scale.* It is desired to obtain DIGITAL geologic map coverage for all identified 7.5' qoi's. (Figures 1,2 and 3).

While numerous "paper" maps at suitable scale have been published for this park, complete DIGITAL geologic map coverage is not known. It is hoped that through the scoping meetings and discussions with park staff , the USGS and state geological surveys that gaps in DIGITAL coverage can be resolved for areas not currently known to have digitized geologic maps. These meetings lay the foundation for a plan to accomplish this task

The contents of this document reflect what is known regarding published geology as of September 6, 2005 from searches done by NPS-GRD staff as discerned from the USGS on-line geologic maps database found at:
http://ngmdb.usgs.gov/ngmdb/ngm_compsearch.html

In short, it appears a few maps do give coverage for the island of Saint Croix as follows:

- NOAA Benthic Habitats map

- Whetten, J.T., 1966, Geology of St. Croix, U.S. Virgin Islands, Geological Society of America, Memoir 98, 1:31,680 scale

During the scoping sessions held in April 2004 for Buck Island Reef National Monument (BUIS), SARI and Christiansted National Historic Site (CHRI), it was decided that the Whetten map would be the best available source to give the bedrock geology of the island of Saint Croix, as it would also encompass all three NPS areas on the island of St. Croix (Figures 1 and 2) . NPS-GRE staff will acquire the original map and convert it into a digital, user-friendly GIS product.

The NOAA benthic habitat maps will accompany the bedrock map of the island and is already available digitally. NPS-GRE staff will incorporate it as well into a final geologic map of the island. A summary table follows along with explanatory graphics.

Extent of Coverage	Published Map Citation	Paper	Digital	GRE Plan
Entire island of Saint Croix	Whetten, J.T., 1966, Geology of St. Croix, U.S. Virgin Islands, Geological Society of America, Memoir 98, 1:31680 scale	yes	Unknown	Acquire paper copy and convert to digtal
Entire island of Saint Croix	Kendall, M.S., M.E. Monaco, K.R. Buja, J.D. Christensen, C.R. Kruer, and M. Finkbeiner, R.A. Warner, 1999, Benthic Habitat Maps of the U.S. Virgin Islands-St. Croix; Prepared by Visual Interpretation from Remote Sensing Imagery Collected by NOAA in 1999, 1:6000 scale	Unknown	Yes, from NOAA	Convert NOAA digital version to NPS format

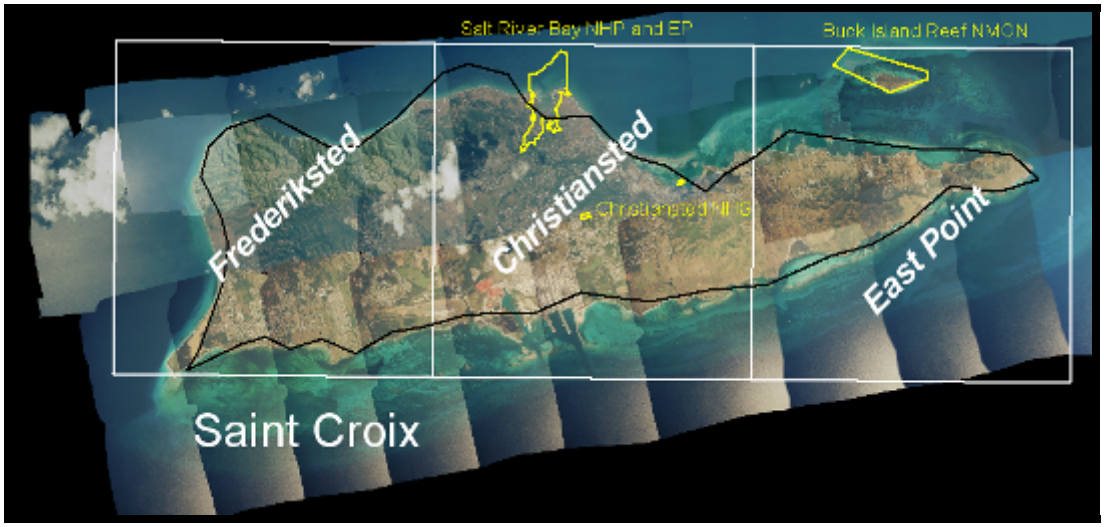


Figure 1: Quadrangles of Interest (QOI's) for BUIS, SARI, and CHRI (7.5' shown in white outline; park boundaries in yellow outline; MrSID image of Island of Saint Croix as background).

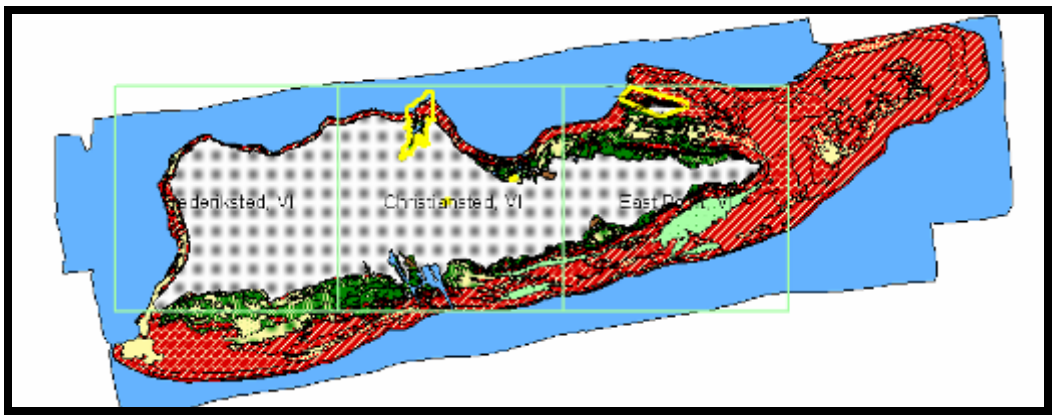


Figure 2: NOAA Benthic Habitats of Saint Croix Island

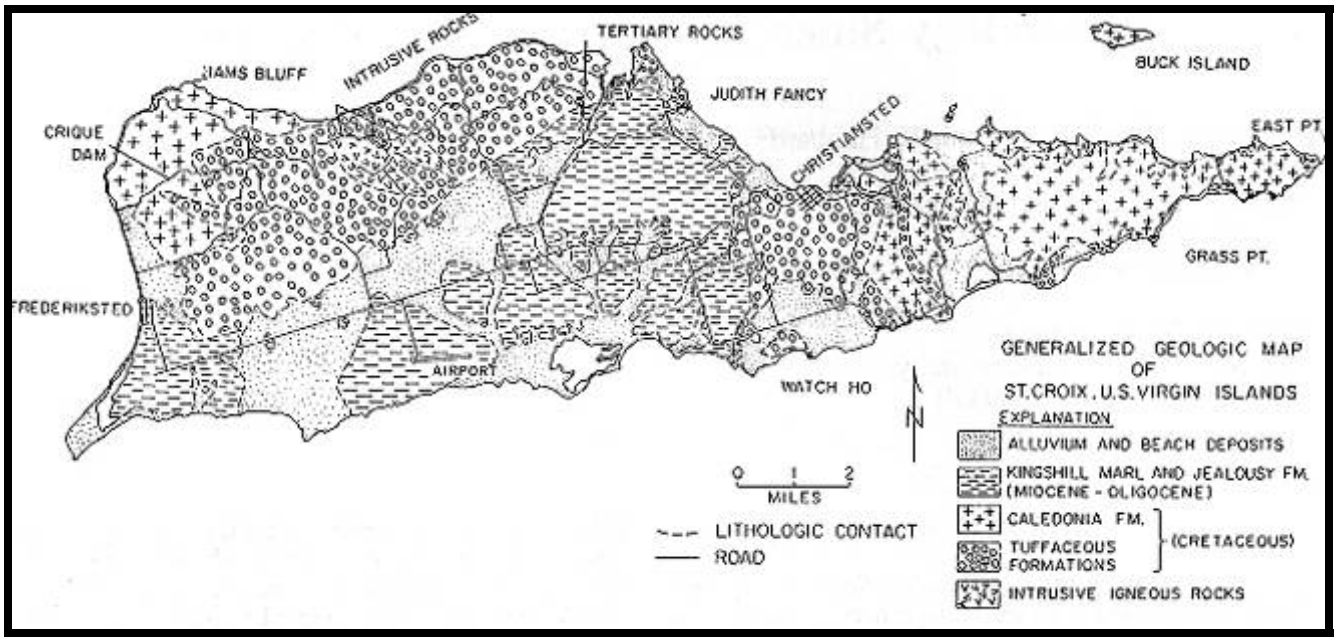


Figure 3: Scan of Generalized Geologic Map of Saint Croix (after Whetten 1974, in Hubbard SP8)

GEOLOGY AND STRATIGRAPHY OF SARI

Salt River Bay consists primarily of two geologic units - the Miocene Kingshill Formation and the Cretaceous Judith's Fancy Formation (Justus et al, 1975: Gill et al, 2002a: Gill et al, 2002b: Kendall et al, 2005). The Kingshill Formation is predominantly composed of limestone. This unit underlies much of the Salt River drainage basin and the area south of the park. The northern portion of the basin and the exposed bedrock around Salt River Bay are composed of the Judith's Fancy Formation. This unit consists of volcaniclastics, sandstone, mudstones, and a few small gabbro and diorite intrusions (Kendall et al, 2005).

The Salt River Bay National Historic Park and Ecological Preserve encompasses an estuary and a submarine canyon that are separated by a narrow coral reef. The estuary is divided into three embayments including Sugar, Triton and Salt River Bays. Sediment cores taken within the park demonstrate a fining-upward in estuarine deposition, most likely reflecting the gradual enclosure of the estuary due to reef accretion, and the corresponding decrease in open marine conditions (Hubbard, 1989).

The accretionary reef at Salt River Bay has effectively created a depositional barrier between the estuary and submarine canyon. Sediments within the upper estuary are terrigenous, containing mollusk and *Halimeda* fragments. Seaward of the reef, sediments rapidly coarsen and reef components become increasingly important. Sediments within the canyon are almost exclusively carbonate in composition due to bioerosion. The canyon floor is composed primarily of medium- to coarse- grained carbonate sands (0.27 – 0.99 mm), becoming increasingly finer down canyon (Kendall et al, 2005).

Salt River Canyon is believed to be related to a previous lowstand of sea level. The Salt River Canyon extends to a depth of 80-100 meters at its seaward edge. Due to sedimentary deposition and reef accretion, the canyon is in a constant state of transition and is most likely different from its original topography.

Currents within Salt River Canyon rarely exceed 10-15 cm/sec. However, currents greater than 50 cm/sec were observed down canyon during storm events (Hubbard, 1989). In addition, suspended sediment loads within the canyon are normally high, and increase dramatically during storm events. It is estimated that 66,000 kg of sediment enter the canyon annually, with approximately one third of the total introduced during storm events. In contrast, only ~18,000 kg of sediment are removed from the system each year, creating a gradual net increase within the canyon. The long term build up of sediments is periodically purged during storm events and hurricanes (Hubbard 1989; Kendall et al, 2005).

In general sediments move from east to west on the shelf adjacent to the submarine canyon. This movement creates highly different characteristics on the east and west canyon walls. The eastern wall is characterized by a gradual slope, covered in cobbles and sparse corals. Organisms that can tolerate high sediment influx and scouring such as gorgonians and sponges are dominant. In contrast, the western canyon wall is steep with

many overhangs and caves. Numerous grooves and tributaries cut into the canyon wall, and abundant fracturing and slumping are evident. Primary organisms found on the western wall include antipatharians, scleractineans corals and plexaurids. The most common corals include *Mantastrea annularis*, *Siderastrea* sp. and *Agaricia* sp. (Hubbard 1989).

SIGNIFICANT MANAGEMENT ISSUES

Salt River Bay National Historic Park and Ecological Preserve is not identified as an inventory and monitoring park, and therefore, significant time was not spent addressing the geologic inventory and monitoring needs. However, it was discussed that if possible, structure and bedrock mapping should be completed to compliment existing benthic habitat maps. Once complete, the geologic framework may help park managers to understand modern coastal dynamics and morphology by defining which areas are predisposed for more rapid change and/or evolution. Surface and subsurface lithology should be included.

INTRODUCTION

The National Park Service conducted a Geologic Resources Evaluation scooping meeting at Salt River Bay National Historic Park and Ecological Preserve on April 6, 2004. The purpose of the meeting was to discuss the status of geologic mapping in the park, the associated bibliography, and the geologic issues in the park. The products to be derived from the scoping meeting are: (1) Digitized geologic maps covering the park; (2) An updated and verified bibliography; (3) Scoping summary (this report); and (4) A Geologic Resource Evaluation Report which brings together all of these products (to be delivered in the future).

Salt River Bay National Historic Park and Ecological Preserve (SARI) was established by Congress on February 24, 1992 to protect and preserve an astounding array of natural and cultural resources. The park includes fragile coral reefs, a submarine canyon, and the largest remaining mangrove forest found in the Virgin Islands. The National Park Service and the Government of the U.S. Virgin Islands jointly manage this 1,015 acre park and preserve.

Salt River Bay National Historic Park and Ecological Preserve is not identified as an inventory and monitoring park, and therefore, significant time was not spent addressing the geologic inventory and monitoring needs. However, the scoping meeting participants identified the following as the most significant geologic resources management issue at the park:

1. Complete structure and bedrock maps to compliment existing benthic habitat maps.

SARI MAPPING PRODUCTS

Salt River Bay National Historic Park and Ecological Preserve has "quadrangles of interest" (or "QOI's") at the 7.5'x7.5'- *(1:24,000) scale.* It is desired to obtain DIGITAL geologic map coverage for all identified 7.5' qoi's.

While numerous "paper" maps at suitable scale have been published for this park, complete DIGITAL geologic map coverage is not known. It is hoped that through the scoping meetings and discussions with park staff , USGS and state geological surveys that gaps in DIGITAL coverage can be resolved for areas not currently known to have digitized geologic maps. These meetings lay the foundation for a plan to accomplish this task

The contents of this document reflect what is known regarding published geology as of September 6, 2005 from searches done by NPS-GRD staff as discerned from the USGS on-line geologic maps database found at
http://ngmdb.usgs.gov/ngmdb/ngm_compsearch.html

All comments and suggestions to improve this understanding are most welcome at this time and will be summarized in a summary report following from this meeting.
In short, it appears a few maps do give coverage for the island of Saint Croix as follows:

- NOAA Benthic Habitats map

- Whetten, J.T., 1966, Geology of St. Croix, U.S. Virgin Islands, Geological Society of America, Memoir 98, 1:31,680 scale

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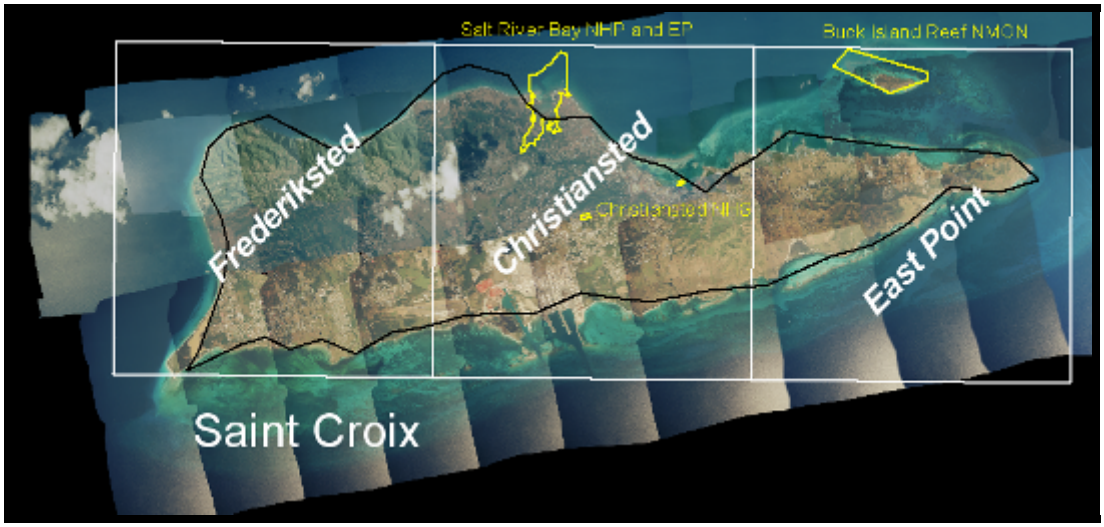
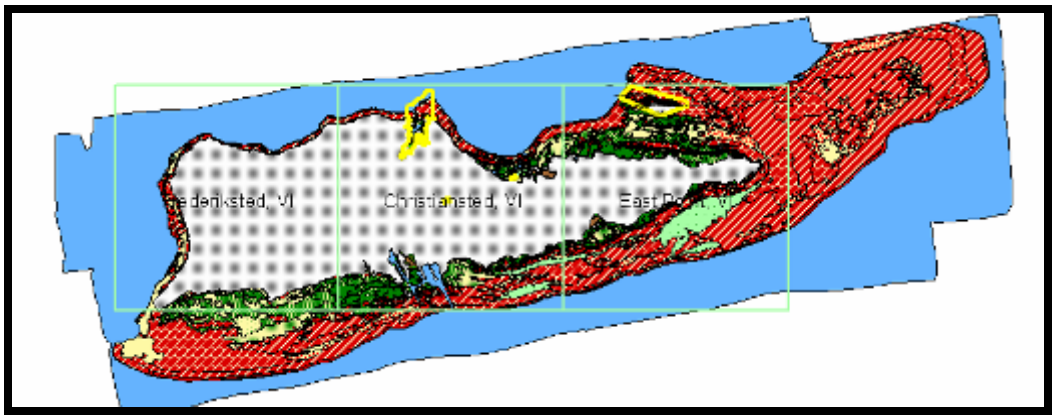
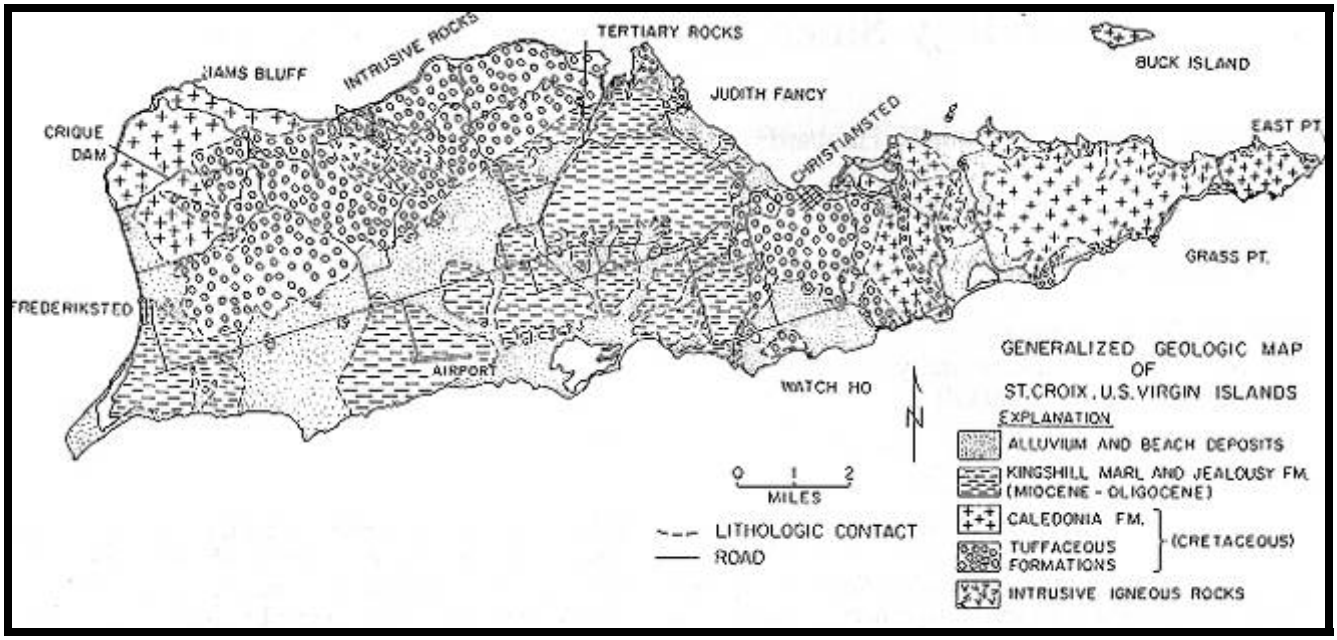


Quadrangles of Interest (QOI's) for BUIS, SARI, and CHRI (7.5' shown in white outline; park boundaries in yellow outline; MrSID image of Island of Saint Croix as background).



NOAA Benthic Habitats of Saint Croix Island



Scan of Generalized Geologic Map of Saint Croix (after Whetten 1974, in Hubbard SP8)

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The most common corals include *Mantastrea annularis*, *Siderastrea* sp. and *Agaricia* sp. (Hubbard 1989).

SIGNIFICANT MANAGEMENT ISSUES

Salt River Bay National Historic Park and Ecological Preserve was not identified as an inventory and monitoring park at the time of the April 6, 2004 meeting, and therefore, significant time was not spent addressing the geologic inventory and monitoring needs. However, it was discussed that if possible, structure and bedrock mapping should be completed to compliment existing benthic habitat maps. Once complete, the geologic framework may help park managers to understand modern coastal dynamics and morphology by defining which areas are predisposed for more rapid change and/or evolution. Surface and subsurface lithology should be included.

SCOPING MEETING PARTICIPANTS

Rebecca Beavers
Coastal Geologist
Geologic Resources Division
303-987-6945
Rebecca_beavers@nps.gov

Tim Connors
Geologist
Geologic Resource Division
303-969-2093
Tim_Connors@nps.gov

Melanie Harris
Geographer
U.S. Geologic Survey
727-803-8747
mharris@usgs.gov

Bruce Heise
Geologist
Geologic Resource Division
303-969-2017
Bruce_Heise@nps.gov

Mark Monaco
Biologist
National Oceanographic and Atmospheric Administration
301-713-3028 x160
Mark.Monaco@noaa.gov

Matt Patterson
South Florida/Caribbean Network,
Inventory and Monitoring Coordinator
305-230-1144
matt_patterson@nps.gov

Zandy Hillis-Starr
Chief of Resource Management
NPS, Buck Island Reef National Monument
340-773-1460 x235
Zandy_Hillis-Starr@nps.gov

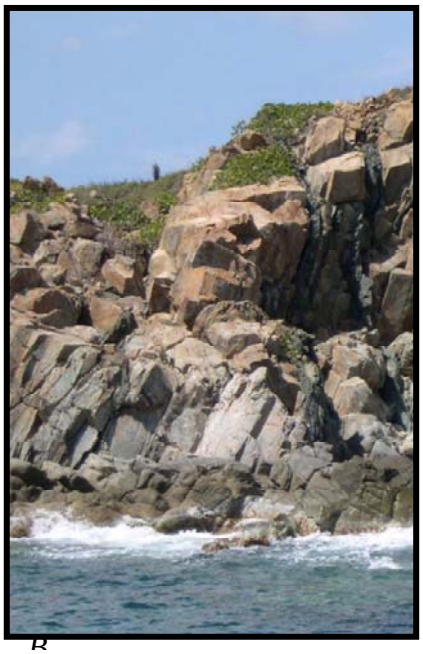
Kimberly Woody
Biologist
NPS, Buck Island Reef National Monument

APPENDIX D.7

VIRGIN ISLANDS NATIONAL PARK
and
CORAL REEF NATIONAL MONUMENT

GEOLOGIC RESOURCE MANAGEMENT ISSUES

SCOPING SUMMARY



Kimberly N. Hall
Geologic Resource Evaluation
September 1, 2005

Columnar Jointing on LeDuck Island, USVI. The south shore of St. John is visible

in the background.

Hydrothermal alteration in the Water Island Formation, south and central St. John, USVI. The White Cliffs display mineral alteration including copper (green), iron (red), and limonite (yellow). Much of the white coloration is due to the large amount of plagioclase feldspar within the igneous rocks.

Title page:

A) Coastal Erosion at Cinnamon Bay. This Seaside Maho was once located in the protected backshore area of the beach. This tree (one of many) died due to continued seawater inundation and coastal erosion. Currently, many important archaeological sites at Cinnamon Bay are threatened due to beach erosion.

Photo: Jack Hopkins

B) Swarming dikes on Ditliff Point, south shore, St. John.

C) Marble Taino trading bead found on Cinnamon Bay, St. John. Scientists question if this bead was created on St. John or imported from an alternate source. This problem demonstrates a clear link between archaeology and geology.

EXECUTIVE SUMMARY

A Geologic Resources Evaluation scoping meeting for Virgin Islands National Park (VIIS)and Virgin Islands Coral Reef National Monument (CRNM) was held at Park headquarters in Cruz Bay, VI on April 7-9, 2004. The scoping meeting participants identified the following as the most significant geologic resource management issues.

1. Minimize the effects of erosion and sedimentation into adjacent marine ecosystems due to land use and grazing.

2. Inventory and monitor coastal resources and processes including beach erosion and accretion due to storm events and recreational demands.

3. Inventory and monitor marine processes and resources such as sediment transport, sediment thickness, coral reef location, and human impacts on benthic habitats.

4. Monitor the possible effects of windblown particulates (i.e. Saharan dust, Monserrat dust) on park resources.

INTRODUCTION

The National Park Service conducted a Geologic Resources Evaluation scooping meeting at Virgin Islands National Park, St. John, USVI, April 7-9, 2004. The purpose of the meeting was to discuss the status of geologic mapping in the park, the associated bibliography, and the geologic issues in the park. The products to be derived from the scoping meeting are: (1) Digitized geologic maps covering the park; (2) An updated and verified bibliography; (3) Scoping summary (this report); and (4) A Geologic Resource Evaluation Report which brings together all of these products.

Virgin Islands National Park (VIIS) was established August 2, 1956, and was declared a Biosphere Reserve by the United Nations in 1976. The park includes slightly more than half of the island of St. John and approximately nine square miles of the surrounding waters. In addition, Virgin Islands National Park includes land in Red Hook, St. Thomas (6 acres), Wintberg Estate, St. Thomas (4 acres), and Hassel Island (135 acres). The total area of VIIS is currently 14,689 acres (FY-2004).

Virgins Islands Coral Reef National Monument (CRNM) was established by President Clinton on January 17, 2001, to protect and preserve the delicate coral resources contained within. This monument contains 12,708 acres of submerged lands adjacent to St. John including Hurricane Hole.

VIIS MAPPING PRODUCTS

Virgin Islands National Park has "quadrangles of interest" (or "QOI's") at the 7.5'x7.5'- *(1:24,000) scale.* It is desired to obtain DIGITAL geologic map coverage for all identified 7.5' qoi's.(Figures 1,2 and 3)

The contents of this document reflect what is known regarding published geology as of September 6, 2005 from searches done by NPS-GRD staff as discerned from the USGS on-line geologic maps database found at *http://ngmdb.usgs.gov/ngmdb/ngm_compsearch.html*

Virgin Islands National Park is covered by the following maps:

- *Rankin, D.W., 2002, Geology of St. John, U.S. Virgin Islands, US Geological Survey, Professional Paper 1631, 1:24000 scale*
- NOAA Benthic Habitats map

During the scoping sessions held in April 2004, for VIIS, it was decided that the Rankin map would be the best available source to give the bedrock geology of the island of Saint John. NPS-GRE staff acquired the original paper map and converted it into a digital user-friendly GIS product that is available on-line at http://science.nature.nps.gov/nrdata/

The NOAA benthic habitat maps will accompany the bedrock map of the island and is already available digitally. NPS-GRE staff will incorporate it as well into a final geologic map of the island. A summary table follows along with explanatory graphics.

Extent of Coverage	Published Map Citation	Paper	Digital	GRE Plan
Entire island of Saint John	Rankin, D.W., 2002, Geology of St. John, U.S. Virgin Islands, US Geological Survey, Professional Paper 1631, 1:24000 scale	yes	Yes	GRE already have digitized this map
Entire islands of Saint John and Saint Thomas	Kendall, M.S., M.E. Monaco, K.R. Buja, J.D. Christensen, C.R. Kruer, and M. Finkbeiner, R.A. Warner, 1999, Benthic Habitat and Zone Maps of St. Thomas and St. John, U.S. Virgin Islands; Prepared by Visual Interpretation from Remote Sensing Imagery Collected by NOAA in 1999, , , 1:6000 scale	Unknown	Yes, from NOAA	Convert NOAA digital version to NPS format

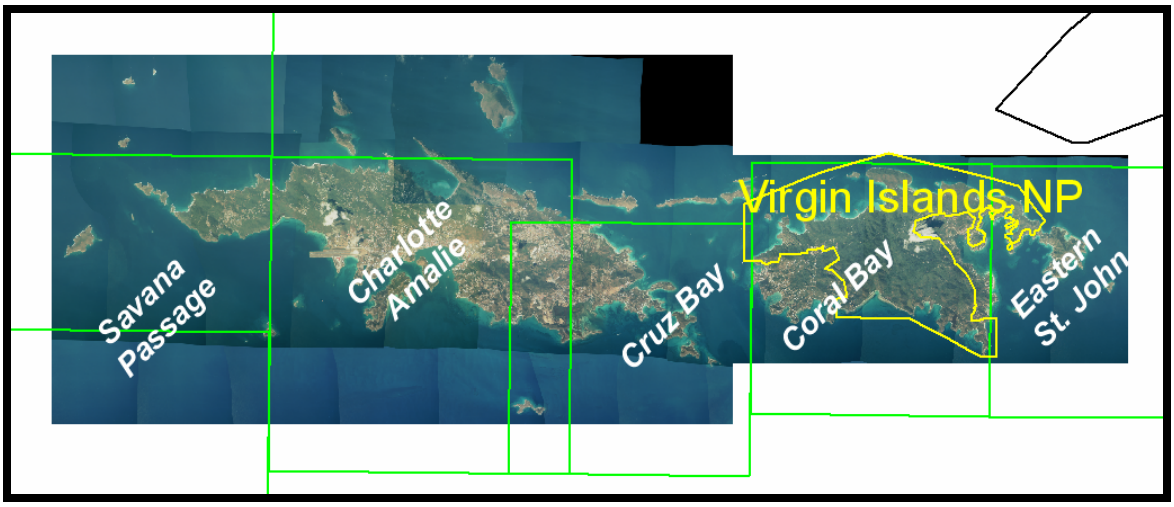


Figure 1:Quadrangles of Interest (QOI's) for VIIS (7.5' shown in light green outline; park boundaries in yellow outline; MrSID image of Islands of Saint John and Saint Thomas as background)

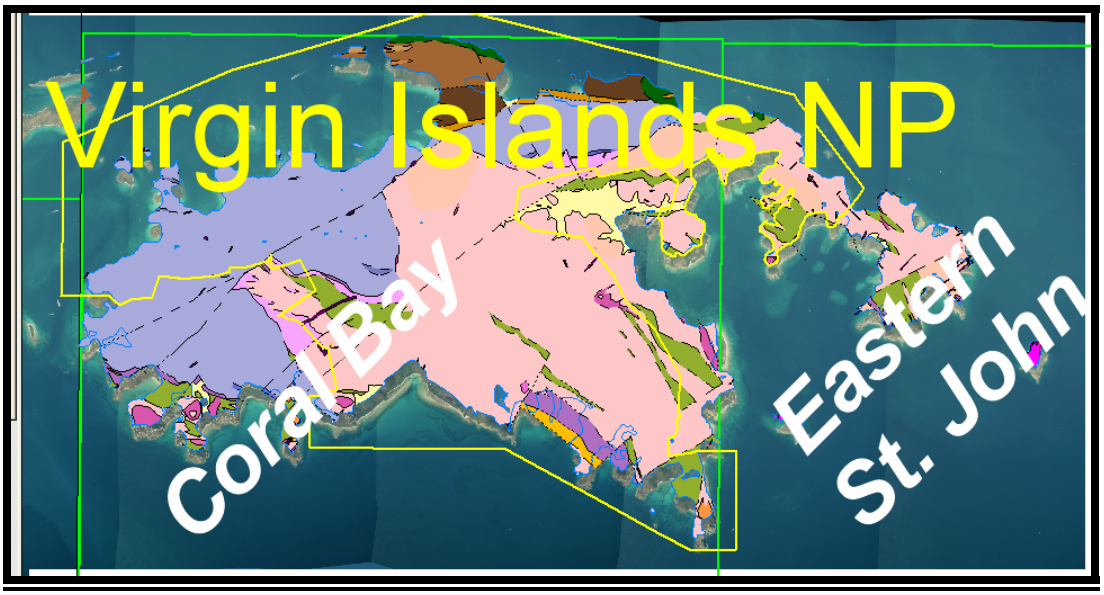


Figure 2:Extent of Rankin, D.W., 2002, Geology of St. John, U.S. Virgin Islands, US Geological Survey, Professional Paper 1631, 1:24000 scale

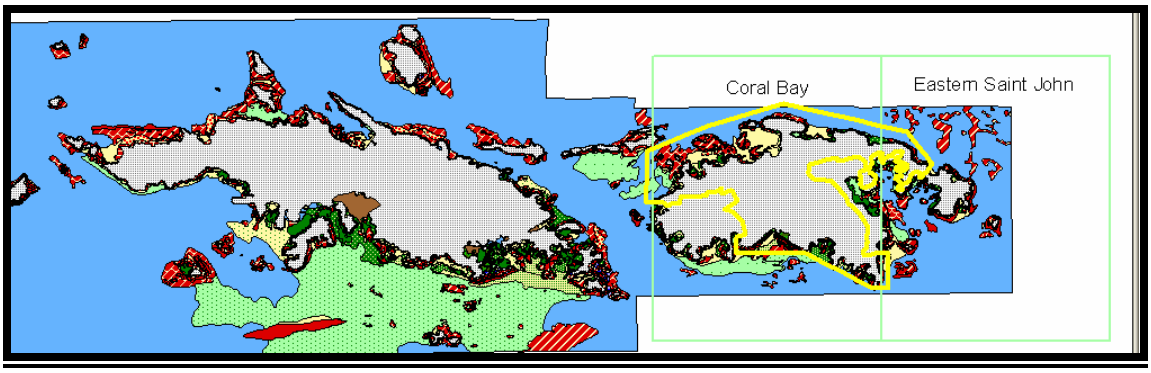


Figure 3: NOAA Benthic Habitats of St John and St Thomas.

GEOLOGY AND STRATIGRAPHY OF ST. JOHN, USVI

The geologic history of St. John began in the Early Cretaceous (~100 my) with the shallow water deposition of the *Water Island Formation*. This unit is composed predominantly of extrusive keratophyres (fine-grained igneous rocks with high Si and K content), basalts, and minor cherts that formed in an extensional oceanic environment (Rankin, 2002). This formation was produced from the same volcanism that formed the Greater Antilles. The Water Island Formation is the oldest unit found on St. John, with exceptional exposures on the south side of the island. The unit is estimated to be at least two kilometers thick (Rankin, 2002), and although the base is not visible, it is presumed to be underlain by oceanic crust (Donnelly, 1989).

Geologic features commonly found within the Water Island Formation include pillow basalts, volcanic wackes and tuffs, amygdaloidal basalts, and nodular keratophyres (high sodium rocks). Internal stratigraphic order has not been observed, although the "attitude of these contacts, along with bedding in the volcanic wacke, flow layering in keratophyres (used cautiously), and "bedding" in pillowed basalt aid in defining the map pattern and overall structure" of the formation (Rankin, 2002). Due to mixed masses of keratophyres and basalts, it is possible that two lava types were extruded concurrently (Rankin, 2002).

Intrusive rocks of the Careen Hill Intrusive Suite are commonly found within the Water Island Formation. The igneous intrusions are primarily the intrusive equivalents of the Water Island Formation. Small dikes and plutons composed of intrusive keratophyres and fine-grained gabbros are found interspersed throughout the Water Island formation. Spectacular features found within the Careen Hill Intrusive Suite include columnar jointing and sheeted dikes. The columnar jointing found on Leduck island is composed of a light colored granite called a trondhjemite. The Water Island Formation and the Careen Hill Intrusive Suite combine to form the Lameshur Volcanic-Intrusive Complex (Rankin, 2002).

The Lameshur Volcanic-Intrusive Complex is overlain by more than 1.5 km of blue andesite ash beds and pyroclastic breccias called the Louisenhoj Formation. This unit was deposited in the Late Cretaceous when explosive subduction-related volcanism occurred in shallow marine waters associated with a developing island arc environment. Graded bedding is evident throughout the formation due to the deposition of volcanic material by submarine slides and slumps. A variety of clast sizes suggest that numerous volcanic vents are located nearby. Geologic features found throughout the Louisenhoj Formation include volcanic conglomerates and wackes, andesite tuff breccias, and bedded, boulder volcanic conglomerates. The Louisenhoj Formation covers the Western half of Saint John, including Cruz Bay and Rendezvous Bay. It is commonly referred to as "Blue Bitch" rock by Saint Johnians.

Following the deposition of the Louisenhoj Formation, St. John experienced a period of reduced volcanism and gradual sea floor subsidence. At that time (L. Cretaceous), approximately 100 m of thinly bedded limestone, referred to as the Outer Brass Limestone, was deposited in a quiet marine environment. It is thought that deposition occurred on moderate slopes a few hundred feet in depth. This formation contains high concentrations of silica tests and thin, interbedded tuffs. Due to contact metamorphism from Tertiary plutons, deposits of white and blue-gray

calcitic marble containing plagioclase, epidote, garnets, diopside, vesuviatnite, and wollastonite are found throughout the formation (Rankin, 2002). This unit forms a discontinuous belt extending from Maho Bay to Brown Bay, with excellent exposures at Mary's Creek on the north shore of the island. It is possible this marble was utilized by native Taino peoples for trading beads and jewelry.

Although the Outer Brass Limestone is a thin, minor unit on St. John, it is a useful tool for separating the conglomeratic Louisenhoj Formation from the lesser conglomeratic Tutu Formation (Rankin, 2002). The Tutu Formation formed by island arc volcanism which resumed in the Late Cretaceous. Most of the material seems to have been deposited by turbidity currents, suggesting deposition on an "unstable slope such as a trench wall leading into an accretionary wedge" (Rankin, 2002).

The Tutu Formation extends from Maho Bay to Leinster Point. This formation is characterized by volcanic wackes, shales, conglomerates, calcareous siltstones, limestones, and rare basalts and andesites (or their metamorphic equivalents) (Rankin, 2002). Volcaniclastic fragments found within the Tutu Formation are generally sand and silt size suggesting the volcanic source was further away than the Louisenhoj vents (Rankin, 2002). Additionally, a distinct fining-upward implies increasingly distant volcanic sources. The extrusive igneous rocks of the Tutu Formation are the last evidence of volcanism on St. John.

The Tertiary Period was marked by intense plutonic activity that produced folding and faulting across the island. Following the intrusion of diabase dikes, north-south compression was created by the collision of the Caribbean plate and the North American plate. The intensity of deformation increases northward on St. John.

The last period of tectonic activity on the island occurred after the late Eocene (post 39 my). At that time a series of strike slip faults occurred due to the spreading of the Cayman Trough. No recent tectonic activity has been recorded.

SIGNIFICANT MANAGEMENT ISSUES

The scoping participants identified the following as the most significant geologic issues at Virgin Islands National Park:

1. Slope stability and erosion

St. John is characterized by rugged terrain with steep, rocky slopes. More than 80% of the island is covered with hillsides in excess of 30% (CH2M Hill, 1979). Slope failure is common during storm events and may have devastating effects on terrestrial, coastal, and marine habitats. Recently, numerous nesting sites of the endangered brown pelican were decimated due to slope instability caused by Tropical Storm Frances (2002). In addition, roads are often impassable during storm events due to rock and mudslides, creating serious hazards to park visitors.

Grazing is another cause of slope failure within the park. Feral goats and hogs negatively impact fragile park resources. Heavy grazing on steep hillsides increase erosion into adjacent coastal and marine ecosystems. Even small increases in sedimentation may have devastating effects on fragile environments including coral reefs and seagrass beds.

2. Coastal Features and Processes

Virgin Islands National Park is known for its beautiful beaches and unique coastal ecosystems. Many of the park's management issues concern the protection and preservation of these valuable resources. Unfortunately, many of these resources are at risk due visitor demands, anthropogenic modifications, and/or natural coastal dynamics. Immediate concerns include, but are not limited to, the following:

1. Beach erosion - Cinnamon Bay contains one of the beaches experiencing rapid erosion in Virgin Islands National Park. This popular tourist beach is the site of numerous archaeological sites, some dating to 900 AD. The Archaeology Center, the oldest remaining active structure on St. John, is at great risk for destruction. Riprap was placed along the shoreline in the 1970s to slow beach erosion. However, this has done little to diminish destructive processes. The loss of shoreline vegetation is an additional management concern associated with beach erosion.

2. Coastal development – coastal development on St. John continues to increase at an alarming rate. Construction increases sedimentation rates into adjacent waters. Sedimentation and runoff may damage fragile marine ecosystems including coral reefs and seagrass beds. Water quality monitoring is performed monthly at numerous locations throughout the park to assess damage from coastal development.

3. Anthropogenic modifications – Modifications have been made to some of St. John's shorelines. For example, docks have been constructed at Lameshur Bay, Caneel Bay, and Cruz Bay. Also, as previously mentioned, the Archaeology Center at Cinnamon Bay is protected by riprap. Any shoreline change will affect shoreline dynamics. Changes in sediment transport, including beach erosion and accretion, should be closely monitored where human structures have been erected.

Dredging is an another concern to park managers. Dredging is often performed in Cruz Bay to benefit shipping, transport and recreation. Coastal dredging increases turbidity and sediment loads, thereby damaging marine resources. Dredging may also interfere with sediment transport and flow dynamics in coastal and marine systems. In addition, dredged sediments may include harmful contaminants and pollutants.

4. Salt pond infilling – the salt ponds found within Virgin Islands National Park are in danger of infilling due to increased sediment loading. High sedimentation rates may be caused by a variety of factors including feral animal grazing, storm events, and/or human activities.

3. Marine Features and Processes

4. Sediment characteristics – sediment thickness, type, and grain size should be integrated into park maps. Available information on sediment distribution, budget, and sources and sinks should be available to park managers for a variety of reasons including, but not limited to, buoy placement and maintenance, boat anchoring, and erosion hotspots. An understanding of the system's sediment supply is critical for monitoring coastal areas and predicting shoreline change (Nelson, 2002).

5. Recreation Impacts –More than 800,000 guests visit the park each year. Common forms of recreation include boating and fishing- both of which may have detrimental impacts on park resources. Two of the most serious impacts defined at this meeting are:

    A. Boating – anchoring and vessel groundings have seriously damaged many coral reefs, seagrass beds, and mangrove forests in VIIS and CRNM. Although anchoring is permissible in certain areas, illegal anchoring and anchor dragging (usually due to operator ignorance) has destroyed marine habitat throughout the park. In addition, vessel groundings due to inexperienced boating and storm events have critically damaged large sections of coral reefs.

    B. Surfing – Surfing occurs at many locations in the park including Johnson's Reef, Fish Bay, and Cinnamon Bay. Surfing hazards include dangers to both park visitors and park resources. For example, surfing at Johnson's Reef may damage fragile coral habitat. In addition, park visitors have been gravely injured while body surfing at Cinnamon Bay due to the steep break at the shoreline. However, the beaches must remain open due to the Free Beach act.

6. Oceanographic Variables – Relative sea level rise, temperature and salinity patterns, currents, and tidal regimes should be monitored for Virgin Islands National Park. These variables may aid in identifying sediment transport patterns within the park. In addition, knowledge of currents at headlands and in channels may reduce visitor injuries.

7. Benthic habitat mapping – Virgin Islands National Park is working in cooperation with NOAA to complete benthic habitat mapping for the park. Benthic habitats including coral reefs and submerged aquatic vegetation should be included in coastal mapping products. These features influence the hydrodynamic regimes within their localized areas, thereby determining sedimentation patterns. The location of marine habitats should be known in order to determine the impacts that coastal development and visitor use may have on their health and survival (Nelson, 2002).

4.Windblown Features and Processes

Currently, the park is investigating the effects of Saharan dust on park resources. It is believed that imported particulates could have harmful effects on fragile marine habitats such as coral reefs and seagrass beds, by carrying fungi and dust-borne pathogens. Dust from alternate sources such as the Montserrat eruption of 1995 could also have negative impacts on park resources.

SCOPING MEETING PARTICIPANTS

Rebecca Beavers
Coastal Geologist
Geologic Resources Division
303-987-6945

Rebecca_beavers@nps.gov

Rafe Boulon
Chief of Natural Resources
Virgin Islands National Park
340-693-8950 x224

Rafe_Boulon@nps.gov

Tim Connors
Geologist
Geologic Resource Division
303-969-2093
Tim_Connors@nps.gov

Melanie Harris
Geographer
U.S. Geologic Survey
727-803-8747
mharris@usgs.gov

Bruce Heise
Geologist
Geologic Resource Division
303-969-2017
Bruce_Heise@nps.gov

Christy Loomis
Data Manager
Virgin Islands National Park
340- 693-8950
christy_loomis@nps.gov

Mark Monaco
Biologist
National Oceanographic and Atmospheric Administration
301-713-3028 x160
Mark.Monaco@noaa.gov

Kim Nelson
Geologist
334- 663-5356
rosydog@hotmail.com

Matt Patterson
South Florida/Caribbean Network,
Inventory and Monitoring Coordinator
305-230-1144
matt_patterson@nps.gov

Doug Rankin
Geologist
U.S. Geologic Survey
703-648-6903
dwrankin@usgs.gov

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APPENDIX E

SCOPING SUMMARY
SFCN NETWORK MANAGEMENT ISSUES

South Florida Caribbean Network
2005

APPENDIX E. Scoping Summary

SFCN Network Management Issues

SFCN Issues Identified during January 2001 meeting	BISC	BICY	BUIS	DRTO	EVER	SARI	VIIS	Overall
Fishing, closures, No extraction	High	N/A	1	High	Med	2	10	High
Hunting	Low	6	N/A		Med/Low	18	N/A	Med/Low
Expansion area, resources in these areas	High	3	2		High	3	N/A	High
Why are coral reefs dying/ processes where management actions help?	High	N/A	3	High		7	2	High
Visitor carrying capacity	Med	14	6	Med	Med	10	1	Med
Resource restoration success	High	7	10		High	17	13	Med
Exotic Plant/Animals impacts	High	2	8	High	High/Med	14	3	High
Fire	Low	8	N/A		Med	13	21	Med
Noise – Soundscape/resource and visitor experience	Low	16	N/A		Med	N/A	14	Low
Reintroduction native species	Low	11	9			N/A	15	Low
Socio-economic benefits	Low	17	13			15	16	Low
Bio-prospecting	Low	10	N/A			N/A	N/A	Low
Public Involvement/Education and Outreach	High	9	4			4	8	High/Med
Economic modeling	Low	18	N/A			N/A	19	Low
Regional Development	High	4	14		High	16	5	High/Med
Traditional/Cultural Use	Low	5	15			11	14	Med/Low
Mooring buoys	Med	N/A	5			N/A	11	Med
Vessel management, how are they using the park? Anchoring	Med	N/A	7	Med/High	High	12	7	Med
Electronic charts	Low	N/A	N/A			N/A	18	Low
Commercial activities (dive boats)	Low	N/A	12			9	15	Med/Low
Concession activities	Low	N/A	11			8	4	Med/Low
Diffuse vs. Concentrate (Visitor concentration/controversial)	Med	15	16			4	8	Med/Low
Air quality	Low	13	N/A		High/Med	N/A	20	Low
Water quality	High	1	N/A	Med	High	6	12	High/Med
Overpopulation of native species	Low	N/A	17			N/A	17	Low
Cultural landscapes/natural environment	Low	12	N/A			5	9	Med
Archeological Resource Protection (SARI Write In)						1		
Sedimentation (VIIS Write In)					High		6	
Global Warming (EVER Write In)					High			
Native Species Reintroduction (EVER Write In)					Med			

SFCN Primary Vital Signs Monitoring Needs

	BISC	BICY	BUIS	DRTO	EVER	SARI	VIIS
No-take zone effectiveness				x			
Ecosystem "health" - marine	x		x	x		x	
Ecosystem "health" - terrestrial		x			x		
Exotic Plants/animals			x		x	x	x
Sedimentation							x
Reef Fish Monitoring							x
Coral Reef Monitoring	x						
Seagrass Monitoring	x				x		
Fishing Pressure					x		
ORV Impacts (airboat)					x		
Birds		x			x		
Herps					x		
Vessel Impacts	x				x		
Groundwater					x		
T&E Species			x			x	

SFCN Network Staffing Priorities

Priority	Position Title	BISC	BICY	BUIS	DRTO	EVER	SARI	VIIS
1	Marine Ecologist	x			x	x		
2	Marine Biologist			x			x	
3	Biometrician/Statistician					x		x
4	Database Developer					x		
5	Entomologist					x		
6	Pilot					x		

7	GIS Specialist (Ecologist)	x					
8	Terrestrial Ecologist						x
9	Fish Ecologist/Biologist				x		
10	Ecologist		x				
11	Research Biologist		x				

Current SFCN I&M Staff Office Availability

	BISC	BICY	BUIS	DRTO	EVER	SARI	VIIS
Open office space	Possibly	0	yes,4	0	1	see BUIS	1

SFCN Equipment Needs

BISC	u/w positioning, mapping equipment; vessels; outboards
BICY	real time telemetry of hydrologic (and other) information
BUIS	SCUBA equipment, F(x)ing herbarium, Updated Science Library with pubs.
DRTO	H2O quality monitoring for human pathogens
EVER	Kevlar Flight helmets, ArcPad GIS/GPS hand held units
SARI	Small inflatable w/ trailer
VIIS	Remote camera fish censusing station for deep water sites; movement trip sensors for wildlife, radio-telemetry applicable for dense/steep environments; large format plotter

SFCN Technical Needs

BISC	GIS, STATS
BICY	Updated competency on software (GIS)
BUIS	Stats (multivariate), Advanced GIS, Access, VBA, Visual Fox Pro
DRTO	GIS
EVER	GIS, ARCGis, ARCPad, General wildlife/fisheries management, instrumentation, ACETA (animal capture, restraint, immobilization, transportation training)
SARI	Stats (multivariate), Advanced GIS, Access, VBA, Visual Fox Pro
VIIS	Intermediate to advanced arcview training, biostatistics workshop, wildlife handling, restraint, and immobilization techniques

SFCN Training Needs

BISC	GIS, stats, NPS I&M program, SFC network
BICY	Anabat or other monitoring equipment
BUIS	Stats (multivariate), Advanced GIS, Access, VBA, Visual Fox Pro
DRTO	Network activities, roles, and f(x); newsletter
EVER	Presentation to explain what we are doing
SARI	Stats (multivariate), Advanced GIS, Access, VBA, Visual Fox Pro
VIIS	MS Access

	SFCN Opinion on Volunteer monitoring
BISC	consistency?; better used for other tasks
BICY	Would support volunteer monitoring
BUIS	good outreach/education - limited data value
DRTO	with sufficient training and supervision
EVER	useful w/ training and supervision
SARI	good outreach/education - limited data value
VIIS	birds, sea turtles OK, fish not OK

APPENDIX F

Ongoing Natural Resource Monitoring

F.1 Big Cypress National Preserve
F.2 Biscayne National Park
F.3 Buck Island Reef National Monument
F.4 Dry Tortugas National Park
F.5 Everglades National Park
F.6 Salt River National Historic Park and Ecological Preserve
F.7 Virgin Islands National Park and Coral Reef National Monument.

APPENDIX F.1

BIG CYPRESS NATIONAL PRESERVE

ONGOING NATURAL RESOURCE MONITORING

South Florida Caribbean Network
2005

Appendix F.1 Big Cypress National Preserve Ongoing Natural Resource Monitoring

Activity	Objective	Organization	Frequency	Year initiated	Primary Parameters	Methods/Scope
Invasive plants systematic reconnaissance flights	To track the distribution and location of exotic plants and create a map to tell contractors where to initiate control actions	NPS-EPMT; SFWMD funds	every 2 years	1989	points where invasive species identified	Collected via air by covering park in 1 km lines
Invasive treatment database	To track where exotics treatment/control efforts have been initiated	NPS	?	1984	?	
Florida Panther Monitoring	To track the locations, home ranges, and mortality of all adult lions in BICY	NPS-BICY	check locations every other day	?	locations of cats at each point in time	Radio collar tracking with signal location every 2 days; new adult cats collared as soon as possible
Red cockaded woodpecker monitoring	To track number, location, and size of RCW colonies (clusters)	NPS-BICY	Annual	?	?	Bird banding
Woodstork nesting success	?	NPS-BICY	Annual	?	?	
Deer surveys	?	NPS-BICY	Annual	?	?	
Hog harvest data	?	FL Fish & Wildlife Conservation Commission	Annual	?	?	Check stations operated during peak hunting season
Deer harvest	?	FL Fish & Wildlife Conservation Commission	Annual	?	?	Check stations operated during peak hunting season
Turkey harvest ???	?	FL Fish & Wildlife Conservation Commission	Annual	?	?	Check stations operated during peak hunting season
Park visitation	To provide relative estimates of park visitor use	NPS-BICY	Continuous	?	# cars passing point	traffic counter at Visitor Center (HWY 41) and Loop Road

Appendix F.1 Big Cypress National Preserve Ongoing Natural Resource Monitoring

Activity	Objective	Organization	Frequency	Year initiated	Primary Parameters	Methods/Scope
Hiking/backcountry visitor use	To estimate off-road visitor use and provide safety check-in data for visitors	NPS-BICY	Continuous	?	# visitors, duration of visit, type of use	permits must be filled out at trail head for hikers & ORV visitors (about 50% compliance)
Weather Stations	To provide weather data for fire program	NWS	Continuous	?	?	3 RAWS stations. One is 25 years old
Water Quality Monitoring	?	SFWMD	?	?	DO, PH, Temperature, Conductivity, ?	20 stations
Water Depth Monitoring	To provide water depth measurements useful for depth computer modeling	SFWMD	?	?	Water depth	100 station; 20 also take water quality data
Fire effects monitoring	?	NPS-BICY			?	
Manatee monitoring	?	USFWS	Annual	?	?	monitoring program
Oil & Gas	To track locations, status, pumpage of wells	Oil & gas companies	?	Varies with well	well depth, zone tapped, locations, date plugged if well closed	
Archaeological sites	Track status of 400 known sites and add new sites	NPS-BICY		1978?	?	Visits to sites
Backcountry camps	Track status of over 100 backcountry camps	NPS-BICY	Annual	mid-1980s?	status of camps, whether buildings are being	Visits to camps

APPENDIX F.2

BISCAYNE NATIONAL PARK

ONGOING NATURAL RESOURCE MONITORING

South Florida Caribbean Network
2005

Appendix F.2 Biscayne National Park Ongoing Natural Resource Monitoring

Activity	Objective	Organization	Frequency	Year initiated?	Primary Parameters	Methods/Scope
Sea Turtle	Nesting activity/success	NPS	Weekly during nesting season	1991	Location, predation, # of eggs	
Sea Grass	Composition, distibution, trend analysis	Dade Co	Monthly/annually	?	density per m2, species	
Creel monitoring	track fishing pressure	NPS	Weekly/bi-weekly	1976	location, species, size, harvest method	
Reef fish monitoring	Estimate exploited species population park-wide	NOAA NMFS	Annual	1980's	location, species, size	
Water quality	Detect trends in WQ parameters	NPS/Dade/FIU/ SFWMD	continuous/monthly	1972	temperature, conductivity, ph, DO, turbidity	
Coral Monitoring	Change in composition of major benthic functional groups	NPS	Annually	2000	location, species, percent cover	
Climate	track changes in local weather	NOAA-NDBC	Continuous	?	Location, windspeed/direction, wind gust, water temperature	
Manatee	Track population size	State/NOAA	Annual	1980's	Location and number of individuals	
Lobster	Track regional trends	State	Annual	1990's	Location, number, sex, size	
Exotic Plants	Track invasion of invasive	NPS	Annual	2003	location and extent	
Boat use	Track boat visitation	NPS	Weekly/bi-weekly	1976	Location, # of boat trailers	
Lobster Mini-season recreational catch	Track recreational extractive use of Spiny Lobster	NPS	Annually	1988	location, #, size, sex, eggs	
Lobster larval and juvenile monitoring	Identify trends in larval supply	NPS	Monthly	2005	Number and larval or juvenile stage	
Larval fish and invertebrates	Identify trends in larval supply	NPS	Monthly	2004	Number per species	
Fish monitoring	Describe and identify trends in shallow-water habitat utilization	NPS/ NOAA/ USGS	Monthly	2003	Species present, abundance, lengths (for target species)	
Avian Monitoring (Christmas Bird Count)	Identify annual trends in abundance and distribution of bird species	NPS	Annually	1979	Species present and abundance	

APPENDIX F.3

BUCK ISLAND REEF NATIONAL MONUMENT

ONGOING NATURAL RESOURCE MONITORING

South Florida Caribbean Network
2005

Appendix F.3 Buck Island Reef National Monument Ongoing Natural Resource Monitoring

Activity	Objective	Organization	Frequency	Year initiated	Primary Parameters	Methods/Scope
Sea Turtle Nesting Monitoring	To assess Hawksbill turtle recovery, and track green, loggerhead, and leatherback nest at Buck Island	NPS-BUIS	Year round	1980	nesting success, nesting population, spatial and temporal info at beach, index site for hawksbill recovery, mongoose predation	
Juvenile Sea Turtle Monitoring	To assess basic life history info, survivorship, and health, habitat utilization, residency, growth rates, foraging	NPS-BUIS	Year round	1994	size, recapture status, blood work, growth rates, location, genetics, population, habitat utilization, foraging behavior, residency	
Coral reef monitoring-chain	To detect changes in coral reef community cover, structure, composition, and disease detection	NPS-BUIS	Every 2 years	1988	% cover, coral spp, rugosity, disease	???
Coral reef monitoring-Random video	To detect changes in coral reef community cover	NPS-SFCN	Annual	2000	% cover, coral spp, urchin density, disease presence	2 sites
Coral reef habitat characterization mapping	To detect changes at landscape scale of benthic community	NOAA-Biogeo	Ongoing	1999	habitat area	
Acropora palmata monitoring	To determine population parameters, distribution, abundance, disease, urchin, and predatory snail presence	NPS-BUIS	Ongoing	2000	location, size, predation, survivorship	
Coral colony monitoring	To detect boulder coral survivorship and life history	NPS-BUIS	biannual	1987	location, size, growth, fission/fusion, survivorship, basic life history	
Seabird Monitoring	To track T&E bird populations	NPS-BUIS	Seasonal	1969	Pelican nesting, least tern nesting, neotropical migrant and residents (songbirds) ducks, pidgeons	
Migratory and native birds	Qualitative avian presence	NPS-BUIS	Incidental, when on site	1960's	Bird data collected in addition to other projects when sighted	
Christmas Bird Count	To loosely assess regional trends in abundance and presence of birds	Audobon	Annual	1999	Spp richness	
Reef fish monitoring	To assess species composition, size and abundance	NOAA-Biogeo	biannual	1987	spp. richness, abundance, habitat/assemblege association	Random sites by habitat sites throughout park; transects (sites)
Lobster	To assess current population	FWRI	Ongoing	2004	larval life history, size, molt condition, reproductive status, distribution and disease	
Conch	To assess current population and fecundity	FWRI	Ongoing	2004	size, lip thickness, and distribution	
Water Quality		USVI-DPNR	Ongoing	1968	temp, conductivity, pH, turbidity (see Horizon report)	
Water Quality - fecal		USVI-DPNR	Ongoing	1975	fecal coliform at swim beaches	
Water temperature		NPS-BUIS	Ongoing	1987	temp	
Air temperature		NPS-BUIS	Ongoing	2003	also in sand at 30 cm	
Precip		NPS-BUIS	Ongoing	2003	rain gauge checked daily July-Oct, interminent (weekly/twice a week when on site)	
Coastal geomorphology		NPS-BUIS	Ocassionally/post storm	1977	sand transport	
Visitation		NPS-BUIS	Daily when LE patrols	1975	visitors, boats, snorkelers	
Exotic animals		NPS-BUIS	biannual	1999	rats, mice	

APPENDIX F.4

DRY TORTUGAS NATIONAL PARK

ONGOING NATURAL RESOURCE MONITORING

South Florida Caribbean Network
2005

Appendix F.4 Dry Tortugas National Park **Ongoing Natural Resource Monitoring**

Activity	Objective	Organization	Frequency	Year initiated	Primary Parameters	Methods/Scope
Sea Turtle	Nesting activity/success	NPS	?		Location, predation, # of eggs	
Sea Grass	Composition, distibution, trend analysis	FIU?	Monthly/annually		density per m2, species	
Creel monitoring	track fishing pressure	NPS	Not continuous		location, species, size, harvest method	
Reef fish monitoring	Estimate exploited species population park-wide	NOAA NMFS	Annual	1980's	location, species, size	
water quality	Detect trends in WQ parameters	FIU	continuous/monthly	1980's	temperature, conductivity, ph, DO, turbidity	
Coral Monitoring	Change in composition of major benthic functional groups	NPS	Annually	2004	location, species, percent cover	
Climate	track changes in local weather	NOAA-NDBC	Continuous	?	Location, windspeed/direction, wind gust, water temperature	
Manatee	Track population size	State/NOAA	Annual	1980's	Location and number of individuals	
Lobster	Track regional trends	State	Annual	1995	Location, number, sex, size	
Exotic Plants	Track invasion of invasive species	NPS	Annual	2003	location and extent	
Coral Monitoring-cremp	Change in composition of major benthic functional groups	State	Annually	1998	location, species, percent cover	
Coral Monitoring-historic	Change in composition of major benthic functional groups	State	Not continuous	1972	location, species, percent cover	
Red Grouper	life history	State	continuous	2005	movement	

APPENDIX F.5

EVERGLADES NATIONAL PARK

ONGOING NATURAL RESOURCE MONITORING

South Florida Caribbean Network
2005

Appendix F.5 Everglades National Park Ongoing Natural Resource Monitoring

Activity	Objective	Organization	Frequency	Year initiated	Primary Parameters	Methods/Scope
Invasive plants systematic reconnaissance flights	To track the distribution and location of exotic plants and create a map to tell contractors where to initiate control actions	NPS-EMPTY; SEWED funds	every 2 years	1999	points where invasive species identified	Collected via air by covering park in 1 km lines
Invasive treatment database	To track where exotics treatment/control efforts have been initiated	NPS	?	1984	?	
Florida Panther Monitoring	To track the locations, home ranges, and mortality of all adult lions in EVER	NPS-EVER	check locations every other day	?	locations of cats at each point in time	Radio collar tracking with signal location every 2 days; new adult cats collared as soon as possible
Woodstork nesting success	Determine Population size and condition	NPS-EVER	Annual	?	?	
Alligator surveys	Determine Population size and condition	USGS	Annual	2000	Condition, length, sex	Night surveys, capture-recapture
Alligator nest surveys systematic reconnaissance flights	Determine Breeding Population	NPS-EVER	Annual	1985	Nest abundance, clutch size, nest success	Collected via air by covering park in 500 m wide belt transect spaced every 1km
Wading Bird surveys systematic reconnaissance flights	Determine Population size and condition	NPS-EVER	Monthly Dec to May	1985	Abundance	Collected via air by covering park in 300 m wide belt transect spaced every 1km
Deer surveys systematic reconnaissance flights	Determine Population size and condition	NPS-EVER	Annual	1985	?	?

Appendix F.5 Everglades National Park Ongoing Natural Resource Monitoring

Activity	Objective	Organization	Frequency	Year initiated	Primary Parameters	Methods/Scope
Pink Shrimp Surveys	Determine Population size and reproductive output	USGS	Annual	?	Density and larval production	Repeat throw trapping, larval spawn netting
Freshwater Fish Surveys	Determine Population size and reproductive output	USGS FIU	Annual	?	Density	Repeat throw trapping
Cape Sable Seaside Sparrow	Determine Population size and condition	NPS-EVER	Annual -during breeding season	?	Abundance of calling males	Abundance of calling males
Vegetation	Detect change in vegetation	NPS-EVER	?	?	Plant distribution and dominant species	5 - Line transects
Solution hole Vegetation Survey	Detect change in vegetation	NPS-EVER	?	?	Plant distribution and dominant species	100 solution holes
Game Fish harvest data	Determine Population size, sustainable harvest, and condition	NPS-EVER	Continuous	1958	Species, Effort, Fish Length, Angler Information, Recreational and Commercial (Guides)	Creel survey Check stations @ Flamingo Ramp, Chokoloskee, Trailer and Boat counts
Park visitation	To provide relative estimates of park visitor use	NPS-EVER	Continuous	?	# cars passing point	
Hiking/backcountry visitor use	To estimate off-road visitor use and provide safety check-in data for visitors	NPS-EVER	Continuous	?	# visitors, duration of visit, type of use	permits must be filled out at trail head for hikers & backcounty boating
Air Quality	To provide Air quality and atmospheric deposition information	NPS-EVER	Deposition - Weekly; Particulates (visibility) Every 3 days; Ozone - Continuous	?	Ozone, Wind Speed, Visibility, Wet & dry deposition of anions, cations, and HG	Atmospheric deposition collector; IMPROVE particle monitor; Ozone monitor
Weather Stations	To provide weather data for fire program	NPS-EVER	Continuous	?	?	?
Surface Water Quality Monitoring	To provide water quality measurements for long-term park management.	NPS-EVER	Monthly	?	DO, PH, Temperature, Conductivity	?

Appendix F.5 Everglades National Park Ongoing Natural Resource Monitoring

Activity	Objective	Organization	Frequency	Year initiated	Primary Parameters	Methods/Scope
Ground Water Quality Monitoring	To provide water quality measurements for long-term park management.	NPS-EVER	?	?	DO, PH, Temperature, Conductivity	?
Surface Water Quality Monitoring	To provide water quality measurements for SFWMD	FIU	Monthly	198?	DO, PH, Temperature, Conductivity, Soluble Reactive Phosphorous	Surface water grab samples
Water Depth Monitoring	To provide water depth measurements useful for depth computer modeling	NPS-EVER	Continuous	1947	Water depth, Conductivity @ Marine Sites, Temperature	>100 station
Soil Elevation	To determine role of accretion, subsidence and change in soil elevation	USGS, SFWMD	Quarterly to yearly	1998	Accretion, soil elevation	Soil Elevation Table (SET)
Seagrass Monitoring	To provide Seagrass popluation and distribution	FIU	Monthly	1990	Seagrass distribution, productivity	Long term plot based sampling
Fire effects monitoring	Determine the effect and role of fire in the ecosystem.	NPS-EVER		1971	Area, ignition source, treatment	GIS survey, ground visits
Manatee monitoring	Determine Population size and condition	USFWS	Annual	?	?	Part of Florida-wide monitoring program
Florida Coastal Everglades Long Term Ecological Research (FCE-LTER)	Track impacxt of Soulble reactive phossorpours	FIU	Continous	2000	SRP, Water monitoring, plant productivity, fish productivity, soil elevation	Shark River Transect (Six Sites), Taylor River Transect (Eight sites)

APPENDIX F.6

SALT RIVER NATIONAL HISTORIC PARK

& ECOLOGICAL PRESERVE

ONGOING NATURAL RESOURCE MONITORING

South Florida Caribbean Network
2005

Appendix F.6 Salt River Bay National Historic Site and Ecological Preserve Ongoing Natural Resource Monitoring

Activity	Objective	Organization	Frequency	Year initiated	Primary Parameters	Methods/Scope
Coral reef habitat characterization mapping	To detect changes at landscape scale of benthic community	NOAA-Biogeo	Ongoing	1999	habitat area	
Water Quality	To provide water quality measurements for long-term park management.	USVI-DPNR	Ongoing	1968	temp, conductivity, pH, turbidity (see Horizon report)	
Water Quality - fecal	To provide water quality measurements for long-term park management.	USVI-DPNR	Ongoing	1975	fecal coliform at swim beaches	
Water temperature		NPS-BUIS	Ongoing	1987	temp	
Coral Monitoring	To detect changes in the coral community	USVI-DPNR	Various	1978	Multiple projects with overlap (see Kendall et al 2005)	

APPENDIX F.7

VIRGIN ISLANDS NATIONAL PARK

& CORAL REEF NATIONAL MONUMENT

ONGOING NATURAL RESOURCE MONITORING

South Florida Caribbean Network
2005

Appendix F.7 Virgin Islands National Park Ongoing Natural Resource Monitoring

Activity	Objective	Organization	Frequency	Year initiated	Primary Parameters	Methods/Scope
Coral reef monitoring-Random video	To detect changes in coral reef community cover	NPS-SFCN	Annual	1999	% cover, major coral spp, urchin density, disease presence	Random video, 4 sites
Coral reef monitoring-video of chain transects	To detect changes in coral reef community cover	NPS-SFCN	Annual	1998	% cover, major coral spp, urchin density, disease presence	2 reference sites
Coral reef monitoring-chain transects	To detect changes in coral reef community cover, structure, composition, and disease detection	NPS-SFCN	Every 5 years	1989	% cover, major coral spp, rugosity, disease	2 reference sites
Coral reef monitoring - disease	To evaluate disease abundance, progression and coral mortality	NPS-SFCN	monthly	1997	% coral cover, % disease cover	1 site (Tektite)
Acropora palmata monitoring	Proposed species for listing; determine if elkhorn coral is recorvering in VIIS & determine role various pressures on recovery	USGS/NPS-VIIS/Univer of Virgin Islands/Disney Wildlife Conservation Fund	at least monthly	2003	spatial distribution, size, % mortality, predators, diseases, physical damage, temperature	2 main sites (Hollover, Hawkness) plus 12 that were visited once; GPS coordinates of colonies
Coral Recruitment	Determine recruitment of corals	USGS - Ilsa Kuffner	?	?	?	?
Coral - White plague monitoring	To determine effects of diseas on major reef building corals		annual	2005	presence/absence & area affected; belt transects along random coral monitoring transects	1 site at buck island, hollover, lameshur, newfound, mennebeck
Coral disease and recruitment	To assess long term dynamics, especially recreuitment, population biology & role of temperature	Cal. State Univ. Northridge-Pete Edmunds	annual	1987	recruitment, % coral cover,, % algae, % vacant space, mortality, seawater chemistry(temperature, salinity)	8 sites (lameshure area) , 250 photo quadrats

Appendix F.7 Virgin Islands National Park Ongoing Natural Resource Monitoring

Activity	Objective	Organization	Frequency	Year initiated	Primary Parameters	Methods/Scope
Re-mapping Mary Creek fringing reef complex, St. John	To assess changes in coral composition & cover	Williams College-Ronadh Cox	1998 remapped, remapping again in 2004	1968	?	Mary's Creek
Seagrass monitoring	To monitor seagrass density	NPS-SFCN	annual	2000	seagrass short-shoots per 0.25 m2	3 sites
Seagrass monitoring - mooring fields	To monitor seagrass recovery in mooring fields and improve effectiveness of moorings	NPS-VIIS	May & Dec	2000	4 transects with 10 quadrats each, 20 cm sq quadrats, seagrass P/A, Algae P/A, count of seagrass, seagrass blade height	4 bays, 4-5 moorings per bay, francis, mahoe, leinster, hawksnest
Reef fish monitoring - fish	To assess species composition, size and abundance	NOAA-Biogeo	annual	?	spp. richness, abundance	Random sites by habitat sites throughout park;approx 170 transects (sites)
Reef fish monitoring - fish associated habitat	benthic community composition, rugosity	NOAA-Biogeo	annual	?	% cover, all coral spp, rugosity, disease	Random sites by habitat sites throughout park;approx 170 transects (sites)
Fish monitoring - reference site - adult	To monitor species composition, size and abundance	NPS-SFCN/cooperators	annual	1991?	spp. richness, abundance	4 Reference sites; point counts
Fish monitoring - reference site - juvenile	To monitor species composition, size and abundance	NPS-SFCN/cooperators	annual	1991?	spp. richness, abundance	4 Reference sites; transects
Sea turtle nest monitoring	To assess Hawksbill turtle recovery	NPS-VIIS	seasonal (June-Dec)	1980	nesting success, nesting population, spatial and temporal info at beach, index site for hawksbill recovery, mongoose predation	2 beaches, volunteer program to monitor other beaches
Seabird monitoring-brown pelicans	To monitor change in pelican population and reproduction	NPS-VIIS	seasonal	1995?	# nests	2 major nesting area (Whistling key, mary's point)

Appendix F.7 Virgin Islands National Park Ongoing Natural Resource Monitoring

Activity	Objective	Organization	Frequency	Year initiated	Primary Parameters	Methods/Scope
Christmas bird count	To loosely assess regional trends in abundance and distribution (presence) of birds	Audobon/NPS-VIIS - Laurel Branick local contact	Annual	1981	Spp richness, presence of individual species	Throughout islands, divided into 4 segments; see data sheets
Shorebird walks - Francis Bay salt pond plus other opportunistic notes	To qualitatively assess shorebird presence at Francis Bay	NPS-VIIS--Laurel Branick	Every Sunday, Nov. - Apr.	?	Species observed	shore walks observing species at Francis Bay salt pond
Water temperature - hobo temps	To monitor water temp	NPS-SFCN	every 2 hours	1987?	temperature	hobo data recorders, 5 sites
Water Quality		NPS-VIIS	quarterly (in 1995; prior was monthly)	1988	temp, salinity, conductivity, DO, turbidity, N, P, Transmisivity, spectralradiometry,	16 sites- most inside & some outside
Water Quality- fecal coliform monitoring		NPS-VIIS	monthly	2000	fecal coliform	3 sites (4 samples per site)
Marine sediments, seawater, fish tissue - chemistry & contaminants	To report periodically on the condition of the nations waters	USEPA-Environmental Monitoring and Assessment Program: National Coastal Assessment	?	2004	marine sediment for organic & inorganic contaminant analysis, TOC, grain size, infaunal organisms, seawater (disolved and total nutrients, chl a TSS); fish tissue - organic & inorganic contaminant analysis	samples from around the island
Beach profiles (sand migration)	To measure beach erosion & migration	NPS-VIIS	quarterly & after major events	Feb, 1998	beach profiles	5 beaches, trunk, cinamon, honeymoon, coco lobo, western reef
Air quality	Baseline site to monitor air quality	NPS-VIIS	Deposition - weekly; Particulates (visibility) - every 3 days	1998	wet & dry deposition of anions and cations, visibility	1 air quality monitoring station -- atmospheric deposition collector, particle monitor

Activity	Objective	Organization	Frequency	Year initiated	Primary Parameters	Methods/Scope
African Dust	To monitor amount and composition of african dust with special focus on contaminants- pesticides, persistent organic pollutants	USGS-Virginia Garrison	seasonal during dust season	late 1990's early 2000	collecting dust	
Tropical dry forest - response to hurricanes	To examine how dry tropical forests react to hurricane events	USDA USFS-Pete Weaver	Every 5 yrs	1983	species, dbh, growth rates, succession	Cinamon bay watershed, 16 sites at 3 elevations? See scope of work
Regional tropical dry forest monitoring	Part of regional network to examine tropical dry forests as part of a regional effort to monitor dry tropical forests	Smithsonian MAB-Francisco Del Mayer	Every 5+ yrs	early 1990s	species, dbh, growth rates, succession	1 1-hectare plot on margaret hill
Forest Inventory and Monitoring in the Puerto Rican and US VI	To monitor basal area, stem density, forest condition, merchantable volume and total aboveground biomass	USDA-USFS	?	2004	basal area, stem density, forest condition, merchantable volume and total aboveground biomass; tree crown condition, soil productivity and down woody debris at a subset of sampling sites; forest structure and diversity described in greater detail in pilot project on St. John	random selection of sample sites using FIA protocol
Catastrophic Event Effects on Plant Growth & Diversity	To evaluate influence of catastrophic events on succession and develop a photo herbarium of tree species at site	Dr. Patrick Keller	revisited 2004 & 2005	1975	map trails, stonewalls, existing dry streambeds, relative elevations, physical locations of 5 uncommon species	using same 40 hectare study area by Forman and Hahn (1980)
Exotic plants	To qualitatively assess need to treat	NPS-EPMT	as needed		inventory prior to treatment & followup site visits	

APPENDIX G

INVASIVE PLANT SPECIES IN (OR NEAR) SFCN PARKS

South Florida Caribbean Network in consultation with Tony Pernas
2005

Appendix G. Invasive plant species in (or near) SFCN parks. This is a list of the more problematic invasive plant species in the south Florida and Caribbean Network parks. Compiled with assistance from Tony Pernas.

		PARKS							Ecological Zones							
Common name	**Scientific name**	EVER	BICY	BISC	DRTO	VIIS	BUIS	SARI	Freshwater wet prairies, marsh, and slough	Forested uplands and wetlands	Island interior	Coastal Wetlands	Florida Bay	Biscayne Bay	Coastal Shelf	Comment
Shoebutton	*Ardisia elliptica*	X	X						X	X						
Casuarina	*Casuarina cunninghamiana, C. equisetifolia, C. gauca*	X	X	X	X	X	X	X	X	X	X	X				
Wild Taro	*Colocasia esculenta.*		X						X							
Latherleaf	*Colubrina asiatica*	X		X	X							X				
Air potato	*Dioscorea bulbifera*	X	X							X						
Water Hyacinth	*Eichhornia crassipes*	X	X						X							
Hydrilla	*Hydrilla verticillata*	X	X						X							
Cogongrass	*Imperata cylindrica*	X	X							X						
Lygodium	*Lygodium japonicum, L. microphyllum*	X	X	X					X	X						
Melaleuca	*Melaleuca quinquenervia*	X	X	X					X							
Silkreed	*Neyraudia reynaudiana*	X	X							X						Disturbed areas along roads
Guinea grass	*Panicum maximum*	minor	minor			X	X	X	minor	minor	X					
Torpedograss	*Panicum repens*	X	X						X							
Elephantgrass	*Pennisetum purpureum*	X	X						X	X						
Waterlettuce	*Pistia stratiotes*	X	X						X							
Beach naupaka, Inkberry	*Scaevola sericea*	X		X	X	X	X	X				X				
Brazilian Pepper	*Schinus terebinthifolius*	X	X	X	X	X	X	X	X	X	X	X				
Tropical Soda Apple	*Solanum viarum*	X	X							X						
Java Plum	*Syzygium cumini*	X	X							X						
Seaside Mahoe	*Thespesia populynea*	X		X	X	X	X	X				X				Disturbed areas, cattle grazing
Pacific algae	*Caulerpa brachypus*	Near		Near	Near								X	X	X	

APPENDIX H

NON-NATIVE FAUNA SPECIES IN (OR NEAR) SFCN PARKS

South Florida Caribbean Network in consultation with
Skip Snow and Jeff Kline
2005

APPENDIX H. Non-native fauna species in (or near) SFCN parks.

This list was compiled in part from lists developed by Skip Snow, Jeff Kline, Lodge (2005), Waddell (2005) and personal communications with park staff. Not all species are considered invasive.

			PARKS							Ecological Zones							
Taxa	**Common name**	**Scientific name**	**EVER**	**BICY**	**BISC**	**DRTO**	**VIIS**	**BUIS**	**SARI**	**Wet prairies and marshes**	**Forest uplands and wetlands**	**Mangroves, beaches and tidal wetlands**	**Island interiors**	**Florida Bay**	**Biscayne Bay**	**Coastal Shelf and Deep Oceanic**	**Comments**
Bird	Cattle egret	*Bubulcus ibis*	?	?	X												
Bird	Monk parakeet	*Myiopsitta monachus*	X								X						
Bird	Helmeted Guineafowl	*Numida meleagris*							X				X				
Bird	House sparrow	*Passer montanus*	?	?	X												
Bird	Purple swamp hen	*Porphyrio porphyrio*	Near							X							
Bird	European starling	*Sturnus vulgaris*	X		X					X	X		X				
Bird	Parrots and parakeets		X	X							X						
Fish	Oscar	*Astronotus ocellatus*	X							X	?						
Fish	Live bearing pike killifish	*Belonesox belizanus*	X							X	X						
Fish	Peacock cichlid	*Cichla ocellaris*	X							X	?						
Fish	Black acara	*Cichlasoma bimaculatum*	X							X	X						
Fish	Jaguar guapote	*Cichlasoma managuense*	X							X							
Fish	Mayan cichlid	*Cichlasoma urophthalmus*	X							X	X	X					
Fish	Walking catfish	*Clarias batrachus*	X	X						X	X						
Fish	North African jewelfish	*Hemichromis letourneuxi*	X							X	X	X					
Fish	Banded cichlid	*Heros severus*	X							X	?	X					
Fish	Brown hoplo (armored catfish)	*Hoplosternum littorale*	X							X	X						
Fish	Spotfinned spinyeel (peacock eel)	*Macrognathus siamensis*	X							X	?	X					
Fish	Asian swamp eel	*Monopterus albus*	X							X							
Fish	Blue tilapia	*Oreochromis aureus*	X							X							
Fish	Mozambique tilapia	*Oreochromis mossambicus*	X							X							
Fish	Lionfish	*Pterois volitans*			?										X	X	
Fish	Sailfish catfish	*Pterygoplichthys multiradiatus*	X							X	?						
Fish	Spotted tilapia	*Tilapia mariae*	X							X	X	X					
Herpetofauna	Cuban knight anole	*Anolis equestris*	X								X						
Herpetofauna	Brown anole	*Anolis sagrei*	X	X	X					X	X						
Herpetofauna	Burmese pythons, boas other constric	*Boa constrictor, python spp.*	X	X						X	X	X					
Herpetofauna	Giant marine toad	*Bufo marinus*	X		X		X		X	X		X					
Herpetofauna	Brown caiman	*Caiman crocodilus*	X							X	X	X		X			
Herpetofauna	Spinytail iguana	*Ctenosaura pectinata, Ctenosau*	X		X		X				X						
Herpetofauna	Corn Snake	*Elaphe guttata*					X		X				X				
Herpetofauna	Puerto Rican Coqui	*Eleutherodactylus coqui*					X		X				X				
Herpetofauna	Greenhouse frog	*Eleutherodactylus planirostris*	X	X	X						X						
Herpetofauna	Tokay gekko	*Gekko gecko*	X		X						X						
Herpetofauna	Red-footed Tortoise	*Geochelone carbonaria*					X		X				X				
Herpetofauna	Indo-Pacific gecko	*Hemidactylus garnotti*															
Herpetofauna	Mediterranean Gecko	*Hemidactylus mabouia*					X		X				X				
Herpetofauna	Cuban tree frog	*Osteopilus septentrionalis*	X		X		X		X	X	X		X				
Herpetofauna	Brahminy blindsnake	*Ramphotyphlops braminus*			X												
Herpetofauna	Fat-tailed Gecko	*Thecadactylus rapicauda*					X		X				X				
Herpetofauna	Red-eared slider turtle	*Trachemys scripta*	?	?			X			X			X				

APPENDIX H. Non-native fauna species in (or near) SFCN parks.

This list was compiled in part from lists developed by Skip Snow, Jeff Kline, Lodge (2005), Waddell (2005) and personal communications with park staff. Not all species are considered invasive.

			PARKS							Ecological Zones							
Taxa	**Common name**	**Scientific name**	**EVER**	**BICY**	**BISC**	**DRTO**	**VIIS**	**BUIS**	**SARI**	**Wet prairies and marshes**	**Forest uplands and wetlands**	**Mangroves, beaches and tidal wetlands**	**Island interiors**	**Florida Bay**	**Biscayne Bay**	**Coastal Shelf and Deep Oceanic**	**Comments**
Invertebrate	Prickly pear moth	*Cactoblastis cactorum*	X								X						
Invertebrate	Asiatic clam	*Corbicula fluminea*	X							X	?	X					
Invertebrate	Asiatic clam	*Corbicula manilensis*	X							X	?	X					
Invertebrate	Diaprepes weevil	*Diaprepes abbreviatus*	X								X						
Invertebrate	Golden-horn marisa	*Marisa cornuaurietus*	X							X							
Invertebrate	Red-rimmed melania	*Melanoides tuberculata*	X							X							
Invertebrate	Bromeliad weevil	*Metamasius callizona*	X	X							X	X					
Invertebrate	Lobate lac scale	*Paratachardina lobata*	X	X							X						
Invertebrate	Neotropical applesnails	*Pomacea spp. (canaliculata grou*	X							X							
Invertebrate	Agave weevil	*Scyphophorus acupunctatus*					X						X				
Invertebrate	Fire ants	*Solenopsis invicta*	X	X	?						X						
Invertebrate	Brown citrus aphid	*Toxoptera citricida*	X								X						
Mammal	Feral & domestic dogs	*Canis familiaris*	X	X	X		X		X		X	X	X				
Mammal	Coyote (range extension?)	*Canis latrans*		X							X						
Mammal	Goats	*Capra hircus*					X					X	X				
Mammal	Armadillo	*Dasypus novemcinctus*	X	X							X						
Mammal	Donkeys	*Equus asinus*					X					X	X				
Mammal	Feral & domestic cats	*Felis domesticus*	X	X	?		X		X		X	X	X				
Mammal	Small Indian Mongoose	*Herpestes javanicus*					X		X			X	X				
Mammal	Primate	*Macaca mulata*	X								X						
Mammal	House mouse	*Mus musculus*	X	X	?		X		X		X		X				
Mammal	White-tailed Deer	*Odocoileus virginianus*							X			X	X				
Mammal	Norway rat	*Rattus norvegicus*	X	X			X		X		X	X	X				
Mammal	Black rat	*Rattus rattus*	X	X	X		X		X		X	X	X				
Mammal	Primate	*Saimiri sciureus*	X								X						
Mammal	Mexican red-bellied squirrel	*Sciurus aureogaster*	X		X								X				
Mammal	Pig	*Sus scrofa*	X	X			X		X		X	X	X				

APPENDIX I

SFCN FEDERAL, STATE, AND TERRITORIAL ENDANGERED SPECIES, THREATENED SPECIES, AND SPECIES OF SPECIAL CONCERN

South Florida Caribbean Network
2006

Appendix I. SFCN Federal, State, and Territorial Endangered Species, Threatened Species, and Species of Special Concern

Printed 9/19/2006

			Legal Status			Presence Status							References							Habitats							
Taxa	**Common name**	**Scientific name**	**Federal Status**	**Florida Status (19, 20)**	**VIIS Status (21)**	**EVER**	**BICY**	**BISC**	**DRTO**	**VIIS**	**BUIS**	**SARI**	**EVER**	**BICY**	**BISC**	**DRTO**	**VIIS**	**BUIS**	**SARI**	**Wet prairie & marsh**	**Forested uplands & wetlands**	**Island interior**	**Coastal Wetlands**	**Florida Bay**	**Biscayne Bay**	**Coastal shelf/ Deep Oceanic**	
Bird	Roseate spoonbill	*Ajaia ajaja*		SSC		P	P	P					16	4	10								f,b,r				
Bird	Cape Sable seaside sparrow	*Ammodramus maritimus mirabilis*	FE	SE		P	P						1, 8, 16, 22, 25, 32	1, 3, 4, 8, 22, 25						f,b,r							
Bird	Florida Grasshopper Sparrow	*Ammodramus savannarum floridanus*	FE	SE		P	P						32	31													
Bird	Limpkin	*Aramus guarauna*		SSC		P	P						16	4						f,b,r							
Bird	Great Blue Heron	*Ardea herodius*			VE	P	P	P		P		P					27		26	f	b,r		f				
Bird	Burrowing owl	*Athene cunicularia*		SSC		P							16							f	f,r		f,b,r				
Bird	Ivory-billed woodpecker	*Campephilus principalis*	FE	SE		H, E							1(historic), 16								f,b,r						
Bird	Great (Common) Egret	*Casmerodius albus*			VE	P	P	P		P		P					27		26	f	b,r		f				
Bird	Snowy Plover (Cuban)	*Charadrius alexandrinus*		ST	VE			P							30												
Bird	Piping plover	*Charadrius melodus*	FT	ST		P	P	P		P			1, 8, 16, 22, 25, 32	1	1, 9, 22, 25, 30	1, 8, 22, 25	22, 25						f,b,r				
Bird	White-crowned pigeon	*Columba leucocepala*		ST	VE	P	P	P		P	P	P	16, 32	4	10		27	28	12, 26		f	f	f,b,r				
Bird	Kirtland's warbler	*Dendroica kirtlandii*	FE							P							22, 25				r						
Bird	Little blue heron	*Egretta caerulea*		SSC		P	P	P					16	4	10				12	f	f,b,r	f	f,b,r				
Bird	Reddish egret	*Egretta rufescens*		SSC		P	P	P					16	4	10								f,b,r				
Bird	Snowy egret	*Egretta thula*		SSC	VE	P	P	P		P	P	P	16	4	10		27	28	26	f	f,b,r	f	f,b,r				
Bird	Tricolored heron	*Egretta tricolor*		SSC		P	P	P					16	4	10					f	f,b,r	f	f,b,r				
Bird	White ibis	*Eudocumus albus*		SSC		P	P	P					16	4	10					f	f,b,r	f	f,b,r				
Bird	Peregrine falcon	*Falco peregrinus*	FE	SE		P	P	P	P	P	P	P	8, 16, 22, 32	3, 4, 8	8, 9, 30	8, 22	1,27	28	26		f,r						
Bird	Southeastern American kestrel	*Falco sparverius paulus*		ST		P		P					16		10					f	f,b,r						
Bird	Florida Sandhill Crane	*Grus canadensis pratensis*		ST		P	P						16, 32	4						f,b,r							
Bird	American oystercatcher	*Haematopus palliatus*		SSC		P	P						16	4									f,b,r				
Bird	Bald eagle	*Haliaeetus leucocephalus*	FT? Proposed delisting	ST		P	P	P					1, 8, 16, 22, 25, 32	1, 3, 4, 8, 22, 25	1, 8, 9, 22, 25, 30					f	b,r		f,b,r	f	f		

Appendix I. SFCN Federal, State, and Territorial Endangered Species, Threatened Species, and Species of Special Concern

Printed 9/19/2006

			Legal Status			Presence Status							References							Habitats							
Taxa	**Common name**	**Scientific name**	**Federal Status**	**Florida Status (19, 20)**	**VIIS Status (21)**	**EVER**	**BICY**	**BISC**	**DRTO**	**VIIS**	**BUIS**	**SARI**	**EVER**	**BICY**	**BISC**	**DRTO**	**VIIS**	**BUIS**	**SARI**	Wet prairie & marsh	Forested uplands & wetlands	Island interior	Coastal Wetlands	Florida Bay	Biscayne Bay	Coastal shelf/ Deep Oceanic	
Bird	Least Bittern	*Ixobrychus exilis*			VE	P	P	P				P							26	f,b,r							
Bird	Wood stork	*Mycteria americana*	FE	SE		P	P	P					1, 8, 16, 22, 25, 32	1, 3, 4, 8, 22, 25, 31	1, 8, 9, 22, 25, 30					f	b,r		f,b,r				
Bird	Black crowned Night Heron	*Nycticorax nycticorax*			VE					P		P					27		26								
Bird	Osprey	*Pandion haliaetus*		SSC		P	P	P					16	4	30				12	f	f,b,r	f	f,b,r	f	f	f	
Bird	Brown pelican	*Pelecanus occidentalis*	FE-Delisted	SSC		P	P	P	P	P	P	P	16, 32	4	10	29	1, 22, 25,27	1, 7, 25, 28	12, 26				f,b,r	f	f	f	
Bird	Red-cockaded woodpecker	*Picoides borealis*	FE	SSC		E	P						1 (historic), 8, 16, 22, 25, 32	1, 3, 4, 8, 22,25							f,b,r						
Bird	Least Grebe	*Podiceps dominicus*			VE					P		P					27		26								
Bird	Black skimmer	*Pynchops niger*		SSC		P	P	P					16	4	10, 30								f,b,r	f	f	f	
Bird	Clapper rail	*Rallus longirostris*			VE	P	P	P				P							26	f,b,r			f,b,r				
Bird	Snail kite	*Rostrhamus sociabilis*	FE	SE		P	P						8, 16, 22, 25	3, 4, 8, 22, 25						f	b,r						
Bird	Least tern	*Sterna antillarum*		ST	VE	P	P	P	P	P	P	P	16, 32	4	10, 22, 25, 30	29	27	25	26				f,b,r	f	f	f	
Bird	Roseate tern	*Sterna dougailii*	FT	ST		P		P	P	P		P	8, 16, 22, 25, 32		22, 25, 30	8, 22, 25, 29	13, 22, 25, 27		26				f,b,r	f	f	f	
Fish	Small-toothed sawfish	*Pristis pectinata*	FE			P		P					23		22, 23, 25					x			x	x	x		
Herpetofauna	American alligator	*Alligator mississippiensis*	FT/SA	SSC		P	P	P					1, 8, 18, 25	1, 3,4, 8, 25	8, 9, 22, 25					f,b,r	f,b,r		f.r				
Herpetofauna	St. Croix ground lizard	*Ameiva polops*	FE								P							1, 25				r	f,b,r				
Herpetofauna	Loggerhead sea turtle	*Caretta caretta*	FT	ST		P		P	P		P		1, 8, 18, 22, 25		1, 8, 9, 22, 25	8, 22, 25		25					b	f	f	f	

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			Legal Status			Presence Status							References							Habitats						
Taxa	**Common name**	**Scientific name**	**Federal Status**	**Florida Status (19, 20)**	**VIIS Status (21)**	**EVER**	**BICY**	**BISC**	**DRTO**	**VIIS**	**BUIS**	**SARI**	**EVER**	**BICY**	**BISC**	**DRTO**	**VIIS**	**BUIS**	**SARI**	**Wet prairie & marsh**	**Forested uplands & wetlands**	**Island interior**	**Coastal Wetlands**	**Florida Bay**	**Biscayne Bay**	**Coastal shelf/ Deep Oceanic**
Herpetofauna	Green sea turtle	*Chelonia mydas*	FE	SE		P		P	P	P	P		1, 8, 18, 22, 25		1, 8, 9, 22, 25	8, 22, 25	1, 22, 25	15, 25					b	f	f	f	
Herpetofauna	American crocodile	*Crocodylus acutus*	FE	SE		P	P	P	P				1, 8, 18, 22, 25	1	1, 8, 9, 22, 25	11							f,b,r	f	f		
Herpetofauna	Leatherback sea turtle	*Dermochelys coriacea*	FE	SE		P		P	P	P	P		1, 8, 18, 22, 25		1, 8, 9	8	1, 22, 25	1, 14,15, 25					b	f	f	f	
Herpetofauna	Eastern indigo snake	*Drymarchon corais couperi*	FT	ST		P	P	P					1, 8, 18, 22, 25	1, 3, 4, 8, 22, 25	1, 8, 9, 22, 25					?	f,b,r		f,b,r				
Herpetofauna	Hawksbill sea turtle	*Eretmochelys imbricata*	FE	SE		P		P	P	P	P		8, 18, 22, 25		1, 8, 9, 22, 25	8	1, 22, 25	1, 7, 15, 25					b	f	f	f	
Herpetofauna	Gopher tortoise	*Gopherus polyphemus*		SSC		P							18										f,b,r				
Herpetofauna	Striped mud turtle	*Kinosternon baurii*		SE		P							18							f,b,r	f,b,r		f,b,r	f,r			
Herpetofauna	Kemps Ridley sea Turtle	*Lepidochelys kempii*	FE	SE		P		P	P				8, 18, 22, 25		1, 9	8							b	f	f	f	
Invertebrate	Miami blue butterfly	*Hermiargus thomasi benthunebakeri*	C			P							22, 25								f,b,r	f,b,r					
Invertebrate	Florida tree snail	*Ligus fasciatus*		SSC			P	P						4	10						f,b,r						
Invertebrate	Stock Island tree snail	*Orthalicus resee*	FT	SE		P							8, 22, 25								f,b,r						
Invertebrate	Schaus swallowtail	*Papilio aristodemus ponceanus*	FE	SE		P		P					8		8, 9, 22, 25						f,b,r						
Invertebrate-Aquatic	Staghorn coral	*Acropora cervicornis*	FT					P	P	P	P	P			22, 23, 25	23	23	23	23							X	
Invertebrate-Aquatic	Elkhorn coral	*Acropora palmata*	FT					P	P	P	P	P			22, 23, 25	23	23	23	23							X	
Invertebrate-Aquatic	Pillar coral	*Dendrogyra cylindrus*		SE				P							10				12							X	
Mammal	Right whale	*Balaena glacialis*	FE	SE				P							1											f,r	
Mammal	Sei whale	*Balaenoptera borealis*	FE	SE				P							1											f,r	
Mammal	Finback whale	*Balaenoptera physalus*	FE	SE				P							1											f,r	
Mammal	Humpback whale	*Megaptera novaeangliae*	FE	SE				P		P					1		22, 25									f,r	

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Mammal	Everglades mink	*Mustela vision evergladensis*		ST			P						17	4						f,b,r	f,b,r		f,b,r				
Mammal	Key Largo woodrat	*Neotoma floridana smaili*	FE	SE		P		P					8		1, 22, 25						f,b,r	?					
Mammal	Key Largo cotton mouse	*Peromyscus gossypinus allapaticola*	FE	SE		P		P					1, 8		22, 25						f,b,r	?					
Mammal	Mountain lion	*Puma concolor*	T (S/A)				P							4						f	f,b,r		f				
Mammal	Florida panther	*Puma concolor coryi*	FE	SE		P	P						8, 17, 22, 25	3, 4, 8, 22, 25						f	f,b,r		f				
Mammal	Big Cypress fox squirrel	*Sciurus niger avicennia*	PT	ST		P	P						25	4						f	f,b,r		f,b,r				
Mammal	West Indian manatee	*Trichechus manatus*	FE	SE		P	P	P	P	P			1, 8, 17, 22, 25	3, 4, 8, 22, 25	1, 8, 9, 22, 25	8, 22, 25	1, 22, 25						f,b,r	f	f		
Mammal	Florida black bear	*Ursus americanus floridanus*		ST		P	P						17	4						f	f,b,r		f,b,r				
Plant	Cinnecord, Florida acacia	*Acacia choriophylla*		SE				P							2							X					
Plant	Twisted acacia	*Acacia tortuosa*		SE		H							2								?	X	?				
Plant	Triangle cactus	*Acanthocereus tetragonus*		ST		P		P					2		2												
Plant	Paurotis palm, Everglades palm	*Acoelorraphe wrightii*		ST		P	P	P					2	2,5,	2												
Plant	Golden leather fern	*Acrostichum aureum*		ST		P	P	P					2	2,5,	2, 10												
Plant	Giant leather fern	*Acrostichum danaei folium*		ST				P							10												
Plant	Fragrant maidenhair	*Adiantum melanoleucum*		SE		P							2								X						
Plant	Fan maidenhair	*Adiantum tenerum*		SE		P							2														
Plant	Sensitive joint-vetch, Meadow joint-vetch	*Aeschynomene pratensis*		SE		P	P						2	2,5,6													
Plant	Egger's agave	*Agave eggersiana*			VE							P							12								
Plant	White colic-root, bracted colic-root	*Aletris bracteata*		SE		P	P						2	2,5,													
Plant	Mexican alvaradoa	*Alvaradoa amorphoides*		SE		P							2														
Plant	Clusterspike false indigo, Crenulaate lead-plant	*Amorpha herbacea var. crenulata*	FE	SE		P							1, 2, 8, 22, 25							x	X						
Plant	Wright's flowering fern	*Anemia wrightii*		SE		P							2							x	X						
Plant	Pineland-allamanda, Pineland golden trumpet	*Angadenia berteroi*		ST		P	P						2	2,5,6													
Plant	Sea rosemary	*Argusia gnaphalodes*		SE		P		P	P				2		2	2											
Plant	Blodgett's silverbush	*Argythamnia blodgettii*	Candidate	SE		P		H					1, 2, 22, 25		1, 2												
Plant	Marsh's Dutchman's pipe	*Aristolochia pentandra*		SE				P							2						X	X					
Plant		*Asplenium dentatum*		SE		P							2														
Plant	Eared spleenwort	*Asplenium erosum*		SE			H							2,							X						
Plant	Bird's-nest fern, Wild birdnest fern	*Asplenium serratum*		SE			P							2,6													
Plant	Carter's orchid	*Basiphyllaea corallicola*		SE		P							2								X						
Plant	Pinepink	*Bletia purpurea*		ST		P	P	P					2	2,5,6	2												
Plant	Pineland strongback	*Bourreria cassinifolia*		SE		P							2								X	X					
Plant	Bodywood, Pigeon berry	*Bourreria succulenta*		SE		P		P					2		2												
Plant	Spider orchid	*Brassia caudata*		SE		E							2								X						
Plant	Fakahatchee bluethread	*Burmannia flava*		SE			P							2,6													

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Plant	Key brysonima, Long Key locustberry	*Byrsonima lucida*		ST		P		P					2		2												
Plant	Yellow nicker	*Caesalpinia major*		SE				P							2							X					
Plant	Manyflowered grasspink	*Calopogon multiflorus*		SE			P							2,													
Plant	Spicewood, Pale lidflower	*Calyptranthes pallens*		ST		P	P	P					2	2,5,	2												
Plant	Thomas' lidflower	*Calyptranthes thomasiana*	FE							P							1, 22, 25										
Plant	Myrtle of the river, Spicewood	*Calyptranthes zuzygium*		SE		P							2														
Plant	Leafless bentspur orchid	*Campylocentrum pachyrrhizum*		SE			P							2,6							X						
Plant	Narrow strap fern, Narrow-leaved strap fern	*Campyloneurum angustifolium*		SE			H							2,6							X						
Plant	Tailed strap fern	*Campyloneurum costatum*		SE			H							2,							X						
Plant		*Canella winterana*		SE		P		P					2		2												
Plant	Powdery strap airplant	*Catopsis berteroniana*		SE		P	P						2	2,6													
Plant	Florida strap airplant	*Catopsis floribunda*		SE		P	P						2	2,6													
Plant	West Indian cock's comb	*Celosia nitida*		SE		P		P					2		2												
Plant	Fragrant pricklyapples	*Cereus eriophorus var. fragrans (Harrisia fragrans)*	FE			H							22, 25								X	X					
Plant	Dildoe cactus	*Cereus pentagonus*		ST				P							10												
Plant	Deltoid spurge, Redland sandmat	*Chamaesyce deltoidea deltoidea*	FE			P							22, 25														
Plant	Wedge sandmat, Pineland sandmat	*Chamaesyce deltoidea ssp. Pinetorum*	C	SE		P							1, 2, 22, 25														
Plant	Garber's spurge	*Chamaesyce garberi*	FE, FT?	SE		P							1, 8, 22, 25														
Plant	Southern Florida sandmat	*Chamaesyce pergamena*		ST		P	P		P				2	2		2											
Plant	Porter's sandmat	*Chamaesyce porteriana*		SE		P	P	P					2	2,5,6	2, 10												
Plant	White sunbonnets	*Chaptalia albicans*		ST		P							2														
Plant	Southern lipfern	*Cheilanthes microphylla*		SE		P							2								X						
Plant	Florida Keys Cape Sable thoroughwort	*Chromolaena frustrata, Eupatorium frustratum (syn.)*	C	SE		P							1 (historic), 2, 22, 25								?						
Plant	Satin leaf	*Chrysophyllum oliviforme*		ST		P	P	P					2	2,5,	2, 10						X	X					
Plant	Balsam apple	*Clusia rosea*		SE				P							10												
Plant	Silver palm (commercially exploited)	*Coccothrinax argentata*		ST		P		P					2		2, 10						X	X					
Plant	Coconut palm	*Cocos nucifera*		ST				P							10												
Plant	Coffee colubrina, Greenheart	*Colubrina arborescens*		SE		P	P	P					2	2,5,6	2						X	X					
Plant	Cuban nakedwood	*Colubrina cubensis var. floridana*		SE		P							2								X						
Plant	Soldierwood	*Colubrina elliptica*		SE		P		P					2		2						X	X					
Plant	Butterflybush, Curacao bush	*Cordia globosa*		SE		P	P						2	2													
Plant	Gieger tree	*Cordia sebestena*		SE				P							10												
Plant	Quailberry, Christmasberry	*Crossopetalum ilicifolium*		ST		P	P						2	2							X						
Plant	Maidenberry Florida crossopetalum	*Crossopetalum rhacoma*		ST		P		P					2		2						X	X					
Plant	Pepperbush	*Croton humilis*		SE			P							2,5,6							X						
Plant	Florida tree fern, Red-hair comb fern	*Ctenitis sloanei*		SE		P	P						2	2							X						
Plant	Blodgett's swallowwort	*Cynanchum blodgettii*		ST		P	P						2	2,5,6							X						
Plant	Cowhorn orchid, Cigar orchid	*Cyrtopodium punctatum*		SE		P	P						2	2,6													
Plant		*Dalbergia brownii*		SE		P		P					2		2						X	X					

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Plant	Florida prairie clover	*Dalea carthagenensis var. floridana*	C	SE		E	P						1, 2, 22, 25	1,2,5						X	X						
Plant		*Digitaria filiformis var. dolichophylla*		ST		P		P					2		2												
Plant	Everglades crabgrass, Twospike crab grass	*Digitaria pauciflora*	C	SE		P	P						1, 2, 22, 25	2						X	X						
Plant	Milkbark	*Drypetes diversifolia*		SE		P		P					2		2												
Plant	Guiana-plum	*Drypetes lateriflora*		ST		P	P	P					2	2,5,6	2												
Plant	Longview orchid	*Eltroplectris calcarata*		SE		P							2								X						
Plant	Dollar orchid	*Encyclia boothiana var. erythronioides*		SE		P		P					2		2, 10												
Plant	Clamshell orchid, cockleshell orchid	*Encyclia cochleata*		SE		P	P						2	2,5,6													
Plant	Florida butterfly orchid	*Encyclia tampensis*		C?			P	P						2,5,6	10												
Plant	Dingy-flowered star orchid	*Epidendrum anceps*		SE		E	P						2	2,5,6													
Plant		*Epidendrum bifidum*			VE							P							12								
Plant	Fringed star orchid	*Epidendrum ciliare*			VE							P							12								
Plant	Umbrella star orchid	*Epidendrum floridense*		SE		P	P						2	2,6													
Plant	Night-blooming epidendrum, Night-scented orch	*Epidendrum nocturnum*		SE		P	P						2	2,5,6													
Plant	Stiff-flower star orchid	*Epidendrum rigidum*		SE		P	P						2	2,5,6													
Plant	Sanibel Island love grass	*Eragrostis tracyi*		SE			P							2,									X				
Plant	Blacktorch	*Erithalis fruticosa*		ST		P							2														
Plant	Redberry ironwood	*Eugenia confusa*		SE		P		P					SE		2, 10												
Plant	Red stopper	*Eugenia rhombea*		SE				P							2, 10							X					
Plant	Binweed dwarf, Morning-glory	*Evolvulus convolvuloides*		SE		P							2														
Plant	Caribbean princewood, princewood	*Exostema caribaeum*		SE		P		P					2		2												
Plant	Small's milkpea	*Galactia smallii*	FE	SE		H							1,2														
Plant	Bey Rich's hooded orchid	*Galeandra beyrichii*		SE		P							2								X						
Plant	Beach verbena, Coastal mock vervain	*Glandularia maritima*		SE		P	P						2	2,6													
Plant	Wild cotton, Upland cotton	*Gossypium hirsutum*		SE		P	P						2	2,													
Plant	Tropical govenia	*Govenia utriculata*		SE		H							2								X						
Plant	Holywood ITIS	*Guajacum sanctum*		SE				P							2,10						X						
Plant	Lignum-vitae	*Guaicacum officinale*			VE							P							12								
Plant	West Indian tufted airplant	*Guzmania monostachia*		SE		P	P						2	2,6													
Plant	Snowy orchid	*Habenaria nivea*		ST			P							2,6													
Plant	Needleroot airplant orchid	*Harrisella porrecta*		ST			P							2,5,6													
Plant	Simpson's applecactus	*Harrisia simpsonii*		SE		P		P					2		2												
Plant	Poeppig's rosemallow	*Hibiscus poeppigii*		SE		P	P						2	2													
Plant	Manchineel	*Hippomane mancinella*		SE		P		P					2		2, 10												
Plant	Hypclate, Inkwood	*Hypelate trifoliata*		SE		P							2														
Plant	Tawnberry, Tawnberry holly	*Ilex krugiana*		ST		P							2														
Plant	Delicate violet orchid	*Ionopsis utricularioides*		SE		H	P						2	2,5,6							X						
Plant	Calcareous morning-glory	*Ipomoea microdactyla glory*		SE		P							2														
Plant	Rockland morning-glory	*Ipomoea tenuissima*		SE		P	H						2	2,													
Plant	Pineland clustervine	*Jacquemontia curtisii*		ST		P	P						2	2,5,6													
Plant	Skyblue clustervine	*Jacquemontia pentanthos*		SE		P	P						2	2,5,6													
Plant	Beach clustervine	*Jacquemontia reclinata*	FE					P							22, 25												sand dunes
Plant	Joewood	*Jacquinia keyensis*		ST		P		P					2		2, 10												
Plant	Florida Keys thoroughwort	*Koanophyllon villosum*		SE		P							2														
Plant	White fenrose	*Kosteletzkya depressa*		SE		P							2										X				
Plant	Depressed shrubverbena	*Lantana depressa*		SE		P							2														
Plant	West coast lantana, Sanibel shrubverbena	*Lantana depressa var. sanibelensis*		SE		P	P						2	2,5,6													
Plant		*Leiphaimos parasitica*		SE		P		P					2		2												

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Plant	Catesby's lily, Pine lily	*Lilium catesbaei*		ST			P							2,													
Plant	Small's flax	*Linum carteri var. smallii*		SE		P	P						2	2,5,6													
Plant	Pantropical widelip orchid	*Liparis nervosa*		SE			E							2,							X						strand swamp
Plant	Holly vine fern	*Lomariopsis kunzeana*		SE		P							2								X						
Plant	Nodding club-moss	*Lycopodiella cernua*		C			P							2,													
Plant	Longgland orchid	*Macradenia lutescens*		SE		E							2								X						
Plant	Stingbush	*Malphigia infestissima*			VE							P							12								
Plant	Cow-itch, Cowage cherry	*Malphigia woodburyana*			VE							P							12								
Plant	Wolly nipple	*Mammilaria nivosa*			VE							P							12								
Plant		*Manilkara jaimiqui subsp. emarginata*		ST		P		P					2		2												
Plant	Hidden orchid	*Maxillaria crassifolia*		SE		E	P						2	2,5							X						
Plant	Florida mayten	*Maytenus phyllanthoides*		ST		P		P					2		2												
Plant	Pineland blackanthers	*Melanthera parvifolia*		ST		P	P						2	2,5,6													
Plant	Climbing vine fern	*Microgramma heterophylla*		SE		P	P	E					2	2,5,	2												
Plant	Sea lavender	*Mollatonia gnaphalodes*		SE				P							10												
Plant	Twinberry, Simpson's stopper	*Myrcianthes fragrans*		ST		P	P	P					2	2,5,6	2												
Plant	Giant sword fern	*Nephrolepis biserrata*		ST		P	P						2	2,5,6													
Plant	Ribbon fern	*Nevrodium lanceolatum*		SE				E							2								X				
Plant	Wild basil, Wild sweet basil	*Ocimum campechianum*		SE		P	H						2	2													
Plant	Clubbed creepingfern	*Odontosoria clavata*		SE		P							2														
Plant	Burrowing four o'clock	*Okenia hypogaea*		SE		E		P					2		2												
Plant	Florida dancinglady orchid	*Oncidium ensatum*		SE		P	P						2	2,							X						
Plant	Mule-ear orchid	*Oncidium undulatum*		SE		P							2								X						
Plant	Hand fern	*Ophioglossum palmatum*		SE		E	P						2	2,5													
Plant	Semaphore pricklypear	*Opuntia corallicola*	C	SE				P							1, 2, 22, 25								X				
Plant	Erect pricklypear	*Opuntia stricta*		ST		P	P	P	P				2	2	2, 10	2											
Plant	Royal fern	*Osmunda regalis var. spectabilis*		C			P							2,5,6													
Plant	Ribbon fern	*Paltonium lanceolatum*		ST				P							10								X				
Plant	Chapman's bristlegrass	*Paspalidium chapmanii*		SE		P							2														
Plant	White flower passionflower	*Passiflora multiflora*		SE		P		P					2		2												
Plant	Pineland passionflower	*Passiflora pallens*		SE		P	P						2	2,5													
Plant	Goatsfoot	*Passiflora sexflora goatsfoot*		SE		P							2								X						
Plant	Swampbush	*Pavonia paludicola*		SE		P							2								?		X				
Plant	Plume polypody	*Pecluma plumula*		SE		P							2								X						
Plant	Comb polypody	*Pecluma ptilodon var. caespitosa*		SE			H							2,													
Plant	Cypress peperomia	*Peperomia glabella*		SE			E							2,6							X						
Plant	Low peperomia	*Peperomia humilis*		SE		P							2								X						
Plant	Florida peperomia, Baby rubberplant	*Peperomia obtusifolia*		SE		P	P						2	2,5,6													
Plant	Yerba linda	*Peperomia rotundifolia*		SE			P							2,6							X						
Plant	Mahogany mistletoe	*Phoradendron rubrum*		SE				P							2							X					
Plant	Southern fogfruit	*Phyla stoechadifolia*		SE		P	P						2	2													
Plant	Bitterbrush	*Picramnia pentandra*		SE		P							2								X						
Plant	Florida Keys blackbean	*Pithecellobium keyense*		ST		P		P					2		2												
Plant	Flor de Llanten	*Pleurothallis gelida Llanter*		SE		E							2								X						
Plant		*Poinsettia pinetorum*		SE		P							2														
Plant	Ghost orchid, Palmplolly	*Polyradicion lindenii*		SE		E	P						2	2,5,6													
Plant	Greater yellowspike orchid	*Polystachya concreta*		SE		P	P	E					2	2,5,6	2												
Plant	Mrs. Britton's shadow witch	*Ponthieva brittoniae*		SE		P							2								X						
Plant	Small Prescott's orchid	*Prescotia oligantha*		SE		P							2								X						
Plant	West Indian cherry	*Prunus myrtifolia*		ST		P							2														

Appendix I. SFCN Federal, State, and Territorial Endangered Species, Threatened Species, and Species of Special Concern

Printed 9/19/2006

			Legal Status			Presence Status							References							Habitats							
Taxa	**Common name**	**Scientific name**	**Federal Status**	**Florida Status (19, 20)**	**VIIS Status (21)**	**EVER**	**BICY**	**BISC**	**DRTO**	**VIIS**	**BUIS**	**SARI**	**EVER**	**BICY**	**BISC**	**DRTO**	**VIIS**	**BUIS**	**SARI**	**Wet prairie & marsh**	**Forested uplands & wetlands**	**Island interior**	**Coastal Wetlands**	**Florida Bay**	**Biscayne Bay**	**Coastal shelf/ Deep Oceanic**	
Plant	Sargent's cherry palm	*Pseudophoenix sargentii*		SE				P							2, 10							X					
Plant	Mangroveberry, Long-stalk stopper	*Psidium longipes*		ST		P							2														
Plant	Bahama ladder brake	*Pteris bahamensis*		ST		P	P	P					2	2,5,6	2												
Plant	Darlingplum	*Reynosia septentrionalis*		ST		H		P					2		2												
Plant	Mistletoe cactus	*Rhipsalis baccifera*		SE		P							2								X						
Plant	Small-leaf snoutbean	*Rhynchosia parvifolia*		ST		P							2														
Plant	Swartz's snoutbean	*Rhynchosia swartzii*		SE			P	P						2	2						X	X					
Plant	Royal palm, Florida royal palm	*Roystonea regia*		SE		P	P						2	2,5,6													
Plant	Bahama sachsia	*Sachsia polycephala*		ST		P							2														
Plant	Leafless beaked lady's-tresses	*Sacoila lanceolata*		ST		P	P						2	2,													
Plant		*Sacoila lanceolata var. paludicola*		ST		P							2														
Plant	Gullfeed	*Scaevola plumieri*		ST		P		E	P				2		2	2											
Plant	Florida boxwood	*Schaefferia frutescens*		SE		P		P					2		2												
Plant	Ray fern	*Schizaea pennula*		SE		E	P						2	2,5,							X						
Plant	Florida Keys nutrush	*Scleria lithosperma*		SE		P	P						2	2,5,													
Plant	Havana skullcap	*Scutellaria havanensis*		SE		P							2														
Plant		*Selaginella armata var. eatonii*		SE		P							2														
Plant	Chapman's senna	*Senna mexicana var. chapmanii*		ST		P							2														
Plant	Everglades bully	*Sideroxylon reclinatum subsp. austrofloridense*	C			P	P						22, 25	2,5,							X						
Plant	Everglades greenbrier	*Smilax havanensis*		ST		P		P					2		2												
Plant	Mullein nightshade	*Solanum verbascifolium*		ST		P	P						2	2,5,6													
Plant	Everglades Keys false buttonweed	*Spermacoce terminalis*		ST		P	P						2	2,5,													
Plant	Texas lady's-tresses	*Spiranthes brevilabris*		SE			H							2,							X						
Plant	Costa Rican lady's-tresses	*Spiranthes costaricensis*		SE		P							2								X						
Plant	Lacelip lady's-tresses	*Spiranthes laciniata*		ST		P	P						2	2													
Plant	Longlip lady's-tresses	*Spiranthes longilabris*		ST			P							2,													
Plant	Florida Keys lady's-tresses	*Spiranthes polyantha*		SE				E							2							X					
Plant	Southern lady's-tresses	*Spiranthes torta*		SE		P	H						2	2						X	X						
Plant	Everglade Key lady's-tresses	*Stylosanthes calcicola pencilflower*		SE		P							2														
Plant	Bay cedar	*Suriana maritima*		SE				P							10												
Plant	West Indian mahogany	*Swietenia mahagoni*		ST		P	P	P					2	2	2, 10												
Plant	Least halberd-fern	*Tectaria fimbriata*		SE		P							2														
Plant	Broad halberd fern	*Tectaria heracleifolia*		ST		P	H						2	2,5													
Plant	Florida clover ash	*Tetrazygia bicolor*		ST		P							2														
Plant	Abruptip maiden fern	*Thelypteris augescens*		ST		P							2														
Plant	Creeping maiden fern	*Thelypteris reptans*		SE		P							2														
Plant	Lattice-vein fern	*Thelypteris reticulata*		SE		P	P						2	2							X						
Plant	Stiff star-hair fern	*Thelypteris sclerophylla*		SE		E							2								X						
Plant	Toothed lattice-vein fern	*Thelypteris serrata*		SE		P							2														
Plant	Aspidium fern	*Thelypterus kunthii*		ST				P							10												
Plant	Key thatch palm	*Thrinax morrisii*		SE		E		P					2		2												
Plant	Florida thatch palm	*Thrinax radiata*		SE		P		P					2		2												
Plant	Reflexed wild-pine, Northern needleleaf	*Tillandsia balbisiana*		ST		P	P	P					2	2,5,6	2												
Plant	Clubspike cardinal airplant	*Tillandsia fasciculata var. clavispica*		SE		H							2								X						
Plant	Stiff-leaved wild-pine, Cardinal airplant	*Tillandsia fasciculata var. densispica*		SE		P	P	P	P				2	2,5,6	2	2											
Plant	Banded wild-pine, Twisted airplant	*Tillandsia flexuosa*		ST		P	P	P					2	2,5,6	2, 10												
Plant	Hoary wild-pine, Fuzzywuzzy airplant	*Tillandsia pruinosa*		SE			P							2,5,6													
Plant	Giant wild-pine, Giant airplant	*Tillandsia utriculata*		ST		P	P	P					2	2,5,6	2, 10												
Plant	Soft-leaved wild-pine, Leatherleaf airplant	*Tillandsia variabilis*		ST		P	P						2	2,5,6													
Plant	Chiggery grapes	*Tournefortia hirsutissima*		SE		P	P						2	2,5,													
Plant	Florida Keys noseburn	*Tragia saxicola*		ST		P							2														
Plant	Lamarck's thema	*Trema lamarckianum*		SE		P		P					2		2												

Appendix I. SFCN Federal, State, and Territorial Endangered Species, Threatened Species, and Species of Special Concern

Printed **9/19/2006**

			Legal Status			Presence Status							References							Habitats						
Taxa	**Common name**	**Scientific name**	**Federal Status**	**Florida Status (19, 20)**	**VIIS Status (21)**	**EVER**	**BICY**	**BISC**	**DRTO**	**VIIS**	**BUIS**	**SARI**	**EVER**	**BICY**	**BISC**	**DRTO**	**VIIS**	**BUIS**	**SARI**	**Wet prairie & marsh**	**Forested uplands & wetlands**	**Island interior**	**Coastal Wetlands**	**Florida Bay**	**Biscayne Bay**	**Coastal shelf/ Deep Oceanic**
Plant	Entire-winged bristle fern	*Trichomanes holopterum*		SE			P							2,5,							X					
Plant	Kraus' bristle fern	*Trichomanes krausii*		SE		E							2								X					
Plant	Florida bristle fern	*Trichomanes punctatum subsp. floridanum*		SE		E							2								X					
Plant	Florida gamagrass	*Tripsacum floridanum*		ST		P	P						2	2,5,6												
Plant	Pearlberry	*Vallesia antillana*		SE		E		P					2		2						X		X			
Plant	Wormvine orchid	*Vanilla barbellata*		SE		P							2													
Plant	Mrs. Lott's vanilla	*Vanilla dilloniana*		SE		H							2								X					
Plant	Leafy vanilla	*Vanilla phaeantha*		SE		E							2													
Plant	St. Thomas pricklyash	*Zanthoxylum thomasianum*	FE							P							1, 22, 25									
Plant	Rain-lily, Redmargin zephyrlily	*Zephyranthes simpsonii*		ST			H							2,6												

Federal Status Codes
- FE Federally Endangered
- FT Federally Threatened
- C Candidate
- SA Simularity of Appearance with federally listed species

State Listed Codes
- SE State Endangered
- ST State Threatened
- SSC State Species of Special Concern

U.S. Virgin Islands Status Codes
- VE U.S. Virgin Islands Territorially Endangered

Presence Status
- P Present
- H Historical Record
- E Presumed Extirpated or Extinct

Habitat Status
- f feeding habitat
- b breeding/reproduction habitat
- r resting/roosting habitat
- X presence

References for Appendix I

Ref. #	Source
1	Source of Data: NPSpecies Database Date of Data Source: Queried on 4/29/2005 Location of Data Source: National Park Service Inventory and Monitoring Program database cataloging species within parks. Database maintained in Fort Collins, CO. http://science.nature.nps.gov/im/apps/npspp/ Other (Methodology, Preparer, etc.): NPS-South Florida Caribbean Network queries can be made by Brian Witcher (Database Manager, 305-252-0347, brian_witcher@nps.gov) Metadata Prepared by: Andrea J. Atkinson, NPS-SFCN
2	Source of Data: "Floristic Inventory of South Florida Database" Date of Data Source: 2005. Queried 6/13/2005 Location of Data Source: The Institute for Regional Conservation, 22601 S.W. 152 Ave., Miami, Florida 33170; URL: www.regionalconservation.org Other (Methodology, Preparer, etc.): Database preparers are George D. Gann, Keith A. Bradley, and Steven W. Woodmansee. Metadata Prepared by: Andrea J. Atkinson, NPS-SFCN
3	Source of Data: "Strategic Plan for Big Cypress National Preserve: Oct. 1, 2001 – Sept. 30, 2005" Date of Data Source: 10/23/2000 Location of Data Source: URL http://www.nps.gov/bicy/bicyclen2.htm#strat Other (Methodology, Preparer, etc.): Metadata Prepared by: Andrea J. Atkinson, NPS-SFCN
4	Source of Data: "Listed Wildlife Species in Big Cypress National Preserve", Date of Data Source: File date is 2/7/2002. Downloaded 6/13/2005 Location of Data Source: Big Cypress National Preserve web page http://www.nps.gov/bicy/tne.pdf Other (Methodology, Preparer, etc.): No author of the document is given Metadata Prepared by: Andrea J. Atkinson, NPS-SFCN
5	Source of Data: Floristic Inventory of Big Cypress National Preserve Vegetation Transects Database titled "BICYFloraEdited" Date of Data Source: 2005 Location of Data Source: NPS South Florida Caribbean Office, 18001 Old Cutler Rd., Suite 419, Village of Palmetto Bay, FL 33157. Phone: 305-252-0347 Other (Methodology, Preparer, etc.): Contains results from 600 vegetation transects plus supplemental data from a Floristic Inventory of Big Cypress National Preserve conducted by Institute for Regional Conservation from 2002-2004. Report is pending. Metadata Prepared by: Andrea J. Atkinson, NPS-SFCN

References for Appendix I

Ref. #	Source
6	Source of Data: "Scope of Work: Inventory of vascular plant species at selected sites within the Big Cypress National Preserve, Appendix A: Vascular plants in Big Cypress National Preserve (BICY) listed as endangered, threatened or commercially exploited. Big Cypress National Preserve, USGS, Biological Resources Division." Date of Data Source: 2001 Location of Data Source: NPS South Florida Caribbean Office, 18001 Old Cutler Rd., Suite 419, Village of Palmetto Bay, FL 33157. Phone: 305-252-0347 Other (Methodology, Preparer, etc.): The description for how Appendix A was compiled is as follows—"Status: State of Florida. Status of plants was determined from a listing by Coile (1998); presence of plant species was determined from a checklist produced by Black and Black (1980) with subsequent collections and annotations to that list. Status: Federal. No species noted here were indicated on a federal list of endangered or threatened plants. Taxonomy and common names follow Wunderlin (1998); names used by Black and Black (1980), if different, are indicated in
7	BUIS park web page http://www.nps.gov/buis/index.htm
8	EVER park web page http://www.nps.gov/ever/eco/toofew.htm
9	BISC park web page http://www.nps.gov/bisc/resource/endspc.htm
10	BISC park web page http://www.nps.gov/bisc/resource/florida.htm
11	Personal observation by DRTO park staff, Jan. 2005
12	Kendall, M.S., L. T. Takata, O. Jensen, Z. Hillis-Starr, and M.E. Monaco. 2005 DRAFT. An Ecological Characterization of the Salt River Bay National Historical Park and Ecological Preserve, U.S. Virgin Islands. NOAA Technical Memorandum NOS NCCOS 14. April 2005. 116 pages.
13	USFWS. 1993. Caribbean Roseate Tern Recovery Plan. USFWS Atlanta Georgia, 40 pp. URL: http://ecos.fws.gov/docs/recovery_plans/1983/830924.pdf
14	National Marine Fisheries Service and U.S. Fish and Wildlife Service.1 992. Recovery Plan for Leatherback Turtles in the U.S. Caribbean, Atlantic and Gulf of Mexico. National Marine Fisheries Service, Washington, D.C. URL: http://ecos.fws.gov/docs/recovery_plans/1992/920406.pdf
15	Mayor, P. A., Z. M. Hillis-Starr, and K. K. Woody. 2003. Buck Island Reef Sea Turtle Research Program Data Summary 2002. National Park Service Buck Island Reef National Monument, 2100 Church Street, #100, Christiansted, St. Croix, USVI 00820. 14 pages.
16	EVER park web page http://www.nps.gov/ever/eco/birds.htm
17	EVER park web page http://www.nps.gov/ever/eco/mammals.htm
18	EVER park web page http://www.nps.gov/ever/eco/herps.htm
19	Florida Fish and Wildlife Conservation Commission. 2004. Florida's Endangered Species, Threatened Species, and Species of Special Concern. January 29, 2004. 6 pages. URL: http://myfwc.com/imperiledspecies//pdf/Endangered-Threatened-Special-Concern-2004.pdf
20	Coile, N. C., and M. A. Garland. 2003. Notes on Florida's Endangered and Threatened Plants. Botany Contribution No. 38, 4th Edition. Prepared for Florida Department of Agriculture and Consumer Services, Div. Plant Industry, Gainesville. 122 pages. URL: http://www.doacs.state.fl.us/pi/enpp/botany/images/Notes2003.pdf

References for Appendix I

Ref. #	Source
21	U.S. Virgin Islands Department of Planning and Natural Resources Division of Fish and Wildlife. 2005. Comprehensive Wildlife Conservation Strategy for the U. S. Virgin Islands. June 1. 2005. 216 pages. URL: http://www.vifishandwildlife.com/Wildlife/05F01WildlifePlan/Part%201%20Introduction/table%20of%20contents.htm
22	Source of Data: “NR-MAP Database” Date of Data Source: 2005. Queried 7/25/2005 Location of Data Source: NPS, Office of Natural Resource Information Systems, Fort Collins, Colorado Other (Methodology, Preparer, etc.): Database preparers are Tim Goddard, Gary Mason, Peter Dratch, Julie Allen Metadata Prepared by: Andrea J. Atkinson, NPS-SFCN
23	Source of Data: “Coral Database” & personal observation of Matt Patterson, William "Jeff" Miller Date of Data Source: 2005. Queried 7/25/2005 Location of Data Source: NPS, SFCN Other (Methodology, Preparer, etc.): Jeff Miller, Rob Waara, Brian Witcher Metadata Prepared by: Andrea J. Atkinson, NPS-SFCN
24	Adams, W. F., C. M. Bailey, S. Branstetter, G. H. Burgess, J. I. Castro, J. L. Lee, and J. A. Musick. December 2000. Status Review of Smalltooth Sawfish (Pristis pectinata). http://isurus.mote.org/~colins/Smalltooth_sawfish.pdf
25	Source of Data: NPS ESA database Date of Data Source: Queried 8/11/2005 Location of Data Source: NPS Other: Cherry Green Metadata Prepared by: Andrea J. Atkinson, NPS-SFCN
26	Watson, Keith. November 2003. DRAFT Avian Conservation Implementation Plan, Salt River Bay National Historic Park and Ecologica Preserve, National Park Service, Southeast Region. Technical Report Prepared for National Park Service South Florida / Caribbean Network. 41 Pages.
27	Watson, Keith. November 2003. DRAFT Avian Conservation Implementation, Plan Virgin Islands National Park, National Park Service, Southeast Region. Technical Report Prepared for National Park Service South Florida / Caribbean Network. 40 Pages.
28	Watson, Keith. November 2003. DRAFT Avian Conservation Implementation Plan, Buck Island Reef National Monument, National Park Service, Southeast Region. Technical Report Prepared for National Park Service South Florida / Caribbean Network. 36 Pages.
29	Watson, Keith. November 2003. DRAFT Avian Conservation Implementation Plan, Dry Tortugas National Park, National Park Service, Southeast Region. Technical Report Prepared for National Park Service South Florida / Caribbean Network. 41 Pages.
30	Watson, Keith. November 2003. DRAFT Avian Conservation Implementation Plan, Biscayne National Park, National Park Service, Southeast Region. Technical Report Prepared for National Park Service South Florida / Caribbean Network. 38 Pages.
31	Watson, Keith. November 2003. DRAFT Avian Conservation Implementation Plan, Big Cypress National Preserve, National Park Service, Southeast Region. Technical Report Prepared for National Park Service South Florida / Caribbean Network. 39 Pages.
32	Watson, Keith. November 2003. DRAFT Avian Conservation Implementation Plan, Everglades National Park, National Park Service, Southeast Region. Technical Report Prepared for National Park Service South Florida / Caribbean Network. 39 Pages.

APPENDIX J

ACRONYMS

APPENDIX J. ACRONYMS

BICY	Big Cypress National Preserve
BISC	Biscayne National Park
BUIS	Buck Island Reef National Monument
CERP	Comprehensive Everglades Restoration Plan
DRTO	Dry Tortugas National Park
EVER	Everglades National Park
FWS	U.S. Fish and Wildlife Service
GPRA	Government Performance and Results Act
I & M	Inventory and Monitoring Program
NOAA	National Oceanic and Atmospheric Administration
NPS	U.S. National Park Service
NWR	National Wildlife Refuge
SARI	Salt River Bay National Historic Park and Ecological Preserve
SFCN	South Florida/Caribbean Network
SFWMD	South Florida Water Management District
USGS	U.S. Geological Survey
USVI	U. S. Virgin Islands
VICR	Virgin Islands Coral Reef National Monument
VIIS	Virgin Islands National Park
VIRR	Virgin Islands Rules and Regulations
WCA	Water Conservation Area
WMA	Wildlife Management Area

APPENDIX K

GLOSSARY

APPENDIX K. GLOSSARY

Adaptive Management a systematic process for continually improving management policies and practices by learning from the outcomes of operational programs. Its most effective form-"active" adaptive management-employs management programs that are designed to experimentally compare selected policies or practices, by implementing management actions explicitly designed to generate information useful for evaluating alternative hypotheses about the system being managed.

Attributes: any living or nonliving feature or process of the environment that can be measured or estimated and that provide insights into the state of the ecosystem. The term **Indicator** is reserved for a subset of attributes that is particularly information-rich in the sense that their values are somehow indicative of the quality, health, or integrity of the larger ecological system to which they belong (Noon 2003). See Indicator.

Baseline is the condition of system or variable of interest that provides a standard against which future change of the system is measured. This can refer to an initial vegetation map of the system, to the first 3-10 years of the implementation of a monitoring protocol in which the baseline is defined by the mean and variability in the system, or it could refer to conditions at some point in the past.

Conceptual model – (1) purposeful representations of reality that provide a mental picture of how something works to communicate that explanation to others. (2) "Explicit statements of the hypothesized functional relationships underlying management decisions regarding environmental resources." [A Proposal for the Development of a Comprehensive Monitoring Assessment and Research Program, April 24, 1998, page 30]; (3) "A simple non-quantitative model, developed for the purpose of building a consensus regarding the most important ecological elements and linkages that characterize a stressed ecosystem." [Nick Aumen, Conceptual Modeling Workshop, UC Davis, June 17-18, 1998]

Covariate is a variable such as precipitation or air temperature that is used in analyses to explain some of the variance in a variable of interest. For example, if animal detectability is temperature dependent, measuring temperature as a covariate will make it easier to detect population trends or experimental treatment effects.

Ecological integrity is a concept that expresses the degree to which the physical, chemical, and biological components (including composition, structure, and process) of an ecosystem and their relationships are present, functioning, and capable of self-renewal. Ecological integrity implies the presence of appropriate species, populations and communities and the occurrence of ecological processes at appropriate rates and scales as well as the environmental conditions that support these taxa and processes.

Ecological zone is a large unit of the SFCN landscape assumed to be affected by similar physical drivers and stressors. Each zone may contain multiple vegetation communities. The management challenge in some of these ecological zones is to maintain an appropriate balance of vegetation communities through management of system drivers

and anthropogenic stressors, i.e. managing fire across the park to maintain a balance of slash pine communities as well as hardwood hammocks. The seven ecological zones in the South Florida and Caribbean network are: “Wet Prairies and Marshes”, “Forest Uplands and Wetlands”, “Mangroves, Beaches and Tidal Wetlands”, “Island Interior”, “Florida Bay”, “Biscayne Bay”, and “Coastal Shelf and Deep Oceanic”.

Ecosystem is defined as, "a spatially explicit unit of the Earth that includes all of the organisms, along with all components of the abiotic environment within its boundaries" (Likens 1992).

Ecosystem management is the process of land-use decision making and land-management practice that takes into account the full suite of organisms and processes that characterize and comprise the ecosystem and is based on the best understanding currently available as to how the ecosystem works. Ecosystem management includes a primary goal of sustainability of ecosystem structure and function, recognition that ecosystems are spatially and temporally dynamic, and acceptance of the dictum that ecosystem function depends on ecosystem structure and diversity. Coordination of land-use decisions is implied by the whole-system focus of ecosystem management.

Edaphic means of or relating to soil, especially as it affects living organisms. Influenced by the soil rather than by the climate. (American Heritage Dictionary, 4th edition)

Focal resources are park resources that, by virtue of their special protection, public appeal, or other management significance, have paramount importance for monitoring regardless of current threats or whether they would be monitored as an indication of ecosystem integrity. Focal resources might include ecological processes such as deposition rates of nitrates and sulfates in certain parks, or they may be a species that is harvested, endemic, alien, or has protected status.

Habitats – Areas that provide specific conditions (e.g., temperature, moisture, soils, vegetation, and cover) necessary to support a community of organisms adapted to life under those conditions.

Halophytic means composed of plants adapted to living in a saline environment.

Hydric means having or characterized by excessive moisture; "a hydric habitat" (WordNet ® 2.0, © 2003 Princeton University)

Indicators are a subset of monitoring attributes that are particularly information-rich in the sense that their values are somehow indicative of the quality, health, or integrity of the larger ecological system to which they belong (Noon 2002). Indicators are a selected subset of the physical, chemical, and biological elements and processes of natural systems that are selected to represent the overall health or condition of the system, known or hypothesized effects of stressors, or elements that have important human values.

Invasive species – A species that is non-native to the ecosystem under consideration and whose introduction causes or is likely to cause economic or environmental harm or harm

to human health (Executive Order 13112; http://www.invasivespecies.gov/laws/execorder.shtml). Invasive species can be plants, animals, and other organisms (e.g., microbes). Human actions are the primary means of invasive species introductions.

Inventory is an extensive point-in-time survey to determine the presence/absence, location or condition of a biotic or abiotic resource.

Measures specific feature(s) used to quantify an indicator, as specified in a sampling protocol. For example, pH, temperature, dissolved oxygen, and specific conductivity are all measures of water chemistry.

Mesic means having or characterized by moderate or a well-balanced supply of moisture; "mesic habitats" (WordNet ® 2.0, © 2003 Princeton University)

Mesohaline is water containing 30-34 ppt salinity.

Metadata: Data about data. Metadata describes the content, quality, condition, and other characteristics of data. It's purpose it to help organize and maintain a organization's internal investment in spatial data, provide information about an organization's data holdings to data catalogues, clearinghouses, and brokerages, and provide information to process and interpret data received through a transfer from an external source.

Monitoring is the collection and analysis of repeated observations or measurements to evaluate changes in condition and progress toward meeting a management objective (Elzinga et al. 1998). Detection of a change or trend may trigger a management action, or it may generate a new line of inquiry. Monitoring is often done by sampling the same sites over time, and these sites may be a subset of the sites sampled for the initial inventory.

Monitoring variable (see *Measures*)

Non-indigenous species – Also called exotic, invasive, introduced, or non-native species. Plants and animals that originate from geographic regions other than the ones that they are found in and, in the case of SFCN parks, originate from areas outside of Florida and the Virgin Islands. They may dominate the local species or have other negative impacts on the environment. They are typically spread to new areas through human activities, either accidentally (Norway rats *(Rattus norvegicus)* hitched rides aboard ships) or deliberately (Eucalyptus was originally introduced as an ornamental). The principle difference between an “invasive” species and a “non-indigenous” species is invasive species are defined as causing harm.

Oligohaline is water containing up to 30 ppt salinity.

Oligotrophic means lacking in plant nutrients and having a large amount of dissolved oxygen throughout. (American Heritage Dictionary, 4th Edition)

Protocols as used by this program, are detailed study plans that explain how data are to be collected, managed, analyzed and reported and are a key component of quality assurance for natural resource monitoring programs (Oakley et al. 2003).

State of the environment means the integrated manifestation of ecological processes, biological composition, ecological function, and rates of change that results in the condition of the system at any given time.

Stressors are physical, chemical, or biological perturbations to a system that are either (a) foreign to that system or (b) natural to the system but applied at an excessive [or deficient] level (Barrett et al. 1976:192). Stressors cause significant changes in the ecological components, patterns and processes in natural systems. Examples include water withdrawal, pesticide use, timber harvesting, traffic emissions, stream acidification, trampling, poaching, land-use change, and air pollution.

System drivers are physical driving forces such as climate, fire cycles, hydrologic cycles, and natural disturbance events (e.g., earthquakes, droughts, floods) that have large scale influences on natural systems. Biota that physically re-shape the environment are also included such as alligators and beavers.

Trend: as used by this program, refers to directional change measured in resources by monitoring their condition over time. Trends can be measured by examining individual change (change experienced by individual sample units) or by examining net change (change in mean response of all sample units).

Vital Signs, as used by the National Park Service, are synonymous with Indicator, and are defined as any measurable feature of the environment that provides insights into changes in the state of the ecosystem. Vital signs are intended to track changes in a subset of park resources and processes that are determined to be the most significant indicators of ecological condition of those specific resources that are of the greatest concern to each park. This subset of resources and processes is part of the total suite of natural resources that park managers are directed to preserve “unimpaired for future generations,” including water, air, geological resources, plants and animals, and the various ecological, biological, and physical processes that act on these resources. Vital signs may occur at any level of organization including landscape, community, population, or genetic levels, and may be compositional (referring to the variety of elements in the system), structural (referring to the organization or pattern of the system), or functional (referring to ecological processes).

Xeric means being deficient in moisture; "deserts provide xeric environments" (WordNet ® 2.0, © 2003 Princeton University)

APPENDIX L

Avian Implementation Plans

L.1 Big Cypress National Preserve
L.2 Biscayne National Park
L.3 Buck Island Reef National Monument
L.4 Dry Tortugas National Park
L.5 Everglades National Park
L.6 Virgin Islands National Park and Coral Reef National Monument.

APPENDIX L.1

BIG CYPRESS NATIONAL PRESERVE

FINAL DRAFT

Avian Conservation Implementation Plan
Big Cypress National Preserve

National Park Service
Southeast Region

Compiled by J. Keith Watson
U.S. Fish and Wildlife Service
In cooperation with

BICY Resource Management Staff, National Park Service
And Bird Conservation Partners
January 2005

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Florida's Endangered Species, Threatened Species, and Species of Special Concern
US Fish and Wildlife Service, Species of Conservation Concern 2002, Peninsular Florida (BCR 31)

Introduction

This Avian Conservation Implementation Plan (ACIP) is provided to the staff at Big Cypress National Preserve (BICY) to help identify and prioritize bird conservation opportunities, and to provide information and guidance for the successful implementation of needed conservation activities. This plan may identify goals, strategies, partnerships, and perhaps specific projects for the preserve to participate in existing bird conservation planning and implementation efforts associated with the North American Bird Conservation Initiative (NABCI). Under the auspice of NABCI, appropriate bird and habitat conservation goals may be recommended as identified in the appropriate existing national or regional bird conservation efforts aligned with this initiative: Partners In Flight (PIF), North American Waterfowl Management Plan (NAWMP), US Shorebird Conservation Plan (USSCP), and Waterbird Conservation for the Americas (WCA). For example, parks in the Appalachians and the Cumberland Plateau will have few if any high priority waterbird conservation issues at a regional landscape or greater scale. As such, little information regarding waterbird conservation will be presented in the ACIP, unless there is an identified park need for this species group, or other mandates, such as federal laws. Similarly, because BICY has a mix of habitat types, recommendations will be derived from the appropriate existing planning document priorities, with an emphasis on waterbirds, including marshbirds, and landbirds. However, all high priority bird conservation issues for BICY will be discussed and integrated as appropriate.

Information and data presented in the ACIP have been obtained from several sources: 1) interviews with BICY staff 2) BICY bird conservation partners 3) the PIF Subtropical Florida Bird Conservation Plan Executive Summary 4) NPS databases, 5) peer reviewed bird conservation and management literature, and 6) personal communications with bird conservation specialists throughout North America, especially in the southeastern United States. This plan has been reviewed by BICY resource management staff and managers, South Florida/Caribbean Inventory and Monitoring (AHN I&M) Network staff, and bird conservation partners and approved by BICY management. Optimally, this plan will be incorporated into the preserve's Resource Management Plan (RMP) and updated annually to reflect completed projects, newly identified needs, and shifts in bird conservation priorities in the region.

BICY is not obligated to undertake any of the proposed actions in this plan. The plan is provided to offer guidance to BICY to voluntarily support important preserve, regional, and perhaps national and international bird conservation projects for which BICY is a primary participant in the proposed actions.

Background

During the past thirty years, monitoring programs across North America have documented declines of certain bird species populations and their habitats, often severe (Sauer et al. 2000). The decline has caused great concern among scientists, biologists,

biodiversity proponents, ecologists, land managers, etc., and the bird conservation community in general. Birds are recognized as critical components of local and global genetic, species, and population diversity, providing important and often critical ecological, social, economic, and cultural values. Their overall decline has stimulated a worldwide focus on conservation efforts and North American interest in bird conservation is rapidly becoming a focus of government, non-government, industry, and private interests and expenditures.

Many state, federal, and non-governmental wildlife agencies and non-government organizations (NGO's) have recognized this alarming bird decline trend and have joined forces in several extensive partnerships to address the conservation needs of various bird groups and their habitats. The primary initiatives are:

- North American Waterfowl Management Plan
- Partners in Flight
- U.S. Shorebird Conservation Plan
- Waterbird Conservation for the Americas

The North American Bird Conservation Initiative: While efforts associated with these plans have generated some successes, it has been increasingly recognized that the overlapping conservation interests of these initiatives can be better served through more integrated planning and delivery of bird conservation. The *North American Bird Conservation Initiative (NABCI*; http://www.nabci-us.org/main2.html*)* arose out of this realization. The vision of NABCI is simply to see ***"populations and habitats of North America's birds protected, restored and enhanced through coordinated efforts at international, national, regional, state and local levels, guided by sound science and effective management."*** NABCI seeks to accomplish this vision through (1) broadening bird conservation partnerships, (2) working to increase the financial resources available for bird conservation in the U.S., and (3) enhancing the effectiveness of those resources and partnerships by facilitating integrated bird conservation (U.S. NABCI Committee 2000). Together, the four bird conservation initiatives mentioned above, as well as several other local and regional partnerships, work collectively to pursue this vision.

NABCI is guided by a set of principles that establish an operational framework within which the Initiative and its partners may conduct integrated bird conservation in the U.S. These will articulate a common understanding of the relationship between NABCI, the individual bird conservation initiatives, and all partner entities to ensure recognition of existing federal legislative and international treaty obligations, state authorities, and respect for the identity and autonomy of each initiative. The fundamental components of the conservation approach to be used by NABCI are expressed within its goal:

> ***To deliver the full spectrum of bird conservation through regionally-based, biologically-driven, landscape-oriented partnerships.***

The Southeastern Bird Conservation Initiative: National Park Service: In 1999, the Southeast Region of the National Park Service (NPS) recognized the importance of coordinating existing bird conservation goals into planning and operations of national park units in the southeast, that is, integration of NABCI. In support of this recognition, the Southeast Regional Office NPS approved and allocated eighty-eight thousand dollars, cost sharing 1:1 with the US Fish and Wildlife Service (FWS) Region 4 (Southeast) to hire a biologist to conduct this two-year project (Interagency Agreement FS028 01 0368). This project is unique in the NPS, and perhaps the nation, and represents a potential model for better coordinating regional bird conservation programs and activities within and outside the NPS. It further represents a progressive action toward institutionalizing bird conservation as a programmatic priority in the Southeast Region of NPS, and potentially the nation.

As envisioned, the integration of NABCI into the Southeastern NPS involves:

1) Development and delivery of Avian Conservation Implementation Plans
2) Coordination with NPS Inventory and Monitoring Program,
3) Development of a web based project site,
4) Establishment or enhancement of bird conservation partnerships,
5) Identification and exploration of potential funding opportunities, and
6) Technical guidance and assistance as needed or requested.

This ACIP fulfills one aspect of the plan outlined above, and serves as a basis for future bird conservation actions in BICY and with adjacent partners or landowners.

Concurrently, the development of a Memorandum of Understanding (MOU) between the FWS and the NPS (Appendix A) to implement Presidential Executive Order (EO) 13186, Responsibilities of Federal Agencies to Protect Migratory Birds (US Government 2000), calls for integration of programs and recommendations of existing bird conservation efforts into preserve planning and operations. Complementing each other, the MOU and the Southeastern Bird Conservation Initiative will advance bird conservation in the Southeast Region of the NPS beyond current regional NPS efforts.

Role of NPS in Avian Conservation

The interagency agreement that facilitates this partnership supports both FWS and NPS management policies. Specifically for the NPS, the agreement supports and advances the Strategy for Collaboration, a visionary document developed and signed by the Southeast Natural Resource Leaders Advisory Group (SENRLAG 2000), a consortium of 13 land and resource management agencies in the Southeastern United States whose vision is to encourage and support cooperation in planning and managing the region's natural resources. Furthermore, the agreement is aligned with and implements a variety of NPS Management Polices (2001) including, but not limited to, External Threats and Opportunities, Environmental Leadership, Cooperative Planning, Land Protection, and especially Natural Resource Management that details policy and management guidelines which apply to bird conservation. Important policies in the

Natural Resource Management chapter include:

- Planning for Natural Resource Management
- Partnerships
- Restoration of Natural Systems
- Studies and Collection
- General Principles for Managing Biological Resources
- Plant and Animal Population Management Principles
- Management of Native Plants and Animals
- Management of Endangered Plants and Animals
- Management of Natural Landscapes
- Management of Exotic Species
- Pest Management
- Fire Management and
- Water Resource Management

The NPS is the fourth largest landowner in the United States, consisting of over 380 national park units covering 83 million acres of land and water with associated biotic resources (www.nps.gov). The 64 units in the Southeast Region of the NPS represent 16% of the total number of park units in the national park system and cover approximately 5% of the total land base in the entire system. Park units in the Southeast Region include national seashores (Canaveral National Seashore, Cape Hatteras National Seashore), national parks (Great Smoky Mountains National Park, Everglades National Park), national recreation areas (Big South Fork National Recreation Area), national preserves (Big Cypress National Preserve), national battlefields (Cowpens National Battlefield, Fort Donelson National Battlefield), national monuments (Ocmulgee National Monument), and others such as the Blue Ridge Parkway, Obed Wild and Scenic River, and Timicuan Ecological and Historic Preserve.

Southeast NPS units provide habitat for over 400 species of migrating, breeding, and wintering birds and include a wide range of Federal and State listed threatened and endangered species. Likewise, these units also provide nest, migration, and winter habitat for most of the eastern species identified in the national bird conservation plans in need of conservation attention.

Additionally, the NPS attracts over 280 million visitors to the parks each year, 120 million of these in the Southeast Region, affording excellent recreational bird watching and opportunities to strengthen bird conservation interpretation, outreach, and education programs. These opportunities, the NPS mission, policies, and organization all lead to the conclusion that the NPS is an extremely valuable partner and contributor to bird conservation in the region.

Nationally, the status of birds in national parks is largely unknown, although many parks have adequate knowledge regarding bird occurrence in the parks (http://www.npwrc.usgs.gov/resource/othrdata/chekbird/chekbird.htm). Parks often

play a role in ongoing regional bird conservation efforts. Indeed many of these parks are often important to regional, national, or international bird conservation, and many have been designated as Important Bird Areas (IBA's) by the National Audubon Society. To date, there are approximately 64 NPS units that are designated IBA's, 35 of which are considered of global importance (http://abcbirds.org/iba/aboutiba.htm). In the Southeast Region, the NPS has 13 IBA's.

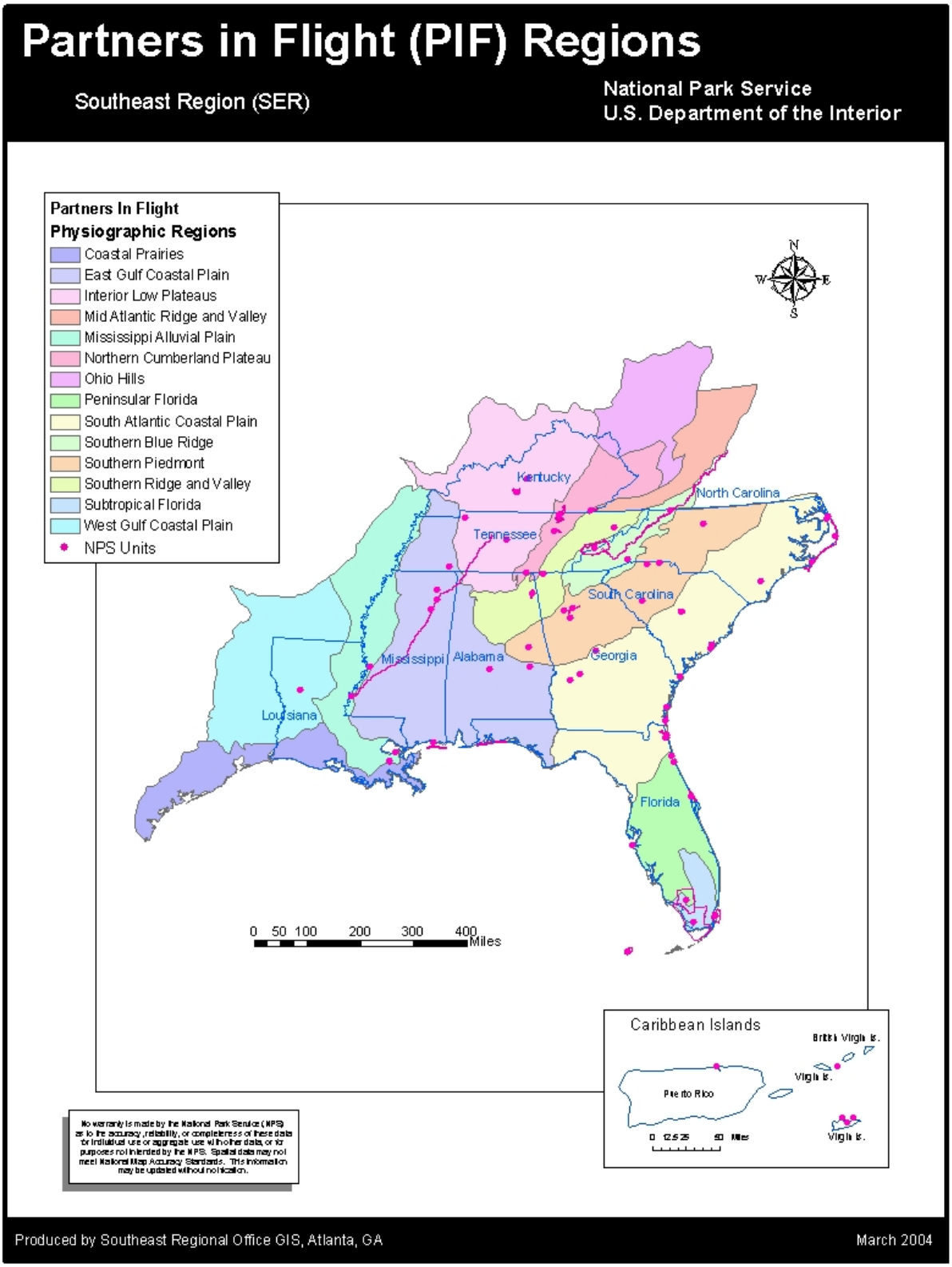
The NPS Inventory and Monitoring (I&M) Program has been developed to provide management driven scientific information to national park managers so that resources can be adequately protected within national parks. One of the first phases of this program is to inventory vertebrates, including birds, within the 260 national park units in the program. Once completed, data from the inventories will provide an account of the occurrence and abundance of birds in all the national parks in the program. These records will be stored in the NPS I&M NPSpecies database http://www.nature.nps.gov/im/apps/npspp/). Coordination with I&M network staff is important to developing long-term bird monitoring programs that fulfill both park and NABCI objectives.

Park Flight is a NPS international partnership initiative that directs funding toward a variety of NPS programs that involve conservation of neotropical migratory birds whose life history range covers a US national park and a Latin American protected area. A relatively new program, Park Flight offers parks the opportunity to partner with a Latin American national park or protected area to cooperate on developing bird conservation and education projects (NPS 2002).

Recent increases in NPS base funded programs such as inventory and monitoring, exotic species management, habitat restoration, and fire management all indicate that national park managers recognize that park lands are increasingly subject to a variety of threats and conditions that must be improved to provide the quality of national park experience articulated in the NPS Organic Act (1916). Programmatic funding in these areas will increase the ability of national parks to provide quality habitat and conditions for increased wildlife conservation, including birds. Furthermore, private interests and non-profit conservation organizations have initiated programs, including grant programs, to provide much needed funding to national parks to meet backlogs of identified yet unfunded needs.

Preserve Description

Water is a principal natural resource of the entire south Florida region. Big Cypress National Preserve clearly illustrates this important resource with close to 90 percent of the preserve's area flooded seasonally. Because the 295,015 ha (729,000 acre) preserve is relatively undeveloped, it serves as a large natural reservoir and nutrient filter, permitting natural biological processes to nourish diverse ecological communities distinctive to south Florida (see PIF and NPS maps below). The preserve's ecology is finely tuned to seasonal water flow patterns, and any interference can alter this sensitive habitat. About 80 percent of the current Big Cypress land mass is wetland and


Partners in Flight (PIF) Regions
Southeast Region (SER)
National Park Service
U.S. Department of the Interior
Partners In Flight
Physiographic Regions
Coastal Prairies
East Gulf Coastal Plain
Interior Low Plateaus
Mid Atlantic Ridge and Valley
Mississippi Alluvial Plain
Northern Cumberland Plateau
Ohio Hills
Peninsular Florida
South Atlantic Coastal Plain
Southern Blue Ridge
Southern Piedmont
Southern Ridge and Valley
Subtropical Florida
West Gulf Coastal Plain
NPS Units
N
W
E
S
Kentucky
North Carolina
Tennessee
South Carolina
Mississippi
Alabama
Georgia
Louisiana
Florida
0 50 100 200 300 400
Miles
Caribbean Islands
British Virgin Is.
Virgin Is.
Puerto Rico
Virgin Is.
0 12.5 25 50 Miles
No warranty is made by the National Park Service (NPS) as to the accuracy, reliability, or completeness of these data for individual use or aggregate use with other data, or for purposes not intended by the NPS. Spatial data may not meet National Map Accuracy Standards. This information may be updated without notification.
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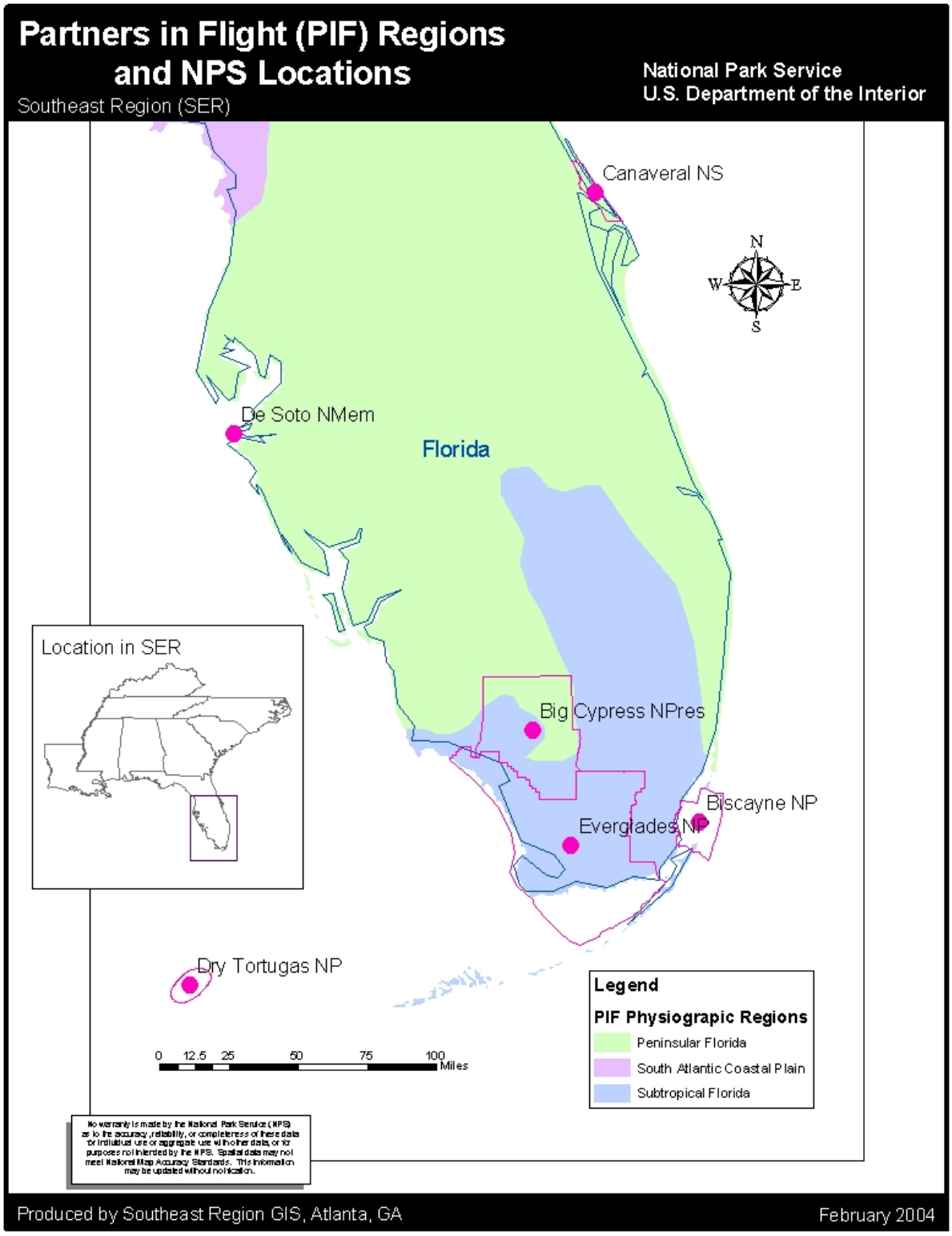
Partners in Flight (PIF) Regions
and NPS Locations
Southeast Region (SER)
National Park Service
U.S. Department of the Interior
Canaveral NS
N
W
E
S
De Soto NMem
Florida
Location in SER
Big Cypress NPres
Biscayne NP
Everglades NP
Dry Tortugas NP
Legend
PIF Physiograpic Regions
Peninsular Florida
South Atlantic Coastal Plain
Subtropical Florida
0 12.5 25 50 75 100
Miles
No warranty is made by the National Park Service (NPS) as to the accuracy, reliability, or completeness of these data for individual use or aggregate use with other data, or for purposes not intended by the NPS. Spatial data may not meet National Map Accuracy Standards. This information may be updated without notification.
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February 2004

is characterized by extensive prairies, freshwater marshes, forested swamps, and shallow sloughs. Most wildlife species native to south Florida occur within the Big Cypress watershed. Ten species are listed by the U.S. Fish and Wildlife Service as threatened or endangered, and 10 species are candidates for threatened or endangered status; an additional 14 species are listed by the state of Florida as threatened, endangered, or of special concern.

Avian Resources of Subtropical Florida

The physiographic area is entirely contained within Florida, and extends from the northern edge of Lake Okeechobee south through the Florida Keys. The region has very little topographic relief, but slight changes in elevation have important consequences for vegetation and the diversity of habitat types. The highest points of elevation are less than 2 meters and correspond with fairly recent shorelines (less than 5,000 years before present). Underlying sediments consist of freshwater marl, peat, freshwater lake and marine sediments, and to a lesser extent, sand deposited during the Pleistocene and Holocene. The subtropical Florida region can be divided into four smaller sub-regions: 1) the everglades, 2) Big Cypress, 3) Miami Ridge and Atlantic Coastal Strip, and 4) Southern Coasts and Islands. The Everglades is the most extensive of these areas, followed by the Big Cypress, Miami Ridge and Southern Coasts. Across all subregions, much of the physical and ecological characteristics of the region resemble tropical ecosystems where seasonal changes are reflected by changing rainfall patterns rather than by dramatic temperature changes. Distinctive dry (winter/spring) and wet (summer) seasons occur annually, and the nesting cycles of many birds are tied to these changes. At least two major forms of disturbance play key roles in the ecology of the region. Fire is an important feature in many pine dominated communities and many marsh and prairie communities. Frequent fires are essential in pine-dominated stands and prairies if understory conditions suitable to many nesting birds are to be maintained. However, the ideal fire frequency in some pine communities is not known. Hurricanes are a second form of disturbance that less frequently but predictably provide early successional habitats or open forest cover (Brawn et al. 2001).

Bird conservation priorities for Subtropical Florida have been stratified by habitat type. Recognized habitat types where high priority conservation actions are needed for both birds and habitats are pine forests (including pine rocklands, pine Flatwoods, sand pine scrub), grassland/grassland-scrub (including dry prairie and coastal strands), subtropical deciduous forest, everglades, brackish saltwater and freshwater marsh, and mangrove swamps. Species associated with each of these habitats and identified as high priority for conservation needs are given below.

Florida Scrub Jay, Red-cockaded Woodpecker, Southeastern American Kestrel, Brown-headed Nuthatch, Bachman's Sparrow, Palm Warbler and Sedge Wren are associated with the pine forests. Both Florida Scrub Jay and Southeastern American Kestrel have been extirpated in Subtropical Florida and the Brown-headed Nuthatch and Bachman's

Sparrow are nearly extirpated here. Both Palm Warbler and Sedge Wren are present only in the non-breeding seasons.

Grasshopper Sparrow, Crested Caracara, Burrowing Owl, Sandhill Crane and Mottled Duck are all species associated with grassland to grassland scrub habitats. Grasshopper Sparrow has been extirpated in South Florida.

In the subtropical deciduous forest, Short-tailed Hawk, Swallow-tailed Kite, White-crowned Pigeon and Gray Kingbird are high priorities for conservation.

In the Everglades, brackish saltwater and freshwater marshes, Snail Kite, Cape Sable Seaside Sparrow, Wood Stork, Black Rail, Reddish Egret, Yellow Rail, White Ibis, and Clapper Rail are species in need of conservation attention.

Prairie Warbler, Yellow Warbler, Black-whiskered Vireo, and Mangrove Cuckoo, species associated with Mangrove swamps and forests, and are of high priority conservation concern.

Human population growth has been phenomenal in subtropical Florida for the last 40 years. The impacts of such tremendous growth include increased infrastructure that directly reduces habitat availability, but also secondary impacts to bird habitats, such as pollution. Other land uses include production of sugarcane, winter vegetables, and citrus. Drastic changes in hydroperiod and natural water cycles are secondary impacts of increasingly intensive agriculture. However, among the best opportunities in the Southeast to work with existing public lands occur in Subtropical Florida, where over 54% of the area is publicly owned. Therefore, primary conservation programs include efforts to reduce impacts from adjacent or nearby lands on management of existing public lands. Many programs have been developed and are in various phases of implementation. These include the Save our Everglades program, the Surface Water Improvement and Management Act, Florida's Everglades Forever Act and the development of the South Florida Ecosystem Restoration Task Force as well as aggressive acquisition programs. These and other programs serve the basis for bird conservation efforts in the region (PIF 2000).

Avian Conservation in BICY

Avian Biodiversity: BICY has a complete avian inventory and a checklist of birds that is available for the public. Preserve staff are in the process of updating the checklist. Over 175 birds have been observed in BICY.

Verified records of birds in BICY have been entered into the NPS I&M program's database, NPSpecies, and may be viewed via the internet at http://www.nature.nps.gov/im/app/npspp with a user identification and password combination authorized by the NPS for NPS personnel and NPS cooperators. Many other avian observational data need to be verified and entered into the database.

Preserve Priorities: Preserve staff and consultants have not identified any particular species that is a preserve management concern or high priority for conservation. However, the presence of 5 Federally listed bird species requires compliance with the Endangered Species Act and a large amount of staff time is given to managing these species. Additionally, preserve staff are concerned about conserving all birds and their habitats in BICY. However, several species that occur in BICY are high priority in Subtropical Florida and conservation efforts in the preserve could focus on these species or groups of species.

Inventory: A complete inventory has been recognized as important information for park managers and the BICY inventory is considered complete. However, BICY has identified additional funding needs to document distribution and abundance of the preserve's avifauna.

Threatened and Endangered Species: Five Federally listed threatened or endangered species nest in BICY. These are Red-cockaded Woodpecker, Wood Stork, Bald Eagle, Snail Kite, and Cape Sable Seaside Sparrow. The recently delisted American Peregrine Falcon is a rare but regular fall transient and winter visitor.

Several Florida listed species occur in BICY as well. Prominent among these are: Florida Grasshopper Sparrow, White-crowned Pigeon, Arctic Peregrine Falcon, Florida Sandhill Crane, and Least Tern.

Partners In Flight (PIF) has also listed Brown-headed Nuthatch, Bachman's Sparrow, Grasshopper Sparrow, Sandhill Crane, Mottled Duck, Short-tailed Hawk, Swallow-tailed Kite, White-crowned Pigeon, Black Rail, Reddish Egret, White Ibis, Florida Prairie Warbler, Yellow Warbler, Mangrove Cuckoo, Black-whiskered Vireo and non-breeding populations of Palm Warbler and Sedge Wren as species of high conservation concern in Subtropical Florida (PIF 2000).

Monitoring: Currently, several avian monitoring projects are being conducted at BICY. These are:

- Cape Sable Seaside Sparrow population monitoring (Population A) conducted by Everglades National Park personnel
- Red-cockaded Woodpecker nest monitoring on 45 clusters of woodpeckers
- Red-cockaded Woodpecker nestling banding
- Wood Stork colony monitoring by helicopter
- Snail Kite Monitoring
- Bald Eagle nest surveys conducted by State of Florida
- Waterbird colony monitoring conducted by Everglades National Park and State of Florida
- Osprey nest monitoring conducted by State of Florida
- Brown-headed Nuthatch and Eastern Bluebird monitoring following translocations
- Three mini-Breeding Bird Survey routes conducted during May

- Regular Breeding Bird Survey route conducted by US Fish and Wildlife Service
- Randomized recreational birding

Research: Scientific research is permitted within the preserve, and several recent projects have been concluded, focusing on several of the listed species that occur in the preserve. The only active current active avian research involves work on the endangered Snail Kite.

Outreach: No specific educational and outreach programs related to birds are undertaken in the preserve, but birds are included in the more generic wildlife programs.

Preserve Identified Needs for Avian Conservation

BICY has identified on high priority projects that would increase the avian knowledge of the preserve and would assist preserve managers in better decision making.

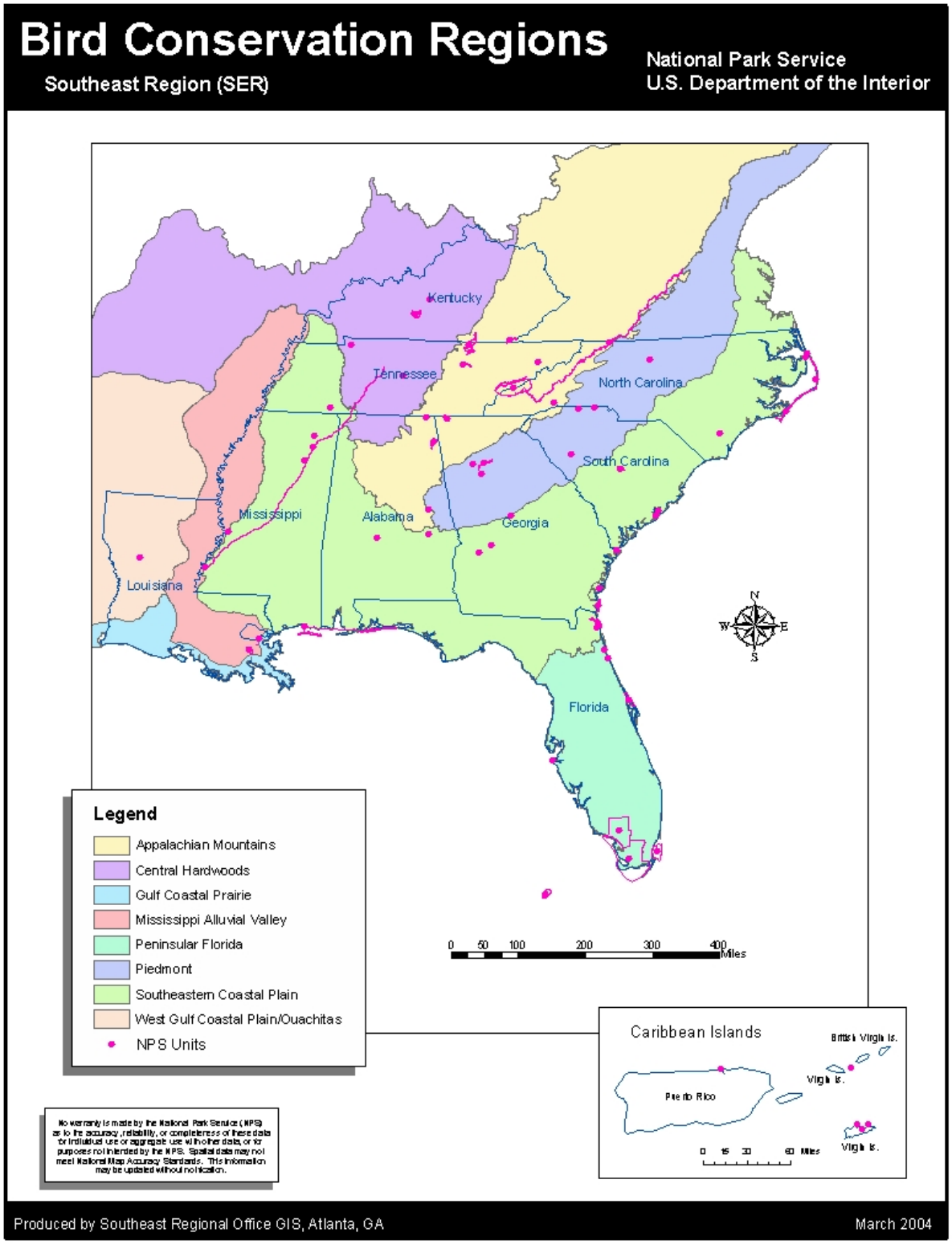
Research*:* The preserve would like to assess the impacts that Off Road Vehicles (ORV's) have on the bird populations, especially birds that nest on the ground or in the herb/shrub layer of the forests.

Coordination with Regional Conservation Initiatives

North American Bird Conservation Initiative: NABCI bird conservation planning units, referred to as Bird Conservation Regions (BCR), are often larger than other planning units associated with other plans, such as Partners In Flight. For example, BICY is within the NABCI Peninsular Florida BCR located entirely within Florida (see BCR map) and encompasses two PIF physiographic areas (the planning unit for PIF)(compare to NPS and PIF maps).

Several NABCI BCR's have coordinators whose primary responsibility is to coordinate all bird conservation planning in the BCR, across all agencies and organizations. Currently, Peninsular Florida does not have a designated coordinator; however, a large portion of the BCR lies within the Atlantic Coast Joint Venture area (Maine to Florida and includes Puerto Rico) and the ACJV has several professional bird conservationists base throughout the region to assist partners in bird conservation efforts (see contacts below). This staff can provide valuable assistance to BICY with implementation of aspects of this ACIP.

North American Waterfowl Management Plan (NAWMP): The NAWMP (http://northamerican.fws.gov/NAWMP/nawmphp.htm) is completed and has been revised several times, incorporating updated goals and strategies based on new information. This plan is one of the most successful bird conservation delivery


Bird Conservation Regions
Southeast Region (SER)
National Park Service
U.S. Department of the Interior
Kentucky
Tennessee
North Carolina
South Carolina
Mississippi
Alabama
Georgia
Louisiana
Florida
N
W
E
S
Legend
Appalachian Mountains
Central Hardwoods
Gulf Coastal Prairie
Mississippi Alluvial Valley
Peninsular Florida
Piedmont
Southeastern Coastal Plain
West Gulf Coastal Plain/Ouachitas
NPS Units
0 50 100 200 300 400 Miles
Caribbean Islands
British Virgin Is.
Virgin Is.
Puerto Rico
Virgin Is.
0 15 30 60 Miles
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March 2004

programs in the United States, being monetarily supported by the North American Wetlands Conservation Act (NAWCA).

Partners In Flight: Goals and strategies for Subtropical Florida have yet to be fully identified and organized into a bird conservation plan. Personnel from the Florida Fish and Wildlife Conservation Commission are currently working on completing the Partners in Flight bird conservation plan for South Florida. In the meantime, Florida's avian priorities and conservation needs are identified in Millsap et al. (1990).

Similar to NABCI BCR's, PIF physiographic areas often do not have designated coordinators. However, state level non-game agencies with investment in PIF will establish key personnel to develop partnerships among cooperators in the physiographic area. The State of Florida has a non-game bird conservation coordinator and can be instrumental in assisting BICY to implement recommendations identified in this ACIP and projects important to bird conservation relative to Florida's role in implementation of the bird conservation goals in Subtropical Florida.

United States Shorebird Conservation Plan (USSCP): The USSCP has been completed and is available on the World Wide Web (http://shorebirdplan.fws.gov/). A regional step down plan is in preparation by FWS personnel and should be available in 2004.

Waterbird Conservation for the Americas (WCA): The WCA plan has been completed and is available on the World Wide Web or can be ordered from the US Fish and Wildlife Service National Conservation Training Center (http://www.waterbirdconservation.org/). BICY will utilize this regional plan when completed.

Integration of NABCI Goals and Objectives into Preserve Planning and Operations: NABCI Implementation Recommendations

To successfully achieve preserve-established goals and actively participate in NABCI, the preserve could implement a variety of projects in different NPS programs. Most of these projects would require some level of participation by many existing preserve programs and could either be achieved through NPS funding, or more likely, through establishing or improving partnerships with agencies and organizations that already have the necessary expertise to provide guidance, funding, and execution of these programs. Programmatic areas where bird conservation actions are likely to be focused are:

- Inventory
- Monitoring
- Habitat Restoration
- Threat Management (includes exotic species, air quality, water quality, etc.)
- Research

- Compliance
- Outreach
- Partnerships

To the extent appropriate, each of these program areas will be discussed separately and within each, specific opportunities identified that, when implemented, will enable the preserve to meet its mandates (current and expected) as well as integrate NABCI into its planning and operations. With emphasis added, the preserve is not expected to implement any of these recommendations or be obligated to pursue any opportunity other than those the preserve is required to do by law or NPS program or policy. In other words, participation in this effort is currently voluntary. However, participation in these efforts at some level could become mandatory with the completion of an MOU with the FWS regarding EO 13186 (US Government 2000). The MOU will establish a formal agreement between the FWS and the NPS to promote bird conservation within the agency by incorporating goals and strategies of existing bird conservation initiatives, plans, and goals into park planning and operations.

Should the preserve decide to implement any of these projects, further consultation with bird conservation contacts is encouraged to obtain updated information on the relevance of these opportunities in regional bird conservation.

High priority projects are identified in **bold** print. Priorities that the preserve is encouraged to seek NPS funding for are marked with and asterisk (*****). These projects are those that are critical to the stabilization or improvement of a bird population in the planning region.

Inventory: The preserve has inventoried its bird fauna exceptionally well. Although the avifauna of BICY is well documented, distribution and abundance data are desired to fully understand the status of birds in the preserve so that conservation actions for birds can be implemented. Status of high priority species is needed to effectively structure preserve management for the continued preservation and enhancement of the preserve's avifauna.

Additional abundance and distribution data is needed for

- **Marshbirds**
- **Wet and Dry Prairie birds**
- **Mangrove birds**
- **Pine Hammock birds**
- **Cypress Strands and Domes**

Additionally, BICY is encouraged to

- **partner with Everglades National Park (EVER), Ten Thousand Island National Wildlife Refuge (TTINWR), Florida Panther National Wildlife Refuge**

(FPNWR), Fakahatchee , Big Cypress Seminole Indians, Miccosukee Indians, and South Florida Water Management District (SFWMD) to coordinate area inventory efforts

- **verify other avian observational data collected in the preserve and enter into the appropriate database (NPSpecies, eBird, etc.)**

- **standardize inventory and monitoring methodology to conform to NPS and/or FWS recommended standards (Fancy and Sauer 2000, Hunter 2000).**

Monitoring: The preserve has an active bird monitoring program resulting in documentation of many high priority species identified for conservation effort occur in the Subtropical Florida and the preserve. Efforts should be made to continue existing monitoring programs, striving to conform to established NPS or FWS surveys protocols. Close coordination with State of Florida biologists, researchers, and local federal land managers is needed to identify and implement high priority projects on preserve lands and to ensure that preserve efforts contribute to preserve or regional bird conservation rather than undertake an action or actions that are not needed or are better conducted in other areas. Specific recommendations are to:

- **continue to conduct existing monitoring programs and enter data into the appropriate database (NPSpecies, eBird, etc.) and provide data to cooperators**

- **conduct follow up monitoring on translocations of Brown-headed Nuthatch and Eastern Bluebird to Everglades National Park***

- **conduct follow up monitoring to determine success of translocation of Red-cockaded Woodpeckers to Dupuis Wildlife and Environmental Area (DWEA)***

- **establish an avian monitoring program based on distribution and abundance surveys that focus on regionally identified high priority species***

- **establish a pre and post fire inventory program to document response of birds to prescribed fire**

- **standardize inventory and monitoring methodology to conform to NPS and/or FWS recommended standards (Fancy and Sauer 2000, Hunter 2000).**

- **partner with Everglades National Park (EVER), Ten Thousand Island National Wildlife Refuge (TTINWR), Big Cypress Seminole Indians,**

- **Miccosukee Indians, and South Florida Water Management District (SFWMD) to coordinate area monitoring efforts**

Habitat Restoration: Historical landscape conditions in the Southeastern US have changed dramatically since early European explorers began documenting the area, its habitats, and its inhabitants. Historic landscape alternation by Native Americans for a variety of uses (Williams 2002), wildfire, Bison (*Bison bison*), beaver (*Castor Canadensis*) and elk (*Cervus elaphus*) effects, weather, and beaver, etc. (Hunter et al. 2001) resulted in a landscape mosaic that supported a rich and diverse bird fauna in the Southeast (Barden 1997, Brawn et al. 2001). The arrival of Europeans and the subsequent change in landscape has dramatically effected bird habitat and bird populations. Bird conservationists have recognized for a long time that habitat restoration is critical to restoration of bird populations, stabilizing or reversing bird declines, and removing birds from both State and Federal Threatened and Endangered Species lists. Recently, habitat restoration efforts have increased nationwide, and on NPS lands; NPS receiving restoration emphasis and guidance in the 2001 Management Policies (NPS 2001). Habitat restoration efforts that parks may undertake are wetland restoration, grassland restoration, woodland restoration, etc. utilizing a wide range of tools to accomplish the restoration. Some of these tools may be but not limited to forest management practices, exotic species management, public use and recreation management, infrastructure development management, and prescribed fire.

Due to the protected nature of BICY lands, and generally those in the national park system, the condition of habitats for bird use may be of higher quality than other natural, developed, agricultural, or forest lands under other management regimes. However, national park lands can be greatly improved for wildlife, and particularly bird use, by restoring processes important for habitat formation, succession, and structural development. Largely, these processes have not been managed historically in the national park system but current policy allows for active management of species, populations, and lands to provide for long-term conservation of park resources. Protection, restoration, and enhancement of habitats in BICY can greatly contribute to established habitat goals identified in the Subtropical Florida bird conservation plan.

BICY is primarily a large wetland that cover a variety of habitats, including freshwater marsh, wet and dry prairies, forested wetlands, mangrove forest, and shallow sloughs. Preservation of these habitats and many species have evolved through a dependence on wildfire. Indeed, BICY is one of the most fire dependant landscapes in Florida and currently conducts the largest prescribed fire program in the NPS. Specific habitat recommendations are to:

- **increase the amount of prescribed fire from current average to approximately 40,000 ha (100,000 acres) to improve habitat conditions in pinelands and prairies for high priority birds**

- **restore previously disturbed lands due to agriculture, ORV's, and developments to natural vegetation**

- **protect existing snag trees, where not identified as a safety hazard, as important to cavity nesting birds**

- **enhance or maintain water quality to support aquatic biota necessary to support existing waterbirds, marshbirds, and other birds that use water for nesting and foraging**

- assess historic landscape cover and determine feasibility of restoring landscape within the context of the preserve's enabling legislation.

Threat Management: Potentially the greatest impact to birds at BICY is the use of ORV's. The preserve has completed and ORV Management Plan. Implementation of the ORV Management Plan should allow the preserve to demonstrate that the preserve's bird populations will improve. However, because ORV's will still impact preserve habitats and vegetation, the preserve is encouraged to:

- **fund and conduct the Project Management Information System (PMIS) project to assess the impacts of ORV's to the preserve's bird populations and at the conclusion of the research implement needed changes in the plan to further protect the preserve's avifauna***

Impact of exotic species on birds at BICY is largely unquantified but feral hogs do occur in the preserve. However, feral hogs are a prey item of the Florida Panther and are not considered a resources threat, but a regulated resource.

Significant exotic plants species are negatively impacting habitat at BICY, particularly Melaleuca. Brazilian Pepper, Australian Pine, and Old World Climbing Fern are present and potentially a threat to habitat at BICY. It is important to establish and continue inventory and monitoring for exotic plant species and implement aggressive removal/reduction projects for these species. The South Florida Exotic Plant Management Team can assist in coordination and implementation of exotic plant management. BICY is encouraged to:

- **implement an aggressive exotic plant reduction program to restore and improve habitat quality**

Research: Several research projects have been identified that would provide additional information to BICY managers for bird conservation purposes.

- **assess ORV impacts on the bird populations throughout the preserve***

- **determine the response of Cape Sable Seaside Sparrow to airboat use***

- **determine the effects of wildfire and fuel treatments on the avifauna of the pine rockland ecosystem in southern Florida***

- determine demographics of Limpkin

- determine winter and Neotropical and temperate migrants use of preserve

- assess the effects of prescribed burning on wintering and breeding birds of wet prairie habitats

Additionally, the preserve is encouraged to:

- **list preserve needs and projects on Research Permit and Reporting System web site (RPRS)**

- develop contact with South Florida/Caribbean Cooperative Ecosystem Studies Unit at the University of Miami, Miami, Fl

Compliance: Preserve compliance with the Migratory Bird Treaty Act EO 13186 (US Government 2000) is necessary to assure that preserve activities incorporate bird conservation into preserve planning and operations. Further, to ensure that migratory birds are considered in all phases of preserve planning processes, especially during the National Environmental Policy Act (NEPA) and the Director's Order #12 Compliance processes, the preserve should consider adding specific language in project evaluations that requires consideration and implications of preserve projects on migratory birds. The MOU being developed between the NPS and the FWS will likely contain specific language requiring a preserve to consider implications of preserve projects on migratory birds, particularly those species identified in the USFWS Species of Conservation Concern 2002 (Appendix C). Additional considerations are to encourage:

- **preserve staff to begin specific consideration of migratory birds during preserve planning processes**

- preserve staff to attend USFWS training on implementation of EO 13186 (US Government 2000) at the National Conservation Training Center (NCTC) (when available) or other training on migratory bird conservation in North America. NCTC has several courses and training related to conservation of migratory birds (http://training.fws.gov/courses.html).

The USFWS NCTC offers and reserves two tuition free slots for National Park Service employees wishing to attend NCTC courses on a first come, first served basis. Additionally, discount lodging is also available while attending a NCTC course.

Outreach:

- **update the bird checklist for public availability**

- **participate in International Migratory Bird Day (IMBD) events with a local partner (http://birds.fws.gov/imbd.html), such as TTINWR or Collier-Seminole State Park**

- **continue to develop and foster relationship with local area bird clubs, such as Naples Bird Club and Collier County Audubon**

- **encourage development of outreach and educational programs to enhance visibility of bird conservation issues, which may include organized bird walks, owl prowls, and raptor surveys with the public**

- **encourage accurate documentation and reporting from these and random outings by visitors (see Cornell University's eBird monitoring program (Cornell Lab. Ornith. 2002 (http://www.ebird.org/about/index.jsp)**

- **develop relationship with Big Cypress Seminole Indian Reservation and Miccosukee Indian Reservation personnel to cooperate on a joint bird conservation project**

- preserve interpretation/education staff are encouraged to attend USFWS training on Migratory Bird Education at NCTC

- consider adding links to bird conservation information, data, etc. to the preserve's web site home page

- support bird conservation by serving shade-grown coffees at meetings, events, and the office buildings in the preserve (http://www.americanbirding.org/programs/conssbcof3.htm)

- subscribe to Florida Birds, an electronic forum for listing bird sightings and publications in Florida

- explore cultural affiliation of landscape to inhabitants, both historical and contemporary. Cultures are strongly tied to the landscape they inhabit and birds often play a role in a cultural tie to the landscape. When these connections are discovered and preserved, a greater appreciation for the landscape and it's value to the culture can be achieved.

Partners and Partnerships: Partnerships for land conservation and protection will perhaps have the greatest positive influence on bird conservation above all other landscape scale planning. Specific recommendations are to:

- **keep abreast of Collier, Broward, and Hendry Counties initiatives or programs that could impact preserve resources***

- **develop relationship with Big Cypress Seminole Indian Reservation and Miccosukee Indian Reservation personnel***

- **contact US Fish and Wildlife Service private lands biologists to discuss private landowner initiatives applicable to the area***

Several private landowner programs could be implemented that would serve to protect areas adjacent to BICY and potentially improve water and habitat quality in the vicinity

- **develop partnership with Florida Wildlife and Conservation Commission, SFWMD, TTINWR, Collier-Seminole State Park and EVER to coordinate and implement various aspects of this ACIP***

- **contact the nearest Joint Venture office (see Funding section for explanation of Joint Ventures) or BCR coordinator to develop partnerships and funding proposals tiered to priorities established by the preserve, this ACIP, and the Subtropical Florida bird conservation plan***

- partner with and engage the local bird clubs, including Naples Bird Club, and Collier County Audubon as active partners in BICY's bird conservation program

- develop land use agreements with local landowners through state, FWS programs to protect important habitats and landscapes adjacent to BICY

Funding Opportunities: Internal NPS funding is often an effective source to obtain funding; however, the project will have to be a fairly high priority among the preserve's natural resource program to successfully compete for the limited funding available in the NPS. Therefore, partnerships and outside funding programs are often more productive for securing bird conservation funding. BICY is encouraged to enter all high priority projects into the NPS Performance Management Information System (PMIS) database. Funding for conservation projects for neotropical migrants is also available through the Park Flight program.

With the exception of the North American Waterfowl Management Plan (NAWMP and its associated funding legislation, the North American Wetland Conservation Act), funding opportunities for bird conservation programs, plans, and initiatives have been lacking. Only within the last decade have other appropriate and specific sources for bird conservation funding been created and used. The NAWMP has been supported for approximately 14 years by the North American Wetlands Conservation Act (NAWCA 1989). This program has provided $487 million in appropriated funds matched with $1.7 billion for wetland and bird conservation projects since its inception. In 2002 alone,

over $70 million US dollars were awarded to US and Canadian agencies and organizations to enhance waterfowl populations by improving, restoring, or protecting wetland habitats. To adequately evaluate projects and distribute these funds, partnerships called Joint Ventures were established. Nationally, 14 (11 US, 3 Canada) Joint Ventures have been established, several which are funded and staffed. Internet links to Joint Ventures are: (http://southwest.fws.gov/gulfcoastjv/ojvcontact.html) and (http://northamerican.fws.gov/NAWMP/jv.htm).

Funding through NAWCA is highly underutilized by the NPS and any park unit that has wetland, water, or bird conservation needs associated with wetland are encouraged to investigate using this funding source. Naturally, there are certain requirements to be eligible for all grants and preserve managers are encouraged to consult with the nearest Joint Venture, BCR, PIF Coordinator, to learn how this program might be applicable to implementation of this plan, and other preserve wetland issues. BICY is not within a region which has an operational Joint Venture, but contact with the Atlantic Coast Joint Venture, Central Hardwoods BCR, and Tennessee PIF coordinators will provide opportunity to investigate use of this funding source and developing proposals. Internal FWS funding programs may be used to support projects, but no effective method of project proposal delivery to these sources is currently in place for the NPS. Current funding in these programs may result from FWS familiarity with NPS needs, or NPS participation in one of the area FWS Ecosystem Teams, where a project has been identified and proposed to be funded through the Ecosystem Team.

One unexplored yet potentially fruitful funding source for national parks is the myriad of grants through the FWS State Programs, where grants are awarded to private individuals engaged in habitat conservation projects. No funding is directly available to national parks, but identified projects with important or critical adjacent landowners can sometimes be funded through these sources. Similar programs are available if the adjacent landowner is a federally recognized American Indian tribe.

Specific congressional appropriations to protect migratory birds has recently been authorized under the Neotropical Migratory Bird Conservation Act (2000) (http://www.nfwf.org/programs/nmbcapp.htm). Appropriations through this Act are authorized up to $5 million per year. However, in 2000, appropriation was approximately $3.75 million and a majority of this funding was directed toward projects in Central and South America.

Many of the identified projects are eligible for funding under various grant programs of the National Fish and Wildlife Foundation http://www.nfwf.org/programs/programs.htm).

Other prominent funding sources available to NPS managers for bird conservation are listed on this projects web site at: http://southeast.fws.gov/birds/NPSHighlits.htm.

Funding opportunities for migratory bird conservation are available yet most natural resource agencies are not fully aware of and/or understanding of how to use these sources. Perhaps a consolidated migratory bird funding source catalog will become

available to managers in the future; this is needed.

Contacts: Primary contacts within the region can be obtained by viewing the web site for the Southeastern Bird Conservation Initiative, National Park Service at http://southeast.fws.gov/birds/npsbirds.htm. This web site will provide contact information of the appropriate bird conservation coordinator in the region for preserve personnel. Preserve staff are encouraged to view the web site and obtain contact information. Primary contacts for BICY are:

US Fish and Wildlife Service

Keith Watson
US Fish and Wildlife Service
160 Zillicoa Street, Suite D
Asheville, NC 28801
828-350-8228
Keith_Watson@fws.gov

Jennifer Wheeler
US Fish and Wildlife Service
Waterbird Conservation Plan
Coordinator
703-358-1714
Jennifer_A_Wheeler@fws.gov

Craig Watson
US Fish and Wildlife Service
Atlantic Coast Joint Venture
Charleston, SC
843-727-4707 ext. 16
Craig_Watson@fws.gov

Chuck Hunter
US Fish and Wildlife Service
Regional Refuge Biologist
Atlanta, GA
404-679-7130
Chuck_Hunter@fws.gov

Ralph Costa
US Fish and Wildlife Service
Clemson University
Clemson, SC
864 656-2432
Ralph_Costa@fws.gov

National Park Service

South Florida/Caribbean
Inventory & Monitoring Network
SF/C Network Coordinator
National Park Service
Matt Patterson
305 224-4211
Matt_Patterson@nps.gov

Mr. Tony Pernas
National Park Service
305 224-4246
Tony_Pernas@nps.gov

Carol Daniels
South Florida/Caribbean CESU
Rosential School of Marine and
Atmospheric Sciences
University of Miami
Miami, Fl
305 361-4904
Carol_Daniels@nps.gov

State of Florida

Jeff Gore
Florida Fish and Wildlife Conservation
Commission
Jeff.Gore@fwc.state.fl.us

Karl Miller
Florida Fish and Wildlife Conservation

Commission
352-955-2230
karl.miller@fwc.state.fl.us

Bernice Constantine
USDA Wildlife Services
Florida
353-377-5556

Rob Bennetts
US Geological Survey
Biological Resources Division
Florida and Caribbean Science Center
7920 NW 71st Street, Gainesville, FL 32653
Phone: 352-378-8181, ext. 374
rbennetts@usgs.gov

Ken Meyer
Avian Research and Conservation Institute
Gainesville, FL
meyer@arcinst.org

Peter Frederick
University of Florida
Gainesville, Fl
(904) 846-0565
pcf@gnv.ifas.ufl.edu

Gary Slater
Ecostudies Institute
P.O. Box 703
Mount Vernon, WA 98273
360-416-6707
glslater@ecoinst.org

Joe Howard
Collier-Seminole State Park
20200 E. Tamiami Trail
Naples, Florida 34114
Phone: 239-394-339
Joe.Howard@dep.state.fl.us

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APPENDIX A

HIGH PRIORITY SPECIES IN PENINSULAR FLORIDA BIRD CONSERVATION REGION (from Table 1, Peninsular Florida Priority Bird Species)

Table 1. Priority bird species for Peninsular Florida: Entry criteria and selection rationale

Priority Entry Criteria[1]	Species	Total PIF Priority Species Score	Conservation Score: Area Importance	Conservation Score: Population Trend	Percent of BBS Population	Migratory Status[2]	Local Geographical or Historical Notes
Ia.	Florida Scrub-Jay[5]	35	5[4]	5[4]	100	R	
	Grasshopper Sparrow[5] (Florida)	35	5[4]	5[4]	100	R	
	Snail Kite[5] (Everglade)	34	5	4[4]	100?	D	
	Crested Caracara[5] (Florida pop.)	34	5[4]	4[4]		D	
	Snowy Plover (SE US)	34	5	5		D	Gulf side only
	Red Knot (SE US)	32	5	5		C	
	Piping Plover[5]	31	4	5		C	
	Prairie Warbler (Florida)	31	5[4]	5[4]		D	
	Wood Stork[5] (SE US pop.)	30	5	4		D	
	Short-tailed Hawk (Florida pop.)	30	5[4]	3		D	
	Swallow-tailed Kite (SE US)	29	5	3	61.7	B	
	Red-cockaded Woodpecker[5]	29	3[4]	3		R	

Table 1 (cont.).

Priority Entry Criteria[1]	Species	Total PIF Priority Species Score	Conservation Score: Area Importance	Conservation Score: Population Trend	Percent of BBS Population	Migratory Status[2]	Local Geographical or Historical Notes
	Mottled Duck	29	5	4[4]	11.3?	D	
	American Kestrel (SE US)	28	5[4]	4[4]		R	
	Burrowing Owl (Florida)	28	5[4]	3		D	
	Bachman's Sparrow	28	5	3	18.9	D	
	Saltmarsh Sharp-tailed Sparrow	28	3	3		C	
	Painted Bunting (Eastern)		28	3[4]	3		D
	American Oystercatcher (Eastern NA pops.)	28	5	3		D	
Ib.	Wilson's Plover	27	4	3		D	
	Nelson's Sharp-tailed Sparrow	27	3	3		C	
	Henslow's Sparrow	27	3	4		C	
	Black Rail	27	4	3		D	
	Sandhill Crane (Florida)	26	5[4]	1		R	
	Audubon's Shearwater (Caribbean)	26	5	3		P	
	Reddish Egret	26	4	3		D	
	Least Tern	26	5	4[4]	4.6?	B	
	Black Skimmer	26	5	5		D	
	Bicknell's Thrush	26	5	3		A	

Table 1 (cont.).

Priority Entry Criteria[1]	Species	Total PIF Priority Species Score	Conservation Score: Area Importance	Conservation Score: Population Trend	Percent of BBS Population	Migratory Status[2]	Local Geographical or Historical Notes
	Yellow Rail	26	4	3		C	
	Buff-breasted Sandpiper	25	3	4		A	Most southbound migration
	Black-throated Blue Warbler	25	5	3		A	
	Seaside Sparrow	25	4[4]	3		D	Gulf populations
	Brown Pelican (SE US)	24	5	1[4]		D	
	Marbled Godwit	24	3	4		C	
	Bobolink	24	5	5		A	
	Tricolored Heron	23	4	3	17.3?	D	
	White Ibis	23	4	4		D	
	King Rail	23	4	3		D	
	Sandhill Crane (Greater)	23	5	3		C	
	Solitary Sandpiper	23	5	3		A	
	Whimbrel	23	3	5		A	
	Stilt Sandpiper	23	4	3		A	
	Brown-headed Nuthatch	23	3	3		R	
	Cape May Warbler	23	5	3		A	
	Connecticut Warbler	23	5	3		A	
	Cory=s Shearwater	22	5	3		P	
	Clapper Rail	22	3	3		R	
	Limpkin	22	3[4]	4[4]	33.2?	R	
	Semipalmated Sandpiper	22	5	5		A	
	Short-billed Dowitcher	22	5	5		C	
	Gull-billed Tern	22	3	4		D	
	Royal Tern	22	4	3		D	
	Sandwich Tern	22	5	3		D	
	Black Tern	22	5	5		A	
	Mangrove Cuckoo	22	3[4]	3		E	

Table 1 (cont.).

Priority Entry Criteria[1]	Species	Total PIF Priority Species Score	Conservation Score: Area Importance	Conservation Score: Population Trend	Percent of BBS Population	Migratory Status[2]	Local Geographical or Historical Notes
	Gray Kingbird	22	3[4]	3	4.5?	B	
	Black-whiskered Vireo	22	3[4]	3		B	
	Loggerhead Shrike	22	5	5	4.1	D	
	Sedge Wren	22	4	2		C	
	Palm Warbler	22	5	5		C	
II a.	Anhinga	21	5	3		D	
	American Bittern	21	4	5		C	
	Northern Bobwhite	21	4	5		R	
	Black-bellied Plover	21	4	5		D	
	Willet	21	5	3		D	
	Western Sandpiper	21	5	3		C	
	Common Ground-Dove	21	5	5	23.8?	R	
	Red-headed Woodpecker	21	3	5	1.0	D	
	Veery	21	4	5		A	
	Pine Warbler	21	4	5		D	
	Grasshopper Sparrow (Eastern)	21	5	5		C	
	Green Heron	20	5	3		D	
	Northern Harrier20	4	4		C		
	Ruddy Turnstone	20	3	4		D	
	Least Sandpiper	20	5	5		C	
	Dunlin	20	4	5		C	
	Yellow-billed Cuckoo	20	3	5		B	
	Gray Catbird	20	5	5		C	
	Eastern Towhee	20	5	5	7.9	D	
	American Avocet	19	3	3		C	

Table 1 (cont.).

Priority Entry Criteria[1]	Species	Total PIF Priority Species Score	Conservation Score: Area Importance	Conservation Score: Population Trend	Percent of BBS Population	Migratory Status[2]	Local Geographical or Historical Notes
	Greater Yellowlegs	19	5	3		C	
	Sanderling	19	3	5		C	
	Pectoral Sandpiper	19	5	3		A	
	Common Nighthawk	19	5	5	3.6	B	
II b.	Chuck-will=s-widow	21	5	3	7.0	B	
	White-eyed Vireo	20	5	2	5.4	D	
II c.	Snowy Egret	19	4	3		D	
	Little Blue Heron	20	3	4	5.1	D	
Local or Regional Interest	Prothonotary Warbler	21	2	3		B	(AA@ Merritt Island)
	American White Pelican	20	4	1		C	
	Redhead	20	2	4		C	
	American Woodcock	20	2	4		D	
	Acadian Flycatcher	20	2	3		B	(AA@ Merritt Island)
	Yellow-throated Vireo	20	3	3		B	(AA@ Merritt Island)
	Yellow-throated Warbler	20	3	3		C	
	Hooded Warbler	20	2	3		B	(AA@ Merritt Island)
	Peregrine Falcon	19	5	1		A	Winters in small numbers
	Northern Parula	19	5	2		C	
	Common Loon	18	4	3		C	
	Least Bittern	18	2	3	7.0?	D	
	Wood Duck	18	4	2		D	
	Ring-necked Duck	18	3	2		C	
	Lesser Scaup	18	3	5		C	

Table 1 (cont.).

Priority Entry Criteria[1]	Species	Total PIF Priority Species Score	Conservation Score: Area Importance	Conservation Score: Population Trend	Percent of BBS Population	Migratory Status[2]	Local Geographical or Historical Notes
	Red-shouldered Hawk	18	5	2		D	
	Eastern Kingbird	18	3	5		B	
	Summer Tanager	18	3	3		B	
	Eastern Meadowlark	18	4	5		D	
	Rusty Blackbird	18	2	5		C	
	Bald Eagle[5]	17	4[4]	1		D	
	Blue-winged Teal	17	5	3		A	
	Barn Owl	17	3	3		D	
	Northern Flicker	17	4	5		D	
	Eastern Wood-Pewee	17	2	3		B	(AA@ Merritt Island)
	Yellow-crowned Night-Heron	16	2	3		D	
	Roseate Spoonbill	16	2	3		D	
	Northern Pintail	16	3	5		C	
	Brown Thrasher	16	2	3		D	
	Black-and-white Warbler	17	3	3		C	
	Smooth-billed Ani	15	2	3		R	
	Blue-gray Gnatcatcher	14	3	2		C	

[1]Entry criteria (Area Importance [AI] scores roughly mean A1" irregular and unpredictable occurrence, A2" rare to uncommon but regular occurrence, A3" low relative abundance, A4" moderate to high relative abundance, A5" highest relative abundance; Population Trend [PT] scores roughly mean A1" definite increase, A2" stable or possible increase, A3" trend unknown, A4" possible decrease, A5" definite decrease):

Ia. <u>Overall Highest Priority Species.</u> Species with total score 28-35. Ordered by total score. Consider deleting species with AI $\leq$ 2 confirmed to be of peripheral occurrence and not of local conservation interest, but retain species

potentially undersampled by BBS or known to have greatly declined during this century.

Ib. **Overall High Priority Species.** **Species with total score 22-27. Ordered by total score. Consider deleting species with AI ≤ 2 confirmed to be of peripheral occurrence and not of local conservation interest, but retain species potentially undersampled by BBS or known to have greatly declined during this century.**

II. **Area Priority Species.** **Species with slightly lower score total 19-21 with PT+AI=8+(a), with high percent BBS population (b), or high level of threats identified (TB+TN=7+, TB or TN=5). Ordered by total score. These are overall moderate priority species.**

III. **Additional Species of Global Priority.** **Add WatchList species (Partners in Flight-National Audubon Society priority species at national level), not already listed in either I or II, with AI=2+. Order by total score. Consider deleting species with AI=2 if confirmed to be of peripheral occurrence and not of local conservation interest, but retain if a local population is viable and/or manageable. These are also overall moderate priority species.**

LORI **Local or Regional Interest Species.** **Includes game or nongame species identified by State Working Groups. Also, may include species often meeting criteria for I or II within other physiographic areas and therefore of regional interest for monitoring throughout the Southeast. These are overall low priority species within physiographic area, but may be more important within one or more States (especially where multiple states have designated some special protective status on the species).**

[2] Local Migratory Status, codes adapted from Texas Partners in Flight as follows:

A = **Breeds in temperate or tropical areas outside of region, and winters in temperate or tropics outside of region (*i.e.*, passage migrant).**

B = **Breeds in temperate or tropical areas including the region, and winters exclusively in temperate or tropics outside the region (*i.e.*, includes both breeding and transient populations).**

C = **Breeds in temperate or tropical areas outside of region, and winters in both the region and in temperate or tropical areas beyond area (*i.e.*, includes both transient and wintering populations).**

D = **Breeds and winters in the region, with perhaps different populations involved, including populations moving through to winter beyond the region in temperate or tropical areas (*i.e.*, populations may be present throughout year, but may include a large number of passage migrants).**

E = **Species reaching distributional limits within the region, either as short-distance or long-distance breeding migrants, but at population levels above peripheral status.**

F = **Same as E except for wintering (non-breeding) migrants.**

R = **Resident, generally non-migratory species (though there may be local movements).**

RP= **Resident, non-migratory species, reaching distributional limits within the region, but at population levels above peripheral status.**

P = **Pelagic, breeding grounds outside of region, but can occur during breeding season.**

PB = **Post-breeding dispersal or non-breeding resident; species present during breeding season, but not known to be breeding in the region proper.**

[3]Highest percent of breeding population recorded in temperate North America; numbers in A @ are likely projections; ? indicates species widespread outside of temperate North America and/or waterbirds poorly sampled by Breeding Bird Survey within physio. area.

[4]AI or PT score revised from what was derived by BBS data, or lack thereof, based on better local information.

[5]Species listed as either Federal Endangered or Threatened.

APPENDIX B

Wildlife Conservation Commission

FLORIDA'S ENDANGERED SPECIES, THREATENED SPECIES AND SPECIES OF SPECIAL CONCERN

Official Lists

Publication Date: 1 August 1997

This document consolidates the state and federal official lists of endangered species, threatened species, and other species categorized in some way by the respective jurisdictional agencies as meriting special protection or consideration. The state lists of animals are maintained by the Florida Game and Fresh Water Fish Commission and categorized as endangered, threatened and of special concern, and constitute Rules 39-27.003, 39-27.004 and 39-27.005, respectively, Florida Administrative Code (F.A.C.). The state lists of plants are categorized into endangered, threatened and commercially exploited, and are administered and maintained by the Florida Department of Agriculture and Consumer Services via Chapter 5B-40, F.A.C. The federal lists of animals and plants are administered by the U.S. Fish and Wildlife Service and categorized into endangered and threatened, and are published in 50 CFR 17 (animals) and 50 CFR 23 (plants). The abbreviations used in part one are:

GFC = Florida Fish and Wildlife Conservation Commission

FDA = Florida Department of Agriculture and Consumer Services

FWS = United States Fish and Wildlife Service

E = Endangered

T = Threatened

T(S/A) = Threatened/Similarity of Appearance

T(E/P) = Threatened/Experimental Population

SSC = Species of Special Concern

C = Commercially Exploited

		Designated Status	
Scientific Name	**Common Name(s)**	**GFC**	**FWS**
Birds			
Ajaia ajaja	Roseate spoonbill	SSC	
Ammodramus maritimus juncicolus	Wakulla seaside sparrow	SSC	

		Designated Status	
Scientific Name	**Common Name(s)**	**GFC**	**FWS**
Ammodramus maritimus mirabilis	Cape Sable seaside sparrow	E	E
Ammodramus maritimus peninsulae	Scott's seaside sparrow	SSC	
Ammodramus savannarum floridanus	Florida grasshopper sparrow	E	
Aphelocoma coerulescens	Florida scrub-jay	T	T
Aramus guarauna	Limpkin	SSC	
Campephilus principalis	Ivory-billed woodpecker	E	E
Charadrius alexandrinus tenuirostris	Southeastern snowy plover	T	
Charadrius melodus	Piping plover	T	T
Cistothorus palustris griseus	Worthington's marsh wren	SSC	
Cistothorus palustris marianae	Marian's marsh wren	SSC	
Columba leucocephala	White-crowned pigeon	T	
Dendroica kirtlandii	Kirtland's warbler	E	E
Egretta caerulea	Little blue heron	SSC	
Egretta rufescens	Reddish egret	SSC	
Egretta thula	Snowy egret	SSC	
Egretta tricolor	Tricolored (=Louisiana) heron	SSC	
Eudocimus albus	White ibis	SSC	
Falco peregrinus tundrius	Arctic peregrine falcon	E	
Falco sparverius paulus	Southeastern American kestrel	T	
Grus americana	Whooping crane	SSC	T(E/P)
Grus canadensis pratensis	Florida Sandhill crane	T	
Haematopus palliatus	American oystercatcher	SSC	
Haliaeetus leucocephalus	Bald eagle	T	T
Mycteria americana	Wood stork	E	E

		Designated Status	
Scientific Name	**Common Name(s)**	**GFC**	**FWS**
Pandion haliaetus	Osprey	SSC*	
Pelecanus occidentalis	Brown pelican	SSC	
Picoides borealis	Red-cockaded woodpecker	T	E
Polyborus plancus audubonii	Audubon's crested caracara	T	T
Rostrhamus sociabilis	Snail kite	E	E
Rynchops niger	Black skimmer	SSC	
Speotyto cunicularia	Burrowing owl	SSC	
Sterna antillarum	Least tern	T	
Sterna dougallii	Roseate tern	T	T
Vermivora bachmanii	Bachman's warbler	E	E
*Applicable in Monroe County only			

APPENDIX C

US FISH AND WILDLIFE SERVICE, SPECIES OF CONSERVATION CONCERN IN PENINSULAR FLORIDA (BCR 31)

Black-capped Petrel
Audubon's Shearwater
Magnificent Frigatebird
American Bittern
Little Blue Heron
Reddish Egret
White Ibis
Swallow-tailed Kite
Short-tailed Hawk
American Kestrel (resident *paulus* ssp. only)
Peregrine Falcon
Yellow Rail
Black Rail
Limpkin
Snowy Plover
Wilson's Plover
American Oystercatcher
Whimbrel
Marbled Godwit
Red Knot
Semipalmated Sandpiper
Stilt Sandpiper
Buff-breasted Sandpiper
Short-billed Dowitcher
Gull-billed Tern
Common Tern
Least Tern
Black Tern
Black Skimmer
White-crowned Pigeon
Common Ground-Dove
Mangrove Cuckoo
Smooth-billed Ani
Burrowing Owl
Chuck-will's-widow
Red-headed Woodpecker
Loggerhead Shrike
Black-whiskered Vireo
Brown-headed Nuthatch
Yellow Warbler (resident *gundlachi* ssp. only)
Yellow-throated Warbler
Prairie Warbler
Bachman's Sparrow
Henslow's Sparrow
Nelson's Sharp-tailed Sparrow
Saltmarsh Sharp-tailed Sparrow
Seaside Sparrow
Painted Bunting

APPENDIX L.2

BISCAYNE NATIONAL PARK

FINAL DRAFT

Avian Conservation Implementation Plan
Biscayne National Park

National Park Service
Southeast Region

Compiled by J. Keith Watson
U.S. Fish and Wildlife Service
In cooperation with

BISC Resource Management Staff, National Park Service
And Bird Conservation Partners
December 2003

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Introduction

This Avian Conservation Implementation Plan (ACIP) is provided to the staff at Biscayne National Park (BISC) to serve as guidance to identify, document, and undertake bird conservation activities in the park and with neighboring communities, organizations, and adjacent landowners. This plan may identify goals, strategies, partnerships, and perhaps specific projects for the park to participate in existing bird conservation planning and implementation efforts associated with the North American Bird Conservation Initiative (NABCI). Under the auspice of NABCI, appropriate bird and habitat conservation goals may be recommended as identified in the appropriate existing national or regional bird conservation efforts aligned with this initiative: Partners In Flight (PIF), North American Waterfowl Management Plan (NAWMP), US Shorebird Conservation Plan (USSCP), and Waterbird Conservation for the Americas (WCA). For example, parks in the Appalachians and the Cumberland Plateau will have few if any high priority waterbird conservation issues at a regional landscape or greater scale. As such, little information regarding waterbird conservation will be presented in the ACIP, unless there is an identified park need for this species group, or other mandates, such as federal laws. Similarly, because BISC is primarily a marine/estuarine/barrier island park with coastal hammock and mangrove forests recommendations will be provided in the ACIP for landbirds and coastal birds and their habitats. However, all high priority bird conservation issues for BISC will be discussed and integrated as appropriate.

Information and data presented in the ACIP have been obtained from several sources: 1) interviews with BISC staff 2) BISC bird conservation partners 3) the PIF Subtropical Florida Bird Conservation Plan Executive Summary (Partners In Flight 2000?) 4) NPS databases, and 5) personal communications with bird conservation specialists throughout North America, especially in the southeastern United States. This plan has been reviewed by BISC resource management staff and managers, South Florida/Caribbean Inventory and Monitoring (SFC I&M) staff, and bird conservation partners and approved by BISC management. Optimally, this plan will be incorporated into the park's Resource Management Plan (USDI NPS 1995) and updated annually to reflect completed projects, newly identified needs, and shifts in bird conservation priorities in the region.

BISC is not obligated to undertake any of the proposed actions in this plan. The plan is provided to offer guidance to BISC to voluntarily support important park, regional, and perhaps national and international bird conservation projects for which BISC is a primary participant in the proposed actions.

Background

During the past thirty years, monitoring programs across North America have documented declines of certain bird species populations and their habitats, often severe (Sauer et al. 2000). The decline has caused great concern among scientists, biologists,

biodiversity proponents, ecologists, land managers, etc., and the bird conservation community in general. Birds are recognized as critical components of local and global genetic, species, and population diversity, providing important and often critical ecological, social, and cultural values. Their overall decline has stimulated a worldwide focus on conservation efforts and North American interest in bird conservation is rapidly becoming a focus of government, non-government, industry, and private interests and expenditures.

Many state, federal, and non-governmental wildlife agencies and organizations (NGO's) have recognized this alarming bird decline trend and have joined forces in several extensive partnerships to address the conservation needs of various bird groups and their habitats. The primary initiatives are:

- North American Waterfowl Management Plan
- Partners in Flight
- U.S. Shorebird Conservation Plan
- Waterbird Conservation for the Americas

While efforts associated with these plans have generated some successes, it has been increasingly recognized that the overlapping conservation interests of the; se initiatives can be better served through more integrated planning and delivery of bird conservation. The *North American Bird Conservation Initiative (NABCI* ;http://www.nabci-us.org/main2.html*)* arose out of this realization. The vision of NABCI is simply to see ***"populations and habitats of North America's birds protected, restored and enhanced through coordinated efforts at international, national, regional, state and local levels, guided by sound science and effective management."*** NABCI seeks to accomplish this vision through (1) broadening bird conservation partnerships, (2) working to increase the financial resources available for bird conservation in the U.S., and (3) enhancing the effectiveness of those resources and partnerships by facilitating integrated bird conservation (U.S. NABCI Committee 2000). Together, the four bird conservation initiatives mentioned above, as well as several other local and regional partnerships, work collectively to pursue this vision.

NABCI is guided by a set of principles that establish an operational framework within which the Initiative and its partners may conduct integrated bird conservation in the U.S. These will articulate a common understanding of the relationship between NABCI, the individual bird conservation initiatives, and all partner entities to ensure recognition of existing federal legislative and international treaty obligations, state authorities, and respect for the identity and autonomy of each initiative. The fundamental components of the conservation approach to be used by NABCI are expressed within its goal:

> ***To deliver the full spectrum of bird conservation through regionally-based, biologically-driven, landscape-oriented partnerships.***

The Southeastern Bird Conservation Initiative: National Park Service: In 2000, the Southeast Region of the National Park Service (NPS) recognized the importance of coordinating existing bird conservation goals into planning and operations of national park units in the southeast, that is, integration of NABCI. In support of this recognition, the Southeast Regional Office NPS approved and allocated eighty-eight thousand dollars, cost sharing 1:1 with the US Fish and Wildlife Service (FWS) Region 4 (Southeast) to hire a biologist to conduct this two-year project (Interagency Agreement FS028 01 0368). This project is unique in the NPS, and perhaps the nation, and represents a potential model for better coordinating regional bird conservation programs and activities within and outside the NPS. It further represents a progressive action toward institutionalizing bird conservation as a programmatic priority in the Southeast Region of NPS, and potentially the nation.

As envisioned, the integration of NABCI into the Southeastern NPS involves:

1) Development and delivery of Avian Conservation Implementation Plans (ACIP),
2) Coordination with NPS Inventory and Monitoring Program,
3) Development of a web based project site,
4) Establishment or enhancement of bird conservation partnerships,
5) Identification and exploration of potential funding opportunities, and
6) Technical guidance and assistance as needed or requested.

This ACIP fulfills one aspect of the plan outlined above, and serves as a basis for future bird conservation actions in BISC and with adjacent partners or landowners. Concurrently, the development of a Memorandum of Understanding (MOU) between the FWS and the NPS to implement Presidential Executive Order (EO) 13186, **Responsibilities of Federal Agencies to Protect Migratory Birds**, calls for integration of programs and recommendations of existing bird conservation efforts into park planning and operations. Complementing each other, the MOU and the Southeastern Bird Conservation Initiative will advance bird conservation in the Southeast Region of the NPS beyond current regional NPS efforts.

Role of NPS in Avian Conservation

The interagency agreement that facilitates this partnership supports both FWS and NPS management policies. Specifically for the NPS, the agreement supports and advances the **Strategy for Collaboration** (March 2000), a visionary document developed and signed by the Southeast Natural Resource Leaders Advisory Group (SENRLAG), a consortium of 13 land and resource management agencies in the Southeastern United States whose vision is to encourage and support cooperation in planning and managing the region's natural resources. Furthermore, the agreement is aligned with and implements a variety of NPS Management Polices (2001) including but not limited to External Threats and Opportunities (Chapter 1.5), Environmental Leadership (Chapter 1.6), Cooperative Planning (Chapter 2.3.1.9), Land Protection (Chapter 3), and especially Natural Resource Management (Chapter 4) that details policy and

management guidelines which apply to bird conservation. Important policies in this chapter include:

- Planning for Natural Resource Management (4.1.1)
- Partnerships (4.1.4)
- Restoration of Natural Systems (4.1.5)
- Studies and Collection (4.2)
- General Principles for Managing Biological Resources (4.4.1)
- Plant and Animal Population Management Principles (4.4.1.1)
- Management of Native Plants and Animals (4.4.2)
- Management of Endangered Plants and Animals (4.4.2.3)
- Management of Natural Landscapes (4.4.2.4)
- Management of Exotic Species (4.4.4)
- Pest Management (4.4.5)
- Fire Management (4.5) and
- Water Resource Management (4.6)

The NPS is the fourth largest landowner in the United States, consisting of over 380 national park units covering 83 million acres of land and water with associated biotic resources (www.nps.gov). The 64 units in the Southeast Region of the NPS represent 16% of the total number of park units in the national park system and cover approximately 5% of the total land base in the entire system. Park units in the Southeast Region include national seashores (Canaveral National Seashore, Cape Hatteras National Seashore), national parks (Great Smoky Mountains National Park, Everglades National Park), national recreation areas (Big South Fork National River and Recreation Area), national preserves (Big Cypress National Preserve), national battlefields (Cowpens National Battlefield, Fort Donelson National Battlefield), national monuments (Ocmulgee National Monument), and others such as the Blue Ridge Parkway, Obed Wild and Scenic River, and Timicuan Ecological and Historic Preserve.

Southeast NPS units provide habitat for over 400 species of migrating, breeding, and wintering birds and include a wide range of Federal and State listed threatened and endangered species. Likewise, these units also provide nest, migration, and winter habitat for most of the eastern species identified in the national bird conservation plans in need of conservation attention.

Additionally, the NPS attracts over 280 million visitors to the parks each year, 120 million of these in the Southeast Region, affording excellent recreational bird watching and opportunities to strengthen bird conservation interpretation, outreach, and education programs. These opportunities, the NPS mission, policies, and organization all lead to the conclusion that the NPS is an extremely valuable partner and contributor to bird conservation in the region.

Nationally, the status of birds in national parks is largely unknown, although many parks have adequate knowledge regarding bird occurrence in the parks

(http://www.npwrc.usgs.gov/resource/othrdata/chekbird/chekbird.htm). Parks often play a role in ongoing regional bird conservation efforts. Indeed many of these parks are often important to regional, national, or international bird conservation, and many have been designated as Important Bird Areas (IBA's) by the National Audubon Society. To date, there are approximately 64 NPS units that are designated IBA's, 35 of which are considered of global importance (http://abcbirds.org/iba/aboutiba.htm). In the Southeast Region, the NPS has 13 global IBA's.

.

The **NPS Inventory and Monitoring (I&M) Program** has been developed to provide management driven scientific information to national park managers so that resources can be adequately protected within national parks. One of the first phases of this program is to inventory vertebrates, including birds, within the 260 national park units in the program. Once completed, data from the inventories will provide an account of the occurrence and abundance of birds in all the national parks in the program. These records will be stored in the NPS I&M NPSpecies database http://www.nature.nps.gov/im/apps/npspp/). Coordination with I&M network staff is important to developing long-term bird monitoring programs that fulfill both park and NABCI objectives.

Park Flight is a NPS international partnership initiative that directs funding toward a variety of NPS programs that involve conservation of neotropical migratory birds whose life history range covers a US national park and a Latin American protected area. A relatively new program, Park Flight offers parks the opportunity to partner with a Latin American national park or protected area to cooperate on developing bird conservation and education projects (NPS 2002).

Recent increases in NPS base funded programs such as inventory and monitoring, exotic species management, habitat restoration, and fire management all indicate that national park managers recognize that park lands are increasingly subject to a variety of threats and conditions that must be improved to provide the quality of national park experience articulated in the NPS Organic Act (1916). Programmatic funding in these areas will increase the ability of national parks to provide quality habitat and conditions for increased wildlife conservation, including birds. Furthermore, private interests and non-profit conservation organizations have initiated programs, including grant programs, to provide much needed funding to national parks to meet backlogs of identified yet unfunded needs.

Park Description

Biscayne National Park was established in 1969 as Biscayne National Monument with expansions in 1974 and 1980 when it was re-designated Biscayne National Park. The park is located in southeast Florida, within sight of a major metropolitan area, the City of Miami, and heavily influenced by growth within metro Miami-Dade County. The Park is comprised of 70,000 total ha (172,924 acres) of which 63,000 ha (155,631 acres) are submerged. Biscayne National Park's enabling legislation charges the National Park Service to keep a rare combination of terrestrial, marine, and amphibious life for the

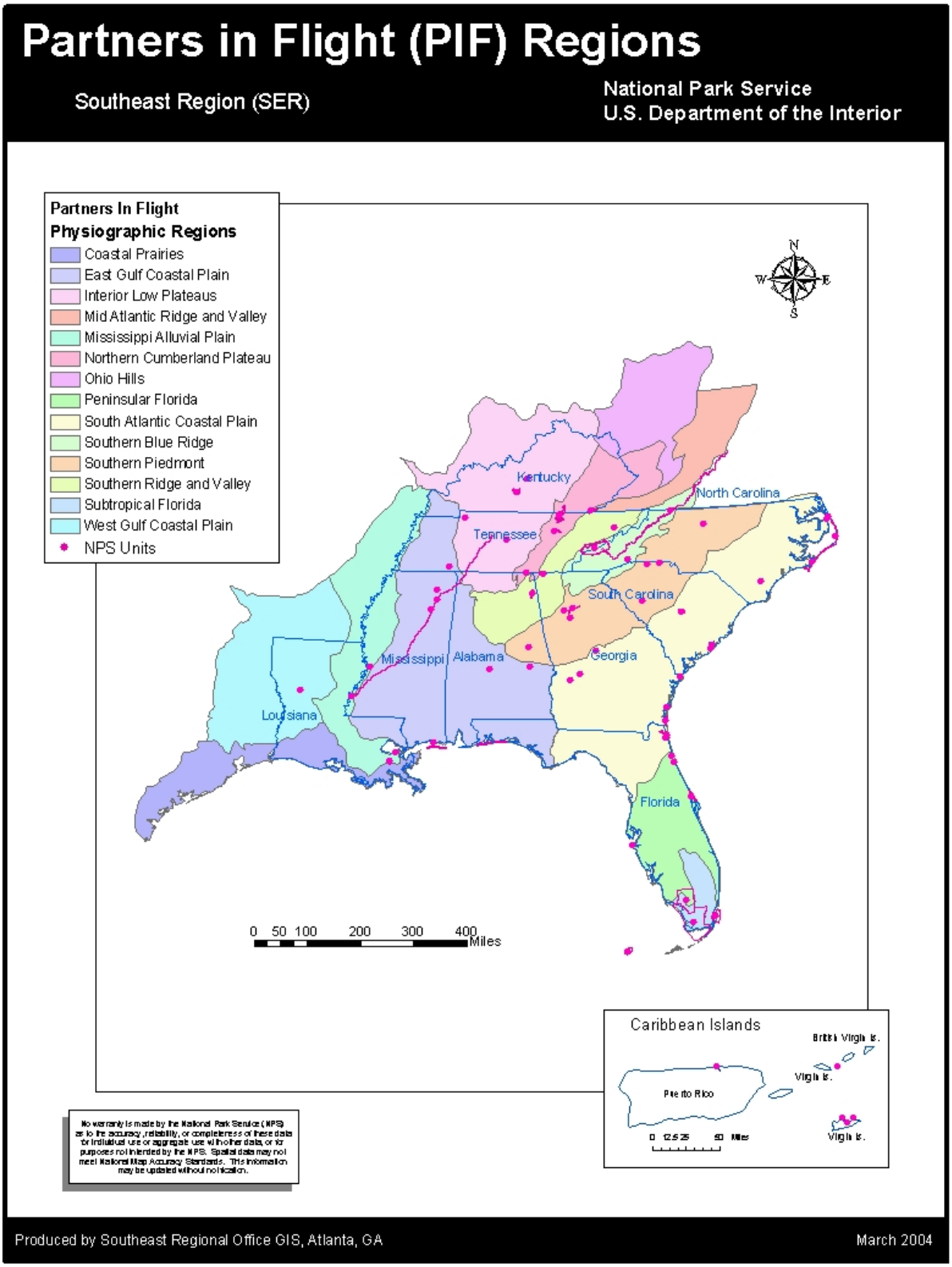
inspiration and enjoyment of present and future generations. The park preserves an entire coastal island ecosystem (upland to oceanic), and is home to over eleven federally threatened and endangered species, and over 28 state listed plants and animals in addition to the federally listed species (Sasso and Patterson 2000).

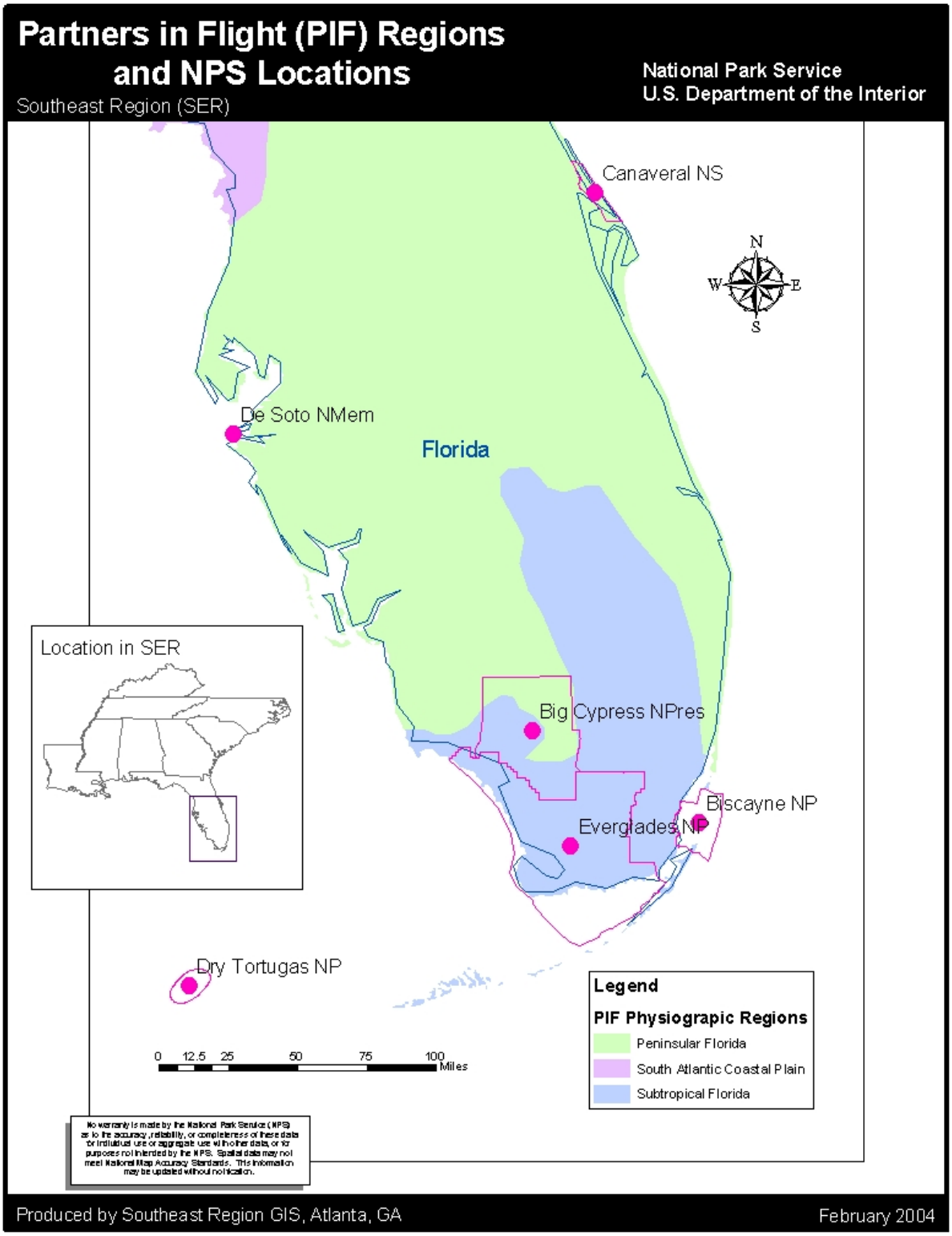
Avian Resources of Subtropical Florida

The physiographic area is entirely contained within Florida, and extends from the northern edge of Lake Okeechobee south through the Florida Keys (see PIF and NPS location maps below). The region has very little topographic relief, but slight changes in elevation have important consequences for vegetation and the diversity of habitat types. The highest points of elevation are less than 2 meters and correspond with fairly recent shorelines (less than 5,000 years before present). Underlying sediments consist of freshwater marl, peat, freshwater lake and marine sediments, and to a lesser extent, sand deposited during the Pleistocene and Holocene. The subtropical Florida region can be divided into four smaller sub-regions: 1) the everglades, 2) Big Cypress, 3) Miami Ridge and Atlantic Coastal Strip, and 4) Southern Coasts and Islands. The Everglades is the most extensive of these areas, followed by the Big Cypress, Miami Ridge and Southern Coasts. Across all subregions, much of the physical and ecological characteristics of the region resemble tropical ecosystems where seasonal changes are reflected by changing rainfall patterns rather than by dramatic temperature changes. Distinctive dry (winter/spring) and wet (summer) seasons occur annually, and the nesting cycles of many birds are tied to these changes. At least two major forms of disturbance play key roles in the ecology of the region. Fire is an important feature in many pine dominated communities and many marsh and prairie communities. Frequent fires are essential in pine-dominated stands and prairies if understory conditions suitable to many nesting birds are to be maintained. However, the ideal fire frequency in some pine communities is not known. Hurricanes are a second form of disturbance that less frequently but predictably provide early successional habitats or open forest cover (Partners in Flight 2000?).

Bird conservation priorities for Subtropical Florida have been stratified by habitat type. Recognized habitat types where high priority conservation actions are needed for both birds and habitats are pine forests (including pine rocklands, pine Flatwoods, sand pine scrub), grassland/grassland-scrub (including dry prairie and coastal strands), subtropical deciduous forest, everglades, brackish saltwater and freshwater marsh, and mangrove swamps. Species associated with each of these habitats and identified as high priority for conservation needs are given below.

Florida Scrub Jay, Red-cockaded Woodpecker, Southeastern American Kestrel, Brown-headed Nuthatch, Bachman's Sparrow, Palm Warbler and Sedge Wren are associated with the pine forests. Both Florida Scrub Jay and Southeastern American Kestrel have been extirpated in Subtropical Florida and the Brown-headed Nuthatch and Bachman's


Partners in Flight (PIF) Regions
Southeast Region (SER)
National Park Service
U.S. Department of the Interior
Partners In Flight
Physiographic Regions
Coastal Prairies
East Gulf Coastal Plain
Interior Low Plateaus
Mid Atlantic Ridge and Valley
Mississippi Alluvial Plain
Northern Cumberland Plateau
Ohio Hills
Peninsular Florida
South Atlantic Coastal Plain
Southern Blue Ridge
Southern Piedmont
Southern Ridge and Valley
Subtropical Florida
West Gulf Coastal Plain
NPS Units
N
W
E
S
Kentucky
North Carolina
Tennessee
South Carolina
Mississippi
Alabama
Georgia
Louisiana
Florida
0 50 100 200 300 400
Miles
Caribbean Islands
British Virgin Is.
Virgin Is.
Puerto Rico
Virgin Is.
0 12.5 25 50 Miles
No warranty is made by the National Park Service (NPS) as to the accuracy, reliability, or completeness of these data for individual use or aggregate use with other data, or for purposes not intended by the NPS. Spatial data may not meet National Map Accuracy Standards. This information may be updated without notification.
Produced by Southeast Regional Office GIS, Atlanta, GA
March 2004


Partners in Flight (PIF) Regions
and NPS Locations
Southeast Region (SER)
National Park Service
U.S. Department of the Interior
Canaveral NS
N
W
E
S
De Soto NMem
Florida
Location in SER
Big Cypress NPres
Biscayne NP
Everglades NP
Dry Tortugas NP
Legend
PIF Physiograpic Regions
Peninsular Florida
South Atlantic Coastal Plain
Subtropical Florida
0 12.5 25 50 75 100
Miles
No warranty is made by the National Park Service (NPS) as to the accuracy, reliability, or completeness of these data for individual use or aggregate use with other data, or for purposes not intended by the NPS. Spatial data may not meet National Map Accuracy Standards. This information may be updated without notification.
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February 2004

Sparrow are nearly extirpated here. Both Palm Warbler and Sedge Wren are present only in the non-breeding seasons.

Grasshopper Sparrow, Crested Caracara, Burrowing Owl, Sandhill Crane and Mottled Duck are all species associated with grassland to grassland scrub habitats. Grasshopper Sparrow has been extirpated in South Florida.

In the subtropical deciduous forest, Short-tailed Hawk, Swallow-tailed Kite, White-crowned Pigeon and Gray Kingbird are high priorities for conservation.

In the Everglades, brackish saltwater and freshwater marshes, Snail Kite, Cape Sable Seaside Sparrow, Wood Stork, Black Rail, Reddish Egret, Yellow Rail, White Ibis, and Clapper Rail are species in of conservation attention.

Prairie Warbler, Yellow Warbler, Black-whiskered Vireo, and Mangrove Cuckoo, species associated with Mangrove swamps and forests, and are of high priority conservation concern.

Human population growth has been phenomenal in subtropical Florida for the last 40 years. The impacts of such tremendous growth include increased infrastructure that directly reduces habitat availability, but also secondary impacts to bird habitats, such as pollution. Other land uses include production of sugarcane, winter vegetables, and citrus. Drastic changes in hydroperiod and natural water cycles are secondary impacts of increasingly intensive agriculture. However, among the best opportunities in the Southeast to work with existing public lands occur in Subtropical Florida, where over 54% of the area is publicly owned. Therefore, primary conservation programs include efforts to reduce impacts from adjacent or nearby lands on management of existing public lands. Many programs have been developed and are in various phases of implementation. These include the Save our Everglades program, the Surface Water Improvement and Management Act, Florida's Everglades Forever Act and the development of the South Florida Ecosystem Restoration Task Force as well as aggressive acquisition programs. These and other programs serve the basis for bird conservation efforts in the region.

Avian Conservation in BISC

Avian Biodiversity: BISC has a complete avian inventory (> 90% avifauna known) but has not developed a checklist of birds that is available for the public. Managers recognize the need to update the inventory and checklist. BISC has recorded over 215 species in the park, including many rare vagrants that often show up on the barrier islands of the park, attracting many birding enthusiasts.

Verified records of birds in BISC have been entered into the NPS I&M program's database, NPSpecies, and may be viewed via the internet at http://www.nature.nps.gov/im/app/npspp with a user identification and password

combination authorized by the NPS for NPS personnel and NPS cooperators. Many other avian observational data need to be verified and entered into the database.

Threatened and Endangered Species: Several federally listed threatened species occur in BISC, Bald Eagle, Wood Stork, Roseate Tern, and the Piping Plover. Only the Bald Eagle and Wood Stork are known to breed in BISC. The Roseate Tern is a migrant, and the Piping Plover is a winter resident. Critical habitat for Piping Plover has been established at BISC.

Several species in BISC are listed on the Florida Fish and Wildlife Conservation Commission (FFWCC) list of Endangered Species, Threatened Species, and Species of Special Concern. Prominent among these are Osprey, White-crowned Pigeon, Least Tern, Black Skimmer, Snowy Plover, and Peregrine Falcon (Arctic subspecies).

Additionally, BISC has several species that have been identified as high priority for conservation by Partners In Flight. These are Cuban Yellow Warbler, Black-whiskered Vireo, Mangrove Cuckoo, Florida Prairie Warbler, Gray Kingbird, Reddish Egret and White Ibis.

Park Priorities: Park staff and consultants have identified the Brown Pelican, Least Tern, and Piping Plover as species of significant management concern and high priority for conservation.

Inventory: The park's avian inventory has been recognized as important information for park managers and is considered complete within the framework of the NPS I&M Program. BISC is one of seven parks in the NPS South Florida/Caribbean I&M Network for which a plan to conduct high priority inventory projects has been prepared (Sasso and Patterson 2000). At this time, no inventory efforts are planned for BISC.

Monitoring: Currently, several avian monitoring projects are being conducted at BISC. These are:

- Breeding surveys are conducted for Least Tern, Wilson's Plover, and Killdeer
- Christmas Bird Count have been reinstated after a lapse in the late 1980's and 1990's
- Bald Eagle and Osprey nest monitoring
- Migration monitoring is occasionally conducted
- Colonial Waterbird surveys on Arsenicker Keys (all egrets and herons; including Reddish Egret)
- Randomized recreational birding

Research: Scientific research is permitted within the park, and currently no research other than existing avian monitoring is ongoing.

Outreach: Some educational information related to birds is conveyed to visitors to BISC.

- A Birdwatching for Beginners program is offered by Tropical Audubon Society

Park Identified Needs for Avian Conservation

BISC has identified several projects that would increase the avian knowledge of the park. They are:

Inventory:

- Better knowledge of nesting birds, and relative abundance of all species, especially high priority species

Monitoring:

- Better information on value of park for migration

Data Management:

- Verify and enter avian observational data into NPSpecies, eBird, or another appropriate database (BISC data is stored in Everglades National Park databases)

Coordination with Regional Conservation Initiatives

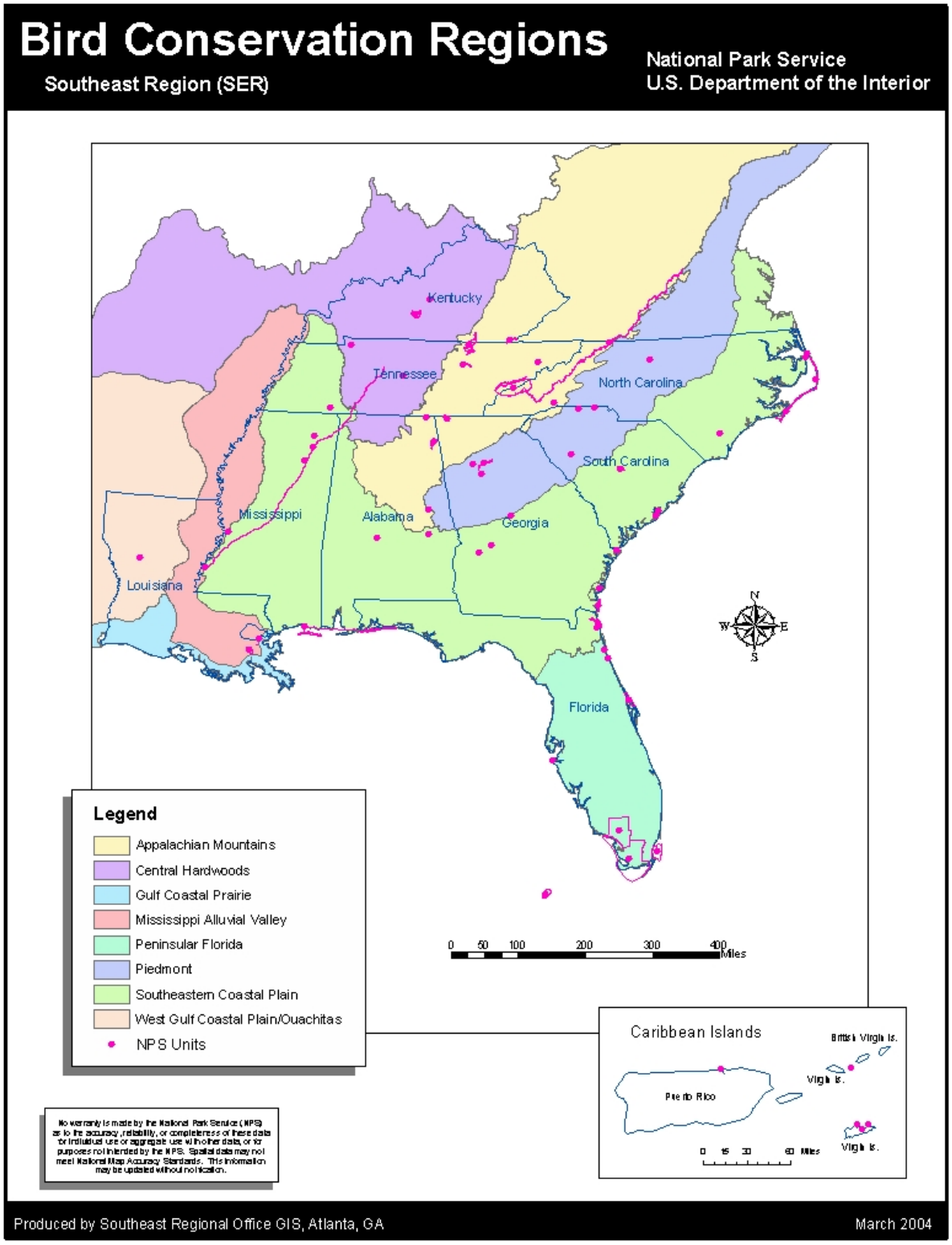
North American Bird Conservation Initiative

NABCI bird conservation planning units, referred to as Bird Conservation Regions (BCR), are often larger than other planning units associated with other plans, such as Partners In Flight. For example, BISC is within the NABCI Peninsular Florida BCR that covers all of Southern Florida south of approximately Jacksonville (see NABCI BCR map below) and encompasses two PIF physiographic areas (the planning unit for PIF)(compare to PIF map).

Several NABCI BCR's have coordinators whose primary responsibility is to coordinate all bird conservation planning in the BCR, across all agencies and organizations. Currently, the Peninsular Florida BCR does not have a designated coordinator; however, the Atlantic Coast Joint Venture (ACJV) has staff that with responsibility to provide bird conservation assistance to agencies and organizations in the area. This staff can provide valuable assistance to BISC with implementation of aspects of this ACIP.

North American Waterfowl Management Plan (NAWMP)

The NAWMP (http://northamerican.fws.gov/NAWMP/nawmphp.htm) is completed and has been revised several times, incorporating updated goals and strategies based on new information. This plan is one of the most successful bird conservation delivery


Bird Conservation Regions
Southeast Region (SER)
National Park Service
U.S. Department of the Interior
Kentucky
Tennessee
North Carolina
South Carolina
Mississippi
Alabama
Georgia
Louisiana
Florida
N
W
E
S
Legend
Appalachian Mountains
Central Hardwoods
Gulf Coastal Prairie
Mississippi Alluvial Valley
Peninsular Florida
Piedmont
Southeastern Coastal Plain
West Gulf Coastal Plain/Ouachitas
NPS Units
0 50 100 200 300 400 Miles
Caribbean Islands
British Virgin Is.
Virgin Is.
Puerto Rico
Virgin Is.
0 15 30 60 Miles
No warranty is made by the National Park Service (NPS) as to the accuracy, reliability, or completeness of these data for individual use or aggregate use with other data, or for purposes not intended by the NPS. Spatial data may not meet National Map Accuracy Standards. This information may be updated without notification.
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March 2004

programs in the United States, being monetarily supported by the North American Wetlands Conservation Act (NAWCA). The ACJV coordinators are responsible for coordination and implementation of this program.

Partners In Flight

Goals and strategies for the Subtropical Florida are not yet fully developed into a draft bird conservation plan. However, as previously noted, bird conservation priorities for BISC are better aligned with Puerto Rico and the US Virgin Islands goals, yet are largely the responsibility of the NPS and the State of Florida, an arrangement that can make bird conservation at BISC challenging.

Similar to NABCI BCR's, PIF physiographic areas often do not have designated coordinators. However, state level non-game agencies with investment in PIF will establish key personnel to develop partnerships among cooperators in the physiographic area. The State of Florida has a non-game bird coordinator who can be instrumental in assisting BISC to implement recommendations identified in this ACIP and projects important to bird conservation relative to Florida's role in implementation of the respective geographical plans.

United States Shorebird Conservation Plan (USSCP)

The USSCP has been completed and is available on the world wide web (http://shorebirdplan.fws.gov/). A regional step down plan is in preparation by FWS personnel and should be available in 2003.

Waterbird Conservation for the Americas (WCA)

The WCA plan has been completed and is available on the World Wide Web or can be ordered from the US Fish and Wildlife Service National Conservation Training Center (http://www.waterbirdconservation.org/).

Integration of NABCI Goals and Objectives into Park Planning and Operations

NABCI Implementation Recommendations

To successfully achieve park-established goals and actively participate in NABCI, the park could implement a variety of projects in different NPS programs. Most of these projects would require some level of participation by many existing park programs and could either be achieved through NPS funding, or more likely, through establishing or improving partnerships with agencies and organizations that already have the necessary expertise to provide guidance, funding, and execution of these programs. Programmatic areas where bird conservation actions are likely to be focused are:

- Inventory
- Monitoring
- Habitat Restoration
- Threat Management (includes exotic species, air quality, water quality, etc.)
- Research
- Compliance
- Outreach
- Partnerships

To the extent appropriate, each of these program areas will be discussed separately and within each, specific opportunities identified that, when implemented, will enable to park to meet its mandates (current and expected) as well as integrate NABCI into its planning and operations. With emphasis added, the park is not expected to implement any of these recommendations or be obligated to pursue any opportunity other than those the park is required to do by law or NPS program or policy. In other words, participation in this effort is currently voluntary. However, participation in these efforts at some level could become mandatory with the completion of an MOU with the FWS regarding EO 13186, **Responsibilities of Federal Agencies to Protect Migratory Birds**. The MOU will establish a formal agreement between the FWS and the NPS to promote bird conservation within the agency by incorporating goals and strategies of existing bird conservation initiatives, plans, and goals into park planning and operations.

Should the park decide to implement any of these projects, further consultation with bird conservation contacts is encouraged to obtain updated information on the relevance of these opportunities in regional bird conservation.

High priority projects are identified in **bold** print. Priorities that the park is encouraged to seek NPS funding for are marked with and asterisk (*****). These projects are those that are critical to the stabilization or improvement of a bird population in the planning region.

Inventory

The park has inventoried its bird fauna exceptionally well. Although the avifauna of BISC is well documented, additional information is needed on abundance and distribution of species. BISC is encouraged to:

- **establish a migration monitoring program throughout the park to determine use of BISC by fall migrants, especially on barrier island habitats***

- **obtain abundance and distributional information of all species that nest in BISC and others of high priority conservation concern that use the park as foraging or roosting areas, especially listed species, and those that occur in the coastal mangrove or hammock forests (White-crowned Pigeon, Yellow Warbler, Black-whiskered Vireo, Prairie Warbler, Mangrove Cuckoo)***

- **verify other avian observational data collected in the park and enter into the appropriate database (NPSpecies, eBird, or other appropriate database)**

- **standardize inventory and monitoring methodology to conform to NPS and/or FWS recommended standards (Fancy and Sauer 2000, Hunter 2000).**

Monitoring

The park's bird monitoring program is focused on primarily federally and state listed species. Efforts should be made to continue existing monitoring programs. Specific recommendations are to:

- **continue to conduct existing monitoring programs and enter data into the appropriate databases (NPSpecies, eBird, or other appropriate database)**

- **establish a mangrove/coastal hammock avian monitoring program to document abundance of species in theses habitats (see Partnerships below)**

- **determine usage of park by migrating and wintering shorebirds and adopt appropriate level of shorebird monitoring to document shorebird use of the park**

- **establish a scientifically based landbird migration monitoring program to document use of BISC during landbird migrations***

- **establish the Christmas Bird Count (CBC) as an institutional program, working with local partners to assure the CBC is conducted annually**

- **standardize inventory and monitoring methodology to conform to NPS and/or FWS recommended standards (Fancy and Sauer 2000, Hunter 2000).**

Habitat Restoration

Recently, habitat restoration efforts have increased nationwide, and on NPS lands; NPS receiving restoration emphasis and guidance in the 2001 Management Policies (NPS 2001). Habitat restoration efforts that parks may undertake are wetland restoration, grassland restoration, woodland restoration, etc. utilizing a wide range of tools to accomplish the restoration. Some of these tools may be but not limited to forest management practices, exotic species management, public use and recreation management, infrastructure development management, and prescribed fire.

Due to the protected nature of BISC lands, and generally those in the national park system, the condition of habitats for bird use may be of higher quality than other natural, developed, agricultural, or forest lands under other management regimes. However,

national park lands can be greatly improved for wildlife, and particularly bird use, by restoring processes important for habitat formation, succession, and structural development. Largely, these processes have not been managed historically in the national park system but current policy allows for active management of species, populations, and lands to provide for long-term conservation of park resources.

The park is entirely coastal/estuarine/barrier island park subject to the forces generated upon and moving across the ocean surfaces. Tropical storms, tidal fluctuations, and sea level rise are processes that influence the dynamic landscape of BISC and likewise, habitats and associated birds. Specific recommendations are to:

- **maintain or enhance water quality in surrounding waters to support aquatic biota necessary to support fish eating birds that either nest or forage in the park***

- **restore hydrological processes in park, particularly in support of restoration of South Florida ecosystems and Comprehensive Everglades Restoration Program (CERP)**

- **enhance seagrass recovery (nursery for bird prey) in the park by managing threats to this vegetation**

- **preserve remaining coastal mangrove and hammock forests for migrating land birds***

- **continue to monitor and eliminate exotic vegetation**

Threat Management

Many different factors pose threats to bird conservation at BISC, but through sound scientific data gathering, these threats can be minimized or avoided. Boats, recreation, predators, and exotic vegetation all affect bird conservation at BISC. A better understanding of the extent and impact of these threats is needed to effectively preserve park resources. The park is encouraged to:

- **manage recreational uses of the park, especially boats and pedestrian traffic to areas where birds nest on barrier islands and to avoid disturbances to foraging, migrating, and wintering colonial waterbirds and shorebirds (develop a Recreational Use Plan)***

- **manage other recreation uses of the park including personal watercraft, kayaking, canoeing, to avoid disturbance to nesting, foraging, migrating, and wintering colonial waterbirds and shorebirds (develop a Recreational Use Plan)***

- **Develop Predator Management Guidelines, similar to those developed at Cape Hatteras National Seashore (USDI 2002) (Cape Hatteras National Seashore has recently completed a feral cat reduction campaign that could be used as a model for a similar program at BISC (Altman 2002, Harrison 2002))***

- **hire additional law enforcement officers to provide protection for beach nesting, foraging, migrating, and wintering birds***

- **continue to work with adjacent landowners and neighbors, the local community, and pubic officials to curb unregulated and free roaming feral cats in the park**

- **manage fishing practices that impact fish eating birds such as providing monofilament dispensers at key locations in the park**

- identify threats from low flying aircraft

Exotic vegetation has been well managed by the South Florida Exotic Plant Management Team at BISC. Efforts should continue to

- **monitor and manage exotic vegetation**

Research

Several research projects have been identified that could improve bird conservation for birds at BISC and contribute to increased bird conservation efforts for these species in the Caribbean. These projects are:

- **Determine importance of BISC as a migration stopover**

- **Conduct impact assessment of park fishing methods and fishing gear on fish feeding birds**

- **List park needs and projects on Research Permit and Reporting System web site (RPRS)**

- Develop contact with South Florida/Caribbean Cooperative Ecosystem Studies Unit (CESU) at the Rosentiel School of Marine and Atmospheric Sciences at the University of Miami, Fl

Compliance

Park compliance with the Migratory Bird Treaty Act and the Executive Order 13186, **Responsibilities of Federal Agencies to Protect Migratory Birds,** is necessary to

assure that park activities incorporate bird conservation into park planning and operations. Further, to ensure that migratory birds are considered in all phases of park planning processes, especially during the National Environmental Policy Act (NEPA) and the Director's Order #12 Compliance processes, the park should consider adding specific language in project evaluations that requires consideration and implications of park projects on migratory birds. The MOU being developed between the NPS and the FWS will likely contain specific language requiring a park to consider implications of park projects on migratory birds, particularly those species identified in the USFWS Species of Conservation Concern 2002 (Appendix D). Additional considerations are to encourage:

- **park staff to begin specific consideration of migratory birds during park planning processes**

- park staff to attend USFWS training on implementation of EO 13186 at the National Conservation Training Center (NCTC) (when available) or other training on migratory bird conservation in North America. NCTC has several courses and training related to conservation of migratory birds (http://training.fws.gov/courses.html).

The USFWS NCTC offers and reserves two tuition free slots for National Park Service employees wishing to attend NCTC courses on a first come, first served basis. Additionally, discount lodging is also available while attending a NCTC course.

Outreach

- **participate in International Migratory Bird Day (IMBD) (http://birds.fws.gov/imbd.html) events with a local partner such as the Tropical Audubon Society and US Fish and Wildlife Service***

- **develop partnerships with local agencies and organizations to implement aspects of this plan, especially with USFWS, Tropical Audubon Society and Bill Baggs Cape Florida State Park***

- **encourage development of outreach and educational programs to enhance visibility of bird conservation issues, which may include organized bird walks, migration monitoring, and perhaps waterbird colony visits**

- **develop educational/outreach program for park fishing persons to avoid or minimize impacts or injury to fish eating birds**

- **encourage accurate documentation and reporting from randomized outings by visitors (see Cornell University's eBird monitoring program (Cornell Lab. Ornith. 2002 (http://www.ebird.org/about/index.jsp)**

- park interpretation/education staff are encouraged to attend USFWS training on Migratory Bird Education at NCTC

- consider adding links to bird conservation information, data, etc. to the park's web site home page

- support bird conservation by serving shade-grown coffees at meetings, events, and the office buildings in the park (http://www.americanbirding.org/programs/conssbcof3.htm)

- subscribe to Florida Birds, an electronic forum for listing bird sightings and publications in Florida

Partners and Partnerships

Partnerships for habitat conservation and protection will perhaps have the greatest positive influence on bird conservation above all other landscape scale planning. Specific recommendations are to:

- **keep abreast of initiatives that may affect water quality in and around BISC**

- **become active in the developing mangrove/coastal hammock avian conservation initiative with USFWS (Terry Doyle at Ten Thousand Islands National Wildlife Refuge)**

- **continue to develop and strengthen relationship with local bird clubs such as the Tropical Audubon Society to coordinate and conduct park bird conservation projects**

- **develop partnership with USFWS, especially local refuges to assist in bird inventory and monitoring efforts and implementation of aspects of this plan**

- **contact the nearest Joint Venture office (see Funding section for explanation of Joint Ventures) or BCR coordinator to develop partnerships and funding proposals tiered to priorities established by the park, this ACIP, and the bird conservation plans that pertain to BISC**

Funding Opportunities

Internal NPS funding is often an effective source to obtain funding; however, the project will have to be a fairly high priority among the park's natural resource program to successfully compete for the limited funding available in the NPS. Therefore, partnerships and outside funding programs are often more productive for securing bird

conservation funding. Within this ACIP, identified priority projects that are considered to be high park priorities as well as NABCI priorities are marked with and asterisk (*). BISC is encouraged to enter all high priority projects into the NPS Performance Management Information System (PMIS) database.

Funding for conservation projects for Neotropical migrants is also available through the Park Flight program.

With the exception of the North American Waterfowl Management Plan (NAWMP and its associated funding legislation, the North American Wetland Conservation Act), funding opportunities for bird conservation programs, plans, and initiatives have been lacking. Only within the last decade have other appropriate and specific sources for bird conservation funding been created and used. The NAWMP has been supported for approximately 14 years by the North American Wetlands Conservation Act (NAWCA 1989). This program has provided $487 million in appropriated funds matched with $1.7 billion for wetland and bird conservation projects since its inception. In 2002 alone, over $70 million US dollars were awarded to US and Canadian agencies and organizations to enhance waterfowl populations by improving, restoring, or protecting wetland habitats. To adequately evaluate projects and distribute these funds, partnerships called Joint Ventures were established. Nationally, 14 (11 US, 3 Canada)

Joint Ventures have been established, several which are funded and staffed. Internet links to Joint Ventures are:

(http://southwest.fws.gov/gulfcoastjv/ojvcontact.html) and
(http://northamerican.fws.gov/NAWMP/jv.htm).

Funding through NAWCA is highly underutilized by the NPS and any park unit that has wetland, water, or bird conservation needs associated with wetland are encouraged to investigate using this funding source. Naturally, there are certain requirements to be eligible for all grants and park managers are encouraged to consult with the nearest Joint Venture, BCR, PIF Coordinator, to learn how this program might be applicable to implementation of this plan, and other park wetland issues. BISC should contact the ACJV assistant coordinator to investigate use of this funding source and developing proposals for implementation of portions of this plan.

Internal FWS funding programs may be used to support projects, but no effective method of project proposal delivery to these sources is currently in place for the NPS. Current funding in these programs may result from FWS familiarity with NPS needs, or NPS participation in one of the area FWS Ecosystem Teams, where a project has been identified and proposed to be funded through the Ecosystem Team.

Specific congressional appropriations to protect migratory birds has recently been authorized under the Neotropical Migratory Bird Conservation Act (2000) (http://www.nfwf.org/programs/nmbcapp.htm). Appropriations through this Act are authorized up to $5 million per year. However, in 2000, appropriation was

approximately $3.75 million and a majority of this funding was directed toward projects in Central and South America.

Many of the identified projects are eligible for funding under various grant programs of the National Fish and Wildlife Foundation (http://www.nfwf.org/programs/programs.htm).

Other prominent funding sources available to NPS managers for bird conservation are listed on this projects web site at:

http://southeast.fws.gov/birds/NPSHighlits.htm.

Funding opportunities for migratory bird conservation are available yet most natural resource agencies are not fully aware of and/or understanding of how to use these sources. Perhaps a consolidated migratory bird funding source catalog will become available to managers in the future; this is needed.

Contacts

Primary contacts within the region can be obtained by viewing the web site for the Southeastern Bird Conservation Initiative, National Park Service at http://southeast.fws.gov/birds/npsbirds.htm. This web site will provide contact information of the appropriate bird conservation coordinator in the region for park personnel. Park staff are encouraged to view the web site and obtain contact information. Primary contacts for BISC are:

US Fish and Wildlife Service

Keith Watson
Asheville, NC 28801
828-350-8228
Keith_Watson@fws.gov

Dean Demarest
1875 Century Blvd.
Atlanta, GA
404-679-7371
Dean_Demarest@fws.gov

Jennifer Wheeler
Waterbird Conservation Plan Coordinator
703-358-1714
Jennifer_A_Wheeler@fws.gov

Craig Watson
Atlantic Coast Joint Venture
Charleston, SC
843-727-4707 ext. 16
Craig_Watson@fws.gov

Chuck Hunter
Regional Refuge Biologist
Atlanta, GA
404-679-7130
Chuck_Hunter@fws.gov

Terry Doyle
US Fish and Wildlife Service
Ten Thousand Islands NWR
Naples, FL
239 353-8442
Terry_Doyle@fws.gov

National Park Service

Rick Clark
Biscayne National Park
Homestead, FL
305 230-1144
Rick_Clark@nps.gov

Matt Patterson
South Florida/Caribbean
Inventory & Monitoring Network
SF/C Network Coordinator
National Park Service
305 224-4211
Matt_Patterson@nps.gov

Tony Pernas
National Park Service
Exotic Plant Management Coordinator
Tony_Pernas@nps.gov

Carol Daniels
South Florida/Caribbean CESU
Rosential School of Marine and Atmospheric Sciences
University of Miami
Miami, Fl
Carol_Daniels@nps.gov

Jeff Gore
Florida Fish and Wildlife Conservation Commission
Jeff.Gore@fwc.state.fl.us

Karl Miller
Florida Fish and Wildlife Conservation Commission
352-955-2230
Karl.Miller@fwc.state.fl.us

Exotic Animal Management

Bernice Constantine
USDA Wildlife Services
Florida
353-377-5556

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APPENDIX A

SUBTROPICAL FLORIDA PRIORITY SPECIES (PARTNERS IN FLIGHT)
Priority Bird Populations and Habitats

Pine forests (including Pine Rocklands, Pine Flatwoods, Sand Pine Scrub)

Florida Scrub Jay	Currently extirpated here.
Red-cockaded Woodpecker	
American Kestrel	Southeastern U.S. subspecies; currently extirpated here.
Brown-headed Nuthatch	Nearly extirpated here.
Bachman's Sparrow	Nearly extirpated here.
Palm Warbler	Non-breeding seasons.
Sedge Wren	Non-breeding seasons.

Grassland/grassland-scrub (including dry prairie and coastal strands)

Grasshopper Sparrow	Florida subspecies; extirpated here.
Crested Caracara	Florida populations.
Burrowing Owl	Florida subspecies.
Sandhill Crane	Florida subspecies.
Mottled Duck	

Subtropical deciduous forest

Short-tailed Hawk	Florida population.
Swallow-tailed Kite	Southeastern U.S. subspecies.
White-crowned Pigeon	
Gray Kingbird	

Everglades, brackish saltwater and freshwater marsh

Snail Kite	Everglades subspecies.
Seaside Sparrow	Cape Sable subspecies.
Wood Stork	Southeast U.S. population.
Black Rail	
Reddish Egret	
Yellow Rail	Non-breeding seasons.
White Ibis	
Clapper Rail	

Mangrove Swamps

Prairie Warbler	Florida subspecies.
Yellow Warbler	Cuban subspecies.
Black-whiskered Vireo	
Mangrove Cuckoo	

APPENDIX B

Southeast Region Waterbird Priorities and Habitat Types

Table 1. Southeast U.S. Waterbird Conservation Plan species priorities and habitat suites (b=breeding, r=resident, w=winter, r=resident).*

Tier	**Tier Title**	**Action Level**	**Herons and allies, Pelicans and allies typically brush and tree nesting colonial waterbirds**	**Larids typically beach (ground)-nesting colonial waterbirds (terns, gulls, skimmers)**	**Marshes/ Savannas/ Grasslands**	**Open water (with mud and sand flats also foraging habitat for most colonial species)**	**Pelagic (all non-breeding populations)**
I.	**Continental Conservation Interest**						
a.	**Multiple concerns**	*Immediate management*	"Great White" Heron		Black Rail (b/r)		Bermuda Petrel
					King Rail (b/r)		Black-capped Petrel
					Yellow Rail (w)		
					Whooping Crane (w-TX, r-FL)		
b.	**High threats and/or declining**	*Immediate management*		Roseate Tern		Horned Grebe (w)	Audubon's Shearwater
		Management attention	Little Blue Heron	Gull-billed Tern			Greater Shearwater
				Least Tern			Band-rumped Storm-Petrel
				Black Skimmer			Bridled Tern
		Planning and responsibility	Masked Booby				Brown Booby
							Razorbill

c.	**Local and/or rare**	*Immediate Management*	Magnificent Frigatebird				
			Reddish Egret				
		Management attention					Cory's Shearwater
							Manx Shearwater
		Planning and responsibility		Bridled Tern			
Tier	**Tier Title**	**Action Level**	**Herons and allies, Pelicans and allies typically brush and tree nesting colonial waterbirds**	**Larids typically beach (ground)-nesting colonial waterbirds (terns, gulls, skimmers)**	**Marshes/ Savannas/ Grasslands**	**Open water (with mud and sand flats also foraging habitat for most colonial species)**	**Pelagic (all non-breeding populations)**
II.	**Regional Conservation Interest**						
a.	**High Concern**	Immediate Management	Wood Stork (b/r, FL, GA, SC, AL))		Least Bittern (b/r)	Red-throated Loon (w)	Sooty Shearwater
		Management attention	Green Heron		Purple Gallinule (b/r)	Common Tern (transient populations)	
			Black-crowned Night-Heron		American Coot (breeding populations only)	Black Tern (transient populations)	
			Wood Stork (nb, MS, LA, TX, AR, elsewhere)		Limpkin (r)		
					American Bittern (w)		

		Planning and responsibility	Yellow-crowned Night-Heron	Royal Tern			
				Sandwich Tern			
b.	**High Threats**	*Immediate management*			Sandhill Crane (Mississippi subspecies)		
		Management attention	White Ibis	Common Tern (Atlantic and Gulf coast breeding populations only)	Pied-billed Grebe (breeding populations only)	Greater Flamingo (formerly bred)	Northern Gannet
						Common Loon (w)	
						American White Pelican (w)	
Tier	**Tier Title**	**Action Level**	**Herons and allies, Pelicans and allies typically brush and tree nesting colonial waterbirds**	**Larids typically beach (ground)-nesting colonial waterbirds (terns, gulls, skimmers)**	**Marshes/ Savannas/ Grasslands**	**Open water (with mud and sand flats also foraging habitat for most colonial species)**	**Pelagic (all non-breeding populations)**
II.							
c.	**High Responsibility**	*Planning and responsibility*	Brown Pelican	Forster's Tern (actually nests in marshes)	Clapper Rail (r)	Franklin's Gull (transient populations)	Sooty Tern
			Tricolored Heron	Sooty Tern (Florida breeding population only; nests under cover)	Sandhill Crane (Florida subspecies)	Bonaparte's Gull (w)	Brown Noddy
				Brown Noddy (Florida breeding population only; elevated nests in shrubs, trees)	Sandhill Crane (Greater, Lesser, and Canadian subspecies)		

III.	**Additional Federal and State Listed Species**						
IV.	**Additional local or regional interest**	*Planning and responsibility*	Anhinga	Caspian Tern	Least Grebe (r)	Eared Grebe (w)	
			Great Blue Heron		Common Moorhen (b/r)		
			Great Egret		Virginia Rail (w)		
			Snowy Egret		Sora (w)		
			Glossy Ibis				
			White-faced Ibis				
			Roseate Spoonbill				
Tier	**Tier Title**	**Action Level**	**Herons and allies, Pelicans and allies typically brush and tree nesting colonial waterbirds**	**Larids typically beach (ground)-nesting colonial waterbirds (terns, gulls, skimmers)**	**Marshes/ Savannas/ Grasslands**	**Open water (with mud and sand flats also foraging habitat for most colonial species)**	**Pelagic (all non-breeding populations)**
IV.		*Population Control*	Neotropical Cormorant	Laughing Gull			
			Double-crested Cormorant	Herring Gull			
			Cattle Egret	Great Black-backed Gull			
	Other species covered in this plan					Pied-billed Grebe (non-breeding populations)	Wilson's Storm-Petrel

						American Coot (non-breeding populations)	Leach's Storm-Petrel
						Ring-billed Gull	Pomarine Jaeger
						Lesser Black-backed Gull	Parasitic Jaeger
							Black-legged Kittiwake
							Dovekie

*See Appendices I-III.

Tier=

I. Continental Conservation Interest (Continental WatchList): (a) Species with multiple causes for concern across their entire range; (b) Moderately abundant or widespread species with declines or high threats, and (c) Species with restricted distributions or low population size.

Species with multiple causes for concern across their entire range: These species are considered by many to be of highest continental concern and of highest priority for conservation actions at national and international scales.

Moderately abundant or widespread species with declines or high threats: These species are on the Watch List primarily because they are declining and/or threatened throughout their range, though still fairly widespread or with moderately large populations.

Species with restricted distributions or low population size: These species are on the Watch List because they are restricted to a small range or have small global populations (often both). Many of these species are not known to be declining or seriously threatened at present, but many others. We recognize that these species with small populations and restricted range are particularly vulnerable to relatively minor changes from current conditions, whether or not their populations are currently in decline.

II. Regional Conservation Interest (non-WatchList; TOT$\geq$19): (a) high regional concern (AI+PT$\geq$8); (b) high regional threats (TB+TN$\geq$7, or TB or TN=5) and includes taxa (subspecies and populations) of regional conservation interest not otherwise included in categories above; (c) high regional responsibility (as measured by percent of global, continental, or regional populations).

III Additional Federally and/or State listed.

IV Local or regional concern or interest.

Act. Level=Action Level at present based on expert opinion, but ultimately rules based on scores would be preferable.

IM=Immediate management needed to reverse or stabilize significant, long-term population declines in species with small populations, or to protect species with the smallest populations for which trends are poorly known. Lack of action may lead to extirpations or extinction.

MA=Management or other on-the-ground conservation actions needed to reverse or stabilize significant, long-term population declines in species that are still relatively abundant.

PR=Long-term Planning and Responsibility needed for species to ensure that sustainable populations are maintained for species for which a region has high responsibility for that species.

PC=Population Control/Suppression needed for species that are otherwise secure and increasing that may come into conflict with other species of higher conservation concern or other resources of interest.

APPENDIX C

Wildlife Conservation Commission

FLORIDA'S ENDANGERED SPECIES, THREATENED SPECIES AND SPECIES OF SPECIAL CONCERN

Official Lists

Publication Date: 1 August 1997

This document consolidates the state and federal official lists of endangered species, threatened species, and other species categorized in some way by the respective jurisdictional agencies as meriting special protection or consideration. The state lists of animals are maintained by the Florida Game and Fresh Water Fish Commission and categorized as endangered, threatened and of special concern, and constitute Rules 39-27.003, 39-27.004 and 39-27.005, respectively, Florida Administrative Code (F.A.C.). The state lists of plants are categorized into endangered, threatened and commercially exploited, and are administered and maintained by the Florida Department of Agriculture and Consumer Services via Chapter 5B-40, F.A.C. The federal lists of animals and plants are administered by the U.S. Fish and Wildlife Service and categorized into endangered and threatened, and are published in 50 CFR 17 (animals) and 50 CFR 23 (plants). The abbreviations used in part one are:

GFC = Florida Fish and Wildlife Conservation Commission

FDA = Florida Department of Agriculture and Consumer Services

FWS = United States Fish and Wildlife Service

E = Endangered

T = Threatened

T(S/A) = Threatened/Similarity of Appearance

T(E/P) = Threatened/Experimental Population

SSC = Species of Special Concern

C = Commercially Exploited

		Designated Status	
Scientific Name	**Common Name(s)**	**GFC**	**FWS**
Birds			
Ajaia ajaja	Roseate spoonbill	SSC	
Ammodramus maritimus juncicolus	Wakulla seaside sparrow	SSC	

		Designated Status	
Scientific Name	**Common Name(s)**	**GFC**	**FWS**
Ammodramus maritimus mirabilis	Cape Sable seaside sparrow	E	E
Ammodramus maritimus peninsulae	Scott's seaside sparrow	SSC	
Ammodramus savannarum floridanus	Florida grasshopper sparrow	E	
Aphelocoma coerulescens	Florida scrub-jay	T	T
Aramus guarauna	Limpkin	SSC	
Campephilus principalis	Ivory-billed woodpecker	E	E
Charadrius alexandrinus tenuirostris	Southeastern snowy plover	T	
Charadrius melodus	Piping plover	T	T
Cistothorus palustris griseus	Worthington's marsh wren	SSC	
Cistothorus palustris marianae	Marian's marsh wren	SSC	
Columba leucocephala	White-crowned pigeon	T	
Dendroica kirtlandii	Kirtland's warbler	E	E
Egretta caerulea	Little blue heron	SSC	
Egretta rufescens	Reddish egret	SSC	
Egretta thula	Snowy egret	SSC	
Egretta tricolor	Tricolored (=Louisiana) heron	SSC	
Eudocimus albus	White ibis	SSC	
Falco peregrinus tundrius	Arctic peregrine falcon	E	
Falco sparverius paulus	Southeastern American kestrel	T	
Grus americana	Whooping crane	SSC	T(E/P)
Grus canadensis pratensis	Florida Sandhill crane	T	
Haematopus palliatus	American oystercatcher	SSC	
Haliaeetus leucocephalus	Bald eagle	T	T
Mycteria americana	Wood stork	E	E

		Designated Status	
Scientific Name	**Common Name(s)**	**GFC**	**FWS**
Pandion haliaetus	Osprey	SSC*	
Pelecanus occidentalis	Brown pelican	SSC	
Picoides borealis	Red-cockaded woodpecker	T	E
Polyborus plancus audubonii	Audubon's crested caracara	T	T
Rostrhamus sociabilis	Snail kite	E	E
Rynchops niger	Black skimmer	SSC	
Speotyto cunicularia	Burrowing owl	SSC	
Sterna antillarum	Least tern	T	
Sterna dougallii	Roseate tern	T	T
Vermivora bachmanii	Bachman's warbler	E	E
*Applicable in Monroe County only			

APPENDIX D

US FISH AND WILDLIFE SERVICE, SPECIES OF CONSERVATION CONCERN IN PENINSULAR FLORIDA (BCR 31)

Black-capped Petrel
Audubon's Shearwater
Magnificent Frigatebird
American Bittern
Little Blue Heron
Reddish Egret
White Ibis
Swallow-tailed Kite
Short-tailed Hawk
American Kestrel (resident *paulus* ssp. only)
Peregrine Falcon
Yellow Rail
Black Rail
Limpkin
Snowy Plover
Wilson's Plover
American Oystercatcher
Whimbrel
Marbled Godwit
Red Knot
Semipalmated Sandpiper
Stilt Sandpiper
Buff-breasted Sandpiper
Short-billed Dowitcher
Gull-billed Tern
Common Tern
Least Tern
Black Tern
Black Skimmer
White-crowned Pigeon
Common Ground-Dove
Mangrove Cuckoo
Smooth-billed Ani
Burrowing Owl
Chuck-will's-widow
Red-headed Woodpecker
Loggerhead Shrike
Black-whiskered Vireo
Brown-headed Nuthatch
Yellow Warbler (resident *gundlachi* ssp. only)
Yellow-throated Warbler
Prairie Warbler
Bachman's Sparrow
Henslow's Sparrow
Nelson's Sharp-tailed Sparrow
Saltmarsh Sharp-tailed Sparrow
Seaside Sparrow
Painted Bunting

APPENDIX L.3

BUCK ISLAND REEF NATIONAL MONUMENT

DRAFT

Avian Conservation Implementation Plan
Buck Island Reef National Monument

National Park Service
Southeast Region

Compiled by J. Keith Watson
U.S. Fish and Wildlife Service
In cooperation with

BUIS Resource Management Staff, National Park Service
And Bird Conservation Partners
November 2003

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Introduction

This Avian Conservation Implementation Plan (ACIP) is provided to the staff at Buck Island Reef National Monument (BUIS) to serve as guidance to identify, document, and undertake bird conservation activities in the park and with neighboring communities, organizations, and adjacent landowners. This plan may identify goals, strategies, partnerships, and perhaps specific projects for the park to participate in existing bird conservation planning and implementation efforts associated with the North American Bird Conservation Initiative (NABCI). Under the auspice of NABCI, appropriate bird and habitat conservation goals may be recommended as identified in the appropriate existing national or regional bird conservation efforts aligned with this initiative: Partners In Flight (PIF), North American Waterfowl Management Plan (NAWMP), US Shorebird Conservation Plan (USSCP), and Waterbird Conservation for the Americas (WCA). For example, parks in the Appalachians and the Cumberland Plateau will have few if any high priority waterbird conservation issues at a regional landscape or greater scale. As such, little information regarding waterbird conservation will be presented in the ACIP, unless there is an identified park need for this species group, or other mandates, such as federal laws. Similarly, because BUIS has both coastal and upland avifauna, recommendations will be provided in the ACIP based on the PIF plan, as well as national shorebird and colonial waterbird plans. However, all high priority bird conservation issues for BUIS will be discussed and integrated as appropriate.

Information and data presented in the ACIP have been obtained from several sources: 1) interviews with BUIS staff 2) BUIS bird conservation partners 3) the PIF Puerto Rico and US Virgin Islands Bird Conservation Plan (Nunez-Garcia and Hunter 2000) 4) NPS databases, and 5) personal communications with bird conservation specialists throughout North America and the Caribbean. This plan has been reviewed by BUIS resource management staff and managers, South Florida/Caribbean Inventory and Monitoring Network (SF/C) staff, and bird conservation partners and approved by BUIS management. Optimally, this plan will be incorporated into the park's Resource Management Plan (RMP) and updated annually to reflect completed projects, newly identified needs, and shifts in bird conservation priorities in the region.

BUIS is not obligated to undertake any of the proposed actions in this plan. The plan is provided to offer guidance to BUIS to voluntarily support important park, regional, and perhaps national and international bird conservation projects for which BUIS is a primary participant in the proposed actions.

Background

During the past thirty years, monitoring programs across North America have documented declines of certain bird species populations and their habitats, often severe (Sauer et al. 2000). The decline has caused great concern among scientists, biologists, biodiversity

proponents, ecologists, land managers, etc., and the bird conservation community in general. Birds are recognized as critical components of local and global genetic, species, and population diversity, providing important and often critical ecological, social, and cultural values. Their overall decline has stimulated a worldwide focus on conservation efforts and North American interest in bird conservation is rapidly becoming a focus of government, non-government, industry, and private interests and expenditures.

Many state, federal, and non-governmental wildlife agencies and organizations (NGO's) have recognized this alarming bird decline trend and have joined forces in several extensive partnerships to address the conservation needs of various bird groups and their habitats. The primary initiatives are:

- North American Waterfowl Management Plan
- Partners in Flight
- U.S. Shorebird Conservation Plan
- Waterbird Conservation for the Americas

While efforts associated with these plans have generated some successes, it has been increasingly recognized that the overlapping conservation interests of these initiatives can be better served through more integrated planning and delivery of bird conservation. The *North American Bird Conservation Initiative (NABCI)* arose out of this realization. The vision of NABCI (http://www.nabci-us.org/main2.html) is simply to see ***"populations and habitats of North America's birds protected, restored and enhanced through coordinated efforts at international, national, regional, state and local levels, guided by sound science and effective management."*** NABCI seeks to accomplish this vision through (1) broadening bird conservation partnerships, (2) working to increase the financial resources available for bird conservation in the U.S., and (3) enhancing the effectiveness of those resources and partnerships by facilitating integrated bird conservation (U.S. NABCI Committee 2000). Together, the four bird conservation initiatives mentioned above, as well as several other local and regional partnerships, work collectively to pursue this vision.

NABCI is guided by a set of principles that establish an operational framework within which the Initiative and its partners may conduct integrated bird conservation in the U.S. These will articulate a common understanding of the relationship between NABCI, the individual bird conservation initiatives, and all partner entities to ensure recognition of existing federal legislative and international treaty obligations, state authorities, and respect for the identity and autonomy of each initiative. The fundamental components of the conservation approach to be used by NABCI are expressed within its goal:

> ***To deliver the full spectrum of bird conservation through regionally-based, biologically-driven, landscape-oriented partnerships.***

The Southeastern Bird Conservation Initiative: National Park Service: In 1999, the Southeast Region of the National Park Service (NPS) recognized the importance of coordinating existing bird conservation goals into planning and operations of national park

units in the southeast, that is, integration of NABCI. In support of this recognition, the Southeast Regional Office NPS approved and allocated eighty-eight thousand dollars, cost sharing 1:1 with the US Fish and Wildlife Service (FWS) Region 4 (Southeast) to hire a biologist to conduct this two-year project (Interagency Agreement FS028 01 0368). This project is unique in the NPS, and perhaps the nation, and represents a potential model for better coordinating regional bird conservation programs and activities within and outside the NPS. It further represents a progressive action toward institutionalizing bird conservation as a programmatic priority in the Southeast Region of NPS, and potentially the nation.

As envisioned, the integration of NABCI into the Southeastern NPS involves:

1) Development and delivery of Avian Conservation Implementation Plans (ACIP),
2) Coordination with NPS Inventory and Monitoring Program,
3) Development of a web based project site,
4) Establishment or enhancement of bird conservation partnerships,
5) Identification and exploration of potential funding opportunities, and
6) Technical guidance and assistance as needed or requested.

This ACIP fulfills one aspect of the plan outlined above, and serves as a basis for future bird conservation actions in BUIS and with adjacent partners or landowners. Concurrently, the development of a Memorandum of Understanding (MOU) between the FWS and the NPS to implement Presidential Executive Order (EO) 13186, **Responsibilities of Federal Agencies to Protect Migratory Birds**, calls for integration of programs and recommendations of existing bird conservation efforts into park planning and operations. Complementing each other, the MOU and the Southeastern Bird Conservation Initiative will advance bird conservation in the Southeast Region of the NPS beyond current regional NPS efforts.

Role of NPS in Avian Conservation

The interagency agreement that facilitates this partnership supports both FWS and NPS management policies. Specifically for the NPS, the agreement supports and advances the **Strategy for Collaboration** (March 2000), a visionary document developed and signed by the Southeast Natural Resource Leaders Advisory Group (SENRLAG), a consortium of 13 land and resource management agencies in the Southeastern United States whose vision is to encourage and support cooperation in planning and managing the region's natural resources. Furthermore, the agreement is aligned with and implements a variety of NPS Management Polices (2001) including but not limited to External Threats and Opportunities (Chapter 1.5), Environmental Leadership (Chapter 1.6), Cooperative Planning (Chapter 2.3.1.9), Land Protection (Chapter 3), and especially Natural Resource Management (Chapter 4) that details policy and management guidelines which apply to bird conservation. Important policies in this chapter includes:

- Planning for Natural Resource Management (4.1.1)
- Partnerships (4.1.4)
- Restoration of Natural Systems (4.1.5)
- Studies and Collection (4.2)
- General Principles for Managing Biological Resources (4.4.1)
- Plant and Animal Population Management Principles (4.4.1.1)
- Management of Native Plants and Animals (4.4.2)
- Management of Endangered Plants and Animals (4.4.2.3)
- Management of Natural Landscapes (4.4.2.4)
- Management of Exotic Species (4.4.4)
- Pest Management (4.4.5)
- Fire Management (4.5) and
- Water Resource Management (4.6)

The NPS is the fourth largest landowner in the United States, consisting of over 380 national park units covering 83 million acres of land and water with associated biotic resources (www.nps.gov). The 64 units in the Southeast Region of the NPS represent 16% of the total number of park units in the national park system and cover approximately 5% of the total land base in the entire system. Park units in the Southeast Region include national seashores (Canaveral National Seashore, Cape Hatteras National Seashore), national parks (Great Smoky Mountains National Park, Buck Island Reef National Monument), national recreation areas (Big South Fork National River and Recreation Area), national preserves (Big Cypress National Preserve), national battlefields (Cowpens National Battlefield, Fort Donelson National Battlefield), national monuments (Congaree Swamp National Monument, Ocmulgee National Monument), and others such as the Blue Ridge Parkway, Obed Wild and Scenic River, and Timicuan Ecological and Historic Preserve.

Southeast NPS units provide habitat for over 400 species of migrating, breeding, and wintering birds and include a wide range of Federal and State listed threatened and endangered species. Likewise, these units also provide nest, migration, and winter habitat for most of the eastern species identified in the national bird conservation plans in need of conservation attention.

Additionally, the NPS attracts over 280 million visitors to the parks each year, 120 million of these in the Southeast Region, affording excellent recreational bird watching and opportunities to strengthen bird conservation interpretation, outreach, and education programs. These opportunities, the NPS mission, policies, and organization all lead to the conclusion that the NPS is an extremely valuable partner and contributor to bird conservation in the region.

Nationally, the status of birds in national parks is largely unknown, although many parks have adequate knowledge regarding bird occurrence in the parks (http://www.npwrc.usgs.gov/resource/othrdata/chekbird/chekbird.htm). Parks often play a

role in ongoing regional bird conservation efforts. Indeed many of these parks are often important to regional, national, or international bird conservation, and many have been designated as Important Bird Areas (IBA's) by the National Audubon Society. To date, there are approximately 64 NPS units that are designated IBA's, 35 of which are considered of global importance (http://abcbirds.org/iba/aboutiba.htm). In the Southeast Region, the NPS has 13 IBA's.

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The **NPS Inventory and Monitoring (I&M) Program** has been developed to provide management driven scientific information to national park managers so that resources can be adequately protected within national parks. One of the first phases of this program is to inventory vertebrates, including birds, within the 260 national park units in the program. Once completed, data from the inventories will provide an account of the occurrence and abundance of birds in all the national parks in the program. These records will be stored in the NPS I&M NPSpecies database http://www.nature.nps.gov/im/apps/npspp/). Coordination with I&M network staff is important to developing long-term bird monitoring programs that fulfill both park and NABCI objectives.

Park Flight is a NPS international partnership initiative that directs funding toward a variety of NPS programs that involve conservation of neotropical migratory birds whose life history range covers a US national park and a Latin American protected area. A relatively new program, Park Flight offers parks the opportunity to partner with a Latin American national park or protected area to cooperate on developing bird conservation and education projects (NPS 2002).

Recent increases in NPS base funded programs such as inventory and monitoring, exotic species management, habitat restoration, and fire management all indicate that national park managers recognize that park lands are increasingly subject to a variety of threats and conditions that must be improved to provide the quality of national park experience articulated in the NPS Organic Act (1916). Programmatic funding in these areas will increase the ability of national parks to provide quality habitat and conditions for increased wildlife conservation, including birds. Furthermore, private interests and non-profit conservation organizations have initiated programs, including grant programs, to provide much needed funding to national parks to meet backlogs of identified yet unfunded needs.

Park Description

President John F. Kennedy established Buck Island Reef National Monument in 1961. The monument was created to preserve one of the Caribbean's finest marine gardens for scientific and educational interest, and for recreational uses. Buck Island is located 1.5 miles northeast of St. Croix, the largest of the U.S. Virgin Islands. The monument totals 356 ha (880 acres), 71 ha (176 acres) are uninhabited subtropical dry forest island and 285 ha (704 acres) are submerged lands. The park's significance lies primarily in the extensive elkhorn coral barrier reefs surrounding the eastern two thirds of the island.

Recent research has identified the Buck Island coral reef ecosystem as critical developmental habitat for the endangered hawksbill sea turtle. The island provides nesting habitat for two endangered species – hawksbill and leatherback turtle– and two threatened species – the green turtle and least tern, as well as several rare native plant species, and one endemic beetle (*Longitarius zandae*).

Avian Resources of Puerto Rico and the US Virgin Islands

Puerto Rico and the Virgin Islands are part of the West Indies, a chain of islands that extends from Florida to Venezuela and separate the Caribbean Sea from the Atlantic Ocean. These tropical Islands are located within 17-19° latitude North and 64-68° longitude West about 1,609 kilometers from Florida and 805 kilometers from Venezuela.

The U.S. Virgin Islands are located about 64 kilometers east of the Puerto Rico. These Islands comprise another archipelago that includes St. Thomas, St. John, St. Croix, and numerous uninhabited small islets and cays. The three main Islands were bought by the U.S.A. from Denmark in 1917 and are now U.S. Territory with a total area of 340 km^2.

The number, size and shape of the islands comprised within this region combined with climate, topography, geological processes, and human activities have produced a tremendous diversity of habitats. Historically different types of forest covered most of the land area of Puerto Rico and the Virgin Islands. However, forest conversion caused by agricultural and other land use practices have shaped the present landscape. Forested landscape in the U.S. Virgin Islands is typified by sub-tropical dry forest and littoral shrubs.

Including vagrants, exotics and fossils, the total number of bird species in the region sums to 364. Presently, 276 species are known to occur in Puerto Rico and 210 in the Virgin Islands for a total of 284 species in the region (Raffaele 1989). Recent studies indicate that these numbers may change as many native forms may be reclassified as species or subspecies on their own. Raffaele (1989) categorized the regional birds species as follows: 97 breeding permanent residents (94 in Puerto Rico and 60 in the Virgin Islands), 11 breed and leave (11 in Puerto Rico and 10 in the Virgin Islands), 134 non-breeding migrants and visitors (134 Puerto Rico and 129 the Virgin Islands), 31 introduced probable breeders (31 in Puerto Rico and 6 in the Virgin Islands), five introduced possible breeders (same species for both Puerto Rico and the Virgin Islands), and one species recently extirpated from Puerto Rico. As the numbers indicate, migrant species comprise almost half of the species playing a major role in the ecology of the region. Also noteworthy is the establishment of a high number of exotic species. As a result of combining both native and exotic species, Puerto Rico supports 85 species of breeding land birds, the greatest number of any West Indian island and except for Cuba, harbors the second largest total number of species in the region (Raffaele 1989).

The oceanic nature of the islands in the region has resulted in increased endemism.

Puerto Rico harbors **16 endemic** bird species including one endemic genus (*Nesospingus*) represented by a single species, the Puerto Rican Tanager (*Nesospingus speculiferus*) and one family (Todidae) shared with the rest of the West Indian islands but found nowhere else. Rafaele (1989) considered 51 species to be threatened in the region mostly because of the detrimental effects of habitat alteration.

Avian Conservation in BUIS

Avian Biodiversity: BUIS has an avian presence inventory that is considered at least 90% complete. No public checklist is available at this time. Verified records of birds in BUIS have been entered into the NPS I&M program's database, NPSpecies, and may be viewed via the internet at http://www.nature.nps.gov/im/app/npspp with a user identification and password combination authorized by the NPS for NPS personnel and NPS cooperators. Many other avian observational data need to be verified and entered into the database.

Threatened and Endangered Species: One Federally listed endangered species, the Brown Pelican, nests in the park. The recently delisted American Peregrine Falcon occurs as a rare winter visitor to the park and vicinity.

Several USVI Territory **Listed** species occur in BUIS including Brown Pelican, White-crowned Pigeon, White-cheeked Pintail, Wilson's Plover, and Least Tern.

Several high priority PIF species for the Caribbean occur in BUIS (see Appendix A and B). Prominent among these species are White-crowned Pigeon, Yellow Warbler, White-cheeked Pintail, and Brown Pelican. It is likely that several Neotropical migrants, especially wood warblers, utilize the subtropical dry forests of the park of Buck Island. Though many of these species are not listed, they are of high conservation concern in the continental U.S. and conservation efforts for this species extend to the USVI. Conservation of these species should be coordinated with the US Virgin Island Department of Planning and Natural Resources (VIDPNR) (see contacts).

Park Priorities: Park staff and consultants have identified the Brown Pelican and Least Tern as a park management concern or high priority for conservation. Additionally, since the successful eradication of tree rats on the island, the staff has an interest in obtaining information on landbirds and how their populations respond to eradication of the rats. BUIS is certain to have some species that are high priority in the USVI and conservation efforts in the park could focus on these species or groups of species.

Inventory: A complete inventory has been recognized as important information for park managers and is being conducted within the framework of the NPS I&M Program. BUIS is one of seven parks in the South Florida/Caribbean I&M Network for which a plan to conduct high priority inventory projects has been prepared (Sasso and Patterson 2000).). Although VIIS avian inventory is considered complete in relation to the NPS's I&M goals

(90% or greater species known), additional inventory is desired to determine breeding bird distribution and abundance in the upland portions of the park.

Monitoring: Currently, several avian monitoring projects are being conducted at BUIS. These are:

- Brown Pelican reproductive survey that includes counts of adults, nests, and fledglings
- Least Tern nest and egg counts
- Christmas Bird Count (CBC) that covers Buck Island

Research: Scientific research is permitted within the park, but no active avian research other than existing avian inventory and monitoring is ongoing.

Outreach: The park conducts outreach and education regarding beach closures for nesting Least Terns on Buck Island.

Park Identified Needs for Avian Conservation

BUIS has identified at two projects that would increase the avian knowledge of the park.
Inventory:

- BUIS desires to identify and quantify all resident and migratory bird species the nest or ground forage

*Monitoring**:***

- The park desires to obtain populations trends data for nesting and ground foraging species

Coordination with Regional Conservation Initiatives

North American Bird Conservation Initiative

NABCI bird conservation planning units, referred to as Bird Conservation Regions (BCR), are often larger than other planning units associated with other plans, such as Partners In Flight. For example, BUIS is within the NABCI BCR 69 that includes all of the Commonwealth of Puerto Rico, the US Virgin Islands and the British Virgin Islands and includes the physiographic region designated by Partners in Flight as Puerto Rico/Virgin Islands (Figure 2; compare to Figure 1).

Several NABCI BCR's have coordinators whose primary responsibility is to coordinate all bird conservation planning in the BCR, across all agencies and organizations. Currently, the Caribbean BCR does not have a designated coordinator; however, the assistant coordinator for the Atlantic Coast Joint Venture (ACJV) can provide valuable assistance to BUIS with implementation of aspects of this ACIP.

North American Waterfowl Management Plan (NAWMP)

The NAWMP (http://northamerican.fws.gov/NAWMP/nawmphp.htm) is completed and has been revised several times, incorporating updated goals and strategies based on new information. This plan is one of the most successful bird conservation delivery programs in the United States, being monetarily supported by the North American Wetlands Conservation Act (NAWCA).

Partners In Flight

Goals and strategies for the Caribbean can be found in the draft bird conservation plan, previously submitted to the park. A revised version of this plan should be available in the near future and may be substantially different from the current format; however, bird and habitat conservation priorities are not likely to be significantly changed. The park will receive updates of the plan as they are completed. The current plan identifies priority bird and habitat conservation goals that must be implemented in order to achieve bird conservation success in this region.

Similar to NABCI BCR's, PIF physiographic areas often do not have designated coordinators. However, state level non-game agencies with investment in PIF will establish key personnel to develop partnerships among cooperators in the physiographic area. The USVI does not have a PIF coordinator, but several VIDPNR personnel are currently engaged in bird conservation in the USVI and will be instrumental with implementation of this ACIP and projects important to bird conservation relative to Buck Island's role in implementation of the Puerto Rico and US Virgin Islands bird conservation plan.

United States Shorebird Conservation Plan (USSCP)

The USSCP has been completed and is available on the world wide web (http://shorebirdplan.fws.gov/). A regional step down plan is in preparation by FWS personnel and should be available in 2003. Since BUIS has little habitat of regional importance to shorebird conservation, recommendations for shorebird conservation are not presented.

Waterbird Conservation for the Americas (WCA)

The WCA plan has been completed and is available on the World Wide Web or can be ordered from the US Fish and Wildlife Service National Conservation Training Center (http://www.waterbirdconservation.org/).

Integration of NABCI Goals and Objectives into Park Planning and Operations

NABCI Implementation Recommendations

To successfully achieve park-established goals and actively participate in NABCI, the park could implement a variety of projects in different NPS programs. Most of these projects would require some level of participation by many existing park programs and could either be achieved through NPS funding, or more likely, through establishing or improving partnerships with agencies and organizations that already have the necessary expertise to provide guidance, funding, and execution of these programs. Programmatic areas where bird conservation actions are likely to be focused are:

- Inventory
- Monitoring
- Habitat Restoration
- Threat Management (includes exotic species, air quality, water quality, etc.)
- Research
- Compliance
- Outreach
- Partnerships

To the extent appropriate, each of these program areas will be discussed separately and within each, specific opportunities identified that, when implemented, will enable to park to meet its mandates (current and expected) as well as integrate NABCI into its planning and operations. With emphasis added, the park is not expected to implement any of these recommendations or be obligated to pursue any opportunity other than those the park is required to do by law or NPS program or policy. In other words, participation in this effort is currently voluntary. However, participation in these efforts at some level could become mandatory with the completion of an MOU with the FWS regarding EO 13186, **Responsibilities of Federal Agencies to Protect Migratory Birds**. The MOU will establish a formal agreement between the FWS and the NPS to promote bird conservation within the agency by incorporating goals and strategies of existing bird conservation initiatives, plans, and goals into park planning and operations.

Should the park decide to implement any of these projects, further consultation with bird conservation contacts is encouraged to obtain updated information on the relevance of these opportunities in regional bird conservation.

High priority projects are identified in **bold** print. Priorities that the park is encouraged to seek NPS funding for are marked with and asterisk (*****). These projects are those that are critical to the stabilization or improvement of a bird population in the planning region.

Inventory

The park has inventoried its bird fauna exceptionally well. Although the avifauna of BUIS is well documented, distribution and abundance data are desired to fully understand the status of birds in the park so that conservation actions for birds can be implemented, especially for ground nesting and foraging birds. Additionally, information on use of Buck Island by Neotropical migrant birds wintering in the park is desired. Status of high priority species as identified in the Puerto Rico/US Virgin Islands bird conservation plan is needed to effectively structure park management for the continued preservation and enhancement of the park's avifauna.

Abundance and distribution data are needed

- **for all resident and migratory landbirds that nest and forage on or near the ground***
- **for birds that nest in mangroves***
- **for High Priority forest species such as White-crowned Pigeon***
- **for nesting, migrating, and wintering shorebirds, particularly American Oystercatcher and Wilson's Plover.**

Additionally, the park is encouraged to:

- **partner with the VIDPNR and USFWS to coordinate area inventory efforts**
- **verify other avian observational data collected in the park and enter into the appropriate database (NPSpecies, eBird Monitoring Program of Cornell's Laboratory of Ornithology, Columbid Database, etc.)**
- **standardize inventory and monitoring methodology to conform to NPS and/or FWS recommended standards (Fancy and Sauer 2000, Hunter 2000).**

Monitoring

The park has an active bird monitoring program resulting in documentation of many high priority species identified for conservation effort in the Caribbean and occur in the park. Efforts should be made to continue existing monitoring programs, striving to conform to established NPS or FWS surveys protocols. Close coordination with adjacent bird conservation initiatives are needed to identify and implement high priority projects on park lands and to ensure that park efforts contribute to park or regional bird conservation rather

than undertake an action or actions that are not needed or are better conducted in other areas. Specific recommendations are to:

- **continue to conduct existing monitoring programs and enter data into the appropriate database (NPSpecies, eBird, or National Point Count Database (USGS 2001) (http://www.mp2-pwrc.usgs.gov/point/)**

- **establish point count monitoring stations along ecologically distinct or vegetative/habitat types to document abundance and distribution of terrestrial landbirds year around in response to eradication of rats**

- **establish monitoring programs based on results of inventory data for High Priority species and with potential for high conservation role for any of these species**

- **standardize inventory and monitoring methodology to conform to NPS and/or FWS recommended standards (Fancy and Sauer 2000, Hunter 2000).**

- **partner with USVI territorial Department of Natural Resources and USFWS staff to coordinate area monitoring efforts**

Habitat Restoration/Management

Recently, habitat restoration efforts have increased on NPS lands; NPS receiving restoration emphasis and guidance in the 2001 Management Policies (NPS 2001). Habitat restoration efforts that parks may undertake are wetland restoration, grassland restoration, woodland restoration, etc. utilizing a wide range of tools to accomplish the restoration. Some of these tools may be but not limited to forest management practices, exotic species management, public use and recreation management, infrastructure development management, and prescribed fire.

Due to the protected nature of BUIS lands, and generally those in the national park system, the condition of habitats for bird use may be of higher quality than other natural, developed, agricultural, or forest lands under other management regimes. However, national park lands can be greatly improved for wildlife, and particularly bird use, by restoring processes important for habitat formation, succession, and structural development. Largely, these processes have not been managed historically in the national park system but current policy allows for active management of species, populations, and lands to provide for long-term conservation of park resources.
Protection, restoration, and enhancement of habitats in BUIS can greatly contribute to established habitat goals identified in the Puerto Rico/US Virgin Islands bird conservation plan.

Research suggests that the large contiguous moist forests of St. John provide significant habitat for wintering Neotropical migrants (Askins et al. 1989). Thought the forests of Buck Island are much smaller, efforts should be made to determine the importance of this habitat to wintering Neotropical migrants.

Specific recommendations are to:

- restore and/or improve hydrological quality and processes where needed, especially in coastal mangrove and salt ponds

- assess Pre-Columbian landscape cover and determine feasibility of restoring landscape within the context of the park's enabling legislation

<u>Threat Management</u>

Impact of exotic species on birds at VIIS has been the greatest threat to the avifauna of BUIS. However, since the eradication of the mongoose in the 1980's and the tree rat in the early 2000's, no significant exotic mammalian threat exists on Buck Island. Current threats include human and dog intrusions on the Least Tern colony on the beach. The park is encouraged to:

- **manage visitor use, especially boat landings and dogs off lease, at the Island to protect and eliminate disturbances to the Least Tern colony***

- **identify, monitor, and document bird mortality associated with the US Coast Guard tower, especially during migrations of Neotropical migrants***

- **enforce the no dog policy***

- **identify potential bird injury or mortality associated with fishing gear and fishing practices in the park and nearby waters, especially for Brown Pelican, Brown Booby, and Magnificent Frigatebird***

Although exotic plants species may negatively impacting habitat at BUIS, the nature of this impact on native birds is unknown. It is important to

- **establish and continue inventory and monitoring of exotic plant species***

- **identify any potential impact these species have on native avifauna***

- **establish appropriate management programs to restore native forests***

If necessary, consult with regional Exotic Plant Management Team (EPMT) to remove

exotic plant species. Currently, no EPMT provides service the VIIS area. Until an EPMT is established that can provide assistance to VIIS, staff is directed to consult with the regional pest management specialist (see contacts).

Additionally, the park is encouraged to:

- **hire additional protection staff to better manage threats and implement projects identified in this plan***

- **develop aggressive outreach and education program for protection of Buck Island resources**

Research

- **list park needs and projects on Research Permit and Reporting System web site (RPRS)**

- develop contact with South Florida/Caribbean Cooperative Ecosystem Studies Unit (CESU) at the University of Miami, Miami, FL

Compliance

Park compliance with the Migratory Bird Treaty Act and the Executive Order 13186, **Responsibilities of Federal Agencies to Protect Migratory Birds,** is necessary to assure that park activities incorporate bird conservation into park planning and operations. Further, to ensure that migratory birds are considered in all phases of park planning processes, especially during the National Environmental Policy Act (NEPA) and the Director's Order #12 Compliance processes, the park should consider adding specific language in project evaluations that requires consideration and implications of park projects on migratory birds. The MOU being developed between the NPS and the FWS will likely contain specific language requiring a park to consider implications of park projects on migratory birds. Additional considerations are to encourage:

- **park staff to begin specific consideration of migratory birds during park planning processes***

- park staff to attend USFWS training on implementation of EO 13186 at the National Conservation Training Center (NCTC) (when available) or other training on migratory bird conservation in North America. NCTC has several courses and training related to conservation of migratory birds (http://training.fws.gov/courses.html).

The USFWS NCTC offers and reserves two tuition free slots for National Park Service

employees wishing to attend NCTC courses on a first come, first served basis. Additionally, discount lodging is also available while attending a NCTC course.

Outreach

- **participate in International Migratory Bird Day (IMBD) events with a local partner (http://birds.fws.gov/imbd.html)***

- **update the bird checklist for public availability***

- **nominate BUIS as an Important Bird Area (http://www.abcbirds.org/iba/nominstr.htm)**

- **continue to develop and implement outreach and educational programs to enhance visibility of bird conservation issues**

- **encourage Virgin Islands Audubon Society to participate in ongoing and new inventory and monitoring programs**

- **encourage accurate documentation and reporting from these and random outings by visitors (see Cornell University's eBird monitoring program (Cornell Lab. Ornith. 2002 (http://www.ebird.org/about/index.jsp)**

- park interpretation/education staff are encouraged to attend USFWS training on Migratory Bird Education at NCTC

- consider adding links to bird conservation information, data, etc. to the park's web site home page

- support bird conservation by serving shade-grown coffees at meetings, events, and the office buildings in the park (http://www.americanbirding.org/programs/conssbcof3.htm)

- participate in bird conservation efforts of the Society for the Conservation and Study of Caribbean Birds (SCSCB), including subscribing to this organization's electronic information forum

- explore cultural affiliation of landscape to inhabitants, both historical and contemporary. Cultures are strongly tied to the landscape they inhabit and birds often play a role in a cultural tie to the landscape. When these connections are discovered and preserved, a greater appreciation for the landscape and it's value to the culture can be achieved

Partners and Partnerships

Partnerships for land conservation and protection will perhaps have the greatest positive influence on bird conservation above all other landscape scale planning. Specific recommendations are to:

- **cooperate and USVI DNR in the preparation and implementation of the USVI Comprehensive Wildlife Conservation Plan**

- **work with the White-crowned Pigeon Working Group of the SCSCB to determine appropriate conservation actions for this species in the park**

- **become a contributing member of the Caribbean Columbid Population Data Center, a cooperative effort of the Puerto Rico Department of Natural Resources, USFWS, and other Caribbean interests to assess populations status and implement conservation actions necessary for these species**

- **contact the nearest Joint Venture office (see Funding section for explanation of Joint Ventures) or BCR coordinator to develop partnerships and funding proposals tiered to priorities established by the park, this ACIP, and the Puerto Rico and US Virgin Islands Bird conservation plan**

- **encourage the USVI territorial government to become a member of the Atlantic Coast Joint Venture, increasing USVI partners chances to utilize NAWCA funds for bird and habitat conservation projects**

- continue to maintain productive relationship with local Audubon Society

- explore the potential to utilize facilities and expertise at the Virgin Island Environmental Research Station (VIERS) to conduct needed avian research and implementation of aspects of this plan

Funding Opportunities

Internal NPS funding is often an effective source to obtain funding; however, the project will have to be a fairly high priority among the park's natural resource program to successfully compete for the limited funding available in the NPS. Therefore, partnerships and outside funding programs are often more productive for securing bird conservation funding. Within this ACIP, identified priority projects that are considered to be high park priorities as well as NABCI priorities are marked with and asterisk (*). BUIS is encouraged to enter all high priority projects into the NPS Performance Management Information System (PMIS) database.

Funding for conservation projects for neotropical migrants is also available through the Park Flight program.

With the exception of the North American Waterfowl Management Plan (NAWMP and its associated funding legislation, the North American Wetland Conservation Act), funding opportunities for bird conservation programs, plans, and initiatives have been lacking. Only within the last decade have other appropriate and specific sources for bird conservation funding been created and used. The NAWMP has been supported for approximately 14 years by the North American Wetlands Conservation Act (NAWCA 1989). This program has provided $487 million in appropriated funds matched with $1.7 billion for wetland and bird conservation projects since its inception. In 2002 alone, over $70 million US dollars were awarded to US and Canadian agencies and organizations to enhance waterfowl populations by improving, restoring, or protecting wetland habitats. To adequately evaluate projects and distribute these funds, partnerships called Joint Ventures were established. Nationally, 14 (11 US, 3 Canada)
Joint Ventures have been established, several which are funded and staffed. Internet links to Joint Ventures are:

(http://southwest.fws.gov/gulfcoastjv/ojvcontact.html) and
(http://northamerican.fws.gov/NAWMP/jv.htm).

Funding through NAWCA is highly underutilized by the NPS and any park unit that has wetland, water, or bird conservation needs associated with wetland are encouraged to investigate using this funding source. Naturally, there are certain requirements to be eligible for all grants and park managers are encouraged to consult with the nearest Joint Venture, BCR, PIF Coordinator, to learn how this program might be applicable to implementation of this plan, and other park wetland issues. BUIS is not within a region which has an operational Joint Venture, but contact with the Atlantic Coast Joint Venture, Central Hardwoods BCR, and Tennessee PIF coordinators will provide opportunity to investigate use of this funding source and developing proposals.

Internal FWS funding programs may be used to support projects, but no effective method of project proposal delivery to these sources is currently in place for the NPS. Current funding in these programs may result from FWS familiarity with NPS needs, or NPS participation in one of the area FWS Ecosystem Teams, where a project has been identified and proposed to be funded through the Ecosystem Team.

One unexplored yet potentially fruitful funding source for national parks is the myriad of grants through the FWS State Programs, where grants are awarded to private individuals engaged in habitat conservation projects. No funding is directly available to national parks, but identified projects with important or critical adjacent landowners can sometimes be funded through these sources. Similar programs are available if the adjacent landowner is a federally recognized American Indian tribe.

Specific congressional appropriations to protect migratory birds has recently been authorized under the Neotropical Migratory Bird Conservation Act (2000) (http://www.nfwf.org/programs/nmbcapp.htm). Appropriations through this Act are authorized up to $5 million per year. However, in 2000, appropriation was approximately $3.75 million and a majority of this funding was directed toward projects in Central and South America.

Many of the identified projects are eligible for funding under various grant programs of the National Fish and Wildlife Foundation (http://www.nfwf.org/programs/programs.htm).

Other prominent funding sources available to NPS managers for bird conservation are listed on this projects web site at:
http://southeast.fws.gov/birds/NPSHighlits.htm.

Funding opportunities for migratory bird conservation are available yet most natural resource agencies are not fully aware of and/or understanding of how to use these sources. Perhaps a consolidated migratory bird funding source catalog will become available to managers in the future; this is needed.

Contacts

Primary contacts within the region can be obtained by viewing the web site for the Southeastern Bird Conservation Initiative, National Park Service at http://southeast.fws.gov/birds/npsbirds.htm. This web site will provide contact information of the appropriate bird conservation coordinator in the region for park personnel. Park staff is encouraged to view the web site and obtain contact information. Primary contacts for BUIS are:

Virgin Islands Department of Planning and Natural Resources
Ms. Judy Pierce
VI Territorial Department of Natural Resources
St. Thomas, USVI
sula@vitelcom.net

Mr. Doug McNair
VI Territorial Department of Natural Resources
St. Thomas, VI
dbmcnair@vipowernet.net

US Fish and Wildlife Service

Mr. Keith Watson
US Fish and Wildlife Service
160 Zillicoa Street, Suite D
Asheville, NC 28801
828-350-8228
Keith_Watson@fws.gov

Mr. Craig Watson
US Fish and Wildlife Service
Atlantic Coast Joint Venture
Charleston, SC
843-727-4707 ext. 16
Craig_Watson@fws.gov

Mr. Dean Demarest
US Fish and Wildlife Service
1875 Century Blvd.
Atlanta, GA
404-679-7371
dean_demarest@fws.gov

Ms. Jennifer Wheeler
US Fish and Wildlife Service
Waterbird Conservation Plan Coordinator
703-358-1714
Jennifer_A_Wheeler@fws.gov

Mr. Chuck Hunter
US Fish and Wildlife Service
Regional Refuge Biologist
Atlanta, GA
404-679-7130
Chuck_Hunter@fws.gov

Mr. Steve Earsom
US Fish and Wildlife Service
Caribbean Refuge Complex Biologist
Boqueron, PR
Steve_Earsom@fws.gov

National Park Service

Mr. Jim Petterson
Virgin Islands National Park
Inventory and Monitoring Coordinator
Cruz Bay, St. John
Jim_Petterson@nps.gov

Ms. Laurel Trager
Virgin Islands National Park
Division of Interpretation
St. John, USVI
Laurel_Trager@nps.gov

South Florida/Caribbean (SF/C)

Inventory & Monitoring Network
Mr. Matt Patterson
SF/C Network **Coordinator**
National Park Service
Homestead, FL
Matt_Patterson@nps.gov

Exotic Plant Management
Mr. Chris Furqueron
404-562-3113 ext 540
National Park Service
Exotic Plant Management Coordinator
Chris_Furqueron@nps.gov

Cooperative Ecosystem Studies Unit

Dr. Carol Daniels
South Florida/Caribbean CESU
Rosentiel School of Marine and
Atmospheric Sciences
University of Miami
Miami, Fl
Carol_Daniels@nps.gov

Others

Exotic Animal Management
Frank Boyd
USDA APHIS Wildlife Services
Director, USVI
118 Extension Hall
Auburn University, AL 36849
334-844-5670
fboyd@acesag.auburn.edu

Mr. Mark Wimer
US Geological Survey

Biological Research Division
Patuxent Wildlife Research Center
Patuxent, MD
Mark_Wimer@usgs.gov

Mr. Will Henderson
Virgin Islands Audubon Society
St. John, USVI
http://www.audubon.org/affiliate/vi/vi/

Mr. Bob Cook
Virgin Islands Audubon Society
http://www.audubon.org/affiliate/vi/vi/

Dr. Robert Askins
Connecticut College
New London, CT
raask@conncoll.edu

Dr. David Ewert
The Nature Conservancy – Michigan
East Lansing, MI
dewert@pilot.msu.edu

The Nature Conservancy – Eastern Caribbean
3052 Estate Little Princess
Christiansted, St. Croix
U.S.V.I. 00820
(340) 773-5575

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APPENDIX A

PUERTO RICO AND VIRGIN ISLANDS (BCR 69) BASED ON CONTINENTAL AND REGIONAL WATCH LIST AMONG ALL BIRDS WITHIN SOUTHEAST U.S., AND THE WEST INDIES*

(Action Levels: IM=Immediate Management; MA=Management Attention; PR=Long-Term Planning and Responsibility) (subspecies/populations of interest noted; all species breed or are resident unless otherwise indicated; ba=number of breeding adults)

Tier I. Continental Conservation Interest

a. Multiple Causes for concern across entire range

White-tailed Tropicbird	(500-600 pairs, 14-19% in West Indies)	IM
Red-billed Tropicbird	(375-450 pairs, 14-22% in West Indies)	IM
West Indian Whistling-Duck	(<100 ba, 1-5% globally)	IM
Black Rail	(Extirpated?)	IM
Snowy Plover	(Threatened Pacific Coast; West Indies subspecies)	IM
Piping Plover	(Endangered, winter)	IM
Plain Pigeon	(Endangered; <5,000 ba, <10% globally)	IM
Puerto Rican Parrot	(Endangered; <100 ba in the wild, 100% globally)	IM
Puerto Rican Nightjar	(Endangered; <2,000 ba, 100% globally)	IM
White-necked Crow	(Endangered/Extirpated from Puerto Rico)	IM
Bicknell's Thrush	(Possible rare winter in Puerto Rico)	PR
Golden-winged Warbler	(Rare winter)	PR
Elfin-Woods Warbler	(Candidate for Listing; <1,000 ba, 100% globally	IM
Yellow-shouldered Blackbird	(Endangered; <500 ba, 100% globally)	IM

b. Moderately abundant or widespread with declines and/or high threats

Audubon's Shearwater	(~150 pairs, 2-4% in West Indies)	IM
Masked Booby	(300 pairs, 50% in West Indies)	IM
Red-footed Booby	(1,450-2,650 pairs, 15-33% in West Indies)	IM
Brown Booby	(2,075-2,300 pairs, 22-36% in West Indies)	MA
Little Blue Heron		MA
American Golden-Plover	(Rare southbound transient)	PR
Lesser Yellowlegs	(non-breeding)	MA
Solitary Sandpiper	(transient)	MA
Upland Sandpiper	(Rare transient)	PR
Whimbrel	(non-breeding)	MA
Sanderling	(non-breeding)	MA
Semipalmated Sandpiper	(non-breeding)	MA
Western Sandpiper	(non-breeding)	MA
Stilt Sandpiper	(non-breeding)	MA
Wilson's Snipe	(winter)	MA
Gull-billed Tern	(non-breeding?)	PR
Roseate Tern	(North Atl. Endangered, West Indies Threatened; 1,200-3,600 pairs, >25% in West Indies)	IM
Least Tern	(Calif. & interior subspecies Endangered; 300-450 pairs, 8-25% in West Indies)	IM
White-crowned Pigeon		MA
Mangrove Cuckoo		MA
Short-eared Owl	(Greater Antillean subspecies)	MA

Puerto Rican Vireo	(100 % globally)	MA
Prairie Warbler	(winter)	MA
Prothonotary Warbler	(winter)	MA
Worm-eating Warbler	(winter)	MA
Kentucky Warbler	(Rare winter)	PR
Greater Antillean Oriole	(10-20% globally)	MA

c. Restricted distributions and/or low population size

Magnificent Frigatebird	(700-900 pairs, 13-21% in West Indies)	IM
Reddish Egret	(Rare, non-breeding)	PR
Caribbean Coot	(1,000 ba, <50,000 West Indies)	IM
Wilson's Plover		MA
American Oystercatcher	(Eastern North American subspecies)	IM
Red Knot	(non-breeding; presumably Alaskan subspecies)	PR
Bridled Tern	(900-1,700 pairs, 15-40% in West Indies)	MA
Antillean Nighthawk		PR
Black Swift	(West Indian subspecies)	MA
Lesser Antillean Pewee	(Puerto Rican subspecies)	PR
Blue-winged Warbler	(Rare, winter)	PR
Adelaide's Warbler	(100% globally)	PR
Swainsons's Warbler	(Rare, winter)	PR

Tier II. Regional Conservation Interest

a. High Concern

Brown Pelican	(West Indies, Endangered; 520-850 pairs, 25-40% in West Indies)	IM
Green Heron		MA
Yellow-crowned Night-Heron		PR
Black-bellied Plover	(non-breeding)	MA
Ruddy Turnstone	(non-breeding)	MA
Least Sandpiper	(non-breeding)	MA
Antillean Mango	(nearly extirpated on Virgin Islands)	MA
Black-whiskered Vireo		PR

b. High Threats

Pied-billed Grebe	(breeding populations only)	MA
Least Bittern		MA
Black-crowned Night-Heron		MA
Greater Flamingo	(Extirpated as a resident, may be recolonizing)	MA
White-cheeked Pintail	(Lesser subspecies; <5,000 ba Puerto Rico-Virgin Islands; ~60,000 ba in West Indies)	MA
Ruddy Duck	(West Indian subspecies; ~1,500 ba Puerto Rico; <<50,000 ba West Indies)	MA
Masked Duck	(West Indian populations; <100 ba Puerto Rico; <<50,000 ba West Indies)	MA
Sharp-shinned Hawk	(Puerto Rican subspecies, Endangered; <100 ba)	IM
Broad-winged Hawk	(Puerto Rican subspecies, Endangered; <100 ba)	IM
American Kestrel	(Eastern Caribbean subspecies)	MA
Clapper Rail		MA

Yellow-breasted Crake	(Hispaniolan-Puerto Rican subspecies)	MA
Purple Gallinule		MA
Limpkin	(Hispaniolan-Puerto Rican subspecies)	IM
Willet		MA
Key West Quail-Dove		MA
Bridled Quail-Dove		MA
Puerto Rican Screech-Owl	(Virgin Islands subspecies, extirpated except on Culebra?)	IM
Yellow Warbler	(West Indian "Golden" subspecies)	MA
Louisiana Waterthrush	(winter)	MA

c. High Responsibility

Tricolored Heron		PR
Black-necked Stilt		PR
Pectoral Sandpiper	(transient)	PR
Sooty Tern	(55,000-80,000 pairs, 20-40% in West Indies)	PR
Black Tern	(transient)	PR
Brown Noddy	(1,300-2,100 pairs, 7-18% in West Indies)	PR
Scaly-naped Pigeon		PR
Zenaida Dove		PR
Puerto Rican Lizard-Cuckoo	(100% global)	PR
Puerto Rican Screech-Owl	(Puerto Rican subspecies; 100% globally)	PR
Green Mango	(100% globally)	PR
Antillean Crested Hummingbird		PR
Puerto Rican Emerald	(100% globally)	PR
Puerto Rican Tody	(100% globally)	PR
Puerto Rican Woodpecker	(100% globally)	PR
Caribbean Elaenia		PR
Puerto Rican Flycatcher	(100% global, nearly extirpated Virgin Islands)	PR
Gray Kingbird		PR
Loggerhead Kingbird	(Puerto Rican-Vieques subspecies)	PR
Caribbean Martin		PR
Cave Swallow		PR
Red-legged Thrush	(Hispaniolan-Puerto Rican subspecies)	PR
Northern Parula	(winter)	PR
Cape May Warbler	(winter)	PR
Black-throated Blue Warbler	(winter)	PR
Puerto Rican Tanager		PR
Puerto Rican Spindalis		PR
Antillean Euphonia		PR
Puerto Rican Bullfinch	(Puerto Rican subspecies; 100% globally)	PR
Grasshopper Sparrow	(Puerto Rican subspecies)	PR

Tier III. Additional State, Territorial Listed Species (drawn from species in Tier IV)

Least Grebe	PR
Great Blue Heron	PR
Great Egret	PR
Snowy Egret	PR

Tier IV. Additional Local or Regional Interest Species (also Stewardship Species identified

by Avifaunal Biome supporting vast majority of breeding population)

Glossy Ibis				PR
Northern Pintail		(winter)		MA
Blue-winged Teal		(winter)		MA
Lesser Scaup		(winter)		MA
Northern Harrier	(winter)		PR	
Osprey				PR
Merlin		(mostly transient)		PR
Peregrine Falcon		(mostly transient)		PR
Sora		(winter)		PR
Common Moorhen				PR
Semipalmated Plover		(non-breeding)		PR
Killdeer				PR
Greater Yellowlegs		(non-breeding)		PR
Spotted Sandpiper		(non-breeding)		PR
White-rumped Sandpiper		(transient)		PR
Royal Tern		(115-315 pairs, >25% in West Indies)		PR
Sandwich Tern		(800-3,600 pairs, 28-71% in West Indies)	PR	
White-winged Dove				PR
Mourning Dove				PR
Yellow-billed Cuckoo				PR
Common Nighthawk				PR
Chuck-will's-widow		(Rare, winter)		PR
White-eyed Vireo		(Rare, winter)		PR
Yellow-throated Vireo		(Rare, winter)		PR
Magnolia Warbler		(Northern Forest Biome, winter)		PR
Yellow-throated Warbler		(winter)		PR
Palm Warbler		(Northern Forest Biome, winter)		PR
Blackpoll Warbler		(transient)		PR
Black-and-white Warbler	(winter)		PR	
American Redstart		(winter)		PR
Ovenbird		(winter)		PR
Northern Waterthrush		(winter)		PR
Hooded Warbler	(Rare, winter)		PR	
Indigo Bunting		(non-breeding)		PR
Bobolink		(transient)		PR
Baltimore Oriole		(transient)		PR

*

WL=WatchList score used for Continental Scoring (PIF Approach); species with WL SUBTOT combined scores of (1) 15 or more, (2) 14 with Tmax+PT $\geq$5, or (3) with 13 with PT=5 are identified. using formula:

Combined Score = PT + PS + maximum of (BD or ND) + maximum of (TB or TN)

Tier=

I. Continental Conservation Interest (Continental WatchList): (a) Species with multiple causes for concern across their entire range; (b) Moderately abundant or widespread species with declines or high threats, and (c) Species with restricted distributions or low population size.

Species with multiple causes for concern across their entire range: These species are considered by many to be of highest continental concern and of highest priority for conservation actions at national and international scales. A majority of these are legally listed as Endangered or Threatened in either the U.S. or Canada, and as such have recovery plans in place. Notable in this group, however, are several species without legal status, including Bicknell's Thrush and Saltmarsh Sharp-tailed Sparrow.

Moderately abundant or widespread species with declines or high threats: These species are on the Watch List primarily because they are declining and/or threatened throughout their range, though still fairly widespread or with moderately large populations. Many of these species still number in the millions (e.g. Dickcissel, Wood Thrush), but are threatened with serious reductions in population or geographic range in the future. Several other species (e.g. Swallow-tailed Kite, Mangrove Cuckoo, Elegant Trogon) are fairly widespread outside the U.S. and Canada, but are threatened in the U.S. portion of their range. Five species are afforded U.S. federal legal status in part of their range or for a particular recognized subspecies. This group also includes four resident game bird species with seriously declining populations.
Species with restricted distributions or low population size: These species are on the Watch List because they are restricted to a small range or have small global populations (often both). Many of these species are not known to be declining or seriously threatened at present, but many others are, (e.g. Spotted Owl, Montezuma Quail, Bendire's Thrasher, Rufous-winged Sparrow, Audubon's Oriole). We recognize that these species with small populations and restricted range are particularly vulnerable to relatively minor changes from current conditions, whether or not their populations are currently in decline.

II. Regional Conservation Interest (non-WatchList; TOT$\geq$19): (a) high regional concern (AI+PT$\geq$8); (b) high regional threats (TB+TN$\geq$7, or TB or TN=5) and includes taxa (subspecies and populations) of regional conservation interest not otherwise included in categories above; (c) high regional responsibility (as measured by percent of global, continental, or regional populations).

III Additional Federally and/or State listed.

IV Local or regional concern or interest, including Stewardship Species as defined in the Continental PIF Plan for North America:

Stewardship Species: Stewardship Species, whether on the Watch List or not, are of continental importance because they represent all the large biogeographic regions in North America. They are broadly distributed across Canada and the U.S. during the breeding seasons, in a pattern that mirrors the richness of all landbird species. Winter Stewardship Species are much more heavily concentrated in the southern U.S., particularly the southwest and into Mexico, and along the U.S. west coast. Stewardship actions that preserve healthy populations of these species will address the PIF goal of 'keeping common birds common.' These species, which are both of high overall concern and also largely dependent on a single biogeographic region, merit special attention for conservation action within their core range.

Component Scores to determine Continental WatchList (minus AI) and Regional Scores (and all smaller geographical units, Bird Conservation Regions, Physiographic Areas, States, Provinces, Territories, etc.) are defined as follows:

PT=Population Trend based on a combination of data sources, principally BBS tempered by local and state datasets for breeding species. For non-breeding species usually best professional judgment often based in part on continental trends shown in BBS and/or CBC.

5=Definite decrease
4=Possible decrease
3=Trend uncertain, No data
2=Possible increase, stable
1=Definite increase

Some guidelines based on BBS data, but for waterbirds trends are often dramatic and not linear so an inspection of trend graphs often is required to make a judgment as to trend score, again tempered by local and state data sets if they exist.

Significant increase (BBS trend ≥1.36%/yr, *P*≤0.10, df>13)	1
Possible increase (≥0.47 to 1.36%/ yr, *P*≤0.35, w/any df)	2a
Possible increase (≥1.36%/yr, 0.1<*P*≤0.35, df>13)	2a
Possible increase (≥1.36%/yr, *P*≤0.10, df<13)	2a
Stable (> -0.54 to < +0.47%/yr, and UCI<0.47 OR LCI>-0.54)	2b
- except when trend is negative and P≤0.10 and LCI<-0.54, then Possible decrease	4
Trend uncertain (≤-0.54%/yr or ≥0.47%/yr and *P*>0.35)	3
Trend uncertain (>-0.54%/yr and <0.47%/yr and UCI>0.47 AND LCI<-0.54)	3
No data	3
Possible decrease (either of next 3 options, but based on 6-13 degrees of freedom)	4
Possible decrease (≤-0.54 to -2.27%/yr, *P*=0.0-0.35)	4
Possible decrease (≤-2.27%/yr, 0.1<*P*≤0.35)	4
Significant decrease (≤-2.27%/yr and *P*≤0.10)	5

PS=Population Size based on best population estimates globally
5=Rare (<50 thousand breeding individuals globally)
4=Uncommon (50-500 thousand breeding individuals globally)
3=Fairly Common (500 thousand-5 million breeding individuals globally)
2=Common (5 million to 50 million breeding individuals globally)
1=Abundant (50 million + breeding individuals globally)

TB and TN=Threats Breeding and Threats Non-breeding

5=Extreme deterioration in the future suitability of breeding/non-breeding conditions is expected; species is in danger of regional extirpation or major range contraction, or has already been extirpated
4=Severe deterioration in the future suitability of breeding/non-breeding conditions is expected
3=Slight to moderate decline in the future suitability of breeding/non-breeding conditions is expected
2=Expected future conditions for breeding/non-breeding populations are expected to remain stable; no known threats
1=Expected future conditions for breeding/non-breeding populations are enhanced by human activities or land-uses; potentially a ‘problem’ species

BD and ND=Breeding Distribution and Non-breeding Distribution

5=Very Local Distribution (<500,000 km2, or very restricted coastal areas or interior uplands)
4=Local Distribution (>500,000 and <1,000,000 km2, or <1,600 km of coast)
3=Moderate Distribution (>1,000,000 and <2,000,000 km2, or >1,600 to <5,000 km of coast)
2=Widespread (>2,000,000 and <4,000,000 km2, or >5,000 to <8,000 km of coast)
1=Very Widespread (>4,000,000 km2, or >8,000 km of coast)

SUBTOT=Subtotal of six scores (absent AI) used to calculate Combined Score for Continental WatchList

AI=Area Importance, “relative” relative abundance for the species for each area within range scaled against its maximum relative abundance (i.e., the BCR or physiographic area supporting the highest relative abundance)

5=Very High relative abundance (~50+% of maximum relative abundance)
4=High relative abundance (~25-49% of maximum relative abundance)

3=Moderate relative abundance (~10-24% of maximum relative abundance)
2=Low relative abundance (~1-9% of maximum relative abundance)
1=Peripheral, scattered occurrences.

TOT=Total Score of all seven factors used for identifying Tiers for which species best fits for conservation planning at Planning Region/Bird Conservation Region/Physiographic Area.

Act. Level=Action Level at present based on expert opinion, but ultimately rules based on scores would be preferable.

IM=Immediate management needed to reverse or stabilize significant, long-term population declines in species with small populations, or to protect species with the smallest populations for which trends are poorly known. Lack of action may lead to extirpations or extinction.

MA=Management or other on-the-ground conservation actions needed to reverse or stabilize significant, long-term population declines in species that are still relatively abundant.

PR=Long-term Planning and Responsibility needed for species to ensure that sustainable populations are maintained for species for which a region has high responsibility for that species.

PC=Population Control/Suppression needed for species that are otherwise secure and increasing that may come into conflict with other species of higher conservation concern or other resources of interest.

APPENDIX B

Bird-Habitat Relationships for Puerto Rico and Virgin Islands, West Indies.

Conservation Tier	Limestone and montane forests	Mangrove and coastal woodlands	Shrub-scrub	Grassland/ Open lands	Landbird Transients	Marshes/long-legged waders	Open water	Mudflats	Beach front and salt ponds	Nesting seabirds
I a. Multiple concerns continentally	Plain Pigeon	West Indian Whistling-Duck	Yellow-shouldered Blackbird			West Indian Whistling-Duck	West Indian Whistling-Duck		Snowy Plover	White-tailed Tropicbird
	Puerto Rican Parrot	Yellow-shouldered Blackbird				Black Rail			Piping Plover*	Red-billed Tropicbird
	Puerto Rican Nightjar									
	White-necked Crow									
	Bicknell's Thrush*									
	Golden-winged Warbler*									
	Elfin-woods Warbler									
I b. High continental threats and/or declining	Mangrove Cuckoo**	White-crowned Pigeon**	Prairie Warbler*	American Golden-Plover*		Little Blue Heron*		Lesser Yellowlegs*	Sanderling*	Audubon's Shearwater
	Puerto Rican Vireo	Mangrove Cuckoo**		Upland Sandpiper*		Wilson's Snipe		Solitary Sandpiper*	Gull-billed Tern	Masked Booby
	Worm-eating Warbler*	Prothonotary Warbler*		Short-eared Owl				Whimbrel*		Red-footed Booby

	Kentucky Warbler*							Semipalmated Sandpiper*		Brown Booby
	Greater Antillean Oriole							Western Sandpiper*		Roseate Tern
								Stilt Sandpiper*		Least Tern
								Short-billed Dowticher*		
Conservation Tier	**Limestone and montane forests**	**Mangrove and coastal woodlands**	**Shrub-scrub**	**Grassland/ Open lands**	**Landbird Transients**	**Marshes/long-legged waders**	**Open water**	**Mudflats**	**Beach front and salt ponds**	**Nesting seabirds**
I c. Local and/or rare continentally	Black Swift**	Lesser Antillean Pewee	Lesser Antillean Pewee	Antillean Nighthawk**		Caribbean Coot	Caribbean Coot		Reddish Egret	Magnificent Frigatebird
	Lesser Antillean Pewee		Adelaide's Warbler						Wilson's Plover*	Bridled Tern
	Blue-winged Warbler*								American Oystercatcher*	
	Adelaide's Warbler								Red Knot*	
	Swainson's Warbler*									
II a. High concern regionally	Black-whiskered Vireo**	Green Heron*	Antillean Mango			Green Heron*		Black-bellied Plover*	Ruddy Turnstone*	Brown Pelican
		Yellow-crowned Night Heron*				Yellow-crowned Night Heron*		Least Sandpiper*		

II b. High threats regionally	Sharp-shinned Hawk	Clapper Rail	American Kestrel	American Kestrel (w/nest trees)		Pied-billed Grebe	Pied-billed Grebe	Greater Flamingo	Willet*	
	Broad-winged Hawk	Yellow "Golden" Warbler	Key West Quail-Dove			Least Bittern*	White-cheeked Pintail			
	Limpkin					Black-crowned Night-Heron*	Ruddy Duck			
	Bridled Quail-Dove					White-cheeked Pintail	Masked Duck			
	Puerto Rican Screech- Owl (VI)					Ruddy Duck				
	Louisiana Waterthrush*					Masked Duck				
						Yellow-breasted Crake				
						Purple Gallinule*				
Conservation Tier	**Limestone and montane forests**	**Mangrove and coastal woodlands**	**Shrub-scrub**	**Grassland/ Open lands**	**Landbird Transients**	**Marshes/long-legged waders**	**Open water**	**Mudflats**	**Beach front and salt ponds**	**Nesting seabirds**
II c. High responsibility regionally	Scaly-naped Pigeon	Puerto Rican Flycatcher	Antillean Crested Hummingbird	Zenaida Dove		Tricolored Heron*		Black-necked Stilt*	Black-necked Stilt*	Sooty Tern
	Puerto Rican Lizard-Cuckoo	Northern Parula*	Caribbean Elaenia	Gray Kingbird**				Pectoral Sandpiper*	Black Tern*	Brown Noddy
	Puerto Rican Screech-Owl (PR subsp.)	Cape May Warbler*	Puerto Rican Flycatcher	Caribbean Martin**						
	Green Mango		Gray Kingbird**	Cave Swallow						
	Puerto Rican Emerald		Northern Parula*	Grasshopper Sparrow						
	Puerto Rican Tody		Puerto Rican Bullfinch							

	Puerto Rican Woodpecker									
	Puerto Rican Flycatcher									
	Loggerhead Kingbird									
	Red-legged Thrush									
	Northern Parula*									
	Cape May Warbler*									
	Black-throated Blue Warbler*									
	Puerto Rican Tanager									
	Puerto Rican Spindalis									
	Antillean Euphonia									
	Puerto Rican Bullfinch									
Conservation Tier	**Limestone and montane forests**	**Mangrove and coastal woodlands**	**Shrub-scrub**	**Grassland/ Open lands**	**Landbird Transients**	**Marshes/long-legged waders**	**Open water**	**Mudflats**	**Beach front and salt ponds**	**Nesting seabirds**
III. Additional State Listed						Least Grebe (USVI)	Least Grebe (USVI)			
						Great Blue Heron (USVI)				
						Great Egret* (USVI)				

						Snowy Egret* (USVI)				
IV. Local or regional interest	Chuck-will's-widow*	White-winged Dove	White-winged Dove	Northern Harrier	Merlin*	Glossy Ibis	Northern Pintail	Semipalmated Plover*		Royal Tern
	Yellow-throated Vireo*	Yellow-billed Cuckoo*	Yellow-billed Cuckoo*	Killdeer	Peregrine Falcon*	Sora	Blue-winged Teal*	Greater Yellowlegs*		Sandwich Tern
	Magnolia Warbler*	Yellow-throated Warbler*	White-eyed Vireo*	Mourning Dove	Common Nighthawk*	Common Moorhen*	Lesser Scaup	Spotted Sandpiper*		
	Blackpoll Warbler*	Palm Warbler*	Indigo Bunting*	Indigo Bunting*	Bobolink*		Osprey*	White-rumped Sandpiper*		
	Black-and-white Warbler*	Blackpoll Warbler*			Baltimore Oriole*					
	American Redstart*	Black-and-white Warbler*								
	Ovenbird*	American Redstart*								
	Hooded Warbler*	Northern Waterthrush*								
		Hooded Warbler*								

*Nearctic-Neotropical Migrant species, those species with populations principally breeding in temperate North American areas that winter principally in tropical North American and/or South America areas.
**Intratropical Migrants species, those species breeding in the northern tropical areas of North America that winter principally further south in tropical North America and/or South America areas.

APPENDIX L.4

DRY TORTUGAS NATIONAL PARK

FINAL DRAFT

Avian Conservation Implementation Plan
Dry Tortugas National Park

National Park Service
Southeast Region

Compiled by J. Keith Watson
U.S. Fish and Wildlife Service
In cooperation with

DRTO Resource Management Staff, National Park Service
And Bird Conservation Partners
January 2005

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Introduction

This Avian Conservation Implementation Plan (ACIP) is provided to the staff at Dry Tortugas National Park (DRTO) to help identify and prioritize bird conservation opportunities, and to provide information and guidance for the successful implementation of needed conservation activities. This plan may identify goals, strategies, partnerships, and perhaps specific projects for the park to participate in existing bird conservation planning and implementation efforts associated with the North American Bird Conservation Initiative (NABCI). Under the auspice of NABCI, appropriate bird and habitat conservation goals may be recommended as identified in the appropriate existing national or regional bird conservation efforts aligned with this initiative: Partners In Flight (PIF), North American Waterfowl Management Plan (NAWMP), US Shorebird Conservation Plan (USSCP), and Waterbird Conservation for the Americas (WCA). For example, parks in the Appalachians and the Cumberland Plateau will have few if any high priority waterbird conservation issues at a regional landscape or greater scale. As such, little information regarding waterbird conservation will be presented in the ACIP, unless there is an identified park need for this species group, or other mandates, such as federal laws. Similarly, because DRTO is oceanic in nature, very few landbird conservation priorities will be made, except as they may relate to seabirds and coastal species utilizing the land base of DRTO. However, all high priority bird conservation issues for DRTO will be discussed and integrated as appropriate.

Information and data presented in the ACIP have been obtained from several sources: 1) interviews with DRTO staff 2) DRTO bird conservation partners 3) the PIF Subtropical Florida Bird Conservation Plan (in preparation) 4) NPS databases, 5) peer reviewed bird conservation and management literature, and 6) personal communications with bird conservation specialists throughout North America, especially in the southeastern United States. This plan has been reviewed by DRTO resource management staff and managers, South Florida/Caribbean Inventory and Monitoring (SF/C I&M) Network staff, and bird conservation partners and approved by DRTO management. Optimally, this plan will be incorporated into the park's natural resource planning and management documents and updated annually to reflect completed projects, newly identified needs, and shifts in bird conservation priorities in the region.

DRTO is not obligated to undertake any of the proposed actions in this plan. The plan is provided to offer guidance to DRTO to voluntarily support important park, regional, and perhaps national and international bird conservation projects for which DRTO is a primary participant in the proposed actions.

Background

During the past thirty years, monitoring programs across North America have documented declines of certain bird species populations and their habitats, often severe (Sauer et al. 2000). The decline has caused great concern among scientists, biologists,

biodiversity proponents, ecologists, land managers, etc., and the bird conservation community in general. Birds are recognized as critical components of local and global genetic, species, and population diversity, providing important and often critical ecological, social, economic, and cultural values. Their overall decline has stimulated a worldwide focus on conservation efforts and North American interest in bird conservation is rapidly becoming a focus of government, non-government, industry, and private interests and expenditures.

Many state, federal, and non-governmental wildlife agencies and non-government organizations (NGO's) have recognized this alarming bird decline trend and have joined forces in several extensive partnerships to address the conservation needs of various bird groups and their habitats. The primary initiatives are:

- North American Waterfowl Management Plan
- Partners in Flight
- U.S. Shorebird Conservation Plan
- Waterbird Conservation for the Americas

The North American Bird Conservation Initiative: While efforts associated with these plans have generated some successes, it has been increasingly recognized that the overlapping conservation interests of these initiatives can be better served through more integrated planning and delivery of bird conservation. The *North American Bird Conservation Initiative (NABCI;* http://www.nabci-us.org/main2.html*)* arose out of this realization. The vision of NABCI is simply to see ***"populations and habitats of North America's birds protected, restored and enhanced through coordinated efforts at international, national, regional, state and local levels, guided by sound science and effective management."*** NABCI seeks to accomplish this vision through (1) broadening bird conservation partnerships, (2) working to increase the financial resources available for bird conservation in the U.S., and (3) enhancing the effectiveness of those resources and partnerships by facilitating integrated bird conservation (U.S. NABCI Committee 2000). Together, the four bird conservation initiatives mentioned above, as well as several other local and regional partnerships, work collectively to pursue this vision.

NABCI is guided by a set of principles that establish an operational framework within which the Initiative and its partners may conduct integrated bird conservation in the U.S. These will articulate a common understanding of the relationship between NABCI, the individual bird conservation initiatives, and all partner entities to ensure recognition of existing federal legislative and international treaty obligations, state authorities, and respect for the identity and autonomy of each initiative. The fundamental components of the conservation approach to be used by NABCI are expressed within its goal:

> ***To deliver the full spectrum of bird conservation through regionally-based, biologically-driven, landscape-oriented partnerships.***

The Southeastern Bird Conservation Initiative: National Park Service: In 1999, the Southeast Region of the National Park Service (NPS) recognized the importance of coordinating existing bird conservation goals into planning and operations of national park units in the southeast, that is, integration of NABCI. In support of this recognition, the Southeast Regional Office NPS approved and allocated eighty-eight thousand dollars, cost sharing 1:1 with the US Fish and Wildlife Service (FWS) Region 4 (Southeast) to hire a biologist to conduct this two-year project (Interagency Agreement FS028 01 0368). This project is unique in the NPS, and perhaps the nation, and represents a potential model for better coordinating regional bird conservation programs and activities within and outside the NPS. It further represents a progressive action toward institutionalizing bird conservation as a programmatic priority in the Southeast Region of NPS, and potentially the nation.

As envisioned, the integration of NABCI into the Southeastern NPS involves:

1) Development and delivery of Avian Conservation Implementation Plans,
2) Coordination with NPS Inventory and Monitoring Program,
3) Development of a web based project site,
4) Establishment or enhancement of bird conservation partnerships,
5) Identification and exploration of potential funding opportunities, and
6) Technical guidance and assistance as needed or requested.

This ACIP fulfills one aspect of the plan outlined above, and serves as a basis for future bird conservation actions in DRTO and with adjacent partners or landowners.

Concurrently, the development of a Memorandum of Understanding (MOU) between the FWS and the NPS (Appendix A) to implement Presidential Executive Order (EO) 13186, Responsibilities of Federal Agencies to Protect Migratory Birds **(**US Government 2000), calls for integration of programs and recommendations of existing bird conservation efforts into park planning and operations. Complementing each other, the MOU and the Southeastern Bird Conservation Initiative will advance bird conservation in the Southeast Region of the NPS beyond current regional NPS efforts.

Role of NPS in Avian Conservation

The interagency agreement that facilitates this partnership supports both FWS and NPS management policies. Specifically for the NPS, the agreement supports and advances the Strategy for Collaboration, a visionary document developed and signed by the Southeast Natural Resource Leaders Advisory Group (SENRLAG 2000), a consortium of 13 land and resource management agencies in the Southeastern United States whose vision is to encourage and support cooperation in planning and managing the region's natural resources. Furthermore, the agreement is aligned with and implements a variety of NPS Management Polices (2001) including, but not limited to, External Threats and Opportunities, Environmental Leadership, Cooperative Planning, Land Protection, and especially Natural Resource Management that details policy and

management guidelines which apply to bird conservation. Important policies in the Natural Resource Management chapter include:

- Planning for Natural Resource Management
- Partnerships
- Restoration of Natural Systems
- Studies and Collection
- General Principles for Managing Biological Resources
- Plant and Animal Population Management Principles
- Management of Native Plants and Animals
- Management of Endangered Plants and Animals
- Management of Natural Landscapes
- Management of Exotic Species
- Pest Management
- Fire Management and
- Water Resource Management

The NPS is the fourth largest landowner in the United States, consisting of over 380 national park units covering 83 million acres of land and water with associated biotic resources (www.nps.gov). The 64 units in the Southeast Region of the NPS represent 16% of the total number of park units in the national park system and cover approximately 5% of the total land base in the entire system. Park units in the Southeast Region include national seashores (Canaveral National Seashore, Cape Hatteras National Seashore), national parks (Great Smoky Mountains National Park, Dry Tortugas National Park), national recreation areas (Big South Fork National River and Recreation Area), national preserves (Big Cypress National Preserve), national battlefields (Cowpens National Battlefield, Fort Donelson National Battlefield), national monuments (Fort Matanzas National Monument, Ocmulgee National Monument), and others such as the Blue Ridge Parkway, Obed Wild and Scenic River, and Timicuan Ecological and Historic Preserve.

Southeast NPS units provide habitat for over 400 species of migrating, breeding, and wintering birds and include a wide range of Federal and State listed threatened and endangered species. Likewise, these units also provide nest, migration, and winter habitat for most of the eastern species identified in the national bird conservation plans in need of conservation attention.

Additionally, the NPS attracts over 280 million visitors to the parks each year, 120 million of these in the Southeast Region, affording excellent recreational bird watching and opportunities to strengthen bird conservation interpretation, outreach, and education programs. These opportunities, the NPS mission, policies, and organization all lead to the conclusion that the NPS is an extremely valuable partner and contributor to bird conservation in the region.

Nationally, the status of birds in national parks is largely unknown, although many parks have adequate knowledge regarding bird occurrence in the parks (http://www.npwrc.usgs.gov/resource/othrdata/chekbird/chekbird.htm). Parks often play a role in ongoing regional bird conservation efforts. Indeed many of these parks are often important to regional, national, or international bird conservation, and many have been designated as Important Bird Areas (IBA's) by the National Audubon Society. To date, there are approximately 64 NPS units that are designated IBA's, 35 of which are considered of global importance (http://abcbirds.org/iba/aboutiba.htm). In the Southeast Region, the NPS has 13 global IBA's.

The **NPS Inventory and Monitoring (I&M) Program** has been developed to provide management driven scientific information to national park managers so that resources can be adequately protected within national parks. One of the first phases of this program is to inventory vertebrates, including birds, within the 260 national park units in the program. Once completed, data from the inventories will provide an account of the occurrence and abundance of birds in all the national parks in the program. These records will be stored in the NPS I&M NPSpecies database (http://www.nature.nps.gov/im/apps/npspp/). Coordination with I&M network staff is important to developing long-term bird monitoring programs that fulfill both park and NABCI objectives.

Park Flight is a NPS international partnership initiative that directs funding toward a variety of NPS programs that involve conservation of Neotropical migratory birds whose life history range covers a U.S. national park and a Latin American protected area. A relatively new program, Park Flight offers parks the opportunity to partner with a Latin American national park or protected area to cooperate on developing bird conservation and education projects (USDI NPS 2002).

Recent increases in NPS base funded programs such as inventory and monitoring, exotic species management, habitat restoration, and fire management all indicate that national park managers recognize that park lands are increasingly subject to a variety of threats and conditions that must be improved to provide the quality of national park experience articulated in the NPS Organic Act (1916). Programmatic funding in these areas will increase the ability of national parks to provide quality habitat and conditions for increased wildlife conservation, including birds. Furthermore, private interests and non-profit conservation organizations have initiated programs, including grant programs, to provide much needed funding to national parks to meet backlogs of identified yet unfunded needs.

Park Description

Almost 70 miles (112.9 km) west of Key West lies a cluster of seven islands, composed of coral reefs and sand, called the Dry Tortugas. Fort Jefferson National Monument was established by Presidential Proclamation on January 4, 1935, to protect historic Fort Jefferson, a military and architecturally significant nineteenth century fort.

Congress re-designated the 25,900 ha (64,000 acres) area as a National Park in October 1992 to provide additional management protection for the area's subtropical marine system, including coral reefs, fisheries, nesting birds and sea turtles, and other wildlife (Public Law 102-525). Dry Tortugas National Park possesses one of the greatest concentrations of historic shipwrecks in North America, with some vessels dating back to the 1600's. Because of its isolation, the islands, magnificent subtropical waters and coral reefs serve as an important resting place for migrating birds and a foraging and nesting place for sea turtles. Pristine subtropical waters, lush coral and seagrass habitat, and hundreds of species of birds and fish affords scientists an outstanding opportunity for education and scientific research. Some of the earliest known coral reef investigations date back to the 1880's when the Carnegie Institution operated one of the first subtropical marine science laboratories in the Western Hemisphere on Loggerhead Key (Sasso and Patterson 2000).

Avian Resources of Subtropical Florida

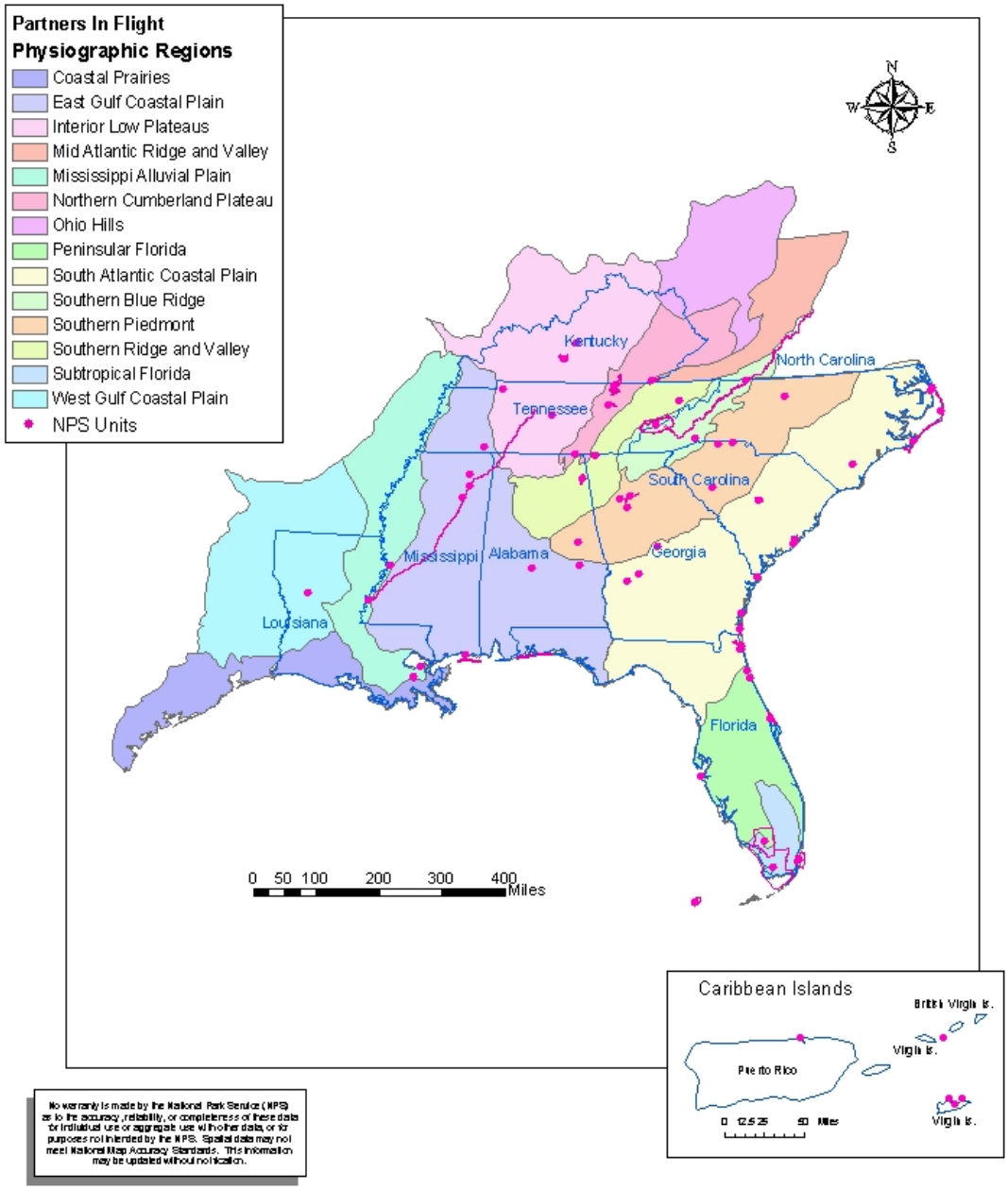
This physiographic area is entirely contained within Florida, and extends from the northern edge of Lake Okeechobee south through the Florida Keys (see PIF and NPS locations maps below). The region has very little topographic relief, but slight changes in elevation have important consequences for vegetation and the diversity of habitat types. The highest points of elevation are less than 2 meters and correspond with fairly recent shorelines (less than 5,000 years before present). Underlying sediments consist of freshwater marl, peat, freshwater lake and marine sediments, and to a lesser extent, sand deposited during the Pleistocene and Holocene. The subtropical Florida region can be divided into four smaller sub-regions: 1) the Everglades, 2) Big Cypress, 3) Miami Ridge and Atlantic Coastal Ridge, and 4) Southern Coasts and Islands. The Everglades is the most extensive of these areas, followed by the Big Cypress, Miami Ridge and Southern Coasts. Across all subregions, much of the physical and ecological characteristics of the region resemble tropical ecosystems where seasonal changes are reflected by changing rainfall patterns rather than by dramatic temperature changes. Distinctive dry (winter/spring) and wet (summer) seasons occur annually, and the nesting cycles of many birds are tied to these changes. At least two major forms of disturbance play key roles in the ecology of the region. Fire is an important feature in many pine dominated communities and many marsh and prairie communities. Frequent fires are essential in pine-dominated stands and prairies if understory conditions suitable to many nesting birds are to be maintained. However, the ideal fire frequency in some pine communities is not known. Hurricanes are a second form of disturbance that less frequently but predictably provide early successional habitats or open forest cover (Partners in Flight 2000).

Bird conservation priorities for Subtropical Florida have been stratified by habitat type. Recognized habitat types where high priority conservation actions are needed for both birds and habitats are pine forests (including pine rocklands, pine Flatwoods, sand

Partners in Flight (PIF) Regions

Southeast Region (SER)

National Park Service
U.S. Department of the Interior



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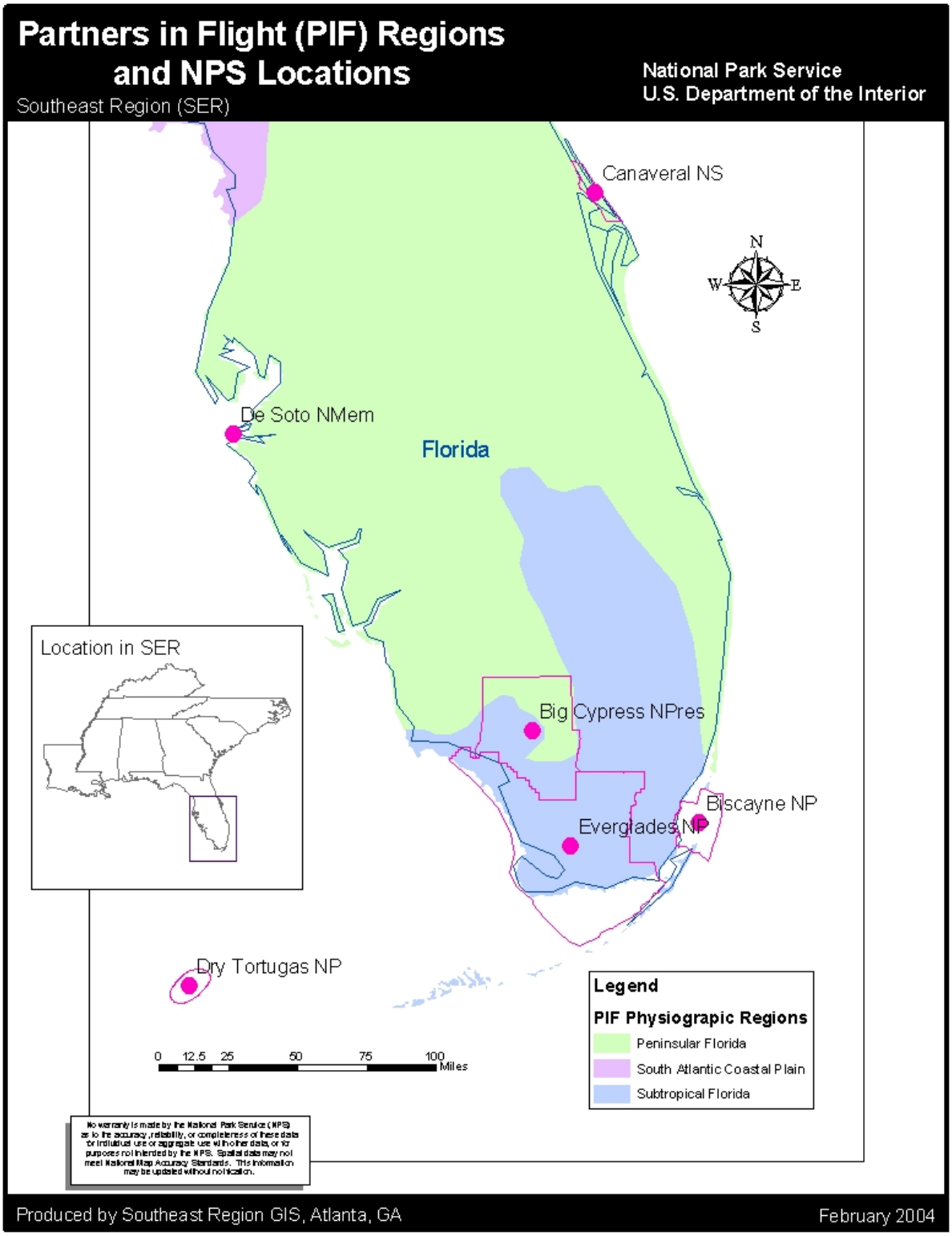
Partners in Flight (PIF) Regions
and NPS Locations
Southeast Region (SER)
National Park Service
U.S. Department of the Interior
Canaveral NS
N
W
E
S
De Soto NMem
Florida
Location in SER
Big Cypress NPres
Biscayne NP
Everglades NP
Dry Tortugas NP
Legend
PIF Physiograpic Regions
Peninsular Florida
South Atlantic Coastal Plain
Subtropical Florida
0 12.5 25 50 75 100
Miles
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pine scrub), grassland/grassland-scrub (including dry prairie and coastal strands), subtropical deciduous forest, Everglades, brackish saltwater and freshwater marsh, and mangrove swamps. Species associated with each of these habitats and identified as high priority for conservation needs are given below.

Florida Scrub Jay, Red-cockaded Woodpecker, Southeastern American Kestrel, Brown-headed Nuthatch, Bachman's Sparrow, Pine Warbler and Sedge Wren are associated with the pine forests. Both Florida Scrub Jay and Southeastern American Kestrel have been extirpated in Subtropical Florida and the Brown-headed Nuthatch and Bachman's Sparrow are nearly extirpated here. Both Palm Warbler and Sedge Wren are present only in the non-breeding seasons.

Grasshopper Sparrow, Crested Caracara, Burrowing Owl, Sandhill Crane and Mottled Duck are all species associated with grassland to grassland scrub habitats. Grasshopper Sparrow has been extirpated in South Florida.

In the subtropical deciduous forest, Short-tailed Hawk, Swallow-tailed Kite and Gray Kingbird are high priorities for conservation.

In the Everglades, brackish saltwater and freshwater marshes, Snail Kite, Cape Sable Seaside Sparrow, Wood Stork, Black Rail, Reddish Egret, Yellow Rail, White Ibis, and Clapper Rail are species of conservation attention.

Prairie Warbler, Yellow Warbler, Black-whiskered Vireo White-crowned Pigeon, and Mangrove Cuckoo, species associated with Mangrove swamps and forests, are of high priority conservation concern.

Human population growth has been phenomenal in subtropical Florida for the last 40 years. The impacts of such tremendous growth include increased infrastructure that directly reduces habitat availability, but also secondary impacts to bird habitats, such as pollution. Other land uses include production of sugarcane, winter vegetables, and citrus. Drastic changes in hydroperiod and natural water cycles are secondary impacts of increasingly intensive agriculture. However, among the best opportunities in the Southeast to work with existing public lands occur in Subtropical Florida, where over 54% of the area is publicly owned. Therefore, primary conservation programs include efforts to reduce impacts from adjacent or nearby lands on management of existing public lands. Many programs have been developed and are in various phases of implementation. These include the Save Our Everglades program, the Surface Water Improvement and Management Act, Florida's everglades Forever Act and the development of the South Florida Ecosystem Restoration Task Force as well as aggressive acquisition programs. These and other programs serve the basis for bird conservation efforts in the region.

This description of South Florida aviafaunal conservation priorities hardly seems relevant to DRTO. Indeed, DRTO has a bird fauna more similar to the Caribbean region

than Subtropical Florida. Yet, bird conservation plans for both Subtropical Florida and Puerto Rico and the US Virgin Islands do not adequately address priority bird conservation issues in DRTO. However, because bird conservation priorities are more closely affiliated with the Caribbean, recommendations in this plan will be tiered to the Puerto Rico and US Virgin Islands bird conservation plan.

Avian Conservation in DRTO

Avian Biodiversity: DRTO has an avian inventory and a checklist of birds that is available for the public. Managers recognize the need to update the inventory and checklist. Approximately 291 species have been observed in the Dry Tortugas, yet only 7 species regularly nest there. This number seems low, especially considering that numbers of birds in spring often exceed 100,000. However, these large numbers are the result of nesting Sooty Tern and Brown Noddy. Other regular nesters there are Masked Booby, Magnificent Frigatebird (only colony in US jurisdiction), Mourning Dove, and Brown Pelican.

Verified records of birds in DRTO have been entered into the NPS I&M program's database, NPSpecies, and may be viewed via the internet at http://www.nature.nps.gov/im/app/npspp with a user identification and password combination authorized by the NPS for NPS personnel and NPS cooperators. Many other avian observational data need to be verified and entered into the database.

Inventory: The park's avian inventory has been recognized as important information for park managers and is considered complete within the framework of the NPS I&M Program. DRTO is one of seven parks in the NPS South Florida/Caribbean I&M Network for which a plan to conduct high priority inventory projects has been prepared (Sasso and Patterson 2000). At this time, no inventory efforts are planned for DRTO.

Threatened and Endangered Species: Two federally listed threatened species occur in DRTO, the Brown Pelican and Roseate Tern. The Brown Pelican nests in the park and the Roseate Tern is now an irregular nesting species and regular winter resident.

One additional Florida listed species, the Least Tern, occurs in DRTO. Other transient species occurring in DRTO are listed in several states, signifying the park's importance to bird migration.

Park Priorities: Park staff and consultants have identified the Sooty Tern, Magnificent Frigatebird and Brown Noddy as species of significant management concern and high priority for conservation. Additionally, the park's significance as a stopover for Neotropical migrants is well known remains a high priority for conservation attention.

Monitoring: Currently, several avian monitoring projects are being conducted at DRTO. These are:

- Sooty Tern and Brown Noddy colony monitoring using point count index methodology; vegetation is also monitored at these sites
- Migration monitoring by private interests, mainly for Neotropical migrants
- Brown Pelican, Masked Booby, and Magnificent Frigatebird colony monitoring using direct count methodology

Randomized recreational birding provides additional bird observation data.

Research: Scientific research is permitted within the park, and currently two projects are ongoing. These are:

- Long-term banding of Sooty Tern chicks in 3 m square plots to track parentage and nest site fidelity
- Determination of causes in shift of breeding season for Sooty Tern, including an analysis of all environmental variables possibly associated with Sooty Tern nesting

Outreach: Some educational information related to birds is conveyed to visitors to DRTO.

- Law enforcement staff inform visitors of the importance of and protecting the tern colonies, as well as other waterbirds
- An observation log is maintained in the visitor center where
- In visitor center, information is available on the practice of gull feeding by visitors
- In visitor center, information is available on importance of DRTO for landbird migration

Park Identified Needs for Avian Conservation

DRTO has identified several projects that would increase the avian knowledge of the park. They are:

Inventory:

- better understand the role the park has for fall migrants

Monitoring:

- Christmas Bird Count
- Scientifically based Migration Monitoring

Research:

- Sooty Tern colony banding is desired
- Nesting chronology and demography of the Magnificent Frigatebird Colony
- Masked Booby nesting chronology and reproductive success
- Determination of importance of DRTO as a migration stopover

Data Management:

- Verify and enter avian observational data into NPSpecies, eBird, or another appropriate database (DRTO data is stored in Everglades National Park databases)

Coordination with Regional Conservation Initiatives

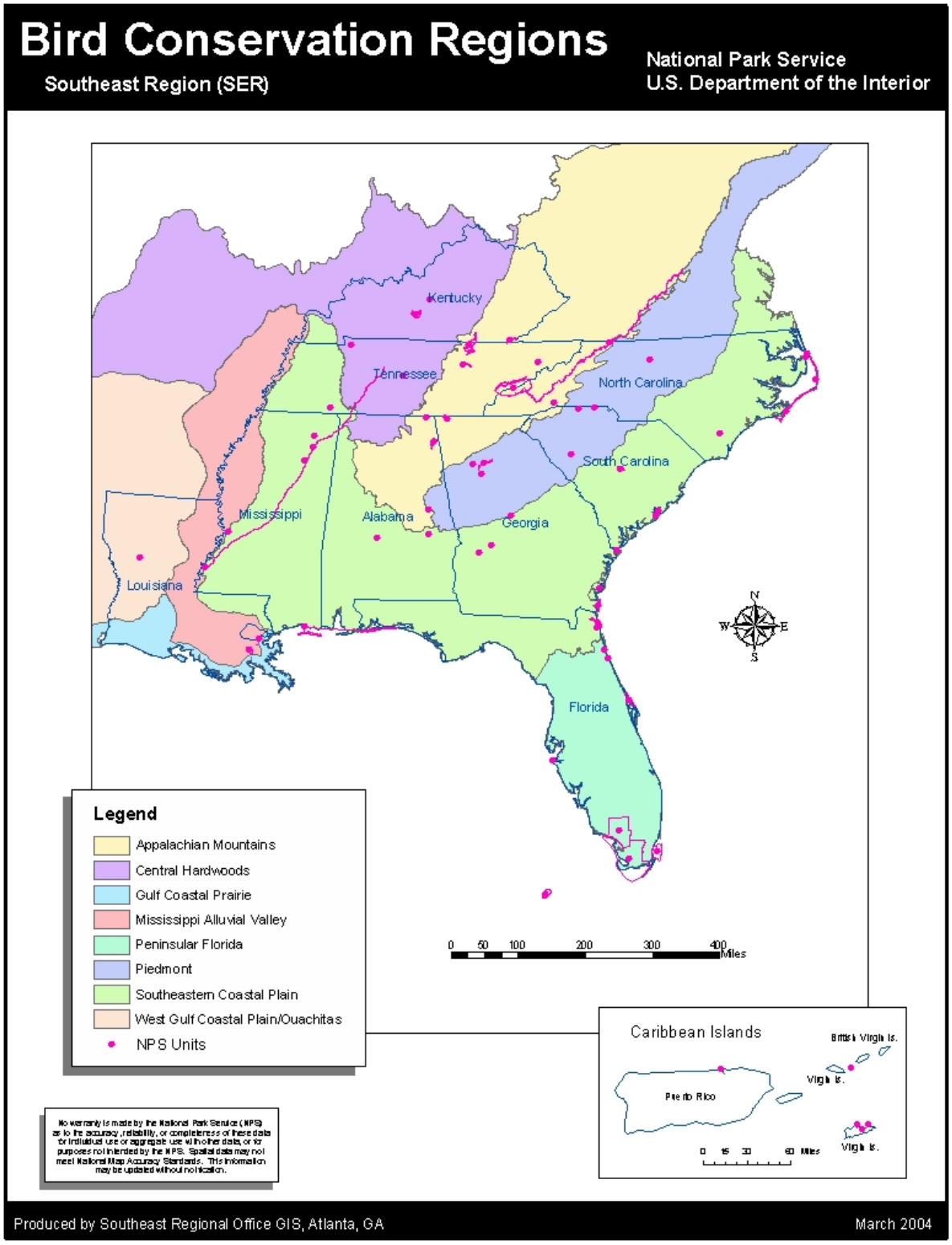
North American Bird Conservation Initiative: NABCI bird conservation planning units, referred to as Bird Conservation Regions (BCR), are often larger than other planning units associated with other plans, such as Partners In Flight. For example, DRTO is within the NABCI Peninsular Florida BCR that covers all of Southern Florida south of approximately Jacksonville (see NABCI BCR map below) and encompasses two PIF physiographic areas (the planning unit for PIF)(compare to PIF map).

Several NABCI BCR's have coordinators whose primary responsibility is to coordinate all bird conservation planning in the BCR, across all agencies and organizations. Currently, the Peninsular Florida BCR does not have a designated coordinator; however, the Atlantic Coast Joint Venture (ACJV) has staff that with responsibility to provide bird conservation assistance to agencies and organizations in the area. This staff can provide valuable assistance to DRTO with implementation of aspects of this ACIP.

North American Waterfowl Management Plan (NAWMP): The NAWMP (http://northamerican.fws.gov/NAWMP/nawmphp.htm) is completed and has been revised several times, incorporating updated goals and strategies based on new information. This plan is one of the most successful bird conservation delivery programs in the United States, being monetarily supported by the North American Wetlands Conservation Act (NAWCA). The ACJV coordinators are responsible for coordination and implementation of this program.

Partners In Flight: Goals and strategies for the Subtropical Florida are not yet fully developed into a draft bird conservation plan. However, as previously noted, bird conservation priorities for DRTO are better aligned with Puerto Rico and the US Virgin Islands goals, yet are largely the responsibility of the NPS and the State of Florida, an arrangement that can make bird conservation at DRTO challenging.

Similar to NABCI BCR's, PIF physiographic areas often do not have designated coordinators. However, state level non-game agencies with investment in PIF will establish key personnel to develop partnerships among cooperators in the physiographic area. The State of Florida has a non-game bird coordinator who can be instrumental in assisting DRTO to implement recommendations identified in this ACIP and projects important to bird conservation relative to Florida and the Caribbean's role in implementation of the respective geographical plans.


Bird Conservation Regions
Southeast Region (SER)
National Park Service
U.S. Department of the Interior
Kentucky
Tennessee
North Carolina
South Carolina
Mississippi
Alabama
Georgia
Louisiana
Florida
N
W
E
S
Legend
Appalachian Mountains
Central Hardwoods
Gulf Coastal Prairie
Mississippi Alluvial Valley
Peninsular Florida
Piedmont
Southeastern Coastal Plain
West Gulf Coastal Plain/Ouachitas
NPS Units
0 50 100 200 300 400 Miles
Caribbean Islands
British Virgin Is.
Virgin Is.
Puerto Rico
Virgin Is.
0 15 30 60 Miles
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United States Shorebird Conservation Plan (USSCP): The USSCP has been completed and is available on the World Wide Web (http://shorebirdplan.fws.gov/). A regional step down plan is in preparation by FWS personnel and should be available in 2003.

Waterbird Conservation for the Americas (WCA): The WCA plan has been completed and is available on the World Wide Web or can be ordered from the US Fish and Wildlife Service National Conservation Training Center (http://www.waterbirdconservation.org/). Most conservation priorities for DRTO are for waterbirds and this plan will eventually provide the best guidance for DRTO bird conservation.

Integration of NABCI Goals and Objectives into Park Planning and Operations

NABCI Implementation Recommendations

To successfully achieve park-established goals and actively participate in NABCI, the park could implement a variety of projects in different NPS programs. Most of these projects would require some level of participation by many existing park programs and could either be achieved through NPS funding, or more likely, through establishing or improving partnerships with agencies and organizations that already have the necessary expertise to provide guidance, funding, and execution of these programs. Programmatic areas where bird conservation actions are likely to be focused are:

- Inventory
- Monitoring
- Habitat Restoration
- Threat Management (includes exotic species, air quality, water quality, etc.)
- Research
- Compliance
- Outreach
- Partnerships

To the extent appropriate, each of these program areas will be discussed separately and within each, specific opportunities identified that, when implemented, will enable to park to meet its mandates (current and expected) as well as integrate NABCI into its planning and operations. With emphasis added, the park is not expected to implement any of these recommendations or be obligated to pursue any opportunity other than those the park is required to do by law or NPS program or policy. In other words, participation in this effort is currently voluntary. However, implementation of EO 13186 (US Government 2000) will require NPS to incorporate a wide range of bird conservation programs into planning and operations. The development of the MOU between the FWS and the NPS will establish a formal agreement to promote bird

conservation within the agency by incorporating goals and strategies of existing bird conservation initiatives, plans, and goals into park planning and operations.

Should the park decide to implement any of these projects, further consultation with bird conservation contacts is encouraged to obtain updated information on the relevance of these opportunities in regional bird conservation.

High priority projects are identified in **bold** print. Priorities that the park is encouraged to seek NPS funding for are marked with an asterisk (*****). These projects are those that are critical to the stabilization or improvement of a bird population in the planning region.

Inventory: The park has inventoried its bird fauna exceptionally well. Although Nonetheless, additional information is needed on fall migration. DRTO is encouraged to:

- **establish a migration monitoring program throughout the islands to determine use of DRTO by fall migrants***

Additionally, DRTO is encouraged to

- **verify other avian observational data collected in the park and enter into the appropriate database (Everglades NP databases, NPSpecies, eBird, or other appropriate database)***

- **standardize inventory and monitoring methodology to conform to NPS and/or FWS recommended standards (Fancy and Sauer 2000, Hunter 2000)**

Monitoring: The park's bird monitoring program is focused on waterbird colonies, two of which occur nowhere else in the United States. Efforts should be made to continue existing monitoring programs and to ensure that park efforts contribute to park or regional bird conservation rather than undertake an action or actions that are not needed or are better conducted in other areas. Specific recommendations are to:

- **continue to conduct existing monitoring programs and enter data into the appropriate databases (NPSpecies, eBird, or other appropriate database)***

- **communicate with other biologists and research scientists working with Sooty Tern, Brown Noddy, and Magnificent Frigatebird to determine DRTO's importance for these nesting species***

- **establish a scientifically based landbird migration monitoring program to document use of DRTO during landbird migrations***

- **establish a gull monitoring program to document increase in gulls and gull predation**

- **establish a Christmas Bird Count area centered on the Dry Tortugas**

- **standardize inventory and monitoring methodology to conform to NPS and/or FWS recommended standards (Fancy and Sauer 2000, Hunter 2000)**

Habitat Restoration: Recently, habitat restoration efforts have increased on NPS lands due to the increased restoration emphasis of the Management Policies (USDI NPS 2001). Parks may use a wide range of management tools to restore wetland, grassland, woodland, and other habitats. Restoration tools include, but are not limited to, forest management practices (e.g. silviculture), prescribed fire, exotic species management, and public use and recreation management. In addition, parks can coordinate infrastructure development (e.g. roads and buildings) with restoration activities to mitigate potential adverse impacts.

Due to the protected nature of DRTO lands, and generally those in the national park system, the condition of habitats for bird use may be of higher quality than other natural, developed, agricultural, or forest lands under other management regimes. However, national park lands can be greatly improved for wildlife, and particularly bird use, by restoring processes important for habitat formation, succession, and structural development. Largely, these processes have not been managed historically in the national park system but current policy allows for active management of species, populations, and lands to provide for long-term conservation of park resources. Protection of habitats in DRTO can contribute to continued waterbird colony nesting, thus contributing to species population goals in South Florida and the Caribbean.

The park is entirely oceanic island park subject to the forces generated upon and moving across the ocean surfaces. Tropical storms, tidal fluctuations, and sea level rise are processes that influence the dynamic landscape of DRTO and likewise, the waterbird colonies. Specific recommendations are to:

- **maintain or enhance water quality in surrounding waters to support aquatic biota necessary to support existing tern and waterbird colonies***

- **manage vegetation on Bush Key to assure Sooty Tern and Brown Noddy have adequate and suitable nesting area***

- **determine feasibility to improve habitat for nesting Masked Booby and implement appropriate actions to improve habitat for nesting Masked Booby***

- **preserve remaining coastal hammock forests and shrub scrub habitats for migrating land birds***

- **document all major habitat management activities, including location (e.g. UTM coordinates) and a description of methods and of pre- and post-management habitat conditions. This information, when coupled with bird distribution and abundance data, is useful for assessing and replicating conservation actions**

Threat Management: Potentially the greatest impact to birds at DRTO is the presence of rats. The recent establishment of a land bridge between Fort Jefferson and Bush Key, where the tern colonies reside, could result rat predation of the tern colony. However, park staff have responded with an aggressive trapping program and rats do not seem to be negatively impacting the tern colony. The park is encouraged to:

- **continue the aggressive removal of rats from Bush Key, striving to eradicate all rats***

- **consider removing the land bridge between Garden and Bush Key to prevent future invasions of mammalian predators and unauthorized visitors and associated disturbance**

- **eliminate gull feeding by visiting public and potentially reduce gull populations to reduce predation on Sooty Terns**

- **manage commercial fishing offal to eliminate attraction to gulls**

- **assess and managed gull predation on Sooty Tern**

- **manage fishing practices that impact fish eating birds**

Exotic vegetation has been well managed at DRTO. Efforts should continue to

- monitor and manage exotic vegetation

Research: Several research projects have been identified that could improve bird conservation for birds at DRTO and contribute to increased bird conservation efforts for these species in the Caribbean. These projects are:

- **Sooty Tern colony banding is desired (10K)***

- **demography and nesting chronology of the Magnificent Frigatebird***

- **determination of importance of DRTO as a migration stopover***

- **Masked Booby nesting chronology and reproductive success***

- **assess gull population dynamics and gull predation on Sooty Tern colony***

- **impact assessment of fishing gear on fish feeding birds**

- **continue to improve knowledge on developing mangrove forest and potential for increased bird nesting**

- **list park needs and projects on Research Permit and Reporting System web site (RPRS)**

- develop contact with South Florida/Caribbean Cooperative Ecosystem Studies Unit (CESU) at the Rosentiel School of Marine and Atmospheric Sciences at the University of Miami, Fl.

Compliance: Park compliance with the Migratory Bird Treaty Act and the Executive Order 13186 (US Government 2000) is necessary to assure that park activities incorporate bird conservation into park planning and operations. Further, to ensure that migratory birds are considered in all phases of park planning processes, especially during the National Environmental Policy Act (NEPA) and the Director's Order #12 Compliance processes, the park should consider adding specific language in project evaluations that requires consideration and implications of park projects on migratory birds. The MOU being developed between the NPS and the FWS will likely contain specific language requiring a park to consider implications of park projects on migratory birds, particularly those species identified in the USFWS Species of Conservation Concern 2002 (Appendix D). Additional considerations are to encourage:

- **park staff to begin specific consideration of migratory birds during park planning processes***

- park staff to attend USFWS training on implementation of EO 13186 at the National Conservation Training Center (NCTC) (when available) or other training on migratory bird conservation in North America. NCTC has several courses and training related to conservation of migratory birds (http://training.fws.gov/courses.html).

The USFWS NCTC offers and reserves two tuition free slots for National Park Service employees wishing to attend NCTC courses on a first come, first served basis. Additionally, discount lodging is also available while attending a NCTC course.

Outreach

- **participate in International Migratory Bird Day (IMBD) events with a local partner (http://birds.fws.gov/imbd.html)**

- **encourage development of outreach and educational programs to enhance visibility of bird conservation issues, which may include organized bird walks, migration monitoring, and perhaps waterbird colony visits***

- **develop educational/outreach program for park fishing persons to avoid or minimize impacts or injury to fish eating birds***

- **develop aggressive outreach and enforcement program to eliminate gull feeding by visiting public***

- **encourage accurate documentation and reporting from randomized outings by visitors (see Cornell University's eBird monitoring program (Cornell Lab. Ornith. 2002 (http://www.ebird.org/about/index.jsp)***

- park interpretation/education staff are encouraged to attend USFWS training on Migratory Bird Education at NCTC

- consider adding links to bird conservation information, data, etc. to the park's web site home page

- support bird conservation by serving shade-grown coffees at meetings, events, and the office buildings in the park (http://www.americanbirding.org/programs/conssbcof3.htm)

- subscribe to Florida Birds, an electronic forum for listing bird sightings and publications in Florida

Partners and Partnerships: Partnerships for habitat conservation and protection will perhaps have the greatest positive influence on bird conservation above all other landscape scale planning. Specific recommendations are to:

- **keep abreast of initiatives that may affect water quality in and around DRTO***

- **partner with Caribbean seabird experts to collaborate on conservation issues with DRTO waterbird colonies***

- **continue to develop and strengthen relationship with local bird clubs such as the Key West Audubon Society and Tropical Audubon Society to coordinate and conduct park bird conservation projects***

- **develop partnership with USFWS, particularly with Key West National Wildlife Refuge***

- **contact the nearest Joint Venture office (see Funding section for explanation of Joint Ventures) or BCR coordinator to develop partnerships and funding proposals tiered to priorities established by the park, this ACIP, and the bird conservation plans that pertain to DRTO**

Funding Opportunities: Internal NPS funding is often an effective source to obtain funding; however, the project will have to be a fairly high priority among the park's natural resource program to successfully compete for the limited funding available in the NPS. Therefore, partnerships and outside funding programs are often more productive for securing bird conservation funding. Funding for conservation projects for Neotropical migrants is also available through the Park Flight program. DRTO is encouraged to enter all high priority projects into the NPS Performance Management Information System (PMIS) database. Needed at DRTO is:

- **increased base funding to implement basic protection and management needs for birds and their habitats (habitat-based management not only benefits the birds but other wildlife as well)**

With the exception of the North American Waterfowl Management Plan (NAWMP and its associated funding legislation, the North American Wetland Conservation Act), funding opportunities for bird conservation programs, plans, and initiatives have been lacking. Only within the last decade have other appropriate and specific sources for bird conservation funding been created and used. The NAWMP has been supported for approximately 14 years by the North American Wetlands Conservation Act (NAWCA 1989). This program has provided $487 million in appropriated funds matched with $1.7 billion for wetland and bird conservation projects since its inception. In 2002 alone, over $70 million US dollars were awarded to US and Canadian agencies and organizations to enhance waterfowl populations by improving, restoring, or protecting wetland habitats. To adequately evaluate projects and distribute these funds, partnerships called Joint Ventures were established. Nationally, 14 (11 US, 3 Canada) Joint Ventures have been established, several which are funded and staffed. Internet links to Joint Ventures are:

(http://southwest.fws.gov/gulfcoastjv/ojvcontact.html) and
(http://northamerican.fws.gov/NAWMP/jv.htm).

Funding through NAWCA is highly underutilized by the NPS and any park unit that has wetland, water, or bird conservation needs associated with wetland are encouraged to investigate using this funding source. Naturally, there are certain requirements to be eligible for all grants and park managers are encouraged to consult with the nearest Joint Venture, BCR, PIF Coordinator, to learn how this program might be applicable to implementation of this plan, and other park wetland issues. DRTO should contact the ACJV assistant coordinator to investigate use of this funding source and developing proposals for implementation of portions of this plan.

Internal FWS funding programs may be used to support projects, but no effective method of project proposal delivery to these sources is currently in place for the NPS. Current funding in these programs may result from FWS familiarity with NPS needs, or NPS participation in one of the area FWS Ecosystem Teams, where a project has been identified and proposed to be funded through the Ecosystem Team.

Specific congressional appropriations to protect migratory birds has recently been authorized under the Neotropical Migratory Bird Conservation Act (2000) (http://www.nfwf.org/programs/nmbcapp.htm). Appropriations through this Act are authorized up to $5 million per year. However, in 2000, appropriation was approximately $3.75 million and a majority of this funding was directed toward projects in Central and South America.

Many of the identified projects are eligible for funding under various grant programs of the National Fish and Wildlife Foundation (http://www.nfwf.org/programs/programs.htm).

Other prominent funding sources available to NPS managers for bird conservation are listed on this projects web site at: http://southeast.fws.gov/birds/NPSHighlits.htm.

Funding opportunities for migratory bird conservation are available yet most natural resource agencies are not fully aware of and/or understanding of how to use these sources. Perhaps a consolidated migratory bird funding source catalog will become available to managers in the future; this is needed.

Contacts: Primary contacts within the region can be obtained by viewing the web site for the Southeastern Bird Conservation Initiative, National Park Service at http://southeast.fws.gov/birds/npsbirds.htm. This web site will provide contact information of the appropriate bird conservation coordinator in the region for park personnel. Primary contacts for DRTO are:

US Fish and Wildlife Service

Keith Watson
Asheville, NC 28801
828-350-8228
Keith_Watson@fws.gov

Dean Demarest
Atlanta, GA
404-679-7371
dean_demarest@fws.gov

Jennifer Wheeler
Waterbird Conservation Plan Coordinator
703-358-1714
Jennifer_A_Wheeler@fws.gov

Craig Watson
Atlantic Coast Joint Venture
Charleston, SC
843-727-4707 ext. 16
Craig_Watson@fws.gov

Chuck Hunter
Regional Refuge Biologist
Atlanta, GA
404-679-7130
Chuck_Hunter@fws.gov

Jorge Saliva
Boqueron, Puerto Rico
787 851-7297
Jorge_Saliva@fws.gov

National Park Service

Matt Patterson
South Florida/Caribbean
Inventory & Monitoring Network
SF/C Network Coordinator
National Park Service
305 224-4211
Matt_Patterson@nps.gov

Sonny Bass
South Florida Natural Resource Center
Homestead, FL
305-242-7833
Sonny_Bass@nps.gov

Tony Pernas
Exotic Plant Management Coordinator
Tony_Pernas@nps.gov

Carol Daniels
South Florida/Caribbean CESU
Rosential School of Marine and Atmospheric Sciences
University of Miami
Miami, Fl
Carol_Daniels@nps.gov

Florida

Jeff Gore
Florida Fish and Wildlife Conservation Commission
Jeff.Gore@fwc.state.fl.us

Karl Miller
Florida Fish and Wildlife Conservation Commission
352-955-2230
karl.miller@fwc.state.fl.us

Exotic Animal Management

USDA APHIS Wildlife Services
Bernice Constantin
Florida Wildlife Services State Director
352- 377-5556
bernice.u.constantin@aphis.usda.gov

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APPENDIX A

EXCERPT FROM SOUTHEAST WATERBIRD CONSERVATION PLAN
PRIORITY BREEDING COLONIAL BIRDS

Appendix I. BREEDING COLONIAL WATERBIRD SCORES AND STATUS FOR THE SOUTHEAST U.S. WATERBIRD CONSERVATION PLAN*

DRAFT (September 8, 2003)

Species/Region (Colonial Breeding Waterbirds)	**PT**	**PS**	**TB**	**TN**	**BD**	**ND**	**SUB TOT**	**AI**	**TOT**	**WL**	**Tier**	**Act. Level**	**Per. Resp.**	**Est. Pop. Cat.**	**Pop. Obj. Cat.**
Masked Booby	**4**	**4**	**4**	**3**	**3**	**2**	20			**15**			**<1 global**		
Southeast U.S. Reg.	**2**		**4**	**3**				**2**	**20**		**I b**	**PR**	**100us-can**	**2**	**2**
PENFL (BCR 31)	**2**		**4**	**3**				**2**	**20**		**I b**	**PR**	**100 reg.**	**2**	**2**
STFL	*2*		*4*	*3*				*2*	*20*		*I b*	*PR*	*(100)*		
Brown Pelican	**1**	**4**	**3**	**2**	**3**	**3**	16						**45 global**		
PENFL (BCR 31)	**3**		**3**	**2**				**5**	**23**		**II a**	**MA**	**22 reg.**	**7a**	
PENFL (BBS)	*4*		*4*	*2*				*5*	*25*		*II a*	*MA*			
STFL	*2*		*3*	*2*				*5*	*20*		*II c*	*PR*			
Magnificent Frigatebird	**4**	**4**	**4**	**3**	**4**	**3**	22			**16**			**<1 global**		
Southeast U.S. Reg.	**5**		**5**	**3**				**2**	**26**		**I c**	**IM**	**100 us-can**	**3**	**4**

Species/Region (Colonial Breeding Waterbirds)	**PT**	**PS**	**TB**	**TN**	**BD**	**ND**	**SUB TOT**	**AI**	**TOT**	**WL**	**Tier**	**Act. Level**	**Per. Resp.**	**Est. Pop. Cat.**	**Pop. Obj. Cat.**
PENFL (BCR 31)	**5**		**5**	**3**				**2**	**26**		**I c**	**IM**	**100 reg.**	**3**	
Roseate Tern	**4**	**5**	**4**	**3**	**3**	**3**	22			**16**			**1 global**		
(North American-West Indies/Florida breeding pops.)	**4**	**5**	**4**	**3**	**5**	**5**									
Southeast U.S. Reg.	**3**		**4**	**3**				**2**	**27/23**		**I b**	**IM**	**7 us-can**	**4**	**5**
PENFL (BCR 31)	**3**		**4**	**3**				**2**	**27/23**		**I b**	**IM**	**100 reg.**	**4**	
STFL	*3*		*4*	*3*				*2*	*27/23*		*I b*	*IM*	*(100)*		
Sooty Tern	**3**	**2**	**3**	**2**	**3**	**2**	15						**<1 global**		
Southeast U.S. Reg.	**2**		**3**	**2**				**5**	**19**		**II c**	**PR**	**100 us-can**	**8**	**8a**
PENFL (BCR 31)	**2**		**3**	**2**				**5**	**19**		**II c**	**PR**	**99 reg.**	**8**	
STFL	*2*		*3*	*2*				*5*	*19*		*II c*	*PR*			
Brown Noddy	**3**	**3**	**3**	**2**	**3**	**2**	16						**<1 global**		
Southeast U.S. Reg.	**2**		**3**	**2**				**4**	**19**		**II c**	**PR**	**100 us-can**	**6**	**6a**
PENFL (BCR 31)	**2**		**3**	**2**				**4**	**19**		**II c**	**PR**	**100 reg.**	**6**	

Species/Region (Colonial Breeding Waterbirds)	PT	PS	TB	TN	BD	ND	SUB TOT	AI	TOT	WL	Tier	Act. Level	Per. Resp.	Est. Pop. Cat.	Pop. Obj. Cat.
STFL	*2*		*3*	*2*				*4*	*19*		*II c*	*PR*	*(100)*		

***Region**

Southeast U.S.: all bird conservation regions making up the Southeast U.S. Waterbird Conservation Planning Area for Waterbirds of the Americas.
EP (BCR 20): Edwards Plateau (TX)
OP (BCR 21): Oaks and Prairies (TX, OK)
WGCP (BCR 25): West Gulf Coastal Plain-Ouachita Mountains (OK, AR, TX, LA)
MAV (BCR 26): Mississippi Alluvial Valley (IL, MO, KY, TN, MS, AR, LA)
SECP (BCR 27): Southeastern Coastal Plain (KY, TN, LA, MS, AL, FL, GA, SC, NC, VA)
SACP: South Atlantic Coastal Plain (VA, NC, SC, GA, FL east of Apalachicola watershed)
EGCP: East Gulf Coastal Plain (KY, TN, LA, MS, AL, FL west of Apalachicola watershed)
APPS (BCR 28): Appalachians (AL, TN, KY, WV, OH, GA, SC, NC, VA, MD, PA, NY, NJ); many distinct physiographic areas with emphasis
here on the Southern Appalachians including Southern Blue Ridge, Southern Ridge and Valley and Southern Cumberland Plateau, Northern Cumberland Plateau, (less emphasis on Mid Atlantic Ridge and Valley and Allegheny Mountains, and

Ohio Hills). With the exception of Great Blue Heron and Green Heron found throughout this BCR, almost all species treated here when recorded in the Appalachians are mostly restricted to the Southern Ridge and Valley especially along the Tennessee River Valley (AL, TN, GA)

PIED (BCR 29): Piedmont (AL, GA, SC, NC, VA, MD, PA, NJ) with emphasis here on Southern Piedmont (AL, GA, SC, NC)

PENFL (BCR 31); Peninsular Florida (FL)

PENFL: Peninsular Florida, essentially north of Lake Okeechobee (Fort Myers and northward on Gulf side, Fort Lauderdale on Atlantic side)

on to northern extent of black mangrove on both coasts and Florida scrub.

STFL: Subtropical Florida, essentially south from Lake Okeechobee (Fort Myers and Fort Lauderdale) to include Florida Keys, Dry Tortugas

TAMB (BCR 36): Tamaulipan Brushlands (TX, Tam.)

GCP (BCR 37): Gulf Coastal Prairies (LA, TX)

LA: Louisiana including both Deltaic and Chenier Plains

UTX: Upper Texas Coast from Sabine River to East Matagorda Bay

CTX: Central Texas Coast from east Matagorda Bay to Baffin Bay

STX/Tam.:South Texas Coast from Baffin Bay (Tamaulipan Prairies, Laguna Madre, Padre Island) south into Tamaulipas, Mexico.

PT=Population Trend based on a combination of data sources, principally BBS tempered by local and state datasets for breeding species. For non-breeding species usually best professional judgment often based in part on continental trends shown in BBS and/or CBC.

5=Definite decrease
4=Possible decrease
3=Trend uncertain, No data
2=Possible increase, stable
1=Definite increase

Some guidelines based on BBS data, but for waterbirds trends are often dramatic and not linear so an inspection of trend graphs often is required to make a judgment as to trend score, again tempered by local and state data sets if they exist.

Significant increase (BBS trend $\geq$1.36%/yr, $P\leq$0.10, df>13)	1	
Possible increase ($\geq$0.47 to 1.36%/ yr, $P\leq$0.35, w/any df)	2a	
Possible increase ($\geq$1.36%/yr, 0.1<$P\leq$0.35, df>13)	2a	
Possible increase ($\geq$1.36%/yr, $P\leq$0.10, df<13)		2a
Stable (> -0.54 to < +0.47%/yr, and UCI<0.47 OR LCI>-0.54)		2b
- except when trend is negative and P$\leq$0.10 **and LCI<-0.54**, then Possible decrease		4
Trend uncertain ($\leq$-0.54%/yr or $\geq$0.47%/yr and P>0.35)		3
Trend uncertain (>-0.54%/yr and <0.47%/yr and UCI>0.47 AND LCI<-0.54)		3
No data	3	
Possible decrease (either of next 3 options, but based on 6-13 degrees of freedom)		4
Possible decrease ($\leq$-0.54 to -2.27%/yr, P=0.0-0.35)		4
Possible decrease ($\leq$-2.27%/yr, 0.1<$P\leq$0.35)		4
Significant decrease ($\leq$-2.27%/yr and $P\leq$0.10)		5

PS=Population Size based on best population estimates globally, most based on Delany and Scott (2002) and Kushlan et al. 2002.

5=Rare (<50 thousand breeding individuals globally)
4=Uncommon (50-500 thousand breeding individuals globally)
3=Fairly Common (500 thousand-5 million breeding individuals globally)
2=Common (5 million to 50 million breeding individuals globally)
1=Abundant (50 million + breeding individuals globally)

TB and TN=Threats Breeding and Threats Non-breeding

5=Extreme deterioration in the future suitability of breeding/non-breeding conditions is expected; species is in danger of regional extirpation or major range contraction, or has already been extirpated
4=Severe deterioration in the future suitability of breeding/non-breeding conditions is expected
3=Slight to moderate decline in the future suitability of breeding/non-breeding conditions is expected
2=Expected future conditions for breeding/non-breeding populations are expected to remain stable; no known threats
1=Expected future conditions for breeding/non-breeding populations are enhanced by human activities or land-uses; potentially a ‘problem’ species

BD and ND=Breeding Distribution and Non-breeding Distribution

5=Very Local Distribution (<500,000 km2, or very restricted coastal areas or interior uplands)
4=Local Distribution (>500,000 and <1,000,000 km2, or <1,600 km of coast)
3=Moderate Distribution (>1,000,000 and <2,000,000 km2, or >1,600 to <5,000 km of coast)
2=Widespread (>2,000,000 and <4,000,000 km2, or >5,000 to <8,000 km of coast)
1=Very Widespread (>4,000,000 km2, or >8,000 km of coast)

SUBTOT=Subtotal of six scores (absent AI)

AI=Area Importance, "relative" relative abundance for the species for each area within range scaled against its maximum relative abundance (i.e., the BCR or physiographic area supporting the highest relative abundance)

5=Very High relative abundance (~50+% of maximum relative abundance)
4=High relative abundance (~25-49% of maximum relative abundance)
3=Moderate relative abundance (~10-24% of maximum relative abundance)
2=Low relative abundance (~1-9% of maximum relative abundance)
1=Peripheral, scattered occurrences.

TOT=Total Score of all seven factors used for identifying Tiers for which species best fits for conservation planning at Planning Region/Bird Conservation Region/Physiographic Area.

WL=WatchList score used for Continental Scoring (PIF Approach); species with WL scores of 14 or more, or with 13 with PT=5 are identified. using formula: Total Continental Score = PT + PS + maximum of (BD or ND) + maximum of (TB or TN)

Tier=

I. Continental Conservation Interest (Continental WatchList): (a) Species with multiple causes for concern across their entire range; (b) Moderately abundant or widespread species with declines or high threats, and (c) Species with restricted distributions or low population size.

Species with multiple causes for concern across their entire range: These species are considered by many to be of highest continental concern and of highest priority for conservation actions at national and international scales.

Moderately abundant or widespread species with declines or high threats: These species are on the Watch List primarily because they are declining and/or threatened throughout their range, though still fairly widespread or with moderately large populations.

Species with restricted distributions or low population size: These species are on the Watch List because they are restricted to a small range or have small global populations (often both). Many of these species are not known to be declining or seriously threatened at present, but many others. We recognize that these species with small populations and restricted range are particularly vulnerable to relatively minor changes from current conditions, whether or not their populations are currently in decline.

II. Regional Conservation Interest (non-WatchList; TOT$\geq$19): (a) high regional concern (AI+PT$\geq$8); (b) high regional threats (TB+TN$\geq$7, or TB or TN=5), (d) taxa (subspecies and populations) of regional conservation interest not otherwise included in categories above; (c) high regional responsibility (as measured by percent of global, continental, or regional populations).

III Additional Federally and/or State listed.

IV Local concern or interest.

Act. Level=Action Level at present based on expert opinion, but ultimately rules based on scores would be preferable.

IM=Immediate management needed to reverse or stabilize significant, long-term population declines in species with small populations, or to protect species with the smallest populations for which trends are poorly known. Lack of action may lead to extirpations or extinction.

MA=Management or other on-the-ground conservation actions needed to reverse or stabilize significant, long-term population declines in species that are still relatively abundant.

PR=Long-term Planning and Responsibility needed for species to ensure that sustainable populations are maintained for species for which a region has high responsibility for that species.

PC=Population Control/Suppression needed for species that are otherwise secure and increasing that may come into conflict with other species of higher conservation concern or other resources of interest.

Per. Resp.: Percent of Responsibility, that is percent of populations within planning region with respect to global population estimates (Delany and Scott 2002, Kushlan et al.2002) and temperate North America (U.S.-Canada) and within bird conservation region and physiographic area with respect to planning region estimates (based on collective estimates among State waterbird conservation coordinators).

Est. Pop. Cat. and **Pop. Obj. Cat.**= **estimated population category** is based on collective estimates among state waterbird conservation coordinators and **population objective category** is still under discussion, but regional suggestions are provided.

[1]Key to population categories:

(1) <10 pairs

(2b) 1>20 pairs
(2) 10-50 pairs
(2a) 40<60 pairs

(3b) 40>60 pairs
(3) 50-100 pairs
(3a) 90<200 pairs

(4b) 90>200 pairs
(4) 100-500 pairs
(4a) 400<600 pairs

(5b) 400>600 pairs
(5) 500-1,000 pairs
(5a) 900<2,000 pairs

(6b) 900>2,000 pairs
(6) 1,000-5,000 pairs
(6a) 4,000<6,000

(7b) 4,000>6,000 pairs
(7) 5,000-10,000 pairs
(7a) 9,000<20,000 pairs

(8b) 9,000>20,000 pairs
(8) 10,000-50,000 pairs
(8a) 40,000<60,000 pairs

(9b) 40,000>60,000 pairs
(9) 50,000-100,000 pairs
(9a) 90,000<200,000 pairs

(10b) 90,000>200,000 pairs
(10) 100,000-500,000 pairs
(10a) 400,000<600,000 pairs

APPENDIX B

Southeast Region Waterbird Priorities and Habitat Types

Table 1. Southeast U.S. Waterbird Conservation Plan species priorities and habitat suites (b=breeding, r=resident, w=winter, r=resident).*

Tier	**Tier Title**	**Action Level**	**Herons and allies, Pelicans and allies typically brush and tree nesting colonial waterbirds**	**Larids typically beach (ground)-nesting colonial waterbirds (terns, gulls, skimmers)**	**Marshes/ Savannas/ Grasslands**	**Open water (with mud and sand flats also foraging habitat for most colonial species)**	**Pelagic (all non-breeding populations)**
I.	**Continental Conservation Interest**						
a.	**Multiple concerns**	*Immediate management*	"Great White" Heron		Black Rail (b/r)		Bermuda Petrel
					King Rail (b/r)		Black-capped Petrel
					Yellow Rail (w)		
					Whooping Crane (w-TX, r-FL)		
b.	**High threats and/or declining**	*Immediate management*		Roseate Tern		Horned Grebe (w)	Audubon's Shearwater
		Management attention	Little Blue Heron	Gull-billed Tern			Greater Shearwater
				Least Tern			Band-rumped Storm-Petrel
				Black Skimmer			Bridled Tern

Tier	Tier Title	Action Level	Herons and allies, Pelicans and allies typically brush and tree nesting colonial waterbirds	Larids typically beach (ground)-nesting colonial waterbirds (terns, gulls, skimmers)	Marshes/ Savannas/ Grasslands	Open water (with mud and sand flats also foraging habitat for most colonial species)	Pelagic (all non-breeding populations)
		Planning and responsibility	Masked Booby				Brown Booby
							Razorbill
c.	**Local and/or rare**	*Immediate Management*	Magnificent Frigatebird				
			Reddish Egret				
		Management attention					Cory's Shearwater
							Manx Shearwater
		Planning and responsibility		Bridled Tern			
Tier	**Tier Title**	**Action Level**	**Herons and allies, Pelicans and allies typically brush and tree nesting colonial waterbirds**	**Larids typically beach (ground)-nesting colonial waterbirds (terns, gulls, skimmers)**	**Marshes/ Savannas/ Grasslands**	**Open water (with mud and sand flats also foraging habitat for most colonial species)**	**Pelagic (all non-breeding populations)**
II.	**Regional Conservation Interest**						
a.	**High Concern**	Immediate Management	Wood Stork (b/r, FL, GA, SC, AL))		Least Bittern (b/r)	Red-throated Loon (w)	Sooty Shearwater

Tier	Tier Title	Action Level	Herons and allies, Pelicans and allies typically brush and tree nesting colonial waterbirds	Larids typically beach (ground)-nesting colonial waterbirds (terns, gulls, skimmers)	Marshes/ Savannas/ Grasslands	Open water (with mud and sand flats also foraging habitat for most colonial species)	Pelagic (all non-breeding populations)
		Management attention	Green Heron		Purple Gallinule (b/r)	Common Tern (transient populations)	
			Black-crowned Night-Heron		American Coot (breeding populations only)	Black Tern (transient populations)	
			Wood Stork (nb, MS, LA, TX, AR, elsewhere)		Limpkin (r)		
					American Bittern (w)		
		Planning and responsibility	Yellow-crowned Night-Heron	Royal Tern			
				Sandwich Tern			
b.	**High Threats**	*Immediate management*			Sandhill Crane (Mississippi subspecies)		
		Management attention	White Ibis	Common Tern (Atlantic and Gulf coast breeding populations only)	Pied-billed Grebe (breeding populations only)	Greater Flamingo (formerly bred)	Northern Gannet
						Common Loon (w)	

Tier	Tier Title	Action Level	Herons and allies, Pelicans and allies typically brush and tree nesting colonial waterbirds	Larids typically beach (ground)-nesting colonial waterbirds (terns, gulls, skimmers)	Marshes/ Savannas/ Grasslands	Open water (with mud and sand flats also foraging habitat for most colonial species)	Pelagic (all non-breeding populations)
						American White Pelican (w)	
II.							
c.	**High Responsibility**	*Planning and responsibility*	Brown Pelican	Forster's Tern (actually nests in marshes)	Clapper Rail (r)	Franklin's Gull (transient populations)	Sooty Tern
			Tricolored Heron	Sooty Tern (Florida breeding population only; nests under cover)	Sandhill Crane (Florida subspecies)	Bonaparte's Gull (w)	Brown Noddy
				Brown Noddy (Florida breeding population only; elevated nests in shrubs, trees)	Sandhill Crane (Greater, Lesser, and Canadian subspecies)		
III.	**Additional Federal and State Listed Species**						
IV.	**Additional local or regional interest**	*Planning and responsibility*	Anhinga	Caspian Tern	Least Grebe (r)	Eared Grebe (w)	
			Great Blue Heron		Common Moorhen (b/r)		

Tier	Tier Title	Action Level	Herons and allies, Pelicans and allies typically brush and tree nesting colonial waterbirds	Larids typically beach (ground)-nesting colonial waterbirds (terns, gulls, skimmers)	Marshes/ Savannas/ Grasslands	Open water (with mud and sand flats also foraging habitat for most colonial species)	Pelagic (all non-breeding populations)
			Great Egret		Virginia Rail (w)		
			Snowy Egret		Sora (w)		
			Glossy Ibis				
			White-faced Ibis				
			Roseate Spoonbill				
IV.		*Population Control*	Neotropical Cormorant	Laughing Gull			
			Double-crested Cormorant	Herring Gull			
			Cattle Egret	Great Black-backed Gull			
	Other species covered in this plan					Pied-billed Grebe (non-breeding populations)	Wilson's Storm-Petrel
						American Coot (non-breeding populations)	Leach's Storm-Petrel
						Ring-billed Gull	Pomarine Jaeger
						Lesser Black-backed Gull	Parasitic Jaeger

Tier	Tier Title	Action Level	Herons and allies, Pelicans and allies typically brush and tree nesting colonial waterbirds	Larids typically beach (ground)-nesting colonial waterbirds (terns, gulls, skimmers)	Marshes/ Savannas/ Grasslands	Open water (with mud and sand flats also foraging habitat for most colonial species)	Pelagic (all non-breeding populations)
							Black-legged Kittiwake
							Dovekie

*See Appendices I-III.

Tier=

I. Continental Conservation Interest (Continental WatchList): (a) Species with multiple causes for concern across their entire range; (b) Moderately abundant or widespread species with declines or high threats, and (c) Species with restricted distributions or low population size.

Species with multiple causes for concern across their entire range: These species are considered by many to be of highest continental concern and of highest priority for conservation actions at national and international scales.

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Species with restricted distributions or low population size: These species are on the Watch List because they are restricted to a small range or have small global populations (often both). Many of these species are not known to be declining or seriously threatened at present, but many others. We recognize that these species with small populations and restricted range are particularly vulnerable to relatively minor changes from current conditions, whether or not their populations are currently in decline.

II. Regional Conservation Interest (non-WatchList; TOT≥19): (a) high regional concern (AI+PT≥8); (b) high regional threats (TB+TN≥7, or TB or TN=5) and includes taxa (subspecies and populations) of regional conservation interest not otherwise included in categories above; (c) high regional responsibility (as measured by percent of global, continental, or regional populations).

III Additional Federally and/or State listed.

IV Local or regional concern or interest.

Act. Level=Action Level at present based on expert opinion, but ultimately rules based on scores would be preferable.

IM=Immediate management needed to reverse or stabilize significant, long-term population declines in species with small populations, or to protect species with the smallest populations for which trends are poorly known. Lack of action may lead to extirpations or extinction.

MA=Management or other on-the-ground conservation actions needed to reverse or stabilize significant, long-term population declines in species that are still relatively abundant.

PR=Long-term Planning and Responsibility needed for species to ensure that sustainable populations are maintained for species for which a region has high responsibility for that species.

PC=Population Control/Suppression needed for species that are otherwise secure and increasing that may come into conflict with other species of higher conservation concern or other resources of interest.

APPENDIX C

Wildlife Conservation Commission

FLORIDA'S ENDANGERED SPECIES, THREATENED SPECIES AND SPECIES OF SPECIAL CONCERN

Official Lists

Publication Date: 1 August 1997

This document consolidates the state and federal official lists of endangered species, threatened species, and other species categorized in some way by the respective jurisdictional agencies as meriting special protection or consideration. The state lists of animals are maintained by the Florida Game and Fresh Water Fish Commission and categorized as endangered, threatened and of special concern, and constitute Rules 39-27.003, 39-27.004 and 39-27.005, respectively, Florida Administrative Code (F.A.C.). The state lists of plants are categorized into endangered, threatened and commercially exploited, and are administered and maintained by the Florida Department of Agriculture and Consumer Services via Chapter 5B-40, F.A.C. The federal lists of animals and plants are administered by the U.S. Fish and Wildlife Service and categorized into endangered and threatened, and are published in 50 CFR 17 (animals) and 50 CFR 23 (plants). The abbreviations used in part one are:

GFC = Florida Fish and Wildlife Conservation Commission

FDA = Florida Department of Agriculture and Consumer Services

FWS = United States Fish and Wildlife Service

E = Endangered

T = Threatened

T(S/A) = Threatened/Similarity of Appearance

T(E/P) = Threatened/Experimental Population

SSC = Species of Special Concern

C = Commercially Exploited

		Designated Status	
Scientific Name	**Common Name(s)**	**GFC**	**FWS**
<u>Birds</u>			
Ajaia ajaja	Roseate spoonbill	SSC	
Ammodramus maritimus juncicolus	Wakulla seaside sparrow	SSC	

		Designated Status	
Scientific Name	**Common Name(s)**	**GFC**	**FWS**
Ammodramus maritimus mirabilis	Cape Sable seaside sparrow	E	E
Ammodramus maritimus peninsulae	Scott's seaside sparrow	SSC	
Ammodramus savannarum floridanus	Florida grasshopper sparrow	E	
Aphelocoma coerulescens	Florida scrub-jay	T	T
Aramus guarauna	Limpkin	SSC	
Campephilus principalis	Ivory-billed woodpecker	E	E
Charadrius alexandrinus tenuirostris	Southeastern snowy plover	T	
Charadrius melodus	Piping plover	T	T
Cistothorus palustris griseus	Worthington's marsh wren	SSC	
Cistothorus palustris marianae	Marian's marsh wren	SSC	
Columba leucocephala	White-crowned pigeon	T	
Dendroica kirtlandii	Kirtland's warbler	E	E
Egretta caerulea	Little blue heron	SSC	
Egretta rufescens	Reddish egret	SSC	
Egretta thula	Snowy egret	SSC	
Egretta tricolor	Tricolored (=Louisiana) heron	SSC	
Eudocimus albus	White ibis	SSC	
Falco peregrinus tundrius	Arctic peregrine falcon	E	
Falco sparverius paulus	Southeastern American kestrel	T	

		Designated Status	
Scientific Name	**Common Name(s)**	**GFC**	**FWS**
Grus americana	Whooping crane	SSC	T(E/P)
Grus canadensis pratensis	Florida Sandhill crane	T	
Haematopus palliatus	American oystercatcher	SSC	
Haliaeetus leucocephalus	Bald eagle	T	T
Mycteria americana	Wood stork	E	E
Pandion haliaetus	Osprey	SSC*	
Pelecanus occidentalis	Brown pelican	SSC	
Picoides borealis	Red-cockaded woodpecker	T	E
Polyborus plancus audubonii	Audubon's crested caracara	T	T
Rostrhamus sociabilis	Snail kite	E	E
Rynchops niger	Black skimmer	SSC	
Speotyto cunicularia	Burrowing owl	SSC	
Sterna antillarum	Least tern	T	
Sterna dougallii	Roseate tern	T	T
Vermivora bachmanii	Bachman's warbler	E	E
*Applicable in Monroe County only			

APPENDIX D

US FISH AND WILDLIFE SERVICE, SPECIES OF CONSERVATION CONCERN IN PENINSULAR FLORIDA (BCR 31)

Black-capped Petrel
Audubon's Shearwater
Magnificent Frigatebird
American Bittern
Little Blue Heron
Reddish Egret
White Ibis
Swallow-tailed Kite
Short-tailed Hawk
American Kestrel (resident *paulus* ssp. only)
Peregrine Falcon
Yellow Rail
Black Rail
Limpkin
Snowy Plover
Wilson's Plover
American Oystercatcher
Whimbrel
Marbled Godwit
Red Knot
Semipalmated Sandpiper
Stilt Sandpiper
Buff-breasted Sandpiper
Short-billed Dowitcher
Gull-billed Tern
Common Tern
Least Tern
Black Tern
Black Skimmer
White-crowned Pigeon
Common Ground-Dove
Mangrove Cuckoo
Smooth-billed Ani
Burrowing Owl
Chuck-will's-widow
Red-headed Woodpecker
Loggerhead Shrike
Black-whiskered Vireo
Brown-headed Nuthatch
Yellow Warbler (resident *gundlachi* ssp. only)
Yellow-throated Warbler
Prairie Warbler
Bachman's Sparrow
Henslow's Sparrow
Nelson's Sharp-tailed Sparrow
Saltmarsh Sharp-tailed Sparrow
Seaside Sparrow

APPENDIX L.5

EVERGLADES NATIONAL PARK

FINAL DRAFT

Avian Conservation Implementation Plan
Everglades National Park

National Park Service
Southeast Region

Compiled by J. Keith Watson
U.S. Fish and Wildlife Service
In cooperation with

EVER Resource Management Staff, National Park Service
And Bird Conservation Partners
January 2005

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Introduction

This Avian Conservation Implementation Plan (ACIP) is provided to the staff at Everglades National Park (EVER) to help identify and prioritize bird conservation opportunities, and to provide information and guidance for the successful implementation of needed conservation activities. This plan may identify goals, strategies, partnerships, and perhaps specific projects for the park to participate in existing bird conservation planning and implementation efforts associated with the North American Bird Conservation Initiative (NABCI). Under the auspice of NABCI, appropriate bird and habitat conservation goals may be recommended as identified in the appropriate existing national or regional bird conservation efforts aligned with this initiative: Partners In Flight (PIF), North American Waterfowl Management Plan (NAWMP), US Shorebird Conservation Plan (USSCP), and Waterbird Conservation for the Americas (WCA). For example, parks in the Appalachians and the Cumberland Plateau will have few if any high priority waterbird conservation issues at a regional landscape or greater scale. As such, little information regarding waterbird conservation will be presented in the ACIP, unless there is an identified park need for this species group, or other mandates, such as federal laws. Similarly, because EVER is primarily a subtropical wetland interspersed with various forest types, waterbird and landbird conservations recommendations will be derived from the appropriate national level plans. However, all high priority bird conservation issues for EVER will be discussed and integrated as appropriate.

Information and data presented in the ACIP have been obtained from several sources: 1) interviews with EVER staff 2) EVER bird conservation partners 3) the PIF Subtropical Florida Bird Conservation Plan Executive Summary (PIF 2000) 4) NPS databases, 5) peer reviewed bird conservation and management literature, and 6) personal communications with bird conservation specialists throughout North America, especially in the southeastern United States. This plan has been reviewed by EVER resource management staff and managers, South Florida/Caribbean Inventory and Monitoring Network (SF/C I&M) staff, and bird conservation partners and approved by EVER management. Optimally, this plan will be incorporated into the park's natural resource planning and management documents and updated annually to reflect completed projects, newly identified needs, and shifts in bird conservation priorities in the region.

EVER is not obligated to undertake any of the proposed actions in this plan. The plan is provided to offer guidance to EVER to voluntarily support important park, regional, and perhaps national and international bird conservation projects for which EVER is a primary participant in the proposed actions.

Background

During the past thirty years, monitoring programs across North America have documented declines of certain bird species populations and their habitats, often severe (Sauer et al. 2000). The decline has caused great concern among scientists, biologists,

biodiversity proponents, ecologists, land managers, etc., and the bird conservation community in general. Birds are recognized as critical components of local and global genetic, species, and population diversity, providing important and often critical ecological, social, economic, and cultural values. Their overall decline has stimulated a worldwide focus on conservation efforts and North American interest in bird conservation is rapidly becoming a focus of government, non-government, industry, and private interests and expenditures.

Many state, federal, and non-governmental wildlife agencies and non-government organizations (NGO's) have recognized this alarming bird decline trend and have joined forces in several extensive partnerships to address the conservation needs of various bird groups and their habitats. The primary initiatives are:

- North American Waterfowl Management Plan
- Partners in Flight
- U.S. Shorebird Conservation Plan
- Waterbird Conservation for the Americas

The North American Bird Conservation Initiative: While efforts associated with these plans have generated some successes, it has been increasingly recognized that the overlapping conservation interests of these initiatives can be better served through more integrated planning and delivery of bird conservation. The *North American Bird Conservation Initiative (NABCI*; http://www.nabci-us.org/main2.html*)* arose out of this realization. The vision of NABCI is simply to see ***"populations and habitats of North America's birds protected, restored and enhanced through coordinated efforts at international, national, regional, state and local levels, guided by sound science and effective management."*** NABCI seeks to accomplish this vision through (1) broadening bird conservation partnerships, (2) working to increase the financial resources available for bird conservation in the U.S., and (3) enhancing the effectiveness of those resources and partnerships by facilitating integrated bird conservation (U.S. NABCI Committee 2000). Together, the four bird conservation initiatives mentioned above, as well as several other local and regional partnerships, work collectively to pursue this vision.

NABCI is guided by a set of principles that establish an operational framework within which the Initiative and its partners may conduct integrated bird conservation in the U.S. These will articulate a common understanding of the relationship between NABCI, the individual bird conservation initiatives, and all partner entities to ensure recognition of existing federal legislative and international treaty obligations, state authorities, and respect for the identity and autonomy of each initiative. The fundamental components of the conservation approach to be used by NABCI are expressed within its goal:

> ***To deliver the full spectrum of bird conservation through regionally-based, biologically-driven, landscape-oriented partnerships.***

The Southeastern Bird Conservation Initiative: National Park Service: In 1999, the Southeast Region of the National Park Service (NPS) recognized the importance of coordinating existing bird conservation goals into planning and operations of national park units in the southeast, that is, integration of NABCI. In support of this recognition, the Southeast Regional Office NPS approved and allocated eighty-eight thousand dollars, cost sharing 1:1 with the US Fish and Wildlife Service (FWS) Region 4 (Southeast) to hire a biologist to conduct this two-year project (Interagency Agreement FS028 01 0368). This project is unique in the NPS, and perhaps the nation, and represents a potential model for better coordinating regional bird conservation programs and activities within and outside the NPS. It further represents a progressive action toward institutionalizing bird conservation as a programmatic priority in the Southeast Region of NPS, and potentially the nation.

As envisioned, the integration of NABCI into the Southeastern NPS involves:

1) Development and delivery of Avian Conservation Implementation Plans,
2) Coordination with NPS Inventory and Monitoring Program,
3) Development of a web based project site,
4) Establishment or enhancement of bird conservation partnerships,
5) Identification and exploration of potential funding opportunities, and
6) Technical guidance and assistance as needed or requested.

This ACIP fulfills one aspect of the plan outlined above, and serves as a basis for future bird conservation actions in EVER and with adjacent partners or landowners. Concurrently, the development of a Memorandum of Understanding (MOU) between the FWS and the NPS to implement Presidential Executive Order (EO) 13186, Responsibilities of Federal Agencies to Protect Migratory Birds (US Government 2000), calls for integration of programs and recommendations of existing bird conservation efforts into park planning and operations. Complementing each other, the MOU and the Southeastern Bird Conservation Initiative will advance bird conservation in the Southeast Region of the NPS beyond current regional NPS efforts.

Role of NPS in Avian Conservation

The interagency agreement that facilitates this partnership supports both FWS and NPS management policies. Specifically for the NPS, the agreement supports and advances the Strategy for Collaboration, a visionary document developed and signed by the Southeast Natural Resource Leaders Advisory Group (SENRLAG 2000), a consortium of 13 land and resource management agencies in the Southeastern United States whose vision is to encourage and support cooperation in planning and managing the region's natural resources. Furthermore, the agreement is aligned with and implements a variety of NPS Management Polices (2001) including, but not limited to, External Threats and Opportunities, Environmental Leadership, Cooperative Planning, Land Protection, and especially Natural Resource Management that details policy and management guidelines which apply to bird conservation. Important policies in the Natural Resource Management chapter include:

- Planning for Natural Resource Management
- Partnerships
- Restoration of Natural Systems
- Studies and Collection
- General Principles for Managing Biological Resources
- Plant and Animal Population Management Principles
- Management of Native Plants and Animals
- Management of Endangered Plants and Animals
- Management of Natural Landscapes
- Management of Exotic Species
- Pest Management
- Fire Management and
- Water Resource Management

The NPS is the fourth largest landowner in the United States, consisting of over 380 national park units covering 83 million acres of land and water with associated biotic resources (www.nps.gov). The 64 units in the Southeast Region of the NPS represent 16% of the total number of park units in the national park system and cover approximately 5% of the total land base in the entire system. Park units in the Southeast Region include national seashores (Canaveral National Seashore, Cape Hatteras National Seashore), national parks (Great Smoky Mountains National Park, Everglades National Park), national recreation areas (Big South Fork National Recreation Area), national preserves (Big Cypress National Preserve), national battlefields (Cowpens National Battlefield, Fort Donelson National Battlefield), national monuments (Ocmulgee National Monument), and others such as the Blue Ridge Parkway, Obed Wild and Scenic River, and Timicuan Ecological and Historic Preserve.

Southeast NPS units provide habitat for over 400 species of migrating, breeding, and wintering birds and include a wide range of Federal and State listed threatened and endangered species. Likewise, these units also provide nest, migration, and winter habitat for most of the eastern species identified in the national bird conservation plans in need of conservation attention.

Additionally, the NPS attracts over 280 million visitors to the parks each year, 120 million of these in the Southeast Region, affording excellent recreational bird watching and opportunities to strengthen bird conservation interpretation, outreach, and education programs. These opportunities, the NPS mission, policies, and organization all lead to the conclusion that the NPS is an extremely valuable partner and contributor to bird conservation in the region.

Nationally, the status of birds in national parks is largely unknown, although many parks have adequate knowledge regarding bird occurrence in the parks (http://www.npwrc.usgs.gov/resource/othrdata/chekbird/chekbird.htm). Parks often play

a role in ongoing regional bird conservation efforts. Indeed many of these parks are often important to regional, national, or international bird conservation, and many have been designated as Important Bird Areas (IBA's) by the National Audubon Society. To date, there are approximately 64 NPS units that are designated IBA's, 35 of which are considered of global importance (http://abcbirds.org/iba/aboutiba.htm). In the Southeast Region, the NPS has 13 global IBA's.

The **NPS Inventory and Monitoring (I&M) Program** has been developed to provide management driven scientific information to national park managers so that resources can be adequately protected within national parks. One of the first phases of this program is to inventory vertebrates, including birds, within the 260 national park units in the program. Once completed, data from the inventories will provide an account of the occurrence and abundance of birds in all the national parks in the program. These records will be stored in the NPS I&M NPSpecies database (http://www.nature.nps.gov/im/apps/npspp/). Coordination with I&M network staff is important to developing long-term bird monitoring programs that fulfill both park and NABCI objectives.

Park Flight is a NPS international partnership initiative that directs funding toward a variety of NPS programs that involve conservation of Neotropical migratory birds whose life history range covers a U.S. national park and a Latin American protected area. A relatively new program, Park Flight offers parks the opportunity to partner with a Latin American national park or protected area to cooperate on developing bird conservation and education projects (USDI NPS 2002).

Recent increases in NPS base funded programs such as inventory and monitoring, exotic species management, habitat restoration, and fire management all indicate that national park managers recognize that park lands are increasingly subject to a variety of threats and conditions that must be improved to provide the quality of national park experience articulated in the NPS Organic Act (1916). Programmatic funding in these areas will increase the ability of national parks to provide quality habitat and conditions for increased wildlife conservation, including birds. Furthermore, private interests and non-profit conservation organizations have initiated programs, including grant programs, to provide much needed funding to national parks to meet backlogs of identified yet unfunded needs.

Park Description

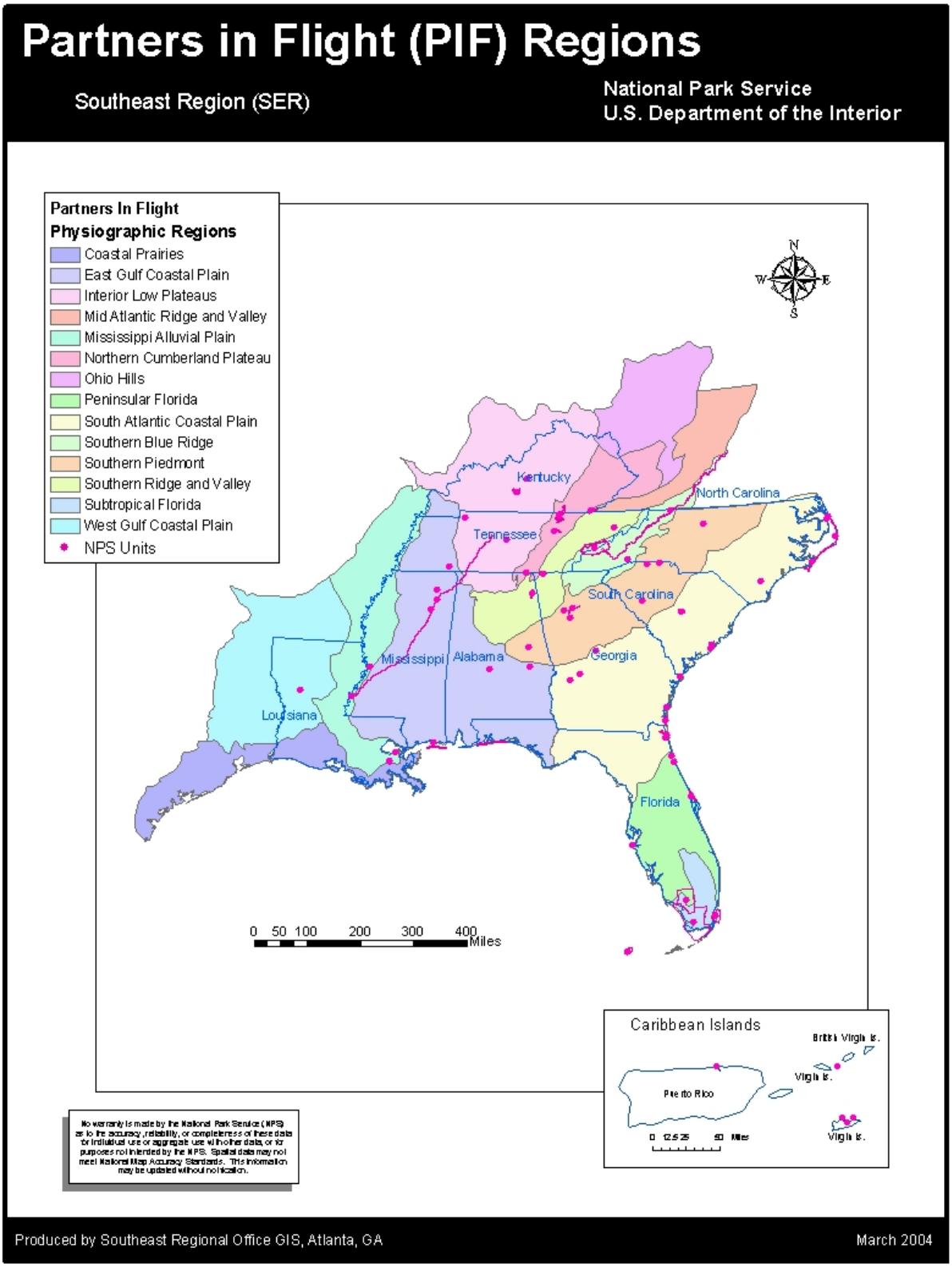
Established in 1947, the Everglades National Park's 610,497 ha (1.5 million acres) include habitats ranging from freshwater marshes in Shark River Slough to Florida Bay, an occasionally hypersaline, seagrass-dominated marine lagoon. Other prominent natural communities are subtropical hardwood hammocks, the last large intact remnant of South Florida upland pineland forests and an extensive mangrove dominated estuary. Everglades National Park is designated as an International Biosphere Reserve (1976), Wilderness Designation (1976), a World Heritage Site (1979), and a Wetland of International Significance (1987). The Park is the southeast's largest designated

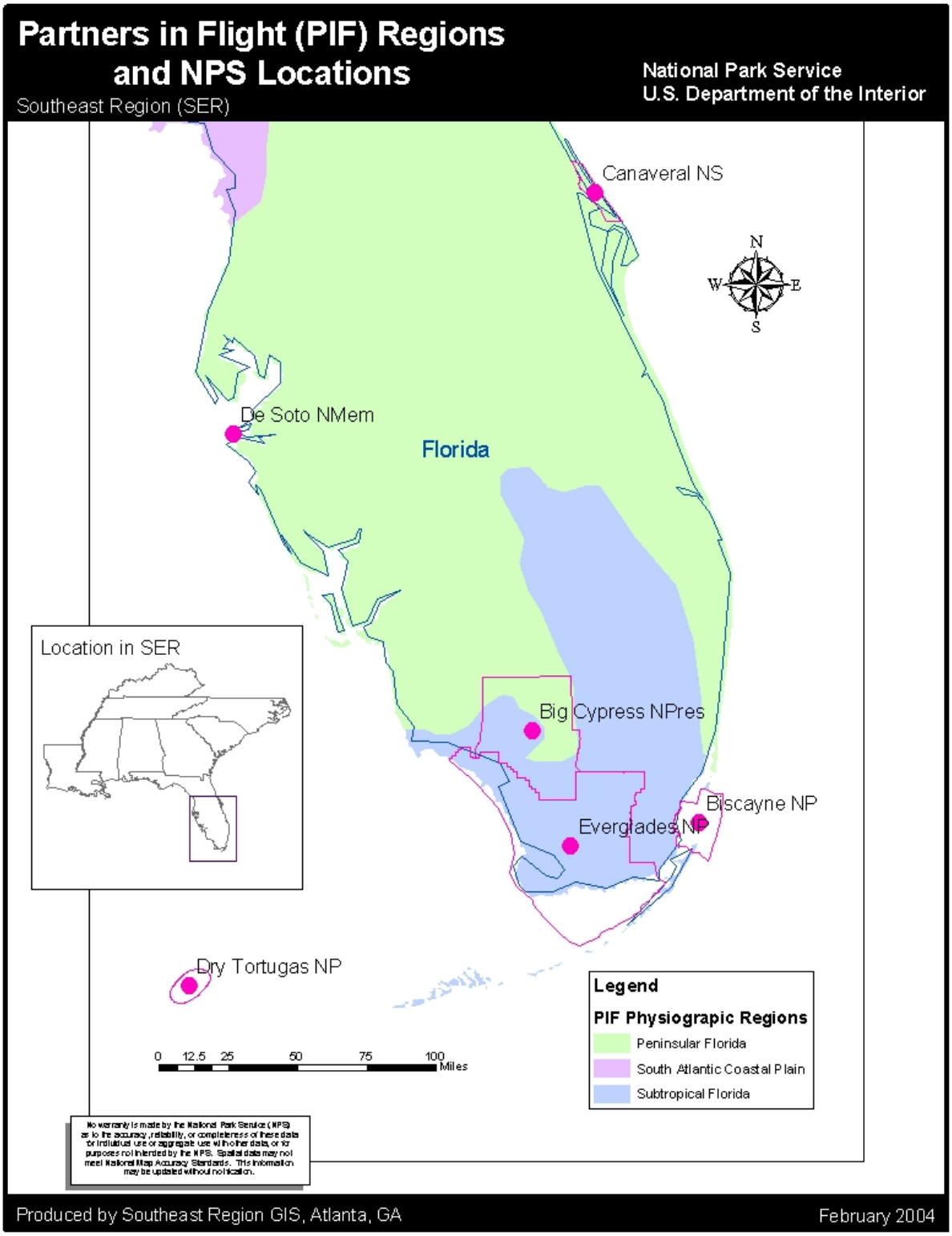
wilderness and hosts 14 threatened and endangered species. It is a significant North American breeding ground for subtropical wading birds and contains the largest mangrove ecosystem in the Western Hemisphere. Together with neighboring Big Cypress National Preserve and Biscayne National Park, these protected habitats are almost 1 million hectares (2,471,053 acres) in size and are significant elements of the South Florida ecosystem, a natural continuum that begins in the Kissimmee River Basin and ends at the Gulf of Mexico and Florida Keys (Sasso and Patterson 2000).

Avian Resources of Subtropical Florida

This physiographic area is entirely contained within Florida, and extends from the northern edge of Lake Okeechobee south through the Florida Keys (see PIF and NPS location maps below). The region has very little topographic relief, but slight changes in elevation have important consequences for vegetation and the diversity of habitat types. The highest points of elevation are less than 2 meters and correspond with fairly recent shorelines (less than 5,000 years before present). Underlying sediments consist of freshwater marl, peat, freshwater lake and marine sediments, and to a lesser extent, sand deposited during the Pleistocene and Holocene. The subtropical Florida region can be divided into four smaller sub-regions: 1) the Everglades, 2) Big Cypress, 3) Miami Ridge and Atlantic Coastal Ridge, and 4) Southern Coasts and Islands. The Everglades is the most extensive of these areas, followed by the Big Cypress, Miami Ridge and Southern Coasts. Across all subregions, much of the physical and ecological characteristics of the region resemble tropical ecosystems where seasonal changes are reflected by changing rainfall patterns rather than by dramatic temperature changes. Distinctive dry (winter/spring) and wet (summer) seasons occur annually, and the nesting cycles of many birds are tied to these changes. At least two major forms of disturbance play key roles in the ecology of the region. Fire is an important feature in many pine dominated communities and many marsh and prairie communities. Frequent fires are essential in pine-dominated stands and prairies if understory conditions suitable to many nesting birds are to be maintained. However, the ideal fire frequency in some pine communities is not known. Hurricanes are a second form of disturbance that less frequently but predictably provide early successional habitats or open forest cover (PIF http://www.blm.gov/wildlife/pl_01sum.htm).

Bird conservation priorities for Subtropical Florida have been stratified by habitat type. Recognized habitat types where high priority conservation actions are needed for both birds and habitats are pine forests (including pine rocklands, pine Flatwoods, sand pine scrub), grassland/grassland-scrub (including dry prairie and coastal strands), subtropical deciduous forest, everglades, brackish saltwater and freshwater marsh, and mangrove swamps. Species associated with each of these habitats and identified as high priority for conservation needs are given below.


Partners in Flight (PIF) Regions
Southeast Region (SER)
National Park Service
U.S. Department of the Interior
Partners In Flight
Physiographic Regions
Coastal Prairies
East Gulf Coastal Plain
Interior Low Plateaus
Mid Atlantic Ridge and Valley
Mississippi Alluvial Plain
Northern Cumberland Plateau
Ohio Hills
Peninsular Florida
South Atlantic Coastal Plain
Southern Blue Ridge
Southern Piedmont
Southern Ridge and Valley
Subtropical Florida
West Gulf Coastal Plain
NPS Units
N
W
E
S
Kentucky
North Carolina
Tennessee
South Carolina
Mississippi
Alabama
Georgia
Louisiana
Florida
0 50 100 200 300 400
Miles
Caribbean Islands
British Virgin Is.
Virgin Is.
Puerto Rico
Virgin Is.
0 12.5 25 50 Miles
No warranty is made by the National Park Service (NPS) as to the accuracy, reliability, or completeness of these data for individual use or aggregate use with other data, or for purposes not intended by the NPS. Spatial data may not meet National Map Accuracy Standards. This information may be updated without notification.
Produced by Southeast Regional Office GIS, Atlanta, GA
March 2004


Partners in Flight (PIF) Regions
and NPS Locations
Southeast Region (SER)
National Park Service
U.S. Department of the Interior
Canaveral NS
N
W
E
S
De Soto NMem
Florida
Location in SER
Big Cypress NPres
Biscayne NP
Everglades NP
Dry Tortugas NP
Legend
PIF Physiograpic Regions
Peninsular Florida
South Atlantic Coastal Plain
Subtropical Florida
0 12.5 25 50 75 100
Miles
No warranty is made by the National Park Service (NPS) as to the accuracy, reliability, or completeness of these data for individual use or aggregate use with other data, or for purposes not intended by the NPS. Spatial data may not meet National Map Accuracy Standards. This information may be updated without notification.
Produced by Southeast Region GIS, Atlanta, GA
February 2004

Florida Scrub Jay, Red-cockaded Woodpecker, Southeastern American Kestrel, Brown-headed Nuthatch, Bachman's Sparrow, Pine Warbler and Sedge Wren are associated with the pine forests. Both Florida Scrub Jay and Southeastern American Kestrel have been extirpated in Subtropical Florida and the Brown-headed Nuthatch and Bachman's Sparrow are nearly extirpated here. Recently, however, EVER and Big Cypress National Preserve (BICY) cooperated on a project to reintroduce Brown-headed Nuthatch and Eastern Bluebird into EVER, a successful project that points the way to potential future relocations of these species throughout South Florida (Slater 2001). Both Palm Warbler and Sedge Wren are present only in the non-breeding seasons.

Grasshopper Sparrow, Crested Caracara, Burrowing Owl, Sandhill Crane and Mottled Duck are all species associated with grassland to grassland scrub habitats. Grasshopper Sparrow has been extirpated as a breeder in South Florida.

In the subtropical deciduous forest, Short-tailed Hawk, Swallow-tailed Kite and Gray Kingbird are high priorities for conservation.

In the Everglades, brackish saltwater and freshwater marshes, Snail Kite, Cape Sable Seaside Sparrow, Wood Stork, Black Rail, Reddish Egret, Yellow Rail, White Ibis, and Clapper Rail are species in need of conservation attention.

Prairie Warbler, Yellow Warbler, Black-whiskered Vireo, White-crowned Pigeon and Mangrove Cuckoo, species associated with Mangrove swamps and forests are of high priority conservation concern.

Human population growth has been phenomenal in subtropical Florida for the last 40 years. The impacts of such tremendous growth include increased infrastructure that directly reduces habitat availability, but also secondary impacts to bird habitats, such as pollution. Other land uses include production of sugarcane, winter vegetables, and citrus. Drastic changes in hydroperiod and natural water cycles are secondary impacts of increasingly intensive agriculture. However, among the best opportunities in the Southeast to work with existing public lands occur in Subtropical Florida, where over 54% of the area is publicly owned. Therefore, primary conservation programs include efforts to reduce impacts from adjacent or nearby lands on management of existing public lands. Many programs have been developed and are in various phases of implementation. These include the Save Our Everglades program, the Surface Water Improvement and Management Act, Florida's Everglades Forever Act and the development of the South Florida Ecosystem Restoration Task Force as well as aggressive acquisition programs. These and other programs serve the basis for bird conservation efforts in the region (PIF http://www.blm.gov/wildlife/pl_01sum.htm).

Avian Conservation in EVER

Avian Biodiversity: EVER has a complete avian inventory and a checklist of birds that is available for the public. Over 350 species have been observed in EVER, and

birdwatching in the park is a primary recreational pursuit due to the large number of species found in the park.

Verified records of birds in EVER have been entered into the NPS I&M program's database, NPSpecies, and may be viewed via the internet at http://www.nature.nps.gov/im/app/npspp with a user identification and password combination authorized by the NPS for NPS personnel and NPS cooperators. Many other avian observational data need to be verified and entered into the database.

Park Priorities: Park staff and consultants have not identified any particular species that is a park management concern or high priority for conservation. However, the presence of 7 Federally listed birds requires compliance with the Endangered Species Act and a large amount of staff time is given to managing these species and their habitats. Additionally, park staff is concerned about conserving all birds and their habitats in EVER. However, several species that occur in EVER are high priority in Subtropical Florida and conservation efforts in the park could focus on these species or groups of species. Generally, great effort in put forth to monitor colonial waterbird species and their nesting success.

Threatened and Endangered Species: Seven Federally listed threatened or endangered species occur in EVER. Wood Stork, Bald Eagle, Snail Kite, Cape Sable Seaside Sparrow, Brown Pelican all nest in the park while Piping Plover is an uncommon winter resident and Roseate Tern is a rare winter visitor. Red-cockaded Woodpecker formerly nested in EVER but is now extirpated. The recently delisted American Peregrine Falcon is a rare but regular fall transient and winter visitor.

In addition to the Federally listed species, several Florida listed species occur in EVER as well. Prominent among these are: White-crowned Pigeon, Florida Sandhill Crane, and Least Tern and Grasshopper Sparrow in winter (rare).

In addition to the species listed above Partners In Flight (PIF) has also listed Brown-headed Nuthatch, Bachman's Sparrow, Mottled Duck, Short-tailed Hawk, Swallow-tailed Kite, Gray Kingbird, Black Rail, Reddish Egret, White Ibis, Clapper Rail, Florida Prairie Warbler, Yellow Warbler, Mangrove Cuckoo, Black-whiskered Vireo and non-breeding populations of Palm Warbler and Sedge Wren as species of high conservation concern in Subtropical Florida (PIF http://www.blm.gov/wildlife/pl_01sum.htm).

Inventory: Bird inventory data provide important information for park management,, and the inventory at EVER is considered complete. However, EVER has identified additional needs to document distribution and abundance of the park's avifauna.

Monitoring: Currently, several avian monitoring projects are being conducted at EVER. These are:

- Cape Sable Seaside Sparrow population monitoring, including banding

- Waterbirds (wading birds) monitoring conducted monthly from December to May and once again in dry season (August to December); distribution and abundance (number of nest and number of birds/species) data are collected; includes Wood Stork nest counts
- Snail Kite Monitoring in Shark Slough Conservation Areas
- Bald Eagle nest surveys conducted by EVER
- Osprey nest surveys conducted by EVER
- Brown Pelican nest surveys conducted by EVER
- Roseate Spoonbill colony nest counts conducted by Florida Audubon Society
- Breeding Bird Survey (BBS) routes in park; two are active but have not been operated lately
- Christmas Bird Count (CBC) circles exist in Coot Bay, Long Pine Key, and Upper Keys
- Brown-headed Nuthatch, Eastern Bluebird, and Wild Turkey monitoring following translocations from Big Cypress National Preserve
- Migration monitoring for landbirds in pine forests during fall and spring
- Regular Breeding Bird Survey route conducted by US Fish and Wildlife Service
- Randomized recreational birding

Research: Scientific research is permitted within the park, and several recent projects have been concluded, focusing on several of the listed species that occur in the park. Current research projects include:

- Breeding ecology of Cape Sable Seaside Sparrow, including demographic analysis and habitat mapping
- Fire effects on populations of Cape Sable Seaside Sparrow
- Determination of winter population of Short-tailed Hawk and their use of EVER habitats

Outreach:

- Educational and outreach programs related to wading birds are undertaken in the park, primarily during high visitor use season
- Birds are emphasized on Environmental Education curricula
- Everglades BirdFest, a three day birding and ecology festival is conducted each winter in the park and organized by the Broward County Audubon Society

Park Identified Needs for Avian Conservation

EVER has identified several high priority projects that would increase the avian knowledge of the park and would assist park managers in making more informed decision regarding bird conservation in EVER.

Inventory: EVER would like to initiate a mangrove avian inventory and monitoring program.

Research: EVER has identified several research projects that need to be completed (Please see Research section below).

Coordination with Regional Conservation Initiatives

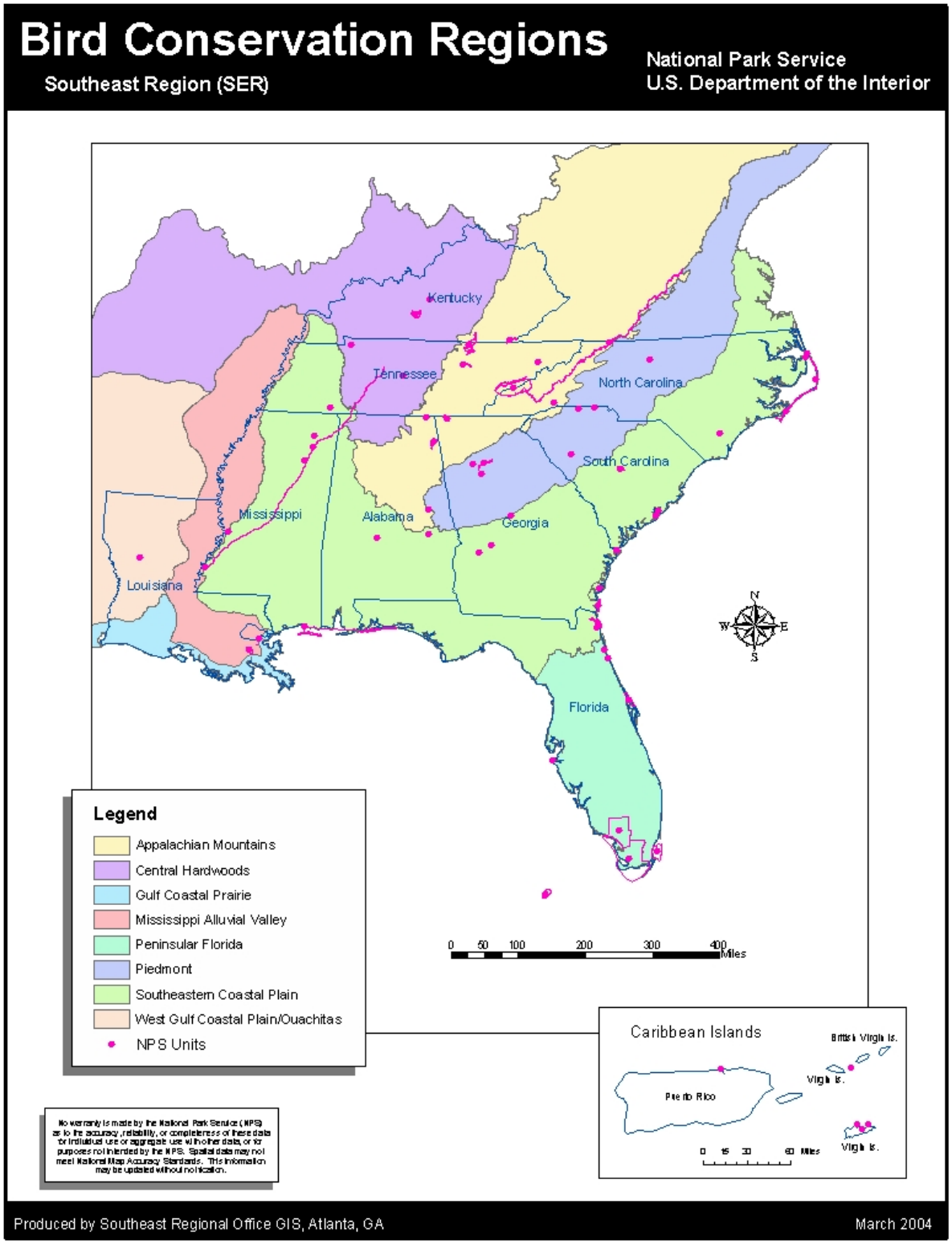
North American Bird Conservation Initiative: NABCI bird conservation planning units, referred to as Bird Conservation Regions (BCR), are often larger than other planning units associated with other plans, such as Partners In Flight. For example, EVER is within the NABCI Peninsular Florida BCR located entirely within Florida (see NABCI BCR map below) and encompasses two PIF physiographic areas (the planning unit for PIF) (compare to PIF map).

Several NABCI BCR's have coordinators whose primary responsibility is to coordinate all bird conservation planning in the BCR, across all agencies and organizations. Currently, Peninsular Florida does not have a designated coordinator; however, a large portion of the BCR lies within the Atlantic Coast Joint Venture area (Maine to Florida and includes Puerto Rico) and the ACJV has several professional bird conservationists base throughout the region to assist partners in bird conservation efforts (see contacts below). This staff can provide valuable assistance to EVER with implementation of aspects of this ACIP.

North American Waterfowl Management Plan (NAWMP): The NAWMP (http://northamerican.fws.gov/NAWMP/nawmphp.htm) is completed and has been revised several times, incorporating updated goals and strategies based on new information. This plan is one of the most successful bird conservation delivery programs in the United States, being monetarily supported by the North American Wetlands Conservation Act (NAWCA).

Partners In Flight: Goals and strategies for Subtropical Florida have yet to be fully identified and organized into a bird conservation plan. Personnel from the Florida Fish and Wildlife Conservation Commission (FFWCC) are currently working on completing the Partners in Flight bird conservation plan for South Florida. In the meantime, Florida's avian priorities and conservation needs are identified in Millsap et al. (1990).

Similar to NABCI BCR's, PIF physiographic areas often do not have designated coordinators. However, state level non-game agencies with investment in PIF will establish key personnel to develop partnerships among cooperators in the physiographic area. The State of Florida has a non-game bird conservation coordinator and can be instrumental in assisting EVER to implement recommendations identified in this ACIP and projects important to bird conservation relative to Florida's role in implementation of the bird conservation goals in Subtropical Florida.


Bird Conservation Regions
Southeast Region (SER)
National Park Service
U.S. Department of the Interior
Kentucky
Tennessee
North Carolina
South Carolina
Mississippi
Alabama
Georgia
Louisiana
Florida
N
W
E
S
Legend
Appalachian Mountains
Central Hardwoods
Gulf Coastal Prairie
Mississippi Alluvial Valley
Peninsular Florida
Piedmont
Southeastern Coastal Plain
West Gulf Coastal Plain/Ouachitas
NPS Units
0 50 100 200 300 400 Miles
Caribbean Islands
British Virgin Is.
Virgin Is.
Puerto Rico
Virgin Is.
0 15 30 60 Miles
Produced by Southeast Regional Office GIS, Atlanta, GA
March 2004

United States Shorebird Conservation Plan (USSCP): The USSCP has been completed and is available on the World Wide Web (http://shorebirdplan.fws.gov/). A regional step down plan is in preparation by FWS personnel and should be available in 2004.

Waterbird Conservation for the Americas (WCA): The WCA plan has been completed and is available on the World Wide Web or can be ordered from the US Fish and Wildlife Service National Conservation Training Center (http://www.waterbirdconservation.org/). EVER will utilize this regional plan extensively when completed.

Integration of NABCI Goals and Objectives into Park Planning and Operations

NABCI Implementation Recommendations

To successfully achieve park-established goals and actively participate in NABCI, the park could implement a variety of projects in different NPS programs. Most of these projects would require some level of participation by many existing park programs and could either be achieved through NPS funding, or more likely, through establishing or improving partnerships with agencies and organizations that already have the necessary expertise to provide guidance, funding, and execution of these programs. Programmatic areas where bird conservation actions are likely to be focused are:

- Inventory
- Monitoring
- Habitat Restoration/Management
- Threat Management (includes exotic species, air quality, water quality, etc.)
- Research
- Compliance
- Outreach
- Partnerships

To the extent appropriate, each of these program areas will be discussed separately and within each, specific opportunities identified that, when implemented, will enable to park to meet its mandates (current and expected) as well as integrate NABCI into its planning and operations. With emphasis added, the park is not expected to implement any of these recommendations or be obligated to pursue any opportunity other than those the park is required to do by law or NPS program or policy. In other words, participation in this effort is currently voluntary. However, implementation of EO 13186 (US Government 2000) will require NPS to incorporate a wide range of bird conservation programs into planning and operations. The development of the MOU between the FWS and the NPS will establish a formal agreement to promote bird

conservation within the agency by incorporating goals and strategies of existing bird conservation initiatives, plans, and goals into park planning and operations.

Should the park decide to implement any of these projects, further consultation with bird conservation contacts is encouraged to obtain updated information on the relevance of these opportunities in regional bird conservation.

High priority projects are identified in **bold** print. Priorities that the park is encouraged to seek NPS funding for are marked with an asterisk (*****). These projects are those that are critical to the stabilization or improvement of a bird population in the planning region.

Inventory: The park has inventoried its bird fauna exceptionally well and has documented over 350 species. Although the avifauna of EVER is well documented, distribution and abundance data are desired to fully understand the status of birds in the park so that conservation actions for birds can be implemented. Information regarding the status of high priority species is needed to effectively structure park management for the continued preservation and enhancement of the park's avifauna. Additional abundance and distribution data is needed for

- **Mangrove birds***
- **Marshbirds***
- **Wet and Dry Prairie birds***
- **Pine Hammock birds***
- **Tropical Hardwood Hammock birds***
- **Shorebirds, especially during migration***

Additionally, EVER is encouraged to

- **partner with BICY, Ten Thousand Islands National Wildlife Refuge (TTINWR), Great White Heron National Wildlife Refuge (GWHNWR), Big Cypress Seminole Indians, Miccosukee Indians, Florida Wildlife and Conservation Commission (FWCC), Rookery Bay National Esutarine Research Reserve (RBNERR), Fakahatchee Strand Preserve State Park (FSPSP) and South Florida Water Management District (SFWMD) to coordinate area inventory efforts**

- **verify other avian observational data collected in the park and enter into the appropriate database (NPSpecies, eBird, etc.)**

- **standardize inventory and monitoring methodology to conform to NPS and/or FWS recommended standards (Fancy and Sauer 2000, Hunter 2000)**

Monitoring: The park has an active bird monitoring program resulting in documentation of many high priority. Efforts should be made to continue existing monitoring programs, striving to conform to established NPS or FWS surveys protocols.

Close coordination with State of Florida biologists, researchers, and local federal land managers is needed to identify and implement high priority projects on park lands and to ensure that park efforts contribute to park or regional bird conservation rather than undertake an action or actions that are not needed or are better conducted in other areas. The park is encouraged to consider establishing permanent monitoring stations in main habitat types to collect baseline data on the distribution and relative abundances of priority species. This information will be useful for documented potential changes in park avifauna resulting from habitat change or management activities. Links to literature detailing inventory and monitoring methodologies for various avian groups (e.g. songbirds, shorebirds, raptors, etc.) can be found at: http://biology.dbs.umt.edu/landbird/mbcp/groups.htm. Specific recommendations are to:

- **continue to conduct existing monitoring programs and enter data into the appropriate database (NPSpecies, eBird, etc.) and provide data to cooperators***

- **conduct follow up monitoring on translocations of Brown-headed Nuthatch, Eastern Bluebird and Wild Turkey to from BICY***

- **establish an inventory and monitoring program to document the avian life in coastal mangrove and coastal hammock forests***

- **establish additional avian monitoring program based on distribution and abundance surveys that focus on regionally identified high priority species***

- **consider expanding wading bird surveys to include summer months***

- **consider establishment of a shorebird survey based on International Shorebird Survey (ISS) protocol during migration and winter**

- **establish a pre and post fire inventory program to document response of birds to prescribed fire**

- **standardize inventory and monitoring methodology to conform to NPS and/or FWS recommended standards (Fancy and Sauer 2000, Hunter 2000).**

- **partner with BICY, TTINWR, GWHNWR, Rookery Bay National Esutarine Research Reserve (RBNERR), Fakahatchee Strand Preserve State Park (FSPSP), Big Cypress Seminole Indians, Miccosukee Indians, FWCC, and SFWMD to coordinate area monitoring efforts**

Habitat Restoration: Landscape conditions in the Southeastern US have changed dramatically since early European explorers began documenting the area, its habitats, and its inhabitants. Historic landscapes were influenced by Native American burning,

wildfire, bison, beaver, and elk, as well as by insect outbreaks and weather events (Hunter et al. 2001, Williams 2002), thus resulting in a landscape mosaic that supported a rich and diverse bird fauna in the Southeast (Barden 1997; Brawn et al. 2001). The arrival of Europeans and the subsequent change in landscape has dramatically effected bird habitat and bird populations. Bird conservationists have long recognized that habitat restoration is critical to restoration of bird populations, stabilizing or reversing bird declines, and removing birds from both State and Federal Threatened and Endangered Species lists.

Recently, habitat restoration efforts have increased on NPS lands due to the increased restoration emphasis of the Management Policies (USDI NPS 2001). Parks may use a wide range of management tools to restore wetland, grassland, woodland, and other habitats. Restoration tools include, but are not limited to, forest management practices (e.g. silviculture), prescribed fire, exotic species management, and public use and recreation management. In addition, parks can coordinate infrastructure development (e.g. roads and buildings) with restoration activities to mitigate potential adverse impacts.

Due to the protected nature of EVER lands, and generally those in the national park system, the condition of habitats for bird use may be of higher quality than other natural, developed, agricultural, or forest lands under other management regimes. However, national park lands can be greatly improved for wildlife, and particularly bird use, by restoring processes important for habitat formation, succession, and structural development. Largely, these processes have not been managed historically in the national park system but current policy allows for active management of species, populations, and lands to provide for long-term conservation of park resources. Protection, restoration, and enhancement of habitats in EVER can greatly contribute to established habitat goals identified for Subtropical Florida.

EVER is primarily a large wetland that covers a variety of habitats, including freshwater marsh, wet and dry prairies, forested wetlands, mangrove forest, and shallow sloughs. Preservation of these habitats and many species have evolved through a dependence on wildfire. Indeed, EVER is one of the most fire effected landscapes in Florida and currently conducts the largest prescribed fire program in the NPS. Specific habitat recommendations are to:

- **continue to be an active participant in the effort to implement the Comprehensive Everglades Restoration Plan (CERP) to restore hydrological cycles and regimes***

- **increase the amount of prescribed fire (when appropriate) to restore and improve conditions in all habitats, but especially in marshes, prairies, mangroves, and pinelands***

- **collaborate with adjacent partners to conduct a joint fire effects project***

- **enhance or maintain water quality to support aquatic biota necessary to support existing waterbirds, marshbirds, and other birds that use water for nesting and foraging**

- **protect existing snag trees, where not identified as a safety hazard, as important to cavity nesting birds**

- **document all major habitat management activities, including location (e.g. UTM coordinates) and a description of methods and of pre- and post-management habitat conditions. This information, when coupled with bird distribution and abundance data, is useful for assessing and replicating conservation actions**

- assess historic landscape cover and determine feasibility of restoring landscape within the context of the park's enabling legislation.

Threat Management: Historically, the plume hunting trade in the early 1900's drastically reduced the colonial waterbird population by as much as 90%. Currently, the greatest impact to birds at EVER is the disruption of natural processes, including alteration of hydrological cycles and reduction in wildfire frequency and extent. Changes in these processes through time have resulted in a shift in habitat quantity and quality and is prominent in the listing of several species under the Endangered Species Act. EVER is actively engaged in restoration of these processes and is encouraged to:

- **continue current efforts to restore hydrological processes***

- **increase the use of prescribed fire to achieve habitat restoration and improvement goals***

Impact of exotic species on birds at EVER is largely unquantified but feral hogs do occur in the park. However, feral hogs are a prey item of the endangered Florida Panther and are not a managed threat. However, impact from feral hog on ground nesting birds is unknown and the park is encouraged to:

- **evaluate the impact of feral hogs on ground nesting birds***

Significant exotic plants, particularly Melaleuca, Brazilian Pepper, Australian Pine, and Old World Climbing Fern, occur in EVER and are a potentially threat to habitat at EVER. It is important to establish and continue inventory and monitoring for exotic plant species and implement aggressive removal/reduction projects for these species. The South Florida Exotic Plant Management Team can assist in coordination and implementation of exotic plant management. EVER is encouraged to:

- **implement an aggressive exotic plant reduction program to restore and improve habitat quality**

Additional unquantified threats to birds and their habitats at EVER include recreational boaters, communications towers, recreational activity, fishing gear (hooks and monofilament line entanglement), and presence of heavy metal toxins, such a mercury in the soils and sediments of the park. To address these issues, the park is encouraged to:

- **establish buffer zone around bird nesting islands and roosting areas for Double-crested Cormorants, Bald Eagle, Osprey, Roseate Spoonbills, and wading bird colony protection***

- **decommission out of date or unused communication towers***

- **assess avian mortality at prominent towers and establish a mortality monitoring program to document tower kill of birds***

- **implement a monofilament line recycling or disposal system at strategic areas in the park***

- **hire additional law enforcement officers and interpretive staff to implement aspects of this plan***

- **assess the extent of avian injury and/or death associated with fishing gear (hooks and monofilament line)**

- **assess the threat of heavy metal toxins to birds in the park and initiate appropriate actions to mitigate presence of any toxins**

Research: Several research projects have been identified that would provide additional information to EVER managers for bird conservation purposes. The South Florida/Caribbean Field Unit of the US Geological Survey, Biological Resources Division is located in the South Florida Natural Resource Center in EVER and can provide excellent service and expertise for implementation of these research projects and consultation on appropriate inventory and monitoring protocols for other projects mentioned in this plan. EVER's identified research needs are:

- **determine the response of Cape Sable Seaside Sparrow to prescribed fire***

- **determine the effects of wildfire and fuel treatments on the avifauna of the pine rockland ecosystem in southern Florida***

- **assess the effects of prescribed burning on wintering and breeding birds of wet prairie habitats***

- **determine impacts or recreational boating in Florida Bay to breeding, foraging, and migrant birds***

- **determine recreational impacts to birds***
- **determine winter and Neotropical and temperate migrants use of park***
- **determine impacts of feral hogs on ground nesting birds***
- **determine demographics and ecology of Limpkin in EVER and BICY**
- **assess threat of heavy metal loads to birds**
- **assess colonial bird nesting mortality due to avian nematode**
- **determine the extent of avian mortality from existing communications towers in the park**

Additionally, the park is encouraged to:

- **list park needs and projects on Research Permit and Reporting System web site (RPRS)***
- **incorporate scientific information needs from the South Florida Ecosystem Restoration program into the park's planning process***
- develop contact with South Florida/Caribbean Cooperative Ecosystem Studies Unit at the University of Miami, Miami, Fl

Compliance: Park compliance with the Migratory Bird Treaty Act and the Executive Order 13186 (US Government 2000) is necessary to assure that park activities incorporate bird conservation into park planning and operations. Further, to ensure that migratory birds are considered in all phases of park planning processes, especially during the National Environmental Policy Act (NEPA) and the Director's Order #12 Compliance processes, the park should consider adding specific language in project evaluations that requires consideration and implications of park projects on migratory birds. The MOU being developed between the NPS and the FWS will likely contain specific language requiring a park to consider implications of park projects on migratory birds, particularly those species identified in the USFWS Species of Conservation Concern 2002 (Appendix C). Additional considerations are to encourage:

- **park staff to begin specific consideration of migratory birds during park planning processes**
- park staff to attend USFWS training on implementation of EO 13186 at the National Conservation Training Center (NCTC) (when available) or other training on migratory bird conservation in North America. NCTC has several courses

and training related to conservation of migratory birds (http://training.fws.gov/courses.html).

The USFWS NCTC offers and reserves two tuition free slots for National Park Service employees wishing to attend NCTC courses on a first come, first served basis. Additionally, discount lodging is also available while attending a NCTC course.

Outreach:

- **participate in International Migratory Bird Day (IMBD) events with a local partner (http://birds.fws.gov/imbd.html), such as BICY, Crocodile Lakes NWR, Tropical Audubon Society, etc.***

- **continue to host the Everglades BirdFest coordinated by the Broward County Audubon Society highlighting bird conservation issues in EVER and South Florida***

- **develop outreach and educational programs to enhance visibility of bird conservation issues, which may include organized bird walks, owl prowls, and raptor surveys with the public***

- **provide bird conservation information in visitors centers***

- **develop education brochure on proper disposal of monofilament fishing line and potential techniques to avoid hooking birds while fishing***

- **continue to develop and foster relationship with local area bird clubs, such as Tropical Audubon Society and local bird clubs***

- **encourage accurate documentation and reporting from these and random outings by visitors (see Cornell University's eBird monitoring program (Cornell Lab. Ornith. 2002 (http://www.ebird.org/about/index.jsp)***

- **develop relationship with Big Cypress Seminole Indian Reservation and Miccosukee Indian Reservation personnel to cooperate on a joint bird conservation project***

- park interpretation/education staff are encouraged to attend USFWS training on Migratory Bird Education at NCTC

- consider adding links to bird conservation information, data, etc. to the park's web site home page

- support bird conservation by serving shade-grown coffees at meetings, events, and the office buildings in the park (http://www.americanbirding.org/programs/conssbcof3.htm)

- subscribe to Florida Birds, an electronic forum for listing bird sightings and publications in Florida

- explore cultural affiliation of landscape to inhabitants, both historical and contemporary. Cultures are strongly tied to the landscape they inhabit and birds often play a role in a cultural tie to the landscape. When these connections are discovered and preserved, a greater appreciation for the landscape and it's value to the culture can be achieved.

Partners and Partnerships: Partnerships for land conservation and protection will perhaps have the greatest positive influence on bird conservation above all other landscape scale planning. Specific recommendations are to:

- **continue to keep abreast of Dade, Collier, Monroe, Broward, and Hendry Counties and other South Florida initiatives or programs that could impact park resources***

- **develop relationship with Big Cypress Seminole Indian Reservation and Miccosukee Indian Reservation personnel***

- **contact US Fish and Wildlife Service private lands biologists to discuss private landowner initiatives applicable to the area***

Several private landowner programs could be implemented that would serve to protect areas adjacent to EVER and potentially improve water and habitat quality in the vicinity

- **develop partnership with FWCC, SFWMD, TTINWR, BICY, Rookery Bay National Esutarine Research Reserve (RBNERR), Fakahatchee Strand Preserve State Park (FSPSP) and other local partners to coordinate and implement various aspects of this ACIP***

- **contact the nearest Joint Venture office (see Funding section for explanation of Joint Ventures) or BCR coordinator to develop partnerships and funding proposals tiered to priorities established by the park, this ACIP, and the Subtropical Florida bird conservation plan***

- partner with and engage the local bird clubs, including Tropical Audubon Society, Audubon Society of the Everglades, Broward County Audubon Society, Naples Bird Club, and Collier County Audubon as active partners in EVER's bird conservation program

- develop land use agreements with local landowners through state, FWS programs to protect important habitats and landscapes adjacent to EVER

Funding Opportunities: Internal NPS funding is often an effective source to obtain funding; however, the project will have to be a fairly high priority among the park's natural resource program to successfully compete for the limited funding available in the NPS. Therefore, partnerships and outside funding programs are often more productive for securing bird conservation funding. Funding for conservation projects for Neotropical migrants is also available through the Park Flight program. EVER is encouraged to enter all high priority projects into the NPS Performance Management Information System (PMIS) database. Needed at EVER is:

- **increased base funding to implement basic protection and management needs for birds and their habitats (habitat based management not only benefits the birds but other wildlife as well)**

With the exception of the North American Waterfowl Management Plan (NAWMP and its associated funding legislation, the North American Wetland Conservation Act), funding opportunities for bird conservation programs, plans, and initiatives have been lacking. Only within the last decade have other appropriate and specific sources for bird conservation funding been created and used. The NAWMP has been supported for approximately 14 years by the North American Wetlands Conservation Act (NAWCA 1989). This program has provided $487 million in appropriated funds matched with $1.7 billion for wetland and bird conservation projects since its inception. In 2002 alone, over $70 million US dollars were awarded to US and Canadian agencies and organizations to enhance waterfowl populations by improving, restoring, or protecting wetland habitats. To adequately evaluate projects and distribute these funds, partnerships called Joint Ventures were established. Nationally, 14 (11 US, 3 Canada) Joint Ventures have been established, several which are funded and staffed. Internet links to Joint Ventures are:

(http://southwest.fws.gov/gulfcoastjv/ojvcontact.html) and
(http://northamerican.fws.gov/NAWMP/jv.htm).

Funding through NAWCA is highly underutilized by the NPS and any park unit that has wetland, water, or bird conservation needs associated with wetland are encouraged to investigate using this funding source. Naturally, there are certain requirements to be eligible for all grants and park managers are encouraged to consult with the nearest Joint Venture, BCR, PIF Coordinator, to learn how this program might be applicable to implementation of this plan, and other park wetland issues. EVER is not within a region which has an operational Joint Venture, but contact with the Atlantic Coast Joint Venture, Central Hardwoods BCR, and Tennessee PIF coordinators will provide opportunity to investigate use of this funding source and developing proposals.

Internal FWS funding programs may be used to support projects, but no effective method of project proposal delivery to these sources is currently in place for the NPS. Current funding in these programs may result from FWS familiarity with NPS needs, or NPS participation in one of the area FWS Ecosystem Teams, where a project has been identified and proposed to be funded through the Ecosystem Team.

One unexplored yet potentially fruitful funding source for national parks is the myriad of grants through the FWS State Programs, where grants are awarded to private individuals engaged in habitat conservation projects. No funding is directly available to national parks, but identified projects with important or critical adjacent landowners can sometimes be funded through these sources. Similar programs are available if the adjacent landowner is a federally recognized American Indian tribe.

Specific congressional appropriations to protect migratory birds has recently been authorized under the Neotropical Migratory Bird Conservation Act (2000) (http://www.nfwf.org/programs/nmbcapp.htm). Appropriations through this Act are authorized up to $5 million per year. However, in 2000, appropriation was approximately $3.75 million and a majority of this funding was directed toward projects in Central and South America.

Many of the identified projects are eligible for funding under various grant programs of the National Fish and Wildlife Foundation http://www.nfwf.org/programs/programs.htm.

Other prominent funding sources available to NPS managers for bird conservation are listed on this projects web site at: http://southeast.fws.gov/birds/NPSHighlits.htm.

Funding opportunities for migratory bird conservation are available yet most natural resource agencies are not fully aware of and/or understanding of how to use these sources. Perhaps a consolidated migratory bird funding source catalog will become available to managers in the future; this is needed.

Contacts: Primary contacts within the region can be obtained by viewing the web site for the Southeastern Bird Conservation Initiative, National Park Service at http://southeast.fws.gov/birds/npsbirds.htm. This web site will provide contact information of the appropriate bird conservation coordinator in the region for park personnel Primary contacts for EVER are:

US Fish and Wildlife Service

Keith Watson
Asheville, NC 28801
828-350-8228
Keith_Watson@fws.gov

Dean Demarest
Atlanta, GA
404-679-7371
dean_demarest@fws.gov

Jennifer Wheeler
Waterbird Conservation Plan
Coordinator
703-358-1714
Jennifer_A_Wheeler@fws.gov

Craig Watson
Atlantic Coast Joint Venture
Charleston, SC
843-727-4707 ext. 16
Craig_Watson@fws.gov

Chuck Hunter
Regional Refuge Biologist
Atlanta, GA
404-679-7130
Chuck_Hunter@fws.gov

Ralph Costa
Clemson University
Clemson, SC
864 656-2432
Ralph_Costa@fws.gov

National Park Service

South Florida/Caribbean
Inventory & Monitoring Network
Coordinator
Matt Patterson
305 224-4211
Matt_Patterson@nps.gov

Sonny Bass
Everglades National Park
305 242-7833
Sonny_Bass@nps.gov

Skip Snow
Everglades National Park
305 242-7827
Skip_Snow@nps.gov

Tony Pernas
National Park Service
305 224-4246
Tony_Pernas@nps.gov

Carol Daniels
South Florida/Caribbean CESU
Miami, Fl
305 361-4904
Carol_Daniels@nps.gov

State of Florida

Jeff Gore
Florida Fish and Wildlife Conservation
Commission
850-265-3677
Jeff.Gore@fwc.state.fl.us

Karl Miller
Florida Fish and Wildlife Conservation Commission
352-955-2230
karl.miller@fwc.state.fl.us

Peter Frederick
University of Florida
Gainesville, Fl
(904) 846-0565
pcf@gnv.ifas.ufl.edu

Ken Meyer
Avian Research and Conservation Institute
Gainesville, FL
352-335-4151
meyer@arcinst.org

Others

Gary Slater
Mount Vernon, WA 98273
Ecostudies Institute
360-416-6707
glslater@ecoinst.org

Bernice Constantine
USDA Wildlife Services
Florida
353-377-5556

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APPENDIX A

HIGH PRIORITY SPECIES IN PENINSULAR FLORIDA BIRD CONSERVATION REGION (from Table 1, Peninsular Florida Priority Bird Species)

Table 1. Priority bird species for Peninsular Florida: Entry criteria and selection rationale

Priority Entry Criteria[1]	Species	Total PIF Priority Species Score	Conservation Score: Area Importance	Conservation Score: Population Trend	Percent of BBS Population	Migratory Status[2]	Local Geographical or Historical Notes
Ia.	Florida Scrub-Jay[5]	35	5[4]	5[4]	100	R	
	Grasshopper Sparrow[5] (Florida)	35	5[4]	5[4]	100	R	
	Snail Kite[5] (Everglade)	34	5	4[4]	100?	D	
	Crested Caracara[5] (Florida pop.)	34	5[4]	4[4]		D	
	Snowy Plover (SE US)	34	5	5		D	Gulf side only
	Red Knot (SE US)	32	5	5		C	
	Piping Plover[5]	31	4	5		C	
	Prairie Warbler (Florida)	31	5[4]	5[4]		D	
	Wood Stork[5] (SE US pop.)	30	5	4		D	
	Short-tailed Hawk (Florida pop.)	30	5[4]	3		D	
	Swallow-tailed Kite (SE US)	29	5	3	61.7	B	
	Red-cockaded Woodpecker[5]	29	3[4]	3		R	

Table 1 (cont.).

Priority Entry Criteria[1]	Species	Total PIF Priority Species Score	Conservation Score: Area Importance	Conservation Score: Population Trend	Percent of BBS Population	Migratory Status[2]	Local Geographical or Historical Notes
	Mottled Duck	29	5	4[4]	11.3?	D	
	American Kestrel (SE US)	28	5[4]	4[4]		R	
	Burrowing Owl (Florida)	28	5[4]	3		D	
	Bachman=s Sparrow	28	5	3	18.9	D	
	Saltmarsh Sharp-tailed Sparrow	28	3	3		C	
	Painted Bunting (Eastern)	28	3[4]	3	D		
	American Oystercatcher (Eastern NA pops.)	28	5	3		D	
Ib.	Wilson=s Plover	27	4	3		D	
	Nelson=s Sharp-tailed Sparrow	27	3	3		C	
	Henslow=s Sparrow	27	3	4		C	
	Black Rail	27	4	3		D	
	Sandhill Crane (Florida)	26	5[4]	1		R	
	Audubon=s Shearwater (Caribbean)	26	5	3		P	
	Reddish Egret	26	4	3		D	
	Least Tern	26	5	4[4]	4.6?	B	
	Black Skimmer	26	5	5		D	
	Bicknell=s Thrush	26	5	3		A	

Table 1 (cont.).

Priority Entry Criteria[1]	Species	Total PIF Priority Species Score	Conservation Score: Area Importance	Conservation Score: Population Trend	Percent of BBS Population	Migratory Status[2]	Local Geographical or Historical Notes
	Yellow Rail	26	4	3		C	
	Buff-breasted Sandpiper	25	3	4		A	Most southbound migration
	Black-throated Blue Warbler	25	5	3		A	
	Seaside Sparrow	25	4[4]	3		D	Gulf populations
	Brown Pelican (SE US)	24	5	1[4]		D	
	Marbled Godwit	24	3	4		C	
	Bobolink	24	5	5		A	
	Tricolored Heron	23	4	3	17.3?	D	
	White Ibis	23	4	4		D	
	King Rail	23	4	3		D	
	Sandhill Crane (Greater)	23	5	3		C	
	Solitary Sandpiper	23	5	3		A	
	Whimbrel	23	3	5		A	
	Stilt Sandpiper	23	4	3		A	
	Brown-headed Nuthatch	23	3	3		R	
	Cape May Warbler	23	5	3		A	
	Connecticut Warbler	23	5	3		A	
	Cory=s Shearwater	22	5	3		P	
	Clapper Rail	22	3	3		R	
	Limpkin	22	3[4]	4[4]	33.2?	R	
	Semipalmated Sandpiper	22	5	5		A	
	Short-billed Dowitcher	22	5	5		C	
	Gull-billed Tern	22	3	4		D	
	Royal Tern	22	4	3		D	
	Sandwich Tern	22	5	3		D	
	Black Tern	22	5	5		A	
	Mangrove Cuckoo	22	3[4]	3		E	

Table 1 (cont.).

Priority Entry Criteria[1]	Species	Total PIF Priority Species Score	Conservation Score: Area Importance	Conservation Score: Population Trend	Percent of BBS Population	Migratory Status[2]	Local Geographical or Historical Notes
	Gray Kingbird	22	3[4]	3	4.5?	B	
	Black-whiskered Vireo	22	3[4]	3		B	
	Loggerhead Shrike	22	5	5	4.1	D	
	Sedge Wren	22	4	2		C	
	Palm Warbler	22	5	5		C	
II a.	Anhinga	21	5	3		D	
	American Bittern	21	4	5		C	
	Northern Bobwhite	21	4	5		R	
	Black-bellied Plover	21	4	5		D	
	Willet	21	5	3		D	
	Western Sandpiper	21	5	3		C	
	Common Ground-Dove	21	5	5	23.8?	R	
	Red-headed Woodpecker	21	3	5	1.0	D	
	Veery	21	4	5		A	
	Pine Warbler	21	4	5		D	
	Grasshopper Sparrow (Eastern)	21	5	5		C	
	Green Heron	20	5	3		D	
	Northern Harrie r	20	4	4		C	
	Ruddy Turnstone	20	3	4		D	
	Least Sandpiper	20	5	5		C	
	Dunlin	20	4	5		C	
	Yellow-billed Cuckoo	20	3	5		B	
	Gray Catbird	20	5	5		C	
	Eastern Towhee	20	5	5	7.9	D	
	American Avocet	19	3	3		C	
	Greater Yellowlegs	19	5	3		C	

Table 1 (cont.).

Priority Entry Criteria[1]	Species	Total PIF Priority Species Score	Conservation Score: Area Importance	Conservation Score: Population Trend	Percent of BBS Population	Migratory Status[2]	Local Geographical or Historical Notes
	Sanderling	19	3	5		C	
	Pectoral Sandpiper	19	5	3		A	
	Common Nighthawk	19	5	5	3.6	B	
II b.	Chuck-will=s-widow	21	5	3	7.0	B	
	White-eyed Vireo	20	5	2	5.4	D	
II c.	Snowy Egret	19	4	3		D	
	Little Blue Heron	20	3	4	5.1	D	
Local or Regional Interest	Prothonotary Warbler	21	2	3	B	(AA@ Merritt Island)	
	American White Pelican	20	4	1		C	
	Redhead	20	2	4		C	
	American Woodcock	20	2	4		D	
	Acadian Flycatcher	20	2	3		B	(AA@ Merritt Island)
	Yellow-throated Vireo	20	3	3		B	(AA@ Merritt Island)
	Yellow-throated Warbler	20	3	3		C	
	Hooded Warbler	20	2	3		B	(AA@ Merritt Island)
	Peregrine Falcon	19	5	1		A	Winters in small numbers
	Northern Parula	19	5	2		C	
	Common Loon	18	4	3		C	
	Least Bittern	18	2	3	7.0?	D	
	Wood Duck	18	4	2		D	
	Ring-necked Duck	18	3	2		C	
	Lesser Scaup	18	3	5		C	
	Red-shouldered Hawk	18	5	2		D	
	Eastern Kingbird	18	3	5		B	
	Summer Tanager	18	3	3		B	
	Eastern Meadowlark	18	4	5		D	

Table 1 (cont.).

Priority Entry Criteria[1]	Species	Total PIF Priority Species Score	Conservation Score: Area Importance	Conservation Score: Population Trend	Percent of BBS Population	Migratory Status[2]	Local Geographical or Historical Notes
	Rusty Blackbird	18	2	5		C	
	Bald Eagle[5]	17	4[4]	1		D	
	Blue-winged Teal	17	5	3		A	
	Barn Owl	17	3	3		D	
	Northern Flicker	17	4	5		D	
	Eastern Wood-Pewee	17	2	3		B	(AA@ Merritt Island)
	Yellow-crowned Night-Heron	16	2	3		D	
	Roseate Spoonbill	16	2	3		D	
	Northern Pintail	16	3	5		C	
	Brown Thrasher	16	2	3		D	
	Black-and-white Warbler	17	3	3		C	
	Smooth-billed Ani	15	2	3		R	
	Blue-gray Gnatcatcher	14	3	2		C	

[1]Entry criteria (Area Importance [AI] scores roughly mean A1" irregular and unpredictable occurrence, A2" rare to uncommon but regular occurrence, A3" low relative abundance, A4" moderate to high relative abundance, A5" highest relative abundance; Population Trend [PT] scores roughly mean A1" definite increase, A2" stable or possible increase, A3" trend unknown, A4" possible decrease, A5" definite decrease):

Ia. <u>Overall Highest Priority Species.</u> Species with total score 28-35. Ordered by total score. Consider deleting species with AI $\leq$ 2 confirmed to be of peripheral occurrence and not of local conservation interest, but retain species potentially undersampled by BBS or known to have greatly declined during this century.

Ib. **Overall High Priority Species.** **Species with total score 22-27. Ordered by total score. Consider deleting species with AI ≤ 2 confirmed to be of peripheral occurrence and not of local conservation interest, but retain species potentially undersampled by BBS or known to have greatly declined during this century.**

II. **Area Priority Species.** **Species with slightly lower score total 19-21 with PT+AI=8+(a), with high percent BBS population (b), or high level of threats identified (TB+TN=7+, TB or TN=5). Ordered by total score. These are overall moderate priority species.**

III. **Additional Species of Global Priority.** **Add WatchList species (Partners in Flight-National Audubon Society priority species at national level), not already listed in either I or II, with AI=2+. Order by total score. Consider deleting species with AI=2 if confirmed to be of peripheral occurrence and not of local conservation interest, but retain if a local population is viable and/or manageable. These are also overall moderate priority species.**

LORI **Local or Regional Interest Species.** **Includes game or nongame species identified by State Working Groups. Also, may include species often meeting criteria for I or II within other physiographic areas and therefore of regional interest for monitoring throughout the Southeast. These are overall low priority species within physiographic area, but may be more important within one or more States (especially where multiple states have designated some special protective status on the species).**

[2] Local Migratory Status, codes adapted from Texas Partners in Flight as follows:

A = **Breeds in temperate or tropical areas outside of region, and winters in temperate or tropics outside of region (*i.e.*, passage migrant).**

B = **Breeds in temperate or tropical areas including the region, and winters exclusively in temperate or tropics outside the region (*i.e.*, includes both breeding and transient populations).**

C = **Breeds in temperate or tropical areas outside of region, and winters in both the region and in temperate or tropical areas beyond area (*i.e.*, includes both transient and wintering populations).**

D = **Breeds and winters in the region, with perhaps different populations involved, including populations moving through to winter beyond the region in temperate or tropical areas (*i.e.*, populations may be present throughout year, but may include a large number of passage migrants).**

E = **Species reaching distributional limits within the region, either as short-distance or long-distance breeding migrants, but at population levels above peripheral status.**

F = **Same as E except for wintering (non-breeding) migrants.**

R = **Resident, generally non-migratory species (though there may be local movements).**

RP= **Resident, non-migratory species, reaching distributional limits within the region, but at population levels above peripheral status.**

P = **Pelagic, breeding grounds outside of region, but can occur during breeding season.**

PB = **Post-breeding dispersal or non-breeding resident; species present during breeding season, but not known to be breeding in the region proper.**

[3]Highest percent of breeding population recorded in temperate North America; numbers in A @ are likely projections; ? indicates species widespread outside of temperate North America and/or waterbirds poorly sampled by Breeding Bird Survey within physio. area.

[4]AI or PT score revised from what was derived by BBS data, or lack thereof, based on better local information.

[5]Species listed as either Federal Endangered or Threatened.

APPENDIX B

Wildlife Conservation Commission

FLORIDA'S ENDANGERED SPECIES, THREATENED SPECIES AND SPECIES OF SPECIAL CONCERN

Official Lists

Publication Date: 1 August 1997

This document consolidates the state and federal official lists of endangered species, threatened species, and other species categorized in some way by the respective jurisdictional agencies as meriting special protection or consideration. The state lists of animals are maintained by the Florida Game and Fresh Water Fish Commission and categorized as endangered, threatened and of special concern, and constitute Rules 39-27.003, 39-27.004 and 39-27.005, respectively, Florida Administrative Code (F.A.C.). The state lists of plants are categorized into endangered, threatened and commercially exploited, and are administered and maintained by the Florida Department of Agriculture and Consumer Services via Chapter 5B-40, F.A.C. The federal lists of animals and plants are administered by the U.S. Fish and Wildlife Service and categorized into endangered and threatened, and are published in 50 CFR 17 (animals) and 50 CFR 23 (plants). The abbreviations used in part one are:

GFC = Florida Fish and Wildlife Conservation Commission

FDA = Florida Department of Agriculture and Consumer Services

FWS = United States Fish and Wildlife Service

E = Endangered

T = Threatened

T(S/A) = Threatened/Similarity of Appearance

T(E/P) = Threatened/Experimental Population

SSC = Species of Special Concern

C = Commercially Exploited

		Designated Status	
Scientific Name	**Common Name(s)**	**GFC**	**FWS**
Birds			
Ajaia ajaja	Roseate spoonbill	SSC	
Ammodramus maritimus juncicolus	Wakulla seaside sparrow	SSC	

		Designated Status	
Scientific Name	**Common Name(s)**	**GFC**	**FWS**
Ammodramus maritimus mirabilis	Cape Sable seaside sparrow	E	E
Ammodramus maritimus peninsulae	Scott's seaside sparrow	SSC	
Ammodramus savannarum floridanus	Florida grasshopper sparrow	E	
Aphelocoma coerulescens	Florida scrub-jay	T	T
Aramus guarauna	Limpkin	SSC	
Campephilus principalis	Ivory-billed woodpecker	E	E
Charadrius alexandrinus tenuirostris	Southeastern snowy plover	T	
Charadrius melodus	Piping plover	T	T
Cistothorus palustris griseus	Worthington's marsh wren	SSC	
Cistothorus palustris marianae	Marian's marsh wren	SSC	
Columba leucocephala	White-crowned pigeon	T	
Dendroica kirtlandii	Kirtland's warbler	E	E
Egretta caerulea	Little blue heron	SSC	
Egretta rufescens	Reddish egret	SSC	
Egretta thula	Snowy egret	SSC	
Egretta tricolor	Tricolored (=Louisiana) heron	SSC	
Eudocimus albus	White ibis	SSC	
Falco peregrinus tundrius	Arctic peregrine falcon	E	
Falco sparverius paulus	Southeastern American kestrel	T	
Grus americana	Whooping crane	SSC	T(E/P)
Grus canadensis pratensis	Florida Sandhill crane	T	
Haematopus palliatus	American oystercatcher	SSC	
Haliaeetus leucocephalus	Bald eagle	T	T
Mycteria americana	Wood stork	E	E

		Designated Status	
Scientific Name	**Common Name(s)**	**GFC**	**FWS**
Pandion haliaetus	Osprey	SSC*	
Pelecanus occidentalis	Brown pelican	SSC	
Picoides borealis	Red-cockaded woodpecker	T	E
Polyborus plancus audubonii	Audubon's crested caracara	T	T
Rostrhamus sociabilis	Snail kite	E	E
Rynchops niger	Black skimmer	SSC	
Speotyto cunicularia	Burrowing owl	SSC	
Sterna antillarum	Least tern	T	
Sterna dougallii	Roseate tern	T	T
Vermivora bachmanii	Bachman's warbler	E	E
*Applicable in Monroe County only			

APPENDIX C

US FISH AND WILDLIFE SERVICE SPECIES OF CONSERVATION CONCERN IN PENINSULAR FLORIDA (BCR 31)

Black-capped Petrel
Audubon's Shearwater
Magnificent Frigatebird
American Bittern
Little Blue Heron
Reddish Egret
White Ibis
Swallow-tailed Kite
Short-tailed Hawk
American Kestrel (resident *paulus* ssp. only)
Peregrine Falcon
Yellow Rail
Black Rail
Limpkin
Snowy Plover
Wilson's Plover
American Oystercatcher
Whimbrel
Marbled Godwit
Red Knot
Semipalmated Sandpiper
Stilt Sandpiper
Buff-breasted Sandpiper
Short-billed Dowitcher
Gull-billed Tern
Common Tern
Least Tern
Black Tern
Black Skimmer
White-crowned Pigeon
Common Ground-Dove
Mangrove Cuckoo
Smooth-billed Ani
Burrowing Owl
Chuck-will's-widow
Red-headed Woodpecker
Loggerhead Shrike
Black-whiskered Vireo
Brown-headed Nuthatch
Yellow Warbler (resident *gundlachi* ssp. only)
Yellow-throated Warbler
Prairie Warbler
Bachman's Sparrow
Henslow's Sparrow
Nelson's Sharp-tailed Sparrow
Saltmarsh Sharp-tailed Sparrow
Seaside Sparrow
Painted Bunting

APPENDIX L.6

VIRGIN ISLANDS NATIONAL PARK

DRAFT

Avian Conservation Implementation Plan
Virgin Islands National Park

National Park Service
Southeast Region

Compiled by J. Keith Watson
U.S. Fish and Wildlife Service

In cooperation with
VIIS Resource Management Staff, National Park Service
and Bird Conservation Partners

November 2003

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Introduction

This Avian Conservation Implementation Plan (ACIP) is provided to the staff at Virgin Islands National Park (VIIS) to serve as guidance to identify, document, and undertake bird conservation activities in the park and with neighboring communities, organizations, and adjacent landowners. This plan may identify goals, strategies, partnerships, and perhaps specific projects for the park to participate in existing bird conservation planning and implementation efforts associated with the North American Bird Conservation Initiative. Under the auspice of NABCI, appropriate bird and habitat conservation goals may be recommended as identified in the appropriate existing national or regional bird conservation efforts aligned with this initiative: Partners In Flight (PIF), North American Waterfowl Management Plan (NAWMP), US Shorebird Conservation Plan (USSCP), and Waterbird Conservation for the Americas (WCA). For example, parks in the Appalachians and the Cumberland Plateau will have few if any high priority waterbird conservation issues at a regional landscape or greater scale. As such, little information regarding waterbird conservation will be presented in the ACIP, unless there is an identified park need for this species group, or other mandates, such as federal laws. Similarly, because most of the parks in the Caribbean are located in and are primarily coastal with some upland landscapes, recommendations will be provided in the ACIP for waterbird, landbird and habitat conservation and will be derived from the appropriate PIF bird conservation plans and regional shorebird and waterbird plans. However, all high priority bird conservation issues for VIIS will be discussed and integrated as appropriate.

Information and data presented in the ACIP have been obtained from several sources: 1) interviews with VIIS staff 2) VIIS bird conservation partners 3) the PIF Puerto Rico and US Virgin Islands Bird Conservation Plan (Nunez-Garcia and Hunter 2000), 4) NPS databases, and 5) personal communications with bird conservation specialists throughout North America, especially in the Caribbean. This plan has been reviewed by VIIS resource management staff and managers, and bird conservation partners and approved by VIIS management. Optimally, this plan will be incorporated into the park's Resource Management Plan (RMP) and updated annually to reflect completed projects, newly identified needs, and shifts in bird conservation priorities in the region.

VIIS is not obligated to undertake any of the proposed actions in this plan. The plan is provided to offer guidance to VIIS to voluntarily support important park, regional, and perhaps national and international bird conservation projects for which VIIS is a primary participant in the proposed actions.

Background

During the past thirty years, monitoring programs across North America have documented declines of certain bird species populations and their habitats, often severe (Sauer et al. 2000). Although these declines were typically for North American continental birds, similar declines have occurred in the Caribbean for many of the same reasons (Raffaele 1989).

The decline has caused great concern among scientists, biologists, biodiversity proponents, ecologists, land managers, etc., and the bird conservation community in general. Birds are recognized as critical components of local and global genetic, species, and population diversity, providing important and often critical ecological, social, and cultural values. Their overall decline has stimulated a worldwide focus on conservation efforts and North American interest in bird conservation is rapidly becoming a focus of government, non-government, industry, and private interests and expenditures.

Many state, federal, and non-governmental wildlife agencies and organizations (NGO's) have recognized this alarming bird decline trend and have joined forces in several extensive partnerships to address the conservation needs of various bird groups and their habitats. The primary initiatives are:

- North American Waterfowl Management Plan
- Partners in Flight
- U.S. Shorebird Conservation Plan
- Waterbird Conservation for the Americas

While efforts associated with these plans have generated some successes, it has been increasingly recognized that the overlapping conservation interests of these initiatives can be better served through more integrated planning and delivery of bird conservation. The *North American Bird Conservation Initiative* (NABCI; http://www.nabci-us.org/main2.html) arose out of this realization. The vision of NABCI is simply to see ***"populations and habitats of North America's birds protected, restored and enhanced through coordinated efforts at international, national, regional, state and local levels, guided by sound science and effective management."*** NABCI seeks to accomplish this vision through (1) broadening bird conservation partnerships, (2) working to increase the financial resources available for bird conservation in the U.S., and (3) enhancing the effectiveness of those resources and partnerships by facilitating integrated bird conservation (U.S. NABCI Committee 2000). Together, the four bird conservation initiatives mentioned above, as well as several other local and regional partnerships, work collectively to pursue this vision.

NABCI is guided by a set of principles that establish an operational framework within which the Initiative and its partners may conduct integrated bird conservation in the U.S. These will articulate a common understanding of the relationship between NABCI, the individual bird conservation initiatives, and all partner entities to ensure recognition of existing federal legislative and international treaty obligations, state authorities, and respect for the identity and autonomy of each initiative. The fundamental components of the conservation approach to be used by NABCI are expressed within its goal:

> ***To deliver the full spectrum of bird conservation through regionally-based, biologically-driven, landscape-oriented partnerships.***

The Southeastern Bird Conservation Initiative: National Park Service: In 1999, the Southeast Region of the National Park Service (NPS) recognized the importance of coordinating existing bird conservation goals into planning and operations of national park units in the southeast, that is, integration of NABCI. In support of this recognition, the Southeast Regional Office NPS approved and allocated eighty-eight thousand dollars, cost sharing 1:1 with the US Fish and Wildlife Service (FWS) Region 4 (Southeast) to hire a biologist to conduct this two-year project (Interagency Agreement FS028 01 0368). This project is unique in the NPS, and perhaps the nation, and represents a potential model for better coordinating regional bird conservation programs and activities within and outside the NPS. It further represents a progressive action toward institutionalizing bird conservation as a programmatic priority in the Southeast Region of NPS, and potentially the nation.

As envisioned, the integration of NABCI into the Southeastern NPS involves:

1) Development and delivery of Avian Conservation Implementation Plans (ACIP),
2) Coordination with NPS Inventory and Monitoring Program,
3) Development of a web based project site,
4) Establishment or enhancement of bird conservation partnerships,
5) Identification and exploration of potential funding opportunities, and
6) Technical guidance and assistance as needed or requested.

This ACIP fulfills one aspect of the plan outlined above, and serves as a basis for future bird conservation actions in VIIS and with adjacent partners or landowners. Concurrently, the development of a Memorandum of Understanding (MOU) between the FWS and the NPS to implement Presidential Executive Order (EO) 13186, **Responsibilities of Federal Agencies to Protect Migratory Birds**, calls for integration of programs and recommendations of existing bird conservation efforts into park planning and operations. Complementing each other, the MOU and the Southeastern Bird Conservation Initiative will advance bird conservation in the Southeast Region of the NPS beyond current regional NPS efforts.

Role of NPS in Avian Conservation

The interagency agreement that facilitates this partnership supports both FWS and NPS management policies. Specifically for the NPS, the agreement supports and advances the **Strategy for Collaboration** (March 2000), a visionary document developed and signed by the Southeast Natural Resource Leaders Advisory Group (SENRLAG), a consortium of 13 land and resource management agencies in the Southeastern United States whose vision is to encourage and support cooperation in planning and managing the region's natural resources. Furthermore, the agreement is aligned with and implements a variety of NPS Management Polices (2001) including but not limited to External Threats and Opportunities (Chapter 1.5), Environmental Leadership (Chapter 1.6), Cooperative

Planning (Chapter 2.3.1.9), Land Protection (Chapter 3), and especially Natural Resource Management (Chapter 4) that details policy and management guidelines which apply to bird conservation. Important policies in this chapter includes:

- Planning for Natural Resource Management (4.1.1)
- Partnerships (4.1.4)
- Restoration of Natural Systems (4.1.5)
- Studies and Collection (4.2)
- General Principles for Managing Biological Resources (4.4.1)
- Plant and Animal Population Management Principles (4.4.1.1)
- Management of Native Plants and Animals (4.4.2)
- Management of Endangered Plants and Animals (4.4.2.3)
- Management of Natural Landscapes (4.4.2.4)
- Management of Exotic Species (4.4.4)
- Pest Management (4.4.5)
- Fire Management (4.5) and
- Water Resource Management (4.6)

The NPS is the fourth largest landowner in the United States, consisting of over 380 national park units covering 33.6 million ha (83 million acres) of land and water with associated biotic resources (www.nps.gov). The 64 units in the Southeast Region of the NPS represent 16% of the total number of park units in the national park system and cover approximately 5% of the total land base in the entire system. Park units in the Southeast Region include national seashores (Canaveral National Seashore, Cape Hatteras National Seashore), national parks (Great Smoky Mountains National Park, Virgin Islands National Park), national recreation areas (Big South Fork National River and Recreation Area), national preserves (Big Cypress National Preserve), national battlefields (Cowpens National Battlefield, Fort Donelson National Battlefield), national monuments (Congaree Swamp National Monument, Ocmulgee National Monument), and others such as the Blue Ridge Parkway, Obed Wild and Scenic River, and Timicuan Ecological and Historic Preserve.

Southeast NPS units provide habitat for over 400 species of migrating, breeding, and wintering birds and include a wide range of Federal and State listed threatened and endangered species. Likewise, these units also provide nest, migration, and winter habitat for most of the eastern species identified in the national bird conservation plans in need of conservation attention.

Additionally, the NPS attracts over 280 million visitors to the parks each year, 120 million of these in the Southeast Region, affording excellent recreational bird watching and opportunities to strengthen bird conservation interpretation, outreach, and education programs. These opportunities, the NPS mission, policies, and organization all lead to the conclusion that the NPS is an extremely valuable partner and contributor to bird conservation in the region.

Nationally, the status of birds in national parks is largely unknown, although many parks have adequate knowledge regarding bird occurrence in the parks (http://www.npwrc.usgs.gov/resource/othrdata/chekbird/chekbird.htm). Parks often play a role in ongoing regional bird conservation efforts. Indeed many of these parks are often important to regional, national, or international bird conservation, and many have been designated as Important Bird Areas (IBA's) by the National Audubon Society. To date, there are approximately 64 NPS units that are designated IBA's, 35 of which are considered of global importance (http://abcbirds.org/iba/aboutiba.htm). In the Southeast Region, the NPS has 13 globally recognized IBA's.

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The **NPS Inventory and Monitoring (I&M) Program** has been developed to provide management driven scientific information to national park managers so that resources can be adequately protected within national parks. One of the first phases of this program is to inventory vertebrates, including birds, within the 260 national park units in the program. Once completed, data from the inventories will provide an account of the occurrence and abundance of birds in all the national parks in the program. These records will be stored in the NPS I&M NPSpecies database http://www.nature.nps.gov/im/apps/npspp/). Coordination with I&M network staff is important to developing long-term bird monitoring programs that fulfill both park and NABCI objectives.

Park Flight is a NPS international partnership initiative that directs funding toward a variety of NPS programs that involve conservation of neotropical migratory birds whose life history range covers a US national park and a Latin American protected area. A relatively new program, Park Flight offers parks the opportunity to partner with a Latin American national park or protected area to cooperate on developing bird conservation and education projects (NPS 2002).

Recent increases in NPS base funded programs such as inventory and monitoring, exotic species management, habitat restoration, and fire management all indicate that national park managers recognize that park lands are increasingly subject to a variety of threats and conditions that must be improved to provide the quality of national park experience articulated in the NPS Organic Act (1916). Programmatic funding in these areas will increase the ability of national parks to provide quality habitat and conditions for increased wildlife conservation, including birds. Furthermore, private interests and non-profit conservation organizations have initiated programs, including grant programs, to provide much needed funding to national parks to meet backlogs of identified yet unfunded needs.

Park Description

Virgin Islands National Park was established in 1956 with an original boundary of 3,840 ha (9,489 acres). Subsequent expansions in 1962 and 1978 added 2,287 ha (5,651 acres) and 55 ha (136 acres) respectively totaling 6,182 ha (15,276 acres). The primary

legislative mandate of Virgin Islands National Park is to protect outstanding scenic values and features of national significance. In 1976, the United Nations Educational, Scientific and Cultural Organization (UNESCO) through its Man and the Biosphere (MAB) program designated the park as a Biosphere Reserve.

VIIS contains examples of most subtropical Atlantic terrestrial, coastal and marine ecosystems. These include various types of subtropical dry to moist forest, salt ponds, beaches, mangroves, seagrass beds, coral reefs and algal plains. Concerted long-term monitoring of biological resources has been ongoing since the 1960s. In 1993 NPS located the South Florida/Virgin Islands Prototype Long Term Ecological Monitoring Program at Virgin Islands National Park and funding for this program was begun in 1997.

Avian Resources of Puerto Rico and the US Virgin Islands

Puerto Rico and the Virgin Islands are part of the West Indies, a chain of islands that extends from Florida to Venezuela and separate the Caribbean Sea from the Atlantic Ocean. These tropical Islands are located within 17-19° latitude North and 64-68° longitude West about 1,609 kilometers from Florida and 805 kilometers from Venezuela.

The U.S. Virgin Islands are located about 64 kilometers east of the Puerto Rico. These Islands comprise another archipelago that includes St. Thomas, St. John, St. Croix, and numerous uninhabited small islets and cays. The three main Islands were bought by the U.S.A. from Denmark in 1917 and are now U.S. Territory with a total area of 340 km^2.

The number, size and shape of the islands comprised within this region combined with climate, topography, geological processes, and human activities have produced a tremendous diversity of habitats. Historically different types of forest covered most of the land area of Puerto Rico and the Virgin Islands. However, forest conversion caused by agricultural and other land use practices have shaped the present landscape. Forested landscape in the U.S. Virgin Islands is typified by sub-tropical dry forest and littoral shrubs.

Including vagrants, exotics and fossils, the total number of bird species in the region sums to 364. Presently, 276 species are known to occur in Puerto Rico and 210 in the Virgin Islands for a total of 284 species in the region (Raffaele 1989). Recent studies indicate that these numbers may change as many native forms may be reclassified as species or subspecies on their own. Raffaele (1989) categorized the regional birds species as follows: 97 breeding permanent residents (94 in Puerto Rico and 60 in the Virgin Islands), 11 breed and leave (11 in Puerto Rico and 10 in the Virgin Islands), 134 non-breeding migrants and visitors (134 Puerto Rico and 129 the Virgin Islands), 31 introduced probable breeders (31 in Puerto Rico and 6 in the Virgin Islands), five introduced possible breeders (same species for both Puerto Rico and the Virgin Islands), and one species recently extirpated from Puerto Rico. As the numbers indicate, migrant species comprise almost half of the species playing a major role in the ecology of the region. Also noteworthy is the establishment of a high number of exotic species. As a result of combining both native and

exotic species, Puerto Rico supports 85 species of breeding land birds, the greatest number of any West Indian island and except for Cuba, harbors the second largest total number of species in the region (Raffaele 1989).

The oceanic nature of the islands in the region has resulted in increased endemism. Puerto Rico harbors 16 endemic bird species including one endemic genus (*Nesospingus*) represented by a single species, the Puerto Rican Tanager (*Nesospingus speculiferus*) and one family (Todidae) shared with the rest of the West Indian islands but found nowhere else. Rafaele (1989) considered 51 species to be threatened in the region mostly because of the detrimental effects of habitat alteration.

Avian Conservation in VIIS

Avian Biodiversity: VIIS has an avian inventory and a checklist of birds that is available for the public. Staff has identified the need to update the checklist.

Verified records of birds in VIIS have been entered into the NPS I&M program's database, NPSpecies, and may be viewed via the internet at http://www.nature.nps.gov/im/app/npspp with a user identification and password combination authorized by the NPS for NPS personnel and NPS cooperators. For a complete listing of birds documented in the park, see Sasso and Patterson (2002).

Threatened and Endangered Species: Several Federally listed threatened or endangered species nest in the park, most notably Brown Pelican and occasionally the Roseate Tern. The recently delisted American Peregrine Falcon occurs as a rare but regular winter resident in the park and vicinity.

Several USVI Territory **Listed** species occur in VIIS including Brown Pelican, Roseate Tern, White-tailed Tropicbird, Audubon's Shearwater (?), Bridled Quail-Dove, White-crowned Pigeon, White-cheeked Pintail, Least Grebe, Great Blue Heron, Great Egret, Snowy Egret, Black-crowned Night Heron, Puerto Rican Flycatcher, and Least Tern.

Several high priority PIF species for the Caribbean occur in VIIS (see Appendix A and B). Prominent among these species are Roseate Tern, White-crowned Pigeon, Yellow Warbler, White-cheeked Pintail, Bridled Quail-Dove, Audubon's Shearwater (?), Brown Pelican, Scaly-naped Pigeon, Antillean Crested Hummingbird, Puerto Rican Flycatcher, Lesser Antillean Bullfinch, White-tailed Tropicbird, and several Neotropical migrants including Worm-eating Warbler, Black-throated Blue Warbler, Prairie Warbler, and Cape May Warbler. Several high priority species may not occur on St. John or in the park and may include Puerto Rican Screech Owl, Antillean Mango, West Indian Whistling Duck, Caribbean Coot, and Ruddy Duck.

Additionally, many wintering Neotropical migrants, mostly wood warblers, utilize the large continuous forests of the park and St. John. Though many of these species are not listed,

they are of high conservation concern in the continental U.S. and conservation efforts for this species extend to the USVI. Conservation of these species should be coordinated with the Virgin Islands Department of Planning and Natural Resources (VIDPNR) (see contacts).

Park Priorities: Park staff and consultants have not identified any particular species that is a park management concern or high priority for conservation. Rather, park staff is concerned about conserving all birds and their habitats in VIIS. However, several species that occur in VIIS are high priority in the Caribbean and conservation efforts in the park could focus on these species or groups of species.

Inventory: A complete inventory has been recognized as important information for park managers and is being conducted within the framework of the NPS I&M Program. VIIS is one of seven parks in the NPS South Florida/Caribbean I&M Network for which a plan to conduct high priority inventory projects has been prepared (Sasso and Patterson 2000). Although VIIS avian inventory is considered complete in relation to the NPS's I&M goals (90% or greater species known), additional inventory is desired to determine breeding bird distribution and abundance in the upland portions of the park.

Monitoring: Currently, several avian monitoring projects are being conducted at VIIS. These are:

- Brown Pelican surveys are conducted weekly to count nesting pairs and numbers of chicks in nests
- Colonial waterbird surveys are conducted in cooperation with the VIDPNR) and US Fish and Wildlife Service
- Least Tern nesting at Salt Pond is monitored during nesting season
- Park staff participate in a Christmas Bird Count (CBC) which is centered on St. John
- Laurel Trager, Division of Interpretation, records observations in a personal journal

Research: Scientific research is permitted within the park. Currently, USFWS staff from Puerto Rico are conducting a constant effort mist netting program in the park to better determine how the role that the park has in stopover and wintering ecology of Neotropical migrants.

Outreach: The park has a very active interpretive and outreach program related to birds and bird conservation. Highlights include:

- Weekly bird walks at Mary Point Pond conducted by Interpretive specialist, Ms. Laurel Trager, every Sunday year around
- Occasional presentations for students at Virgin Islands Ecological Research Station (VIERS) and park visitors at Cinnamon Bay Campground
- Occasional bird walks at various locations for students at Pine Peace School

- Educational programs presented to students at Pine Peace School
- Community Foundation donated binoculars to students
- Audubon Society bought bird books and David Attenborough videos for students
- Audubon Society published bird guide to Reef Bay, a prominent park watershed
- Articles written for local newspaper

Park Identified Needs for Avian Conservation

VIIS has identified several projects that would increase the avian knowledge of the park. These are:

Monitoring

- Establish a winter Neotropical migrant monitoring program, either repeating work conducted by Askins and Ewert or establishing a new program with comparable results

Data Management:

- Analyze Rob Norton's CBC warbler count data during the 1970's to mid 1980's
- Analyze CBC shorebird data

Coordination with Regional Conservation Initiatives

North American Bird Conservation Initiative

NABCI bird conservation planning units, referred to as Bird Conservation Regions (BCR), are often larger than other planning units associated with other plans, such as Partners In Flight. For example, VIIS is within the NABCI BCR 69 that includes all of the Commonwealth of Puerto Rico, the US Virgin Islands and the British Virgin Islands and includes the physiographic region designated by Partners in Flight as Puerto Rico/Virgin Islands (Figure 2; compare to Figure 1).

Several NABCI BCR's have coordinators whose primary responsibility is to coordinate all bird conservation planning in the BCR, across all agencies and organizations. Currently, the Caribbean BCR does not have a designated coordinator; however, the assistant coordinator for the Atlantic Coast Joint Venture (ACJV) can provide valuable assistance to VIIS with implementation of aspects of this ACIP.

North American Waterfowl Management Plan (NAWMP)

The NAWMP (http://northamerican.fws.gov/NAWMP/nawmphp.htm) is completed and has been revised several times, incorporating updated goals and strategies based on new information. This plan is one of the most successful bird conservation delivery programs in the United States, being monetarily supported by the North American Wetlands Conservation Act (NAWCA). This plan can be consulted for priority waterfowl conservation

needs in the Virgin Islands. The ACJV assistant coordinator has coordination responsibility for the USVI.

Partners In Flight

Goals and strategies for the Caribbean can be found in the draft bird conservation plan, previously submitted to the park (Nunez-Garcia and Hunter 2000). The park will receive updates of the plan as they are completed. The current plan identifies priority bird and habitat conservation goals that must be implemented in order to achieve bird conservation success in this region. Because the Partners In Flight bird conservation plan for this region is better developed than other plans, and includes all species, VIIS will utilize this plan more than any other plan to participate in NABCI implementation.

Similar to NABCI BCR's, PIF physiographic areas often do not have designated coordinators. However, state level non-game agencies with investment in PIF will establish key personnel to develop partnerships among cooperators in the physiographic area. The VI territorial government, Department of Natural Resources has prime responsibility for implementation of the Puerto Rico/US Virgin Islands Partners in Flight bird conservation plan and can be instrumental in implementing recommendations identified in this ACIP and projects important to bird conservation relative to the VI's role in Caribbean bird conservation.

United States Shorebird Conservation Plan (USSCP)

The USSCP has been completed and is available on the world wide web (http://shorebirdplan.fws.gov/). A regional step down plan is in preparation by FWS personnel and should be available in 2003.

Waterbird Conservation for the Americas (WCA)

The WCA plan has been completed and is available on the World Wide Web or can be ordered from the US Fish and Wildlife Service National Conservation Training Center (http://www.waterbirdconservation.org/).

Integration of NABCI Goals and Objectives into Park Planning and Operations

NABCI Implementation Recommendations

To successfully achieve park-established goals and actively participate in NABCI, the park could implement a variety of projects in different NPS programs. Most of these projects would require some level of participation by many existing park programs and could either be achieved through NPS funding, or more likely, through establishing or improving

partnerships with agencies and organizations that already have the necessary expertise to provide guidance, funding, and execution of these programs. Programmatic areas where bird conservation actions are likely to be focused are:

- Inventory
- Monitoring
- Habitat Restoration
- Threat Management (includes exotic species, air quality, water quality, etc.)
- Research
- Compliance
- Outreach
- Partnerships

To the extent appropriate, each of these program areas will be discussed separately and within each, specific opportunities identified that, when implemented, will enable to park to meet its mandates (current and expected) as well as integrate NABCI into its planning and operations. With emphasis added, the park is not expected to implement any of these recommendations or be obligated to pursue any opportunity other than those the park is required to do by law or NPS program or policy. In other words, participation in this effort is currently voluntary. However, participation in these efforts at some level could become mandatory with the completion of an MOU with the FWS regarding EO 13186, **Responsibilities of Federal Agencies to Protect Migratory Birds**. The MOU will establish a formal agreement between the FWS and the NPS to promote bird conservation within the agency by incorporating goals and strategies of existing bird conservation initiatives, plans, and goals into park planning and operations.

Should the park decide to implement any of these projects, further consultation with bird conservation contacts is encouraged to obtain updated information on the relevance of these opportunities in regional bird conservation.

High priority projects are identified in **bold** print. Priorities that the park is encouraged to seek NPS funding for are marked with and asterisk (*****). These projects are those that are critical to the stabilization or improvement of a bird population in the planning region.

Inventory

The park has inventoried its bird fauna exceptionally well. Although the avifauna of VIIS is well documented, distribution and abundance data are desired to fully understand the status of birds in the park so that conservation actions for birds can be implemented, especially for Neotropical migrant birds wintering in the park. Status of high priority species as identified in the Puerto Rico/US Virgin Islands bird conservation plan and the USVI territorial watchlist is needed to effectively structure park management for the continued preservation and enhancement of the park's avifauna.

Abundance and distribution data are needed

- **for wintering birds in the subtropical dry and moist forests, particularly Neotropical migrants***
- **for birds that nest in mangroves***
- **for resident breeding birds in the subtropical dry and moist forests, especially for High Priority forest species such as Bridled Quail-Dove and White-crowned Pigeons***
- **for White-tailed and Red-billed Tropicbirds and Audubon's Shearwater**
- **to determine presence of rare or potentially extirpated species such as Puerto Rican (Virgin Islands) Screech Owl and Antillean Nighthawk**
- **for nesting, migrating, and wintering shorebirds in salt pond habitats of the park, particularly American Oystercatcher and Wilson's Plover.**

Additionally, the park is encouraged to:

- **partner with the VIDPNR and USFWS to coordinate area inventory efforts**
- **verify other avian observational data collected in the park and enter into the appropriate database (NPSpecies, eBird Monitoring Program of Cornell's Laboratory of Ornithology, Columbid Database, etc.)**
- **standardize inventory and monitoring methodology to conform to NPS and/or FWS recommended standards (Fancy and Sauer 2000, Hunter 2000).**

Monitoring

The park has an active bird monitoring program resulting in documentation of many high priority species identified for conservation effort in the Caribbean and occur in the park. Efforts should be made to continue existing monitoring programs, striving to conform to established NPS or FWS surveys protocols. Close coordination with adjacent bird conservation initiatives are needed to identify and implement high priority projects on park lands and to ensure that park efforts contribute to park or regional bird conservation rather than undertake an action or actions that are not needed or are better conducted in other areas. Specific recommendations are to:

- **continue to conduct existing monitoring programs and enter data into the appropriate database (NPSpecies, eBird, or National Point Count Database (USGS 2001) (http://www.mp2-pwrc.usgs.gov/point/)**

- **establish shorebird monitoring program at various salt ponds, especially Salt Pond and Mary Point Pond using International Shorebird Survey (ISS) protocol and submit data to Manomet Center for Conservation Sciences***

- **monitor resident and migrant birds at established forest point counts along ecologically distinct or vegetative/habitat types ***

- **establish monitoring programs based on results of inventory data for High Priority species and with potential for high conservation role for any of these species**

- **standardize inventory and monitoring methodology to conform to NPS and/or FWS recommended standards (Fancy and Sauer 2000, Hunter 2000).**

- **partner with USVI territorial Department of Natural Resources and USFWS staff to coordinate area monitoring efforts**

Habitat Restoration/Management

Recently, habitat restoration efforts have increased on NPS lands; NPS receiving restoration emphasis and guidance in the 2001 Management Policies (NPS 2001). Habitat restoration efforts that parks may undertake are wetland restoration, grassland restoration, woodland restoration, etc. utilizing a wide range of tools to accomplish the restoration. Some of these tools may be but not limited to forest management practices, exotic species management, public use and recreation management, and infrastructure development management.

Due to the protected nature of VIIS lands, and generally those in the national park system, the condition of habitats for bird use may be of higher quality than other natural, developed, agricultural, or forest lands under other management regimes. However, national park lands can be greatly improved for wildlife, and particularly bird use, by restoring processes important for habitat formation, succession, and structural development. Largely, these processes have not been managed historically in the national park system but current policy allows for active management of species, populations, and lands to provide for long-term conservation of park resources.
Protection, restoration, and enhancement of habitats in VIIS can greatly contribute to

established habitat goals identified in the Puerto Rico/US Virgin Islands bird conservation plan.

Research suggests that the large contiguous moist forests of St. John provide significant habitat for wintering Neotropical migrants (Askins et al. 1989). Management efforts should strive to maximize the amount of remaining forests in the park by avoiding or minimizing park developments, acquiring inholdings, and acquiring conservation easements with landowners on adjacent land and inholdings.

Specific recommendations are to:

- **continue mangrove restoration in Lameshur and protect remaining mangroves throughout the park**

- **identify inholdings of high value and work with landowner to acquire conservation easement or fee title to land***

- **avoid or minimize park developments**

- **work with VI Coastal Zone Management and community developers to design appropriate landscapes suitable for island avifauna and minimize impacts to native habitats and species**

- **develop a Wild Burro Management Plan that identifies the need to reduce or eliminate their impact on forest vegetation and soils***

- restore and/or improve hydrological quality and processes where needed, especially in coastal mangrove and salt ponds

- assess Pre-Columbian landscape cover and determine feasibility of restoring landscape within the context of the park's enabling legislation

Threat Management

Impact of exotic species on birds at VIIS is perhaps the greatest threat to the avifauna of VIIS. Though this impact is largely unquantified, the elimination of many ground nesting animals, including birds, by the introduced mongoose is well documented throughout the Caribbean. Other significant introduced mammals such as feral hogs, domestic and feral dogs and cats, feral and domestic goats, and wild burros occur in the park and may damage birds directly through predation or habitat alteration. The park is encouraged to:

- **continue to aggressively reduce populations of these species throughout the island and cooperate with VIDPNR to manage the wild burro population**

- **manage visitor use and predation (fencing?) at Salt Pond to reduce or eliminate these disturbances to the Least Tern nesting colony***

- **identify, monitor, and document bird mortality associated with the communication tower on Bordeaux Mountain, especially during migrations of Neotropical migrants***

- **work with adjacent landowners and neighbors, the local community, and pubic officials to curb unregulated and free roaming feral and domestic dogs, cats, pigs, and goats in the park***

- **identify potential bird injury or mortality associated with fishing gear and fishing practices in the park and nearby waters, especially for Brown Pelican and Brown Booby***

Although exotic plants species are negatively impacting habitat at VIIS, the nature of this impact on native birds is unknown. Genip and Spanish Lime are common in the moist gallery forest of the park, and the basin moist forest has essentially been extirpated by colonization by Genip and Sweet Lime. It is important to

- **establish and continue inventory and monitoring of exotic plant species***

- **identify any potential impact these species have on native avifauna***

- **establish appropriate management programs to restore native forests***

If necessary, consult with regional Exotic Plant Management Team (EPMT) to remove exotic plant species. Currently, no EPMT provides service the VIIS area. Until an EPMT is established that can provide assistance to VIIS, staff is directed to consult with the regional pest management specialist (see contacts).

Additionally, the park is encouraged to:

- **hire additional protection staff to better manage threats and implement projects identified in this plan***

- **develop close working relationship with VIDPNR Coastal Zone Management to promote protection of islands natural resources**

- **develop aggressive outreach and education program for ongoing rat, cat, and**

mongoose eradication/reduction efforts*

Research

- **determine feasibility to reintroduce extirpated species that occur elsewhere in the Caribbean (Puerto Rican Screech Owl)**

- **cooperate with research scientists who desire to conduct research on avian ecology**

- **list park needs and projects on Research Permit and Reporting System web site (RPRS)**

- develop contact with South Florida/Caribbean Cooperative Ecosystem Studies Unit (CESU) at the University of Miami, Miami, FL

Compliance

Park compliance with the Migratory Bird Treaty Act and the Executive Order 13186, **Responsibilities of Federal Agencies to Protect Migratory Birds,** is necessary to assure that park activities incorporate bird conservation into park planning and operations. Further, to ensure that migratory birds are considered in all phases of park planning processes, especially during the National Environmental Policy Act (NEPA) and the Director's Order #12 Compliance processes, the park should consider adding specific language in project evaluations that requires consideration and implications of park projects on migratory birds. The MOU being developed between the NPS and the FWS will likely contain specific language requiring a park to consider implications of park projects on migratory birds. Additional considerations are to encourage:

- **park staff to begin specific consideration of migratory birds during park planning processes***

- park staff to attend USFWS training on implementation of EO 13186 at the National Conservation Training Center (NCTC) (when available) or other training on migratory bird conservation in North America. NCTC has several courses and training related to conservation of migratory birds (http://training.fws.gov/courses.html).

The USFWS NCTC offers and reserves two tuition free slots for National Park Service employees wishing to attend NCTC courses on a first come, first served basis. Additionally, discount lodging is also available while attending a NCTC course.

Outreach

- **participate in International Migratory Bird Day (IMBD) events with a local partner (http://birds.fws.gov/imbd.html)***

- **update the bird checklist for public availability***

- **nominate VIIS as an Important Bird Area (http://www.abcbirds.org/iba/nominstr.htm)***

- **continue to develop and implement outreach and educational programs to enhance visibility of bird conservation issues***

- **develop aggressive outreach and education program for ongoing rat, cat, and mongoose eradication/reduction efforts**

- **continue to provide bird conservation information and issues in the Virgin Island Audubon Society newsletter, *The Bananaquit***

- **encourage Virgin Islands Audubon Society to participate in ongoing and new inventory and monitoring programs**

- **encourage accurate documentation and reporting from these and random outings by visitors (see Cornell University's eBird monitoring program (Cornell Lab. Ornith. 2002 (http://www.ebird.org/about/index.jsp)**

- **work with adjacent landowners and neighbors, the local community, and pubic officials to curb unregulated and free roaming feral and domestic dogs and cats in the park**

- **develop Parks as Classrooms project related to habitat and bird conservation***

- **acquire bird coloring books and other outreach materials from USFWS and distribute at visitor center, school programs, and contact points**

- **develop and produce a recording of bird calls common to the island**

- **develop bird identification posters for schools in the area**

- park interpretation/education staff are encouraged to attend USFWS training on

Migratory Bird Education at NCTC

- consider adding links to bird conservation information, data, etc. to the park's web site home page

- support bird conservation by serving shade-grown coffees at meetings, events, and the office buildings in the park (http://www.americanbirding.org/programs/conssbcof3.htm)

- participate in bird conservation efforts of the Society for the Conservation and Study of Caribbean Birds (SCSCB), including subscribing to this organization's electronic information forum

- explore cultural affiliation of landscape to inhabitants, both historical and contemporary. Cultures are strongly tied to the landscape they inhabit and birds often play a role in a cultural tie to the landscape. When these connections are discovered and preserved, a greater appreciation for the landscape and it's value to the culture can be achieved

- summarize and publish known information on prehistoric avifauna (extinct shearwater and flightless rail) of St. John

- summarize and publish Taino use of birds on St. John

Partners and Partnerships

Partnerships for land conservation and protection will perhaps have the greatest positive influence on bird conservation above all other landscape scale planning. Specific recommendations are to:

- **keep abreast of USVI territorial initiatives that could impact park resources, particularly with Coastal Zone Management**

- **cooperate and VIDPNR in the preparation and implementation of the USVI Comprehensive Wildlife Conservation Plan**

- **work with the White-crowned Pigeon Working Group of the SCSCB to determine appropriate conservation actions for this species in the park**

- **become a contributing member of the Caribbean Columbid Population Data Center, a cooperative effort of the Puerto Rico Department of Natural Resources, USFWS, and other Caribbean interests to assess populations**

status and implement conservation actions necessary for these species

- **contact the nearest Joint Venture office (see Funding section for explanation of Joint Ventures) or BCR coordinator to develop partnerships and funding proposals tiered to priorities established by the park, this ACIP, and the Puerto Rico and US Virgin Islands Bird conservation plan**

- **encourage the USVI territorial government to become a member of the Atlantic Coast Joint Venture, increasing USVI partners chances to utilize NAWCA funds for bird and habitat conservation projects**

- continue to maintain productive relationship with local Audubon Society

- explore the potential to strengthen the Man and the Biosphere program

- explore the potential to utilize facilities and expertise at the Virgin Island Environmental Research Station (VIERS) to conduct needed avian research and implementation of aspects of this plan

Funding Opportunities

Internal NPS funding is often an effective source to obtain funding; however, the project will have to be a fairly high priority among the park's natural resource program to successfully compete for the limited funding available in the NPS. Therefore, partnerships and outside funding programs are often more productive for securing bird conservation funding. Within this ACIP, identified priority projects that are considered to be high park priorities as well as NABCI priorities are marked with and asterisk (*). VIIS is encouraged to enter all high priority projects into the NPS Performance Management Information System (PMIS) database.

Funding for conservation projects for neotropical migrants is also available through the Park Flight program.

With the exception of the North American Waterfowl Management Plan (NAWMP and its associated funding legislation, the North American Wetland Conservation Act), funding opportunities for bird conservation programs, plans, and initiatives have been lacking. Only within the last decade have other appropriate and specific sources for bird conservation funding been created and used. The NAWMP has been supported for approximately 14 years by the North American Wetlands Conservation Act (NAWCA 1989). This program has provided $487 million in appropriated funds matched with $1.7 billion for wetland and bird conservation projects since its inception. In 2002 alone, over $70 million US dollars were awarded to US and Canadian agencies and organizations to enhance waterfowl populations by improving, restoring, or protecting wetland habitats. To adequately evaluate projects and distribute these funds, partnerships called Joint Ventures

were established. Nationally, 14 (11 US, 3 Canada)
Joint Ventures have been established, several which are funded and staffed. Internet links to Joint Ventures are:

(http://southwest.fws.gov/gulfcoastjv/ojvcontact.html) and
(http://northamerican.fws.gov/NAWMP/jv.htm).

Funding through NAWCA is highly underutilized by the NPS and any park unit that has wetland, water, or bird conservation needs associated with wetland are encouraged to investigate using this funding source. Naturally, there are certain requirements to be eligible for all grants and park managers are encouraged to consult with the nearest Joint Venture, BCR, PIF Coordinator, to learn how this program might be applicable to implementation of this plan, and other park wetland issues. VIIS is not within a region which has an operational Joint Venture, but contact with the Atlantic Coast Joint Venture will provide opportunity to investigate use of this funding source and developing proposals.

Internal FWS funding programs may be used to support projects, but no effective method of project proposal delivery to these sources is currently in place for the NPS. Current funding in these programs may result from FWS familiarity with NPS needs, or

NPS participation in one of the area FWS Ecosystem Teams, where a project has been identified and proposed to be funded through the Ecosystem Team.

One unexplored yet potentially fruitful funding source for national parks is the myriad of grants through the FWS State Programs, where grants are awarded to private individuals engaged in habitat conservation projects. No funding is directly available to national parks, but identified projects with important or critical adjacent landowners can sometimes be funded through these sources. Similar programs are available if the adjacent landowner is a federally recognized American Indian tribe.

Specific congressional appropriations to protect migratory birds has recently been authorized under the Neotropical Migratory Bird Conservation Act (2000) (http://www.nfwf.org/programs/nmbcapp.htm). Appropriations through this Act are authorized up to $5 million per year. However, in 2000, appropriation was approximately $3.75 million and a majority of this funding was directed toward projects in Central and South America.

Many of the identified projects are eligible for funding under various grant programs of the National Fish and Wildlife Foundation (http://www.nfwf.org/programs/programs.htm).

Other prominent funding sources available to NPS managers for bird conservation are listed on this projects web site at:

http://southeast.fws.gov/birds/NPSHighlits.htm.

Funding opportunities for migratory bird conservation are available yet most natural resource agencies are not fully aware of and/or understanding of how to use these sources. Perhaps a consolidated migratory bird funding source catalog will become available to managers in the future; this is needed.

Contacts

Primary contacts within the region can be obtained by viewing the web site for the Southeastern Bird Conservation Initiative, National Park Service at http://southeast.fws.gov/birds/npsbirds.htm. This web site will provide contact information of the appropriate bird conservation coordinator in the region for park personnel. Park staff are encouraged to view the web site and obtain contact information. Primary contacts for VIIS are:

Virgin Islands Department of Planning and Natural Resources

Ms. Judy Pierce
VIDPNR
St. Thomas, USVI
sula@vitelcom.net

Mr. Doug McNair
VIDPNR
St. Thomas, VI
dbmcnair@vipowernet.net

US Fish and Wildlife Service

Mr. Keith Watson
US Fish and Wildlife Service
160 Zillicoa Street, Suite D
Asheville, NC 28801
828-350-8228
Keith_Watson@fws.gov

Mr. Craig Watson
US Fish and Wildlife Service
Atlantic Coast Joint Venture
Charleston, SC
843-727-4707 ext. 16
Craig_Watson@fws.gov

Mr. Dean Demarest
US Fish and Wildlife Service
1875 Century Blvd.
Atlanta, GA
404-679-7371
dean_demarest@fws.gov

Ms. Jennifer Wheeler
US Fish and Wildlife Service
Waterbird Conservation Plan Coordinator
703-358-1714
Jennifer_A_Wheeler@fws.gov

Mr. Chuck Hunter
US Fish and Wildlife Service
Regional Refuge Biologist
Atlanta, GA
404-679-7130
Chuck_Hunter@fws.gov

Mr. Steve Earsom

US Fish and Wildlife Service
Caribbean Refuge Complex Biologist
Boqueron, PR
Steve_Earsom@fws.gov

National Park Service

Mr. Jim Petterson
Virgin Islands National Park
Inventory and Monitoring Coordinator
Cruz Bay, St. John
Jim_Petterson@nps.gov

Ms. Laurel Trager
Virgin Islands National Park
Division of Interpretation
St. John, USVI
Laurel_Tragers@nps.gov

South Florida/Caribbean (SF/C) Inventory & Monitoring Network
Mr. Matt Patterson
SF/C Network Coordinator
National Park Service
Homestead, FL
Matt_Patterson@nps.gov

Exotic Plant Management
Mr. Chris Furqueron
404-562-3113 ext 540
National Park Service
Exotic Plant Management Coordinator
Chris_Furqueron@nps.gov

Cooperative Ecosystem Studies Unit

Dr. Carol Daniels
South Florida/Caribbean CESU
Rosentiel School of Marine and Atmospheric Sciences
University of Miami
Miami, Fl
Carol_Daniels@nps.gov

Others

Mr. Mark Wimer
US Geological Survey
Biological Research Division
Patuxent Wildlife Research Center
Patuxent, MD
Mark_Wimer@usgs.gov

Frank Boyd
USDA APHIS Wildlife Services
Director, USVI
118 Extension Hall
Auburn University, AL 36849
334-844-5670
fboyd@acesag.auburn.edu

Dr. Robert Askins
Connecticut College
New London, CT
raask@conncoll.edu

Dr. David Ewert
The Nature Conservancy – Michigan
East Lansing, MI
dewert@pilot.msu.edu

The Nature Conservancy –Eastern Caribbean
100 Blackbeard's Hill, Unit 8-C
St. Thomas, VI 00802
(340) 774-7633

Mr. Will Henderson
Virgin Islands Audubon Society
St. John, USVI
http://www.audubon.org/affiliate/vi/vi/

Mr. Bob Cook
Virgin Islands Audubon Society
http://www.audubon.org/affiliate/vi/vi/

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APPENDIX A

PUERTO RICO AND VIRGIN ISLANDS (BCR 69) BASED ON CONTINENTAL AND REGIONAL WATCH LIST AMONG ALL BIRDS WITHIN SOUTHEAST U.S., AND THE WEST INDIES*

(Action Levels: IM=Immediate Management; MA=Management Attention; PR=Long-Term Planning and Responsibility) (subspecies/populations of interest noted; all species breed or are resident unless otherwise indicated; ba=number of breeding adults)

Tier I. Continental Conservation Interest

a. Multiple Causes for concern across entire range

White-tailed Tropicbird	(500-600 pairs, 14-19% in West Indies)	IM
Red-billed Tropicbird	(375-450 pairs, 14-22% in West Indies)	IM
West Indian Whistling-Duck	(<100 ba, 1-5% globally)	IM
Black Rail	(Extirpated?)	IM
Snowy Plover	(Threatened Pacific Coast; West Indies subspecies)	IM
Piping Plover	(Endangered, winter)	IM
Plain Pigeon	(Endangered; <5,000 ba, <10% globally)	IM
Puerto Rican Parrot	(Endangered; <100 ba in the wild, 100% globally)	IM
Puerto Rican Nightjar	(Endangered; <2,000 ba, 100% globally)	IM
White-necked Crow	(Endangered/Extirpated from Puerto Rico)	IM
Bicknell's Thrush	(Possible rare winter in Puerto Rico)	PR
Golden-winged Warbler	(Rare winter)	PR
Elfin-Woods Warbler	(Candidate for Listing; <1,000 ba, 100% globally	IM
Yellow-shouldered Blackbird	(Endangered; <500 ba, 100% globally)	IM

b. Moderately abundant or widespread with declines and/or high threats

Audubon's Shearwater	(~150 pairs, 2-4% in West Indies)	IM
Masked Booby	(300 pairs, 50% in West Indies)	IM
Red-footed Booby	(1,450-2,650 pairs, 15-33% in West Indies)	IM
Brown Booby	(2,075-2,300 pairs, 22-36% in West Indies)	MA
Little Blue Heron		MA
American Golden-Plover	(Rare southbound transient)	PR
Lesser Yellowlegs	(non-breeding)	MA
Solitary Sandpiper	(transient)	MA
Upland Sandpiper	(Rare transient)	PR
Whimbrel	(non-breeding)	MA
Sanderling	(non-breeding)	MA
Semipalmated Sandpiper	(non-breeding)	MA
Western Sandpiper	(non-breeding)	MA
Stilt Sandpiper	(non-breeding)	MA
Wilson's Snipe	(winter)	MA
Gull-billed Tern	(non-breeding?)	PR
Roseate Tern	(North Atl. Endangered, West Indies Threatened; 1,200-3,600 pairs, >25% in West Indies)	IM
Least Tern	(Calif. & interior subspecies Endangered; 300-450 pairs, 8-25% in West Indies)	IM
White-crowned Pigeon		MA
Mangrove Cuckoo		MA

Short-eared Owl	(Greater Antillean subspecies)	MA
Puerto Rican Vireo	(100 % globally)	MA
Prairie Warbler	(winter)	MA
Prothonotary Warbler	(winter)	MA
Worm-eating Warbler	(winter)	MA
Kentucky Warbler	(Rare winter)	PR
Greater Antillean Oriole	(10-20% globally)	MA

c. Restricted distributions and/or low population size

Magnificent Frigatebird	(700-900 pairs, 13-21% in West Indies)	IM
Reddish Egret	(Rare, non-breeding)	PR
Caribbean Coot	(1,000 ba, <50,000 West Indies)	IM
Wilson's Plover		MA
American Oystercatcher	(Eastern North American subspecies)	IM
Red Knot	(non-breeding; presumably Alaskan subspecies)	PR
Bridled Tern	(900-1,700 pairs, 15-40% in West Indies)	MA
Antillean Nighthawk		PR
Black Swift	(West Indian subspecies)	MA
Lesser Antillean Pewee	(Puerto Rican subspecies)	PR
Blue-winged Warbler	(Rare, winter)	PR
Adelaide's Warbler	(100% globally)	PR
Swainsons's Warbler	(Rare, winter)	PR

Tier II. Regional Conservation Interest

a. High Concern

Brown Pelican	(West Indies, Endangered; 520-850 pairs, 25-40% in West Indies)	IM
Green Heron		MA
Yellow-crowned Night-Heron		PR
Black-bellied Plover	(non-breeding)	MA
Ruddy Turnstone	(non-breeding)	MA
Least Sandpiper	(non-breeding)	MA
Antillean Mango	(nearly extirpated on Virgin Islands)	MA
Black-whiskered Vireo		PR

b. High Threats

Pied-billed Grebe	(breeding populations only)	MA
Least Bittern		MA
Black-crowned Night-Heron		MA
Greater Flamingo	(Extirpated as a resident, may be recolonizing)	MA
White-cheeked Pintail	(Lesser subspecies; <5,000 ba Puerto Rico-Virgin Islands; ~60,000 ba in West Indies)	MA
Ruddy Duck	(West Indian subspecies; ~1,500 ba Puerto Rico; <<50,000 ba West Indies)	MA
Masked Duck	(West Indian populations; <100 ba Puerto Rico; <<50,000 ba West Indies)	MA
Sharp-shinned Hawk	(Puerto Rican subspecies, Endangered; <100 ba)	IM
Broad-winged Hawk	(Puerto Rican subspecies, Endangered; <100 ba)	IM
American Kestrel	(Eastern Caribbean subspecies)	MA

Clapper Rail		MA
Yellow-breasted Crake	(Hispaniolan-Puerto Rican subspecies)	MA
Purple Gallinule		MA
Limpkin	(Hispaniolan-Puerto Rican subspecies)	IM
Willet		MA
Key West Quail-Dove		MA
Bridled Quail-Dove		MA
Puerto Rican Screech-Owl	(Virgin Islands subspecies, extirpated except on Culebra?)	IM
Yellow Warbler	(West Indian "Golden" subspecies)	MA
Louisiana Waterthrush	(winter)	MA

c. High Responsibility

Tricolored Heron		PR	
Black-necked Stilt			PR
Pectoral Sandpiper	(transient)		PR
Sooty Tern	(55,000-80,000 pairs, 20-40% in West Indies)		PR
Black Tern	(transient)		PR
Brown Noddy	(1,300-2,100 pairs, 7-18% in West Indies)		PR
Scaly-naped Pigeon			PR
Zenaida Dove			PR
Puerto Rican Lizard-Cuckoo	(100% global)		PR
Puerto Rican Screech-Owl	(Puerto Rican subspecies; 100% globally)		PR
Green Mango	(100% globally)		PR
Antillean Crested Hummingbird			PR
Puerto Rican Emerald	(100% globally)		PR
Puerto Rican Tody	(100% globally)		PR
Puerto Rican Woodpecker	(100% globally)		PR
Caribbean Elaenia			PR
Puerto Rican Flycatcher	(100% global, nearly extirpated Virgin Islands)		PR
Gray Kingbird			PR
Loggerhead Kingbird	(Puerto Rican-Vieques subspecies)		PR
Caribbean Martin			PR
Cave Swallow			PR
Red-legged Thrush	(Hispaniolan-Puerto Rican subspecies)		PR
Northern Parula	(winter)		PR
Cape May Warbler	(winter)		PR
Black-throated Blue Warbler	(winter)		PR
Puerto Rican Tanager			PR
Puerto Rican Spindalis			PR
Antillean Euphonia			PR
Puerto Rican Bullfinch	(Puerto Rican subspecies; 100% globally)		PR
Grasshopper Sparrow	(Puerto Rican subspecies)		PR

Tier III. Additional State, Territorial Listed Species (drawn from species in Tier IV)

Least Grebe	PR
Great Blue Heron	PR
Great Egret	PR
Snowy Egret	PR

Tier IV. Additional Local or Regional Interest Species (also Stewardship Species identified by Avifaunal Biome supporting vast majority of breeding population)

Glossy Ibis			PR
Northern Pintail	(winter)		MA
Blue-winged Teal	(winter)		MA
Lesser Scaup	(winter)		MA
Northern Harrier	(winter)	PR	
Osprey			PR
Merlin	(mostly transient)		PR
Peregrine Falcon	(mostly transient)		PR
Sora	(winter)		PR
Common Moorhen			PR
Semipalmated Plover	(non-breeding)		PR
Killdeer			PR
Greater Yellowlegs	(non-breeding)		PR
Spotted Sandpiper	(non-breeding)		PR
White-rumped Sandpiper	(transient)		PR
Royal Tern	(115-315 pairs, >25% in West Indies)		PR
Sandwich Tern	(800-3,600 pairs, 28-71% in West Indies)	PR	
White-winged Dove			PR
Mourning Dove			PR
Yellow-billed Cuckoo			PR
Common Nighthawk			PR
Chuck-will's-widow	(Rare, winter)		PR
White-eyed Vireo	(Rare, winter)		PR
Yellow-throated Vireo	(Rare, winter)		PR
Magnolia Warbler	(Northern Forest Biome, winter)		PR
Yellow-throated Warbler	(winter)		PR
Palm Warbler	(Northern Forest Biome, winter)		PR
Blackpoll Warbler	(transient)		PR
Black-and-white Warbler	(winter)	PR	
American Redstart	(winter)		PR
Ovenbird	(winter)		PR
Northern Waterthrush	(winter)		PR
Hooded Warbler	(Rare, winter)	PR	
Indigo Bunting	(non-breeding)		PR
Bobolink	(transient)		PR
Baltimore Oriole	(transient)		PR

*

WL=WatchList score used for Continental Scoring (PIF Approach); species with WL SUBTOT combined scores of (1) 15 or more, (2) 14 with Tmax+PT $\geq$5, or (3) with 13 with PT=5 are identified. using formula:

Combined Score = PT + PS + maximum of (BD or ND) + maximum of (TB or TN)

Tier=

I. Continental Conservation Interest (Continental WatchList): (a) Species with multiple causes for concern across their entire range; (b) Moderately abundant or widespread species with declines or high threats, and (c) Species with restricted distributions or low population size.

Species with multiple causes for concern across their entire range: These species are considered by many to be of highest continental concern and of highest priority for conservation actions at national and international scales. A majority of these are legally listed as Endangered or Threatened in either the U.S. or Canada, and as such have recovery plans in place. Notable in this group, however, are several species without legal status, including Bicknell's Thrush and Saltmarsh Sharp-tailed Sparrow.

Moderately abundant or widespread species with declines or high threats: These species are on the Watch List primarily because they are declining and/or threatened throughout their range, though still fairly widespread or with moderately large populations. Many of these species still number in the millions (e.g. Dickcissel, Wood Thrush), but are threatened with serious reductions in population or geographic range in the future. Several other species (e.g. Swallow-tailed Kite, Mangrove Cuckoo, Elegant Trogon) are fairly widespread outside the U.S. and Canada, but are threatened in the U.S. portion of their range. Five species are afforded U.S. federal legal status in part of their range or for a particular recognized subspecies. This group also includes four resident game bird species with seriously declining populations.
Species with restricted distributions or low population size: These species are on the Watch List because they are restricted to a small range or have small global populations (often both). Many of these species are not known to be declining or seriously threatened at present, but many others are, (e.g. Spotted Owl, Montezuma Quail, Bendire's Thrasher, Rufous-winged Sparrow, Audubon's Oriole). We recognize that these species with small populations and restricted range are particularly vulnerable to relatively minor changes from current conditions, whether or not their populations are currently in decline.

II. Regional Conservation Interest (non-WatchList; TOT$\geq$19): (a) high regional concern (AI+PT$\geq$8); (b) high regional threats (TB+TN$\geq$7, or TB or TN=5) and includes taxa (subspecies and populations) of regional conservation interest not otherwise included in categories above; (c) high regional responsibility (as measured by percent of global, continental, or regional populations).

III Additional Federally and/or State listed.

IV Local or regional concern or interest, including Stewardship Species as defined in the Continental PIF Plan for North America:

Stewardship Species: Stewardship Species, whether on the Watch List or not, are of continental importance because they represent all the large biogeographic regions in North America. They are broadly distributed across Canada and the U.S. during the breeding seasons, in a pattern that mirrors the richness of all landbird species. Winter Stewardship Species are much more heavily concentrated in the southern U.S., particularly the southwest and into Mexico, and along the U.S. west coast. Stewardship actions that preserve healthy populations of these species will address the PIF goal of 'keeping common birds common.' These species, which are both of high overall concern and also largely dependent on a single biogeographic region, merit special attention for conservation action within their core range.

Component Scores to determine Continental WatchList (minus AI) and Regional Scores (and all smaller geographical units, Bird Conservation Regions, Physiographic Areas, States, Provinces, Territories, etc.) are defined as follows:

PT=Population Trend based on a combination of data sources, principally BBS tempered by local and state datasets for breeding species. For non-breeding species usually best professional judgment often based in part on continental trends shown in BBS and/or CBC.

5=Definite decrease
4=Possible decrease
3=Trend uncertain, No data

2=Possible increase, stable
1=Definite increase

Some guidelines based on BBS data, but for waterbirds trends are often dramatic and not linear so an inspection of trend graphs often is required to make a judgment as to trend score, again tempered by local and state data sets if they exist.

Significant increase (BBS trend ≥1.36%/yr, *P*≤0.10, df>13)	1
Possible increase (≥0.47 to 1.36%/ yr, *P*≤0.35, w/any df)	2a
Possible increase (≥1.36%/yr, 0.1<*P*≤0.35, df>13)	2a
Possible increase (≥1.36%/yr, *P*≤0.10, df<13)	2a
Stable (> -0.54 to < +0.47%/yr, and UCI<0.47 OR LCI>-0.54)	2b
- except when trend is negative and P≤0.10 and LCI<-0.54, then Possible decrease	4
Trend uncertain (≤-0.54%/yr or ≥0.47%/yr and *P*>0.35)	3
Trend uncertain (>-0.54%/yr and <0.47%/yr and UCI>0.47 AND LCI<-0.54)	3
No data	3
Possible decrease (either of next 3 options, but based on 6-13 degrees of freedom)	4
Possible decrease (≤-0.54 to -2.27%/yr, *P*=0.0-0.35)	4
Possible decrease (≤-2.27%/yr, 0.1<*P*≤0.35)	4
Significant decrease (≤-2.27%/yr and *P*≤0.10)	5

PS=Population Size based on best population estimates globally
5=Rare (<50 thousand breeding individuals globally)
4=Uncommon (50-500 thousand breeding individuals globally)
3=Fairly Common (500 thousand-5 million breeding individuals globally)
2=Common (5 million to 50 million breeding individuals globally)
1=Abundant (50 million + breeding individuals globally)

TB and TN=Threats Breeding and Threats Non-breeding

5=Extreme deterioration in the future suitability of breeding/non-breeding conditions is expected; species is in danger of regional extirpation or major range contraction, or has already been extirpated
4=Severe deterioration in the future suitability of breeding/non-breeding conditions is expected
3=Slight to moderate decline in the future suitability of breeding/non-breeding conditions is expected
2=Expected future conditions for breeding/non-breeding populations are expected to remain stable; no known threats
1=Expected future conditions for breeding/non-breeding populations are enhanced by human activities or land-uses; potentially a ‘problem’ species

BD and ND=Breeding Distribution and Non-breeding Distribution

5=Very Local Distribution (<500,000 km2, or very restricted coastal areas or interior uplands)
4=Local Distribution (>500,000 and <1,000,000 km2, or <1,600 km of coast)
3=Moderate Distribution (>1,000,000 and <2,000,000 km2, or >1,600 to <5,000 km of coast)
2=Widespread (>2,000,000 and <4,000,000 km2, or >5,000 to <8,000 km of coast)
1=Very Widespread (>4,000,000 km2, or >8,000 km of coast)

SUBTOT=Subtotal of six scores (absent AI) used to calculate Combined Score for Continental WatchList

AI=Area Importance, “relative” relative abundance for the species for each area within range scaled against its maximum relative abundance (i.e., the BCR or physiographic area supporting the highest relative abundance)

5=Very High relative abundance (~50+% of maximum relative abundance)
4=High relative abundance (~25-49% of maximum relative abundance)
3=Moderate relative abundance (~10-24% of maximum relative abundance)
2=Low relative abundance (~1-9% of maximum relative abundance)
1=Peripheral, scattered occurrences.

TOT=Total Score of all seven factors used for identifying Tiers for which species best fits for conservation planning at Planning Region/Bird Conservation Region/Physiographic Area.

Act. Level=Action Level at present based on expert opinion, but ultimately rules based on scores would be preferable.

IM=Immediate management needed to reverse or stabilize significant, long-term population declines in species with small populations, or to protect species with the smallest populations for which trends are poorly known. Lack of action may lead to extirpations or extinction.

MA=Management or other on-the-ground conservation actions needed to reverse or stabilize significant, long-term population declines in species that are still relatively abundant.

PR=Long-term Planning and Responsibility needed for species to ensure that sustainable populations are maintained for species for which a region has high responsibility for that species.

PC=Population Control/Suppression needed for species that are otherwise secure and increasing that may come into conflict with other species of higher conservation concern or other resources of interest.

APPENDIX B

Bird-Habitat Relationships for Puerto Rico and Virgin Islands, West Indies.

Conservation Tier	Limestone and montane forests	Mangrove and coastal woodlands	Shrub-scrub	Grassland/ Open lands	Landbird Transients	Marshes/long-legged waders	Open water	Mudflats	Beach front and salt ponds	Nesting seabirds
I a. Multiple concerns continentally	Plain Pigeon	West Indian Whistling-Duck	Yellow-shouldered Blackbird			West Indian Whistling-Duck	West Indian Whistling-Duck		Snowy Plover	White-tailed Tropicbird
	Puerto Rican Parrot	Yellow-shouldered Blackbird				Black Rail			Piping Plover*	Red-billed Tropicbird
	Puerto Rican Nightjar									
	White-necked Crow									
	Bicknell's Thrush*									
	Golden-winged Warbler*									
	Elfin-woods Warbler									
I b. High continental threats and/or declining	Mangrove Cuckoo**	White-crowned Pigeon**	Prairie Warbler*	American Golden-Plover*		Little Blue Heron*		Lesser Yellowlegs*	Sanderling*	Audubon's Shearwater
	Puerto Rican Vireo	Mangrove Cuckoo**		Upland Sandpiper*		Wilson's Snipe		Solitary Sandpiper*	Gull-billed Tern	Masked Booby
	Worm-eating Warbler*	Prothonotary Warbler*		Short-eared Owl				Whimbrel*		Red-footed Booby
	Kentucky Warbler*							Semipalmated Sandpiper*		Brown Booby

	Greater Antillean Oriole							Western Sandpiper*		Roseate Tern
								Stilt Sandpiper*		Least Tern
								Short-billed Dowticher*		
Conservation Tier	**Limestone and montane forests**	**Mangrove and coastal woodlands**	**Shrub-scrub**	**Grassland/ Open lands**	**Landbird Transients**	**Marshes/long-legged waders**	**Open water**	**Mudflats**	**Beach front and salt ponds**	**Nesting seabirds**
I c. Local and/or rare continentally	Black Swift**	Lesser Antillean Pewee	Lesser Antillean Pewee	Antillean Nighthawk**		Caribbean Coot	Caribbean Coot		Reddish Egret	Magnificent Frigatebird
	Lesser Antillean Pewee		Adelaide's Warbler						Wilson's Plover*	Bridled Tern
	Blue-winged Warbler*								American Oystercatcher*	
	Adelaide's Warbler								Red Knot*	
	Swainson's Warbler*									
II a. High concern regionally	Black-whiskered Vireo**	Green Heron*	Antillean Mango			Green Heron*		Black-bellied Plover*	Ruddy Turnstone*	Brown Pelican
		Yellow-crowned Night Heron*				Yellow-crowned Night Heron*		Least Sandpiper*		
II b. High threats regionally	Sharp-shinned Hawk	Clapper Rail	American Kestrel	American Kestrel (w/nest trees)		Pied-billed Grebe	Pied-billed Grebe	Greater Flamingo	Willet*	
	Broad-winged Hawk	Yellow "Golden" Warbler	Key West Quail-Dove			Least Bittern*	White-cheeked Pintail			

	Limpkin					Black-crowned Night-Heron*	Ruddy Duck			
	Bridled Quail-Dove					White-cheeked Pintail	Masked Duck			
	Puerto Rican Screech- Owl (VI)					Ruddy Duck				
	Louisiana Waterthrush*					Masked Duck				
						Yellow-breasted Crake				
						Purple Gallinule*				
Conservation Tier	**Limestone and montane forests**	**Mangrove and coastal woodlands**	**Shrub-scrub**	**Grassland/ Open lands**	**Landbird Transients**	**Marshes/long-legged waders**	**Open water**	**Mudflats**	**Beach front and salt ponds**	**Nesting seabirds**
II c. High responsibility regionally	Scaly-naped Pigeon	Puerto Rican Flycatcher	Antillean Crested Hummingbird	Zenaida Dove		Tricolored Heron*		Black-necked Stilt*	Black-necked Stilt*	Sooty Tern
	Puerto Rican Lizard-Cuckoo	Northern Parula*	Caribbean Elaenia	Gray Kingbird**				Pectoral Sandpiper*	Black Tern*	Brown Noddy
	Puerto Rican Screech-Owl (PR subsp.)	Cape May Warbler*	Puerto Rican Flycatcher	Caribbean Martin**						
	Green Mango		Gray Kingbird**	Cave Swallow						
	Puerto Rican Emerald		Northern Parula*	Grasshopper Sparrow						
	Puerto Rican Tody		Puerto Rican Bullfinch							
	Puerto Rican Woodpecker									
	Puerto Rican Flycatcher									
	Loggerhead Kingbird									
	Red-legged									

	Thrush									
	Northern Parula*									
	Cape May Warbler*									
	Black-throated Blue Warbler*									
	Puerto Rican Tanager									
	Puerto Rican Spindalis									
	Antillean Euphonia									
	Puerto Rican Bullfinch									
Conservation Tier	**Limestone and montane forests**	**Mangrove and coastal woodlands**	**Shrub-scrub**	**Grassland/ Open lands**	**Landbird Transients**	**Marshes/long-legged waders**	**Open water**	**Mudflats**	**Beach front and salt ponds**	**Nesting seabirds**
III. Additional State Listed						Least Grebe (USVI)	Least Grebe (USVI)			
						Great Blue Heron (USVI)				
						Great Egret* (USVI)				
						Snowy Egret* (USVI)				
IV. Local or regional interest	Chuck-will's-widow*	White-winged Dove	White-winged Dove	Northern Harrier	Merlin*	Glossy Ibis	Northern Pintail	Semipalmated Plover*		Royal Tern
	Yellow-throated Vireo*	Yellow-billed Cuckoo*	Yellow-billed Cuckoo*	Killdeer	Peregrine Falcon*	Sora	Blue-winged Teal*	Greater Yellowlegs*		Sandwich Tern
	Magnolia Warbler*	Yellow-throated Warbler*	White-eyed Vireo*	Mourning Dove	Common Nighthawk*	Common Moorhen*	Lesser Scaup	Spotted Sandpiper*		

	Blackpoll Warbler*	Palm Warbler*	Indigo Bunting*	Indigo Bunting*	Bobolink*		Osprey*	White-rumped Sandpiper*		
	Black-and-white Warbler*	Blackpoll Warbler*			Baltimore Oriole*					
	American Redstart*	Black-and-white Warbler*								
	Ovenbird*	American Redstart*								
	Hooded Warbler*	Northern Waterthrush*								
		Hooded Warbler*								

*Nearctic-Neotropical Migrant species, those species with populations principally breeding in temperate North American areas that winter principally in tropical North American and/or South America areas.
**Intratropical Migrants species, those species breeding in the northern tropical areas of North America that winter principally further south in tropical North America and/or South America areas.