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EXOTIC AND INVASIVE SPECIES MANAGEMENT

DRAFT SPECIAL RECONNAISSANCE REPORT COMPREHENSIVE EVERGLADES RESTORATION PLAN (CERP)

US Army Corps of Engineers
Jacksonville District
South Atlantic Division

- Draft -

SPECIAL RECONNAISSANCE REPORT

EXOTIC AND INVASIVE SPECIES MANAGEMENT
COMPREHENSIVE EVERGLADES RESTORATION PLAN (CERP)

1. BACKGROUND

First authorized by Congress in 1948, the Central and Southern Florida (C&SF) Project provides the South Florida ecosystem with flood control, regional water supply, prevention of saltwater intrusion, preservation of fish and wildlife, recreation, and navigation. In fulfilling these objectives, the project has had unintended adverse effects on the natural environment that constitutes the Everglades and South Florida ecosystem. As a result, in 2000 Congress authorized the Comprehensive Everglades Restoration Plan (CERP) or "Plan" to restore, preserve, and protect the South Florida ecosystem while providing for other water-related needs of the region. CERP consists of structural and operational modifications to the C&SF Project and will be implemented over the next 35 years. Together these components are expected to deliver benefits to improve the ecological functioning of over 2.4 million acres of the South Florida ecosystem, improve urban and agricultural water supply, improve deliveries to coastal estuaries, and improve regional water quality conditions, while maintaining the existing levels of flood protection.

CERP included a feature to evaluate Melaleuca Eradication and Other Exotic Plants. This feature included the following elements: 1) construct a new quarantine and research facility, 2) renovation and improvements to the current quarantine facility in Gainesville, and 3) implement biological controls (mass rearing, field release, establishment, and field monitoring) of approved biological control agents. The purpose of this feature is to increase the effectiveness of biological control technologies to manage Melaleuca and other invasive exotic species. The projected cost to implement this feature was $5.8 million in October 1999 dollars. These elements were originally proposed for implementation under the Critical Projects program authorized by the Water Resources Development Act of 1986.

An information paper was prepared 21 May 2002, and approved 4 October 2002, which provided a conceptual plan to address exotic and invasive species management and control in southern Florida. The four-part plan included the three previously discussed elements, as outlined in CERP, along with a fourth. The fourth element was to prepare a Special Report that incorporates the "Weeds Won't Wait" document prepared for the Working Group. The total cost of the plan was estimated at $10.8 million and would be cost shared 50-50, except for the Special Report, which would cost $200,000 at 100 percent Federal expense.

2. STUDY AUTHORITY

Section 601 of the *Water Resources Development Act of 2000* (PL 106-541), Congress approved the Central and Southern Florida (C&SF) Project Comprehensive Review Study Integrated Feasibility Report and Programmatic Environmental Impact Statement

(known as the "Comprehensive Plan"), which describes and outlines the Comprehensive Everglades Restoration Plan (CERP):

> *(b) Comprehensive Everglades Restoration Plan -*
> *(1) Approval -*
> *(A) IN GENERAL. —Except as modified by this section, the Plan is approved as a framework for modifications and operational changes to the Central and Southern Florida Project that are needed to restore, preserve, and protect the South Florida ecosystem while providing for other water-related needs of the region, including water supply and flood protection. The Plan shall be implemented to ensure the protection of water quality in, the reduction of the loss of fresh water from, and the improvement of the environment of the South Florida ecosystem and to achieve and maintain the benefits to the natural system and human environment described in the Plan, and required pursuant to this section, for as long as the project is authorized.*

Approval to develop the Special Reconnaissance Report for Exotic and Invasive Species Management was provided 4 October 2002. The approved Information Paper, entitled "Proposed Plan for Fiscal Year (FY) 03 Exotic and Invasive Species Management and Control" states:

> *"Preparation of a special report that incorporates the "Weeds Won't Wait" document prepared by the Working Group. This special report would further identify the overall problem with exotic and invasive species and provide a recommendation regarding further Federal involvement. The estimated cost of $200,000 is proposed at 100% Federal funding, as it would be a reconnaissance type report that would identify any Federal interest, identify a potential sponsor, and develop a plan for further efforts."*

3. STUDY PURPOSE

The purpose of this report is to identify the problem with exotic and invasive species (as defined in the *"Weeds Won't Wait"* report and Appendix A – *"Executive Summary of the Assessment",* of this report) and provide a recommendation regarding further Federal involvement. This report will describe the serious threat that invasive exotic species pose to CERP and to ecosystem restoration, clarify the role of individual Federal agencies in dealing with the problems presented by invasive exotic plants in South Florida, describe the importance of Federal agency support in managing and controlling invasive exotic plants as part of South Florida Ecosystem Restoration, and provide recommendations regarding the combined Federal interests. Federal and State programs will be evaluated to ensure that an overall interagency plan can be developed for exotic and invasive species management.

The strategy section of the *"Weeds Won't Wait"* document will be used to identify the key components necessary for managing invasive exotic species, and to prioritize those components and identify specific responsibilities and roles for each Federal agency in the management and control of invasive exotic species as it relates to ecosystem restoration. The "*Executive Summary of the Strategic Plan"* is included in Appendix B.

This Special Reconnaissance Report is important because of the acknowledgement that the CERP program does not address invasive species in the project alternatives, and that without invasive species control, full restoration benefits will not be achieved. This report will provide recommendations to develop and implement a framework for invasive species management along with specific projects, related to CERP activities.

It is estimated that over 32,000 exotic species (25,000 plants & 7,000 animals) have been introduced into Florida (Stein, Kutner & Adams 2000). Florida has approximately 4 – 5 thousand native species of plants and animals. The number of exotic species that have been introduced is eight times the total number of native species in the entire state.

Of the total of 32,000 exotic introductions, about 2,000 plant and 400 animal species have been documented as having reproducing free-living (naturalized) populations established in Florida. Of the 2,000 plant species 66 are documented as serious threats to natural areas, and an additional 63 are considered as serious potential threats and require careful monitoring. Of these, forty-eight species are documented to cause ecosystem level impacts, 14 species are documented to be directly impacting threatened and endangered species and rare habitats within Florida and 19 species are documented as being among the world's worst weeds (Holm 1977). Land management agencies in Florida spend a combined total of approximately $91 million each year trying to manage just a few of those 129 plant species.

Within the Central and Southern Florida Restudy Area (see Figures 1 & 2) just six species of invasive exotic plants have replaced approximately 1.9 million acres of habitat (Doren and Ferriter 2001). One species alone, Old World Climbing fern has spread exponentially during the last two years. Its current range covers over 125,000 acres across 7 south Florida counties in Everglades habitat, and model predictions for this species estimates over 5 million acres covered by 2014.

4. LOCATION / STUDY AREA MAPS

This report covers the entire Central and Southern Florida Restudy area, which encompasses approximately 18,000 square miles from Orlando to the Florida Reef Tract with at least 11 major physiographic regions:

> Everglades, Big Cypress, Lake Okeechobee, Florida Bay, Biscayne Bay, Florida Reef Tract, near shore coastal waters, Atlantic Coastal Ridge, Florida Keys, Immokalee Rise, and the Kissimmee River Valley. The Kissimmee River, Lake Okeechobee and the Everglades are the dominant watersheds that connect a mosaic of wetlands, uplands, coastal areas, and marine areas. This area includes all or part of the following 16 counties: Monroe, Miami-Dade, Broward, Collier, Palm Beach, Hendry, Martin, St. Lucie, Glades, Lee, Charlotte, Highlands, Okeechobee, Osceola, Orange, and Polk.

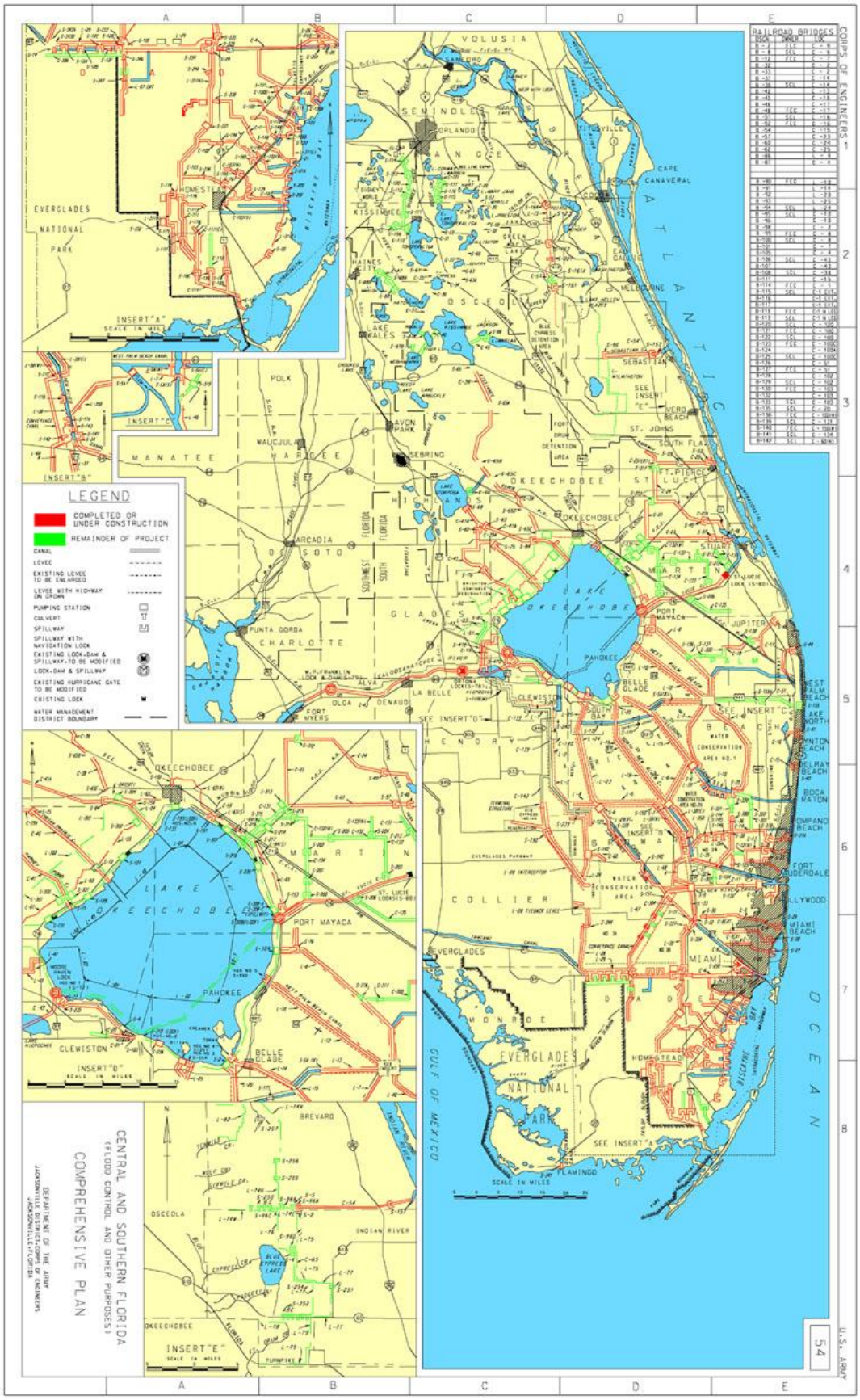

Figure 1: Central and Southern Florida Study Area

The project is located in 14 U.S. Congressional Districts including 3, 6, 8, 12, 14, 15, 16, 17, 18, 19, 20, 21, 22 and 23 (see Figure 3).

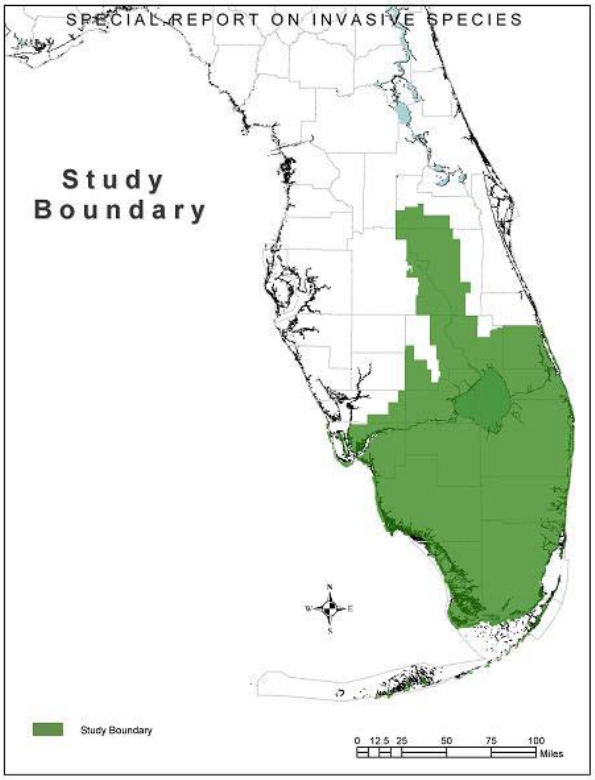

Figure 2: Study Boundary

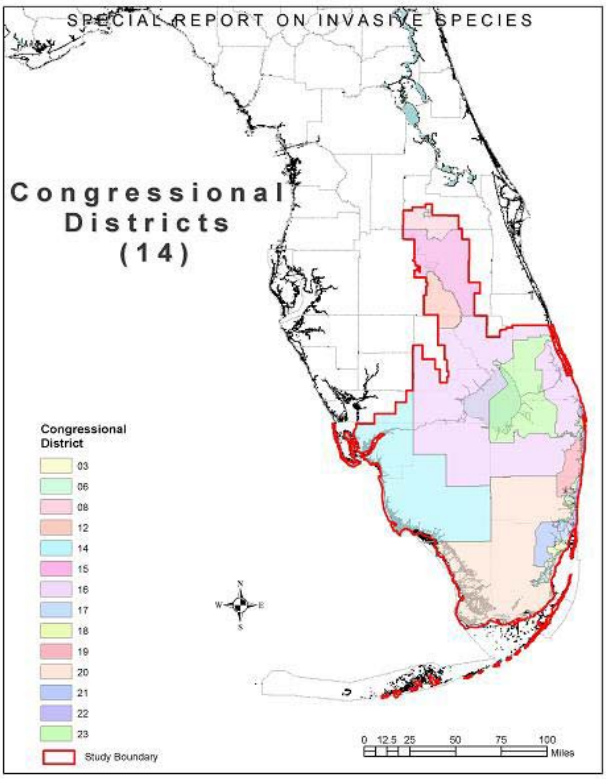

Figure 3: Congressional Districts

5. DISCUSSION OF PRIOR STUDIES, PROJECTS AND REPORTS

5.1 Prior Federal Studies and Reports

Weeds Won't Wait. 2001. Doren, R.F. & A. Ferriter (eds.), South Florida Ecosystem Restoration Task Force, Miami, Florida. This document was completed for the South Florida Ecosystem Restoration Task Force and Working Group by the Noxious Exotic Weed Task Team (NEWTT) and is composed of two parts: an assessment of the problems with Florida's most invasive plants and a strategy for their control and management.

Assessment of Florida's Most Invasive Plants. Part one of Weeds Won't Wait discusses the issues related to invasive plants, how bad the problem is, which species are priorities for control and the threat they pose to Florida and Everglades Restoration.

Strategy for Managing Invasive Plants in Florida. Part two of Weeds Won't Wait is based on the assessment of the problem and outlines a multi-agency consensus approach for dealing with invasive exotic plants with a focus on Everglades Restoration.

Filling the Gaps, Ten Strategies to Strengthen Invasive Species Management in Florida, 2004. Environmental Law Institute. This report provides a discussion of authorities, gaps and conflicts affecting invasive species prevention and management in Florida and is included in Appendix C.

Harmful Non-Indigenous Species in the United States. 1993. Office of Technology Assessment (OTA-f-565), US Government Printing Office, Washington D.C. This report details a study requested by the Congressional House Merchant Marine and Fisheries Committee. It profiles the international, national and state problems with invasive exotic species (both plants and animals), discusses policy implications and options, describes the social, economic and natural area consequences resulting from invasive exotic species, and provides recommendations for Federal and state actions to counter the threats.

National Invasive Species Council

National Invasive Species Management Plan, January 2001. This initial Plan provides a general blueprint for action to deal with the threats posed by invasive species; however, many of the details of the actions called for will require further development in the implementation phase. At that point specific measures of success as well as personnel and other resources needed to achieve the Plan's goals will be described. The action items included in the Plan outline an array of prospective approaches for preventing the introduction and spread of invasive species. The Plan requires agencies to report on their invasive species activities and steps taken to comply with the Executive Order and with the Plan, and provides for an oversight mechanism to ensure agency compliance.

National Early Detection-Rapid Response Plan, 2003. This plan provides guidelines to assist agencies in establishing a Early Detection-Rapid Response capability.

Invasive Plants Fact Book. 1998. Westbrooks. This book provides statistics related to invasive exotic species in the US, their costs of management, economic losses, threats to natural resources and case examples.

National Park Service

National Park Service. 1980. State of the Parks; A Report to Congress. This report documents the results of a survey of all national park areas (including the four south Florida parks) regarding the threats that have been identified and endanger the natural or cultural resources of the NPS. It identifies specific threats, sources of threats and endangered resources. Seven broad categories of threat were identified including encroachment of exotic species.

General Accounting Office. 1987. Limited Progress Made in Documenting and Mitigating Threats to the Park. This GAO report to congress updates the progress made by the NPS on implementing the actions reported in their 1980 report to congress on threats to the National Parks. The report is critical of the NPS for not doing enough to deal with these threats.

Exotic Plant Management Plan and EIS: South Florida and Caribbean Parks, 2004. The National Park Service has begun an Environmental Impact Statement and Management Plan for invasive exotic plants. This plan will address issues related to the current and future management of exotic plants in nine national parks, five in south Florida and four in the Caribbean. The plan is scheduled for completion in 2006.

U.S. Army Corps of Engineers

U.S. Army Corps of Engineers. 1997. Non-Indigenous Invasive Plants and Hydrologic Alteration in Lake Okeechobee and the Everglades. This report details the impacts and affects of invasive exotic plants on the littoral zones and hydrology of Lake Okeechobee. It discusses the species involved and their effects on various zones of the lake and the control measures being taken to manage them.

U.S. Army Corps of Engineers. 2002. Noxious and Nuisance Plant Management Information System. A Web site produced by the COE that provides information regarding invasive exotic plants and the role the COE plays in managing them. The site includes species that are threats to Everglades' restoration and the actions being taken to manage them. http://www.wes.army.mil/el/pmis/pmishelp.htm

U.S. Army Corps of Engineers, U.S. Department of Agriculture, U.S. Department of Interior. 1999. Interagency Agreement for Construction of a Quarantine Facility. This agreement outlines the roles each agency accepts in the design, construction and operation of the Biological Control Quarantine Facility being built in Davie, Florida. This facility will be key in developing biological control agents for controlling invasive exotic species in southern Florida.

U.S. Army Corps of Engineers. 1998. Central and Southern Florida Project Comprehensive Review Study. This report details the restoration program developed by the agencies involved in restoration. It focuses heavily on hydrological fixes to the system but does identify invasive exotic species as threats to restoration and recognizes the need for managing them.

U.S. Fish and Wildlife Service

U.S. Fish and Wildlife Service. 1999. South Florida Multi-Species Recovery Plan. This plan was developed to help direct the recovery and protection of T&E species within the Central and Southern Florida Restudy Area and focuses on habitat and ecosystem restoration rather than single species management. It identifies invasive exotic species as a serious threat to these rare resources.

U.S. Fish and Wildlife Service. 2001. Integrated Pest Plant Management Plan for Loxahatchee NWR. This plan details the program for management of invasive exotic species affecting Loxahatchee National Wildlife Refuge, which is located within the Central and Southern Florida Restudy Area

Other Federal Agency Annual Reports

US Department of Agriculture Agricultural Research Service. 2003. Annual Report on the Biological Control Program for invasive exotic species. The USDA biocontrol laboratory in Davie, Florida produces annual reports detailing their research and progress in implementing biological control programs for high priority invasive exotic species (such as Melaleuca and Old World Climbing Fern) affecting south Florida.

South Florida Ecosystem Restoration Task Force (SFERTF) 2003. Biennial Strategic Plan Report. This report details the work of the Task Force and Working Group in helping agencies coordinate their collective efforts to restore the Everglades ecosystem. The plan also outlines the numerous agency projects being carried out including those on invasive exotic species.

Aquatic Nuisance Species Task Force, 2002. Guidance for State and Interstate ANS Management. This plan outlines recommended approaches for states in managing Aquatic Nuisance Species. Development of the state plans is being facilitated and implemented by the ANSTF as directed under the Nonindigenous Aquatic Nuisance Prevention and Control Act (NANPCA) of 1990 and the National Invasive Species Act (NISA) of 1996.

5.2 Prior Studies and Reports by State Agencies and Others

Florida Department of Environmental Protection – Assessment of Invasive Non-Indigenous Species in Florida (1994). As part of a review of the kinds and most abundant invasive exotic species in Florida the DEP developed this assessment to help inform the Florida Legislature on the serious threat exotic species posed to Florida's economy and natural areas. This report lead to the publication of the book Strangers in Paradise (Simberloff et al. 1997).

Florida Invasive Species Working Group – Statewide Invasive Species Management Plan for Florida, 2003. As a result of the heightened concern about invasive species in Florida the Governor directed DEP to lead a group of state agencies to develop an Invasive Species Management Plan for State Agencies in Florida. This group has recently completed the plan. Agency specific elements of the plan are still being developed.

Florida Department of Environmental Protection Invasive Plant Summit 2000. As part of a directive to determine the role of DEP and other state agencies in managing invasive exotic species the Florida DEP held a "summit" of all the cooperating organizations and agencies in Florida dealing with invasive exotic species. They used the results of this summit to help guide their future planning for invasive exotic species management in DEP.

South Florida Water Management District Consolidated Report. Each year the South Florida Water Management District produces a consolidated report on Everglades' Restoration and management. This report contains details on the invasive

exotic species management activities of the water management districts located in south Florida as those activities relate to management of invasive species in the Everglades.

University of Florida Institute of Food and Agricultural Sciences (UF IFAS) – Identification & Biology of Non-Native Plants in Florida's Natural Areas, K.A. Langeland & K.C. Burks, 1998. The UF IFAS produced an ID manual with descriptions of habit and habitat for the most invasive species throughout Florida.

South Florida Water Management District Vegetation Management. The Vegetation Management Division of the SFWMD is responsible for managing nuisance vegetation in 16 counties in the C&SF area. Annual reports are prepared, which identifies the problems, work completed, and costs incurred each year.

Florida Department of Environmental Protection – Bureau of Invasive Plant Management. DEP prepares annual reports, which contain detailed information about the problems, work completed, and costs incurred each year.

State Management Plans. There are three species based management plans for the most serious and widespread species in south Florida. These plans were developed with the many involved organizations through workshops conducted by the Florida Exotic Pest Plant Council. These plans are intended to assist agencies in coordinating their activities and management approaches to control these specific and serious species. There is no individual agency specifically responsible for implementing these plans, as they were developed under a team approach. However, the SFWMD has taken on the role of leading the efforts under these plans partly through their financial sponsorship of those activities.

1) *"Melaleuca Management Plan", dated May 1999.* The Melaleuca Management Plan was developed to provide criteria to make recommendations for the integrated management of Melaleuca in Florida.

2) *"Brazilian Pepper Management Plan for Florida", dated July 1997.* The Brazilian Pepper Management Plan was developed to provide criteria to make recommendations for the integrated management of Brazilian Pepper in Florida.

3) *"Lygodium Management Plan for Florida", dated 2001.* The Lygodium Management Plan was developed to provide information and make recommendations for the integrated management of Lygodium in Florida.

5.3 Existing Federal Projects in the South Florida Ecosystem Restoration Task Force Comprehensive Project List

Integrate Federal, state and local agency invasive exotic plant control programs and projects into comprehensive strategic plan by 2007. This project is the most recent directive from the South Florida Ecosystem Restoration Working Group to NEWTT to develop an implementation plan for integrating agency management of invasive exotic species. This implementation plan is based on the Assessment and Strategy from

Weeds Won't Wait. The implementation plan structure has been completed and agency project information is being incorporated into the plan to allow agencies to better coordinate projects and assist in developing cross-cut budgets.

Complete an invasive exotic plant prevention, early detection and rapid response plan by 2005. The need for such a plan has been identified both nationally and statewide. However, no development work has taken place on such a program. There are individual agency actions for some species that are viewed as posing extreme risks (e.g. DEP actions on Mimosa pigra and Salvinia molesta) but no collective action organization or plan has been developed and no funds are yet available. The Natural Park Service has agreed to take the lead, should funding become available.

Complete construction of the invasive exotic species biological control quarantine facility. The facility is operated by the U.S. Department of Agriculture. This project has been completed and was opened March 2005.

CERP - Melaleuca Eradication and Other Exotic Plants - Implement Biological Controls. This is a CERP project, being cost shared between the Corps and SFWMD. The approved CERP report estimated $5.7 million for Melaleuca Eradication and other Exotic Plants. This study is scheduled to be initiated July 2005. Developing and distributing biological control agents for invasive exotic species in south Florida will be studied.

National Park Service Invasive Exotic Plant Control Program. The National Park Service is developing a regional management plan and EIS for invasive exotic plants. The plan will cover 5 south Florida parks and 4 Caribbean parks. The plan and EIS was initiated in 2004 and is scheduled for completion in 2006.

Everglades National Park wetland restoration-Schinus removal program in the Hole-in-the-Donut (HID). The HID wetland restoration project is restoring former farmland that became dominated by Brazilian Pepper back into wetlands. As part of this restoration process the Brazilian Pepper is being removed. The project began in 1996 and is scheduled to be completed in 2010, subject to availability of funds.

Lygodium management in Loxahatchee National Wildlife Refuge. As part of the National Wildlife Refuge System Improvement Act of 1997 the U.S Fish and Wildlife service developed a Comprehensive Conservation Plan. As part of this Conservation Plan and a lease agreement with the South Florida Water Management District the Loxahatchee National Wildlife Refuge has developed a comprehensive Lygodium management plan. Funding has been limited and the project is focused on control, prediction of spread and the biology of Lygodium.

Melaleuca control on Big Cypress National Preserve (BICY). BICY has recently completed their first initial treatment of all Melaleuca in the preserve. They are now focusing on maintenance control of melaleuca and control of other species.

5.4 Existing Non-Federal Projects (as listed in the SFERTF comprehensive project list)

Development of Management Plans for top 20 south Florida invasive exotic plants. This project entails the development of management plans for additional priority invasive exotic plants in southern Florida. The success of the Melaleuca, Brazilian Pepper and Lygodium plans in helping agencies coordinate their control activities for these species underscores the value of developing a species plan that synthesizes the current knowledge for managing a species, sets regional priorities and identifies areas of needed research or information. Two plans will be initiated each year and require an estimated 18 months to complete. All 20 plans should be completed in 10 – 12 years, if funds are available. Lead agencies for those plans, which have been initiated are as follows: South Florida Water Management District, Florida Department of Environmental Protection, U.S. Fish and Wildlife Service, National Park Service, Seminole Tribe of Florida, and the U.S. Department of Agriculture.

6. PROBLEM STATEMENT

While there are many different exotics in south Florida only a few are causing serious environmental harm, but costing millions of dollars to control. These few have proven difficult to control because of a lack of resources to gain the necessary knowledge about the biology and effective control approaches for these species and the lack of a statewide, prevention, early detection and rapid response capability that makes prevention and early control the priority.

The current invasive exotic plant control projects and programs being implemented by various governmental agencies, while functional and operational, are simply inadequate to achieve the desired level of success within a reasonable timeframe, given the magnitude of the problem of exotic invasion in the south Florida ecosystem. The main reasons for this are insufficient funding levels for the various programs, and insufficient interagency integration of exotic plant control programs. Sometimes, there is even a lack of adequate integration and coordination of programs (and even direct policy conflicts) within the same agency or department.

CERP has largely focused on water quality, quantity, timing and distribution. Although a few projects incorporate some localized invasive species components there has been no programmatic, systematic approach. The premise of the current approach is to “getting the water right” first in order to allow the ecosystem to recover. However, the destructive potential of invasive species has been underestimated and the current approach if not corrected may jeopardize CERP restoration goals. CERP should fully utilize the adaptive management process and implement a programmatic and comprehensive approach to invasive species management.

Of the estimated 3,834 plant species documented in Florida approximately 1,200 species are exotic, have established, and are spreading in Florida’s natural areas. Exotic plants account for more than one third of all the plants found in Florida. Of the most serious exotic plant species evaluated in the Weeds Won’t Wait Assessment, one or more of

them have managed to invade every natural ecosystem and habitat in the state of Florida. These species have been documented to be spreading in natural areas and many are documented to alter ecosystem structure and function. Individual plant species that modify ecosystem properties are considered extremely serious threats to native habitats and ecosystems. South Florida has several widespread species that alter habitat and ecosystem properties and pose a serious threat to successful ecosystem restoration and CERP.

Species that are successful invaders and able to alter the habitat are likely to modify the structure (e.g Melaleuca changes grasslands into forests), composition (e.g. Old World Climbing Fern replaces existing plants reducing species richness), habitat quality (e.g. Old World Climbing Fern literally smothers and causes a collapse in hammock forest canopies with over 1 meter thick mats of fern stems), soil formation and chemistry (e.g. Australian Pine fixes nitrogen in the soil and Melaleuca increases deposition of organic matter), biogeochemical processes (e.g. Brazilian Pepper is replacing mangrove forests seriously reducing carbon sequestration—a situation that has enormous implications for the sustainability of native wetland and marine animals in the Everglades), fire regimes (e.g. Melaleuca forests burn as crown fires carrying fires into native forests that historically do not burn) and habitat connectivity (e.g. where large populations of invasive species occur the connectivity between native habitats is severed affecting hydrology, and movement of plant propagules and wildlife). Such species have also been documented to cause extinctions of native species where they invade. In Florida, seven species are documented to alter geomorphologic processes, two species increase erosion rates, four species increase soil deposition and soil elevation, three species increase sedimentation rates, four species impact the geometry or configuration of natural water drainages, four species alter disturbance regimes (e.g. fire), five species fix nitrogen, three species alter water chemistry, six species alter surface water flows, two species modify water table depth, twenty-one species alter light availability, fifteen species alter plant community structure and composition, seven species create physical barriers reducing connectivity, three species alter microclimate and sixteen species are documented to reduce recruitment of native species. These numbers are conservative as little research has been done on most invasive plants regarding their ecological effects (Gordon 1998).

The most threatening characteristic of these invasive species is their ability to alter their environment and the foremost problem facing Everglades restoration and CERP success is that once these species invade and alter the ecosystem those alterations are extremely difficult if not impossible to reverse.

While some agencies are directing their control activities toward all these listed species (see list below), the reality is that the vast majority of the regional or landscape-scale control efforts and funding that agencies themselves have identified are being spent on only about thirty-two different exotic plant species statewide and even fewer for southern Florida (Doren and Ferriter 2001). Based on reported figures among agencies, approximately $91 million dollars are being spent in Florida annually to control these thirty-two species. Unfortunately, by all calculations we are currently maintaining a reasonable measure of control over significant parts of the region for just a handful of species statewide (e.g. Mimosa Pigra, Hydrilla, Water Hyacinth, Water Lettuce, Melaleuca, Alligator Weed, and Giant Salvinia) and only one species in southern Florida

(Melaleuca). However, even some of the successful control programs (e.g. Hydrilla) have suffered serious setbacks when funding for control efforts have been cut or curtailed (see Weeds Won't Wait – Box 1). While it is important to focus needed attention and resources by prioritizing the most threatening species the resources needed to monitor possible future "most threatening" species simply do not exist.

By using the single species or single site approach to managing invasive exotic species we face the danger of simply replacing one exotic species with another. There are numerous potential exotic threats that need to be examined and managed programmatically so that we can be more certain that the species we expend the most resources on are the correct ones and that we are not letting the next potential Melaleuca slip through our watch. The following prioritized list of species was produced by NEWTT as part of the strategic plan (Part 2 of the Weed Won't Wait report). This priority list was developed to enhance and support the development of a prevention, early-detection rapid-response system for invasive exotic plant control for South Florida Ecosystem Restoration.

There is significant scientific evidence and research documenting that invasive exotic plants are degrading and damaging natural ecosystems in south Florida (see Doren and Ferriter 2001). These species are causing significant ecological harm through crowding out and displacing native vegetation upon which native fish and wildlife are dependent for food and shelter, altering soil types and soil and water chemistry, altering ecosystem functions such as carbon sequestration and nutrient cycling, altering gene pools and genetic diversity, and altering native species diversity and composition. Exotics provide little or no habitat value for native wildlife. They can cause changes in hydrology and soil composition, degrade water quality, and decrease the biodiversity of an entire ecosystem. If the Everglades are to be restored and preserved as the Everglades and South Florida's natural environments are to remain intact the problem of invasive species must be addressed comprehensively and with sufficient resources to address the magnitude and seriousness of the problem.

NEWTT PRIORTY EXOTIC PLANT LIST FOR EVERGLADES RESTORATION

The following statements should be considered in prioritizing.

1. All species on the Florida Exotic Pest Plant Council categories I & II should be controlled, acknowledging that different species will pose threats in different regions, sites, and plant communities across Florida

2. The following species are ranked into categories A, B and C, based on (1.) need for biological information; (2.) degree and rapidity of invasion; (3.) and developmental stage of management plans and programs.

   - Category A = these species have the most pressing needs because of rapid expansion and little (to no) understanding of how to control that increase. The methods to halt the spread are not completed. [Some species (e.g., *Melaleuca quinquenervia)* which are critically impacting Florida and have high priority will not fit into Category A, because methods and means for control are known and in time should become effective.]

- Category B = the spread of these species is still a critical issue, but not as pressing as that of A.

- Category C = these species have the least pressing needs because control recommendations have been developed; the species is not widespread, or is not presently alarming in its spread.

Ranking species relating to South Florida Ecosystem Restoration:

Category A

Colocasia esculenta. wild taro	*Neyraudia reynaudiana* Burma reed
Colubrina asiatica, lather-leaf	*Panicum repens,* torpedo grass
Cupaniopsis anacardioides, carrotwood	*Psidium cattleianum,* strawberry-guava
Dioscorea alata, winged yam	*Rhodomyrtus tomentosa,* downy rose-myrtle
Dioscorea bulbifera, air potato	*Scheffiera actinophylla,* umbrella tree or octopus plant
Ficus microcarpa, laurel fig	*Senna pendula,* Christmas cassia
Hygrophila polysperma, green hygro	*Solanum tampicense,* wetland nightshade
Hymenachne amplexicaulis, West Indian marsh grass	*Syzygium cumini,* Java-plum
Imperata cylindrica, cogongrass	*Thespesia populnea,* seaside mahoe
Lygodium microphyllum, Old World Climbing Fern	*Tradescantia fluminensis*, white-flowered wandering jew
Nephrolepis cordifolia, sword fern	*Wedelia trilobata,* wedelia

Category B

Abrus precatorius, rosary pea	*Manilkara zapota,* sapodilla
Acacia auriculiformis, earleaf acacia	*Nephrolepis multiflora,* Asian sword ferri
Antigonon leptopus, coral vine	*Paederia cruddasiana,* sewer vine
Ardisia elliptica, shoebutton ardisia	*Paederiafoetida,* skunk vine
Cestrum diurnum, day jessamine	*Pennisetumpurpureum,* Napier grass
Cinnamomum camphora, camphor-tree	*Pennisetum setaceum,* green fountain grass
Cyperus involucratus, umbrella plant	*Ptychosperma elegans, solitary palm*
Dalbergia sissoo, Indian rosewood	*Ricinus communis, castor-bean*
Eugenia uniflora, Surinam-cherry	*Sansevieria Hyacinthoides, bowstring-hemp*
Hydrilla verticillata, hydrilla	*Scaevola sericea,* beach naupaka, half-flower
Leucaena leucocephala, lead tree	*Tribulus cistoides,* puncture vine
Ligustrum sinense, hedge privet	*Syngonium podophyllum,* arrowhead vine
Lygodium japonicum, Japanese climbing fern	*Urochloa mutica,* Para grass
Macfadyena unguis-cati, cat-claw vine	

Category C

Adenanthera pavonina, red sandalwood	*Melia azedarach,* chinaberry
Agave sisalana, sisal hemp	*Melinis minutiflora,* molasses grass
Albizia lebbeck, woman's tongue	*Merremia tuberosa,* wood-rose
Alstonia macrophylla, devil-tree	*Mimosa pigra,* catclaw mimosa
AIternanthera philoxeroides, alligator weed	*Murraya paniculata*, orange-jessamine
Asparagus desiflorus, asparagus-fern	*Myriophy//um spicatum,* Eurasian water-milfoil
Asystasia gangetica, Ganges primrose	*Ochrosia elliptica,* kopsia
Bauhinia variegata, orchid-tree	*Oeceoclades maculata,* ground orchid
Bischofia javanica, bischofia	*Passiflora biflora,* twin-flowered passion vine
Callisia fragrans, spironema	*Passiflorafoetida,* stinking passion flower
Calophyllum antillanum, santa maria	*Phoenix reclinata,* Senegal date palm
Casuarina cunninghamiana, Australian-pine	*Pistia stratiotes,* water lettuce
Casuarina equisetifolia, Australian-pine	*Psidium guajava,* guava
Casuarina glauca, suckering Australian-pine	*Pteris vittata,* Chinese brake fern
Cordia dichotoma, sebsten plum	*Pueraria montana,* kudzu
Cryptostegia madagascariensis, rubber vine	*Rhynchelytrum repens,* Natal grass
Eichhornia crassipes, water-hyacinth	*Ruellia brittoniana,* Mexican-petunia
Epipremnum pinnatum 'Aureum', pothos	*Sapium sebiferum,* Chinese tallow tree
Ficus altissima, false banyan	*Schinus terebinthifolius,* Brazilian pepper
Flacourtia indica, governor's plum	*Sesbania punicea,* scarlet sesban
Flueggea virosa, Chinese waterberry	*Solanum diphy//um,* twinleaf nightshade
Hibiscus tiliaceus, mahoe	*Solanum torvum,* susumber
Hiptage benghalensis, hiptage	*Solanum viarum,* tropical soda-apple
Jasminum dichotomum, Gold Coast jasmine	*Syzygium jambos,* rose-apple
Jasminum fluminense, Brazilian jasmine	*Tectaria incisa,* incised halberd fern
Jasminum sambac, Arabian jasmine	*Terminalia catappa,* tropical-almond
Koelreuteria elegans, flamegold tree	*Terminalia mue//eri,* Australian almond
Lantana camara, lantana	*Tradescantia spathacea,* oyster plant
Limnophila sessiliflora, Asian marshweed	*Urena lobata,* Caesar's-weed
Lonicera japonica, Japanese honeysuckle	*Xanthosoma sagittifolium,* elephant ear
Melaleuca quinquenervia, melaleuca	

3. This listing of species should not cause the species which are listed lower in priority to be ignored in control efforts. Note that this ranking of species in no way implies that the species of lower rank for management plans/research development are of lower priority for control efforts. There is concern that agency funding allocations (e.g. within the DEP aquatic and upland programs) may be affected adversely by how this ranking is done.

7. OPPORTUNITIES

With a well-planned, integrated and organized approach that is part of a multi-agency implementation plan, there is an opportunity to develop a successful invasive exotic plant control program in which each agency can take part, and benefit from the programs and efforts of the others. This in turn should help us at best, ultimately win the war against invasive exotic pest plants, or at least reduce the likelihood of forever losing our natural ecosystems as a result of invasive exotic pest plants.

8. PLANNING OBJECTIVES

These planning objectives reflect the problems and opportunities and represent desired positive changes from the without project conditions. In order to determine a potential solution to the related problems, such as those previously described, it is necessary to identify the objectives that any such solution should strive to attain. According to the Water Resource Council's (WRC) Principles and Guidelines (P&G), all water resource related studies should strive to develop plans that enhance, or make positive contributions to National Economic Development (NED) in a manner that is consistent with the protection of the environment. The planning objectives, to be evaluated over a 50 year period of analysis, are specified as follows:

1) To eliminate or significantly reduce invasive exotic plants in south Florida in terms of numbers of species, numbers of individuals of each species, and the acreage or aerial coverage of the invasive exotics infestation.

2) To improve coordination and integration of invasive exotic plant control efforts amongst all agencies involved in the various aspects of invasive exotic plant control in south Florida.

3) To provide for restoration of native species and habitat conditions in ecosystems that have been invaded by invasive exotics.

9. STUDY CONSTRAINTS

While the above planning objectives describe the goals of the study, there are certain limitations, which must be considered in evaluating any plan for possible implementation. The primary constraint that must be considered is the overall scope of the study. This special report is a reconnaissance level study, which uses existing data and readily available information. The study constraints identified in this study are as follows:

1) No current authority for control of invasive exotic plants on upland areas or invasive exotic plants that may be considered as upland species (except on Corps owned land).

2) Authority for exotic aquatic plant control only applies to existing Federal navigational channels (River and Harbor Act of 1899, as amended), except as noted below regarding CERP.

3) Some exotic plant control alternatives may include research and development.

Several laws, including Section 10 of the Rivers & Harbors Act of 1899 (33 U.S.C. § 403), Sections 2 and 4 of the Flood Control Act of 1944, (33 U.S.C. § 701-a, 16 U.S.C. § 460d), and Sections 1 and 2 of the Forest Cover Act of 1960 (16 U.S.C. § 580m-n) provide general authority to the U.S. Army Corps of Engineers Civil Works Program to fund and manage the navigable waters of the United States. This includes the operation and maintenance of Federally-owned water resource projects, as well as the development and restoration of the nation's water-related resources. The Corps uses this general operations and maintenance (O&M) authority to remove invasive aquatic vegetation that interferes with flood control, navigation, irrigation, water supply, and fish and wildlife conservation in Corps-managed Federally designated navigation channels.

The Corps' authority to control invasive aquatic weeds has also grown since its first experience with water hyacinth in 1899. Mechanical and chemical controls were added to the Corps' arsenal in 1902. In 1958, Congress approved an "Expanded Project for Aquatic Plant Control" that authorized the removal of several new aquatic plant species "in the combined interest of navigation, flood control, drainage, agriculture, fish and wildlife conservation, public health and related purposes…." Today, these authorities are consolidated in the Corps' Removal of Aquatic Growth (RAG) and Aquatic Plant Control (APC) Programs, summarized below.

U. S. Army Corps of Engineers Aquatic Plant Control Programs

Program	Original Authority	Eligible waters	Cost-Share
Removal of Aquatic Growth (RAG)	Rivers & Harbors Act of 1899, Ch. 425	Only Federally designated navigation channels	100% Federal
Aquatic Plant Control (APC)	Rivers & Harbors Act of 1958, Sec. 104	All public waters	50% Federal / 50% local

In 1999, President Bill Clinton issued *Executive Order 13112*, on invasive species, that contains some important policy directives for Federal agencies. The Executive Order stated the following:

1) to use the full extent of their authority to prevent, control, monitor, and research invasive species;
2) not to authorize, fund, or carry out actions that it believes are likely to cause or promote the introduction or spread of invasive species, unless the agency can demonstrate that the benefits "clearly outweigh the potential harm caused by invasive species" and all measures are taken to minimize the risk of such harm;

3) to provide for restoration of native species and habitat conditions in ecosystems that have been invaded.

Compliance with the Executive Order seems to demand a more proactive and creative Federal response to invasives. This will require agencies to rethink their current approaches and find new ways to use their existing authorities to address invasive species threats. The U.S. Army Corps of Engineers can play a leading role in this effort. Congress could help by expanding the Corps' traditional RAG and APC programs to address additional species and impacted areas in Florida. In addition, CERP's adaptive management process offers several opportunities to more effectively incorporate and enhance invasive species management in Florida. These steps would be consistent with the Executive Order and could help ensure Congress's goals of "restoring, preserving, and protecting the South Florida ecosystem" are eventually achieved.

CERP offers several opportunities for more effective invasive species management in Florida. The Plan has been described as the world's largest ecosystem restoration effort. It includes more than 60 elements, and will take more than 35 years to construct. CERP projects have largely focused on water delivery. The premise of the current approach is to "get the water right" first in order to set the stage for the ecosystem to rebound. However, many believe that the destructive potential of invasive species in South Florida has exceeded original expectations, and that the current approach, if not amended, will not fully achieve the desired restoration benefits.

10. EXISTING CONDITIONS

CERP identified numerous invasions of exotic species {i.e. Australian pine (*Casuarina equisetifolia)*, Brazilian pepper (*Schinus terebinthifolius)*, climbing fern (Lygodium microphyllum), Melaleuca (*Melaleuca quinquenervia*), lather leaf (*Colubrina asiatica)* and calophyllum (*Calophyllum inophyllum*)}, and there effects {i.e. disappearance of native species, decreases in water levels, changes in water quality, changes in frequency and seasonality of burning}; throughout the Everglades ecosystem. Since that time, conditions have deteriorated significantly. The following graphs (Figure 4) show the change in conditions of four key invasive species between 1997 and 2003, a six-year period. The most alarming change is with Lygodium, which has almost tripled its spatial extent in the past six years. If this trend continues, Lygodium could become the dominant species in the Everglades within the next 50 years (see Figure 5). Melaleuca on the other hand is the only case of a reduction in spatial extent, this being attributed to interagency cooperation and an effective management plan.

The Monitoring and Assessment Plan (MAP) is the primary tool by which the REstoration COoordination and VERification (RECOVER) program will assess the performance of the Comprehensive Everglades Restoration Plan (CERP). The scientific and technical information generated from the MAP implementation will be organized to provide a process for RECOVER to evaluate CERP performance and system responses and to produce assessment reports describing and interpreting the responses. The Adaptive Assessment Team of RECOVER has the lead responsibility for developing, implementing, and updating the MAP. The overarching goal for implementation of the

MAP is to have a single, integrated, system-wide monitoring and assessment plan that will be used and supported by all participating agencies and tribal governments as the means of tracking and measuring the performance of the CERP.

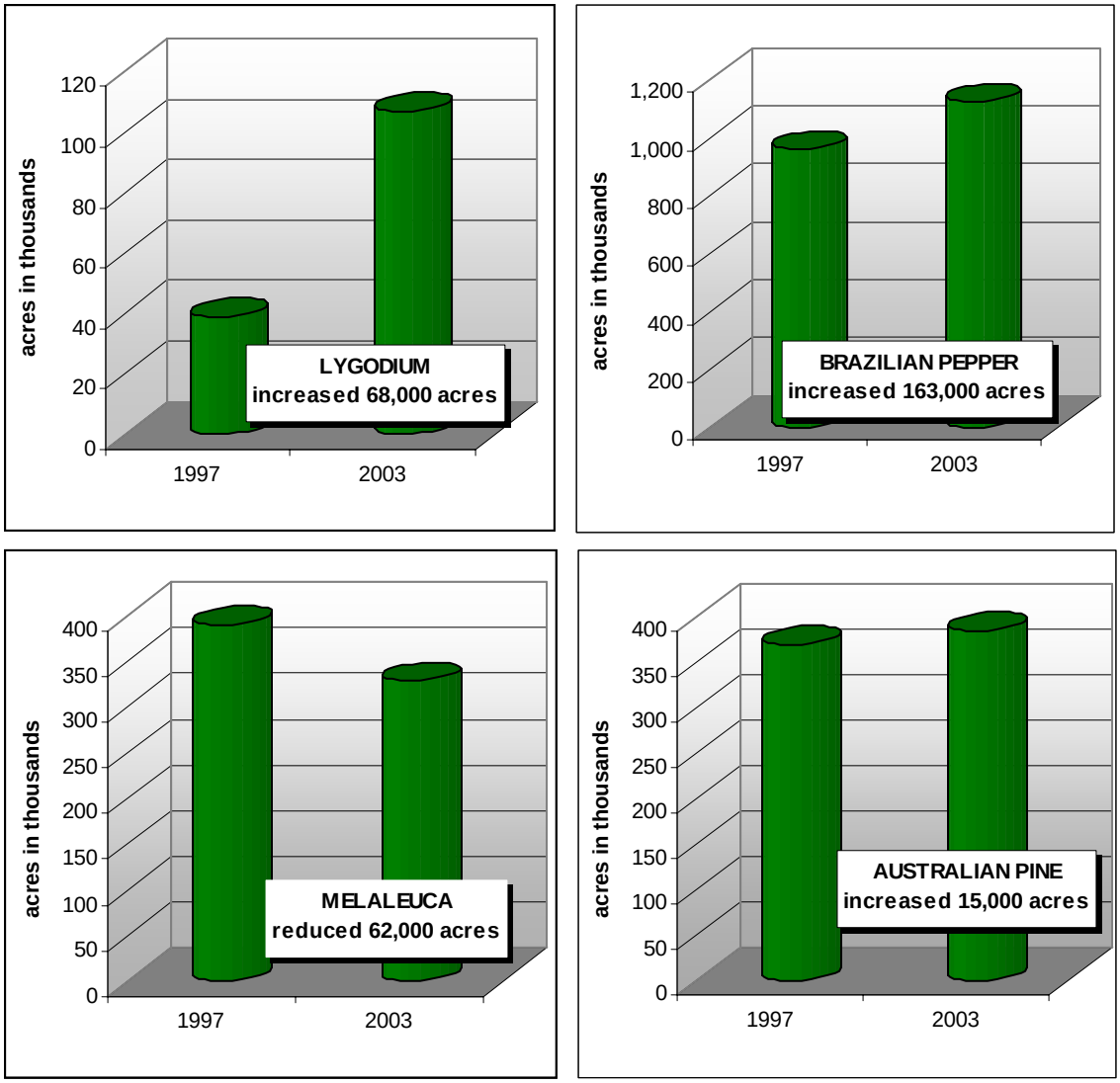

Figure 4: Growth Rate Between 1997 and 2003

The RECOVER program recognizes that the MAP is a key component of a system-wide adaptive management strategy that is essential for the success of the CERP. Basic components and purposes of the CERP Adaptive Management Program are described in the Programmatic Regulations for the Comprehensive Plan (DOD 2003). The Adaptive Management Program is designed to maximize the success of the CERP by refining the Plan during its implementation to respond to new information or technologies to ensure that the goals and purposes of the Plan are fulfilled. These uncertainties include unpredicted and undesired responses and events in the natural and human systems of South Florida that result from CERP implementation or from non-CERP projects and

programs. A successful adaptive management program will provide early warnings of undesired impacts and a process that will allow decision makers to: 1) effectively integrate science and management to ensure that the CERP goals and purposes are fulfilled and 2) to seek continuous improvements of the CERP.

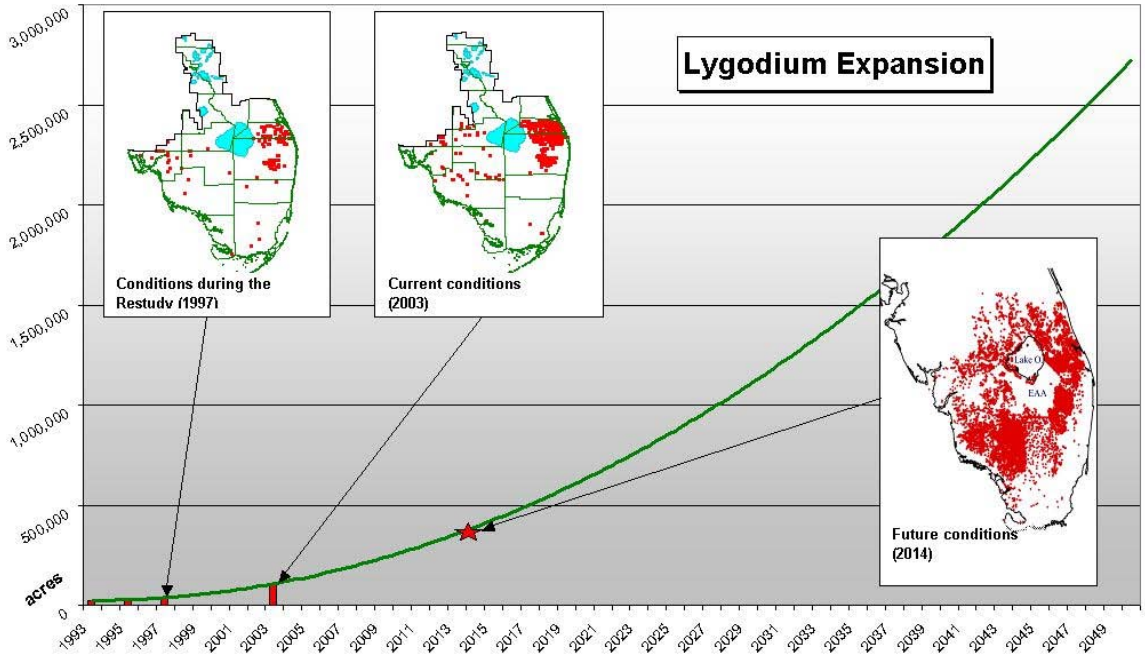

Figure 5: Growth Rate of Lygodium Estimated to 2050

Through the MAP, RECOVER has identified invasive species as “drivers”, “stressors”, and or “ecological effect” in the conceptual ecological models for the Everglades Ridge and Slough, Southern Marl Prairies, Everglades Mangrove Estuaries, Bog Cypress Regional, Lake Okeechobee, and the Loxahatchee Watershed. This identification, highlights the importance of invasive species management as identified in the Plan and relates directly to the future success of CERP.

Sixteen different Federal and State agencies and numerous local agencies are involved in the management, regulation, control, interdiction and prevention of invasive exotic species in Florida. Combined, these agencies have management authority for more than 13.7 million acres (about 21,500 square miles) of Florida’s natural lands. Individual agencies have noted 32 out of the 66 priority species included in the Weeds Won’t Wait report as particularly serious and specifically targeted for control. This is in a context of 125 species identified by the Florida Exotic Pest Plant Council as invasive and over 1,180 naturalized exotic species documented in Florida.

The agencies spend an estimated combined total of $91 million each year on management of exotic invasive plants. The agencies also reported an estimated annual shortfall (five agencies did not report shortfall needs) of approximately $88 million for existing programs. Each agency decides on operations, funding and implementation

based on individual agency policy, regulations, criteria and funding levels. Agencies coordinate and integrate their activities and funding support entirely on a voluntary cooperative basis through agreements and plans. Agency programs are highlighted in Appendix D. Table 1 provides a summary of those programs.

Table 1: Summary of Federal and State Programs

AGENCY	PROGRAM
U.S. Army Corps of Engineers	▪ Removal of Aquatic Growth (RAG) Project ▪ Aquatic Plant Control (APC) Program ▪ USACE Operations and Maintenance (O&M) Program
Animal & Plant Health Inspection Service	Plant Protection and Quarantine
Agricultural Research Service	ARS biological control programs
National Park Service - Big Cypress National Preserve	Melaleuca control program
National Park Service - Everglades National Park	▪ HID Brazilian pepper control project ▪ Melaleuca management program
National Park Service - Dry Tortugas National Park	None in place
U. S. Fish and Wildlife Service	▪ A.R.M Loxahatachee NWR - Integrated Pest Plant Management Plan ▪ Exotic plant program at J.N. "Ding" Darling NWR ▪ Invasive Species Strike Team
Florida Fish and Wildlife Conservation Commission	None in place
Florida Department of Environmental Protection	▪ Bureau of Invasive Plant Management - Upland Plant Control Group ▪ Bureau of Invasive Plant Management - Aquatic Plant Control Group
Florida Department of Agriculture	5-year exotic invasive species strategic plan
Florida Department of Transportation	No official policy or plan for vegetative control along transportation corridors
Florida Water Management Districts	Exotic and invasive plant management programs

11. FUTURE WITHOUT PROJECT CONDITIONS

Predicting the future of invasive exotic species 30 - 50 years into the future of the Everglades is not a trivial task. Many factors affect the future outcomes of invasions and the future outcomes of (much less their predictions) such complex biological events are confounded and compounded by many factors.

Each species has its own diverse and intricate biological heritage and each responds to new situations and new environments differently both spatially and temporally. Management actions across the state and the country are variable in their activities, in their effectiveness, and in their funding; making it impractical or impossible to predict how management may affect a species spread or control over the landscape. We know

virtually nothing about the biology or possible effective controls for most of the invasive species already here, and we have essentially no knowledge about species yet to arrive. Pathways of expansion once a species arrives are essentially unknown, and where we do understand those pathways controlling the spread of a species by restricting or regulating pathway movements are often opposed due to social or economic concerns such as with the recent movement of Sudden Oak Death fungus from California into Florida through the nursery trade. The ability to predict which species under which conditions may become invasive is imperfect and is limited to the use of several predictive models that currently are only being used in the academic environment. No agency within the US has developed or adapted, tested and implemented a predictive system of regulation for preventing the importation or movement of existing or potential new invaders. For Example: 8,000 acres of giant reed (*Arundo donax)* (a well documented and serious invasive species) was planted in the northern Everglades, which points to the ineffective regulatory and predictive environment within agencies. Even in situations where management is able to demonstrate effective landscape-level control, as with melaleuca, the borders of the US are effectively wide-open to new species. Potential invaders, and other existing "lower priority" invaders will continue to be left unmanaged or under-managed.

The principal failings to deal effectively with the broader problem of invasive species stems from four issues: 1) The problem of invasive species has in the past generally been viewed more as an annoyance than as a serious danger to our environment and our economy; 2) Existing management programs are carried out by each agency individually. No lead agency for Florida provides for multi-agency coordination and prioritization statewide, for all species, and all areas. There needs to be a consensus driven comprehensive strategy and coordinated approach to the problem; 3) Funding has not been commensurate with the level of the threat; 4) Policy and regulatory conflicts within and among agencies have made regulations relatively ineffective.

There is clear evidence both in the Everglades' environment and throughout the world that there are effective approaches to managing and controlling nearly every aspect of the problem of biological invasions. This includes not only the control of individual species that already are widely spread, but species with incipient infestations and even prevention of the importation or spread of new suspected invaders. Like any other serious issue, where sufficient resources have been provided and appropriately directed toward this problem, extremely successful control of invasive species has been achieved. While the Everglades restoration program could directly or indirectly affect some of these issues, effective control of the species that threaten the Everglades and its restoration can only be accomplished if specific responsibility, focus and collaboration is truly implemented.

OLD WORLD CLIMBING FERN (Lygodium microphyllym)

Old World climbing fern serves as an excellent example for predicting what might happen if we were to fail to do anything to control invasive exotic species. This relatively new species has reached the exponential spread rate phase and is still expanding. We are only in the earliest stages of understanding its biology, while testing herbicides and

biological agents for control. A model has been developed and verified which can predict its continued spread spatially and temporally.

Old World climbing fern is native to Australia, Asia and Africa and was first found in Florida in the late 1960s. From its introduction site in Martin county, this exotic twining fern has now spread into more than 100,000 acres of undisturbed south Florida wetlands. It was unknown in Loxahatchee National Wildlife Refuge as late as 1999 and now occupies more than 37,000 acres of the Refuge. Figures 6 and 7 show the location and spread of Lygodium from 1993 to 2003. These maps are generated from data taken by the South Florida Water Management District during their biennial Systematic Reconnaissance Flights (SRF).

Old World climbing fern can climb tens of meters into cypress forests, overtop and smother everglades tree islands literally collapsing the tree canopies, and spread horizontally into open wetland marshes. Once established, this plant seriously alters fire ecology. Prescribed burns and wildfires that normally terminate at cypress sloughs in the wet season now continue through. Burning mats of fern break free during fires, and are kited away by heat plumes, leading to distant fire spotting. Additionally, the plant acts as a "ladder" carrying fire into native tree canopies where it historically never went. Preliminary data on spore counts (724 spores/cubic meter/hour) indicates that Lygodium microphyllum is capable of long distance dispersal. Plants have recently been discovered in Collier County's Fakahatchee Strand, and the southern coastal marshes of Everglades National Park.

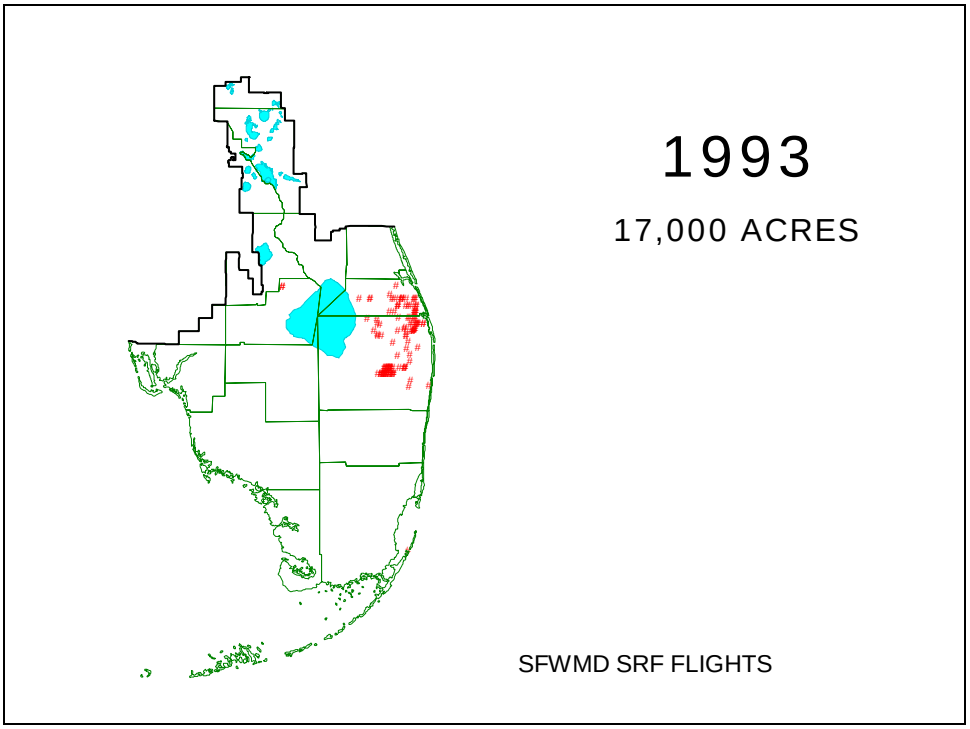

Figure 6: Location Map of Lygodium

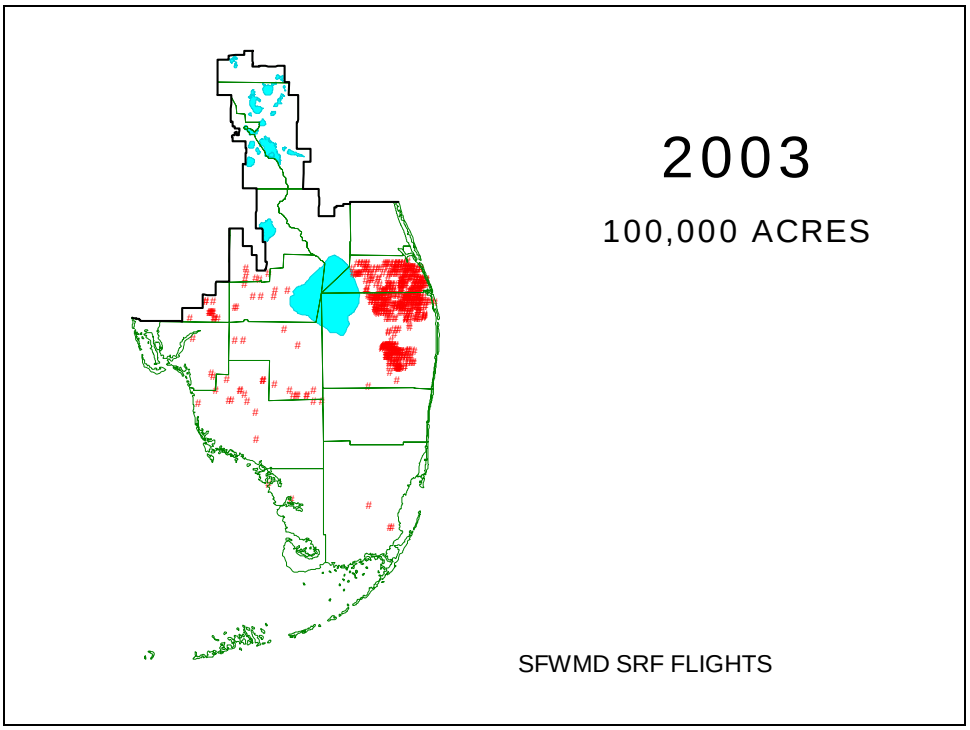

Figure 7: Location Map of Lygodium

Preliminary herbicide trials have resulted in variable control. It seems that several repeat applications will be necessary, and long-term results are not yet available. Investigations into herbicidal and physical control methods need to be explored further in areas where Lygodium microphyllum already has a strong foothold. The successful establishment of biological controls will be important in reducing the exponential rate of expansion now occurring in south Florida. The potential for biocontrol of Lygodium microphyllum is high due to few native and economic plant conflicts. Preliminary and brief examinations of a few populations in its native range have already identified several natural enemies. Biocontrol is essential if this invader is to be effectively contained, much less controlled.

Considering the present rate of Lygodium spread, and the lack of effective controls currently in place we can predict coverage for Lygodium using a quantitative predictive model developed specifically for Lygodium (Volin 2004). The model results are predictive of the spread of Lygodium in the absence of any control activities and used the existing aerial location data from the SFWMD SRF flights for calibration and hindcast accuracy checking. The following Figures 8 , 9 and 10 show expected Lygodium extent using a 22 year future prediction with a starting date of 1993 (the beginning of the SRF survey exotic plant flights). These maps show the actual location data from the SRF flight (yellow dots) with the superimposed predicted spread of Lygodium (red dots) for 1993, 2003, and predicted spread of Lygodium out to the year 2014.

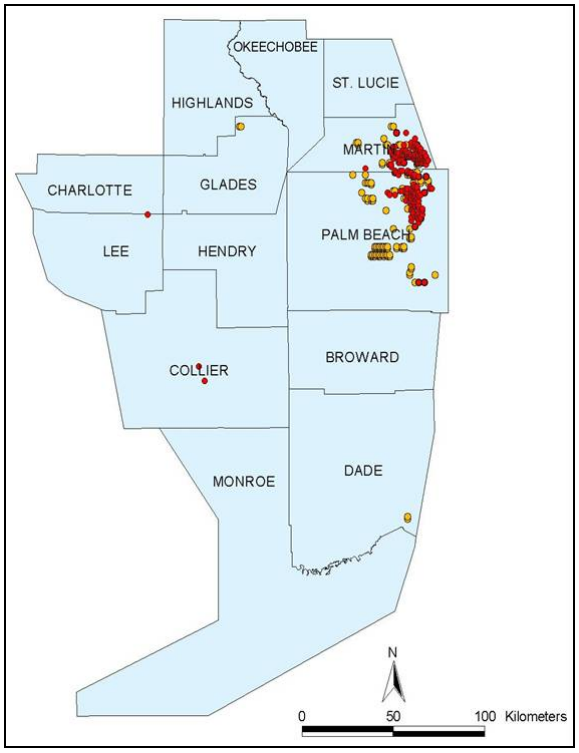

FIGURE 8: Lygodium spread for 1993

- **Yellow dots actual cover data from SRF**
- **Red dots model prediction cover data.**

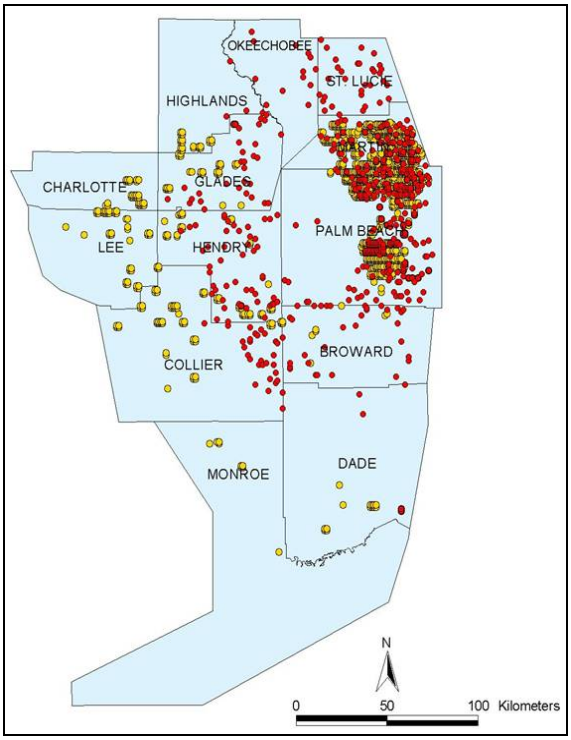

FIGURE 9: Lygodium spread for 2003

- **Yellow dots actual cover data from SRF**
- **Red dots model prediction cover data.**

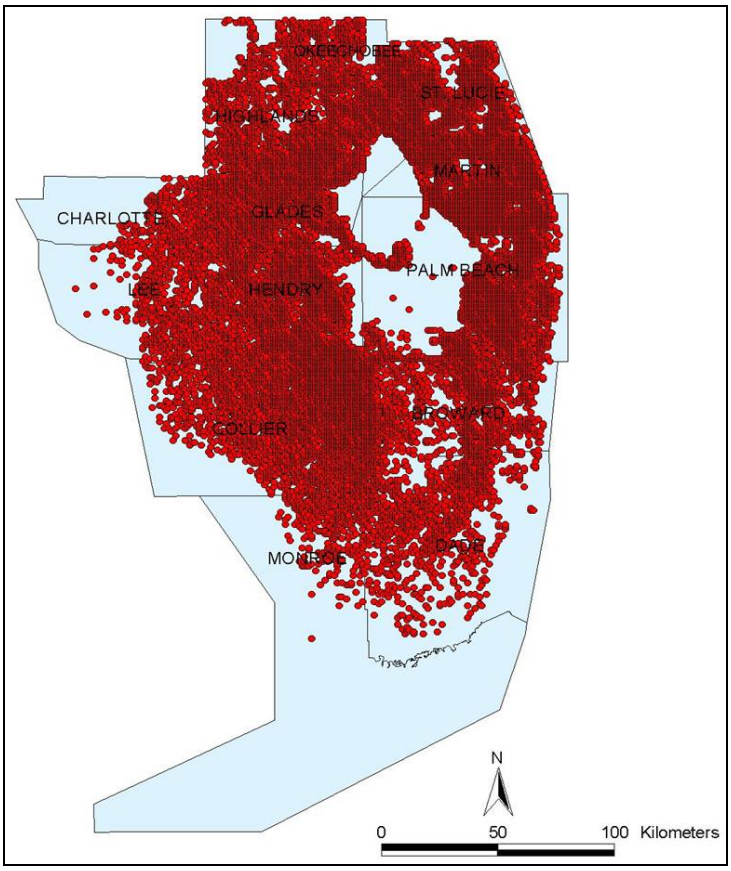

FIGURE 10: Lygodium spread model prediction for 2014

- **Red dots model prediction cover data.**

It is important to note in each of the maps depicting Lygodium spread how the model data (red dots) compare to the actual cover data (yellow dots.) In each case it should be noted that the model data are significantly more conservative that the actual monitoring data and even in the prediction of the distance of outliers—those points farthest from the main infestation—the model is still more conservative. The fact that the model results track the actual data extremely closely and is slightly more conservative is a good indicator that the model prediction for 2014 is an accurate reflection of the rate and extent of Lygodium spread in the absence of any effective control program.

The blank space in the middle of all the red dots in Figure 10 is Lake Okeechobee, and the area just to the south is the Everglades Agricultural Area (EAA). The possible extent and impacts from the spread of a species in its exponential rate of expansion are alarming and illustrate just how serious a threat invasive exotic species pose to Everglades' restoration. These results are for only one species and there are dozens of invasive exotic species in south Florida that are of critical concern to ecologists. While Lygodium happens to be the species we are currently most alarmed about, if one were to have asked those same ecologists 20 years ago if they thought Lygodium might become such a serious pest the answer probably would have been no. That's the reason very little was done to control Lygodium until quite recently.

Multiply the threat documented for Lygodium by 100 or perhaps by 1,000 if you also include all the other serious plant invaders in Florida and perhaps multiply this threat by thousands if you include all the potentially invasive plant species not here yet and all the invasive animal species. One can then begin to have a glimpse of the extreme danger we have put our environment and our economy in, not to mention Everglades Restoration.

12. PRELIMINARY ALTERNATIVES

As defined by ER-1105-2-100, Planning Guidance Notebook, plans should be in compliance with existing statutes, administrative regulations, and common law or include proposals for changes as appropriate. Alternative plans shall not be limited to those the Corps of Engineers could implement directly under current authorities. Plans that could be implemented under the authorities of other Federal agencies, State and local entities and non-government interest should also be considered.

Alternative plans have been formulated to identify specific ways to achieve the planning objectives within the constraints, so as to solve the problems and realize the opportunities that have been identified. A list is provided below:

A. Project Implementation Report (PIR). Recommend that a PIR be initiated under the CERP authority with the South Florida Water Management District (SFWMD). The Corps and SFWMD will take the lead, however, this study will require a collaborative effort with other Federal and state agencies. The PIR would include those areas or gaps not covered by the existing CERP components, from which a detailed project would be prepared in accordance with existing Federal policies, guidelines and regulations for water resources development. This PIR would further identify the problem with exotic and invasive species, and provide a recommendation for further Federal, State and local involvement. Utilizing the currently approved guidance, EC 1105-2-409, “Planning in a Collaborative Environment”, collaborative planning with other Federal agencies and Tribes requires the Corps to move beyond the Corps interest and embrace solutions that reflect the full range of the national Federal interest (the collection of all responsibilities assigned to Federal agencies). National interest plans address one or more products or services that reflect the full range of the Federal interest as defined in the study authorities and public laws, executive orders, and other statements of the Administration and the Congress.

The total estimated cost for the PIR would be developed upon completion of this Special Reconnaissance Report, along with the Project Management Plan. The development of the PMP and PIR would be cost shared 50 percent Federal and 50 percent non-Federal. PIR development would include the following:

1) Develop an Everglades Ecosystem Invasive Species Master Plan (This could be developed similar to the others currently being worked. Examples: Economic Equity Master Plan, Recreational Master Plan, and Data Management Master Plan)

2) Enhance understanding of current and future invasive species with in-depth biological studies,
3) Enhance detection, assessment and monitoring capabilities
4) Establish and coordinate rapid response methods and teams to most effectively deal with new invasions,
5) Develop methods for risk assessment and prioritization
6) Determine Federal, State and local interest (i.e. economic studies, risk assessment) in implementing recommendations, and
7) Test and demonstrate innovative management technologies.

Examples of proposed projects that could be recommended by the PIR include the following:

- Lake Okeechobee – This project would deal primarily with the Lake Okeechobee western marsh area and include species control of Melaleuca, Torpedo grass and West Indian Marsh grass. Estimated cost is $7.5 million over 10 years.

- Conservation Lands – This project would include lands acquired by the SFWMD for conservation purposes, which lay within the CERP Project Area. Species to be controlled would include Lygodium, Brazilian Pepper, Melaleuca, Torpedo grass and Australian pine. Estimated cost is $14.5 million over 10 years.

- Water Conservation Areas – This project would include lands acquired by the SFWMD for water conservation purposes, which lay within the CERP Project Area. Species to be controlled would include Melaleuca and Lygodium. Estimated cost is $5 million over 10 years.

- Stormwater Treatment Areas – This project would include lands acquired by the SFWMD for stormwater treatment, which lay within the CERP Project Area. Species to be controlled would include hydrilla. Estimated cost is $2 million over 10 years.

- Species Based Management Plans – This project would develop, write and assist in implementation of management plans for priority species. Estimated cost is $250,000 over 10 years.

Table 2: Summary of the Estimated Costs for the Proposed Projects ($ in Thousands)

PROJECT	YEAR										COST
	1	2	3	4	5	6	7	8	9	10	
Lake Okeechobee	$1,000	$1,000	$1,000	$1,000	$1,000	$1,000	$500	$500	$250	$250	$7500
Conversation Land	$1,000	$1,000	$1,000	$1,500	$1,500	$1,500	$2,000	$2,000	$2,000	$1,000	$14,500
WCAs	$500	$500	$500	$500	$500	$500	$500	$500	$500	$500	$5,000
STAs	$100	$100	$100	$200	$200	$200	$200	$300	$300	$300	$2,000
Special Management Plans	$25	$25	$25	$25	$25	$25	$25	$25	$25	$25	$250
TOTAL	$2,625	$2,625	$2,625	$3,225	$3,225	$3,225	$3,225	$3,225	$3,075	$2,075	$29,250

B. Amend Aquatic Plant Control Authorization. Utilize the existing authorization of the Aquatic Plant Control Program {*Section 104 of the River and Harbor Act of 1958 (33 U.S.C.610)},* to treat currently authorized species. Recommend that the existing authorization of the Aquatic Plant Control Program be amended to include all exotic and invasive species within the CERP project boundary. The program would be cost shared 50% Federal and 50% non-Federal. The authority for this program would not be species specific, because it is not possible to predict which exotic species will become problems in the future. This Program would use an integrated pest management approach that would include mechanical, chemical, and biological control methods, and would feature a programmatic EIS or EA to satisfy NEPA requirements.

C. Develop and Implement an Invasive Species Demonstration Project. Utilize this Special Reconnaissance Report to pursue congressional authority for the establishment and implementation of a demonstration project to address invasive species issues important to everglades ecosystem restoration. This demonstration project would be 100% Federally funded. This project would provide information necessary to:

- Develop an Everglades Ecosystem Invasive Species Master Plan
- Enhance understanding of current and future invasive species with in-depth biological studies
- Enhance detection, assessment and monitoring capabilities
- Establish and coordinate rapid response methods and teams to most effectively deal with new invasions
- Develop methods for risk assessment and prioritization
- Determine Federal interest (i.e. economic studies, risk assessment)
- Test and demonstrate innovative management technologies
- Serve as a National Demonstration Project/Model for invasive species management

The demonstration project would be located in Dade County, Florida (See Figure 12) and would include the following:

Part I – Demonstrate economic and environmental value of treating invasive species.

Compile and analyze spatial data associated with invasive species in the Everglades Protection Area and model what plant populations would be today if operational control measures had not been undertaken in 1990. This will be accomplished through the use of historical survey and cross-agency operational control data. Areas of the Everglades where control programs have not been successful (i.e. LNWR) will be used as a controls. This analysis would provide important economic data on the importance of early control and prevention and allow for predictions when control is not taken up early.

Part II – Demonstrate technique for monitoring and assessing invasive species.

a) Analyze various detection methods for invasive species in the Everglades and provide recommendations for the use of these techniques. This work would focus on the potential for the use of aerial sketchmapping techniques to establish baseline invasive species data for CERP performance.

b) The SFERTF has directed the Science Coordination Group to develop system wide ecological indicators/performance measures for the success of Everglades restoration. The Science Coordination Group feels that invasive species have to be part of this process. This project would compare South Florida Water Management District 2005 sketchmapping data with the most accurate vegetation/land use spatial data to identify a context for invasive species and review and test this as a means for monitoring the invasive species, vegetation, and land use interactions. This would be used to track invasive plants in the context of restoration ecological indicators and allow for the determination of the presence (or absence) of adequate data for tying invasive species to other geographic features such as vegetation, water and soils.

Part III – Demonstrate method to develop and execute a management plan for invasive species control. Invasive species can be plants, animals, and other organisms (e.g., microbes). Human actions are the **primary** means of invasive species introductions.

a) Develop a cross-taxa management plan for the C-111 project interphase between works of CERP and Everglades National Park. This all-taxa approach would include plants (i.e. Casuarina, Melaleuca, Schinus), reptiles (i.e. Burmese python, iguana) mammals (i.e. feral hog), birds (i.e. Muscovy duck) fish (i.e. swamp eel) and insects (i.e. lac scale). This management plan would be the first of its kind to address management of a cross-taxa/cross-agency nature.

b) Develop an operational implementation plan to actively control invasive species across taxa in the C-111 project area. This work would fund operational programs outlined in the above cross-taxa management plan.

Part IV – Demonstrate how to organize and coordinate invasive species management strategies and budgets.

a) ECOSTEMS.ORG: Complete the final development of the Ecostems project tracking database by adding Search, Analysis, Graphing component, develop the GIS/Mapserver element, search and dynamic user and undo features with integrated help system, implement the upload, store and search capability for Ecostems products and publications, refine and improve the graphic and use of temporal information and export to text or pdf formats for data extraction.

b) Coordinate and work with the National Invasive Species Council to do a trial expansion and development of Ecostems to include another state in addition to Florida as a prototype for a national invasive species project tracking data system.

Table 3: Estimated Costs for the Demonstration Project

Project	Cost
Part I – Economics	$100,000
Part II – Monitoring and Assessment	$175,000
Part III – Management and Control	$525,000
Part IV – Coordination and Planning	$140,000
TOTAL	**$940,000**

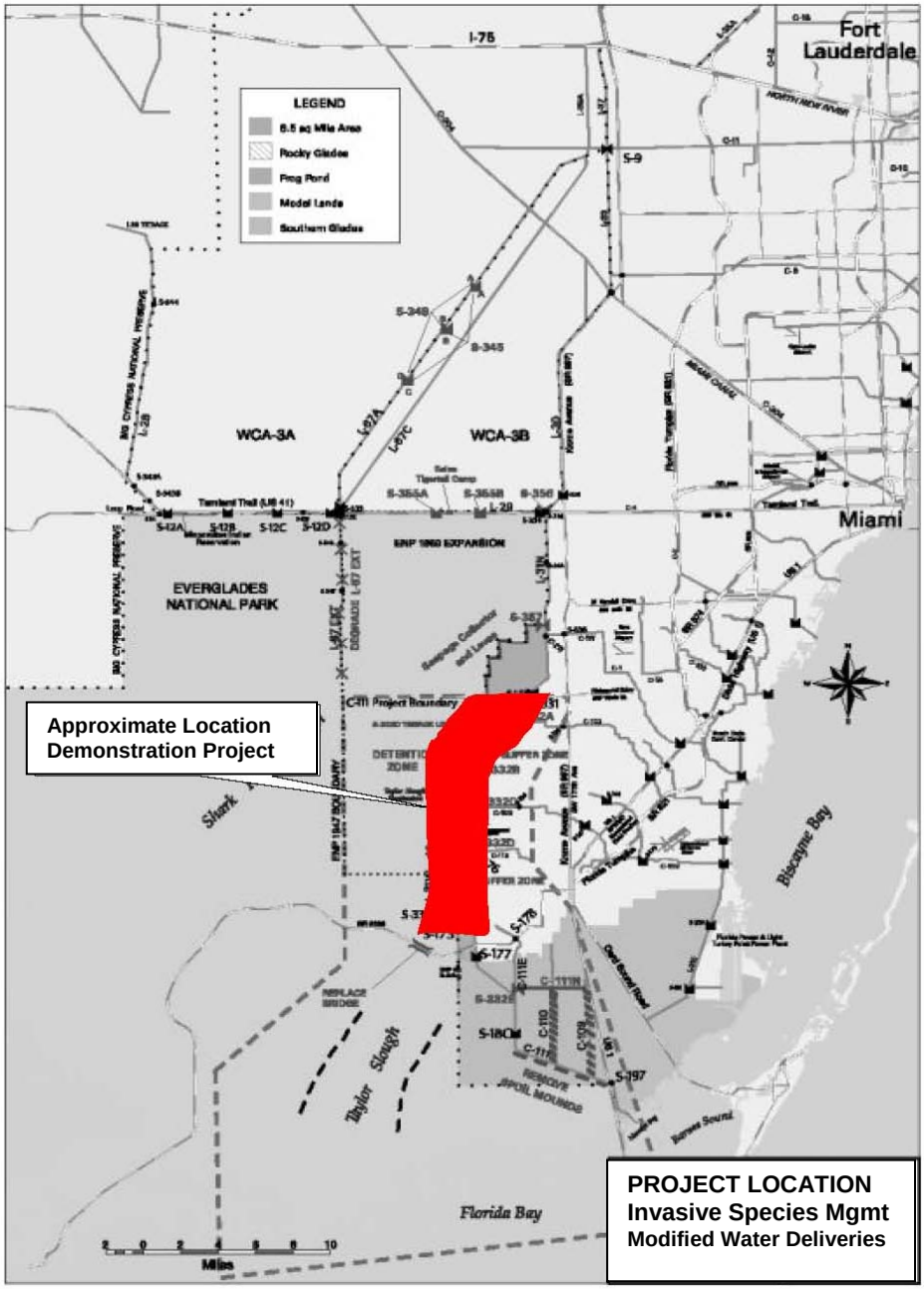

Figure 11

13. EVALUATION OF ALTERNATIVES

This Special Reconnaissance Report reaffirms the findings of the Comprehensive Study and acknowledges that at this time the CERP program does not address invasive species in the project alternatives, and that without invasive species control, full restoration benefits will not be achieved. This report was developed from readily available information gathered and evaluated by the District study team.

Based on information from the *"Weeds Won't Wait"* document and input from subject matter experts, exotic and invasive species are causing serious threats to native habitats and ecosystems. The current administration has placed a high priority on invasive species management, as exemplified by the following:

> President George Bush on April 23, 2004 when talking about the Everglades; "…one of the problems has been that non-native plants have invaded. And so one of the things we're going to do is encourage programs that will remove the invasive species to allow the native vegetation to return. It sounds simple, but it's hard work, and it requires Federal government support. And I'm willing to dedicate that support because I understand how important wetlands are."

Executive Order 13112, Invasive Species, dated February 3, 1999 provided the following directive:

> "Each Federal agency whose actions may affect the status of invasive species shall, to the extent practicable and permitted by law…use relevant programs and authorities to: (i) prevent the introduction of invasive species; (ii) detect and respond rapidly to and control populations of such species in a cost-effective and environmentally sound manner; (iii) monitor invasive species populations accurately and reliably; (iv) provide for restoration of native species and habitat conditions in ecosystems that have been invaded; (v) conduct research on invasive species and develop technologies to prevent introduction and provide for environmentally sound control of invasive species; and (vi) promote public education on invasive species and the means to address them".

Guidance provided by Executive Order 13112, through the National Invasive Species Management Plan, directs Federal agencies to:

- Develop and recommend to the President draft legislation to authorize matching Federal funds for State programs to manage invasive species.

- Develop and recommend to the President draft legislation, in consultation with the States, to address rapid responses to incipient invasions, possibly including permanent funding for rapid response activities.

The Government Accountability Office (GAO) released a report GAO-05-185, February 2005, "Cooperation and Coordination Are Important Effective Management of Invasive

Weeds". GAO stated that invasive weeds, native or nonnative plant species, cause harm to natural areas such as rangelands or wildlife habitat and economic impacts due to lost productivity of these areas. While the Federal investment in combating invasive species is substantial most has been concentrated on agricultural lands, not on natural areas. The Federal government is the largest source of funding through the general budgets of Federal land management agencies and numerous grant programs for natural resource management. State and local agencies and nongovernmental entities often rely on a mix of their own funding, grant resources, and collaboration with other entities or volunteers to implement weed management projects. Not surprisingly, given the magnitude of the invasive weed problem, Federal and nonfederal officials questioned believed that the lack of consistent and adequate funding limits effective management of the problem. Specifically, some officials commented that funding needs to be consistent from year to year to ensure that invasive weeds are eradicated or kept in check, but available resources for weed management often fluctuate.

Melaleuca acres are decreasing throughout the region, but other species like Old World climbing fern (*Lygodium microphyllum*) are overtaking vast areas of unspoiled wilderness. The melaleuca program proves that an invasive species can be effectively contained and controlled if agencies work together to focus attention on developing essential resources such as funding, integrated control strategies, increased public awareness and legislative initiatives.

Using Melaleuca as an example, here are the ways and reasons why invasive exotic species management can and is succeeding.

1) A multi-level organization, although informal in nature, has existed for 10 years and has provided consistency among agencies in tactical management approaches and priorities for control and funding. While all areas of the plan have not been successful (in part because they have been unable to be implemented usually due to funding) those parts that have been implemented and followed consistently by agencies has been very successful in the removal and control of melaleuca in priority areas.

2) Information collected on this species has not been sufficiently integrated, however, because of the coordination among groups, data and information became more uniform. Some of this has been a formal part of the plan and some an informal result of consistent plan implementation.

3) Specifically for melaleuca, employees involved have had this issue as a principal duty and their role within their organization is in many instances entirely focused on invasive exotic species management or research.

4) Resources within agencies have often been shared by priorities within the plan, and much of the funding has crossed agency boundaries.

5) Specific agency bureaucratic obstacles (such as Federal employees flying in state helicopters, or inter-agency funding transfers) were evaluated and clear

rationales and means for overcoming them were established and implemented at all agency levels and divisions.

6) The difficulty of invasive species management is recognized but the reality of effective invasive species management through integration and coordination of practical solutions were developed and implemented by trained and experienced professionals.

7) The devastating effects of species homogenization and loss of natural areas were well recognized and provided impetus for development of a practical plan.

8) Short-term interests were overcome by taking the long-term view that recognized the problem and the solutions as many-fold and one that will require continuous development, resources and refinement at the tactical, strategic, political and educational level.

9) The problem was clearly identified as a long-term problem with long-term solutions and it was clearly understood that this is no different from dealing with any environmental restoration program in its ultimate planning and implementation.

10) Explicit and frank recognition of the need for non-local thinking and species-based planning formed the basis for the plan development.

The concept of adaptive management is a crucial element of CERP. The long-term nature of the Plan requires periodic reassessment and design modifications in order to ensure that its goals and purposes are fulfilled. This process is guided by RECOVER, an interagency and interdisciplinary scientific and technical team that "support[s] implementation of the Plan with the overall goal of ensuring that the goals and purposes of the Plan are achieved." In considering how the Plan may be improved, the Corps of Engineers and non-Federal sponsor could consider modifying the design or operational plan for a component to include invasive and exotic plant management.

There are several ways that this adaptive management process could be employed to better address invasive species in Florida. First, adaptive management could lead to modifications of existing CERP projects to improve their performance with respect to invasive species management. For example, technologies to keep invasives out of natural areas, like fish screens, could have a dramatic impact on ecosystem health, and are much less costly than control and eradication efforts. RECOVER could lead a technical review of CERP technical design and operation plans to minimize the introduction of invasives into the Everglades. The Corps could also design and implement one or more separate CERP projects to improve invasive species management in Florida.

14. ENVIRONMENTAL CONSIDERATIONS

The benefits to the environment of controlling invasive species can best be described by understanding the threat they represent. Invasive exotic plants threaten wildlife habitats and displace native plants that are important to Florida's ecology. They can out compete most native plants because they tend to grow quickly and are not easily affected by native pests and diseases. This reduction in biodiversity can have a severe impact on wildlife and alter natural processes such as fire and water flow.

14.1 Status of Exotics in South Florida

The following information excerpted from "Weeds Won't Wait" is a good overview of exotics in South Florida.

The exact number of plant species that have been purposely or accidentally introduced into Florida is unknown, but is estimated to be over 25,000 (Gordon and Thomas 1997, Wunderlin 1998). Of 3,834 species of plants documented in Florida in the most recently published statewide survey – Guide to the Vascular Plants of Florida (Wunderlin 1998) – 1,180 are exotic species with naturalized populations. Other countywide or site surveys indicated that these statewide numbers are conservative as not all exotic plant species known to be in Florida are captured in the Wunderlin survey (Watkins and Sheehan 1977, Hammer and Bradley 1999, IRC 1999). Only minimal information is available on some of the other 25,000 species that may have been introduced some of which may still be cultivated, but may not have established naturalized populations (Watkins and Sheehan 1977, Griffiths 1995, Langeland and Burks 1998, Hammer and Bradley 1999, IRC 1999)….The 1,180 species that are naturalized represent about 5% of the estimated 25,000 species introduced. These have naturalized in disturbed sites like roadsides and agricultural lands as well as in natural areas (Langeland and Burks 1998, FLEPPC 1999).

Generalized distributions, usually from herbarium specimens or routine sightings, are available for the 66 most invasive species and a few others. Detailed distribution maps are available for only four species and only for part of their Florida range, although individual sites, such as parks, may produce local maps of exotic locations as part of a site- or species-focused control program. Information on the natural history and biology is generally inadequate for the majority of species. The information gap for exotic plants is enormous and hinders both species-focused and ecosystem-level management efforts.

The lack of rapid and consistent response in controlling species is also a major factor in both the large number of species in the state and their widening distribution (Mack et al. 2000, Westbrooks 2000a). Old World Climbing Fern is a good example. An infestation of about 3-5 acres was found in Everglades National Park during an overflight in August of 1999. Later survey flights to determine the full extent of the infestation revealed a total area of about 500 acres. An aerial spray program was instituted with assistance from the SFWMD and a total of 850 acres were ultimately

found but only 720 acres were treated due to limited funding. Over 100 acres of this rapidly spreading weed still needs to be treated but treatment must wait for a new fiscal year for additional funding. It is estimated that this population may only have been there for 2-3 years. During the several months' hiatus in control actions, due to lack of funding, a serious and ecologically dangerous weed is continuing to spread within Everglades National Park (Pernas 2000).

Among the 66 species included in this assessment one or more of them have invaded every ecosystem and habitat in Florida (Craig et al. 1978, Long and Lakela 1978, Ewel 1986, Gregg 1994, Haller 1994, Schmitz 1994, Schmitz and Brown 1994, FDEP 1997, Gordon and Thomas 1997, Simberloff et al. 1997, FLEPPC1998, Gordon 1998, Langeland and Burks 1998, Wunderlin 1998, FLEPPC 1999). Some of these species invade many different habitats and others invade only one or a few types of habitat (Long and Lakela 1978, Langeland and Burks 1998, Wunderlin 1998). Forty-eight of these species predominantly invade forest habitat including: pine, cypress, scrub, temperate and tropical hardwood, coastal mangroves, wet and dry forest, and forest understory. Eight species are aquatic (both submerged, emergent and floating plants) and invade all aquatic habitats including: lakes, rivers, streams and man-made structures. Three species predominantly invade coastal dunes and seven invade wet-prairie and march habitat. The number of species that invade a particular habitat may be an indication of the vulnerability of that type of habitat, however, the level of impact may be just as great with one dominant exotic species as with several. However, developing control programs for habitats invaded by multiple species requires sufficient knowledge of all the species and habitats to be managed, making control more complex. Following is a general summary of (the 66 plants in this report):

- 48 species are documented to cause ecosystem level impacts in Florida
- 63 species are documented as having invasive characteristics and are known to be invasive elsewhere
- 14 species are documented to be impacting threatened, endangered and rare species or rare habitats in Florida
- GIS supported databases are available for the entire Florida range for 2 species (catclaw mimosa and giant salvina)
- GIS supported databases are available for parts of the Florida ranges for 35 species (only four of these 35 have significant portions of their range covered)
- Sufficient biological information exists for a risk-assessment for 34 species
- Sufficient biological information exists to develop effective control methods for 20 species
- 19 species are identified as being among the world's worst weeds
- 33 are from Asia (depending on the species its Asian origins may include: northern Australia, India, China, other areas of Asia and tropical east Africa)
- 18 are from Mexico, Central or South America
- 5 are from Africa
- 4 are from Australia
- 2 are from the West Indies-Caribbean

- The origins of 3 species are uncertain
- 20 species are trees, 15 are vines, 14 are shrubs, 7 are forbs, 6 are grasses, 3 are floating aquatics and 2 are submerged aquatics
- These 66 species occur in 32 different plant families
- 27 are still being sold, or recommended for use for agricultural or horticultural purposes

14.2 Environmental Impact

The following information excerpted from "FWS Draft Planning Aid Report – Part 2, CERP Initial Update.

Florida is at high risk for the introduction of new invasive species (Florida Invasive Species Working Group 2002). Florida is second only to Hawaii in the severity of the threat posed by invasive species and is particularly vulnerable to the introduction and spread of invasives because of its "subtropical climate, major ports of entry, burgeoning pet, aquarium, and ornamental plant industries, high rates of human immigration, increasing urbanization, and extensive environmental manipulation," according to a U.S. Congress, Office of Technology Assessment study (OTA 1993). Statistics from the FWS Office of Law Enforcement at the Miami International Airport disclose that the Port of Miami is the third largest port in the nation for imports and exports of wildlife and the second largest in the nation for shipments of live wildlife. Approximately 12,000 shipments of wildlife come through Miami each year, 85 percent of which are live animals for the pet trade. Tropical fish, reptiles, birds, mammals, and marine/terrestrial invertebrates are the bulk of the live animals that pass through Miami. Most nonindigenous fauna in the Everglades area can be traced to importation primarily for the pet trade (Goodyear 2000).

South Florida's subtropical climate provides an excellent growth environment for the rapid spread of exotic plants that can cause extensive alterations to natural ecosystems. Currently more than 1,180 naturalized exotic plant species occur in Florida, making up at least 31 percent of the total number of plant species in the state. Florida is the nation's second-most invaded state after Hawaii.

Florida's most invasive plants are often species that: 1) are easily and widely dispersed; 2) increase their biomass rapidly without cultivation through high rates of photosynthesis, respiration, transpiration, and growth; 3) have high fecundity (reproductive allocation); 4) are adapted to environmental disturbance or cyclic variation in conditions (fire, drought, flood, salt intrusion, etc.); 5) are hardy, *i.e.*, difficult to kill or control; 6) originate from similar climates; 7) have high population growth rates; 8) have comparatively short life cycles; 9) have early reproductive maturity; 10) are self-fertile, autogamous, wind pollinated, or pollinated by generalists; 11) are broad-niched, *i.e.*, generalist in resource use; 12) can acclimate rapidly to new habitats; and 13) show rapid response to resource availability (Austin 1999). Primary exotic plant species of concern in south Florida include melaleuca (*Melaleuca quinquenervia*), Old World climbing fern (*Lygodium microphyllum*),

Brazilian pepper (*Schinus terebinthifolius*), and Australian pine (*Casuarina equisetifolia*).

Exotic plant invasions can cause: 1) loss of and encroachment upon endangered and threatened species and their habitat; 2) changes to natural ecological processes such as plant community succession; and 3) alteration of hydrological flows and conditions. Generally, exotic plants in south Florida tend to establish in disturbed areas such as abandoned farm fields, along roadways, canals, and drainage ditches, and in wetlands which have been altered or stressed due to hydroperiod changes (Ferriter 1998). Environmental changes caused by extensive hydroperiod alterations have been an important factor in exotic plant invasion. Exotic plant invasion can result in partial or total displacement of native plants, loss of wildlife habitat, and the degradation of public use areas. According to the District (Amy Ferriter, District, telephone communication, March 23, 2004), as of 1999 in the south Florida region (from the north rim of Lake Okeechobee south to Florida Bay), melaleuca has infested 359,000 acres, Brazilian pepper 1,024,000 acres, Old World climbing fern 107,000 acres, and Australian pine 385,000 acres. Generally, melaleuca, Brazilian pepper, and Australian pine are found from mid-Brevard County transecting to mid-Pinellas County and extending to the southern border of Florida. The acreage estimates presented are not a comprehensive assessment because the area north of Lake Okeechobee has not yet been surveyed.

14.3 An Invasive Control Success Story

Melaleuca (Melaleuca quinquinervia) provides a good example for predicting what might happen were we to succeed in implementing a comprehensive and well financed interagency program for managing invasive exotic plants. Melaleuca is a well established and wide spread exotic plant that has been in south Florida for over 100 years. It's exponential phase of expansion appears to have reached its peak and spread seems to be slowing, there are several decades of research into the biology and control of melaleuca, and we have a well documented and implemented management plan that virtually all the agencies are using to guide their management activities for melaleuca. While there is no comprehensive spread model for melaleuca, two models have been developed, one uses nascent foci as the spread concept for seed dispersal and establishment of outliers as the principle means of aerial expansion, and the second was developed based on a time series of aerial images of a site that was originally not infested with melaleuca but over a 25 year period became infested. This model provides an algorithm for rate of expansion from analysis of actual data but only for the test area. These models provide us a reasonable idea of the nature and rate of expansion of melaleuca.

Melaleuca provides a good example of an invasive exotic plant where an effective multi-agency control program has been in place on most public lands and maintenance control levels have been achieved, and where control is beginning in other areas.

Melaleuca (*Melaleuca quinquenervia*) is an evergreen tree native to Australia that

was introduced into Florida around 1885 by well-meaning plant enthusiasts. Unbridled by natural controls, and occasionally aided by man, the tree soon began to spread through the "useless swampland" of South Florida, replacing Everglades' tree islands, marshes and prairies. By the late 1980s, melaleuca - deemed the "Tree from Hell" - had reached crisis levels throughout the region. Biologists were predicting ecological collapse in the Everglades. Indeed, melaleuca dominated almost a half million acres in South Florida, and showed no signs of stopping. Early in 1990 the Florida Exotic Pest Plant Council and the South Florida Water Management District jointly convened a task force of Federal, state and local land managers, scientists and others. Their charge was to develop a comprehensive, interagency plan for managing this notorious Everglades invader. The result was the first edition of the Melaleuca Management Plan for Florida.

In the ten years since its original publication, this management plan has served as a framework for agencies managing or seeking to protect natural areas infested by melaleuca. It has facilitated interagency cooperation and coordination of control efforts, improved resource utilization efficiency, enhanced public awareness of the problem and inspired legislative support.

The strategy outlined in the management plan is based on finding and controlling outliers (isolated, mature seed-bearing trees) to halt the advance of existing melaleuca populations, and then progressively eliminating trees toward the source of the infestation. This "quarantine strategy" has been highly successful, with melaleuca acreage declining by nearly a third in the past decade. The largest reductions have occurred at Big Cypress National Preserve, Everglades National Park, the Everglades Water Conservation Areas and Lake Okeechobee. Overall more than 78 million mature trees and saplings have been treated and/or removed on over 100,000 acres since control efforts began (see Table 2 and Figure 11).

Table 4: Acreage of Melaleuca, Brazilian Pepper, Australian pine, Old World Climbing Fern, Lather Leaf and Burma Reed in Southern Florida

	Year of Survey			
SPECIES	**1993**	**1995**	**1997**	**2003**
MELALEUCA	488,000	464,000	391,000	329,000
BRAZILIAN PEPPER	547,000	899,000	961,000*	1,124,000
AUSTRALIAN PINE	344,000	357,000*	370,000	385,000*
OLD WORLD CLIMBING FERN	25,000	25,000	39,000	107,000
LATHER LEAF	Not surveyed	Not surveyed	Not surveyed	6,500
BURMA REED	Not surveyed	Not surveyed	Not surveyed	15,000

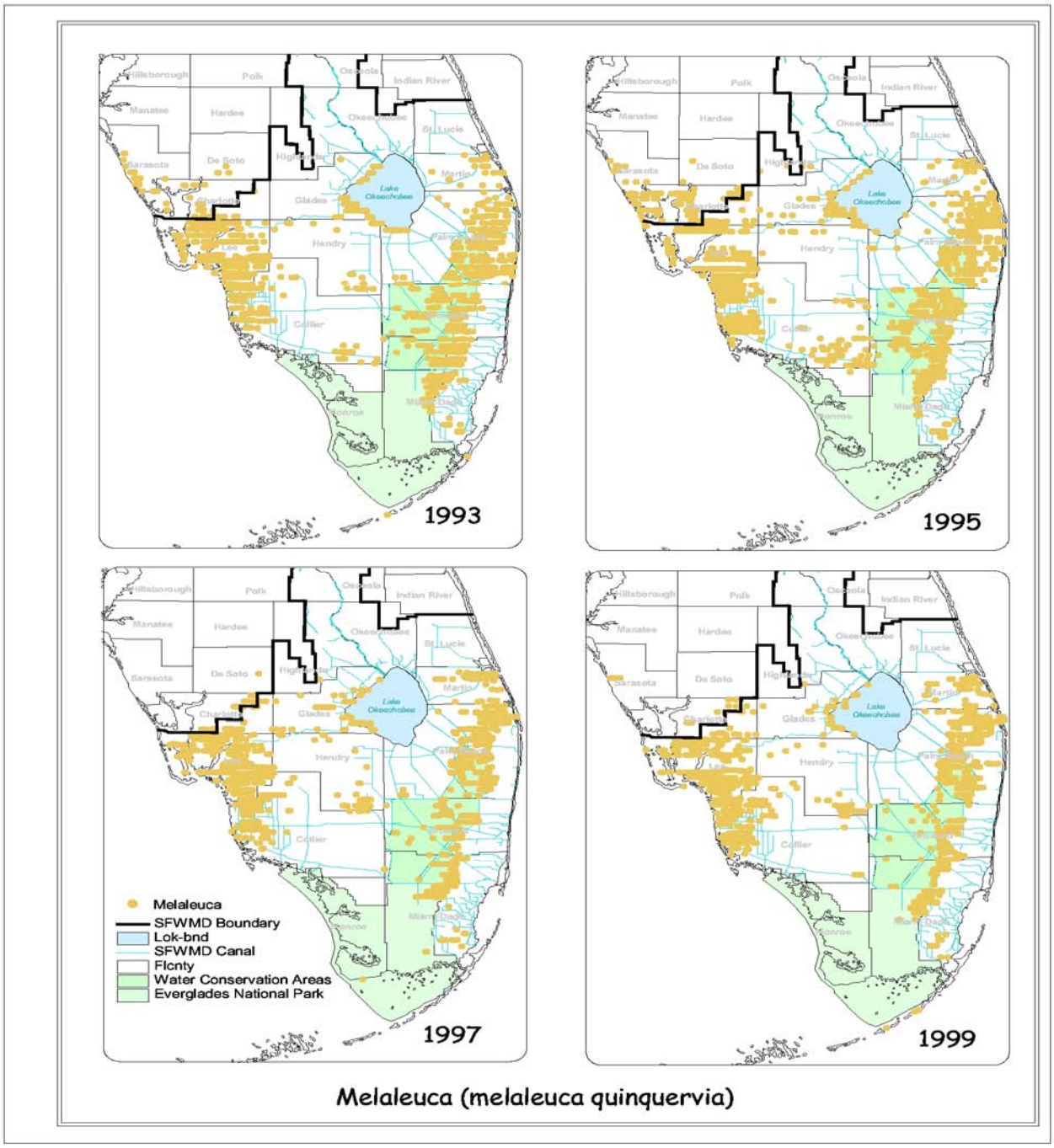

Figure 12: Aerial Coverage of Melaleuca 1993 – 1999. Showing reduction of coverage in Water Management Areas, Big Cypress National Preserve and Everglades National Park. Reduction in acreage equal approximately 100,000 acres.

Biocontrol agents play an essential role in the long-term melaleuca management strategy. Total eradication is not feasible, and biocontrol agents offer a way to keep melaleuca in check - by limiting its ability to reproduce and spread. Overseas explorers discovered more than 400 insects that damage melaleuca in its native

Australia, and identified the most promising for use as biological controls. The first melaleuca biocontrol insect, a tip-feeding weevil, was released into Florida during 1997. Field populations of this insect are increasing, and melaleuca saplings are already being highly stressed at some release sites.

The melaleuca management program in Florida is an example of a successful work in progress. Resource managers faced seemingly insurmountable obstacles when the fight began, but interagency cooperation has successfully turned the tide. Achieving this level of success has not been inexpensive. The melaleuca project (including biological, mechanical, chemical and physical control efforts) has cost about $25 million to date. To place this in perspective however, it was estimated that failing to act against melaleuca would have eventually cost the region $169 million annually in lost revenues. Ecological losses would have been immeasurable.

14.4 Fish and Wildlife Resources

As mentioned earlier in this report, the benefits to native fish and wildlife are best realized by reviewing the negative effects of exotic species. The introduction of invasive exotic plants is the second greatest threat to biodiversity next to habitat destruction (U.S. Fish and Wild Life Service (USFWS), Loxahatchee National Wildlife Refuge Website). These exotic species often become a monoculture, because they do not have a natural predator in these habitats. This reduces biodiversity and limits habitat area suitable for the life cycles of many species. The benefit to fish and wildlife would be a greater habitat and species diversity allowing for more species to thrive.

The USFWS Planning Aid Letter dated March 10, 2005, described the following impacts to fish and wildlife resources resulting from invasive species.

The Everglades and other habitats of south Florida are susceptible to enormous stress from the invasions of exotic plants. Exotic weed species such as melaleuca and Brazilian pepper are but 2 important and successful invaders (of 126 plant species listed as invasive) of natural Everglades communities (Florida Exotic Pest Plant Council 2003). Old World Climbing Fern is native to wet tropical and subtropical regions of Asia, Africa and Australia. It has become a serious threat to south Florida natural areas, especially the Everglades, where it is increasing in density and range. New populations, presumably from wind-borne spores, are constantly being reported by natural resource managers and private landowners throughout the southern peninsula. Old World Climbing Fern may dominate many native plant communities in south and central Florida within the next decade (Ferriter 1999).

The spread of invasive plants impacts native plant communities and ecosystem functions. As invasive plants take the place of native plants, plant communities and associated habitat functions are altered and wildlife habitat and biodiversity is reduced. Ecosystem functions are being impacted through changes to a variety of components including hydrology, chemistry, and fire behavior, and the overall values

of our natural resources are decreasing. The dominance of invasive plants degrade ecosystems in several ways: (1) some species alter soil chemistry, inhibiting the growth and germination of other species; (2) invasive species may interfere with natural nutrient and water cycles, creating secondary impacts to other plants and the ecosystem; (3) some invasive species alter the fire cycle and the characteristics of fire within an ecosystem; and (4) these changes to ecosystems alter plant communities, wildlife habitat, and ecosystem functions.

Eliminating the invasive and exotic species and the conditions that favor these species will contribute to restoration of native plants and animal species and a more natural ecosystem hydrology and function. Control or eradication of invasive exotic plants is necessary to improve and protect habitat quality and heterogeneity. Exotic plants have the potential to thwart any restoration attempt if not controlled.

14.5 Threatened and Endangered Species

The benefit to threatened and endangered species would be found in the protection and regrowth of native habitats. For example, melaleuca invades many habitats found within the Everglades ecosystem, including saw grass marsh, tree islands, wet prairies, and sloughs, directly affecting the endangered and threatened species which depend on these habitats for nesting and foraging. Many of the threatened and endangered species in south Florida have specific preferences for habitat. When that habitat is gone, the species will not survive. Therefore, by limiting exotics, and thereby protecting native habitats, the threatened and endangered species have a more likely chance of thriving in the future.

An EA titled "*Integrative Approach to Melaleuca Management in the State of Florida*" was completed in January of 1996, and was fully coordinated with the applicable resource agencies. According to the USFWS, Federally listed threatened and endangered species, which may occur on sites chosen for melaleuca management, include the American crocodile, Cape Sable seaside sparrow, snail kite, West Indian manatee, and the Okeechobee gourd. As biological control agent release sites are chosen, further consultation with USFWS will be initiated to ensure that threatened and endangered species will not be adversely affected.

Other species potentially directly effected by CERP, listed by USFWS in the “Initial Cerp Update Planning Aid Report”, dated May 6, 2004, include the Florida Panther, Bald Eagle, Red-cockaded woodpecker, Wood stork, and Eastern indigo snake.

Scientists, government officials, and industry leaders have all recognized invasive species as one of the most serious environmental threats of the twenty-first century. More specifically, conservation biologists ranked invasive species as the second most serious threat to endangered species after habitat destruction (U.S. General Accounting Office 2003). About 42 percent of the species that are listed as threatened or endangered under the Endangered Species Act are considered at risk primarily because of competition with and predation by non-indigenous species (Wilcove et al. 1998).

14.6 Potential Benefits

Managing invasive exotic plants would produce numerous ecological and economic benefits as listed below;

1) Reduce loses in agricultural, horticultural, and silvicultural production.

2) Decrease significant direct control costs.

3) Save billions of dollars lost each year in the U.S. due to major environmental damage from invasive exotic species.

4) Save millions of acres of natural areas that are infested with these plants with an additional loss of native species.

5) Protect hundreds of Threatened & Endangered species and habitats that are jeopardized by the rampant spread of these alien invaders.

6) Prevent the loss of critical wetland habitat and function.

7) Stop and/or slow the spread and invasion of approximately 700,000 hectares (1,730,000 acres) of nonindigenous weeds to US wildlife habitat per year (Babbitt 1998).

8) Prevent choking of waterways by aquatic invasive exotic plants.

9) Prevent serious and perhaps irreversible alterations in ecological structure and function caused by the replacement of native plants and animals and the subsequent alteration of community structure and abundance: Examples of scientifically documented ecological alterations caused by invasive exotic plants include:

   a. Carbon sequestration
   b. Nutrient cycling and nutrient mineralization
   c. Alterations in geomorphology including soil erosion, soil deposition and sediment accumulation, soil composition (i.e. soil types), soil decomposition, and changes in soil elevation
   d. Alterations of natural fire regimes; fire intensity, fire frequency and fire seasonality
   e. Alterations in surface water flow, quantity and quality
   f. Alteration in water table depth
   g. Alterations in salinity of soil and water
   h. Alteration in primary productivity, food web structure and energy flow patterns both up and down the ecosystem
   i. Nitrogen fixation
   j. Alterations of disturbance regimes and effects of disturbance such as floods or hurricanes
   k. Reductions in ecosystem stability and resilience

l. Alterations in channelization of wetlands, estuaries and coastal marshes
m. Decreased recruitment of native plants and animals
n. Allelopathic effects of invasive exotic plants
o. Alterations in water and nutrient uptake
p. Development of physical barriers to native plant and animal movement from invasive species
q. Alterations in insolation (sunlight)
r. Alterations of evolutionary processes
s. Alterations in microclimate
t. Alterations in population and stand structure in plants and animals
u. Alterations in resource competition and competitive interactions among native species
v. Alterations in competitive ability and selective pressures on native species
w. Alterations in evapotranspiration rates
x. Alterations in genetic makeup of populations of plants and animals including: loss of genotypes, genotypic changes due to isolation resulting from invasive species creating barriers to movement, hybridization of native species with exotic species and the possible development of hybrid swarms
y. Increases in the natural background rate of species extinctions (natural rate is approximately 1 to 10 million years per species, current extinction rate due to habitat loss and invasive exotic species is approximately 500 years per species).

10) Prevention of the irreversible reorganization of the Everglades' ecosystem resulting in a new altered stable state (structural and functional) that is entirely manifested by and dependent on invasive exotic species.

11) Prevention of the counter adaptation of native species through both evolution and ecological interactions

12) Increase recreational use of rivers and lakes.

13) Prevent the loss of native habitat

14) Prevent the development of anoxic bacteria and low level of dissolved oxygen in wetlands and waterways resulting from infestations of exotic vegetation.

15) Preserve and protect grasslands.

16) Preserve and protect forests.

17) Prevent alterations or elimination of natural vegetation community structure or abundance.

18) Prevent faunal shifts.

19) Reduce landscape-scale ecological effects.

20) Reduce hydrology impacts.

21) Prevent the elimination or decrease in the abundance and diversity of populations of native animals including; birds, mammals, invertebrates, reptiles, amphibians, fish.

22) Prevent the loss of biodiversity within the Everglades ecosystem.

23) Reduce sediment build-up in waterways.

24) Reduce nutrient loading in waterways

25) Prevention of physical damage and loss to water control and conveyance structures such as canal banks, pumps, etc.

26) Expand habitat available for native and migratory birds.

15. ECONOMIC ANALYSIS

The introduction of non-indigenous species into the United States environment regardless of the intent of the original introduction has resulted in some rather disastrous and costly outcomes. Non-indigenous species have caused widespread damages to agricultural outputs, have destroyed and reduced indigenous species and contributed to overall environmental degradation. Invasive plants can destroy native plants and animals, particularly endemic species. Thus, an invasive species that is not a pest in its native land can cause significant damage in a new environment.

There are approximately 50,000 nonnative species that have been introduced into the United States (Pimental, etal), and over 1/2 of these are species that have been introduced into Florida. These nonnative species have been introduced due to a variety of reasons, including economic and social benefits, and through accidental introductions. Commercial trade of living organisms in Florida has been increasing, along with interstate and international commerce and tourism, leading to increasing rates of accidental and intentional introduction. Increased availability of exotic species enhances invasion potential and will also lead to increased invasion rates. It is estimated that approximately 10% of introduced species lead to reproduction and 10% of these become invasive. (Weeds Won't Wait)

These invasive species may cause severe ecological damage and substantial economic losses. The invasive plants in Florida cause economic damage to agriculture and forestry, flood control, human and animal health, irrigation, navigation, recreational opportunities and land values. Little attempt has been made to quantify the economic damages resulting from invasive species due to few impacts or benefits influencing the economic markets. One recent and well-referenced study projected that the annual economic costs associated with invasive species damages and control costs are estimated at hundreds of billions of dollars, with weeds causing a reduction in crop yields leading to approximately $24 billion in lost crop production annually. (Pimental, etal) The

economic benefits from nonnative introductions greatly outweigh the damages, such as more than $800 billion per year in benefits to the agricultural industry (USBC 2001) and substantial benefits to the ornamental plant industry, thereby demonstrating that it would not be cost effective to eliminate the introduction of invasive plants but does strongly suggest that control is the only feasible and acceptable approach.

Typically, public planning agencies generally use economic benefit/cost ratio analysis to influence decision making regarding investing in the opportunity of controlling invasive species. There are no direct market transactions to measures the economic benefits associated with control costs, so estimations of the harm caused by invasive plants, or conversely the potential damages prevented are quantified. The costs associated with the process would be the direct control costs for managing the invasive species and the benefits will be attributed to the reduction in damages to agriculture and forestry, flood control, human and animal health, irrigation, navigation, recreational opportunities and land values.

Damage caused by invasive species can be classified as either direct economic costs or indirect costs or damages. Direct economic costs include costs of species removal and the impact of those activities on indigenous species and ecosystems. Indirect economic costs are those caused by the species itself: detrimental impacts on indigenous species, local infrastructure and down stream environments. An economic analysis focused upon the removal of a non-indigenous species from an ecosystem is by nature and necessity a least cost analysis.

The traditional approach of monetarizing economic benefits through the inception of a construction project is not entirely applicable when dealing with the attempt to remove invasive and exotic species. These damages are both environmental and economic. The underlying objective in dealing with the removal of exotics is to reduce existing damages caused by the exotics and potentially eliminate any additional damages that could be caused in the future. It is expected that the total cost of species removal and the size of the invasion or containment reflect a linear relationship.

Benefits of the invasive species removal include both economic and environmental benefits. There is no debate that by eliminating or reducing invasive species an economic benefit will be realized. Literature searches have yielded extensive examples of benefits attributed to removing exotics, but these benefits are difficult if not impossible to quantify for every species of exotics but general representations can be given.

This analysis will only focus on the implementation period of direct costs of remediation assuming the environmental benefits derived from control warrants the investment. The goal of this analysis is to demonstrate that by addressing this problem sooner rather than later is more cost effective and will prove an economic benefit in a savings to the nation. This analysis does not attempt to quantify economic benefits that will be associated with damage reduction to land, agriculture or infrastructure. One of the expected outcomes of this study will be a separate report that will quantify the benefit/cost ratio of exotic control.

Complete eradication of an introduced species although desirable would not likely be a cost effective solution as any attempt at complete removal of a species would in general

involve monetary costs in excess of the damages caused by the species itself. Removal of an invasive species is therefore subject to the law of diminishing returns: that the marginal cost of removal per acre or hectare will increase at an increasing rate while the marginal benefits of removal will decline after a certain point eventually approaching zero. Notwithstanding the prohibitive cost of eradication, it may be possible to completely remove a species from the study area environment.

The issue then becomes one of containment. The level of containment is a function of the current size of the invasion, availability of ecosystems conducive to the species and the rate of infestation. The current size of the invasion and the rate of spread are variables that affect the cost of containment. The larger the current size of the invasion and the faster the species spreads into the remaining natural ecosystem, the larger the increase in the cost of delaying containment. Conversely, the slower the rate of propagation the smaller the increase in cost of delaying containment efforts.

An analysis of starting containment activities in the current year versus commencement of containment in some future period will depend on the size of the invasion relative to the remaining ecosystem and the rate of species propagation. If the rate of spread is low the cost differential between the two alternatives is reduced. It is assumed that both costs and benefits of species containment/removal increase as the spatial extent of the invasion expands. If the rate of propagation is sufficiently low then the spatial differences between the two alternatives will be minimized as will the cost of the two alternatives.

For this analysis, it is reasonable to assume a linear relationship between the spatial extent of the invasive species and the cost to control the species. Likewise it is reasonable to assume a linear relationship between the spatial extent of the invasion and the environmental benefits of species removal. Stated differently, the marginal benefit per acre realized through containment of the species is constant and the marginal cost per acre of containment/removal is constant. A comparison of the annual costs of various implementation periods would yield a least cost alternative and a decision to proceed with the containment or removal is made.

If a species is allowed to increase its spatial extent or if efforts to control the pest are relaxed for several years it can be assumed that the cost of cleanup will increase in direct relation with the increase in the spatial expansion of the invasive species. The difference between the two described scenarios, containment/removal action in the current year and containment/removal action in some future year, is the difference in the life cycle costs of each approach. The preferred alternative will be that scenario which minimizes the cost of containment/removal.

The second alternative; postponing action against an invasive specie until some future time period is subject to increased costs associated with continued growth of the invasive. There is also the potential for increased environmental damages to non-target species and ecosystems. It is possible that should the propagation of an invasive species go unchecked for a time and then be eradicated in a short period of time, the impact of an increased or aggressive control strategy on non-target specie and the environmental would be more pronounced. Scenario two could be used effectively when the propagation rate of the species is relatively slow in spreading itself through the

ecosystem or when the pest is confined to a relatively small geographical space. Additionally, when containment/removal costs are low on per acre or marginal basis the difference between the two scenarios is minimized.

The comparison of the annual costs of various implementation periods was conducted for one representative invasive species (see Figure 13). The species of concern is Lygodium, included below is the Lygodium expansion rate and corresponding years.

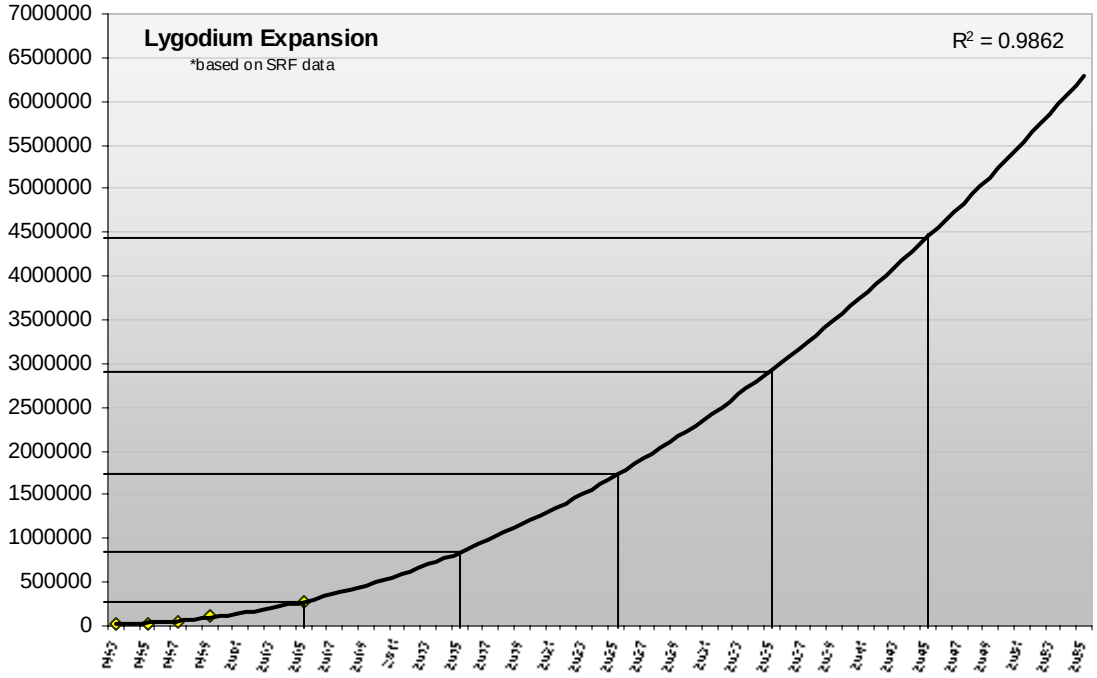

Figure 13: Lygodium Expansion Chart

The end of the period of investment that was used for the cost savings approach was the year 2050. The end year was constant regardless of the start of benefits, to account for the investment decision out to a set point. The implementation and start of benefits varied in ten-year increments starting in the year 2005. The periods of analysis ranged from 45 years to 5 years. For expenditures that began in the year 2005, there would be a 45-year period of investment, and every ten years later the expenditures began would incur a 10-year fewer period of investment. It is noted that in the year 2050 the benefits will not end, but a constant end date is necessary to demonstrate the savings due to earlier implementation over a set period of time.

The cost for containment is set for the first seven years at a high rate to get the spread to a manageable level. The remainder of the investment life will be at a low cost per acre to maintain the invasive at a manageable level. For Lygodium, it was estimated that the first seven years of management would cost $4.71 per acre, and for the remainder of the investment period would cost $0.3775 per acre. As the acreage increases the costs will increase on a linear scale.

This analysis is not a comparison of alternatives, but merely a representation of the investment costs over a set period of time. The following table (Table 5) and figure includes implementation year, acreage, total cost and annual cost. Figure 14 includes a graphical representation of the increase in annual costs associated with later implementation periods. The earlier the plan is implemented the less the environmental damages, and as can be seen from the table the annual costs increase with later implementation periods. As can be noted from this analysis, the earlier the control begins, the lower the annual cost for control will be, as well as the greater the benefits, over a set period of time.

Table 5: Annual Investment Cost Associated with Implementation Period

Implementation Period	Acres	Investment Period	Annual Investment Cost
2005	275,000	46 Years	$532,699
2015	825,000	36 Years	$1,001,636
2025	1,725,000	26 Years	$1,381,189
2035	2,900,000	16 Years	$1,728,678
2045	4,450,000	6 Years	$2,720,289

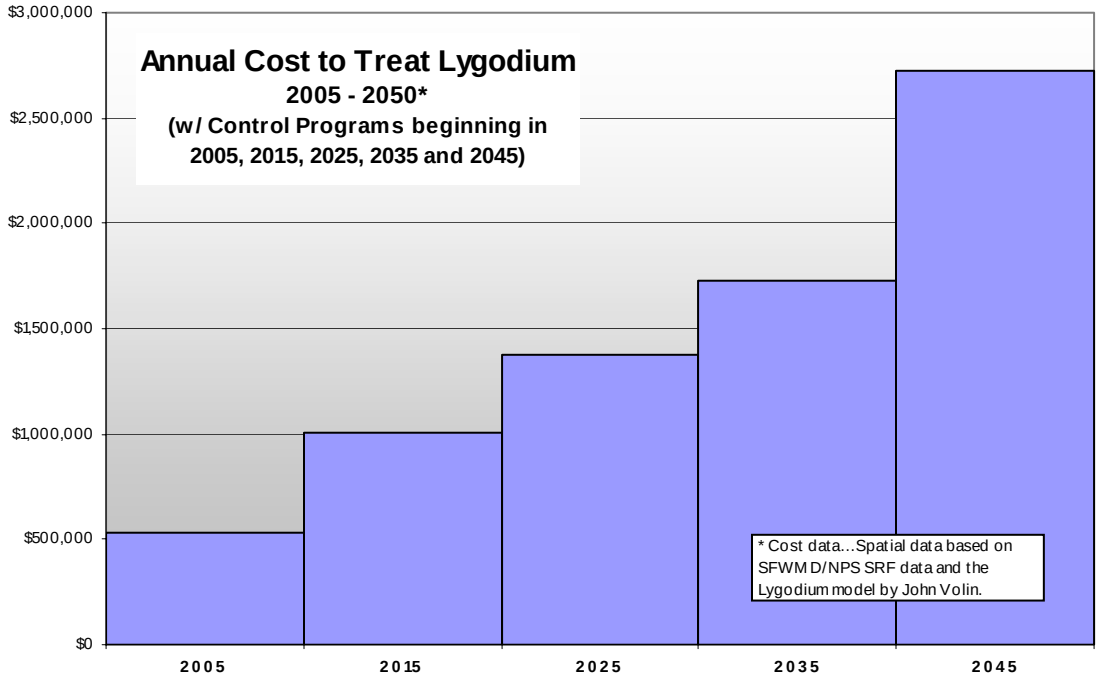

Figure 14: Annual Costs to treat Lygodium

16. LOCAL SPONSOR AND PRELIMINARY FINANCIAL ANALYSIS

The South Florida Water Management District (SFWMD) supports the project. The letter of intent will be submitted under separate cover. The Corps and SFWMD will prepare a Project Management Plan (PMP) outlining the scope, cost and schedule to complete the PIR. The proposed alternatives would be cost shared under the current Design Agreement for CERP. The SFWMD understands the cost sharing responsibilities and has signed an amendment to the Design Agreement (executed by the Corps 29 July 2004) for the Melaleuca Eradication and Other Exotic Plants – Implement Biological Controls project.

17. POTENTIAL ISSUES AFFECTING INITIATION OF RECOMMENDED ACTIONS

There are no known detractors to this study. The above referenced Environmental Assessment was widely disseminated, and received mostly positive comments at that time. It is not uncommon for landscape nursery owners and farmers to voice concerns over these types of Biological Control Programs out of perception or fear of potential adverse affects to their operations. Past releases of biological control agents have met with minimal, if any, negativity.

This study is widely supported throughout south Florida. Due to the high public, political, and media interest in the area, extensive public involvement is a critical component of the study effort.

18. VIEWS OF OTHER RESOURCE AGENCIES

The U.S. Fish and Wildlife Service was informed of the study initiation. They were invited to provide information for the analysis. Their Planning Aid Letter, in support of the project, is included in Appendix E.

Various agencies, such as the Florida Department of Environmental Protection, U.S. Fish and Wildlife Service and the Environmental Protection Agency, participated in the critical project selection process in 1997 and provided project support at that time for exotic and invasive species management.

19. RECOMMENDATIONS

I recommend that a Project Implementation Report (PIR) and an Invasive Species Demonstration Project be initiated, under the existing CERP authority. The Corps and SFWMD will take the lead, however, the “Planning in a Collaborative Environment” guidance will be utilized to develop this study with other Federal and state agencies.

From this report and demonstration project, a plan would be developed for exotic and invasive species management, in accordance with existing Federal policies, guidelines and regulations for water resources development. There are sufficient indications that cost-effective solutions can be formulated that would provide environmental improvement benefits that contribute to the national ecosystem restoration goals.

_____
ROBERT M. CARPENTER
Colonel, Corps of Engineers
Jacksonville District

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APPENDIX A

WEEDS WON'T WAIT REPORT

EXECUTIVE SUMMARY OF THE ASSESSMENT

WEEDS WON'T WAIT !

The Strategic Plan for Managing Florida's Invasive Exotic Plants

Part Three: Executive Summary of the Assessment

Cover photo: Old World Climbing Fern *(Lygodium microphyllum)* smothering a forest habitat.

Old World Climbing Fern occurs predominantly in southern Florida while Japanese Climbing Fern *(Lygodium japonicum)* occurs in northern Florida. *Lygodium* sp. are spreading at an alarming rate. Several new populations have been discovered throughout Florida including Big Cypress National Preserve and the Florida Panther Refuge. Some are convinced that *Lygodium* may become the next Melaleuca.

Photo courtesy of the South Florida Water Management District.

WEEDS WON'T WAIT!

PART THREE

EXECUTIVE SUMMARY OF

AN ASSESSMENT OF INVASIVE EXOTIC PLANTS IN FLORIDA

A Report to the South Florida Ecosystem Restoration Task Force and Working Group

This Report was Produced Through the Support and Partnership of the Agency Members of the Noxious Exotic Weed Task Team

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US Army Corps of Engineers

US Dept. of Interior - National Park Service

US Dept. of Interior - Fish and Wildlife Service

US Geological Survey - Biological Resources Division

US Dept. of Agriculture - Agricultural Research Service

US Dept. of Agriculture - Animal & Plant Health Inspection Service

Florida Dept. of Agriculture and Consumer Services

Florida Dept. of Transportation

The Seminole Tribe of Indians of Florida

The Miccosukee Tribe of Indians of Florida

Miami-Dade County – Dept. of Environmental Resources Management

Miami-Dade County - Parks Department

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INTRODUCTION

HOW THE PLAN GOT STARTED

The Restoration of the South Florida Ecosystem and greater Everglades has received high-level attention and support from federal, state and local governments. As a result of the importance of South Florida Ecosystem Restoration and the threats to restoration, such as invasive exotic plants, Congress established the South Florida Ecosystem Restoration Task Force (SFERTF) to coordinate the restoration effort among the many different agencies and user groups that would be part of or affected by this initiative. The SFERTF authorized the South Florida Ecosystem Restoration Working Group (WG) to carry out the work of the Task Force. The SFERTF&WG identified the importance of incorporating invasive species issues into restoration planning. In 1997 they established the Noxious Exotic Weed Task Team (NEWTT) and charged them with developing a comprehensive strategy to cover the issues and the problems of invasive exotic pest plants and assess the status of invasive plants in Florida. This Assessment, the companion executive summary and addendum comprise Part One of that comprehensive plan. The Strategy is Part Two of the comprehensive plan. This document is the Executive Summary of the Assessment.

NEWTT

The Noxious Exotic Weed Task Team is made up of agency representatives from federal, state, local, and Indian Tribal governments. NEWTT members include managers and scientists from key federal, state and local government agencies and Indian Tribal representatives that deal with exotic pest plant issues.

EXOTICS – THE PROBLEM

Through our actions of moving species around the globe, we have become the perpetrators and witnesses to the homogenization of the world's flora and fauna; concomitant losses of billions of dollars of agricultural production and billions of dollars spent on control; millions of acres of natural lands impacted; and dramatic changes in the world's biological diversity. In the modern world-without-borders, we are disrupting hundreds of millions of years of evolutionary patterns at jet speed. This may well prove to be the beginning of the sixth great planetary extinction and the single least-reversible human impact to global biological diversity and global change in the entire history of life.

What are exotic plants and why are they here?

Exotic plants are those species not native to an area (usually referred to as nonindigenous) and found beyond their natural range. Some nonindigenous plants may become established outside of cultivation and develop self-sustaining or reproducing (usually referred to as naturalized) populations. Some of those that naturalize will

become invasive causing environmental or economic impacts. Exotic plants are introduced by people intentionally for social and economic reasons, and as accidental consequences of travel and commerce.

Why are invasive exotic plants so widespread and numerous?

Documented introductions of plants into Florida have been occurring for over 200 years, and the numbers of introductions have increased over this period. Over 25,000 exotic species of plants have been introduced into Florida. Accidental introductions have been growing as a consequence of increased commerce and tourism. The more often a species is imported and made more available, the greater chance it will become invasive, and the more different species introduced the greater the chance that one will become invasive.

Why are invasive exotic plants considered undesirable?

Invasive exotic plants cause substantial economic losses, reductions in agricultural production, and significant direct control costs. Billions of dollars are lost each year in the US. Millions of hectares of natural areas are infested with exotic plants with a concomitant loss of native species. Hundreds of rare and endangered species and rare habitats are in jeopardy from them.

How frequently do exotic species establish self-sustaining populations and do they all become invasive?

Approximately 10% of introduced species establish reproducing populations and approximately 10% of those become invasive. However, even a single species may cause severe ecological damage and substantial economic losses. Increased availability of exotic species enhances invasion potential and may accelerate invasion rates. Continued human modification of natural habitats provides additional opportunities for exotic species to become established.

Why do we still introduce exotic plants if some of them can cause so much harm?

Exotic organisms are introduced for economic and social benefit. The ecological and social costs of invasive exotics have been largely ignored and been borne by the general public. Both rates and kinds of introductions have fluctuated widely in response to social, political and technological factors. Commercial trade of living organisms in Florida has grown, increasing the likelihood of additional plants becoming invasive. Plants are not viewed as pests by the current US regulatory and port-interdiction programs.

Why should you care about invasive exotic species? Who should care?

FEDERAL AND STATE

Federal and state governments have many similar reasons to care about invasive exotic species. Public health and safety, and the safety of US and Florida agricultural resources are paramount concerns for federal and state agencies including the USDA, the Centers for Disease Control (CDC) and FDACS. Introductions of invasive exotic species have been documented to cause catastrophic failures of entire industries. These

are very obvious and well-founded reasons for great caution regarding exotic species. Less obvious is the insidious and often slow replacement by foreign organisms, of native plants and animals that form the basis of our natural biological systems. This subtle replacement is usually overlooked and appears to most people to be of little direct consequence to the individual, unlike contracting a disease from an exotic organism such as West Nile virus. However, the very foundations of US ecosystems are slowing being undermined and altered, perhaps irreversibly. This alteration is not just about melaleuca invasion in the everglades, or zebra mussel in the Mississippi river. It includes changes in entire gene pools and communities of species, alterations of soil and water chemistry, changes in ecosystem functions and productivity; in short, a complete restructuring of the ecosystems that support the entire socio-economic structure of the US, and the world. The long-term consequences to the sustainability of our natural and agro-ecosystems are unknown, but current scientific understanding indicates they are in serious jeopardy from exotics.

INDUSTRY

Industries such as agriculture, horticulture and the pet trade use many different exotic species in their business. They may often feel they have more to gain from exotic species—in terms of profit from the business in exotic organisms—than they have to lose from any possible escape and naturalization of such organisms. While industries are sensitive to the introduction of exotic organisms that are universally considered pests (including pests and diseases of the exotic organisms they import), these same industries clearly rely on the use and availability of exotic species that many consider desirable. However, reliance on exotic species is not the real problem. The problem stems from an industry-wide opposition to risk-assessment of species invasion potential and subsequent regulation of the importation of species identified as invasion risks. A major issue that industry representatives have voiced regards their concern that agencies will over-regulate and tightly restrict the importation of non-native species, especially if the "precautionary principle" forms the basis for regulatory policy.

The reality may actually be much different. Science has reasonably documented that a relatively few organisms appear to become invasive. Most of the plants and animals that industries currently utilize are generally considered non-invasive. It's doubtful that any industry wants to appear to be the importer of a serious pest, and more doubtful that such an industry would want to be held possibly liable for damages at some future date. Partnerships between industry, science and regulators to develop scientifically rigorous risk-assessment techniques, stand a better chance of not only protecting our environment, but also providing industry an assured source of 'tested/safe' species, which offer both industry and ecology better long-term sustainability.

PUBLIC

All the reasons noted above certainly apply to the general public. Expanding public concern from exotic issues of immediate threat such as West Nile Virus, to more subtle invasions like the slow invasion of exotic plants into natural areas has been difficult. If invasive species issues are ever to be adequately addressed and dealt with, the public must come to understand the broad nature and consequences of invasive exotic species.

STATEWIDE COORDINATION THROUGH EFFECTIVE PLANNING WILL HELP

Who says we even need a statewide plan?

International, national, state and local awareness of invasive species has increased significantly since the mid 1980s. All levels of government now recognize that partnerships, planning and coordination and funding are essential to the successful risk-assessment, interdiction, detection, prevention, eradication and management of invasive species. It is now widely recognized that a statewide plan will provide the framework for coordinating with national and local governments and developing national and international partnerships.

Why hasn't something been done before now?

The serious impacts from invasive species have only recently been widely accepted. Economic interests often work against regulations and prohibitions on importation, cultivation, and use of many exotic plants and animals. Concerns for safety of agriculture or development of exotics for commercial use have dominated exotic species regulation and policy, which overshadows concern for environmental or economic impacts.

What's missing in invasive species management programs?

A General lack of coordination, piecemeal tactical approaches, commercial opposition, and a business-as-usual attitude has helped create the current crisis-level situation. The large numbers, complex nature and wide distributions of invasive species in Florida, and elsewhere, will require a holistic, better-coordinated, long-term, landscape-level strategy for successful management. Exotic species issues cross all agency mandates and jurisdictions and agencies are currently not organized to deal effectively with invasive species. Holistic-Management, Research, Integrated Programs, and Partnerships are Key to Successful Invasive Exotic Plant Management.

How will research, program integration, and partnerships help?

Well-planned, integrated and organized programs have shown success in controlling or eradicating individual infestations or species of exotic organisms even with modest funding. However, even programs with large budgets have failed when adequate research on the natural history or pathways of movement of a species was not done or they were not integrated or were inadequately planned or implemented. Given the complexity and number of species involved effective management requires a holistic, landscape-level strategy rather than tactical approaches based on controlling one species or one site at a time. This approach can lead to the unintended consequence of simply replacing one pest with another. Inconsistencies and contradictions in agency funding, roles and policies have hindered management of invasive exotic plants.

What's needed to be able to Identify Species and predict their Potential for Invasion?

Scientists are generally able to provide quantitative predictions of invasiveness for individual species where sufficient studies are available. Quantitative predictions of invasiveness for groups of similar plants or congeners, or of ecosystems or plant communities or even regions are more qualitative and therefore less reliable. However, useful systems of prediction and risk-assessment for individual species are being successfully used. A risk-assessment system to evaluate existing and forthcoming species, and a comprehensive invasive species information scheme are needed for Florida and the US.

What's Needed to Prioritize and Manage "High-Risk" Species?

Accurate and timely identification of species, comprehensive and user-friendly information are essential for helping identify, locate, prioritize and manage invasive plants. A coherent information system and consistent assessment techniques to determine distribution need to be developed for Florida. A national "Early-Warning" information system is being considered. Objective science-based methods for assessing species risk and evaluating control success need to be developed and employed.

Where are the Plants and what's influencing their Distribution?

All regions of Florida and all its ecosystems have populations of naturalized exotics. There are local and regional differences in impacts, in total numbers of species present, and acres infested. South Florida and the Tampa Bay area, have more species and acres of invasive exotic plants than other areas of Florida. Disturbed natural areas, proximity to major points of import, increasing commercial availability of exotics, growing human population and migration, and increasing urbanization probably accounts for the higher numbers of exotics in these two regions.

FLORIDA'S MOST INVASIVE EXOTIC PLANTS, WHERE THEY ARE, AND WHAT WE KNOW ABOUT THEM

The Statewide Picture

Chapter one of the Assessment provides information on each of the FLEPPC Category I species and Giant salvinia. Included are photographs of each species and individual maps showing their statewide distribution by county with a comparison of the US infestations by state (See Table 1 and Appendix 1 in the Assessment). Additional information includes the scientific name, common names, origin of each species, habit, and an evaluation of its invasiveness and impacts on Florida's natural areas. A summary Florida map shows the total numbers of invasive species by county (See Figure 1).

How many exotic plants are in Florida and how many of them are considered invasive?

1,180 exotic plant species are documented as naturalized in Florida. The Florida Exotic Pest Plant Council has assessed their impacts and invasiveness in natural areas and has identified 125 of them as serious threats to natural areas. Of those, 65 are considered to be extremely serious and highly disruptive to native plant communities. This report includes those 65 and giant salvinia as the priority species.

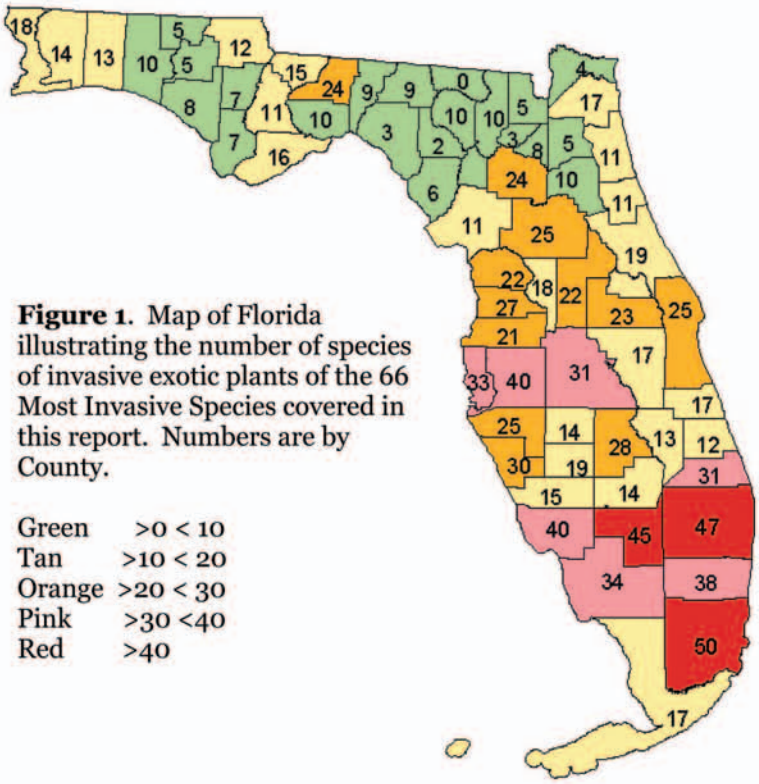

Figure 1. Map of Florida illustrating the number of species of invasive exotic plants of the 66 Most Invasive Species covered in this report. Numbers are by County.

Green	>0 < 10
Tan	>10 < 20
Orange	>20 < 30
Pink	>30 <40
Red	>40

What's needed to actually know where the exotics are, and control them?

A set of standardized assessment techniques to detect species, determine distribution and density, assess the threat, prioritize control, and measure the success of control efforts will be needed. Information on species distributions is only one element of an invasive plant management information system that must also include biological and diagnostic data linked through various invasive species databases that serve as a comprehensive registry and search engine.

How much do we actually know about exotic species and their distributions?

Generalized distributions, usually from herbarium specimens or routine sightings, are available for the 66 most invasive species and a few others. Detailed distribution maps are available for only four species and only for part of their Florida range, although individual sites, such as parks, may produce local maps of exotic locations as part of a site- or species-focused control program. Generalized distributions can be evaluated using the county sightings surveys (see Figure 1). Information on the natural history and biology is generally inadequate for the majority of species. The information gap for exotic plants is enormous and hinders both species-focused and ecosystem-level management efforts.

THE MAPS AND PHOTOS

Appendix 1 of the Assessment contains photographs, illustrations and maps showing the locations of individual exotic plants by county for all 65 FLEPPC Category I species and Giant salvinia.

Summary Of Information On The 66 Most Invasive Species Included In The Assessment

- 48 species are documented to cause ecosystem level impacts in Florida
- 63 species are documented as having invasive characteristics and are known to be invasive elsewhere
- 14 species are documented to be impacting threatened, endangered and rare species or rare habitats in Florida
- GIS supported databases are available for the entire Florida range for 2 species (Catclaw mimosa and Giant Salvinia)
- GIS supported databases are available for parts of the Florida ranges for 35 species (only four of these 35 have significant portions of their range covered)
- Sufficient biological information exists for a risk-assessment for 34 species
- Sufficient biological information exists to develop effective control methods for 20 species
- 19 species are identified as being among the world's worst weeds
- 33 are from Asia (depending on the species its Asian origins may include: northern Australia, India, China, other areas of Asia and tropical east Africa)
- 18 are from Mexico, Central or South America
- 5 are from Africa
- 4 are from Australia
- 2 are from the West Indies-Caribbean
- The origins of 3 species are uncertain
- 20 species are trees, 15 are vines, 14 are shrubs, 7 are forbs, 6 are grasses, 3 are floating aquatics and 2 are submerged aquatics
- These 66 species occur in 32 different plant families
    - 46% of the species occur in 7 families
        - 8 species are in Fabaceae (pea family; includes Kudzu and Catclaw mimosa)
        - 6 species are in Myrtaceae (myrtle family; includes melaleuca)
        - 6 species are in Poaceae (grass family; includes cogon grass)
        - 4 species are in Solanaceae (tomato family; includes aquatic soda apple)
        - 6 are ferns in three families (includes Old World climbing fern and Giant salvinia)

- 27 are still being sold, or recommended for use for agricultural or horticultural purposes

CONTROL METHODS, TECHIQUES AND APPROACHES

Which Control Method is Best?

No "silver-bullets" exist for invasive exotic plant control. Knowledge of species biology is essential in the development of successful management plans. Chemical or biological controls are often mistakenly viewed as panaceas. Prevention is the most efficient and cost-effective approach to combating invasive species.

What's the best tactical approach to develop effective invasive plant control programs?

Programs that integrate several control approaches—based on ecological knowledge of a species—into plan implementation have had proven success in individual site-based or species-focused control or eradication programs. Different methods may be required to control different life stages of a species, or overcome challenges presented by different habitats. However, even integrated control approaches are still piecemeal targeting one site or one species at a time and these tactical approaches have not proven adequate to deal with the extent and magnitude of the invasive exotic plant problems in Florida and elsewhere.

Why are site- or species-based modes inadequate and why do we need control programs with Long-term holistic Strategies and Ecosystem-level Approaches?

Current programs are piecemeal in approach, tackling one area or one species at a time. Unintended outcomes of this approach may be simply trading an "old" pest for a "new" one. Strategic planning must incorporate large-scale, ecosystem-level approaches given the magnitude and complexity of the invasive species threat.

REGULATIONS AND POLICIES

With the plethora of regulations and policies regarding the control of exotic invasive species, why is the invasive species problem so big?

The current federal, state and local regulatory framework is largely an uncoordinated hodgepodge of laws, regulations, policies and programs. Serious conflicts and inconsistencies (political and economic) exist both in regulations and policies among federal and state agencies that adversely affect the detection, prevention, eradication or control of invasive exotic plants. Policies and guidelines are infrequently or inconsistently followed or applied and tend to favor enhancement of economic development and trade. Enforcement is predominantly oriented toward protection of agriculture.

WHAT CAN BE DEDUCED FROM ALL OF THIS?

Sixty-six species are detailed in the Assessment and significant information about their origins, invaded habitats, invasiveness in other areas of the world, habit, control activities or techniques, and Florida and US distributions is discussed, summarized and referenced. Information on all the other exotic species in Florida (evaluated from a review of a few of those species selected at random) was more difficult to find. Information for most of the species was insufficient to be of any use in risk-assessment, detection or control. The level of data available for these sample species likely represents the level of data available for the rest of them.

Four Key Elements have been identified as essential for planning and for future success in managing invasive exotic species.

Key elements:

1. Cross-agency consistency in assessment techniques that include:
    a. Early-Detection
    b. Rapid-Assessment
    c. Rapid-Response
    d. Species distribution data and maps
    e. Population density estimates
    f. Evaluation of control success within and among programs

2. Cross-agency consistency in types of information collected
    a. Funding
    b. Personnel
    c. Control methods
    d. Control results

3. An Exotic plant information system
    a. Diagnostic for accurate identification
    b. Sufficient information for rapid species risk-assessment
    c. Web-based, meet library standards [Florida Center for Library Automation (FCLA)], interoperable and user friendly
    d. Serve as a registry for invasive species information and data

4. Risk-Assessment system to evaluate species invasiveness (Not a screening process for determination of importation)
    a. Biologically/ecologically based
    b. Documented data

How does the current lack of information and inability to respond rapidly affect exotic plant management, what are the key problems and what principal conclusions can be drawn that would improve response and management?

Problem I. A huge gap exists in exotic plant data related to control, distribution and biology.

Problem II. No information system on exotic species exists to provide a sufficient resource base for assessment and planning.

Problem III. No Risk-assessment tools or pathways analysis are currently available to evaluate the invasive potential of existing plants and any proposed for introduction.

Problem IV. No system of rapid-detection, rapid-assessment, and rapid-response is in place in Florida or the US to address incipient populations of already established species and for populations of newly introduced species.

Conclusion I. A sufficient information base does exist to refine and expand current species- and site-based control programs for high-priority species and natural areas, and to assess those species and sites for management actions. However, this applies only to about 25-50 species.

Conclusion II. A sufficiently complete information base about the exotic plant species in Florida does not exist to be able to implement a holistic landscape-level strategy for invasive exotic plant management for Florida; including the need for Florida to integrate management strategies with surrounding states and countries.

Conclusion III. A sufficient set of information, and storage and access framework does exist to serve as a base for developing a Florida-wide information system and "risk-assessment" protocol, and eventual integration into a national "Early-Warning", "Rapid-Assessment and "Rapid-Response" system.

Conclusion IV. Pathways analyses need to be completed for invasive plants to help determine how species move into and around Florida. Additional research in species movement and invasion needs to be conducted to pinpoint the key causal factors affecting prevention, eradication and control. This would facilitate predictions of the areas most vulnerable to invasion, the species most likely to become invasive, and provide insights into ways to prevent invasion from occurring and develop more effective control tactics. It would also make "Early-Detection" and "Rapid-Response" more effective components of a holistic management strategy.

Conclusion V. A Risk-Assessment system to evaluate species invasiveness needs to be developed as a component of a holistic management plan. Risk-Assessments then need to be done for every exotic plant species in Florida, and potential future introductions. This should be a biologically based system to evaluate invasion potential and not a screening tool for species import restrictions.

Conclusion VI. Sufficient capability does exist to develop a statewide organization (including agency-NGO partnerships, and national coordination) to integrate, coordinate and implement a comprehensive and holistic statewide strategy for the management of invasive exotic plants.

REGULATORY PROBLEMS

Federal

1) Harmful exotic species are generally prohibited entry and placed on a "dirty-list" only after becoming well established.
2) The Lacey Act and the Nuisance Exotic Weed Act allow continued importation of harmful species until they are added to prohibited lists by promulgation of regulations, which may take several years.
3) Regulations do not account for propagation of prohibited species, control of species from accidental importations that become invasive, or interstate transport of invasive species.
4) Biological control research is being done by several agencies independently.
5) No federal emergency authority exists to impose quarantines on invasive species that are not agricultural pests.
6) Continued use of so-called "tame" grasses for forage on federal lands.
7) Federal restoration programs under the Conservation Reserve Program still permits use of exotic plants.
8) There are no regulations or standards for horticultural or wildflower seed mixes.
9) The different goals and obligations agencies have lead to conflicts in the management and regulation of invasive exotic plant issues.
10) Invasive exotic plant management issues are handled as part time staff issues and funding is insufficient.
11) Many agencies either do not or are not able to comply with mandates. For example, the 1990 Farm Bill mandates that federal agencies must adequately fund invasive plant management programs. Few agencies have done this.

State

1) Two separate state agencies regulate and prohibit invasive exotic plants under different rules sometimes creating serious agency and management conflicts.
2) Two separate state noxious weed lists are maintained by two different state agencies and have different criteria and listing processes.
3) The two separate state weed lists have failed to provide for quick and effective listing and management of proven harmful species, and have been used to the benefit of industry.
4) Regulation of invasive species sometimes appears to be assigned to agencies based more on the desire to lessen regulation on industry or users than to effectively manage invasive species.

5) State agencies with statutory authority appear reluctant to exercise that authority.
6) No state agency has authority to halt the introduction of invasive exotic species into Florida.
7) No lead agency has been designated for managing exotic species and no agency has broad authority over these species to protect the state's environmental fisc.
8) State land management and land acquisition authorities have not generally considered management of invasive exotic plants as part of the planning process.
9) State programs and regulations do not offer incentives or assistance to private landowner for the control of invasive exotic species on private lands.

Local

1) Local regulations do not account for adjacent county or city regulations often leading to conflicting management activities.
2) Local regulations are not coordinated with state or federal efforts.

Ex

APPENDIX B

WEEDS WON'T WAIT REPORT

EXECUTIVE SUMMARY OF THE STRATEGIC PLAN

WEEDS WON'T WAIT !

The Strategic Plan for Managing Florida's Invasive Exotic Plants

Part Four: Executive Summary of the Strategic Plan

Cover photo: Old World Climbing Fern *(Lygodium microphyllum)* smothering a forest habitat.

Old World Climbing Fern occurs predominantly in southern Florida while Japanese Climbing Fern *(Lygodium japonicum)* occurs in northern Florida. *Lygodium* sp. are spreading at an alarming rate. Several new populations have been discovered throughout Florida including Big Cypress National Preserve and the Florida Panther Refuge. Some are convinced that *Lygodium* may become the next Melaleuca.

Photo courtesy of the South Florida Water Management District.

WEEDS WON'T WAIT!

PART FOUR EXECUTIVE SUMMARY OF

THE STRATEGY FOR MANAGING INVASIVE EXOTIC PLANTS IN FLORIDA

A Report to the South Florida Ecosystem Restoration Task Force and Working Group

This Report was Produced Through the Support and Partnership of the Agency Members of the Noxious Exotic Weed Task Team

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Florida Dept. of Environmental Protection

US Army Corps of Engineers

US Dept. of Interior - National Park Service

US Dept. of Interior - Fish and Wildlife Service

US Geological Survey - Biological Resources Division

US Dept. of Agriculture - Agricultural Research Service

US Dept. of Agriculture - Animal & Plant Health Inspection Service

Florida Dept. of Agriculture and Consumer Services

Florida Dept. of Transportation

The Seminole Tribe of Indians of Florida

The Miccosukee Tribe of Indians of Florida

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FOREWORD

"A land ethic for tomorrow should be as honest as Thoreau's Walden, and as comprehensive as the sensitive science of ecology.

It should stress the oneness of resources and the live-and-help-live logic of the great chain of life.

If, in our haste to "progress" the economics of ecology are disregarded by the citizens and policy makers alike, the result will be an ugly America"

Stewart Lee Udall
Secretary of the Interior 1960 - 1969

STRATEGIES FOR SUCCESS

WHAT'S THE PROBLEM WITH INVASIVE EXOTIC SPECIES, AND IS IT REALLY AS BAD AS THEY SAY?

The problems with Invasive species are not limited to South Florida, or Florida or even the US. They have become one of the most serious global ecological dilemmas today. Biological pollution is rapidly becoming one of the most important environmental topics for the 21st Century. Invasive species are hurdling environmental obstacles and evolutionary time scales at jet speed and in numbers that defy imagining. Human intervention has effectively shattered the planet's ecological barriers to species movement, a situation without precedent in the entire history of life.

BIOINVASION AND BIODIVERSITY ARE LINKED

Introduced species have become a significant component of human-caused global environmental change. Even though this fact has been understood for some time, most people, even many scientists have failed to recognize or appreciated the seriousness and potential magnitude of the issue. Biological invaders are capable of altering ecosystem structure and function. The long-term consequences of global ecological alterations in disturbance regimes, nutrient dynamics, soil and water chemistry, changes in species dominance, community composition and structure and recruitment, evapotranspiration, erosion, soil formation, microclimate, competition, etc. are basically unknown.

The wholesale and uncontrolled movement of biological organisms by humans has essentially eliminated the natural biogeographic barriers that originally created and sustained the major floral and faunal regions of earth and are obscuring the distinctiveness of the earth's biota. While many of these plants and animals are considered essential to human health and welfare and are not regarded as threats to biodiversity, they are often a reflection of other human caused change such as land development, which also threatens biodiversity. Some non-indigenous species have caused enormous economic losses, especially in agriculture. Some species affect the structure and function of ecosystems or the preservation or restoration of native biological diversity. While economic costs may be able to be documented and cost-risk analyses for these species may be possible (although little has actually been done in this regard), the loss of natural ecosystems and native biodiversity is seldom measurable in economic terms and sometimes considered an unfortunate byproduct of economic growth.

Humans affect bioinvasion by eliminating the natural barriers to species movement. Bioinvasion reduces biodiversity through direct loss, extirpation or extinction of species and through introduction of pests and diseases.

Why Do Some Species Seem More Invasive Than Others? Why Do Some Ecosystems Seem More Invasible Than Others? What Contributions Can the Current Science Provide Toward Understanding the Ecology, the Risk, the Prediction, and the Management of Invasion Events?

Recent research has begun to focus on the fundamental questions of invasion ecology. Questions like, "what makes some species more invasive than others?" or "what makes some ecosystems more invasible than others?" While some useful predictive information is becoming available for individual species that are the focus of specific research projects, useful generalizations that can be applied to species characteristics overall or ecosystem properties have not developed because sufficient quantitative studies are not currently available.

Several theories have been developed from the available science related to what is generally known about the characteristics of invaders and invaded ecosystems, and the more decided theories developed from specific ecological studies.

The principal theories include:

ALTERATION OF ECOSYSTEM PROCESSES THEORY

Invasive species that are capable of altering ecosystem processes or characteristics are generally thought to be the most serious of invaders and are likely to have the most dramatic effects on ecosystems. They often differ in life form from native species, and usually cause change either by creating new habitat or modifying existing habitat. Alteration of ecological factors such as hydrology, biogeochemistry, stand structure, resource utilization and competition are well documented in the literature, and the number of invasive species capable of altering ecosystem functions and properties is probably much higher than previously thought.

DISTURBANCE CREATES GAPS THEORY

Disturbance is often attributed to enhancement of invasion especially in "island-like" areas such as south Florida in particular where either natural disturbance is prevalent or where significant and widesperad human alteration of the natural system has occurred. However there are many examples of exotic species invading undisturbed habitats and out competing native species.

OPEN-NICHE THEORY

Initially it was thought that if evolution and species migration filled all a plant communities 'niches' that community was considered 'species-saturated' and was impervious to invasion by exotic species. The scientific evidence related to this concept is inconsistent at best, and more recent research suggests that higher native species richness does not impart resistance to exotic species invasion and some research has even shown a positive correlation of exotic species invasion with high native diversity.

Lack of Predators and Pathogens Theory

This theory presumes that introduced species become invasive because they are introduced without their natural pests and diseases and with an assumed concomitant reduction in competition. Some species are reported to grow and reproduce more robustly in the absence of predators, indicating that predator-free exotic species may enjoy an advantage over native species but the lack of predators is not always associated with invasiveness. However, the lack of predators is a key concept in the rationale for biological control.

Faster Reproductive Potential Theory

Many invasive species show either a rapid vegetative growth rate compared to native homologues. Several species in Florida (such as hydrilla and water hyacinth) are documented to be able to reproduce much faster that the native plants in the same habitat. This theory is closely allied with following concept relating to the questions of poor adaptation in native species versus better adaptation in exotic species.

Poor Adaptation in Native Species Theory

It is unclear whether some native species in their native ecosystem are truly less well adapted or tolerant, or if exotic species are simply better able to utilize existing resources or take advantage of reproductive opportunities (Also see previous theory on faster reproductive potential). Research indicates that the later two concepts certainly apply in many well documented instances, and that invasive species capable of altering ecosystem properties may also create a relatively novel environment to which the native species may no longer be adapted.

Availability Increases Invasibility Theory

There is convincing evidence that the more available a species is the greater the opportunity for eventual establishment of self-sustaining populations. The increase in availability of new species over time, and the repeated availability of existing species also appears to increase the absolute invasion rate. People are the major cause of species homogenization.

SUMMARY

The Basics of Bioinvasion

Most if not all of the exotic species that become invasive share many traits that help account for their invasive properties. The theories that endeavor to explain how and why these species are able to become invasive overlap in many instances, and most species share characteristics of invasiveness that includes behavior, genetics, physiology, and demography.

How well do these theories predict species invasiveness or ecosystem invasibility? Unfortunately science currently offers no adequate solutions to this vexing problem. Invasion characteristics of individual species may be predictable using biological characters where sufficient data exist. Broader generalizations are usually limited to

plant physiology, species behavior, genetics or demography of single species, or rarely congeneric species.

Invasive species are the second biggest cause of the loss of global biodiversity after habitat loss. Bioinvasion is here to stay and will only get worse if we continue to deal with the problems of exotic species in a piecemeal and parochial fashion. The message is loud and clear—we must act cooperatively, collectively, and decisively—if we are to halt the inevitable loss of our natural environment and other natural resources to non-native invasive species. Business as usual has not and will not work.

In reviewing the available strategies and plans—from the global to the national to the local level—for managing invasive exotics on a site or species basis, a consistent set of six basic components was common to virtually every plan. Management plans are still focusing on one or a few species or places at a time.

As important as planning for individual- and site-based species management is, it is equally important that future planning efforts become large-scale in order to better account for the complexity and extent of the invasive species problem. None of the plans reviewed were implemented at the ecosystem or large scale effort and this may well be because, in spite of numerous calls for such planning in the literature, no one seems to know exactly what it means to manage invasive exotic species at the ecosystem level.

The following six basic components elements were identified as essential in nearly every plan or recommendation reviewed:

1. **A Clear and Definite Goal**
2. **A Cross-Unit/Multi-Level Organizational Element**
3. **An Integrated Means of: Preventing, Prioritizing, Assessing, Managing, and Studying, Exotic Pests.**
4. **An Emphasis on appropriate and Harmonious Policies and Regulations.**
5. **A Means of Transferring Information and Technology**
6. **Consistent and Sufficient Resources**

WHAT'S BROKEN?

WHY EXISTING WEED MANAGEMENT MEASURES ARE NOT ADEQUATE

Rudimentary elements of a good invasive exotic plant management strategy—legislation, coordination, planning, research, education, training, and resource input—have been in place in Florida for years. While Florida is well ahead of most other states, programs within the state have been implemented with varying degrees of commitment, coordination and success, often stemming from a failure by agency and political leaders to appreciate the full scope and significance of the problem, and because of direct conflicts with special interest groups like the nursery industry. Research in particular has been inadequate and usually only focused on the species of immediate concern rather that taking a broader approach to invasion biology generally.

The following 13 points provide the context in which the invasive exotic plant management strategy is developed. In some cases, improvements to invasive species management through reorganizing or rethinking existing measures are recommended; in others we recognize that new procedures will be required.

1. Local-thinking and a lack of multi-agency integration have typified weed management

No formal organizing body exists that adequately and directly represents all agencies and organizations that have primary involvement in the array of invasive exotic plant issues such as research, planning, management, regulation, policy development, and education. Because of the lack of coordination invasive species management is fragmented.

2. Lack of appropriate mechanisms for assessing and prioritizing statewide and bioregional invasive exotic species issues

In Florida, there is a need for a formally recognized multi-agency organization with direct representation from key agencies and indirect representation from other agencies and non-governmental organizations (NGOs) and others may be only proximally involved with invasive exotic plant issues. Procedures must also be put in place to ensure an integrated and coordinated approach to assessing the significance and priority of particular weed issues Florida-wide.

3. Exotic plant invasion is slow and deceptive

Weed problems are often slow to develop. The status of invasiveness may be attained by a species on a time scale that works against methodical observations of encroachment. Plants that appear benign for many years or even decades may suddenly spread rapidly. There is a need to recognize these species during their incipient phase or even prior to introduction.

4. Disturbance and invasion are closely linked

While disturbance is not necessary for invasion, weeds are encouraged by disturbance and disturbance can take many different forms. Disturbance of the natural environment is often a consequence of economic and social development. Many of the most significant weed problems are plant species that have evolved to colonize disturbed habitats. In order to manage the weed problems that may be a consequence of this phenomenon we need to develop land-use and restoration systems that cause minimal disturbance to the natural environment.

5. Failure to acknowledge the seriouness of the problem

There has been a pervasive failure to recognize the scope and seriousness of invasive exotic plants. The public (and many policy-makers) generally gives inadequate regard to weeds, especially those of natural areas. Even conservation organizations have not given invasive species the attention they merit and have been slow to recognize invasive exotic species as a serious threat to natural areas.

6. Agriculture has dominated the weed issue

Historically weed problems have been treated principally as an agricultural issue. Today, funding for agricultural weed problems and weed problems associated with human nuisance issues receives the vast majority of invasive species funding and support.

7. Shortcomings in prevention

While the US already has many established invasive exotic species, there are an estimated 25,000 additional 'recognized' weeds worldwide. Only about 3,000 of these species are known to occur in the continental US. Except for certain listed species of plants (those on the Federal Noxious Weed and Seed Lists), plants themselves are not prohibited from entry even if they are documented as a species that is known to be an invasive weed in the US or elsewhere.

8. No process for conflict resolution

Stakeholders and even agencies that may represent the interests of a particular user group, often hold differing opinions on invasive exotic species issues. What may be a serious pest to one group—like elephant grass (*Pennisetum* purpureum) is to natural lands managers—is a desirable forage and silage crop that is still the subject of research for improved cultivars by other groups—in this case the UDSA and FDACS. These conflicts occur at every level of government. These differences can often lead either by design or default to acceptance of the status quo, which works in favor of the weeds.

9. Belief that chemical control is the answer

Approaches that include mechanical, ecological and system management have generally been neglected in favor of cost and convenience. Chemical control is a vital and useful part of invasive exotic plant management but it must be realized that it is only one part of a complete management program.

10. Belief that biological control is the answer

Probably because of the confusion with different kinds and uses of biological agents, people generally hold one of two extreme views regarding biological weed control. Either they believe that biological control is a panacea that can eliminate all pest problems. Just as with chemical control there is a failure to realize that classical biological control is not a panacea, but is one important component of a carefully developed and integrated management program.

11. Inconsistencies and gaps in legislation and regulation

Federal, state and local legislation dealing with the spread of invasive exotic species is a hodgepodge of uncoordinated and unfocused laws and regulations. Regulatory coverage is not coherent, nor was it strategically developed.

12. Inconsistent or insufficient resources

The resources currently devoted to the problem are not commensurate with the risks posed. It is also quite clear that resources devoted to effective prevention of introduction of potentially harmful species can return manifold millions or billions of dollars in future control costs. The need for additional funds is understood and in some cases being addressed, however, a more urgent issue is the problem of inconsistent and uncoordinated utilization of existing resources.

13. Insufficient research and study of invasion ecology

The development of a comprehensive and integrated science program to delve into the complexities of invasion ecology is essential if we are to seriously tackle these two questions that form the nexus of all invasive species ecology. Like management, research in invasion ecology has been piecemeal, and while many useful products are available there has never been a coordinated approach of inquiry into these questions.

FIXING IT, HOW TO GET FROM WHERE WE ARE TO WHERE WE NEED TO BE:

DEVELOPING THE RIGHT STRATEGIES,
IDENTIFYING THE RIGHT CONCEPTS AND GOALS,
IMPLEMENTING THE RIGHT ACTIONS,
GETTING THE RIGHT OUTCOMES

CONCEPT NUMBER 1

ASSESS, MANAGE, CONTROL AND RESTORE

GOAL 1: Reduce the impact and contain the distribution of existing significant invasive exotic plant and other weed problems

OUTCOME:

Natural areas are free of the harmful effects of invasive exotic plants

Steps:

A. Establish procedures, mechanisms, and information network to assist in identifying, assessing, and ranking weed problems on an integrated statewide, eco-regional or unit area basis.

B. Establish procedures for the development and revision of integrated species-based management plans to provide for coordinated actions against priority weed problems.

C. Develop integrated plans and implement cross-agency control programs for highest priority problems.

D. Develop science program to support implementation of assessment, management, control and restoration actions and support ecosystem level management.

CONCEPT NUMBER 2

ASSESS, DETECT AND PREVENT

GOAL 2.1: Prevent new weeds being introduced that could become problems in natural areas and prevent incipient weed populations in natural areas from spreading

OUTCOME:

Reduced spread of weeds into natural areas and reduced risk of introducing new weed species

Steps:

A. Develop science-based procedures for assessing the invasive potential of new and existing species.
B. Develop and implement more effective interdiction actions at importation sites.
C. Develop science-based techniques and procedures consistent among agencies to detect incipient populations of existing plants or newly introduced species (Also see Concept 1, step D, action D-4.2).
D. Develop and implement capability for rapid-response to control or eradicate incipient populations of invasive plant species or significant new weed problems.

CONCEPT NUMBER 3

INFORM, ADVISE AND EDUCATE

GOAL 3: Generate public awareness of the invasive exotic plant problems and broad support for efforts to control invasive exotic plants

OUTCOME:

Better-informed and more supportive policy makers, scientists, industry and public

Steps

A. Integrate invasive species issues, identification, ecology and management into academic courses and institutions and agency training.
B. Engage the public in the invasive exotic plant issues and in early detection and reporting of suspected new species or infestations.
C. Identify key public and policy groups and establish partnerships to create a network for collaboration and provide information to policy makers and managers.

D. Provide support to the horticultural and agricultural industries to ensure an economically viable horticultural industry that is responsive to the need for preventing the introduction of invasive exotic species and is compatible with a sustainable and viable natural ecosystem.

CONCEPT 4

ORGANIZE, COORDINATE AND PLAN

GOAL 4: Marshall federal, state, regional and local actions and resources on invasive exotic plants to provide integrated, consistent, cost efficient and effective weed management

OUTCOME:

Agency programs and planning for control and management are integrated and agency actions are coordinated

Steps

A. Establish a formal multi-agency organization with mechanisms to implement the state invasive exotic plant management strategy to provide a consistent, continuous capability for cost effective, efficient, integrated and sustainable weed management.

B. Write the strategic implementation plan that identifies agency roles and actions, and short and long-term strategic elements to establish priorities for funding and execution.

C. Coordinate Florida-wide agency actions and integrate with national and international control efforts in order to integrate planning and management programs.

D. Develop an inter-agency supported research, education and training capacity to ensure scientific rigor and currency, and integration and coordination of weed management.

How this Strategic Plan Fits with the National Planning Efforts

Put simply, in one form or another almost every other document reviewed provided sound strategic principles and concepts and thus presented some insights toward the development of this strategy. The result is a strategic plan that contains not only the concepts and principles inherent in good invasive species management applicable at the local and global levels, but also incorporates measurable outcomes and actions specific to helping implement an effective invasive exotic plant management program for Florida and the Everglades. In addition, several members of NEWTT have also been participating in the concurrent national level planning efforts and this plan benefited

from that involvement. As a result, coordination and integration with national planning efforts has been built into this plan.

GET REAL!

ARE ANY OF THESE CONCEPTS, GOALS, STEPS AND ACTIONS PRACTICAL AND WILL THEY HELP?

OVERVIEW

Implementing an effective program of invasive species management will be a complex, long-term and predictably onerous task. But unless we face this issue directly the real nightmare would be to do nothing and wait until the problem is intractable, an all too common situation. At that point everyone, including industry, would be calling for something to be done and it will probably be too late for our natural areas.

Successful invasive species management will require that policymakers and the public alike accept the value of preserving natural areas and agricultural resources, and acknowledge invasive species management as an essential component of ecosystem preservation. Controlling just the few plants that everyone can agree are pests will continue to be ineffectual.

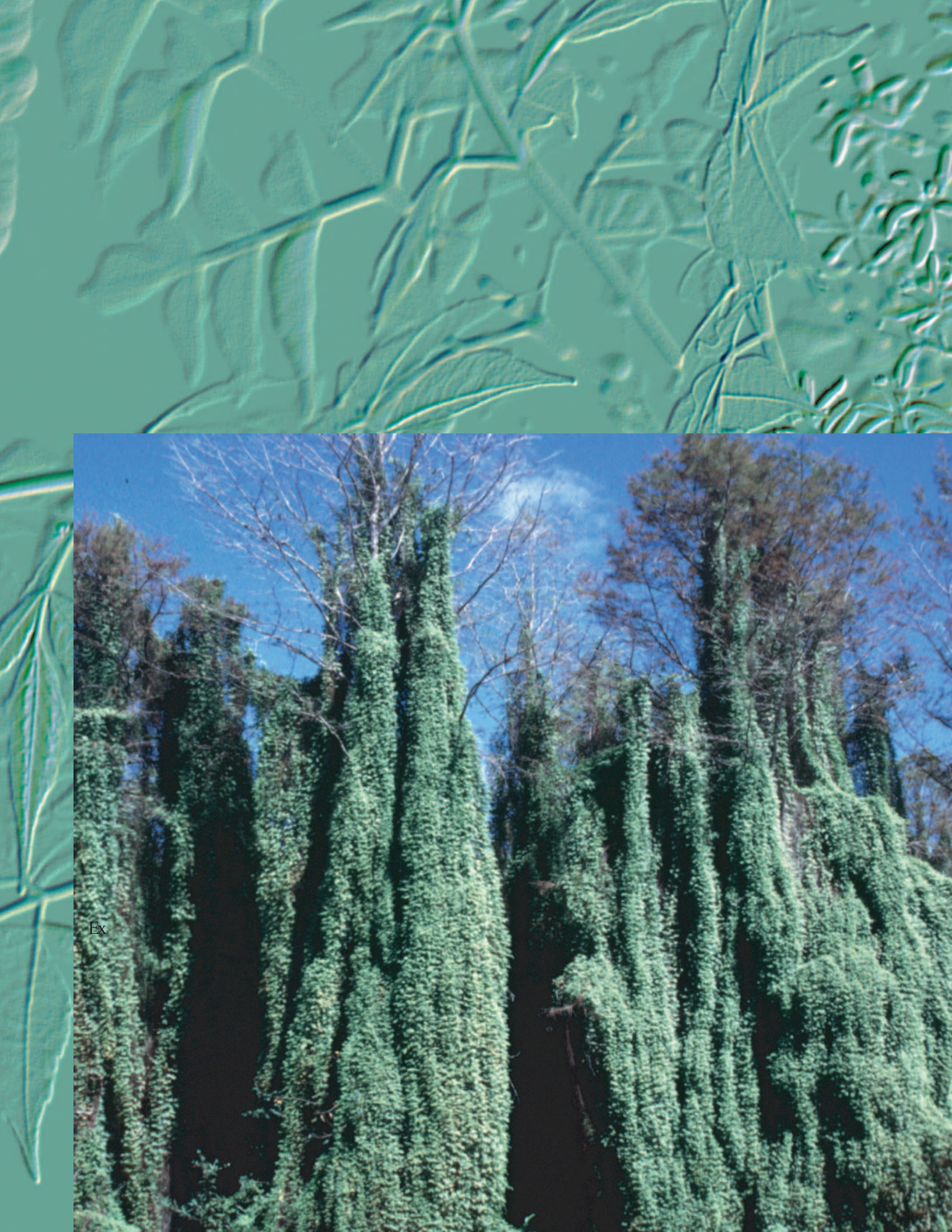
Without scientific certainty public policy and law have typically required "the public" to carry the burden of proof that a particular activity or thing is harmful, while those undertaking potentially harmful activities and the products of those activities are considered innocent until proven guilty. This burden of scientific proof, especially in light of the enigmatic nature of biological pollution, has posed a significant deterrent to activities to protect the environment from many forms of pollution including biological pollution. Only after significant harm occurs are corrective actions usually taken. By that point it may either be too late or extremely costly to reverse.

Invasive exotic plants clearly fit into this typical pattern of US regulation. Anyone can legally bring plants or seeds (and many other exotic life forms) into the US with virtual disregard to the possible weedy or invasive nature of the plant. Yet once a plant becomes a pest, those responsible for bringing it are not accountable for the damage, often pointing out that there was no clear scientific proof that a particular species would be invasive.

The Strategic Plan provides examples of approaches and current practices for managing exotic invasive plants. The examples provided are not all-inclusive and are only intended to provide illustrations of existing and proven programs or activities that have successfully applied some of the key strategic approaches to invasive species management.

WHAT ARE THE 5 MOST IMPORTANT THINGS WE SHOULD DO RIGHT AWAY?

1. ORGANIZE (SEE CONCEPT 4, STEP A)
2. WRITE THE STRATEGIC IMPLEMENTATION PLAN (SEE CONCEPT 4, STEP B)
3. PRIORITIZE SPECIES FOR CONTROL AND WRITE THEIR CONTROL PLANS (SEE CONCEPT 1, STEP A)
4. DEVELOP A MEANINGFUL LEVEL OF STANDARIZATION NEEDED FOR A COMMON LEVEL OF INTER-OPERABILITY AMONG AGENCIES (SEE CONCEPT 1, STEP A)
5. DEVELOP AN EARLY-WARNING AND RAPID-RESPONSE CAPABILITY (SEE CONCEPT 2, STEP D)



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APPENDIX C

ENVIRONMENTAL LAW INSTITUTE RESEARCH REPORT

FILLING THE GAPS

TEN STRATEGIES TO STRENGTHEN INVASIVE SPECIES MANAGEMENT IN FLORIDA

THE ENVIRONMENTAL LAW INSTITUTE
AUGUST 2004

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Filling the Gaps:
Ten Strategies to Strengthen Invasive Species Management in Florida

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Chapter 1: Introduction

Of all the states, Florida is among the most affected by harmful non-indigenous species.[1] Non-natives can be found in Florida's reefs, shorelines, estuaries, forests, lakes, rivers, dunes, swamps, prairies, sand-pine ridges, and beaches—essentially every Florida habitat. "Parts of South Florida look good to the uninitiated," writes biologist and Pulitzer Prize-winning author E.O. Wilson, "but in the naturalist's eye it is substantially a Potemkin façade of foreign species."[2] While the majority of these non-native species are benign, causing no lasting damage to their new ecosystems and habitats, others—the invasives[3]—have the potential to cause extreme ecological disruption by outcompeting native species and altering natural habitats.

Perhaps nowhere are these impacts more evident than in the Everglades. Marjory Stoneman Douglas's famed "River of Grass" once stretched across much of South Florida, the surface and ground water flowing south in a uniform and unchanneled sheet from the Kissimmee chain of lakes to Florida Bay.[4] Today, however, the glades are dissected by a latticework of more than 1,000 miles of canals, 720 miles of levees, and hundreds of water control structures—the result of more than 100 years of labor to provide suitable farmland and a steady water supply to the rapidly growing South Florida region.[5]

This "re-plumbing" of the Everglades, coupled with pressures from agriculture and urban development, has severely stressed the sensitive ecosystem and increased its vulnerability to invasive species. Old World climbing fern, an exotic plant that enshrouds and smothers native grasses and trees, has spread from one small infestation in 1979 to more than 200,000 acres today. Escaped or intentionally released exotic pets, including giant Amazonian pythons, are lurking in the channels surrounding Everglades National Park, and evidence suggests they are breeding.[6] Unless urgent action is taken, an increasing number of experts agree that the unique and diverse ecosystem that inspired Ms. Douglas may be forever lost.

PURPOSE OF THIS REPORT

The state and federal response to invasive species in the Everglades and throughout Florida has been hampered by a convoluted patchwork of laws and regulations, most of which were not originally promulgated with invasive species in mind.[7] Jurisdictional boundaries, conflicts in agencies' missions and goals, public apathy, and industry opposition have further stymied effective progress. Formulating a coherent policy response requires a thorough understanding of the gaps and shortcomings in the legal authorities currently available for invasive species management in Florida. In 2001, an interagency task team affiliated with the South Florida Ecosystem Restoration Task Force (SFERTF) identified this need,[8] and the U.S. Army Corps of Engineers has provided the funding necessary to accomplish this task.[9]

This report builds on the findings in the SFERTF report[10] and the Environmental Law Institute's

invasive species expertise[11] to identify and analyze both the obstacles to and the opportunities for preventing, controlling, managing, and eradicating invasive species in Florida. The centerpiece of this study is an evaluation of the strengths, weaknesses, and gaps in existing legal authorities and the development of concrete recommendations to strengthen invasive species policy in Florida, either through the adoption of new laws, policies, or programs, or through amendments to or creative application of existing laws and regulations. The report covers the entire state of Florida, but devotes a particular focus to the role of federal authority in Everglades restoration. Similarly, although the recommendations are largely directed to federal actors, they include steps that can be taken at all levels of government to improve invasive species management in Florida or in other states facing comparable invasive species threats.

METHODOLOGY

More than thirty invasive species veterans, representing local, state, and federal government agencies and non-governmental organizations in Florida, contributed to this study. Their insights, combined with ELI's legal analysis, form the core of this report. The report breaks down invasive species programs and authorities by the intended purpose or function they are intended to serve. This kind of functional approach ties together descriptions and analysis of related programs and helps highlight gaps and weaknesses. The five functional categories used in this report are not precise classifications, but help clarify the report's presentation.[12]

1) Prevention. This category includes all legal tools and measures taken to prevent the introduction or establishment of new invasive species. Invasive species lists that regulate the import, possession, or sale of specific species are commonly used prevention tools. Pre-screening requirements, early detection, and rapid response/eradication programs also belong in this category. As the first line of defense against invasives, prevention is often thought to be the most effective and cost-efficient strategy available.

2) Control and Management. This category covers government attempts to control established infestations of invasive species. Because complete eradication is not generally feasible for established species, most of these measures are intended to limit the spread of invasive populations and reduce infestations to manageable levels. Public land management agencies often fund invasive species control projects under their general or "organic" authorities. Regulations requiring control of invasive species on private lands are less common. This category also includes the regulation and use of biological control agents and programs to restore native species and habitat.

3) Research. Research supports each of the other categories of invasive species responses. This umbrella category includes research on the biological traits that make certain species invasive and certain ecosystems susceptible, efforts to understand the major invasion pathways, and attempts to improve existing aquatic and terrestrial control methods (including biocontrol).

4) Education, Outreach, and Public Partnerships. This broad category covers the interface between government programs and private action. It includes, for example, technical assistance and incentive programs to encourage invasive species control on private lands. Government sponsored public awareness campaigns and the development of industry partnerships and "codes of conduct" are other examples. These programs and authorities build the government's capacity to deal with invasives by changing prevailing beliefs and behaviors and by enlisting private activity in a broader campaign.

5) Strategic Planning and Coordination. This category encompasses efforts to bridge gaps between local, state and federal agencies and to set priorities and strategic goals across jurisdictions. Coordinated responses and agency partnerships maximize government resources, avoid redundancy, and drive innovation. Interagency cooperation and strategic planning are particularly important in Florida, given the federal government's leadership in South Florida Ecosystem Restoration.

ORGANIZATION

The report is organized as follows:

The Federal Legal Framework. This initial section lays out the primary federal authorities that relate to prevention and control of invasive species. As will be explained further, the United States lacks a comprehensive statutory framework for invasive species, and many relevant provisions reside exclusively in agency policies and regulations. This section highlights the fundamental federal authorities in the area and points out the major gaps and weaknesses. The unusual fusion of federal and state authorities driving South Florida Ecosystem Restoration is an important part of Florida's legal landscape, and is also described in this section.

Ecosystem Restoration Authorities and the State Role. This section briefly describes the network of interrelated federal and state ecosystem restoration authorities that overlay traditional invasive species authorities in Florida. The analysis outlines how government agencies are using their authorities to address invasive species in Florida, particularly with respect to Everglades restoration. Included in this section are state and local programs which put the federal role in context and highlight gaps in government responses.

Gaps and Conflicts Analysis. This section presents the weaknesses, gaps, and conflicts in the fabric of invasive species authority in Florida and emphasizes practical issues of implementation. Most deficiencies were initially revealed through conversations with professionals working on a full spectrum of invasive species issues in Florida. State and federal authorities and programs are analyzed together in order to bring into focus specific areas where existing laws and regulations are inadequate (gaps in authority), situations where agencies could be doing more to fully exercise the authority available to them (gaps in implementation), and examples of direct conflicts and inconsistencies in the legal framework.

Recommendations. In this section, clear recommendations for improving invasive species management in Florida accompany the discussion of gaps. This serves two interrelated goals. The immediate goal is to provide a foundation for future federal contributions to the invasive species fight in South Florida. More broadly, these recommendations can be used to strengthen invasive species control and management throughout Florida, at all levels of government, and in other states facing similar invasive species challenges. The recommended actions are as follows:

1) Close the gaps in regulatory authority and implementation;
2) Implement a systematic, science-based listing process;
3) Beef up border protection;
4) Build monitoring and rapid response capacity;
5) Devote adequate resources to public lands management;
6) Reframe uplands authority to reach private lands;
7) Refocus research;
8) Raise awareness in the public and beyond;
9) Emphasize incentives for private action; and
10) Reconcile the state and federal planning processes.

[1] These problems are well-documented. *See, e.g.,* U.S. Congress, Office of Technology Assessment, *Harmful Non-Indigenous Species in the United States, OTA-F-565* (Sept. 1993) ("OTA Report"); Simberloff, Schmitz, and Brown, *Strangers in Paradise: Impact and Management of Nonindigenous Species in Florida* (Island Press, 1997).

[2] Wilson's quote is from *Strangers in Paradise, supra*.

[3] Executive Order 13112 defines "invasive species" to mean a species (a) that is not native to the ecosystem under consideration; and (b) whose introduction does or is likely to cause economic or environmental harm or harm to human health.

[4] Ms. Douglas, a tireless advocate for the protection of the Everglades, published her book *The Everglades: River of Grass* in 1947.

[5] These works are managed by the U.S. Army Corps of Engineers and their local sponsor, the South Florida Water Management District, in accordance with the "Central and South Florida (C&SF) Project" authorized by section 203 of the Flood Control Act of 1948 (62 Stat. 1176).

[6] Abby Goodnough's *New York Times* article, "Forget the Gators: Exotic Pets Run Wild in Florida" (Feb. 29, 2004), chronicles the extent of the Everglades infestation.

[7] For an in-depth discussion of the gaps and inconsistencies in U.S. federal invasive species law, *see* M. Miller and R. Fabian, *Harmful Invasive Species: Legal Responses*, Ch. 6 (ELI, 2004). The OTA Report, note 1, *supra*, contains perhaps the earliest and most comprehensive treatment of the issues.

[8] The report was identified as a critical project in *Weeds Won't Wait: The Strategic Plan for Managing Florida's Invasive Exotic Plants* (2001), produced by the Noxious Exotic Weed Task Team (NEWTT) as part of their effort on behalf of the South Florida Ecosystem Restoration Task Force and Working Group.

[9] This study is part of a broader special-report funded by the Corps on the role of federal agencies in controlling and managing invasive exotic plants as part of Everglades' restoration.

[10] *See Weeds Won't Wait*, note 8, *supra*.

[11] Invasive species management is a primary focus of ELI's State Biodiversity Program. The present study draws, in part, from ELI's H*alting the Invasion: State Tools for Invasive Species Management* (2002) and *Harmful Invasive Species: Legal Responses* (edited by M. Miller and R. Fabian) (2004); along with various other ELI studies and reports, including *Invasive Species Control: A Comprehensive Model Law* (2004) and *Making a List: Prevention Strategies for Invasive Plants in the Great Lakes States* (2004).

[12] The five categories correspond roughly, but not exactly, to the categorizations used in the National Invasive Species Council's 2001 Management Plan and ELI's *Halting the Invasion* report. NISC selected nine categories for its action plan for the nation:

1) Leadership and Coordination;
2) Prevention;
3) Early Detection and Rapid Response;
4) Control and Management;
5) Restoration;
6) International Cooperation;
7) Research;
8) Information Management; and
9) Education and Public Awareness.

Halting the Invasion used:

1) Prevention;
2) Regulation;
3) Control and Management;
4) Enforcement and Implementation; and
5) Coordination.

Chapter 2: The Federal Legal Framework

Invasive species have beleaguered the South Florida economy and environment for well over a century. According to local legend, one Mrs. Fuller bought a "floating aquatic plant with a pretty purple flower," a water hyacinth, from the New Orleans World Fair in the late 1800s. After the South American species took over her goldfish pond, the story goes, she pulled the plant up and threw it into the St. John's River. By 1897, the invasive species had choked commerce and navigation throughout the Gulf States. Congress responded in 1899 by authorizing the expenditure of $25,000 for the construction of two boats to remove water hyacinths, $1,000 for log booms to use with the boats, and $10,000 for operating costs in the states of Florida and Louisiana.[1] Thus began the Army Corps of Engineers' pitched battle against invasive aquatic vegetation, that continues to this day.

Water hyacinth was not the first, and is certainly not the last, in an invasive menagerie that is causing inestimable damages in Florida and across the United States. In many cases, the government has attempted to stem the tide through legislative enactment and expenditure. Unfortunately, like the case of the water hyacinth, these efforts often follow a familiar pattern. Little is done to prevent the initial introduction of the species, and expensive control measures are required when major infestations result.

This pattern of ad hoc, reactive government action has left scores of overlapping, piecemeal legal authorities. There is no single federal law that addresses invasive species in a proactive and comprehensive manner. At best, our laws target a particular class of invasive species, such as plant pests, or pests and diseases of livestock, or "injurious" wildlife. At the same time, numerous minor provisions provide several agencies with fragmented authority that could be used to address certain invasive species in circumscribed situations. Marc Miller calls this the "paradox" of U.S. invasive species law—the abundance and, at the same time, essential absence of relevant legal authority.[2]

An exhaustive accounting of all potentially relevant federal authority would be a laborious task. Instead, this section provides a broad overview of the primary federal laws that relate to invasive species, and highlights prominent weaknesses and gaps. A full discussion of how these gaps affect invasive species prevention and management in Florida is found in Chapter 4. Here as throughout the report, the presentation is organized according to functional categories (prevention, control and management, etc.).

PREVENTION

Several federal laws are intended to protect the nation from introductions of individual species or classes of species, but gaps in the framework abound.

The Lacey Act
(18 U.S.C. § 42 and 16 U.S.C. §§ 3371* et seq.*)
Dating from the early 1900s, the Lacey Act is one of the federal government's first attempts to deal

J.S. Peterson, USDA-NRCS PLANTS Database. Water Hyacinth.

with invasive animal species (although the term "invasive species" had not yet been coined). The Lacey Act prohibits the importation of certain categories of fish and wildlife determined to be "injurious to human beings, to the interests of agriculture, horticulture, forestry, or to wildlife or the wildlife resources of the United States."[3] The Act delegates authority to the Secretary of the Interior to create a list of prohibited injurious species.[4] In 1981, Lacey Act amendments "incorporated" other federal and state wildlife laws by prohibiting the import, transport, or sale of fish, wildlife, and certain plants "taken, possessed, transported, or sold" in violation of any federal, tribal, state or foreign law.[5] Today, wildlife inspectors from the U.S. Fish and Wildlife Service's Division of Law Enforcement operate wildlife inspection offices at thirteen designated ports across the country to enforce the provisions of the Act.[6]

A major weakness of the law is limitation of federal listing authority to: a) animal species; b) only certain classes of animals (namely mammals, birds, fish, crustacea, amphibians, and reptiles); and c) only "wild" members of the class.[7] Of these categories, only those species determined to be "injurious" to the interests of agriculture, horticulture, forestry, and wildlife (or the vegetation upon which they depend) may be listed.[8] This narrow definition does not explicitly cover invasive animals that may harm the environment without harming the traditional enumerated categories above (for example, by injuring plant resources in natural areas).

The U.S. Department of the Interior (DOI) has used its Lacey Act authority sparingly, listing less than twenty genera of prohibited wildlife.[9] The Act's "dirty list" approach[10] contributes to this problem—species are only regulated after they have become major problems and have generated enough political momentum to spur action. There is no required pre-screening of potentially harmful species before they are allowed to be imported freely.

One strength of the Lacey Act Amendments is that they specifically leave U.S. states free to make or enforce laws "not inconsistent" with the federal provisions.[11] This feature, coupled with the Amendments' incorporation of other state and federal wildlife laws, means that the U.S. FWS has much broader enforcement authority than listing authority. This enforcement authority extends to wild animals protected by state law and indigenous plants protected by the Convention on International Trade in Endangered Species (CITES) or a state endangered species law.[12]

The Plant Protection Act (PPA)
(7 U.S.C. §§ 7701 et seq.*)*

The Plant Protection Act consolidates and updates most of the Department of Agriculture's prior statutory authorities concerning plant protection (including former provisions of the Plant Quarantine Act, the Federal Plant Pest Act, and the Federal Noxious Weed Act).[13] The Act authorizes the Secretary of Agriculture to "prohibit or restrict the importation, entry, exportation, or interstate movement of any plant, plant product, biological control organism, noxious weed, article, or means of conveyance, if the Secretary determines that the prohibition or restriction is necessary to prevent the introduction into the United States, or

dissemination of a plant pest or noxious weed within the United States."[14] APHIS Plant Protection and Quarantine (PPQ) requires permits for imports and interstate movement of any live plant pests,[15] biological control organisms, or federal noxious weeds.[16] Articles from foreign sources that can provide a pathway for the introduction of pests, such as wood products, soil, and fresh fruits and vegetables, are also strictly controlled and require permits.[17]

The initial line of defense is a network of fifteen Plant Inspection Stations located at major U.S. ports of entry. At these plant inspection stations, Customs and Border Protection (CBP) officers work with PPQ scientists (including botanists, entomologists, and plant pathologists) to identify pests, diseases, and prohibited plants and enforce the requirements of the PPA. Emergency measures and quarantines are authorized if pests slip through border defenses in order to slow potential invasive infestations.[18] APHIS PPQ's Safeguarding, Intervention, and Trade Compliance (SITC) program works alongside the inspection protocol to detect and close pathways for smuggled products and potential exotic pest introductions.

The Act has several strong points. It authorizes a **federal noxious weed list** and imposes restrictions on the entry and movement of listed species within the United States.[19] The statutory definition of "noxious weed" also expands the department's jurisdiction beyond traditional agricultural pests to plants that can "directly or indirectly" injure "the natural resources of the United States, the public health, or the environment."[20] Unlike former federal plant protection laws, it provides clear authority to regulate the interstate movement of plant pests and noxious weeds rather than just importation.[21] It also authorizes emergency remedial measures within a state (i.e., when interstate movement is not involved) if "the measures being taken by the State are inadequate to eradicate the plant pest or noxious weed."[22]

The Plant Protection Act's consolidation of ten statutes greatly simplifies the administration of federal plant protection authority. However, gaps remain. The Secretary of Agriculture's authority to declare quarantines, declare extraordinary emergencies, or take other remedial measures is limited to plant pests or noxious weeds that are "new to or not known to be widely prevalent or distributed within and throughout the United States."[23] This excludes a significant number of invasive plants and pests that have already become widely established in the United States. In addition, the Federal Noxious Weed list retains a time-consuming "dirty list" approach, increasing the likelihood that species will be listed only after they have already become major problems.

Unlike the Lacey Act, the PPA does not incorporate state plant protection laws. Instead, it specifically preempts state and local plant protection regulations that are more stringent than the federal requirements unless the state can demonstrate a "special need" for additional restrictions.[24] Such a demonstration must be based on "sound scientific data or a thorough risk assessment."[25]

The Animal Health Protection Act (AHPA) (7 U.S.C. §§ 8301 et seq.*)*

In 2002, Congress consolidated all of the existing animal quarantine and related laws—some dating back to the late 1800's—and replaced them with the Animal Health Protection Act of 2002. The AHPA grants broad authority to the Secretary of Agriculture to control pests and diseases of livestock through import restrictions, quarantines, and eradication programs.[26] APHIS administers the AHPA and restricts the entry of certain live farm or game animals and birds (including carcasses, meat and trophy skins), poultry and other birds (including hatching eggs), and the entry and interstate shipment of potential carriers of animal diseases under the Act's authority. Some animals are prohibited; others must be cleared at USDA Animal Import Centers or quarantine stations after entry.[27]

Unlike the PPA, the AHPA retains a traditional focus on agriculture, and does not expand USDA's authority to consider pests and diseases that are not

specific to livestock.[28] In addition, the definition of "pests" does not encompass invasive vertebrate animals.[29] These gaps greatly limit the AHPA's usefulness as a general invasive species prevention tool. Still, there are a few potential applications. For example, AHPA authority extends to any animal or conveyance carrying a regulated pest or disease. Therefore, exotic birds carrying a pest or disease that could affect poultry (or other livestock) may be quarantined under AHPA authority.

The National Invasive Species Act (NISA) (16 U.S.C. §§ 4701* et seq.*)

Despite its broad title, the National Invasive Species Act (NISA) is narrowly focused on one class of species (aquatic nuisance species, or ANS) and one pathway (the exchange of ballast water). NISA created an Aquatic Nuisance Species Task Force to develop and implement programs to prevent the introduction and dispersal of aquatic nuisance species.[30] NISA also directed the U.S. Coast Guard to develop guidelines and regulations to prevent ANS introductions through ballast water exchange in U.S. waters.[31] These guidelines were initially voluntary, but in June 2002 the Coast Guard began working on regulations to require mandatory ballast water management practices for all ships entering U.S. ports from outside the Exclusive Economic Zone. The Coast Guard published a proposed rule in 2003,[32] and is expected to have a final rule by the fall of 2004.[33]

NISA authorization expired in 2002, and new bills are pending in Congress that would provide a more comprehensive approach to ANS prevention and control, including more effective and timely ballast water standards.[34]

Miscellaneous Prevention Authorities

There are many other minor provisions that relate in some way to invasive species prevention. The **Federal Seed Act** (7 U.S.C. §§ 1581 *et seq.*) requires accurate labeling of noxious weed seeds moving in interstate and foreign commerce. The **Alien Species Prevention Enforcement Act of 1992** (ASPEA) (Pub. L. 102-393) amended the Postal Service's "nonmailable matter" provisions (U.S.C. Title 39) to include species identified under the Lacey Act and Plant Pest Acts. Other miscellaneous authorities regulate the use of genetically engineered organisms[35] and introductions of exotic species in specific conservation areas.[36]

CONTROL AND MANAGEMENT

There are very few federal authorities that directly address the control and management of invasive species. The Lacey Act is silent on control and management measures. The Plant Protection Act includes a few provisions on the control of grasshoppers and Mormon crickets on federal lands[37] and the preparation of integrated management plans for noxious weeds.[38] The National Invasive Species Act authorizes the Aquatic Nuisance Species Task Force to develop cooperative efforts to control established aquatic nuisance species[39] and to assist states with the preparation of aquatic nuisance species management plans.[40] Federal agencies typically have authority to control invasive species on lands and waters under their jurisdiction, but the effectiveness of this authority is often limited by the high cost of invasives control and a lack of dedicated funding.

The Animal Damage Control Act (ADCA) (7 U.S.C. §§ 426-426c)

The Animal Damage Control Act authorizes the Secretary of Agriculture to "conduct a program of wildlife services with respect to injurious animal species and take any action the Secretary considers necessary in conducting the program."[41] This broadly worded law dates back to 1931 and has been traditionally used to control predators of livestock in the West. However, the Act was comprehensively amended in 2000 to clarify that its scope extends beyond the protection of

agricultural and other economic interests to include wildlife threats to public health and the environment.[42] These amendments give APHIS a broad mandate for control of invasive animal species on both public and private lands. APHIS Wildlife Services has tentatively begun to use this authority to control brown tree snakes in Guam, invasive coqui frogs in Hawaii, and feral pigs in Florida.

Although the statute is notably broad, there are a few limitations. The ADCA authorizes the USDA to "take any action the Secretary considers necessary" in conducting a program of wildlife services, but it is not clear if this includes the authority to promulgate regulations.[43] Therefore, the agency can use the Act to authorize control of injurious species, but not to manage their import or use. Additionally, APHIS has applied the ADCA only to vertebrate animal species,[44] although the term "injurious animal" is not defined by the Act.

Federal Land Management Authorities

Most activities to control and manage invasive species on federal lands are carried out under the authority of general federal land management laws and agency organic acts. The **Federal Land Policy and Management Act (FLPMA)** (P.L. 94-579, 43 U.S.C. § 1701 *et seq.*) declares congressional policy for the management of federal lands. FLPMA calls for management that will protect the quality of environmental and ecological values according to the principles of multiple use and sustained yield. Other federal laws address specific categories of public lands. These laws, while narrower in applicability, are just as sweeping in scope. For example, the **National Park Service Organic Act** (16 U.S.C. § 1 *et seq.*) created the Park Service to promote and regulate the use of park system lands in a manner that "will leave them unimpaired for the enjoyment of future generations." The **National Wildlife Refuge System Administration Act** (16 U.S.C. § 668dd) requires the Fish and Wildlife Service to provide for the "conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats" and to "ensure that the biological integrity, diversity, and environmental health of the System are maintained." USDA's authority to manage and protect National Forest System lands originates in the **Organic Administration Act of 1897**, as amended (16 U.S.C. § 551); the **Multiple-Use Sustained-Yield Act**, Pub. L. 94-588 (16 U.S.C. §§ 528-531); and the **Forest and Rangeland Renewable Resources Planning Act**, Pub. L. 93-378, as amended by the **National Forest Management Act**, Pub. L. 94-588 (16 U.S.C. §§ 1600 *et seq.*).

Federal agencies use these foundational laws to formulate guidelines and policies for the

Table 1: U.S. Army Corps of Engineers Aquatic Plant Control Programs

Program	Original Authority	Eligible waters	Cost-Share
Removal of Aquatic Growth (RAG)	Rivers and Harbors Act of 1899, Ch. 425[i]	Only federally designated navigation channels	100% federal
Aquatic Plant Control (APC)	Rivers and Harbors Act of 1958, Sec. 104[ii]	All public waters	70% federal/ 30% local

[i] As amended by subsequent legislation, including the Rivers and Harbors Acts of 1902 (Ch. 1079); 1905 (Ch. 1482); 1912 (Ch. 253); and 1916.

[ii] As amended (33 U.S.C. § 610). Implementing regulations are found in Army Corps regulations at 33 C.F.R. Part 273.

Table 2: U.S. Army Corps of Engineers Continuing Authorities Programs (CAP)

	"Section 1135"	**"Section 206"**
Authority	33 U.S.C. § 2309a	33 U.S.C. § 2330
Project purpose	Restore fish or wildlife habitat impacted by a Corps project	Restore fish or wildlife habitat (not necessarily related to a Corps project)
Sponsor restrictions	Public agency, some private interests, or large nonprofit organization	Same as sec. 1135
Sponsor responsibilities	Acquire needed land, easements, etc; operate and maintain project; and provide non-federal cost share	Same as sec. 1135
Cost-sharing	75% federal, 25% non-federal	65% federal, 35% non-federal
Maximum federal share	$5 million per project, $25 million for the program (annually)	Same as sec. 1135

management of invasive species on jurisdictional lands.[45] They afford federal agencies great discretion to choose control techniques and their targets.[46] However, the laws have been generally ineffective in controlling invasive species infestations for two main reasons. First, they apply only on federal lands. Adjacent private lands are off-limits, even if they are the source of the invasions in concern. Secondly, these authorities do not create a source of funding for invasive species control projects. Therefore, federal land managers often cannot afford to divert resources from competing agency needs such as facility maintenance, public use management, law enforcement, and other habitat management priorities.

U.S. Army Corps of Engineers Authorities

Several laws, including Section 10 of the **Rivers and Harbors Act of 1899** (33 U.S.C. § 403), Sections 2 and 4 of the **Flood Control Act of 1944**, (33 U.S.C. § 701-a, 16 U.S.C. § 460d), and Sections 1 and 2 of the **Forest Cover Act of 1960** (16 U.S.C. § 580m-n) provide general authority to the U.S. Army Corps of Engineers Civil Works Program to fund and manage the navigable waters of the United States. This includes the operation and maintenance of federally-owned water resource projects, as well as the development and restoration of the nation's water-related resources.[47] The Corps uses this general operations and maintenance (O&M) authority to remove invasive aquatic vegetation that interferes with flood control, navigation, irrigation, water supply, and fish and wildlife conservation in Corps-managed federally designated navigation channels.

The Corps' authority to control invasive aquatic weeds has also grown since its first experience with water hyacinth in 1899. Mechanical and chemical controls were added to the Corps' arsenal in 1902.[48] In 1958, Congress approved an "Expanded Project for Aquatic Plant Control," which authorized the removal of several new aquatic plant species "in the combined interest of navigation, flood control, drainage, agriculture, fish and wildlife conservation, public health and related purposes…."[49] Today, these authorities are consolidated in the Corps' **Removal of Aquatic Growth (RAG) and Aquatic Plant Control (APC) Programs**, summarized in Table 1.

The Comprehensive Everglades Restoration Plan (CERP)

In 1948, Congress authorized the U.S. Army Corps of Engineers to construct the Central and Southern Florida (C&SF) Project, a massive water delivery system encompassing the Everglades and intended to ensure adequate water supply and flood control for the rapidly growing region.[i] In 1992, aware that the C&SF Project had severely impacted the South Florida environment, Congress directed the Chief of Engineers to prepare a comprehensive review to determine whether modifications to the existing Project were advisable.[ii] This "Restudy" resulted in the development of a Comprehensive Everglades Restoration Plan (CERP), which was approved by Congress in Sec. 601 of WRDA 2000 (Pub. L. 106-541).

CERP has been described as the world's largest ecosystem restoration effort. It includes more than sixty elements, will take more than thirty years to construct, and will cost an estimated $7.8 billion shared between the federal government and the state of Florida.[iii] The initial round of CERP projects focus primarily on water allocation. Project engineers are designing and constructing vast water preserve and storage areas (including large underground storage reservoirs), and are removing barriers to sheetflow. These initial steps are intended to restore a more natural hydrologic regime and to set the baseline conditions for healthy natural communities.[iv] Although a few projects incorporate some invasive species components, there has been no comprehensive, systemic approach. However, many believe that the destructive potential of invasive species in South Florida has exceeded original expectations,[v] and that a new focus on invasives is needed in order to achieve the Plan's overarching restoration goal (set forth in Table 3).

Table 3: Comprehensive Everglades Restoration Plan's Goal

Purpose of the Restudy (WRDA 1996): "Restoring, preserving, and protecting the South Florida ecosystem."[vi]
Congress's instructions to the Corps of Engineers (WRDA 2000): "Establish a process to ensure the protection of the natural system consistent with the goals and purposes of the Plan."[vii]
CERP's Restoration Goal (CERP Final Programmatic Regulations): "The recovery and protection of the South Florida ecosystem so that it once again achieves and sustains those essential hydrological and biological characteristics that defined the undisturbed South Florida ecosystem."[viii]

[i] *See* Sec. 203 of the Flood Control Act of 1948, 62 Stat. 1176. A full description of the Central and Southern Florida Project is available at: http://www.evergladesplan.org/about/rest_plan_csf_devel.cfm.

[ii] *See* Sec. 309 of WRDA 1992 (Pub. L. 102-580). Congress expanded the Restudy and authorized additional critical restoration projects in 1996. *See* Sec. 528 of WRDA 1996 (Pub. L. 104-303) (directing the Secretary of the Army to develop a "comprehensive plan for the purpose of restoring, preserving, and protecting the South Florida ecosystem").

[iii] CERP's official website provides an excellent overview, http://www.evergladesplan.org.

[iv] SFERTF's integrated plan for South Florida Ecosystem Restoration, Success in the Making, elaborates this premise. It describes the overall goals as follows: Goal 1: Get the Water Right; Goal 2: Restore and Enhance the Natural System; Goal 3: Transform the Built Environment. The full report is available at: http://www.sfrestore.org/documents/success/06.htm.

[v] There are several reasons for this. First, invasives have colonized impacted ecosystems faster than originally expected. In addition, the piecemeal incorporation of invasive species components into individual water delivery projects leaves significant unmanaged areas. Therefore, invasives simply reinfest project areas when work is complete. Finally, many project components addressing invasives are cut out of CERP projects as their scope is narrowed between design and implementation.

[vi] *See* WRDA 1996 § 528(b) ("The Secretary shall develop, as expeditiously as practicable, a proposed comprehensive plan for the purpose of restoring, preserving, and protecting the South Florida ecosystem.").

[vii] "The Secretary shall … promulgate programmatic regulations to ensure that the goals and purposes of the Plan are achieved." WRDA 2000 §601(h)(3). These Programmatic Regulations must "establish a process…to ensure the protection of the natural system consistent with the goals and purposes of the Plan." *Id*.

[viii] *See* 33 CFR § 385.3 (CERP Final Programmatic Regulations) (Restoration means the recovery and protection of the South Florida ecosystem so that it once again achieves and sustains those essential hydrological and biological characteristics that defined the undisturbed South Florida ecosystem.). *See* also 68 Fed. Reg. at 64205 (Defining Restoration).

While the traditional RAG and APC programs are limited to aquatic plants (and often limited to work in federal navigation channels), the Corps has much broader authority to address invasive species through newer **ecosystem restoration authorities**. Although the Army Corps of Engineers has historically focused on flood control and navigation, its primary mission "has matured" to now include environmental protection.[50] This new outlook involves an "ecosystem approach"[51] that "consists of restoring and/or protecting the structure and function of an ecosystem, or parts thereof, recognizing that all its components are interrelated."[52] A "large body of legislation" supports this new environmental protection mission.[53]

The broad restoration authority can be triggered in several ways. **Reconnaissance studies** can be initiated under Section 216 of the Rivers and Harbors Act of 1970 (Pub. L. 91-611) or by individual study authorities enacted in Congress. These studies evaluate existing Army Corps projects and recommend modifications in order to improve the environment.[54] The Restudy of the Corps' Central and South Florida Project, which led to the development of the Comprehensive Everglades Restoration Plan (CERP), is a good example (*see* sidebar on CERP). In addition, the Corps' **Continuing Authorities Programs (CAP)** allow local sponsors to approach the Corps with cost-sharing proposals for restoration projects.[55] These studies, which often have invasive species components, do not require specific authorization by Congress. Table 2 provides greater detail on these programs.

The concept of **adaptive management** is a crucial element of CERP. The long-term nature of the Plan requires periodic reassessment and design modifications in order to ensure that its goals and purposes are fulfilled.[56] This process is guided by RECOVER (Restoration Coordination and Verification), an interagency and interdisciplinary scientific and technical team that "support[s] implementation of the Plan with the overall goal of ensuring that the goals and purposes of the Plan are achieved."[57] In considering how the Plan may be improved, the Corps' Programmatic Regulations state that:

> the Corps of Engineers and non-federal project sponsors specifically shall consider modifying the design or operational plan for a project of the Plan not yet implemented; modifying the sequence or schedule for implementation of the Plan; adding new components to the Plan or deleting components not yet implemented; removing or modifying a component of the Plan already in place; or a combination of any of these actions.[58]

There are several ways that this adaptive management process could be employed to better address invasive species in Florida. First, adaptive management could lead to *modifications of existing CERP projects* to improve their performance with respect to invasive species management.[59] For example, technologies to keep invasives out of natural areas, like fish screens, could have a dramatic impact on ecosystem health, and are much less costly than control and eradication efforts.[60] RECOVER could lead a technical review of CERP technical design and operation plans to minimize the introduction of invasives into the Everglades.[61]

The Corps could also *design and implement one or more separate CERP projects* to improve invasive species management in Florida.[62] The South Florida Ecosystem Restoration Task Force could help formulate potential projects and justify their ability to contribute to the goals and purposes of the Plan. Ideal projects would address invasives throughout the study area, and could incorporate recommendations from the ISWG and SFERTF strategic planning processes as well as this report. Such an approach is not unprecedented. In 2002, the Corps implemented a CERP project focused on improving the research, quarantine, and release of biological control agents for invasive plants

throughout South Florida.[63] While the project as currently planned is focused exclusively on biocontrol, it provides an important example of the type of stand-alone invasive species projects available to the Corps under its restoration authorities.

Finally, adaptive management could result in a *Comprehensive Plan Modification* to broadly reevaluate and enhance the role of invasive species management through CERP. The Corps of Engineers and South Florida Water Management District may initiate a Comprehensive Plan Modification Report "whenever significant revisions to the Plan are necessary to ensure that the goals and purposes of the Plan are met."[64]

RESEARCH

There are several federal research programs that have some application to invasive species prevention and control. USDA's Agricultural Research Service (ARS) is a leader in biocontrol research.[65] The National Invasive Species Act funded several research grants on aquatic nuisance species prevention and control.[66] USDA Wildlife Services research efforts target introduced and invasive predator species that can devastate island habitats.[67] The U.S. Army Corps of Engineers maintains a Center for Aquatic Plant Research and Technology (CAPRT) in Vicksburg, Mississippi that focuses on biological control, chemical control, ecological assessment, and management strategies for problem aquatic plants. The U.S. Geological Survey (USGS)[68] and the National Oceanic and Atmospheric Administration (NOAA)[69] also conduct invasive species research.

Notably, there are no federal programs sponsoring comprehensive invasive species research across taxa.

EDUCATION, OUTREACH, AND PUBLIC PARTNERSHIP

The federal government offers several technical assistance and cost-sharing opportunities that can be used by private landowners and non-federal agencies to address invasive species issues. A few of the most important programs are outlined in this section. Invasive species projects must compete with other natural resource and habitat-related proposals for funding, and the total amount of funding available is relatively modest in comparison to the scope of overall invasive species control needs. Despite these limitations, these programs are an important resource for invasive species control on private lands and often spur creative partnerships and innovative actions to restore and manage degraded habitats.

Natural Resources Conservation Service (NRCS) Programs

The Natural Resources Conservation Service provides leadership in partnership efforts to help private landowners conserve, maintain, and improve America's natural resources.[70] The Service's roots are in the soil conservation movement of the 1930s; the program continues to operate under the authority of the Soil Conservation and Domestic Allotment Act (Pub. L. 74-46, as amended (16 U.S.C. §§ 590(a)-590(f)), which created the Soil Conservation Service in 1935. However, NRCS programs now reflect a broader conservation mission. The Conservation Technical Assistance Program (CTAP) provides voluntary technical assistance in areas such as soil health, water quality, wetlands enhancement, habitat improvement, and other natural resource issues to individuals, communities, units of state and local government, and others interested in implementing conservation practices.

The Farm Security and Rural Investment Act (2002 Farm Bill), Pub. L. 107-171, reauthorized several NRCS voluntary partnership programs that

Table 4: Selected Invasive Species Bills in the 108th Congress

H.R. 119, The Harmful Invasive Weed Control Act
Sponsor: Joel Hefley (CO)
Status: Referred to House Committee on Resources, Committee on Agriculture

- Establishes a national program in the Department of the Interior to provide financial assistancethrough states to eligible weed management entities to control invasive weeds on public and private land.
- Authorizes $100 million per year from 2003-2007.
- Requires states to use seventy-five percent of financial awards to weed management entities; no more than twenty-five percent for incentives. Requires a fifty percent cost-share with non-federal dollars or in-kind services.
- Prohibits such assistance from being used to carry out projects to control or eradicate animal pests.
- Requires the consent of the landowner for any activity involving real property.
- Requires the Secretary to coordinate with the Federal Interagency Committee for the Management of Noxious and Exotic Weeds (FICMNEW).

S. 144, The Noxious Weed Control Act of 2003
Sponsor: Larry Craig (ID)
Status: Passed Senate (3/4/2003) Referred to House Committee on Resources, Committee on Agriculture

- Establishes a national program in the Department of the Interior to provide financial assistance through states to eligible weed management entities to control invasive weeds on public and private lands.
- Authorizes $100 million per year from 2003-2007.
- Limits the federal share of any project or activity approved by a state or Indian tribe under this Act to fifty percent, with exceptions to meet the needs of underserved areas or to address critical needs.
- Requires the consent of the landowner for any activity carried out under this Act involving real property.
- Prohibits the use of funding under this Act to carry out projects to: (1) control or eradicate animal pests or submerged or floating noxious aquatic weeds; or (2) protect an agricultural commodity other than livestock or an animal—or insect—based product.

H.R. 266 and S. 536, The National Invasive Species Council Act
Sponsors: House version, Vernon Ehlers (MI); Senate version, Mike DeWine (OH)
Status: House version, referred to House Committee on Resources; Senate version, referred to Committee on Environment and Public Works

- Recognizes the National Invasive Species Council as an independent executive branch entity and authorizes the Council to provide coordination among federal agencies on invasive species issues.

H.R. 2310, Species Protection and Conservation of the Environment Act (SPACE)
Sponsor: Nick Rahall (WV)
Status: Referred to House Committee on Resources

- Authorizes the Secretary of the Interior to make renewable two-year Aldo Leopold Native Heritage Grants for both terrestrial and aquatic invasive species control projects to states, local governments, interstate or regional agencies, or private persons.
- Establishes a grant program to help states assess invasive species restoration needs, action priorities, and capacity.
- Establishes funding for rapid response to new outbreaks.
- Establishes the National Invasive Species Council and Invasive Species Advisory Committee to provide leadership and coordination among federal agencies, and between the federal government and state and local governments.
- Authorizes $80 million in 2004, increasing to $94 million in 2008.

provide technical, educational, and financial assistance to landowners in order to enhance environmental conservation. These programs represent one of the few ways that federal resources can be applied to invasive species problems in purely private lands. The Environmental Quality Incentives Program (EQIP) is targeted at agricultural lands, and offers resources to farmers and ranchers who face serious threats to soil, water, and related natural resources.[71] The Wetlands Reserve Program (WRP) provides an opportunity for landowners to receive financial incentives to restore wetlands in exchange for retiring marginal agricultural land.[72] Finally, the Wildlife Habitat Incentives Program (WHIP) is open to all landowners that are interested in establishing or improving fish and wildlife habitat on their property.[73]

Cooperative Forestry Assistance

The U.S. Forest Service (USFS) plays a role in managing the nearly 500 million acres of non-federal forest land in the United States. USFS Cooperative Forestry Staff work with states, private landowners, and other partners on a variety of programs to promote good stewardship of private forestland. The Forest Stewardship Program (FSP), authorized by the Cooperative Forestry Assistance Act of 1978, Pub. L. 95-313, as amended (16 USC §§ 2101-2111) is one example. FSP provides technical assistance, through state forestry agency partners, for non-industrial private forest owners to encourage and enable active long-term forest management.[74]

The Forest Land Enhancement Program (FLEP),[75] also authorized by the 2002 Farm Bill, is an additional source of educational and technical resources, and provides millions of dollars in cost-share assistance for active management in private forests.[76] FLEP is a voluntary program, and each participating state develops a state priority plan that describes which categories of projects will be available to landowners for cost-share funding. FLEP regulations confirm that invasive species control projects are eligible for cost-share assistance.[77]

Department of Interior Cooperative Conservation Programs

The Department of Interior also sponsors several cost-share and technical assistance programs that can be used to fund invasive species control on private lands.[78] The Department of the Interior and Related Agencies Appropriations Act of 2004 (Pub. L. 108-108) included $30 million for conservation efforts under the Landowner Incentive Program (LIP), which provides technical and financial assistance to protect and restore habitats on private lands. The U.S. Fish and Wildlife Service's Challenge Cost Share Program matches federal funds with non-federal funds and in-kind services to cost-share projects supporting fish and wildlife conservation both on and off USFWS lands.[79] The USFWS Partners for Fish and Wildlife program offers technical and financial assistance directly to private landowners that volunteer to restore wetlands and other fish and wildlife habitats on their land.[80]

STRATEGIC PLANNING AND COORDINATION

Because the framework of laws relating to invasive species is so fragmented, federal agencies often take action against invasives with little information about the actions of other agencies. The lack of information results in incomplete coverage and inefficient uses of federal resources. The first step in combating the communication gaps and assembling a coordinated response is authorizing interagency cooperation, especially between federal and state governments. A handful of laws have taken steps in this direction. For example, both the Plant Protection Act and Animal Health Protection Act authorize the Secretary of Agriculture to cooperate with other federal, state and local entities and persons in order to carry out the goals of the Acts.[81] Section 15 of the Federal Noxious Weed Act calls for cooperation with other state and federal agencies to ensure that control,

research, and educational efforts associated with federal, state, and locally designated noxious weeds are properly coordinated.[82] The Act also provides for federal cost-share assistance to state and local agencies to develop noxious weed management programs.[83] The Carlson Foley Act of 1968 (P.L. 90-583) directs federal agencies to permit state governments to intervene on federal lands to destroy noxious plants and provides reimbursement.[84] Similar laws and directives that attempt to coordinate efforts exist for other individual federal departments and agencies.[85]

Executive Order 13112

Recently, the government has taken another step in the direction of greater coordination. In 1999, President Bill Clinton issued an Executive Order on invasive species,[86] which updated and supplanted an earlier Order from President Jimmy Carter.[87] The order contains some important policy directives for federal agencies. The decree directs federal agencies:

1) To use the full extent of their authority to prevent, control, monitor, and research invasive species;[88]

2) Not to authorize, fund, or carry out actions that it believes are likely to cause or promote the introduction or spread of invasive species, unless the agency can demonstrate that the benefits "clearly outweigh the potential harm caused by invasive species" and all measures are taken to minimize the risk of such harm;[89] and

3) To provide for restoration of native species and habitat conditions in ecosystems that have been invaded.[90]

The order also establishes an interagency **National Invasive Species Council (NISC)** to "see that the Federal agency activities concerning invasive species are coordinated, complementary, cost-efficient, and effective."[91] NISC is specifically directed to:

1) Facilitate development of a coordinated network among Federal agencies to document, evaluate, and monitor impacts from invasive species on the economy, the environment, and human health;[92]

2) Facilitate establishment of a coordinated interagency information sharing system, including information on distribution of species, management techniques, and laws and programs for management, research, and education;[93] and

3) Prepare a National Invasive Species Management Plan to detail and recommend performance oriented goals and objectives and specific measures of success for Federal agency efforts concerning invasive species.[94]

Executive Order 13112 contains ambitious language and goals, but its actual effectiveness in coordinating a federal response to invasive species is questionable. Most of the goals from the 2001 NISC Management Plan have not yet been met.[95] In addition, the extent to which federal agencies can be forced to comply with the Order's policy directives is unclear.[96] Some have suggested that codifying the Executive Order would clarify agency responsibilities and increase the likelihood of substantive policy action.[97] Others maintain that the National Invasive Species Council does not have the resources to make a meaningful difference, and that a "National Center for Biological Invasions," perhaps modeled after the Center for Disease Control in Atlanta, is needed to effectively make a difference.[98] In any event, compliance with the Executive Order seems to demand a more proactive and creative federal response to invasives. This may require agencies to rethink their current approaches and find new ways to use their existing authorities in addressing invasive species threats.[99]

Federal Consultation Requirements

A number of federal laws require federal agencies to consult with the Fish and Wildlife Service or the

National Marine Fisheries Service (NMFS) before undertaking or approving activities that may affect natural resources. This consultation process serves as an additional mechanism for coordinating federal agency responses to invasive species and ensuring that the directives of Executive Order 13112 are met. For example, Section 7 of the Endangered Species Act (ESA) requires consultation to ensure that federal actions are not likely to "jeopardize the continued existence" of endangered or threatened species or damage their habitat.[100] The Fish and Wildlife Coordination Act (16 U.S.C. §§ 661-664) requires that wildlife conservation (including "minimizing damages from overabundant species") receive "equal consideration" and be coordinated with other features of water-resource development programs.[101] It requires federal agencies (most often the U.S. Army Corps of Engineers) to consult with the Fish and Wildlife Service before taking or authorizing any actions that will impound, divert, or otherwise control or modify streams or other water resources.[102] The Magnuson-Stevens Act, as amended by the Sustainable Fisheries Act of 1996 (Public Law 104-297), requires federal agencies to consult with NMFS on all activities that may adversely affect "essential fish habitat."[103] These consultations are typically folded into the National Environmental Policy Act process, and often include recommendations regarding the removal and management of invasive species to improve habitat and benefit threatened wildlife.

With the exception of ESA consultations, the Service's recommendations are only advisory and do not bind the agencies. However, these requirements do build awareness of the impact of federal actions on invasive species and, when combined with the policy directives in the Executive Order, build a strong case for agency accountability with respect to federal actions likely to promote the introduction or spread of invasives.

International Agreements and Authorities

Several international treaties and conventions have provisions that either directly or indirectly relate to invasive species, including the International Plant Protection Convention (IPPC), Convention on Prevention of Diseases in Livestock (U.S.-Mexico); Convention on International Trade in Endangered Species of Wild Flora and Fauna (CITES); Convention for the Protection of Migratory Birds (U.S.-Canada); and Convention for the Protection of Migratory Birds and Game Animals (U.S.-Mexico).

The spread of aquatic nuisance species carried in ballast water is also the subject of a new convention adopted by the International Maritime Organization, which calls not only for ballast water exchange, but also ballast water treatment technology for all ships.[104] The convention will enter into force twelve months after ratification by thirty States, representing thirty-five percent of world merchant shipping tonnage. Under the treaty, the United States can take domestic actions that are more stringent than those outlined in the convention.

International trade agreements, specifically the Agreement on the Application of Sanitary and Phytosanitary Measures (SPS Agreement) impose requirements that may limit domestic policy choices on invasive species. The SPS Agreement requires states to articulate and justify quarantine measures in terms of scientific risk and requires that trade measures be "not more trade restrictive than required to achieve their appropriate level of... protection."[105] Since rigorous scientific methods for determining the invasiveness of exotic species have not yet been developed, domestic bans on imports of foreign species could be open to challenge under the World Trade Organization (WTO).

In 2003, the European Community initiated a WTO challenge to Australia's aggressive quarantine regime.[106] The WTO Dispute Settlement Body appointed a panel to consider the matter on November 7, 2003. The ultimate resolution of this case will determine, to a large extent, the precise limits imposed by the WTO regime to national measures aimed at preventing introductions of harmful invasive species.[107]

RECAP AND PENDING LEGISLATION

In sum, the federal framework for safeguarding the country from new introductions of invasive species is piecemeal, inconsistent, and replete with gaps. The laws cover only a fraction of the types of species that may become invasive. Furthermore, federal agencies are often slow to regulate potentially harmful members of the categories of species that are covered. This is due, in part, to the lack of pre-screening requirements and the reliance on outdated "dirty listing" approaches. Congress's failure to provide adequate resources for inspections and law enforcement weakens the effectiveness of the laws on the books, and the lack of "rapid response" and dedicated management funding and authority exacerbates the impact of species that slip through our porous border defenses.

The 1999 Executive Order is intended to build a more coordinated federal response to these problems. However, a complete solution will require a legislative response. An increasing number of invasive species-related bills are being debated in Congress, including proposals to reauthorize and expand the National Invasive Species Act, codify the Executive Order on Invasive Species, establish grant programs for state assessments and control, and fund emergency rapid response programs. This demonstrates a growing congressional awareness of the seriousness of invasive species impacts on the nation's economy and environment and the inadequacy of the current federal response. Some pending invasives bills in the 108th Congress are summarized in Table 4.

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[1] Rivers and Harbors Act (RHA) of 1899, Ch. 425.

[2] Miller devotes an entire chapter to this "paradox" in the book *Harmful Invasive Species*, Chapter 1, note 7, *supra*.

[3] 18 U.S.C. § 42(a)(1).

[4] These regulations are found at 50 C.F.R. Part 16.

[5] 16 U.S.C. § 3372(a).

[6] FWS also regulates importation and movement of restricted wildlife and wildlife products under the Convention on International Trade in Endangered Species (CITES), the Endangered Species Act, the Marine Mammal Protection Act, and other federal wildlife laws.

[7] 18 U.S.C. § 42(a). The term "wild" relates to any creatures that, whether or not raised in captivity, normally are found in a wild state. *Id*.

[8] *Id.*

[9] The current list of injurious wildlife species is found at 50 C.F.R. § 16.11-16.15. While imports of unlisted species are allowed, Lacey Act regulations do prohibit the release into the wild of all covered animal species (wild mammals, birds, fish, amphibians, and reptiles). *See* FWS Injurious Wildlife regulations at 50 C.F.R. Part 16.

[10] A dirty list imposes restrictions only on the listed species, leaving all unlisted species free from regulation. This approach assigns to regulators the burden of determining whether a species is harmful. In contrast, a "clean list" identifies species approved for import, introduction, or release. This approach generally places the burden on the regulated community to prove that the new species will not pose an economic or environmental threat. There are several other possible approaches that blend elements of a pure dirty and clean listing approach. *See Halting the Invasion*, Chapter 1, note 11, *supra*, or *Making a List: Prevention Strategies for Invasive Plants in the Great Lakes States* (2004) for more details.

[11] 16 U.S.C. § 3378.

[12] 16 U.S.C. § 3372(a)(2).

[13] The Department of Agriculture's responsibility for invasive plants and plant pests can be traced through eleven separate Acts of Congress, beginning with the Plant Quarantine Act of 1912.

[14] 7 U.S.C. § 7712. Authority to take remedial actions extends to the progeny of restricted products as well as the facilities and the means of conveyance used in the movement of these products. 7 U.S.C. § 7714(a).

[15] Plant pests include "any living stage of any insects, mites, nematodes, slugs, snails, protozoa, or other invertebrate animals, bacteria, fungi, other parasitic plants or reproductive parts thereof, viruses, or any organisms similar to or allied with any of the foregoing, or any infectious substances which can directly or indirectly injure or cause disease or damage in any plants or parts thereof, or any processed, manufactured, or other products of plants." 7 C.F.R § 330.100. Federal Plant Pest regulations are found at 7 C.F.R. Part 330.

[16] Federal noxious weeds are listed at 7 C.F.R. § 360.200. *See generally* 7 C.F.R. Part 360 (Noxious Weed Regulations).

[17] *See, e.g.,* 7 C.F.R. Part 319 (Foreign Quarantine Notices), 7 C.F.R. § 330.330 (Soil From Foreign Counties), and 7 C.F.R. § 319.56 (Fruits and Vegetables).

[18] PPA Sec. 414 (7 U.S.C. § 7714); *see* 7 C.F.R. § 330.106.

[19] 7 U.S.C. § 7712(f)). The list is located at 7 C.F.R. § 360.200.

[20] *See* 7 U.S.C. § 7702. "Noxious weeds" are "any plant or plant product that can directly or indirectly injure or cause damage to crops (including nursery stock or plant products), livestock, poultry, or other interests of agriculture, irrigation, navigation, the natural resources of the United States, the public health, or the environment." "Plant pests" are defined as "any living stage of any of the following that can directly or indirectly cause damage to, or cause disease in any plant or plant product: A protozoan, nonhuman animal, parasitic plant, bacterium, fungus, virus or viroid, infectious agent or other pathogen, or any article similar to or allied with any of the preceding."

[21] 7 U.S.C. § 7712(c). 7 C.F.R. § 360.300 requires a permit for any movement

of federal noxious weeds "into or through the United States, or interstate."

[22] 7 U.S.C. § 7715.

[23] 7 U.S.C. § 7714-15. *See* also 7 C.F.R. § 330.106 (describing authorized emergency measures when international or interstate inspections reveal new plant pests).

[24] *See* PPA Sec. 436 (7 U.S.C. § 7756).

[25] *Id.*

[26] *See* 7 U.S.C. §§ 8303-8308.

[27] A new quarantine facility was recently completed at the Miami Animal Import Center. It replaces the high-security Harry S. Truman Animal Import Center (HSTAIC) in Key West that closed its doors in 1998 after nearly 20 years of service.

[28] Livestock is defined as "all farm-raised animals," including fish. 7 U.S.C. § 8302(10).

[29] The term "pest" means any of the following that can directly or indirectly injure, cause damage to, or cause disease in livestock: a) a protozoan, b) a plant, c) a bacteria, d) a fungus, e) a virus or viroid, f) an infectious agent or other pathogen, g) an arthropod, h) a parasite, i) a prion, j) a vector, k) any organism similar to or allied with any of the organisms described in this paragraph. 7 U.S.C. § 8302(13).

[30] 16 U.S.C. § 4721-24.

[31] *See* 16 U.S.C. § 4711.

[32] *See* 68 Fed. Reg. 44691 (July 30, 2003).

[33] *See Invasive Species: Clearer Focus and Greater Commitment Needed to Effectively Manage the Problem*, U.S. General Accounting Office (GAO), Report 03-1 (2002).

[34] Senate and House versions of the National Aquatic Invasive Species Act of 2003 (NAISA) were introduced on March 5, 2003. H.R. 1080 is sponsored by Rep. Wayne Gilchrest (MD). S. 525 is sponsored by Senator Carl Levin (MI).

[35] APHIS's Biotechnology Regulatory Service (BRS) regulates the import, movement, and field testing of genetically engineered plants under the agency's general plant pest authorities. In January 2004, USDA announced plans to strengthen and expand APHIS's regulatory scope beyond GE organisms that may pose a plant pest risk to those that may pose a risk to natural areas or could be used as biological control agents. *See* USDA Press Release No. 0033.04, *USDA Announces First Steps To Update Biotechnology Regulations* (Jan. 22, 2004). GE animals are regulated by the U.S. Food and Drug Administration (FDA) under the New Animal Drug provisions of the Federal Food, Drug, and Cosmetic Act (FFDCA). *See Regulatory Issues in Agricultural Biotechnology*, FDA Veterinarian Newsletter, Volume XIII, No. I (1998).

[36] For example, NOAA regulations for the Florida Keys National Marine Sanctuary specifically prohibit the release of exotic species into the sanctuary. *See* 15 C.F.R. § 922.163.

[37] 7 U.S.C. § 7717.

[38] 7 U.S.C. §7714(c).

[39] 16 U.S.C. § 4722(e).

[40] 16 U.S.C. § 4724.

[41] 7 U.S.C. § 426.

[42] *See* Pub. L 106-387 (Oct. 28, 2000). Prior to amendment, the Act read: "The Secretary of Agriculture is authorized . . . to promulgate the best methods of eradication, suppression, or bringing under control . . . animals injurious to agriculture, horticulture, forestry, animal husbandry, wild game animals, fur-bearing animals, and birds, and for the protection of stock and other domestic animals…." The amendments significantly shortened and broadened the scope of the law.

[43] As currently organized, APHIS Wildlife Services is not a regulatory agency.

[44] Phone conversation with Bill Wallace, Associate Deputy Administrator, Policy and Program Development, APHIS (April 30, 2004).

[45] For example, the National Park Service's interpretation of FLPMA and the Park Service Organic Act provided the basis for development of the *NPS Strategic Plan for Managing Invasive Non-Native Plants on National Park Service Lands* (1997). Invasive species are also addressed through individual park Resource Management Plans. The U.S. Forest Service's noxious weeds policy is set forth in USDA Department Regulation 9500-10 and Forest Service Manual 2080. This policy calls for an integrated weed management approach to prevent the introduction of new invaders, conduct early treatment of new infestations, and contain and control established infestations on forest system lands.

[46] One federal law actually creates affirmative obligations for federal agencies. Sec. 15 of the Federal Noxious Weed Act (7 U.S.C. § 2814)—the only section of the 1974 Act left in effect after passage of the Plant Protection Act—requires federal land management agencies to establish and fund undesirable plant control programs on lands under their jurisdiction. However, this requirement only applies if similar programs are being implemented generally on state or private lands in the same area.

[47] Water Resources Development Acts (WRDAs) also provide overall direction and guidance to the Corps for the hundreds of water resources projects it undertakes. Each Act includes authorizations, deauthorizations, and modifications to individual projects as well as provisions of general applicability.

[48] Rivers and Harbors Act of June 13, 1902, Ch. 1079.

[49] Rivers and Harbors Act of July 3, 1958 (Public Law 85-500), Section 104. The project was further amended in 1965, Public Law 89-298, Section 302, and again several times in response to increasing problems and needs. Corps of Engineers Aquatic Plant Control authority is now codified at 33 U.S.C. 610 and regulations appear at 33 C.F.R. Part 273.

[50] Section 306 of the Water Resources Development Act (WRDA) of 1990 directs the Secretary to "include environmental protection as one of the primary mission of the Corps of Engineers in planning, designing, constructing, operating, and maintaining water resources projects." Pub. L. 101-640 (codified at 33 U.S.C. § 2316). *See* U.S. Army Corps of Engineers Engineer Regulation (ER) 1165-2-501, *Civil Works Ecosystem Restoration Policy,* and Engineer Policy (EP) 1165-2-502, *Ecosystem Restoration-Supporting Policy Information.*

[51] The "Ecosystem Approach" is the Army Corps' fundamental philosophy behind ecosystem restoration. It is described in these excerpts from the Corps' policy document on ecosystem restoration, EP 1165-2-502 (1999).

> **Ecosystem Restoration.** Ecosystem Restoration is a primary mission of the Civil Works program. Civil Works ecosystem restoration initiatives attempt to accomplish a return of natural areas or ecosystems to a close approximation of their conditions prior to disturbance, or to less degraded, more natural conditions. In some instances a return to pre-disturbance conditions may not be feasible. However, partial restoration may be possible, with significant and valuable improvements made to degraded ecological resources. The needs for improving or re-establishing both the structural components and the functions of the natural area should be examined. The goal is to partially or fully reestablish the attributes of a naturalistic, functioning, and self-regulating system.
>
> **Ecosystem Approach.** Ecosystem restoration in the Civil Works program uses a systems view in assessing and addressing restoration needs and opportunities. Recognition of the interconnectedness and dynamics of natural systems, along with human activities in the landscape, is integral. The philosophy behind ecosystem restoration promotes consideration of the effects of decisions over the long term and incorporates the ecosystem approach. The goal of the ecosystem approach is to restore and sustain the health, productivity, and biological diversity of ecosystems and the

overall quality of life through a natural resources management approach that is fully integrated with social and economic goals. The ecosystem approach recognizes and seeks to address the problems of habitat fragmentation and the piecemeal restoration and mitigation previously applied in addressing the Nation's natural resources. Civil Works studies, projects and activities to meet ecological resource restoration objectives will be conducted using an ecosystem approach, the elements of which have been incorporated into this pamphlet.

In recognition of the principles of the ecosystem approach, the Corps, along with thirteen other Federal agencies, signed an MOU "To Foster the Ecosystems Approach" in December of 1995. The MOU states it is "the policy of the Federal Government to…provide leadership in and cooperate with activities that foster the ecosystem approach to natural resource management, protection and assistance. Federal agencies will use their authorities in a manner that facilitates an ecosystems approach."

[52] U.S. Army Corps of Engineers Policy Digest, EP 1165-2-1, Ch. 19 (1999).

[53] *See* Ch. 19 of the U.S. Army Corps of Engineers "Policy Digest" (Engineer Pamphlet (EP) 1165-2-1), Ch. 19 (1999).

[54] Section 216 authorizes the Secretary to "review the operation of projects … and to report thereon to Congress with recommendations on the advisability of modifying the structures or their operation, and for improving the quality of the environment in the overall public interest." 84 Stat. 1830.

[55] There are two primary CAP programs, known by the section number of their originating authority:

Section 1135 Projects, *Project Modification for the Improvement of the Environment*, authorize the Secretary to "undertake measures for restoration of environmental quality" if the construction or operation of an Corps of Engineers water resources project "has contributed to the degradation of the quality of the environment" and such modifications "will improve the quality of the environment in the public interest." Sec. 1135 of WRDA 1986, Pub. L. 99-662 (33 U.S.C. § 2309a).

Section 206 Projects, *Aquatic Ecosystem Restoration*, are open to all "aquatic ecosystem restoration and protection" projects that, in the judgment of the Secretary, will improve the quality of the environment, are in the public interest, and are cost-effective. Sec. 206 of WRDA 1996, Pub. L. 104-303 (33 U.S.C. § 2330).

[56] The Corps discusses CERP's adaptive management program in the CERP Programmatic Regulations Final Rule. 68 Fed. Reg. 64200 at 64213 (Nov. 12, 2003). The report of the Senate Committee on Environment and Public Works on WRDA 2000 (Senate Report No. 106-362) contains a discussion of that committee's expectations with respect to adaptive management: The Committee does not expect rigid adherence to the Plan as it was submitted to Congress. This result would be inconsistent with the adaptive management principles in the Plan. Restoration of the Everglades is the goal, not adherence to the modeling on which the April 1999 Plan was based. Instead, the committee expects that the agencies responsible for project implementation report formulation and Plan implementation will seek continuous improvement of the Plan based upon new information, improved modeling, new technology and changed circumstances. 68 Fed. Reg. at 64213.

[57] *See* 33 C.F.R. § 385.20.

[58] *See* CERP Programmatic Regulations, Final Rule, 68 Fed. Reg. 64200, 64213. (Nov. 12, 2003).

[59] The Corps is authorized to implement modifications to existing CERP projects that "will produce a substantial benefit to the restoration, preservation and protection of the South Florida ecosystem." *See* Sec. 601(c)(1) of WRDA 2000. These modifications may be implemented without separate Congressional authorization as long as each costs less than $25 million and the total cost of all modifications carried out under this authority does not exceed $206 million. *See* id. at § 601(c)(3).

[60] For example, the Corps is currently constructing an electrified barrier in the Chicago Sanitary and Ship Canal to prevent invasive bighead carp from entering Lake Michigan. *See* Dan Egan, *Law no barrier to invasive bighead carp*, Milwaukee Journal Sentinel (May 1, 2004).

[61] RECOVER is instructed to "assist Project Delivery Teams in ensuring that project design and performance is fully linked to the goals and purposes of the Plan." *Id.* at § 385.20(e)(1).

[62] The Corps would need to prepare a Project Implementation Report and get Congressional authorization before implementing such stand-alone invasive species projects. *See* Sec. 601(d) of WRDA 2000, Authorization of Future Projects.

[63] The Corps used its critical restoration project authority under WRDA 1996 to design and implement CERP Project 95, entitled *Melaleuca Eradication and Other Exotic Plants*. Project documents for this project are available at http://www.evergladesplan.org/pm/projects/proj_95_melaleauca.cfm#desc. Critical restoration authority, which expired in 1999, allowed the Corps to implement restoration projects without separate Congressional approval if the Secretary determined they would produce "independent, immediate, and substantial restoration, preservation, and protection benefits." *See* WRDA 1996 § 528(b)(3).

[64] *See* 68 Fed. Reg. at 64214. This report must be transmitted to Congress for approval before recommended modifications may take effect.

[65] ARS acts as USDA's principal in-house research agency under authority of the Act of 1946, P.L. 79-733, as amended (7 U.S.C. §§ 1621 *et seq.*) and the National Agricultural Research, Extension, and Teaching Policy Act of 1977, P.L. 95-113, Title XIV as amended (7 U.S.C. §§ 3101 *et seq.*).

[66] *See, e.g.,* Sections 1102 and 1202 of NISA, Pub. L. 104-332 (1996). Authorizations for these programs expired in 2002 and are awaiting reauthorization in Congress.

[67] Wildlife Services maintains a National Wildlife Research Center in Fort Collins, CO.

[68] The USGS Biological Resources Discipline has seventeen science and technology centers located throughout the United States focusing on a range of different invasive species. *See* http://biology.usgs.gov/invasive/research.htm.

[69] NOAA's National Center for Research on Aquatic Invasive Species is housed at the Great Lakes Environmental Research Laboratory in Ann Arbor, Michigan.

[70] *See* 7 C.F.R. Part 601, NRCS, Functions assigned.

[71] *See* EQIP Final Rule, 68 Fed. Reg. 32337 (May 30, 2003). EQIP regulations are codified at 7 CFR Part 1466.

[72] *See* WRP Final Rule, 67 Fed. Reg. 39254 (June 7, 2002). WRP regulations are codified at 7 CFR Part 1467.

[73] *See* WHIP Final Rule, 67 Fed. Reg. 48353 (July 24, 2002). WHIP regulations are codified at 7 CFR Part 636.

[74] *See* Forest Stewardship Program website at http://www.fs.fed.us/spf/coop/programs/loa/fsp.shtml.

[75] FLEP was authorized in the Farm Security and Rural Investment Act of 2002 (the 2002 Farm Bill), which amended the Cooperative Forestry Assistance Act (16 U.S.C. 2101, *et seq.*). Forest Service regulations implementing FLEP are found at 36 C.F.R. Part 230, Subpart C. FLEP replaces the former Forestry Incentives Program (FIP) and Stewardship Incentive Program (SIP), which were repealed by the 2002 Farm Bill.

[76] $100 million of Commodity Credit Corporation funds are authorized for program years 2002-2007, including $20 million in its inaugural year (FY 2003). *See* Forest Land Enhancement Program, Interim Final Rule, 68 Fed. Reg. 34309 (June 9, 2003).

[77] *See* 36 C.F.R. § 230.40, Eligible practices for cost-share assistance.

[78] Overall, the 2005 budget includes $507.3 million for the Interior Department's cooperative conservation programs, more than a forty-three percent increase for these programs since 2001.

[79] The Challenge Cost Share Program is authorized in part by the Fish and Wildlife Coordination Act, Pub. L. 85-624 (1958) (16 U.S.C. § 661-666c) which authorizes the Secretary to cooperate with federal, state, public and private agencies and organizations regarding the protection and conservation of wildlife. Distinct authority for the Service to fund a challenge cost share program has been cited annually in the House Report that accompanies the annual Appropriations Legislation. Explicit funding has been authorized by Congress for this purpose since 1988. Funds available through the Challenge Cost Share Program require at least a fifty percent match from project partners. *See* USFWS Policy 055-FW-6, Challenge Cost Share (http://policy.fws.gov/055fw6.html).

[80] This program is authorized by the Partnerships for Wildlife Act, Pub. L. 102-587 (1992) (16 U.S.C. § 3741 *et seq.*). Normally, FWS and the landowner each pay half of the project costs, but the percentage is flexible. Estimated total program funding for FY 2004 is $32,000,000, with an award ceiling of $25,000 per project. *See* FWS Policy 640-FW-1 Partners for Fish and Wildlife Program (http://policy.fws.gov/640fw1.html).

[81] *See* 7 U.S.C. § 7751 (PPA) and 7 U.S.C. § 8310 (AHPA).

[82] *See* 7 U.S.C. § 2814(c)(1), (f)(1).

[83] 7 U.S.C. § 2814(f)(3).

[84] 43 U.S.C. §§ 1241-1243.

[85] For example, the Fish and Wildlife Coordination Act authorizes the Secretary of Interior to "provide assistance to, and cooperate with, Federal, State, and public or private agencies and organizations in...minimizing damages from overabundant species" and for other purposes. *See* 16 U.S.C. § 661. This congressional policy is supported by DOI regulations encouraging cooperative agreements for the protection of fish and wildlife. *See* 43 C.F.R. § 24.6.

[86] Exec. Order No. 13112, 64 Fed. Reg. 25 (Feb. 8, 1999).

[87] Exec. Order No. 11987, 3 C.F.R. § 116 (1997). Carter's order directed federal agencies to use the full extent of their authorities to 1) "restrict the introduction of exotic species into natural ecosystems on lands and waters which they own, lease, or hold for purposes of administration;" and 2) to the extent that they have been authorized by statute to restrict the importation of exotic species, to "restrict the introduction of exotic species into any natural ecosystems of the United States."

[88] *See* Exec. Order 13112 § 2(a)(2). This responsibility is "subject to the availability of appropriations and within Administration budgetary limits." *Id*.

[89] Exec. Order 13112 § 2(a)(3).

[90] *Id*. at § 2(a)(2)(iv).

[91] *Id.* at § 4(a).

[92] *Id.* at § 4(e).

[93] *Id*. at § 4(f).

[94] *Id.* at § 5. The first edition of the NISC plan was released in October 2001.

[95] An October 2002 General Accounting Office (GAO) report criticized the NISC Plan as "lack[ing] a clear long-term outcome and quantifiable performance criteria against which to evaluate the overall success of the plan…." U.S. GAO, *Invasive Species: Clearer Focus and Greater Commitment Needed to Effectively Manage the Problem* (2002).

[96] Section 6(a) states that the Order is "intended only to improve the internal management of the executive branch" and is not intended to create any enforceable substantive or procedural rights. Executive Order 13112 § 6(a).

[97] Bills have been introduced in both the Senate and the House to codify the Executive Order and authorize the National Invasive Species Council as an independent executive branch entity. *See* H.R. 266 and S. 536 (The National Invasive Species Council Act).

[98] *See* Schmitz and Simberloff, *Needed: A National Center for Biological Invasions*, Issues in Science and Technology (summer 2001).

[99] One interesting prospect is EPA's potential use of the Clean Water Act to regulate invasive aquatic species as "biological pollutants." The Ocean Conservancy is currently testing this theory in federal court, by seeking to compel EPA to identify and ensure the cleanup of California waters contaminated with invasive species. The lawsuit, brought in the Northern District of California, contends that EPA violated the CWA by failing to require California to identify waters impaired by invasive species such as the Caulerpa taxifolia algae and Chinese mitten crab on its 303(d) list of "impaired waters." *See* Ocean Conservancy Press Release, dated April 5, 2004 (available at http://www.oceanconservancy.org/dynamic/press/releases/archive.htm?id=040410). Note, however, that a TMDL for exotic species has already been set for San Francisco Bay. *See* California Regional Water Quality Control Board, *Prevention of Exotic Species Introductions to the San Francisco Bay Estuary: A Total Maximum Daily Load Report to U.S. EPA*, (May 2000) (available at http://www.swrcb.ca.gov/rwqcb2/download/Tmdl.pdf).

[100] *See* 16 U.S.C. § 1536.

[101] 16 U.S.C. § 661.

[102] 16 U.S.C. § 662(a). 43 C.F.R. 24.1-24.7.

[103] Sec. 305(b) of the Magnuson-Stevens Act (16 U.S.C. 1855(b)). *See* Department of Commerce's EFH consultation regulations (50 CFR 600.905-930). Essential fish habitat includes those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity. *See* 50 C.F.R. § 600.10.

[104] *See International Convention for the Control and Management of Ships' Ballast Water and Sediments,* International Maritime Organization (IMO) (2003).

[105] SPS Agreement Art. 5.6. Quarantines based on international standards developed through international organizations such as the International Plant Protection Convention (IPPC) or the Office International des Epizooties (OIE) (the world organization for animal health) are presumed to be consistent with the SPS Agreement.

[106] Australia's regulatory system for importing plants and animals are among the most aggressive in the world. It is close to a pure "clean list" approach, where importers must prove the safety of their products before they are approved for import. *See* Australia-Quarantine Regime for Imports, WT/DS287/7.

[107] For an extended discussion of these issues, *see* Marc L. Miller, *NIS, WTO, SPS, WIR: Does the WTO Substantially Limit the Ability of Countries to Regulate Harmful Non-Indigenous Species?*, 17 Emory International L.J. 100 (2003).

Chapter 3: Ecosystem Restoration Authorities and the State Role

The federal authorities discussed in Chapter 2 are only a small part of the overall landscape of invasive species management in Florida. Many tools to combat Florida's invasive species reside either exclusively in state rules or in the federal/state amalgam of South Florida Ecosystem Restoration authorities. The State of Florida has a long history with invasives, and has developed a relatively robust (though unwieldy) collection of policies and programs. Jurisdiction over different aspects of invasive species regulation and management is divided between nine state agencies, each of which is influenced by distinct legislative directions and historical orientations.[1] Many municipal and county governments have joined the fray, attempting to control invasions of harmful species through land-use regulations and removal programs.[2] Economic interests, such as the nursery industry and pet trade, exert considerable influence over state legislative and regulatory policy. Nonprofit organizations, citizen groups, and the federal government's interests in Everglades National Park and Florida's other unique ecological resources also contribute to the milieu.

This section attempts to tie together the various authorities and programs, and provides a snapshot of the overall structure of invasive species efforts in Florida. The examination begins with an overview of the Ecosystem Restoration programs that overlay the traditional federal and state authorities in South Florida. The State's principal invasive species policies and programs are described next and placed in context with the federal government's role. The section maintains a bird's-eye view of the landscape and does not delve into details; this perspective highlights the extent of interagency efforts in Florida and creates a more coherent backdrop for identifying gaps and developing recommendations.

South Florida Ecosystem Restoration Authorities

By the late 1960s, the state and federal governments began taking steps to counter the relentless loss of wetlands to agricultural and urban development, the introduction of nutrients and other contaminants into pristine ecosystems, and the corresponding loss of native species in South Florida. This movement began slowly, but picked up momentum as concerned citizens and policymakers realized that only a full commitment could save the Everglades. New enactments and protections augmented previous ones in an ever-increasing latticework of federal and state programs.

Today, nearly all federal and state policy decisions affecting Florida are influenced in some way by ecosystem restoration concerns. Invasive species management is no exception, and in some ways it is central to the entire endeavor. Therefore, a basic grasp of the key events and authorities is essential to a full understanding of regional invasive species policy. An overview of the evolutionary nature of these ecosystem restoration authorities and their relation to invasive species management in Florida is encapsulated in Table 5.

STATE AGENCIES AND AUTHORITIES

The Florida Department of Environmental Protection (FDEP), the Florida Department of Agriculture and Consumer Services (FDACS), the Florida Fish and Wildlife Conservation Commission (FWC), and several state water management districts implement policies and programs to minimize and control the impacts of invasives on Florida's economy and environment. FDEP, FDACS, and FWC each regulate private conduct as well as businesses that depend in part on exotic species, such as the state's nursery industry and pet trade. FDEP and the state water management districts coordinate and fund programs to control and manage invasive vegetation in the state's public water bodies and conservation lands.[3] The South Florida Water Management District (SFWMD) also has a large role in controlling invasive species on lands acquired for South Florida ecosystem restoration. In 2001, at the request of the governor, an interagency Invasive Species Working Group (ISWG) was created to develop and implement a Statewide Invasive Species Strategic Plan.[4] Several local governments administer their own invasive species prohibitions and control requirements. These local programs offer a more regional response to invasive species management and can be crafted to account for unique local conditions and challenges.

Florida Department of Environmental Protection (FDEP)

The Florida Department of Environmental Protection is the lead agency for the control and regulation of aquatic plants in Florida.[5] The agency administers permit programs for importation, transportation, cultivation, sale, possession, and control of aquatic plants in the state.[6] Recently, the Florida Legislature charged FDEP with the task of creating a program to bring invasive upland plant species under maintenance control.[7] FDEP's Bureau of Invasive Plant Management (BIPM) is now responsible for coordinating and funding two statewide invasive species control programs—one focused on aquatic vegetation in public waters and the other on terrestrial invasive plants on public conservation lands.

FDEP authorities relating to invasive species:

Florida Statutes (FS):

§ 369.20	Florida Aquatic Weed Control Act
§ 369.22	Non-indigenous aquatic plant control
§ 369.25	Aquatic plants; definitions; permits; powers of department; penalties
§ 369.251	Invasive non-native plants; prohibitions; study; removal; rules
§ 369.252	Invasive exotic plant control on public lands
§ 369.255	Green utility ordinances for funding greenspace management and exotic plant control

Florida Administrative Code (FAC):

Ch. 62C-20	Aquatic Plant Control Permits
Ch. 62C-52	Aquatic Plant Importation, Transportation, Non-nursery Cultivation, Possession, and Collection (Prohibited Aquatic Plant List at § 62C-52.011)
Ch. 62C-54	Funding for Aquatic Plant Management
Ch. 62D-2	Operation of Division Recreation Areas and Facilities

Florida Department of Agriculture and Consumer Services (FDACS)

The Florida Department of Agriculture and Consumer Services is responsible for the protection of Florida's agricultural industries, native plant life, and the public through the exclusion, detection, eradication and control of injurious plant and domestic animal pests and diseases.

FDACS is essentially the state counterpart to USDA APHIS; the two agencies are authorized to cooperate with each other to achieve their shared goals.[8] Florida's vulnerability to plant pest invasions has led to several collaborative eradication efforts through the years.[9]

FDACS has historically focused on agricultural pests rather than natural areas invaders while FDEP focused on environmental risks. This has led to conflicts between the agencies in past years. However, recent rule changes confirm FDACS's

authority to regulate invasive plants that disrupt native plant communities as well as agricultural weeds.[10] This may help streamline regulatory authority over invasive plants in the state.

FDACS authorities relating to invasive species:

Florida Statutes (FS):
§ 570.32 Division of Plant Industry; powers and duties
§ 570.36 Division of Animal Industry, power and duties
§ 570.235 Pest Exclusion Advisory Committee
§ 570.191 Agricultural Emergency Eradication Trust Fund
Ch. 581: Plant Industry
- § 581.032 Department; powers and duties
- § 581.083 Introduction or release of plant pests, noxious weeds, or organisms affecting plant life
- § 581.091 Noxious weeds and infected plants or regulated articles; sale or distribution; receipt; information to department; withholding information
- § 581.145 Aquatic plant nursery registration; special permit requirements

Ch. 585: Division of Animal Industry
- § 585.08 General power of the department; rules.
- § 585.145 Control of animal diseases
- § 585.15 Dangerous transmissible disease or pest a public nuisance

Florida Administrative Code (FAC):
Ch. 5A-16: Agricultural Vehicle Inspection
Ch. 5B: Division of Plant Industry
- Ch. 5B-2 Florida Nursery Stock and Certification Fee
- Ch. 5B-3 Plant Quarantine and Certification Entry Requirements
- Ch. 5B-57 Introduction or Release of Plant Pests, Noxious Weeds, Arthropods, and Biological Control Agents, (Noxious Weed List at § 5B-57.007)
- Ch. 5B-59 Plant Pest Control

Ch. 5C: Division of Animal Industry
- Ch. 5C-3 Importation of Animals

Ch. 5E-4: Seeds, (Noxious Weed Seed List at § 5E-4.003)

Florida Fish and Wildlife Conservation Commission (FWC)

In 1998, the citizens of Florida approved a Constitutional amendment merging the Florida Game and Freshwater Fish Commission, the Marine Fisheries Commission, the Florida Marine Patrol, and the Florida Marine Research Institute. The newly created single agency has full constitutional authority for managing, protecting and conserving Florida's freshwater and marine fisheries and its aquatic and terrestrial wildlife.[11] The mission of the FWC is: "To Manage Fish and Wildlife Resources for Their Long-term Well-being and the Benefit of People."

As a constitutional agency, FWC has nearly unlimited authority over the fish and wildlife of the state, including power to regulate the importation, sale, and personal possession of non-native species. However, the agency's multiple roles, including both conservation of Florida's native species and promotion of recreational hunting and fishing, sometimes complicate its position on non-natives.[12] FWC has not aggressively used its authority to create lists of restricted species, but the agency recently announced the creation of a new invasive species division that could signal a new era of proactive invasive species policy.[13]

FWC authorities relating to invasive species:

Florida Statutes (FS):
§ 370.0811 Illegal importation or possession of non-indigenous marine plants and animals; rules and regulations
§ 372.121 Control and management of state game lands
§ 372.26 Imported Fish
§ 372.265 Regulation of Foreign Animals
§ 372.921 Exhibition or sale of wildlife
§ 372.922 Personal possession of wildlife
§ 372.98 Possession of nutria; license; inspection; penalty for violation

Florida Administrative Code (FAC):
§ 68A-1.002 Regulation of Wild Animal Life and Freshwater Aquatic Life in the State
§ 68A-4.005 Introduction of Foreign Wildlife or Freshwater Fish or Carriers of Disease
Ch. 68A-6 Wildlife as Personal Pets
§ 68A-23.008 Introduction of Non-Native Aquatic Species in the Waters of the State

Florida Water Management Districts

Florida's five regional water management districts are responsible for water resource management and environmental protection in their respective

Table 5: Milestones and Key Authorities in South Florida Ecosystem Restoration[i]

1948	**Central and Southern Florida (C&SF) Project** *(Federal)* · Authorized by Section 203 of the Flood Control Act of 1948, 62 Stat. 1176. · Provided congressional authorization to U.S. Army Corps of Engineers to begin construction of a massive water delivery system for South Florida. The resulting canals and flood control structures compartmentalized the originally free-flowing Everglades and drained large areas of wetlands.
1972	**Florida Water Resources Act**[ii] *(Florida)* · Established a fundamental water policy for Florida. Authorized the state water management districts to regulate the construction and operation of storm water management systems and consider water quality as one of their management objectives. **Florida Land Conservation Act**[iii] *(Florida)* · Authorized the issuance of bonds to purchase environmentally endangered and recreation lands.
1983	**Save Our Everglades Program** *(Florida)* · Initiated by Governor Bob Graham · Outlined a six-point plan for restoring and protecting the Everglades ecosystem. · Established the Kissimmee River Restoration Project and facilitated the congressional expansion of Big Cypress National Preserve in 1988 and Everglades National Park in 1989.
1987	**Surface Water Improvement and Management Act (SWIM)**[iv] *(Florida)* · Required each Florida water management district to develop plans to clean up and preserve rivers, lakes, estuaries, and bays affected by water districts.
1988	**Federal Everglades Litigation** *(Federal and Florida)* · Challenged Florida's Everglades SWIM plan; alleged that elevated nutrient levels from agricultural runoff were damaging federally owned or leased lands in the Everglades. · Mediated solution incorporated into Florida's Everglades Forever Act, enacted in 1994.
1990	**Florida Preservation 2000 Act**[v] *(Florida)* · Established a coordinated land acquisition program, at $300 million per year for ten years, to protect the integrity of ecological systems and preserve Florida's natural heritage. · Funded programs such as the Conservation and Recreation Lands program (CARL) and Save Our Rivers (SOR) programs, which have been responsible for the public acquisition and protection of more than 1.75 million acres of Florida lands. · Extended and essentially superseded by the Florida Forever Act in 1999.
1992	**Water Resources Development Act (WRDA) of 1992** *(Federal)* · Authorized a comprehensive review of the C&SF Project known as the Restudy.[vi] · Authorized the Kissimmee River Restoration Project.[vii]
1993	**South FL Ecosystem Restoration Task Force** *(Federal and Florida)* · Created by an interagency agreement to coordinate the policies and programs for environmental restoration in South Florida.
1994	**Everglades Forever Act** *(Florida)* · Expanded and implemented Everglades water quality settlement agreement to reduce phosphorus loading and restore significant portions of the South Florida ecosystem through construction, research, and regulation.[viii] **Governor's Commission for a Sustainable South Florida** *(Florida)* · Forty-member Governor's Commission appointed by Governor Lawton Chiles to develop restoration plans that will protect the economy and environment.

1996	**1996 Farm Bill** *(Federal)* · Provided $200 million to conduct restoration activities in the Everglades ecosystem, including land acquisition, resource protection, and resource maintenance. **WRDA 1996, Sec. 528, Everglades and South Florida Ecosystem Restoration** *(Federal)* · Expanded the WRDA 1992 Restudy and directed the Secretary to "develop, as expeditiously as practicable, a proposed comprehensive plan for the purpose of restoring, preserving, and protecting the South Florida ecosystem." · Authorized an additional $75 million for critical restoration projects that would produce "independent, immediate, and substantial restoration, preservation, and protection benefits.…"[ix] · Formally established the South Florida Ecosystem Restoration Task Force (SFERTF) under federal law and expanded membership to tribal, state, and local governments.
1997	**Noxious Exotic Weed Task Team** *(Federal and Florida)* · Created by SFERTF as an interagency group and charged with developing a strategic plan to manage Florida's invasive weeds.[x]
1999	**South Florida Multi-Species Recovery Plan**[xi] *(Federal)* · Prepared by the U.S. Fish and Wildlife Service. · Identified invasive species control as one of the most significant recovery actions for South Florida. **Comprehensive Everglades Restoration Plan (CERP)** *(Federal and Florida)* · Resulted from Corps of Engineers' Restudy of the C&SF Project, submitted to Congress in 1999. · Outlines a framework of modifications and operational changes to the C&SF Project intended to restore and enhance the Everglades. **Florida Forever Act**[xii] *(Florida)* · Established the Florida Forever Trust Fund to improve and continue the coordinated land acquisition program initiated by the Florida Preservation 2000 Act; commits another $300 million per year for ten years.[xiii] · Authorized $25 million in additional funds for invasive plant management efforts in Florida (eighty percent for aquatic plant control and twenty percent for upland plant control).
2000	**Florida Everglades Restoration Investment Act** *(Florida)* · Created a funding and accountability plan to help implement the CERP. · Committed an estimated $2 billion in state funding to Everglades restoration over ten years. **WRDA 2000** *(Federal)* · Authorized $1.4 billion for the first round of CERP infrastructure projects.[xiv] · Established a fifty percent federal cost share for implementation of CERP and for operation and maintenance. · Created water resource reservations for natural system needs.[xv]
2002	**CERP Invasives Project** *(Federal and Florida)* · Authorized a multimillion-dollar project, to be implemented as part of CERP and sponsored locally by the South Florida Water Management District. · Funded improvements in the research, quarantine, and release of biological control agents in South Florida and authorized the preparation of a report to detail further opportunities for federal invasive species management in South Florida.
2003	**Everglades Forever Act Amendments** *(Florida)* · Clarifies controversial implementation of Everglades Forever Act water quality commitments.[xvi] · Allows the use of "moderating provisions" in Everglades permits when existing technology is not available to achieve the ten ppb phosphorous water quality standard.[xvii] **CERP Final Programmatic Regulations**[xviii] · Promulgated by the Army Corps of Engineers to guide the implementation of CERP to "ensure that the goals and purposes of the Plan are achieved."[xix] **Florida Invasive Animal Task Team (FIATT)** · Established by SFERTF to investigate and strategically plan Florida's response to invasive animal species.

Table 5 References

[i] This condensed timeline draws from SFERTF's overall strategy document, *Coordinating Success* (2002).

[ii] *See* FS Ch. 373, Title XXVIII.

[iii] *See* FS Ch. 259.

[iv] *See* FS Ch. 373.451.

[v] *See* FS § 259.101.

[vi] See section 309(l) of WRDA 1992 (106 Stat. 4844).

[vii] *See* section 101 of WRDA 1992 (106 Stat. 4802).

[viii] *See* FS § 373.4592 (Everglades improvement and management). The Everglades Forever Act declares "the intent of the Legislature to pursue comprehensive and innovative solutions to issues of water quality, water quantity, hydroperiod, and invasion of exotic species which face the Everglades ecosystem," and it creates a number of programs to help achieve its goals, including:

1. The Everglades Construction Project to construct six large wetland areas (called stormwater treatment areas, or STAs) to reduce phosphorus loads in waters entering the conservation areas. *See* FS § 373.4592(4)(a). The STAs cover 47,000 acres between the Everglades Agricultural Area and the natural areas to the south.
2. An Everglades Best Management Practices Program designed to work with the agricultural industry to reduce the phosphorus load in waters moving southward from the Everglades Agricultural Area into the Stormwater Treatment Areas and the Everglades Protection Area. *See* FS § 373.4592(4)(f).
3. The development of a phosphorus criterion to meet water quality standards in the Everglades Protection Area. *See* FS § 373.4592(4)(e). The Florida Department of Environmental Protection's (FDEP) proposed total phosphorus criterion of 10 ppb was approved in July 2003. The approved rule was immediately challenged.
4. The establishment of a biological monitoring network to survey for exotic species throughout the Everglades Protection Area and "coordinate with federal, state, or other governmental entities the control of continued expansion and the removal of these exotic species." FS § 373.4592(4)(g).

[ix] *See* section 528 of WRDA 1996 (110 Stat. 3767). In 1997, SFERTF, through a public process, developed a prioritized list of critical restoration projects to be transmitted to the U.S. Army Corps of Engineers. Invasive species control was at the top of the list.

[x] *See Weeds Won't Wait*, Chapter 1, note 8, *supra*.

[xi] Available at http://verobeach.fws.gov/Programs/Recovery/vbms5.html.

[xii] FS § 259.105.

[xiii] The Florida Legislature expressed its intent that projects or acquisitions funded under the program "increase the protection of Florida's biodiversity at the species, natural community, and landscape levels…" and "protect, restore, and maintain the quality and natural functions of land, water, and wetland systems of the state" as measured, in part, by the level of control of invasive plants in public waters and conservation lands. *See* FS § 259.105(4).

[xiv] *See* section 601 of WRDA 2000 (Pub. L. 106-541).

[xv] These water reservations are memorialized in a January 2002 Memorandum of Agreement between the State of Florida and the United States.

[xvi] The U.S. House Report (H. Rept. 108-195) accompanying the Fiscal Year 2004 Interior Appropriations bill (H.R. 2691) expresses concern that the EFA amendments threaten the future of Everglades restoration. The bill includes stipulations that Federal funding for Everglades restoration be linked to specific progress on improving water quality. Concern from environmentalists and Florida's federal partners prompted Governor Bush to call for a special legislative session to "clarify" certain language in the original May 20, 2003 bill. The amended bill passed on June 10, 2003. *See* FL Senate Bill 0626ER, available at www.dep.state.fl.us/evergladesforever/legislation/s0626er.pdf.

[xvii] The use of moderating provisions is allowed until the year 2016.

[xviii] *See* 68 Fed. Reg. 64199. The final regulations are codified at 33 C.F.R. Part 385.

[xix] These procedural rules are required by WRDA 2000 § 601(h)(3).

hydrologic basins.[14] Each district owns large tracts of land and waterworks (such as canals and levees) which they manage for flood control, water supply, and public use.[15] The South Florida Water Management District (SFWMD) is the largest district, spanning 16 counties in central and southern Florida and including over 1,800 miles of canals and levees. SFWMD is also the primary local sponsor for implementing CERP.

The water management districts play varying roles with respect to invasive species. The St. John's, South Florida and Southwest Florida Districts have major roles in invasive species management and control. SFWMD has additionally taken a lead role among the state water management districts and in Everglades Restoration to help fund and coordinate invasive species management including herbicide trials, monitoring programs, and biological control programs for melaleuca, Old World climbing fern, and Brazilian pepper. Additionally, the five water management districts have formed a planning committee on invasive species in an attempt to coordinate their collective actions and help set

mutual control, management, and funding priorities.

LOCAL INVASIVE SPECIES PREVENTION AND CONTROL

At least twelve Florida counties have their own invasive species requirements and programs, along with a number of municipal governments. Many counties have control and maintenance programs (often partially funded by the state) to manage invasive species infestations in county parklands and preserves. Others use "dirty lists" embedded in zoning ordinances, land development codes, and local xeriscape ordinances[16] to restrict plantings of nuisance species. A few counties use innovative incentives and tax credits to encourage removal of invasives. A comprehensive accounting of all of these local programs is beyond the scope of this report, but three local programs are described to highlight the diverse tools available to local governments to control invasives within their jurisdictions.[17]

Palm Beach County

Palm Beach County has an aggressive program requiring landowners within 500 feet of a conservation area to remove nine invasive plant species (air potato, Australian pine, Brazilian pepper, carrotwood, earleaf acacia, kudzu, Old-world climbing fern, melaleuca, and umbrella tree).[18] Properties outside the 500-foot buffer area are only required to remove air potato and Old-world climbing fern. The County is offering incentive/financial assistance programs to residents within the buffer areas whereby the County pays for the removal of Australian pine and Melaleuca and offers a cost share program for the removal of the other seven invasive plant species.[19] Buffer area properties that choose not to participate in the incentive programs will be required to remove the plant species on their own, with removal deadlines between 2004-2012 depending on the plant species.

Palm Beach County's Department of Environmental Resources Management (DERM) also administers an Invasive Vine Strike Force program to assist property owners County-wide with the removal of Air Potato and Old-world climbing fern and a Public Lands Grant Program is assist local municipalities with the removal of invasive vegetation from public properties.

Miami-Dade County

The Miami-Dade County Code prohibits the importation, sale, propagation, and planting of a list of thirty prohibited exotic plant species throughout the county.[20] The County Landscape Code also contains lists of "Prohibited" and "Controlled" species subject to planting restrictions on properties that require a building permit.[21]

Miami-Dade County also has an interesting property tax incentive program to encourage land conservation. Property owners are eligible for a tax credit if they pledge to keep their property preserved as a natural area for ten years and prepare a Natural Areas Management Plan that includes exotic species control.[22]

City of Sanibel

Sanibel recently completed a successful fifteen-year effort to eradicate Melaleuca from the island, and has moved on to Brazilian pepper. The Brazilian Pepper Removal Program establishes numbered zones within the City, in which residents are given technical and financial assistance to voluntarily remove Brazilian pepper, along with six other invasive plant species, within a specified time period. After the specified time period expires, Brazilian pepper removal becomes mandatory and City incentives will no longer be available.[23] Sanibel also requires the removal of Melaleuca and Brazilian pepper when land development permits are issued.[24]

State preemption of new local lists

In 2002, the Florida Legislature, in response to nursery industry pressure, passed a bill that significantly cuts back local authority to respond to new regional invasive species problems. The new bill prohibits local governments from regulating plant species not already listed on the FDACS noxious weed or FDEP prohibited aquatic plant lists.[25] The effect of this provision is tempered slightly by a "savings clause" that "grandfathers" local ordinances in effect prior to March 1, 2002, such as the Palm Beach, Miami-Dade, and City of Sanibel programs described above.[26]

STATE PROGRAMS AND PARTNERSHIPS

The sheer number of interconnected actors and actions involved in invasive species management complicates attempts at organized and articulate presentation. Nearly all authorities and agency actions overlap in certain respects with other programs or are reinforced by multi-agency partnerships. This section presents the general outline of Florida's major state programs, and highlights key components and partnerships. Strengths and weaknesses, while only lightly touched upon here, are examined in more detail in Chapter 4.

Prevention

The Florida Department of Environmental Protection, Department of Agriculture and Consumer Services, and the Fish and Wildlife Conservation Commission administer regulatory programs aimed at preventing the entry and establishment of various invasive species in the state. The programs augment federal prevention authorities and impose additional layers of requirements. While FDEP, FDACS, and FWC have dedicated inspection and enforcement staff, the state agencies rely extensively on cooperation and information sharing with APHIS, Customs and Border Protection (CBP), and USFWS employees at Florida's ports of entry, especially at Miami International Airport. The major state regulatory programs are described in the following subsections.

FDACS Plant Pest, Noxious Weed, Animal Disease Regulations

By law, any organism which may pose a risk to Florida agriculture, become a nuisance, threaten native Florida wildlife, or pose a serious health risk to humans or livestock requires a permit to import into the state. The FDACS Division of Plant Industry (DPI) administers a comprehensive permit program to regulate the entry and movement of plant pests and noxious weeds that threaten Florida's agricultural, horticultural, and native plant resources.[27] The Bureau of Plant and Apiary Inspection requires the registration of all nurseries and conducts inspections of nursery stock several times each year. The Bureau of Entomology, Nematology and Plant Pathology administers a permit program for the movement of commercial and biological control arthropods and screens permit applications for the importation or movement within Florida of plant pathogens or plant materials suspected of harboring plant pathogens. FDACS Division of Animal Industry regulates animal imports and is authorized to "take such measures as may be necessary and proper for the control, suppression, eradication, and prevention" of communicable animal diseases and pests.[28]

FDACS has broad authority to declare quarantines and conduct eradication and control programs if harmful invaders slip through border defenses.[29] The FDACS Office of Law Enforcement maintains Agricultural Inspection Stations along the highway system to examine incoming vehicles for prohibited items and to determine if agricultural products are properly certified for entry into the state.[30] FDACS also has exclusive authority to regulate, inspect, and permit nursery owners, plant brokers, and stock dealers to

prevent dissemination of plant pests and noxious weeds.[31]

FDACS permit programs include:

- Division of Plant Industry (DPI) Permits (FAC Ch. 5B-57):
  Permits are required to "introduce, possess, move, or release any arthropod, plant pest, biological control agent, noxious weed, or invasive plant regulated by the department or the USDA."[32] The Department maintains a **Noxious Weed and Invasive Plant List**.[33] Plants may be listed if they are "determined to be a serious agricultural threat in Florida, or have a negative impact on [protected native flora], or if the plant is a naturalized plant that disrupts naturally occurring native communities."[34]

- Noxious Weed Seeds (FS § 578.13; FAC Ch. 5E-4):
  It is unlawful to "sell, distribute for sale, offer for sale, expose for sale, handle for sale, or solicit orders for the purchase of any agricultural, vegetable, flower, or forest tree seed within this state" that contains listed noxious weed seeds in violation of the tolerances set out in FDACS rules.

- Animal Imports and Movement (FS § 585.145; FAC Ch. 5C-3):
  "No animal shall be imported into the state, moved within the state, or the ownership thereof transferred" without complying with FDACS regulations.[35] The department is authorized to declare by rule that a certain pest or disease of animals is a public nuisance, and is empowered to take broad measures to prevent or eradicate it.[36]

FDEP Aquatic Plant Permits

The Florida Department of Environmental Protection is the lead state agency with respect to invasive aquatic plants.[37] On the regulatory side, the agency requires permits for any business activities involving aquatic plant species.[38] In addition, the Department maintains a **Prohibited Aquatic Plant List**[39] and prohibits the personal use and possession of listed plants without a permit. A third FDEP permit program regulates the removal or control of aquatic plants in order to ensure the correct use of herbicides and protect native and beneficial aquatic plant populations.[40]

FDEP has authority to enter and inspect any other facility or place where aquatic plants are cultivated, stored, or sold and to seize or destroy any plants held in violation of the Department's rules.[41] The one exception is aquatic plants grown in nurseries, which are under the exclusive jurisdiction of FDACS.[42]

FDEP permit programs include:

- Business activities (FS § 369.25; FAC Ch. 62C-52):
  All non-nursery business activities involving the importation, transportation, cultivation, collection, sale, or possession of *any* aquatic plant species requires a permit from DEP.

- Prohibited aquatic plants (FS § 369.25, FS § 369.251; FAC Ch. 62C-52):
  FDEP administers a regulatory list of aquatic plants that have "the potential to hinder the growth of beneficial plants, interfere with irrigation or navigation, or adversely affect the public welfare or the natural resources of the state."[43] Class I Prohibited Aquatic Plants may not be possessed, collected, transported, cultivated, or imported under any circumstances without a permit from DEP.[44] A shorter list of Class II Prohibited Aquatic Plants may be cultured in a nursery for sale out of state only, but they may not be imported or collected from the wild and must be securely contained in the nursery.[45]

- Aquatic plant control (FS § 369.20(7); FAC Ch. 62C-20):

  A DEP permit is required to control, eradicate, remove, or otherwise alter any non-indigenous aquatic plants in waters of the state.

Florida Fish and Wildlife Conservation Commission (FWC) Wildlife Permits

The Florida Fish and Wildlife Conservation Commission administers a wide range of fish and wildlife permit programs, a number of which apply to nonnative species. Wildlife inspectors from the FWC Division of Law Enforcement monitor wildlife importers, zoos, pet shops and dealers, and personal wildlife owners for compliance with state and federal rules. FWC permit programs include:

- Non-natives, generally (FS § 372.265; FAC § 68A-4.005):

  It is unlawful to possess, transport, or otherwise bring into the state or to release or introduce in the state animal species not indigenous to Florida without having first obtained a permit from FWC.

- Non-native aquatic species (FS § 372.26; FAC § 68A-23.008):

  A permit is required to "transport into the state, introduce, or possess for *any* purpose that can be reasonably expected to result in liberation into the waters of the state any aquatic species not native to the state," *except* for two listed species (the fathead or tuffy minnow and the variable platy).[46]

  "Restricted species" may only be possessed with a special permit and sold only to individuals with a special permit for that species.[47] Species classified as such include:

Bighead carp	Nile perches
Bony-tongue fishes	Silver carp
Blue catfish	Snail or black carp
Dorados	Tilapias (some)
Freshwater stingrays	Various crayfish species
Grass carp[48]	Walking catfish

  "Prohibited species" may not be imported, sold, possessed, or transported in state (limited exceptions may be made for large public aquaria or research purposes).[49] Species classified as such include:

African electric catfish	Mitten crabs
African tigerfish	Piranhas
Airbreathing catfish Airsac	Pirambebas
catfishes Australian crayfish	Snakeheads
Candiru catfish Freshwater	Tilapias
electric eels	Trahiras
Green sunfish	or tigerfish
Lampreys	Zebra mussels

- Non-native marine species (FS § 370.081):

  It is unlawful to import or possess any non-indigenous marine plant or animal that "may endanger or infect the marine resources of the state or pose a human health hazard." All species of sea snakes (Family *Hydrophiidae*), Weeverfishes (Family *Trachinidae*), and Stonefishes (Genus *Synanceia*) are specifically prohibited by statute.[50] FWC is authorized to adopt rules to include any additional marine plants and animals, but it has not exercised this authority.[51]

- Sale and exhibition of wildlife (FS § 372.921; FAC § 68A-6.0021):

  Every person, firm, or corporation that sells or exhibits wildlife in Florida (whether indigenous or not) must be licensed. It is illegal to buy, sell, or transfer any wildlife to or from any unpermitted entity within Florida.

- Personal Pet Permits (FS § 372.922; FAC Ch. 68A-6):

  FWC regulates the personal possession of wildlife (whether indigenous or not). The agency classifies wildlife according to the danger it presents to the owner and general public.[52]

  Class I wildlife (including great apes and other large primates, large cats such as lions and tigers, elephants, rhinos, hippos,

crocodiles, and bears) may not be possessed as a personal pet in Florida.

Class II wildlife (including mid-size cats such as cougars and bobcats, medium-sized primates such as macaques and howler monkeys, wolves, coyotes, caiman, badgers, and ostriches) may be possessed as pets, but applicants must demonstrate a substantial amount of personal experience to qualify for a permit.

Class III wildlife (all those not listed in Class I or II or specifically exempted by rule) require an easily obtainable no-cost permit for personal use.

Unregulated wildlife: Several species of wildlife are exempted from permitting requirements. Wildlife that may be possessed for personal use without a permit include all non-protected and non-venomous reptiles and amphibians, several species of small rodents, song birds, and various other species.[53]

· Triploid grass carp (FAC § 68A-23.088):
A permit is required to use these fish as biological control agents.

· Nutria (FS § 372.98):
Personal possession and the release of any animal of the species *myocastor coypu* (nutria) are prohibited without a permit from the Commission.

Control and Management

The need for invasive plant management affects nearly every large property holder in South Florida. The state and federal governments, as owners and managers of vast tracts of South Florida lands, are no exceptions. While individual agencies are generally responsible for management of their own parcels, large cooperative networks have been established under the auspices of FDEP's Bureau of Invasive Plant Management to share resources and set priorities. Exotic animal control is at a less developed stage, although it is beginning to attract attention.

Invasive Aquatic Plant Control

The Florida Department of Environmental Protection, in partnership with the U.S. Army Corps of Engineers and Florida's water management districts, is responsible for invasive aquatic plant control in Florida's canals, channels, lakes, and other public waters.[54] The Corps of Engineers Jacksonville District[55] oversees the Corps' Removal of Aquatic Growth (RAG) and Aquatic Plant Control (APC) programs, and is generally responsible for controlling floating invasive plants such as water hyacinth and water lettuce in Florida's federal navigation channels and structures.[56] Florida's water management districts are concerned with invasive aquatic plants in thousands of canals, levees and lakes in their respective hydrological basins.[57] FDEP is specifically responsible for all intercounty waters, but also supervises, coordinates, and funds broader aquatic plant control efforts statewide.[58]

· FDEP Aquatic Plant Control Grant Program, (FS § 369.22; FAC Ch. 62C-54):
In 1971, the Florida Legislature designated FDEP (then the Florida Department of Natural Resources) as the lead agency for coordinating aquatic plant control activities in the state, and authorized the agency to "disburse funds to any special district or other local authority charged with the responsibility of controlling or eradicating aquatic plants."[59] FDEP's Bureau of Invasive Plant Management (BIPM) carries out this responsibility by distributing funds from an Invasive Plant Control Trust Fund[60] to water management districts, local governments, and others "for the purpose of managing noxious aquatic plants in sovereignty lands."[61]

Because funding is limited, FDEP rules establish criteria to identify waters eligible for funding.[62]

The agency conditions eligibility on public boating access as follows:

1) The waterbody must be sovereignty lands, or a site which might adversely impact sovereignty lands; and

2) The waterbody must have access to the boating public by way of an established, improved boat ramp or a direct navigable connection to an eligible waterbody.[63]

FDEP reimburses government and private sector contractors for approved aquatic plant control conducted in program-eligible waters. Annual work plan priorities are established during consultation with participating governments, FWC, and other interested stakeholders, and are incorporated into task assignment contracts with the FDEP.[64] Since many eligible waters are under multiple agency jurisdictions, BIPM holds regular interagency meetings to determine management objectives. BIPM's Field Operations Service (FOS) supports priority setting through annual surveys of the state's publicly accessible water bodies for types and extent of aquatic plant communities.

An estimated 450 public water bodies covering approximately 80 percent of Florida's open water surface (nearly 1.2 million acres) are eligible for funding. Agricultural canals and lakes with no public boat access are not eligible for BIPM funding, and are the responsibility of water management districts, local governments, and adjacent property owners. Wetland areas such as Everglades National Park or SFWMD-managed water conservation areas (WCAs) are also not eligible, and must rely on other sources of funding.

Invasive Plant Management on State and Federal Conservation Lands

Invasive plant control on state and federal conservation lands has become a high priority in Florida. The Florida Park Service,[65] FDACS Division of Forestry,[66] Florida FWC,[67] and state water management districts,[68] along with the U.S. Forest Service,[69] U.S. Fish and Wildlife Service,[70] and the National Park Service[71] are all responsible for managing conservation lands in Florida and all are faced with daunting invasive plant infestations.[72] Instead of having to face these challenges alone, however, they are being assisted by a relatively new FDEP program that provides coordination, funding, and expertise.

· FDEP Upland Weed Control Grant Program (FS § 369.252):

In 1997, the Florida Legislature expanded FDEP's authority from regulation of solely aquatic plants to also include upland invasive plants, and further directed the Bureau of Invasive Plant Management (BIPM) to establish a program to "achieve eradication or maintenance control of invasive exotic plants on public lands" when determined to be "detrimental to the state's natural environment or…a threat to the agricultural productivity of the state."[73] The Uplands Program funds individual site-based invasive plant removal projects on public conservation lands throughout the state (local, state, and federal proposals are equally eligible).[74]

The Uplands Program is based on a philosophy that persons familiar with local conditions should have a role in setting project priorities. This philosophy is built into the project selection and funding process through a statewide network of eleven regional Invasive Plant Working Groups composed mainly of federal, state, and local government conservation land managers.[75] Each Working Group meets regularly to discuss local conditions and regional control priorities. Once each year, representatives from each Working Group gather at a statewide meeting to review regional proposals, rank statewide control priorities, and award funding to the highest rated projects.[76] Local, state, and federal proposals are equally eligible for FDEP funding,

although the program is limited to projects on public conservation lands.

· Ecosystem Restoration Acquisition Lands: Accelerating state and federal land acquisition under South Florida Ecosystem Restoration authorities is driving a greater need for invasive species control in upland areas. The Save Our Rivers (SOR) and Conservation and Recreation Lands (CARL) programs enable water management districts to buy lands needed for water management, water supply, and the conservation and protection of water resources with funds from a Water Management Lands Trust Fund.[77] Land acquisition accelerated under the Preservation 2000 and Florida Forever Programs, which authorized the state to sell bonds to acquire and protect environmentally sensitive land and water resources.[78] SFWMD also acquires lands to implement the state's obligations under the Everglades Forever Act,[79] including the acquisition and creation of stormwater treatment areas to reduce phosphorus levels entering Everglades National Park. Land acquisition is also proceeding through CERP and under local government programs.[80]

Many of these acquisition lands are severely impacted by invasive species and require a great deal of resources and work. According to SFWMD, exotic species control is consistently the single largest item in its Land Stewardship Program annual budget.[81]

Research

The primary agencies driving invasive species related research in Florida are the USDA Agricultural Research Service (ARS) and the University of Florida Institute of Food and Agricultural Sciences (IFAS). The ARS Invasive Plant Research Lab in Fort Lauderdale provides expertise in entomology and biological control ("biocontrol"); the lab finds insects that will target invasive plant species and are safe to be released into the ecosystem.[82] The Army Corps of Engineers, FDEP Bureau of Invasive Plant Management, and FDACS Division of Plant Industry contribute research and technology transfer on invasive plant control technologies. NOAA's Southeast Fisheries Science Center and USGS's Florida Caribbean Science Center are active in exploring the invasive potential of Florida's marine and fish species. FWC's Florida Marine Research Institute monitors selected invasive species and is pursing funding for more in-depth research.

Strategic Planning and Coordination

There are three primary groups (two state and one federal) dedicated to strategic planning and coordination of overall invasive species efforts in Florida. The **State Invasive Species Working Group (ISWG)** was formed in 2001 and comprises ten representatives from nine state agencies and one university. The group completed a Statewide Invasive Species Strategic Plan in 2002 that recommends a total of eighteen general action items to improve statewide coordination and cooperation, prevention of new biological invasions, surveillance, rapid response, control and management, and public education about invasive species.[83]

The **Florida Pest Exclusion Advisory Committee** is another multi-stakeholder committee composed of 24 members from DACS, agricultural interests, citizens at large, research and extension programs, USDA APHIS, Florida Department of Health, FDEP, FWC, and the Florida Legislature. It was created by the Florida Legislature in 1999 to conduct a comprehensive review of Florida's existing and proposed exclusion, detection, and response programs.[84] The committee published a report in 2001 that reviewed the state's exclusion, detection, and eradication policies, and suggested improvements to Florida's laws, policies, and programs.[85]

The **South Florida Ecosystem Restoration Task Force (SFERTF)** was created in 1993 by an interagency agreement among six federal agencies

(Interior, Army, Justice, Agriculture, EPA, and Commerce) to "coordinate the development of consistent policies, strategies, plans, programs, and priorities for addressing the restoration, preservation, and protection of the South Florida ecosystem."[86] The Water Resources Development Act (WRDA) of 1996 formally authorized the Task Force and expanded it to include State, SFWMD, local, and tribal representatives.[87] The Task Force also creates a Florida-based management team of senior officials, known as the Working Group (WG), from each participating agency. The Task Force and Working Group are generally responsible for the broad range of federal and non-federal programs designed to restore and sustain the South Florida Ecosystem,[88] but they do not have individual oversight or project authority. Rather, they are responsible for coordinating programs and research, and facilitating the exchange of information and resolution of conflicts involving restoration of the South Florida ecosystem.[89]

SFERTF's Strategy for Restoration of the South Florida Ecosystem (entitled *Coordinating Success*) was initially released in July 2000, and includes invasive species management as one of its primary goals.[90] The Working Group also established two interagency teams-one focused on invasive plants and the other on animals-to coordinate and set management priorities in South Florida. The Noxious Exotic Weed Task Team (NEWTT) published a comprehensive assessment and strategic plan in 2001.[91] The Florida Invasive Animal Task Team (FIATT) is currently initiating a similar effort.

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[1] Including the Florida Department of Environmental Protection (FDEP), Fish and Wildlife Conservation Commission (FWC), Department of Agriculture and Consumer Services (FDACS), Department of Transportation (FDOT), and Northwest Florida, Southwest Florida, South Florida, St. John's River, and Suwannee River Water Management Districts. These responsibilities are summarized below and are described in detail in the Florida Invasive Species Working Group's *Statewide Invasive Species Strategic Plan for Florida* (2002).

[2] A recent FDEP survey of county activities reported that 28 Florida counties have active invasive plant programs and 16 have ordinances on invasive plants. *See Weeds Won't Wait*, Chapter 1, note 8, *supra*.

[3] The South Florida Water Management District (SFWMD) is the largest district in Florida and has the largest invasives control program. SFWMD is also the lead local sponsor of CERP.

[4] ISWG comprises ten representatives from nine state agencies and one university. The working group and its strategic plan for Florida are discussed in more detail below and in Chapter 4, *infra*.

[5] Florida's aquatic plant management program dates back to the early 1900s. Responsibility for contracting herbicide and mechanical aquatic plant control was transferred from the FWCC to FDEP in 1980.

[6] The cultivation of aquatic plants raised in Florida nurseries is regulated by FDACS Division of Plant Industry.

[7] *See* FS § 369.252. FDEP's Bureau of Aquatic Plant Management's name was changed to the Bureau of Invasive Plant Management (BIPM) to better reflect this expanded mission.

[8] *See* 7 U.S.C. § 7751 and FS § 581.031.

[9] In 1975, USDA and Florida declared success in a joint effort to eradicate a giant African snails outbreak. The two agencies have successfully battled infestations of the Mediterranean fruit fly and are currently cooperating in an effort to eradicate citrus canker. In addition, much of the southeast, including Florida, is currently under quarantine to stop the spread of the imported red fire ant.

[10] *See* FAC Ch. 5B-57.

[11] *See* Art. IV, Sec. 9 of the Florida Constitution.

[12] FWC's management of feral hogs and introduction of non-native peacock bass as game species have proven controversial (although the peacock bass was introduced in large measure to control overabundant populations of other exotic freshwater fish in southeast Florida canals). *See Strangers in Paradise,* Chapter 1, note 1, *supra*.

[13] This new interdisciplinary group will be responsible for coordinating an overall exotic species policy within FWC. Education and information processing will be early priorities for the group.

[14] The Florida Legislature created the Central and Southern Florida Flood Control District (the predecessor to the South Florida Water Management District) in 1949 to take over the infrastructure of the flood control and water works constructed by the U.S. Army Corps of Engineers through the Central and Southern Florida (C&SF) Project. The present arrangement of five regional districts was created by the Florida Water Resources Act of 1972 (FS Ch. 373).

[15] Florida law requires the water management districts to manage and maintain their lands for multiple purposes "to ensure a balance between public access, general public recreational purposes, and restoration and protection of their natural state and condition." FS § 373.1391 (Management of real property).

[16] "Xeriscape" means "quality landscapes that conserve water and protect the environment." FS § 373.185 directs Florida's water management districts to "design and implement an incentive program to encourage all local governments within its district to adopt new ordinances or amend existing ordinances to require Xeriscape landscaping." The districts are also instructed to assist local governments by providing a model xeriscape code and other technical assistance. In order for a local xeriscape ordinance to qualify for a district's incentive program, it must include "identification of prohibited plant species." *See* FS § 373.185(2)(a)(b).

[17] *Weeds Won't Wait*, Chapter 1, note 8, *supra*, presents a comprehensive summary of local invasive plant programs in Florida.

[18] For new construction, Section 9.5 of the County's Unified Land Development Code requires the removal of the nine invasive plant species prior to the receipt of a Certificate of Occupancy.

[19] *See* Palm Beach County Vegetation and Protection Code §§ 9.5(D)(2) and 9.5(F)(2)(a).

[20] *See* Ch. 24-27.1 of the Miami-Dade County Code.

[21] Miami-Dade County Landscape Code, Ch. 18A.

[22] *See* Miami-Dade County Code, Ch. 25, art. 2, §§ 25B-11-25B-19.

[23] *See* Sanibel Ordinance 97-89.

[24] *See* Section I.D.2 of the Sanibel Land Development Code.

[25] *See* House Bill 1681 (amending FS § 581.091(4)) ("A water management district when identifying by rule pursuant to s. 373.185, or a local government when identifying by ordinance or regulation adopted on or after March 1, 2002, a list of noxious weeds, invasive plants, or plants deemed to be a public nuisance or threat, shall only adopt the lists developed under this chapter or rules adopted thereunder").

[26] *See* FS § 581.091(4) ("All local government ordinances or regulations, adopted prior to March 1, 2002, that list noxious weeds or invasive plants shall remain in effect"). The rider also requires FDACS, in conjunction with the Institute of Food and Agricultural Sciences at the University of Florida (IFAS), to "biennially review the official state lists of noxious weeds and invasive plants." *Id*.

[27] *See* FAC Ch. 5B-57.

[28] FS § 585.145 (Control of Animal Disease).

[29] *See generally* FS Ch. 581 and 7 C.F.R. Part 330. The DPI Bureau of Pest Eradication and Control supports these programs.

[30] *See* FAC Ch. 5A-16; FAC § 5B-59.001(3).

[31] FS § 581.031(1) grants the Department power "to make all rules governing nurseries and the movement of nursery stock as may be necessary for the eradication, control, or prevention of the dissemination of plant pests and noxious weeds. FDACS regulations provide instructions to the Bureau of Plant and Apiary Inspection for registering, inspecting, and certifying nurseries for compliance with plant pest and noxious weed requirements. *See* FAC §§ 5B-1.005 (Inspection of Nursery Stock or Articles), 5B-2.002 (Registering with the Division), 5B-2.0025 (Certification and Quarantine of Nursery Stock).

[32] FAC § 5B-57.004.

[33] FAC § 5B-57.007.

[34] FAC § 5B-57.010. Formerly, only agricultural pests were eligible for listing, but new noxious weed classification procedures authorizing listing of "invasive plants" were added in April 2004. *See Id*. Plants listed on both the federal and FDACS noxious weed list require both a state and federal permit.

[35] FS § 585.145. The term "animal" includes "wild or game animals whenever necessary to effectively control or eradicate dangerous transmissible diseases or pests which threaten the agricultural interests of the state." *See* FS § 585.01(10).

[36] *See* FS § 585.15.

[37] The Florida Aquatic Weed Control Act charges DEP with "direct[ing] the control, eradication, and regulation of noxious aquatic weeds … so as to protect human health, safety, and recreation and, to the greatest degree practicable, prevent injury to plant and animal life and property." FS § 369.20(2).

[38] FAC § 62C-52.003(1).

[39] FAC § 62C-52.011.

[40] FAC Ch. 62C-20.

[41] FDEP's enforcement authority is found at FS § 369.25(3)(h).

[42] *See* FS § 581.035 (Preemption of regulatory authority over nurseries).

[43] FS § 369.25(3)(a). The Prohibited Aquatic Plant list is found at FAC 62C-52.011.

[44] FAC Ch. 62C-52.011(1).

[45] FAC Ch. 62C-52.011(2).

[46] FAC § 68A-23.008(1).

[47] FAC § 68A-23.008(2).

[48] Special regulations governing the use of grass carp for biological control are found at FAC § 68A-23.088.

[49] FAC § 68A-23.008(3).

[50] FS § 370.081(2).

[51] FS § 370.081(3).

[52] A complete list of Class I and Class II wildlife may be found in FAC § 68A-6.002.

[53] A complete list of exempted species may be found at FAC § 68A-6.0022.

[54] *See* FS § 369.20(2) ("The Department of Environmental Protection shall direct the control, eradication, and regulation of noxious aquatic weeds … so as to protect human health, safety, and recreation and, to the greatest degree practicable, prevent injury to plant and animal life and property").

[55] The U.S. Army Corps of Engineers Jacksonville District is the second-largest civil works district in the nation. It is responsible for flood control, navigation, and environmental restoration in thousands of miles of rivers, canals, and wetlands in a region stretching from southern Georgia to the U.S. Virgin Islands. The Aquatic Plant Control section at the Jacksonville District is a Corps-wide center of expertise on aquatic plant management. In addition to its work with aquatic vegetation, the Corps' Aquatic Plant Control Section in Jacksonville also participates in a multi-agency Melaleuca management program and is responsible for development and implementation of a monitoring plan for the zebra mussel.

[56] The Corps is responsible for the St. Johns River and its tributaries north of Highway 520 and the waters within the levee of Lake Okeechobee. DEP funds the control of other plants within the St Johns River and all plant control in the River south of Highway 520. Other agencies control non-floating plants in Lake Okeechobee.

[57] The Northwest and Suwannee River Water Management Districts do no aquatic plant control in lakes and rivers and the St Johns River Water Management District controls plants in 5-6 public lakes and rivers. The majority of the control in public lakes and rivers is contracted by the FDEP with South and Southwest FL Water Management Districts and 9 Counties. About 30% is contracted with private companies.

[58] *See* FS § 369.22 (Non-indigenous aquatic plant control). "It is, therefore, the intent of the Legislature that the state policy for the control of non-indigenous aquatic plants in waters of state responsibility be carried out under the general supervision and control of the department."

[59] FS § 369.20(5).

[60] The Invasive Plant Control Trust Fund is funded by documentary stamps, state gas taxes, and vessel registrations. The Fund received a total of $33.5 million in 2002. Eighty percent—approximately $25 million in 2002—is distributed to the aquatics program. The remainder funds FDEP's upland invasive species control program. *See* FS § 369.252(4).

[61] *See* FAC § 62C-54.0035(1). "Noxious aquatic plants" are defined as any part of an aquatic plant "which has the potential to hinder the growth of beneficial plants, to interfere with irrigation or navigation, or to adversely affect the public welfare or the natural resources of this state." FAC 62C-54.003(23).

[62] *See* FAC Ch. 62C-54 (Funding for Aquatic Plant Management).

[63] FAC § 62C-54.0035 (Waters Eligible and Eligibility Criteria for Aquatic Plant Management Funds). Several other minor eligibility criteria related to public access are included in the rules.

[64] *See* FAC § 62C-54.005 (Approval, Allocation, and Disbursement Procedures for Aquatic Plant Management Funds).

[65] The State Park Service (a Division of FDEP) seeks to restore and maintain original landscapes in over 150 state parks. The Park Service is currently following a five-year invasive species strategic plan to help guide longer-term invasives strategy.

[66] The Division of Forestry cares for thirty-six state forests spread over roughly 800,000 acres of forest and recreational lands.

[67] FWC is responsible for wildlife management and recreation on a combined 4.5 million acres in 130 wildlife management areas (WMA) and wildlife and

environmental areas (WEA) in the state. The Commission does not have a statewide management plan for invasive species control.

[68] SFWMD is responsible for invasive species control on much of the Everglades located outside the boundaries of Everglades National Park (including 500,000 surface acres of public lakes, over 850,000 acres of Everglades Water Conservation Areas (WCA), roughly 42,000 acres of Stormwater Treatment Areas (STAs), 150,000 acres of interim lands (lands slated for either STAs or water preserve areas) and on 250,000 acres of public conservation lands).

[69] USFS staff in Florida's four national forests (the Apalachicola, Ocala, Osceola, and Choctawhatchee—together encompassing over 1.25 million acres of land) carry out USFS noxious weeds policy by attempting to identify and control invasive plant species that have been identified on the FLEPPC list.

[70] USFWS is responsible for invasive species management in Florida's 29 National Wildlife Refuges. There are especially heavy infestations at A.R.M. Loxahatchee and J.N. "Ding" Darling NWR. Melaleuca and Old World climbing fern have infested nearly eighty percent of the habitat area at Loxahatchee.

[71] The National Park Service manages eleven National Parks, Monuments, Preserves, and other sites in Florida. Everglades and Biscayne Bay National Parks have the greatest need for invasive species management. The National Park Service is currently undertaking a major revision of the Everglades General Management Plan, which will comprehensively address invasive species management. The scoping process began in January 2003 and the new plan is scheduled for implementation by summer 2006. *See* Everglades National Park, Park Planning website (http://www.nps.gov/ever/gmp/gmp_index.htm).

[72] FDACS is not a land management agency, and is therefore less involved with control and management activities. But *see* FAC 5B-57.006 (directing FDACS to "cooperate with the USDA, the Florida Department of Environmental Protection, and other appropriate parties to eradicate or control noxious weeds and invasive plants that are established in the State . . . ").

[73] FS § 369.252(1).

[74] Twenty percent of DEP's Invasive Plant Control Trust Fund has been carved out for "controlling nonnative, upland, invasive plant species on public lands." *See* FS § 369.252(4).

[75] Non-governmental organization representatives may also elect to participate.

[76] Proposals are ranked according to the following criteria:

1) Cooperative cost-share / matching funds are available through the management steward;
2) Target exotic species a) is recognized as having high invasion potential, and b) have current control technologies already established for control;
3) Control project will benefit specific threatened or endangered species;
4) Site has relatively high restoration potential.

See BIPM's Upland Invasive Plant Management Program Annual Report (2002).

[77] *See* FS § 373.59. Lands acquired through this program "shall be managed in an environmentally acceptable manner and, to the extent practicable, in such a way as to restore and protect their natural state and condition."

[78] *See* FS Ch. 259. The 2004 Florida Forever Work Plan reports that a total of $282.2 million was spent in fiscal year 2003 to acquire 19,438 acres of land.

[79] EFA (FS 373.4592(5)) "The legislature declares that it is necessary for the public health and welfare that the Everglades water and water-related resources be conserved and protected. The Legislature further declares that certain lands may be needed for the treatment or storage of water prior to its release into the Everglades Protection Area. The acquisition of real property for this objective constitutes a public purpose for which public funds may be expended."

[80] Local governments, including Brevard, Lee, Barton, and Palm Beach Counties, have expended hundreds of millions of dollars on land acquisition programs to preserve and protect environmentally endangered lands.

[81] *See* SFWMD Land Stewardship Annual Report (2002). Vegetation management is funded through district and basin ad valorem taxes, mitigation funds, the Water Management Lands Trust Fund, CERP, and through DEP's cooperative funding program. SFWMD spent $22 million on exotics control in 2003, about half of which came from DEP.

[82] These efforts began in 1989 with the inception of a melaleuca biocontrol research program. In 2003, the lab cultured and released tens of thousands of psyllids in Dade and Broward counties to control stands of melaleuca trees. The lab is currently developing biological controls for Old World climbing fern. ARS also coordinates Area-wide Pest Management Initiatives that assemble a coalition of research institutions, land managers, and property owners to develop sustainable Integrated Pest Management (IPM) plans for specific invasive pests. Two notable examples in Florida are the Area-Wide Initiatives to control the red imported fire ant and melaleuca. *See, e.g.*, The Areawide Management Evaluation of Melaleuca quinquenervia (TAME Melaleuca), http://tame.ifas.ufl.edu/index.htm.

[83] *See Statewide Invasive Species Strategic Plan for Florida*, ISWG (2002) (available at http://ipm.ifas.ufl.edu/reports/FL_invasive_species_Strategic_Plan.pdf).

[84] *See* FS § 570.235 (Pest Exclusion Advisory Committee).

[85] *See* Pest Exclusion Advisory Committee Report, PEAC (2001) (available at http://www.doacs.state.fl.us/pi/peac-full.pdf).

[86] *See* sec. 528(g) of WRDA 1996 (Duties of the Task Force).

[87] WRDA 1996 § 528(f).

[88] The Comprehensive Everglades Restoration Plan (CERP) is the largest of these programs. It builds on many other projects that were authorized by Congress or the Florida Legislature prior to and independent of CERP.

[89] Congress has also directed the Task Force to assist in the establishment of an independent scientific panel to review progress made in restoring the ecology of the natural system. *See* WRDA 2000 § 601(j).

[90] The Task Force's Strategic Plan identifies three primary goals for the restoration effort:

1) Get the Water Right;
2) Restore, Preserve, and Protect Natural Habitats and Species; and
3) Foster Compatibility of the Built and Natural Systems.

Invasive species control and management is a critical subgoal of Goal 2. Specific objectives identified by the Task Force for achieving this subgoal are:

a) Complete an invasive exotic plant species prevention, early detection, and eradication plan by 2005;
b) Coordinate the development of management plans for the top twenty South Florida invasive exotic plant species by 2010; and
c) Achieve maintenance control status for Brazilian pepper, melaleuca, Australian pine, and Old World climbing fern in all natural areas statewide by 2020.

See Coordinating Success: Strategy for Restoration of the South Florida Ecosystem, South Florida Ecosystem Restoration Task Force (2002) (available at http://www.sfrestore.org/documents/index.html).

[91] *See Weeds Won't Wait*, Chapter 1, note 8, *supra*.

Chapter 4: Gaps, Conflicts, and Recommendations

The central question of this report is how legal authorities can be interpreted, amended, or used differently to better address Florida's invasive species problems. Marc Miller, in his critique of U.S. federal invasive species law, clearly identifies the challenge in answering this type of question:

> If [the] combination of substantive statutes, general agency organic acts, various appropriation provisions, and binding international agreements have allowed 21 federal agencies to respond to varying degrees and in varying ways to harmful NIS [non-indigenous species], again an observer might fairly say: "Sure, this is a legal mess, but the total is, at least, the sum of the parts, and perhaps the parts, all together, make a working machine." If this were so, the legal mess would be a lawyer's quibble, and in the United States at least, those concerned about harmful NIS could focus solely on increasing appropriations and encouraging the various agencies to do more and to do what they do better. . . .
>
> [H]owever…[i]f the question is changed from "what are these myriad agencies doing?" to "what would we want government agencies to do in response to harmful NIS?" then huge gaps are revealed.[1]

Miller's observations are equally applicable to this study. The preceding sections of this report answer the first question, "What are state and federal agencies doing in response to Florida's invasive species?" The following analysis addresses the second, "What would we want them to do?" This section recommends several actions to improve overall invasive species management in Florida. The recommendations may be implemented through amendments or creative application of existing authorities, or through the creation of new laws, regulations, and policies. They may be taken one at a time or, ideally, all at once through comprehensive legislation.

As demonstrated throughout this report, the state of Florida and the federal government both have an important role to play. Thus, the recommendations in this section may be implemented at either the state or federal levels, or both. Although federal regulation is critical, it should not preempt innovative state and local solutions, especially in states like Florida with unique invasive species problems.[2] An increasing level of intergovernmental coordination and cooperation will be needed to strike the appropriate balance.

As before, this section is organized by function, with recommendations one through four dealing with prevention; recommendations five and six with control and management; recommendation seven with research; recommendations eight and nine with education, outreach, and public partnership; and recommendation ten with strategic planning and coordination.

PREVENTION

As described in Chapter 2, a fractured and often contradictory legal framework is the prime obstacle to effective prevention efforts in Florida and throughout the United States. Other

impediments include fragmented regulatory authority, an incoherent and uncoordinated listing process, and a lack of resources for border inspection and rapid response. This subsection presents four recommendations to help fortify Florida's invasive species defenses through improvements in legal authority, implementation, and enforcement.

1) Close the gaps in regulatory authority and implementation.

The legal framework for preventing the introduction and establishment of invasive species currently involves a stopgap collection of federal and state laws passed at different times and for different purposes. This has created gaps in agency authority and contributed to implementation failures that frustrate effective invasive species prevention at both the state and federal levels.

Gaps in authority

Because there is no overarching law that covers the full spectrum of potentially invasive species, regulators are forced to use a series of laws that address narrow slices of the invasive species problem. The jurisdictional definitions of each law determine which particular slice is covered. These definitions depend on the original purpose of each law. For example, federal and state plant protection authorities cover some microorganisms, some plants, and some animals, but only those that fit within their respective definitions of "plant pests," "invasive plants," or "noxious weeds."[3]

Not surprisingly, there are many gaps between the narrowly calibrated definitions in these various laws, which leave scores of potentially invasive species or species groups unregulated. For example, because the PPA is fundamentally a "plant protection" authority, CBP inspectors are powerless to stop invasive organisms that arrive with plants but are not themselves plant pests.[4] As long as a piecemeal legal framework is used to regulate the entire field of invasive species, certain classes of species will inevitably fall between the cracks.

Gaps in implementation

Compounding the gaps in authority are gaps in implementation. The Florida Fish and Wildlife Commission is unique in that it is a constitutional agency, possessing the full regulatory and executive powers of the state with respect to wild animal, freshwater aquatic and marine life.[5] Therefore, FWC regulators are not limited by traditional jurisdictional definitions, and have essentially unlimited authority over all animal species in Florida.

However, FWC has exercised very little of its authority to regulate potentially harmful exotic animals. FWC rules categorically prohibit the release of nonnative species without a permit,[6] but there is no practical way to enforce this type of prohibition, and citations are virtually nonexistent. The agency imposes some minimal licensing requirements on exotic pet dealers, though there are relatively few restrictions on the types of species they are allowed to import and sell. Similarly, FWC's lists of prohibited wildlife and aquatic species are out of date and very short.[7] In the meantime, new exotic animal species (some of which may become invasive) continue to show up in South Florida's protected areas. This example demonstrates that effective prevention requires more than just adequate authority-it requires consistent and proactive implementation.

Implementation failures are by no means unique to FWC, and the discussion above is not meant to assign blame, but rather to highlight a broader structural problem. The fragmentation of existing invasive species authority between disparate local, state, and federal government agencies allows each agency to exercise its individual authority according to its own historic role and legislative mandates. In general, agricultural agencies tend to be sympathetic to farming interests; fish and game agencies appreciate non-native species for their recreational and commercial values; park managers favor a return to pristine conditions without any non-natives, whether invasive or not. The current legal regime, however, provides no help in sorting out these competing policy preferences. This

failure, coupled with extensive overlapping authority (there are three different prohibited plant lists administered by three different agencies in Florida alone), results in confusion, coordination problems, and conflict.[8]

The lack of a common underlying rationale for invasive species policy has also allowed interest groups to set lawmakers against one another to win specific statutory loopholes and exclusions. Florida law is full of such inconsistencies and conflicts, including a provision allowing Florida nurseries to cultivate water hyacinth despite the fact that the State spends millions of dollars per year to keep the invasive plant under maintenance control.[9] Florida's preemption of new local invasive species programs[10] and FDACS veto power over the FDEP Prohibited Aquatic Plant List[11] are additional examples of these kinds of internal inconsistencies.

A holistic approach

The current reliance on a piecemeal legal framework is not surprising, given that scientists and policymakers have only recently begun to think about invasive species as a conceptual whole instead of a collection of individual problems. However, it is now becoming clear that the current approach is unsustainable. A new holistic legal framework is needed to close the gaps in authority and better reflect an ecological understanding of biological invasions.

Some commentators have called for a new "core" invasive species law to replace the current framework.[12] However, instead of wholly displacing current programs, new state and federal laws could simply establish a lead agency with a clear environmental mandate to link together current programs and fill the gaps between them.[13] Systematic procedures to assess and prioritize threats would focus regulations on the most harmful invaders, and action-forcing provisions could help ensure consistent implementation. Until this vision is achieved, creative thought is needed to obtain the most mileage possible from existing authorities and programs.[14]

2) Implement a systematic, science-based listing process.

The use of harmful species lists is one of the most common prevention mechanisms for invasive species. The act of listing generally triggers laws and rules regulating the possession, sale, or movement of listed species.[15] Five state and federal agencies maintain lists of regulated harmful species that apply in Florida:

- FDACS Noxious Weed List;
- FDEP List of Prohibited Aquatic Plants;
- FWC wildlife lists;
- USDA Federal Noxious Weed List; and
- USFWS lists of "injurious" animal species.

Table 6: Minnesota's Four-tiered Listing System for Exotic Species

Prohibited exotic species (Minn. Rule 6216.0250)	It is unlawful to possess, import, purchase, transport, or introduce these species except under a permit for disposal, control, research or education.
Regulated exotic species (Minn. Rule 6216.0260)	It is legal to possess, sell, buy, and transport these species, but they may not be introduced into a free-living state.
Unregulated exotic species (Minn. Rule 6216.0270)	These exotic species are not subject to regulation under the program (a "clean list" approach).
Unlisted exotic species (Minn. Rule 6216.0290)	Persons wishing to release any exotic species not listed as prohibited, regulated, or unregulated must first file an application with the state so that the species may be classified.

John M. Randall, The Nature Conservancy. Left to Right: Lygodium microphyllum; Melaleuca quinquenervia.

Each of these agencies follows a "dirty list" approach. A dirty list imposes restrictions only on the listed species, leaving all unlisted species free from regulation. This approach assigns to regulators the burden of determining whether a species is harmful. In contrast, a "clean list" identifies species approved for import, introduction, or release. This approach generally places the burden on the regulated community to prove that any new species will not pose an economic or environmental threat.

The problems with dirty lists are twofold. First, it generally takes a long time to add a species, even after it is clear the species is harmful. Species are often listed only after they have become established in the wild, which is too late for purposes of prevention. Second, there are typically few mechanisms in place to predict whether newly introduced species are invasive. This leads to legislative inertia and inaction in the face of unknown risk. Extensive private investment in existing uses of exotic species contributes to this chilling effect. In Florida, regulatory gridlock has become severe, especially with regard to exotic animals. Few agencies have a structured process in place to evaluate and list new species.

Systematic procedures needed

New listing procedures could help break this regulatory logjam, and more effectively prevent outbreaks of invasive species in Florida. The listing process should be transparent, scientific, and would ideally provide for public, industry, and other stakeholder input. It should also require regular review and revision of existing lists (including both listing and delisting decisions). A *pre-screening process* for all intentionally imported species could dramatically reduce the chances of unwanted invasions. This process could include easy exemptions for large groups of species that have a record of prior introductions and safety (cattle, crop varieties, etc) or where adequate scientific data shows the species is not likely to become invasive.

Consider "hybrid" lists

There is a lot of pressure in Florida against the use of clean lists. This is due in part to fears in the regulated community that a clean listing approach will unfairly restrict harmless exotic species. Many states, however, have used clean lists to protect their economy and environment without

disproportionately burdening industry.[16] In addition, the choice between clean or dirty listing is not so black or white. Hybrid or "tiered" lists represent a middle ground that can be used to balance the burdens of regulation.

Minnesota's exotic species law is a good example of a hybrid approach. Minnesota's program uses multiple lists to create a four-tiered classification system for exotic wildlife and aquatic plant species.[17] The program blends two different dirty lists ("prohibited" and "regulated" species) with a clean list of approved exotic species that are not subject to regulation under the program.[18] This framework shares the burden between the regulators and the regulated community, and seeks to balance this burden with an appropriate and prudent level of environmental protection.[19] Table 6 summarizes Minnesota's system.

A similar hybrid approach could easily be adapted into Florida's rules. In fact, FWC currently uses a tiered listing approach for aquatic species. The rules for non-native aquatics include a clean list,[20] a "restricted" list, and a "prohibited" list.[21] It is not clear, however, how active the Commission has been in implementing, enforcing, or updating these requirements.

In sum, listing can be one of the government's most effective prevention tools, but it needs to have a scientific basis, a rational "theory" or structure, and be regularly updated. There are some indications that Florida is moving in this direction. New classification procedures spelled out in FDACS regulations create a "Noxious Weed and Invasive Plant Review Committee" to review listing and delisting petitions, and conduct a required biennial review of the department's noxious weed list.[22] These kinds of systematic, public, and transparent procedures impart legitimacy to the listing process, and will likely result in greater support from the regulated community.

Federal agencies should also explore new listing theories for invasive species. The current dearth of listed species and the federal government's continuing failure to screen the unrelenting stream of exotics into Florida should concern those responsible for South Florida ecosystem restoration. The arrival of another species like melaleuca or Old World climbing fern could set efforts back by many years and millions of dollars. If the federal government leads on listing, the states will likely follow.

3) Beef up border protection.

Florida's front lines need reinforcements

The heart of Florida's prevention program consists of a small troop of federal and state inspectors and law enforcement officials at Florida's ports of entry and highway inspection stations. Unfortunately, these public servants are understaffed and underfunded. Inspectors can only individually examine approximately two percent of the incoming shipments to the Miami Plant Inspection Station.[23] The U.S. Fish and Wildlife Service Division of Law Enforcement has ten wildlife inspectors and four criminal investigators assigned to cover the entire region from West Palm Beach through the Caribbean.[24] Moreover, because the Lacey Act and Florida regulations prohibit so few species, the agents rarely have authority to stop exotic wildlife shipments.

Homeland Security Act leaves status of invasives border security uncertain

On March 1, 2003 the Homeland Security Act transferred nearly 2,600 employees from APHIS' Agriculture Quarantine Inspection force into the Department of Homeland Security's Bureau of Customs and Border Protection (CBP).[25] Under the new organization, APHIS maintains a policy and scientific development role, but is no longer responsible for front-line inspection and enforcement duties. Many observers in the agriculture and natural resources communities are concerned about the reassignment. Customs and Border Protection officers have a much broader homeland security mission than the former PPQ staff, and may not consider invasive species a priority. They also lack training in plant science.

Asa Hutchinson, the Undersecretary for Border and Transportation Security at DHS anticipates a "smooth transition," and has expressed hope that the merger will bring even more attention to agriculture.[26] However, it is too early to tell whether an awareness of the importance of agricultural inspection has been transferred to the front lines.[27]

Concerns about other pathways

Border protection has long focused on invasive "hitchhikers" that stow away in plant or commodity shipments or the ballast water of ships. However, intentional introductions are also a threat. Florida's Pest Exclusion Advisory Committee (PEAC) recently concluded that commercial smuggling of prohibited plants and animals is far more widespread in Florida than was previously imagined.[28] Their report called for increased state and federal support for smuggling interdiction efforts at ports of entry and the marketplace.[29]

The interstate shipment of exotic plants and pests through the mail presents regulators with another serious challenge. The PPA prohibits the unauthorized mailing of plant pests,[30] and APHIS regulations require all mail from foreign countries "which, either from examination or external evidence, are found or are believed to contain plants or plant products" to be submitted to plant quarantine inspectors.[31] However, the Postal Service and APHIS have little capacity to inspect and regulate the massive volume of U.S. mail. Florida's prevention framework relies heavily on inspections of in-state nurseries and places of business. This approach is compromised by the increasing rate of internet and mail order sales of exotic species (which are shipped door-to-door and from outside the state). This represents a rapidly growing hole in the invasives safeguarding system.

Stronger federal protection is essential

The U.S. Constitution places strict limits on state regulations that burden interstate or foreign commerce.[32] Therefore, strong federal enforcement of import regulations is essential.[33] Most importantly, federal inspectors and law

The Florida Citrus Canker Controversy

Florida has struggled with citrus canker, a bacteria that attacks the fruit, leaves, and stems of citrus plants, since it was first discovered in the state in 1914. In order to protect Florida's citrus industry, the state legislature enacted a detailed program requiring FDACS to control and prevent the spread of the canker.[i] After a new outbreak in the late 1990s, FDACS began aggressively implementing an eradication program. The most controversial provision required FDACS to remove and destroy all citrus trees (including healthy trees) that had been "exposed to infection."[ii] Private landowners, furious that their healthy trees were being destroyed without their consent, challenged the constitutionality of the eradication program in the Florida courts. In February 2004, the Florida Supreme Court upheld the constitutionality of the program, finding that it was a valid exercise of the state's police power and did not violate the landowner's rights to substantive due process.[iii]

[i] *See* FS § 581.184.

[ii] *See* FS § 581.184(2). Trees "exposed to infection" were defined as those trees "located within 1,900 feet of an infected tree." FS § 581.184(1)(b).

[iii] *See* Haire v. FDACS, 870 So.2d 774 (Fla. 2004) (upholding the Constitutionality of FS § 581.184 which authorized the FDACS to implement and enforce the eradication of citrus canker by destroying both healthy and infected privately owned citrus trees, but finding that the state had to offer landowners "more than token compensation" for the loss of each citrus tree they destroy).

enforcement agents must be supported with adequate resources. There is little logic in spending billions of dollars to restore the South Florida ecosystem while a gaping hole in Florida's border defenses is ignored.

4) Build monitoring and rapid response capacity.

Once an invasive species becomes established, it is nearly impossible to achieve complete eradication. The most that can typically be hoped for is maintenance control. A key element of prevention is the capacity to discover and eliminate small, easily controllable outbreaks of new pests before they develop into expensive, unmanageable invasions. This capacity involves three factors: 1) an awareness of high-risk species and the likely pathways for their entry; 2) vigilant monitoring of those pathways; and 3) the capacity to respond quickly to new introductions. Florida is deficient in all three respects.[34]

Florida could improve its rapid response capabilities by investing in a surveillance program that targets high-risk areas, such as the perimeter of the Miami airport and other ports of entry.[35] An ideal program would connect these discrete monitoring networks to a widely available statewide database or mapping system that could improve statewide coordination and better inform policy decisions regarding control and maintenance.[36] The system could quickly disseminate surveillance data to regional rapid strike forces, which could be mobilized to eliminate new infestations before they become unmanageable.[37]

Achieving the necessary improvements in monitoring and rapid response capacity will require extensive interagency coordination. Funding is a critical issue.[38] Because the need for emergency funding is unpredictable, a dedicated funding source that does not require annual appropriations (such as a contingency trust fund) would be ideal.[39]

CONTROL AND MANAGEMENT

Control and management measures are necessary if prevention efforts fail and invasive species manage to establish themselves within a state. Florida has a relatively well-developed framework for control and management, especially for invasive plants on public lands. However, Florida's efforts are limited by funding shortfalls and legal limitations. Most significantly, the government lacks adequate authority to control invasive plants on private lands. The following recommended actions would help Florida enhance the scope and effectiveness of its current programs to better control established populations of invasives in the state.

5) Devote adequate resources to public lands management.

Loxahatchee National Wildlife Refuge, located in Palm Beach County, encompasses the northernmost remnant of the original freshwater Everglades. With more than 220 square miles of Everglades habitat, visitors may spot an American alligator or one of more than 250 species of birds found here in any given year. However, two species are impossible to miss-invasive melaleuca trees and Old World climbing fern. Together, they have overrun more than eighty percent of the refuge, choking out native plant species and threatening wildlife that depend on the habitat for nesting and foraging. Loxahatchee's FY 2000 Comprehensive Conservation Plan estimated that $3 million per year would be needed to reduce this infestation to maintenance control levels.[40]

Loxahatchee's situation demonstrates the scale of the invasive species problem in South Florida-one site, two species, three million dollars per year. By way of comparison, there are more than 600 participants in FDEP's Upland Invasive Plant Control Program, and approximately 130 new projects funded each year. Put in this perspective,

the Upland Program's annual budget of approximately $7 million is merely a drop in the bucket.[41] FDEP's aquatics program fares a little better, with nearly $24 million of annual state funding. However, federal support for the aquatics program has been steadily decreasing for several years.[42]

Florida needs federal help. Congress occasionally appropriates special funds to bring particular infestations under control.[43] However, effective invasive species management requires both initial control and ongoing maintenance, and the federal government has failed to create the type of permanent funding source needed.[44]

Take advantage of natural partnerships—and formalize them

Florida's public land managers realize that they cannot afford to wait for help from Congress, and they have begun to take creative interim actions. Interagency partnerships allow local, state, and federal land managers to share costs, specialize in their strengths, and prioritize resources for the most critical problems.[45] At this point, however, partnering takes place on an ad hoc basis, and is very dependent on individual personalities. Efforts to streamline and formalize the partnering process could lead to more effective marshaling of limited state resources.

Use other government programs creatively

A number of other federal programs offer opportunities for creative implementation of invasive species control projects. The Corps of Engineers' CAP authorities[46] can be used to implement restoration projects with significant invasive species components. NRCS Conservation Programs and the Fish and Wildlife Service's Partners for Fish and Wildlife Program (PFFW) can also be used strategically to fund invasives control work, especially on private lands.[47] Finally, CERP offers tremendous untapped authority and resources for systematic invasives species control work in furtherance of the greater South Florida Ecosystem Restoration goals. Focused and purposeful use of these and other federal programs and authorities could help narrow the gap between Florida's needs and the resources currently available for invasive species control.[48]

6) Reframe uplands authority to reach private lands.

Invasive species are unaffected by political boundaries—they move with ease across and between private and public lands alike. However, state and federal legal authorities for upland invasive plant control in Florida do not reflect this reality. FDEP's Upland Program grants are earmarked for projects on public conservation lands, and federal agencies usually take action only within their own jurisdictions.[49] The gaps in authority seriously undermine the effectiveness and efficiency of overall control efforts. Infestations on abutting private lands often serve as reservoirs of seeds and spores beyond the reach of control efforts. Therefore, invasive species managers can spend millions cleaning up public conservation lands without ever eliminating the root source of the problem.[50]

Other programs are quite different. FDEP has specific authority to enter private property to engage in aquatic plant control activities.[51] FDEP's Aquatic Plant Control Grant Program is ordinarily limited to waters with public boating access.[52] However, a key provision of FDEP's rules expands the agency's jurisdiction by also allowing funding for waters "which might adversely impact sovereignty lands."[53] APHIS and FDACS are also able to enter private property and eradicate pests under their plant pest and noxious weed authorities.[54] Similarly, the Animal Damage Control Act apparently creates broad federal authority for control of invasive vertebrate animals on both public and private lands.[55]

Reframing authority to reach private lands

Both Congress and the Florida Legislature have the power to protect public lands from invasive species through the regulation of private property.[56]

However, as demonstrated by FDAC's Citrus Canker Eradication Program, regulations affecting private land are often controversial (*see* sidebar). Intrusive regulations risk public backlash.[57] However, effective authorities need not be intrusive. A judicious exercise of regulatory authority, combined with an emphasis on public education, can help avert potential problems. Grants or incentive payments to assist private landowners with invasive species control would also be helpful.[58]

Expanded authority should be accompanied by a wise allocation of resources. The restoration and protection of native ecosystems is most valuable in protected natural areas and less important in heavily modified environments. Policymakers could take a "buffer zone" approach, modeled after FDEP's Aquatic Plant Control Program or the new Palm Beach County Invasive Vegetation Removal Incentive Program, and authorize invasive species control on private lands "which might adversely impact" public lands. At an even more sophisticated level, the law could create a concentric model with a protected natural area in the center, and decreasing levels of monitoring and control towards the periphery. The buffer zone and concentric approaches both recognize that when resources are limited, invasive species control should be targeted to the most critical areas.

RESEARCH

7) Refocus Research.

Develop capacity to predict the potential invasiveness of exotic species

The National Research Council recently found that "[t]here are currently no known broad scientific principles or reliable procedures for identifying the invasive potential of plants, plant pests, or biological control agents in new geographic ranges…."[59] This shortcoming has slowed the adoption of an effective pre-screening process, and is sometimes used as cover for a deregulatory agenda. Development of a tool to predict whether introduced exotic species will be invasive or benign is essential to strong invasive species policy. An ideal predictive tool would be adaptable to regional conditions, and could be embedded into a mandatory pre-screening process for proposed exotic imports.[60]

Develop tools to accurately measure the full ecological costs of individual invasive species

Research is also needed on tools to estimate the true economic and ecological costs of individual exotic species. Florida's current gridlock on exotic animals can be explained, in part, because it is much harder to assess the ecological impacts of animals (such as the exotic fish in the canals surrounding Everglades National Park) than it is to measure the economic impact of an agricultural weed. An accurate measure of ecological costs would help resolve regulatory conflicts and could lead to more responsible private sector decisions regarding exotics.[61]

Streamline biocontrol research and the regulatory approval process

The development and release of biocontrol agents will likely remain an essential element of any future strategy for managing invasive species in Florida. Therefore, it is essential that research efforts be supported to develop new biocontrol agents as quickly as possible.[62] Recent biocontrol agents are successfully controlling infestations of melaleuca, but the agents took nearly ten years to develop and be approved.[63] Florida cannot afford to wait ten years for new invaders like Old World climbing fern.

One factor contributing to these delays is the length of time needed for the regulatory approvals of new biocontrol agents. Releases of new agents require a permit from APHIS-PPQ.[64] APHIS's permitting decision is informed by an interagency review team of researchers called the Technical Advisory Group for Biological Control Agents of Weeds (TAG). TAG members examine new

biocontrol applications and suggest inclusions of certain test plants, identify conflicts of interest, and assess risks associated with a release. Other environmental documentation, including environmental impact statements and Endangered Species Act consultations, are often required. All told, the current approval process consists of ten steps that may take several years.[65]

Streamlining regulatory review could significantly reduce the length of time needed to disseminate new biocontrol agents into the field. However, the emphasis needs to focus on streamlining and not decreasing the overall level of scrutiny. APHIS should search for opportunities that make the administrative process quicker and more efficient, but should be careful not to sanction the release of a biocontrol agent that could become a harmful invasive itself.

EDUCATION, OUTREACH, AND PUBLIC PARTNERSHIP

8) Raise awareness in the public and beyond.

Regulation is only one part of a comprehensive invasive species policy-education and outreach are also critical elements. Invasive species policies are affected by many different social, cultural, psychological, and commercial realities. For example, a natural "green is good" mentality can often cause setbacks or delays for government plans to eradicate invasive plants, especially on private lands.[66] A general lack of awareness leads to problems that could have easily been prevented, such as the release of unwanted (and potentially invasive) pets into the wild. Education holds two primary values. It can raise support for and increase compliance with government regulations, and can also shape private conduct to prevent problems and reduce the need for regulations in the first place. These qualities make education an essential foundation of a strong invasive species policy.

Florida has several good models for education and outreach. The Florida Yards and Neighborhoods Program is a traditional agricultural extension program that raises residents' awareness of invasive species and other environmental issues associated with home and landscape management.[67] The Florida Exotic Pest Plant Council (FLEPPC) publishes a non-regulatory list of harmful exotic plants that has been successful at raising awareness and guiding voluntary cultivation decisions in both the public and private sectors. The Areawide Management Evaluation of *Melaleuca quinquenervia* (TAME Melaleuca) is a collaborative multi-agency project to develop a sustainable and integrated melaleuca control program through partnerships with public agencies and private land managers.[68] Local efforts, such as the City of Gainesville's G.E.A.R. Program,[69] are particularly effective ways to encourage citizens to take an active role in the stewardship of local natural resources. Invasive species management would benefit from efforts to build on these successful programs and seek out additional opportunities to educate the public and make them full partners in the fight against invasives.

Effective education and outreach must extend beyond the general public to reach business and professional communities. These efforts should seek to engage industries that trade in exotic species and professionals whose work involves exotics.[70] For example, FLEPPC and The Nature Conservancy's work with the Florida Nurserymen and Growers Association is helping to bridge misunderstandings, and may eventually lead to new industry practices to reduce the potential for dissemination of invasive species.[71] Lastly, lawmakers must be educated about the threats of invasive species, so that an effective legal framework may someday become a reality.[72]

9) Emphasize incentives for private action.

In addition to education, the government should seek to enroll private action in invasive species

prevention and control through the use of incentives. Incentives may take many forms, including technical assistance, tax breaks, reimbursements for private control work, and federal cost-share programs. The Allapattah Ranch Project in Martin County, Florida is a promising model. The project, one of the largest Wetland Reserve Program (WRP) projects in the nation, will restore and preserve approximately 15,370 acres of agriculturally impacted wetlands and associated upland buffer habitat just east of Lake Okeechobee. The success of this project will rely on an intensive initial effort to remove and treat invasive exotic plants, such as Brazilian pepper and Old World Climbing Fern, and follow-up management to maintain native plant communities.[73]

There are opportunities in Florida to use these types of federal conservation programs to address invasive species on private lands. Florida has actually been a leading recipient of federal cost-share dollars.[74] These programs, however, are not earmarked exclusively for invasive species, and proposals must compete with other habitat conservation projects for funding. This sometimes works against invasive species proposals, because their high costs deter officials interested in distributing funds to the largest possible number of projects.[75] Greater federal support for these types of conservation programs, or earmarking some portion of these funds for invasive species projects, would help preserve the value of these incentives for invasive species management.

The Florida Forever Act recognizes that "acquisition is only one way" to achieve the goals of the Act, and encourages the development of "creative partnerships between governmental agencies and private landowners…to bring environmentally sensitive tracts under an acceptable level of protection at a lower financial cost to the public."[76] These "creative partnerships" can and should happen at all levels of government. For example, Palm Beach County administers a cost-share program for voluntary removal of listed invasive plants, and a canopy replacement program to help minimize the loss of canopy associated with the removal of prohibited vegetation.[77] Florida law provides for conservation easements and includes a tax incentive when the covenant extends ten years or more.[78] The Allapattah Ranch Project offers a strong model for the creative use of these kinds of legal tools that can help keep large tracts of Florida land protected and free of invasive species.

STRATEGIC PLANNING AND COORDINATION

10) Reconcile the state and federal planning processes.

In general, federal and state agencies work well together in Florida-especially with regard to joint invasive species control efforts. However, the broader strategic planning processes remain somewhat disconnected. There appear to be two parallel planning efforts: the first composed of state agencies and centered around the State Invasive Species Working Group (ISWG), the second led by interagency task teams assembled under the South Florida Ecosystem Task Force (SFERTF).[79]

These groups overlap, but have disparate orientations. ISWG is composed exclusively of state members. Federal participation is invited, but only on an "informal" and nonvoting basis. The SFERTF Task Teams involve both state and federal members, and are affiliated with the South Florida Ecosystem Restoration. Both claim to be producing strategic plans for invasive species prevention, control, and management in Florida.[80]

Both groups have made excellent recommendations for improving invasive species management in Florida. Still, strategic plans are intended to consolidate, coordinate, and prioritize competing policies and set a longer-term strategy in motion. This is impossible with multiple plans. Thus, the current split has the potential to frustrate and delay implementation of the many solid ideas in both plans. Florida needs to reconcile the

parallel planning processes and reach agreement on a single strategic plan.

Reaching common ground

In order to reach common ground, state and federal players will have to explore the reasons for the current split. There has been some tension underlying the state and federal relationship in Florida for many years. Some frustrations are still simmering from the Everglades water quality lawsuit brought against the state more than fifteen years ago. The root causes, however, may stem from slightly divergent core philosophies on exotic species management.

The current dispute surrounding feral hogs is emblematic of the deeper issues. Feral hogs are not native to Florida, though they have existed there for several hundreds of years. The federal government, citing the significant habitat damage caused by hogs, generally views them as invasive species that should be controlled or eradicated. The state, however, cites the long-term presence of hogs in Florida and their value to sport hunters and the Florida economy in arguing that hog populations should be managed, but not eradicated.[81] It would be a gross simplification to label the federal approach to exotics as "purist" and the state approach as "pragmatic" or perhaps "protectionist," but there is a grain of truth to this caricature.

Several misunderstandings and communication failures overlay these deep tensions and have perpetuated the federal-state rift. State managers sometimes feel that there has been too much planning and not enough on-the-ground action. Some feel that federal strategic planning efforts have not given adequate consideration to an already workable state control strategy, and are concerned that the federal strategic planning is simply "reinventing the wheel."[82] The federal government, for its part, feels frustrated by the state's apparent lack of willingness to cooperate. ISWG's decision to exclude non-state entities from full membership is a considerable stumbling block. Potential federal partners have little incentive to join the state process if they will simply be subordinate to the state group.

The rift between federal and state strategic planners should not be overstated, and it is by no means insurmountable. The community of invasive species "specialists" in Florida is relatively small. Local, state, and federal employees work together often and most have extremely good working relationships. All of these professionals have a large stake in the preservation and restoration of Florida's natural heritage and are deeply concerned about the threats of invasive species. No one wants to delay the process.

With a little more time and better communication, a solution to the current impasse would likely occur naturally. Unfortunately, time is in short supply. With each passing month, invasive species tighten their grip on Florida. A single, forward-looking strategic planning process that provides for local, state, and federal participation on an equal footing is within reach, and could dramatically drive forward Florida's invasive species policy at this critical time.

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[1] *See Harmful Invasive Species*, Chapter 1, note 7, *supra*.

[2] In this regard, an ideal invasives approach would follow the Lacey Act model rather than the Plant Protection Act. *See* discussion of the PPA's preemption provision (7 U.S.C. § 7756) in Chapter 2, *supra*.

[3] *See, e.g.*, 7 U.S.C. § 7702 and F.S. § 581.011.

[4] Invasive species managers in Hawaii are feeling the effects of this shortcoming first-hand as they struggle to eradicate the coqui frog, a native of Puerto Rico that has infested the islands.

[5] *See* Article IV, Section 9 of the Florida Constitution.

[6] *See* FS § 372.265 (Regulation of Foreign Animals), which prohibits the import or release of "any species of the animal kingdom not indigenous to Florida" without a permit, and authorizes the agency to "issue or deny such a permit upon the completion of studies of the species made by it to determine any detrimental effect the species might have on the ecology of the state."

[7] *See* FAC § 68A-6.002 (Categories of Captive Wildlife); FAC § 68A-23.008 (Non-Native Aquatic Species).

[8] Overlapping authority also results in unnecessarily burdensome requirements. For example, persons seeking to move federally regulated noxious weeds across state lines require a permit from APHIS. Since the plant may also be subject to state regulations, the agency checks with the

destination state on a case-by-case basis to determine whether to approve the permit. A Florida regulator explained that this is a big burden on both regulators and industry. He suggested implementing blanket state prohibitions that are known in advance (e.g. "All sales of *Salvinia* to the state of Texas are prohibited"), rather than the current case-by-case evaluation of individual permits.

[9] *See* FS § 581.145(3). Water hyacinth can only be cultivated in Florida for export outside the United States. However, critics have noted that sales to Canada were primarily to mail-order businesses that in turn shipped the species worldwide—including to the United States and Florida. *See Strangers in Paradise*, Chapter 1, note 1, *supra*. FDEP rules have a similar loophole. FAC § 62C-52.011(2) permits Class II Prohibited Aquatic Plants to be cultivated in Florida nurseries for sale out of state.

[10] This amendment to FS § 581.091 was introduced as a rider on a 2002 Agricultural Bill by Florida State Representative Richard A. Machek (D-District 78), with the full support of the Florida Nurserymen and Growers Association. The provision is discussed in Chapter 3, *supra*.

[11] *See* FS § 369.25(3)(b). This has resulted in some tension between the agencies over proposed listing decisions, especially over plants with potential agricultural or commercial value. Recent conflicts involved the proposed listing of carrotwood and Chinese tallow, two highly invasive (but popular) ornamental tree species.

[12] *See Harmful Invasive Species*, Chapter 1, note 7, *supra*.

[13] This would preserve the benefits of the current multiple-agency approach, which brings different perspectives and expertise to the invasives issue as well as additional funding, personnel, and equipment.

[14] For example, the Comprehensive Everglades Restoration Plan (CERP) opens the door for the U.S. Army Corps of Engineers to assume a position of leadership in this effort. A decision to incorporate and enhance invasive species management through CERP would be consistent with the President's Executive Order and could help ensure Congress's goals of "restoring, preserving, and protecting the South Florida ecosystem" are eventually achieved.

[15] *See Making a List: Prevention Strategies for Invasive Plants in the Great Lakes States*, ELI (2004) for more details on the listing process.

[16] *See Halting the Invasion*, Chapter 1, note 11, *supra*, for an overview of state programs using a clean list approach.

[17] *See* Minn. Stat. Ch. 84D.

[18] *See* Minn. Rule §§ 6216.0250-6216.0270. Unlisted species are legal to possess, sell, buy, and transport, but they may not be released into a free-living state until an application has been filed with the Department of Natural Resources and the agency has classified the species on one of the state's three lists. *See* Minn. Rule § 6216.0290.

[19] For more discussion of the Minnesota program, *see Making a List,* note 15, *supra*.

[20] FWC regulations prohibit the "transport into the state," introduction, or possession "for any purpose that might reasonably be expected to result in liberation into the waters of the state" of any non-native aquatic species without having secured a permit from FWC except for species on a clean list (only two are currently listed). *See* FAC § 68A-23.008(1)

[21] FAC § 68A-23.008.

[22] *See* FAC § 5B-57.010. The regulations direct the Vice President for Agricultural and Natural Resources of the University of Florida to recommend two faculty members, one specializing in research on production agriculture and the other on natural resources, to the department to serve on the committee. A representative from the Botany Section of the FDACS Bureau of Plant and Apiary Inspection will represent the department. All reviews must also provide for public input. *Id*.

[23] The Miami Plant Inspection Station is the busiest in the country, with an estimated annual volume of over 550 million plants. Nearly 80% of all U.S. plant inspections are performed at the Miami Station. Inspectors report that they attempt to screen at least one box from each incoming shipment and 100% of "wild collected" plants.

[24] These officials are responsible for nearly 12,000 shipments of wildlife that pass through the Port of Miami each year (85 percent of which are live animals for the pet trade). State enforcement of wildlife law is similarly stretched. FWC has only twelve law enforcement inspectors to cover all of Florida's ports, pet stores, and game farms.

[25] This move is in line with CBP's new "one face at the border" concept, which moves away from a multiple inspector approach towards having one inspector who is supported by specialists with expertise.

[26] Secretary Hutchinson expressed these sentiments in an address to the National Association of State Departments of Agriculture on February 3, 2003.

[27] Early signs are not encouraging. According to some concerned observers, DHS inspectors at the Port of Miami no longer inspect cut flowers for hitchhiking plant pests. Imports of Spanish and Italian tiles, which are a favorite for stowaway insects and snails, are also no longer inspected.

[28] *See Pest Exclusion Advisory Committee (PEAC) Report*, findings of the Exclusion Subcommittee (March 2001).

[29] APHIS PPQ has established a Smuggling Interdiction and Trade Compliance (SITC) program to provide a national focus for smuggling and trade compliance issues. The Florida Interdiction and Smuggling Team (FIST) has operated to identify and close smuggling pathways in the state since 1998.

[30] 7 U.S.C. § 7711(d).

[31] 7 C.F.R § 351.3.

[32] The Commerce Clause of the U.S. Constitution grants to Congress the power to regulate international and interstate trade. Therefore, the Supreme Court regularly strikes down state laws that discriminate against or unreasonably burden such commerce. However, state regulations that serve a legitimate local purpose and which cannot be achieved by nondiscriminatory means may be upheld. In *Maine v. Taylor*, 477 U.S. 131 (1986) the Supreme Court upheld a complete ban on the importation of live bait-fish imposed by the State of Maine on grounds that there was no reliable non-discriminatory alternative means for the state to protect its citizens and natural resources from the risks of imported parasites and invasive species.

[33] This is especially true in Florida, because FDAC and FDEP do not have authority to inspect foreign imports. In the past, APHIS notified the state when border inspectors identified a state-listed pest, but it is not yet clear whether CPB will continue this practice. The creation of formal communication channels between federal border inspectors and state regulatory agencies would improve regulatory efficiency and help state agencies prevent state-regulated pests from slipping through the border.

[34] The need for enhanced early warning and emergency response capacities in Florida was discussed by the PEAC Detection and Response subcommittee in the *PEAC Report*.

[35] FDEP, through its annual surveys of 450 public waters, has been very effective in identifying new infestations of invasive aquatic plants. Additional monitoring programs are needed for other classes of invasive species.

[36] USGS's Florida Integrated Science Center (FISC) in Gainesville has a Non-indigenous Plants and Animals Program that is beginning to track the status of introduced aquatic organisms for dissemination for research, management, and education.
See http://cars.er.usgs.gov/Nonindigenous_Species/nonindigenous_species.htm.
Similar efforts are now needed in the terrestrial context.

[37] A rudimentary response capacity already exists in the form of Exotic Plant Management Teams (EPMT's) established under FDEP's Upland Invasive Plant Management Program. An improved rapid strike force could perhaps be developed from this foundation.

[38] For example, APHIS is becoming more constrained in its ability to fund emergency eradication of emergent pests. Although the agency has no

dedicated source of funding for emergencies, the Secretary of Agriculture has authority to transfer funds from the Commodity Credit Corporation (CCC) to conduct emergency eradications. However, the OMB is tightening restrictions on these types of transfers, and proposals to increase the states' share of APHIS emergency program costs have been received negatively. Without new sources of emergency funding, APHIS will have to wait for congressional appropriations before responding to new pest infestations. This time-consuming process could result in missed eradication opportunities, and would represent a serious gap in the federal government's prevention network.

[39] Sec. 5 of H.R. 2310, the Species Protection and Conservation of the Environment Act (SPACE), creates a federal program to assist local and State agencies in rapidly responding to immediate invasive species threats.

[40] *See Loxahatchee National Wildlife Refuge Comprehensive Conservation Plan* (2000), available at http://loxahatchee.fws.gov/CCP/index.asp.

[41] In addition, the relatively large federal allocation at Loxahatchee means that other Refuges (e.g., Hobe Sound NWR) are not receiving the allocations that they require to address invasives.

[42] The Jacksonville District of the Corps of Engineers received only $3.4 million in RAG funding in 2003. The APC program hasn't been funded since 1996.

[43] For example, a special Congressional appropriation of $4 million in 2004 will permit treatment of exotics on an estimated 25,000 to 35,000 acres within Loxahatchee NWR.

[44] Several pending invasives bills would authorize additional federal expenditures for invasive species control and management on public lands. H.R. 119 (The Harmful Invasive Weed Control Act) and S. 144 (The Noxious Weed Control Act of 2003) would authorize $100 million per year to establish a national program in the Department of Interior to provide financial assistance through states for invasive weed control on public and private lands. Senator Akaka (HI) is also preparing to introduce a bill entitled "The Public Land Protection and Conservation Act" which would create a grant program for control and continuing management of invasive species on federal and adjacent private lands.

[45] One promising example is a cooperative agreement between the National Park Service and FDEP to seek out cost-sharing and labor partnerships for invasive species control throughout all eleven National Park Service units in Florida.

[46] The Corps' CAP authorities are discussed in Chapter 2, *supra*.

[47] Although grants under the state Uplands Invasive Plant Control Program are strictly limited to public lands, FDEP and USFWS have discovered a creative way to leverage DEP upland money with the PFFW Program to achieve some measure of control in private "buffer zones." Under this arrangement, the state Uplands Program pays for control work within a federal wildlife refuge while USFWS and adjacent private landowners agree to control invasives under the PFFW Program.

[48] A recent Memorandum of Understanding between the Nature Conservancy and Corps of Engineers offers a model for others to follow. Under the MOU, TNC and the Corps have pledged to work together to promote the conservation of biological diversity within the context of the Corps' civil works and regulatory missions. This will involve seeking out opportunities to use Corps authorities, such as the CAP program, to address invasive species and other threats to healthy habitats. *See* Memorandum of Understanding Between the U.S. Department of the Army, the U.S. Army Corps of Engineers, and The Nature Conservancy (12/14/2000).

[49] *See* discussion at Chapters 2 and 3, *supra*.

[50] Florida's preemption of new local invasives programs makes this gap even more significant, because local programs are one of the few ways private landowners can be required to keep their properties free from invasive species.

[51] *See* FS § 369.20(4)(d). Although FDEP has the statutory authority to enter private lands for aquatic plant control, the agency devotes the vast majority of its resources to aquatic plant control in public waters.

[52] *See* FAC § 62C-54.0035 (Waters Eligible and Eligibility Criteria for Aquatic Plant Management Funds). The FDEP aquatics program is described in Chapter 3, *supra*.

[53] *See* FAC § 62C-54.0035.

[54] *See, e.g.,* FAC § 5B-57.006.

[55] *See* discussion at Chapter 2, *supra*.

[56] The federal Property Power gives Congress the authority to "prohibit the doing of acts upon privately owned lands that imperil [federal property]." *See U.S. v. Alford,* 274 U.S. 264 (1927) (broadly interpreting the Property Clause of the U.S. Constitution (Article IV, Section 3, Clause 2)). State power to regulate private property derives from the state's general police power. *See Golden v. McCarty,* 337 So. 2d 388, 390 (Fla. 1976) ("all … property rights are held subject to the fair exercise of the police power").

[57] For example, requiring private citizens to remove invasives at their own expense may be perceived as unfair, especially if the infestations are not the result of private action. In certain circumstances, regulations requiring the absolute destruction of private property may require compensation. *See Corneal v. State Plant Board,* 95 So.2d 1, 4 (Fla. 1957) ("absolute destruction of property is an extreme exercise of the police power and is justified only within the narrowest limits of actual necessity, unless the state chooses to pay compensation").

[58] *See, e.g.,* the Aldo Leopold Native Heritage Grant Program proposed in the Species Protection and Conservation of the Environment Act, H.R. 2310, Sec. IV.

[59] *See Predicting Invasions of Nonindigenous Plants and Plant Pests* (National Academies Press, 2002).

[60] There have been several early attempts to develop biological risk assessments for exotics. *See, e.g.,* Weed-Initiated Pest Risk Assessment Guidelines for Qualitative Assessments (APHIS, 2002) (available at http://www.aphis.usda.gov/ppq/weeds/Wragui5-2.pdf); Generic Non-indigenous Aquatic Organisms Risk Analysis Review Process (ANSTF, 1996) (available at http://www.anstaskforce.gov/gennasrev.htm); Risk Assessment for the Import and Keeping of Exotic Vertebrates in Australia (Australia Department of Agriculture, Fisheries, and Forestry, 2003) (available at http://www.affa.gov.au/corporate_docs/publications/pdf/rural_science/lms/feals/risk_assess_book.pdf). While none of these tools are perfect, Australia's system for assessing exotic vertebrates is a noteworthy model.

[61] For example, Florida's nursery industry has recommended to their membership not to propagate, use, or sell a suite of 45 species whose ecological costs are clearly greater than their economic value. Better information on the true ecological costs of exotic species could help support further responsible decisions.

[62] Researchers at the ARS Invasive Plant Research Lab in Fort Lauderdale are actively engaged in looking for new biocontrol agents for invasive plants in Florida.

[63] The District began funding USDA investigations into melaleuca biocontrols in 1991. Australian weevil was released in 1997 and Australian psyllid released in spring of 2002. Both have been successful in reducing melaleuca infestation levels.

[64] *See* Sec. 412 of the Plant Protection Act (7 U.S.C. § 7712) (providing the Secretary of Agriculture with the authority to "prohibit or restrict the importation, entry, exportation, or movement in interstate commerce of any…biological control organism").

[65] Chapter three of USDA's *Reviewers Manual for the Technical Advisory Group for Biological Control Agents of Weeds* describes this process: 1) Early Input; 2) Permits for U.S. Introduction; 3) Maintain the Permit for Importation; 4) Environmental Documentation in Support of Permit for Release; 5) TAG Recommendation; 6) Permit for Release; 7) Section 7 Consultation; 8) Public Comment; 9) Environmental Protection Agency; 10) Interstate Movement of Approved Weed Biological Control Agents. *See* http://www.aphis.usda.gov/ppq/permits/tag/tag.pdf.

[66] Exotic animals raise a number of additional delicate issues. For example, feral cats are technically "invasive" and can have a devastating impact on

native songbird populations. However, potential government responses must consider the fact that they are also sentient beings that people care about deeply. A straight "eradication" plan will not likely be acceptable.

[67] FYN is directed by the University of Florida IFAS Extension. The program offers a handbook on environmentally friendly landscaping that emphasizes the importance of native species in Florida's landscapes. *See* http://hort.ufl.edu/fyn/hand.htm.

[68] TAME is administered through the USDA Agricultural Research Service's Areawide Pest Management Initiative. Areawide projects seek to demonstrate the effectiveness of an integrated pest management (IPM) approach for controlling invasive species. They are funded for up to five years and then carried on by cooperators, growers, and land owners. For more information on TAME, *see* http://tame.ifas.ufl.edu/.

[69] G.E.A.R. (or Gainesville Ecosystems at Risk) is an organization created by the Nature Operations Division of the City of Gainesville for the purpose of educating Gainesville residents about threats to the proper functioning and vitality of the area's natural and native ecosystems. Invasive species are a primary focus of the program.

[70] For example, landscape architects are often not aware of the invasive potential of exotic species they include in their plans. Greater education (through, for example, professional society conventions or training courses offered for continuing education credit) could result in more ecologically sound landscape plans.

[71] Over the years, Florida's nursery industry has lobbied strongly against invasive species regulations, based partly on fears that the state would not distinguish between harmful invasive species and other commercially valuable exotic species. However, the industry now seems ready to support a regulatory system that is fair, transparent, and based on science.

[72] The number of invasives-related bills currently pending in Congress demonstrates that some progress is being made here.

[73] *See* http://www.fl.nrcs.usda.gov/programs/flwrp.html.

[74] Florida pocketed $27 million of WRP funds and $8.5 million in EQIP funds in FY 2002. In 2003, eight of Florida's eleven DOI Challenge Cost-Share projects involved invasive species components, bringing in more than $2.1 million for invasive species control. DOI's new Landowner Incentive Program (LIP) represents a brand new source of cost-share resources that can be used for invasive species management and habitat restoration.

[75] For example, FDACS did not select invasive species control as a focal area for 2004 Forest Land Enhancement Program (FLEP) funding because invasive species control would have eaten up all of the program funding on just a couple of projects.

[76] FS § 259.105(2)(b).

[77] For more information on these programs, contact Palm Beach County's Department of Environmental Resources Management (DERM) (www.co.palm-beach.fl.us/erm).

[78] Fla. Stat. Ann. §§ 704.06, 193.501, 193.501(3)(a). Miami-Dade County has a similar property tax credit incentive program. A natural area management plan that includes exotics species control is required to qualify for the credit.

[79] The Noxious Exotic Weed Task Team (NEWTT) and the Florida Invasive Animal Task Team (FIATT) are both pursuing strategic planning objectives for invasive species.

[80] *See, e.g.,* the ISWG Statewide Invasive Species Strategic Plan (2002) and NEWTT's Statewide Strategic Plan for Managing Florida's Invasive Exotic Plants (*Weeds Won't Wait*) (2001).

[81] FWC employs a variety of approaches to the management of wild hogs, depending in part on the desires of the landowner with whom it partners.

[82] Some state actors are also hesitant to participate in federal planning because they feel like they "got burned" the last time they tried it. In the initial stages of CERP, the Army Corps initiated a public process to set priorities for critical restoration projects. Several state agencies participated and invasive species control was recommended as the number one priority. The state participants expected the process to result in significant federal funds for invasive species control through CERP. However, for many reasons, this never materialized.

Chapter 5: Conclusion

Invasive species have always existed, but awareness of the "invasive species issue" as a discrete matter of environmental policy is relatively new. As with other emerging issues, it is not surprising that invasives are currently addressed with a patchwork of unconnected laws. However, the scale of the invasive species problem in Florida (and across the nation) demonstrates that changes are needed. This report calls for a consolidation and reorganization of invasive species law to create a holistic approach focusing on the prevention of new invasions.[1] The eventual framework should preserve a role for state and local authority, and should be built from an ecological understanding of biological invasions.

Until this holistic vision is achieved, it will be essential for all agencies to exercise the full extent of their existing authority to prevent and respond to invasives.[2] This will require a new mindset and creative application of existing law. Florida is particularly challenged by invasive species, but it has a wealth of federal, state, and local experts, and several established agencies with the capacity and expertise to address these issues. The recommendations in this report are all steps they can take to help end the invasion.

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[1] *See* Recommendation 1, *supra*.

[2] *See* discussion of Executive Order 13112 and its mandate for federal agencies in Chapter 2, *supra*.

Glossary

ADCA	Animal Damage Control Act
AHPA	Animal Health Protection Act of 2002
ANS	Aquatic Nuisance Species
APC	Aquatic Plant Control
APHIS	Animal and Plant Health Inspection Service
ARS	Agricultural Research Service
ASPEA	Alien Species Prevention Enforcement Act of 1992
CBP	Customs and Border Protection
BIPM	Bureau of Invasive Plant Management
BRS	Biotechnology Regulatory Service
C&SF	Central and Southern Florida Project
CAP	Continuing Authorities Programs
CARL	Conservation and Recreation Lands Program
CCC	Commodity Credit Corporation
CERP	Comprehensive Everglades Restoration Plan
CITES	Convention on International Trade in Endangered Species
CTAP	Conservation Technical Assistance Program
DHS	Department of Homeland Security
DOI	U.S. Department of the Interior
DPI	Division of Plant Industry
EPA	U.S. Environmental Protection Agency
EQIP	Environmental Quality Incentives Program
ESA	Endangered Species Act
FAC	Florida Administrative Code
FDA	Federal Food and Drug Administration
FDACS	Florida Department of Agriculture and Consumer Services
FDCA	Federal Food, Drug, and Cosmetic Act
FDEP	Florida Department of Environmental Protection
FIATT	Florida Invasive Animal Task Team
FICMNEW	Federal Interagency Committee for the Management of Noxious and Exotic Weeds
FLEP	Forest Land Enhancement Program
FLEPPC	Florida Exotic Pest Plant Council
FLPMA	Federal Land Policy and Management Act
FSP	Forest Stewardship Program
FWC	Florida Fish and Wildlife Conservation Commission
IFAS	University of Florida Institute of Food and Agricultural Sciences
IPPC	International Plant Protection Convention
ISWG	Invasive Species Working Group
LIP	Landowner Incentive Program
NEWTT	Noxious Exotic Weed Task Team
NISA	National Invasive Species Act of 1996
NISC	National Invasive Species Council
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NRCS	Natural Resources Conservation Service

PEAC	Pest Exclusion Advisory Committee
PFFW	Partners for Fish and Wildlife Program
PPA	Plant Protection Act of 2000
PPQ	Plant Protection and Quarantine
RAG	Removal of Aquatic Growth Program
RECOVER	Restoration Coordination and Verification
RHA	Rivers and Harbors Act
SFERTF	South Florida Ecosystem Restoration Task Force
SFWMD	South Florida Water Management District
SPS Agreement	WTO Agreement on the Application of Sanitary and Phytosanitary Measures
SWIM	Surface Water Improvement and Management Act
TAG	Technical Advisory Group for Biological Control Agents of Weeds
USDA	U.S. Department of Agriculture
USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
WCAs	Water Conservation Areas
WHIP	Wildlife Habitat Incentives Program
WRDA	Water Resources Development Act
WRP	Wetlands Reserve Program
WTO	World Trade Organization

APPENDIX D

AGENCY PROGRAMS

FEDERAL AGENCIES

US Army Corps of Engineers

The USACOE is the lead Federal agency for funding aquatic plant control in Florida's navigable waters through the Removal of Aquatic Growth (RAG) Project, the Aquatic Plant Control (APC) Program and through the USACOE Operations and Maintenance (O&M) program.

The RAG Project is Florida's oldest aquatic plant control project and funding has been stable in recent years. Regional staff works closely with DEP and SFWMD staff on treatment schedules and evaluation of program success. Management activities for the past 20 years have been recorded on Form 454, however only the last 3-4 years worth of data have been archived in a database and much past data have been lost. Data collection, archiving, access, analysis and reporting needs to be improved in order to provide meaningful use of this information and for long-term analysis and comparison. Management success is monitored by USACOE surveys, interagency surveys and the annual FDEP plant surveys. Evaluation relies on informal comparisons of information from each agency, which is not objectively comparable and where record keeping has been inconsistent.

The APC Program research component is charged with conducting research into technologies for controlling certain noxious aquatic plants. Research includes biological control, chemical control, ecological assessment, and management strategies and applications. Funding for cost-shared aquatic plant control operations is not currently authorized.

The USACOE Operations and Maintenance (O&M) program has been responsible for melaleuca control operations and removal of floating island material in project areas. Areas not eligible for treatment through the RAG Project and the APC program benefit through this authority.

The USACOE authorizations for invasive exotic plant management programs are primarily focused on individual species or areas. This hampers the Corps' ability to address new problem species or to act more comprehensively and programmatically to manage and control groups of invasive exotic species throughout an ecosystem. Each new species or area being controlled generally requires that the Corps request additional authorization from congress to deal with that species. Time delays of this nature significantly impact the ability of agencies to effectively manage for invasive exotic species and works to the benefit of the invader.

US Department of Agriculture

Animal & Plant Health Inspection Service – Plant Protection and Quarantine

The USDA-APHIS is the only agency whose chief role is to prevent introductions of

undesirable alien species. This agency has the key responsibility for preventing the introduction of prohibited and new species into the US. Invasive weeds are currently an insignificant part of the interdiction process. Since interdiction and prevention methods are inherently imperfect, USDA must incorporate a plants-as-weeds philosophy into their overall strategy for prevention of the introduction of invasive weeds. This is the only means of stemming the tide of invasive exotic plants being introduced and becoming established. Many harmful exotic species are not excluded from entry, such as many potentially affecting only natural areas.

The agency attempts to inspect approximately 2% of all incoming cargo for prohibited species, of which there are hundreds, but the 2% standard is differentially applied by commodity. For example, out of a shipment of 1000 boxes of cut flowers entering the US, 20 will be inspected assuming that if the 20 samples were taken randomly the statistical chance of spotting a prohibited species would be acceptable. For some commodities statistical models have been developed that suggest 2% is a reasonable sub-sample. However, there appears to be no field verification of these models. The statistical relationships that have been established for this process, do not yet account for differences in commodity type, growing methods and location, and individual pest characteristics. It is also unclear how consistently the 2% sub-sample examination is actually achieved. A system of evaluation of the effectiveness of exclusion and prevention measures was implemented in 1996. However, objective measures of determining pest risk only exist for cut flowers, fruits and vegetables (USDA 1996). Continued entry of harmful species is an indication that interdiction and exclusion are imperfect in absolute terms, and US operations appear to be extremely inefficient. Updating and integrating newer strategies into standards for all commodities with rigorous model verification and field evaluations could probably improve them. It appears that continued pest introductions are attributable to agency deficiencies, conflicting policies and priorities, and the burden of astronomical numbers of possible introductions. Agency mandates for prevention and interdiction are sometimes at variance with other pressing national interests. These delays in preventing the introduction of harmful species may be due to differing agency mandates, as well as agency inability to respond rapidly when new pathways of introduction occur with no regulatory history. One example includes a situation where US trade representatives delayed the implementation of treating raw wood products from China (because of Chinese objections and US concerns of impacting trade with China), the importation of which resulted in the introduction of the Asian long-horned beetle. The beetle is now becoming a serious pest of North American maples and threatens the US and Canadian maple syrup industries (Berenbaum 2000).

Of the Federal agencies involved in invasive exotic species activities, APHIS has the largest role. USDA—APHIS is the pivotal agency on the prevention side of invasive species management. While the agency's programs are substantial and national in scope, the primary focus remains agricultural pests.

APHIS has developed a risk assessment protocol for determining the potential risk a species has for invasion. However, review of the APHIS risk assessment system indicates that species that are not widespread throughout the US (Old World Climbing fern is an example) receive a low priority rating from the assessment. Therefore, this

system cannot be used to determine the priorities for species that threaten regional ecosystems like the Everglades. In addition, as a matter of policy APHIS is currently not using this ranking system to rate and evaluate plants as to their potential invasiveness prior to importation.

Agricultural Research Service

ARS biological control programs are an essential element of any future strategy for managing invasive species in Florida and the US. The current program in Florida has been successful in developing control agents for several species but inconsistent funding and inadequate facilities have hampered the program.

The ARS field office in Fort Lauderdale has directed research toward managing exotic invasive plants in natural areas since the inception of the melaleuca biocontrol research program was instituted in 1989. The melaleuca program has now released two insects and has approval for a third. The two released insects are having dramatic documented affects on melaleuca and seem to be spreading rapidly throughout the melaleuca infestation in Florida. This priority has continued with the additions of skunkvine, Old World climbing fern, and Brazilian pepper. Two additional insects, one for Brazilian pepper and one for Old World climbing fern have been approved and are expected to be released in the near future.

The new quarantine facilities are expected to be on line and operational in 2004 and should help improve not only the capability to handle more insects but improve the time for getting insects tested on target species. USDA has also increased the research budget for the laboratory but has not sought funding for operations and maintenance for the new quarantine facility.

Conflicts arise with biological control programs and insect releases because other agencies have overview and often approval of the overall process leading to the development of biocontrol agents. These conflicts generally occur within the review process conducted by the Technical Advisory Group (TAG). In some cases the conflicts simply result from a lack of coordination or breakdown in direction as to assignments for review of these complex research programs. In other cases there are differences in agency interest or philosophy. These conflicts and time delays appear to be significant enough to warrant review. The inter-agency system for approval of biocontrol agents for release needs to become more efficient and bureaucratic delays only work in favor of the weeds.

U.S. Department Of Interior

U.S. National Park Service - Regionwide

The National Park Service areas in southern Florida include Everglades National Park, Big Cypress National Preserve, Biscayne National Park and Dry Tortugas National Park. The NPS regional office is co-funding with the Florida Department of Environmental Protection invasive exotic control teams that target high priority species in NPS and DEP sites throughout the region. The team priorities are established by the lead agencies in

collaboration with local park or area managers. An important key to their success is the ability of the teams to respond quickly where needed, train local managers how to identify and control species, and to work in locations irrespective of agency ownership or management.

National Park Service – Big Cypress National Preserve

The melaleuca control program closely follows the strategy outlined in the Melaleuca Management Plan for Florida (LaRoche 1999), using the "quarantine strategy," treating smaller populations first, and working toward larger populations. SRF data provides melaleuca coverage and allows for the development of a flexible work plan. For example, new infestations can be targeted immediately. Through the use of an incremental approach, this program has succeeded in controlling all mature melaleuca trees in 186 square miles (first assessed in 1984), in less than 15 years. BICY is currently in the maintenance-control phase for melaleuca within the preserve. Other species, such as Brazilian pepper and Old World climbing fern have not achieved the same control effort or level.

Sufficient funding, clear species priorities, coordination and established tactics and strategies have made the BICY melaleuca management program successful.

National Park Service – Everglades National Park

The HID Brazilian pepper control project aims to remove a minimum of 100 hectares a year. Progress is dependent on funding levels and weather. All Brazilian pepper could be cleared from the HID project in about 20 years. The melaleuca management program at Everglades National Park is one of the oldest in the state. Most other large-scale melaleuca control programs in Florida (Big Cypress National Preserve, South Florida Water Management Districts, etc.) are modeled after the Park's melaleuca control program, which was the first to implement a "quarantine strategy." This system has proved successful – in the Everglades and elsewhere and was used as a basis by FLEPPC to develop the first Florida Melaleuca Plan (LaRoche 1994, LaRoche 1999).

Other species (such as Colubrina) are controlled in localized areas of the Park, although it is not clear how treatment success/failures are tracked. This program is successful in the projects listed above but thousands of acres of infestations are not being controlled. Work progresses in a consistent manner within a project, and Park staff monitors progress closely. However, other problematic, high priority plants (such as Australian pine) are left untreated at melaleuca control sites in the East Everglades. Thousands of acres of Brazilian pepper remain in the remote Ten Thousand Islands, and along many roadsides near Florida Bay. It is unclear how the Park plans to address treatment in these areas. Lygodium is a recent and expanding problem on the west coast and management is currently seriously under funded.

National Park Service – Dry Tortugas National Park

The Park covers over 64,000 acres and only 0.02% (124 acres) of the park comprises extremely remote sand islands supporting terrestrial plants and animals. The smaller

islands or keys are relatively undisturbed, and consist mainly of native species. The two larger islands - Loggerhead Key and Garden Key - have a long history of human influence and have been dominated by exotic plants for many decades.

Garden Key is the site of Fort Jefferson; the largest brick fort in North America and it dominates the key. Most of the exotic species found in the park occur on Garden Key's landscaped fort grounds and on Loggerhead Key, which was under control of the Coast Guard until the early 1990s. Some exotic plants threaten the structure of the fort and are removed by hand.

There is no formal assessment system in place to ensure that these plants are not escaping onto nearby keys. Exotic plant fruits (from species like Surinam cherry and Scaevola) are easily spread by birds, and Dry Tortugas National Park is a favorite "resting spot" for many species of migrating birds.

US Fish and Wildlife Service

The U.S. Fish and Wildlife Service recognizes the importance of invasive exotic plant control, but as of yet, has not fully adopted nor implemented the strategies outlined in the National Invasive Species Council Management Plan. Recent guidelines, however, have indicated a move to adopt the recommendation of the NISC for managing invasive exotic plant species throughout the National Wildlife Refuge System. A recently completed Internet-based invasive species survey indicated severe inadequacies in the NWR system. Those refuges that responded (n = 432) reported problems with 432 non-native plants. However, less than half the refuges that responded lacked basic information such as species lists and/or were lacking basic inventory data (Simonson et. al. 2003). Most refuges were lacking baseline data on non-indigenous plant species indicating a lack of an organized or uniform approach to invasive species management. This is likely tied to a lack of funding and staff, or other priority issues. In Florida, however, the emphasis recently has been to prioritize invasive species management throughout the NWR system, and to adopt strategies and recommendations of the NISC. These strategies include: leadership and coordination development, prevention, early detection and rapid response, control and management, restoration, research, education and public awareness, etc (NISC 2001). The invasive exotic plant management issue has become a much higher priority in Florida because of the extreme susceptibility of South Florida habitats to invasion by non-native pest plants second only to Hawaii.

A.R.M Loxahatchee NWR is one of the few refuges in Florida to boast an established exotic plant management program. Being that Loxahatchee NWR is the last remnant of the northern Everglades Ecosystem, and a key component of the CERP, A.R.M. Loxahatchee NWR has benefited recently from funding increases through special Congressional Appropriations that have permitted the exotic plant management program to expand. These funding increases have permitted refuge management and staff to implement the Integrated Pest Plant Management Plan (2001). This plan identifies and prioritizes management of key exotic plant species such as melaleuca and Old World climbing fern. The plan incorporates management strategies outlined in other successful state-developed exotic plant management plans. The IPPMP stresses management of

invasive exotic plants using an IPM approach including chemical, cultural, biological and physical controls, and raising public awareness. Other important components of Loxahatchee's exotic plant management program include collaborative partnerships with other local, state (DEP/SFWMD), and Federal agencies (NPS/USDA), and a monitoring and research component. Theoretically, this should permit staff to effectively manage problem species such as melaleuca and Old World climbing fern that currently infest over 70% of refuge lands. A special Congressional Appropriation of $ 4 million should permit the refuge to complete initial treatments of all exotic plants on the lower half of the refuge. Other management techniques such as biological controls and prescribed fire will be used to maintain areas where exotics have been treated. Additionally, A.R.M. Loxahatchee NWR recently requested annual funding of $ 2 million per year to effectively manage invasive exotic pest plants. The refuge's Comprehensive Conservation Plan (2000) identified a need for $3 million annually for control of invasive exotic plant species, and incorporates a goal of meeting 'maintenance control' of the major pest plant species by the year 2017.

Other NWRs in South Florida are also addressing exotic plant species, but not to the extent of A.R.M. Loxahatchee NWR. The exotic plant program at J.N. "Ding" Darling NWR demonstrates that cooperative programs with local governments (City of Sanibel Island) and other conservation organizations can successfully augment an established exotic plant control program. The U.S. Fish and Wildlife Service provides small grants for non-Federal landowners for exotic plant removal. Although limited in annual funding, this program has created partnerships that have benefited Federal and non-Federal lands. Current funding levels are not adequate to support the exotic plant management program. Funding needs have been identified, but these requests have not been addressed.

In addition, the FWS has recently approved the formation of a FWS Invasive Species Strike Team. Like the NPS Exotic Plant Management Teams, the Service's ISST will incorporate early detection and rapid response to new exotic plant threats, and will provide guidance and oversight concerning exotic plant management to all Florida refuges. This program will also rely on the NWRs vast cadre of volunteers to identify, map, and/or treat new exotic plant infestations or threats. The ISST will also partner with the FL-DEP in hopes of acquiring dedicated exotic control matching funds for control operations.

STATE AGENCIES

Florida Fish and Wildlife Conservation Commission

No actions are currently being taken to determine the overall exotic plant problem on Commission-managed lands and no methods are currently being used to assess the extent of invasion. No resources are specifically allocated or dedicated for exotic plant management, and appear to be local reallocations from other programs. Without dedicated funding Commission exotic plant control efforts are piecemeal at best. Exotic plant control efforts are based more on individual efforts and not a commission-wide approach or program. The only program for weed control that is separately identified is

the Grass Carp Program.

Only $86,000 was spent to control exotics on 4.5 million managed acres in FY'98. The level of funding required to bring exotic plants under control on Commission lands is not clear.

The Commission's activity occasionally conflicts with exotic plant control efforts in that some exotic plant species (such as hydrilla and kudzu) are considered by some agency personnel to provide fish and wildlife habitat and food. The Commission has also used exotic introductions, as with the Peacock Bass (that consequently have become invasive), to develop urban fisheries and promote recreational activities.

Florida Department of Environmental Protection – Bureau of Invasive Plant Management – Upland Plant Control Group

The FDEP Regional Working Group program has taken an important step in reaching out to, coordinating, and supporting local governments and land management agencies faced with various exotic plant management issues. This program may serve as a model for developing coordination among agencies and land managers statewide. The established regional working group system allows land managers to assess plant problems on their lands within specified regions and prioritize projects at local levels.

An objective of FDEP's long-term program is to reduce invasive exotic plants on public lands by 25% by 2010 based on an acreage estimate of 1.5 million exotic plant acres. This calls for the control of approximately 34,000 acres a year. However, there appears to be no assessment or monitoring of programs to evaluate effectiveness or success. Should, for example, an individual project not maintain control and is re-infested (or invaded by another exotic plant species) by 2010 (when the proposed mapping program is to be established) the program will be unable to determine program effectiveness for the first 10 years of activity.

FDEP's charge is to "bring invasive exotic upland plant species under maintenance control." The regional working group program asks that funding for follow-up monitoring and maintenance be "reasonably documented as available" by the partner. The regional partner in the proposal may establish a maintenance control goal, but required maintenance and follow-up in later years is not specifically addressed or mandated.

Through the prioritization process, regional working groups may rate projects that implement integrated management higher but this does not appear to ensure that work among projects is integrated. It is unclear if funded projects will remain or become long-term or if once maintenance control is achieved that funding at that level will continue.

The FDEP program points to a need to develop a system to map exotic plants. It's not clear if this effort will be statewide, or will focus within regional working group agency sites and proposed project areas only.

Regional working group projects are not appraised from a statewide perspective. Each

regional working group is allocated an equal number of funded projects—overall acreage affected in the area is not taken into account—irrespective of any real or perceived statewide priority. Additionally, ranking systems vary from region to region, diminishing consistency among groups.

Florida Department of Environmental Protection – Bureau of Invasive Plant Management – Aquatic Plant Control Group

FDEP is the designated lead state agency for permitting and funding aquatic plant control in Florida. This program funds aquatic plant control projects on public water bodies statewide and includes funds from FDEP and the US Army Corps of Engineers.

There are 460 designated lakes and navigable rivers eligible under this program, out of over 8,000 statewide that account for about 80% of the open water surface in Florida. This program has been effective in coordinating and centralizing aquatic plant control activities among participating agencies. Any control of aquatic plants on the remaining 8,000+ water bodies is the responsibility of local governments, water control districts, homeowner's associations and private landowners. Most of these are small (<10 acres) lakes. Treatment under the DEP program is sometimes authorized for connecting private water bodies if there is a danger of plants moving into state waters. When a state water body is separated from the private water body by a structure, DEP does not consider treating the adjacent area. Thousands of miles of weed infested agricultural canals are not included in this program.

"Maintenance-control" is FDEP's ultimate goal in aquatic plant management. Water hyacinth has been under "maintenance-control" on participating water bodies for more than a decade. Hydrilla populations have fluctuated widely over the past 15 years, primarily due to funding inconsistencies. When funding increases, hydrilla coverage decreases and vice versa. Hydrilla infestations are currently under "maintenance-control".

DEP regional biologists recommend treatment schedules and assess treatment success. Cooperators are required to record control data and report successes or failures for individual control programs or sites. Annual surveys allow FDEP to assess populations for a site or region (including early detection), establish general trends, and determine costs for treatment.

Base funding is supplied by state gas taxes. (The US Army Corps of Engineers provides some Federal funding for this state program). FDEP cites "chronic deficient funding" as a limitation to this program. However, this is the best-funded exotic plant control program in the state. In fiscal year '98, $14 million dollars were spent to control water hyacinth, hydrilla and water lettuce. FDEP estimates that it needs a total of $22 million annually to properly fund the control programs in public waters for these three species and an additional $3 million annually to begin controlling other FLEPPC Category I aquatics like torpedo grass, catclaw mimosa and wild taro, in public waters. No estimate has been made regarding costs for treatment of currently untreated areas.

Herbicides are the major control approach. Other control options like drawdowns, fire, flooding, biocontrol agents, etc. are generally not considered for funding. The use of herbicides in aquatic situations sometimes leads to conflicts with anglers. There are misperceptions about the use of herbicides in water, and some anglers consider certain exotic plants (like hydrilla) beneficial to fisheries. Some serious disagreements with anglers has stopped control programs and led to major reinfestation of some large lakes with hydrilla. Draw downs used to control exotic plants also impact neighboring properties. For example, a draw down on Alligator Lake was halted because of concerns of draining nearby aquaculture ponds.

Florida Department of Agriculture - Division of Recreation and Parks

The Florida Park Service has clearly identified exotic plants and their control as a high priority in their overall planning efforts and is moving forward with their invasive species control efforts. A recently completed 5-year exotic invasive species strategic plan that includes plants and animals adds significantly to the existing program and is helping the FPS develop longer-term strategies for exotic species programs. In spite of these gains FPS exotic strategy is still primarily an internal agency approach and focuses on individual sites or species.

As an agency the FPS manages some of the last remnants of Florida's natural history making their role an extremely important one in natural areas management. Many of Florida's state parks are heavily impacted by exotic species. Future FPS efforts and programs will need significant increases in funding and support and integration into the larger FDEP and Florida-wide effort in order to help achieve stated goals. Coordination of exotic plant control among FDEP agencies would improve FPS programs significantly as the Bureau of Invasive Plant Management has a stronger and better-organized program and staff dealing with invasive plants.

Florida Department of Transportation

Roadsides are common weed corridors. There is no method in place to determine the overall exotic plant problem on the state's roadsides. While FDOT is proposing implementing a $200,000 pilot project to inventory exotic plant species in 10 counties in southern Florida there appears to be no consideration of the integrated needs statewide for such inventory methods development. Other agencies have also proposed such projects. If a number of independent distribution and detection projects are developed the agencies will simply be continuing the current piecemeal approach to managing invasive exotic plants, one agency and one project at a time.

There is no official FDOT policy or plan on how to deal with exotic plants on Florida's roadsides. FDOT districts are encouraged to work with adjacent property owners in exotic plant control efforts, but it is unclear what percentage of projects takes advantage of this cooperation. Funds used to control invasive exotic plants are not tracked separately from other general vegetation control activities. FDOT estimates that less than 20% of the vegetation control budget is spent on exotic plant control. Conflicts can

arise when one branch of an individual district conducts plant control operations and another branch of the same district re-plants roadsides with exotic ornamental plants.

Florida Water Management Districts

The Water Management Districts have mixed levels of invasive plant management programs and funding. This appears to be due to two main reasons. First, each district is essentially autonomous and self-funded and therefore, the level of each program is generally dictated by the size of the district, and its resource base. Second, until establishment of the Inter-District Exotic Plant Management Committee, each district had varied levels of qualified personnel to both understand the issues with invasive species and actually develop an effective control program for those species. In addition, internal agency conflicts between agency branches or groups sometime caused delays in management actions. The Inter-District Committee is becoming quite effective in two principal ways: first, there is awareness of the seriousness of the issue being generated within districts that heretofore did not either understand the problem, or simply were unaware they had a problem at all; second, shared knowledge and resources appear to be helping all the districts begin to address this issue. For example: St. Johns River Water Management District is paying for the Standard Assessment Method (SAM) development but it was identified by all districts as a need and is supporting all districts.

There is no statewide policy or plan on how the districts as a whole should deal with exotic plants. While the Inter-District Committee formed as a result of a multi-district review process is making good progress toward developing unified approach to management of invasive exotic plants across all districts.

Overall, three of the Water Management Districts have strong exotic plant management programs and provide effective leadership, funds and support to many other cooperating agencies. Since these Districts play lead roles in exotic plant management programs statewide, improved coordination and consistency would offer both the Districts and other cooperators a significantly better program statewide.

APPENDIX E

U. S. FISH AND WILDLIFE SERVICE

PLANNING AID LETTER

United States Department of the Interior

FISH AND WILDLIFE SERVICE
South Florida Ecological Services Office
1339 20th Street
Vero Beach, Florida 32960

March 10, 2005

James C. Duck
Chief, Planning Division
U.S. Army Corps of Engineers
Post Office Box 4970
Jacksonville, Florida 32232-0019

Attention: Susan Conner

Dear Mr. Duck:

The Fish and Wildlife Service (Service) has prepared this Planning Aid Letter (PAL) in support of the Melaleuca Eradication and Other Exotic Plants Project of the Comprehensive Everglades Restoration Plan (CERP), as authorized under the Water Resources Development Act of 2000 (Public Law 106-541). The Melaleuca Eradication and Other Exotic Plants Project is an Other Project Element as indicated in the 1999 Central and Southern Florida Project Comprehensive Review Study designed to address invasive species management and control in southern Florida.

The Service has been involved in early project planning meetings coordinated by the U.S. Army Corps of Engineers (Corps) which included participation by the U.S. Department of Agriculture (USDA), Agricultural Research Service (ARS) and the South Florida Water Management District (District). Comments included in this PAL are based on project documents, including the Draft Final Project Management Plan (PMP) for the project dated July 2004, along with data from the ARS field office in Fort Lauderdale on invasive plant biological control programs. This PAL also reflects the direct involvement by Service personnel with PMP preparation, numerous informal planning meetings held prior to Project Delivery Team (PDT) formation, and the initial PDT kick-off meeting. In addition, the Corps should reference the Service's May 6, 2004, Draft Planning Aid Report - Part 2 on the Initial CERP Update regarding system-wide fish and wildlife resource issues such as the spread of invasive exotic plant species and a discussion of nonindigenous species impacts relevant to the CERP.

This letter is provided in accordance with the Fish and Wildlife Coordination Act of 1958, as amended (FWCA) (48 Stat. 401; 16 U.S.C. 661 *et seq.*) and the Endangered Species Act of 1973, as amended (ESA) (87 Stat. 884; 16 U.S.C. 1531 *et seq.*). This letter does not constitute the report of the Secretary of the Interior as required by section 2(b) of the FWCA, nor does it constitute a biological opinion under section 7 of the ESA.

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Project Background

The Melaleuca Eradication and Other Exotic Plants Project is currently composed of a two-part plan that includes: (1) Mass rearing, field release, establishment and field monitoring of approved biological agents throughout south Florida; and (2) Preparation of a *Special Report on Invasive Species* to further identify the overall problem with exotic invasive plants and provide a recommendation regarding further Federal interest. The *Special Report on Invasive Species* is also being supported by the South Florida Ecosystem Restoration Task Force (SFERTF) and Working Group through the Noxious Exotic Weed Task Team (NEWTT) and the Florida Invasive Animal Task Team.

The Environmental Law Institute report entitled, "Filling the Gaps: Ten Strategies to Strengthen Invasive Species Management in Florida," was published August 2004. This report was commissioned by the Corps through the CERP as part of the *Special Report on Invasive Species* for inclusion in the Initial CERP Update. *Filling the Gaps* provides a comprehensive overview of the Federal legal framework affecting invasive species management in Florida, with particular focus on the Everglades. The study is an evaluation of the strengths, weaknesses, and gaps in existing legal authorities and the development of concrete recommendations to strengthen invasive species policy in Florida. The report analyzes weaknesses and conflicts, as well as opportunities, in the Federal and State legal framework for invasive species management in Florida. Recommendations are included that can be implemented not only by Federal agencies, but also at all levels of government.

Implement Biological Agents

The purpose of this project is to increase the effectiveness of biological control technologies to manage melaleuca (*Melaleuca quinquenervia*) and other invasive exotic species. The first part of the project will be executed in cooperation with the District and calls for the mass rearing, field release, establishment and field monitoring of approved biological control agents for melaleuca and other exotic plants such as Old World Climbing fern (*Lygodium microphyllum*) and Brazilian pepper (*Schinus terebinthifolius*). Periodic monitoring will be conducted to quantify the impact of a particular insect upon exotic plants, thereby evaluating the effectiveness of the biological control agent. Sampling methods will be developed to recover insects for re-release or observation and to estimate the population of insects in the field.

This part of the project, to implement biological control agents, will be addressed in a future Project Implementation Report.

Special Report on Invasive Species

The second part of the project is the preparation of a Special Report that will further identify the problem with invasive exotic species and will provide recommendations regarding further Federal involvement. In 1999, the NEWTT was established by the SFERTF and Working Group to respond to the need for acting on invasive weed problems threatening Everglades restoration.

NEWTT was directed to develop an assessment of the problem and a strategy to approach dealing with the problem. NEWTT published the assessment and strategy in 2002 under the title "Weeds Won't Wait." As a result of their participation in the SFERTF and the understanding that invasive species threaten the successful implementation of the CERP, the Corps authorized the preparation of a Special Report that incorporates the "Weeds Won't Wait" document prepared for the Working Group. The Special Report is being developed by the Corps and the Department of the Interior (100 percent federally funded) and will be a reconnaissance type report that will identify any Federal interest, identify a potential sponsor, and develop a plan for further efforts.

Uniform Terminology

A consensual set of definitions regarding bioinvasions is essential in order to facilitate discourse among the science, policy, and management communities dealing with the issue. The terms employed vary among scientific disciplines, linguistic and State/National borders, or are applied in different ways, and frequently constitute synonyms, partial synonyms and neologisms that can hinder or confuse communication. To avoid confusion, the Service recommends that the definition used in Executive Order 13112 – Invasive Species, be used to define an invasive species in the PMP document. An "invasive species" is defined as a species that is: (1) non-native (or alien) to the ecosystem under consideration; and (2) whose introduction causes or is likely to cause economic or environmental harm, or harm to human health (Executive Order 13112). Invasive species can be plants, animals, and other organisms (*e.g.*, microbes).

Invasive Plant Characteristics Relevant to CERP Projects

Many invasive plant species grow and spread aggressively following various types of disturbances. Some of these species, once established, have been observed to spread from disturbed sites into undisturbed areas. Common characteristics of Florida invasive plants include: (1) they are habitat generalists, able to invade a wide range of sites; (2) are early germinators and leaf out before native plants; (3) may out-compete native species, particularly in disturbed sites, becoming dominant or even becoming a monoculture; (4) have adaptations such as toxins or thorns that render them unpalatable; and (5) have long flowering and fruiting periods with large quantities of seeds produced. The most troublesome are those that persist as dominants for years or decades, and alter plant communities and ecosystem functions.

Although many exotic species more readily invade disturbed sites, several species such as melaleuca, are not restricted only to areas of disturbance. Melaleuca is a pioneering species and has been spreading since its introduction. In its native range, it grows in low lying flooded areas and is especially well adapted to ecosystems that are periodically swept by fire. These are the conditions that are common to most of south Florida, making it ideal habitat for melaleuca. It is only now after intensive control efforts by State, Federal, and private entities that we are observing a decline in melaleuca-infested acreage.

Potential Invasive Species Impacts

Invasive plant species have impacted the quality of south Florida landscapes. Non-native ("invasive") plant species, such as melaleuca, Australian pine (*Casuarina equisetifolia*), Old World climbing fern, Brazilian pepper, torpedo grass (*Panicum repens*), and hydrilla (*Hydrilla verticillata)* have invaded large portions of the south Florida ecosystem. The increasing dominance of any community by a single species ultimately reduces the habitat variability necessary to sustain a healthy community of both plants and animals. Water management has encouraged the spread of these invasive species by creating conditions under which they can out-compete the native habitat that existed under pre-drainage conditions. For example, high phosphorus loads and increased hydroperiods have contributed to cattails (*Typha* spp.), a native invasive species spread by anthropogenic activities, out-competing sawgrass; altered hydrologic regimes have increased the spread of melaleuca and Brazilian pepper; and the construction of levees has contributed to the spread of Australian pine and Brazilian pepper. This occupation has resulted in the displacement of native species and/or the degradation of habitat essential to native plants and animals. Aerial and other types of surveys reveal the proliferation of exotic plants has resulted in the formation of melaleuca monocultures in some areas of the Water Conservation Areas (WCA). Surveys also show their occurrence throughout most areas east of the WCAs, particularly those that may be included as Water Preserve Areas. Even when these plants do not occur in natural areas, they act as seed sources and pose a threat to natural areas.

The Everglades and other habitats of south Florida are susceptible to enormous stress from the invasions of exotic plants. Exotic weed species such as melaleuca and Brazilian pepper are but 2 important and successful invaders (of 126 plant species listed as invasive) of natural Everglades communities (Florida Exotic Pest Plant Council 2003). Old World climbing fern is native to wet tropical and subtropical regions of Asia, Africa, and Australia. It has become a serious threat to south Florida natural areas, especially the Everglades, where it is increasing in density and range. New populations, presumably from wind-borne spores, are constantly being reported by natural resource managers and private landowners throughout the southern peninsula. Old World climbing fern may dominate many native plant communities in south and central Florida within the next decade (Ferriter 1999).

The spread of invasive plants impacts native plant communities and ecosystem functions. As invasive plants take the place of native plants, plant communities and associated habitat functions are altered and wildlife habitat and biodiversity is reduced. Ecosystem functions are being impacted through changes to a variety of components including hydrology, chemistry, and fire behavior, and the overall values of our natural resources are decreasing. The dominance of invasive plants degrade ecosystems in several ways: (1) some species alter soil chemistry, inhibiting the growth and germination of other species; (2) invasive species may interfere with natural nutrient and water cycles, creating secondary impacts to other plants and the ecosystem; (3) some invasive species alter the fire cycle and the characteristics of fires within an ecosystem; and (4) these changes to ecosystems alter plant communities, wildlife habitat, and ecosystem functions.

Eliminating the invasive and exotic species and the conditions that favor these species will contribute to restoration of native plants and animal species and a more natural ecosystem hydrology and function. Control or eradication of invasive exotic plants is necessary to improve and protect habitat quality and heterogeneity. Exotic plants have the potential to thwart any restoration attempt if not controlled.

The Multi-Species Recovery Plan and Exotic Species

The South Florida Multi-Species Recovery Plan (MSRP) is an ecosystem-based recovery plan to restore and maintain the biodiversity of native plants and animals, as well as the threatened and endangered species of south Florida (Service 1999). The MSRP provides the biological and ecological framework for a proactive approach toward the conservation and sustainability of biodiversity within south Florida.

Ecological restoration in the broad sense is defined as any activity which improves the overall ecological condition of a natural community or disturbed site. It includes both ecological restoration *sensu strictu*, the return of a community or ecosystem to a pre-disturbance condition, as well as the creation of an ecosystem *de novo* when it uses a historic natural community as a model. Restoration activities may involve biological or hydrological manipulation, repatriation of extirpated or nonviable native species, control and elimination of invasive or damaging non-native (exotic) species, and clean up of environmental contaminants (Service 1999).

Because the MSRP includes multiple species, there was a need to include tasks at the community level that are also necessary for species recovery. In the MSRP, restoration criteria are established at the community level with community-specific restoration actions. Community-level restoration actions, following each ecological community, equate to recovery actions for the federally listed species. These actions are the tasks needed at the community/ecosystem level to restore the structure, function, and biological composition of a particular ecological community, to the extent possible. The enclosed table lists the ecological communities and community-specific restoration actions directly associated with exotic species restoration actions. One of the most significant recovery actions identified in the MSRP is control of invasive exotic species such as melaleuca, Brazilian pepper, Australian pine, and Old World climbing fern. Sixteen ecological communities (18 total with 2 aquatic communities) associated with south Florida, identify restoration of the ecological community (*i.e.*, functions, processes, etc.) to include control of exotic plants (and animals in some communities) before they become established. In addition, funding and support for eradication and control of exotic pest species is identified as a community-level restoration action along with monitoring of land management actions to determine their effectiveness with changes made to management activities as appropriate (adaptive management).

Development of the CERP Monitoring Plan Related to Exotic Species

Conceptual ecological models developed for the major physiographic regions in south Florida provide the scientific basis for the development of the CERP system-wide monitoring design and

adaptive assessment process. The conceptual ecological model process provides a planning tool for translating the overall restoration goals of the CERP into the specific performance measures that will be used to plan, design, and assess the success of the plan. Specifically, the process of developing the conceptual ecological models was designed to meet the following purposes:

1. Illustrate the ecological linkages between the physical, chemical, and biological elements in specific physiographic regions of south Florida.

2. Develop a suite of causal hypotheses linking the most important physical stressors with the major ecological effects as a basis for predicting responses to the CERP's restoration projects and other restoration efforts.

3. Create a set of measurable indicators of success (*i.e.*, "performance measures") as a basis for assessing how well the projects achieve system-wide goals that have been established for the CERP.

Six of the 11 conceptual ecological models (*e.g.*, Loxahatchee Watershed, Lake Okeechobee, Big Cypress Regional Ecosystem, Everglades Mangrove Estuaries, Southern Marl Prairies, and Everglades Ridge and Slough) developed for the major physiographic regions in south Florida, identify exotic plants (and exotic animals in some models) as a source or driver, stressor, or ecological effect or a combination source and stressor. The other five conceptual ecological models encompass aquatic habitats such as bays or estuaries located in south Florida. A driver or source is a major external force having large scale influences on natural systems. Stressors are the physical or chemical changes that occur within natural systems that are brought about by the drivers, and which cause significant changes in the biological components, patterns and relationships in natural systems. Ecological effects are the biological responses caused by the stressors.

A Total System Conceptual Ecological Model is being developed by the CERP Restoration Coordination and Verification (RECOVER) team to represent the ecological linkages among the major working hypotheses and cause-and-effect relationships that explain the important consequences of system-wide stressors on the south Florida ecosystem. These stressors, which include altered hydropatterns, **exotics and invasive species**, excess nutrients, mercury contamination, compartmentalization, loss of spatial extent, sea level rise, water management practices, and changes in land use patterns, will be complementary to those stressors identified in the set of regional conceptual ecological models described above.

The Total System Conceptual Ecological Model integrates system-wide hypotheses that are common to several or all of the regional models, identifies stressors and ecological effects that have not been adequately characterized in the regional models due to their spatial and temporal scales, and identifies important downstream effects of altered hydrological conditions across the boundaries of adjacent regional models. These 11 regional models and the Total System Conceptual Ecological Model provide a basis for developing performance measures for

evaluating alternative restoration plans, for designing a performance-based monitoring program, and for adaptive assessment of the south Florida ecosystem restoration programs (RECOVER 2004). The attempt in creating the Total System Conceptual Ecological Model was to identify the working hypotheses that explain the major ecological changes that have occurred at the larger scale or system-wide of the Greater Everglades Ecosystem such as exotic plant and animal invasions. The presence of exotic plants and animals has been identified as one of several factors that preclude any serious consideration of achieving true restoration of the natural system (Corps and District 1999).

Performance measures for exotic species have yet to be developed for the Total System Conceptual Ecological Model. The performance measures for exotic species could include evaluating the distribution, abundance, and diversity of exotic invasive plants within watersheds or regions. The target is to decrease the abundance of, or eliminate, these species within the system. Presence and distribution of these species need to be continually monitored as means to focus control efforts and to develop a better understanding of factors that contribute to their spread.

Preliminary Observations from CERP Picayune Strand Restoration Project (formerly known as Southern Golden Gate Estates Hydrologic Restoration), Prairie Canal Early Start Project

The long-term goal of the Picayune Strand Restoration Project (PSRP) is to return the hydrology of the area downstream of pumps and spreader canals to a condition comparable to that which existed prior to drainage. The combination of a restored hydrologic regime, a restored fire regime, and an appropriate exotic vegetation control program can be expected to return the PSRP area to its pre-drainage character, including the plant communities and wildlife that it supported at that time. It will be important to continually monitor for the presence of exotic/invasive plant species and implement control measures while their populations are still small and manageable. Initial observations of the Prairie Canal Early Start Project indicate that invasion of Brazilian pepper seedlings on substrates that have been disturbed by restoration activities and fire (in the presence of seed source) will be a primary concern. The managing entity, the Florida Department of Forestry, does not currently have sufficient staff or funds to control exotic plants (and some exotic animals) on the project site.

Scope of Current CERP Invasive Plant Species Management Program

Research on biological controls of invasive exotic plants is a necessary part of any long-term planning to bring invasive exotic plants under maintenance control, and to meet the challenges of cost-effective invasive exotic plant management on public lands. Lack of quarantine space for testing biological control agents has impeded research and testing. The new USDA bio-control quarantine facility in Davie, Florida, will greatly aid in evaluating potential biological control agents.

In recent years there has been promising research involving the control of melaleuca in the Florida Everglades ecosystem using biological control agents. Two biological control agents have been released to aid in the suppression of this species. The melaleuca snout beetle (*Oxyops vitiosa*) attacks young foliage of the melaleuca tree and was introduced to south Florida in 1997. Today, millions of the beetles occupy melaleuca stands in the Everglades and throughout south Florida, cutting seed production by up to 50 percent (Florida Department of Environmental Protection 2003). More recently, the melaleuca psyllid (*Boreioglycaspis melaleucae*), a sap feeding insect, was released in the spring of 2002. Feeding damage from these two insects is reducing melaleuca reproduction and seedling establishment (Pratt et al. 2004). Additional melaleuca bio-controls, as well as the first bio-controls for Brazilian pepper and Old World climbing fern, have recently been approved for release in Florida.

A key component of an effective and long-lasting invasive plant management program is the introduction of biological control agents. Without biological control, invasive species removal will be much more expensive and could not be truly integrated. However, relying solely on biological control will not effectively control invasive species spread.

General planning objectives should include a reduction in the spatial extent of invasive plant species to reduce their effect on natural systems.

To deal adequately with the problem of invasive species, a multi-stage approach is required, comprising of risk assessment, prioritization of the problems, and control action. Consideration should be given to the following:

1. Community Type Potentially Affected - Assess how resistant or susceptible the community is to invasion by the species in question.

2. Effect on System - Assess how significantly the exotic changes species composition or habitat structure suppresses regeneration and persists over time (life-span).

3. Biological Success Rating - Include an assessment of maturation rate, seed/spore production, seed viability span, means of dispersal, establishment and growth rate, importance of vegetative reproduction.

4. Additional Information - Including increase in fire risk, competitive ability, resistance to management.

The ability of most CERP projects to reduce exotic vegetation should be based on the assumption that an Exotic/Invasive Species Management Plan will be developed and implemented as part of the selected alternative. This management plan should have three components: (1) best management practices to implement during construction activities that reduce the spread of exotic plants; (2) initial aggressive treatment and management of substrates that are disturbed where invasive plant seedlings are evident; and (3) extensive site

management activities by the land manager. Without such a plan, exotic vegetation would re-infest the project area and the existing condition would persist and worsen. Old World climbing fern should be added to the Corps' list of targeted invasive plants so that funds can be allocated for its control. Goals should include achievement of "maintenance control" status for Brazilian pepper, melaleuca, Australian pine, and Old World climbing fern in all natural areas of south Florida.

Invasive plant species have colonized impacted ecosystems faster than originally expected. In addition, the piecemeal incorporation of invasive species components into individual projects leaves significant unmanaged areas. Therefore, invasives simply reinfest project areas when work is complete. Finally, many project components addressing invasives are removed from CERP projects when in the planning design and implementation phases of projects.

There is a significant question as to whether rehydration will act as the primary control mechanism for some invasive plant species, especially in the short term, or whether more intensive management activities may be necessary on a short or long-term basis. Additionally, management/control activities, or a lack thereof, may affect federally listed species.

Potential Construction-Related Effects

The spread of invasive plants tends to increase in response to activities that disturb the soil and native plants. CERP projects include a wide variety of construction activities including new or modified water control structures, pump stations, spreader swales, stormwater treatment areas, flowways, levees, culverts, and backfilling of canals along with a combination of above ground and in-ground reservoirs. Each one of these specific project features creates bare ground or soil disturbances creating ideal environmental conditions that promote invasive plant germination and establishment.

The Service strongly recommends best management practices that minimize the spread of invasive species be required as a part of all construction activities and that sufficient funding be provided for control and follow-up monitoring of invasive plant species that do arise subsequent to CERP restoration activities.

Recommendations for Further Federal Involvement and Invasive Species Program Development

Prevention is by far the most important measure for controlling the spread of invasive species. Once plants become established, their removal and even just control has proven very difficult and costly. Many infestations require multiple control efforts each year and for several years. Early detection of an infestation and early and aggressive application of control methods are the most successful and by far least costly in time and expenses. Invasive exotic plants are one of the greatest long-term threats to the Everglades ecosystem.

The Service believes that a comprehensive invasive exotic plant control program that includes monitoring activities designed to map the distribution and abundance of exotics throughout south Florida should be developed and implemented to control and eventually remove invasive exotics from natural habitats. An exotic species control program should be developed and funded that is geographic (*i.e.*, watershed-based) or programmatic in scope. The program should prioritize the most sensitive resources in each geographic location for exotic species control efforts, identify critical areas where strategic exotic species control would maximize ecosystem benefits, and consider the special overlap with proposed hydrological restoration areas to determine funding priorities. Integrating invasive plant management into the overall ecosystem restoration activities is essential to create sustainable native plant communities and bio-diverse ecosystems.

The Service appreciates this opportunity to provide guidance and recommendations to the Corps regarding the Melaleuca Eradication and Other Exotic Plants Project and the future direction of invasive plant management as a component of Everglades restoration. As a member of the team, we look forward to continuing to provide technical support to the Corps during all phases of the project. If you have any questions regarding the contents of this PAL, please contact Art Roybal at 772-562-3909, extension 317.

Sincerely yours,

James J. Slack
Field Supervisor
South Florida Ecological Services Office

Enclosure

cc: w/enclosure

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Enclosure

Ecological Communities Identified in the 1999 Fish and Wildlife Service Multi-Species Recovery Plan in Need Of Exotic Species-Related Restoration Actions

Ecological Communities	Community-Level Restoration Actions	Community-Specific Restoration Actions
High Pine	2. Restore existing degraded high pine communities. 3. Maintain high pine communities in a natural condition in perpetuity.	2.3. Eliminate or control exotic and off-site species. 3.2. Continue to control exotic species.
Florida Scrub (Including Scrubby Flatwoods and Scrubby High Pine)	2. Restore existing degraded scrubs.	2.3 Eliminate or control exotic and off-site species.
Beach Dune, Coastal Strand and Maritime Hammock	1. Prevent further destruction or degradation of existing beach dune/coastal strand/maritime hammock communities. 2. Restore existing degraded beach dune/coastal strand/maritime hammock communities.	1.1. Prevent colonization by Australian pine of newly deposited or storm-denuded coastal areas in public ownership by regularly scheduled pulling of Australian pine seedlings. 2.1. Restore native maritime hammock communities at coastal areas dominated by invasive exotic species, such as Australian pine forests, by introducing seeds or seedlings of native woody species in the understory if they are not already present, and by killing the exotic species with hand-administered herbicide application. 2.2. Restore coastal strand communities in areas dominated by invasive exotic species.
Mesic Temperate Hammock	1. Protect intact mesic temperate hammocks from further degradation. 2. Restore existing degraded mesic temperate hammocks by active management. 2.1. Restore ecosystem function. 3. Maintain mesic temperate hammocks in a natural condition.	1.1. These activities will preserve the interrelationship of mesic hammocks with adjacent natural communities, as well as provide opportunities for better control of direct impacts, such as grazing, exotics invasion, vehicle use, and development. 2.1.2. Eliminate or control exotic species. 3.1. Continue exclusion or eradication of exotic plants and animals, including hogs and cattle. 3.2. Monitor status of native plant and animal species for negative trends and potential extirpations.

Enclosure

Ecological Communities	Community-Level Restoration Actions	Community-Specific Restoration Actions
Tropical Hardwood Hammock	2. Restore existing degraded tropical hardwood hammocks through active management. 3. Maintain tropical hardwood hammocks in a natural condition in perpetuity. 8. Monitor land management actions. All management actions should be monitored to determine their effectiveness, and changes should be made to management activities as appropriate. Managers should have a plan for monitoring relative population levels of selected plant and animal species.	2.4. Eradicate exotic plants and control exotic animals. Develop control programs that eliminate, to the extent possible, exotic plants and animals from tropical hardwood hammocks, including outlying populations. 3.4. Continue to monitor for and control exotic plant and animal species, especially outlying populations before they become established.
Pine Rocklands	1. Prevent further destruction or degradation of existing pine rocklands. 2. Restore existing degraded pine rocklands through active management. 3. Maintain pine rocklands in a natural condition in perpetuity. 8. Monitor land management actions. All management actions should be monitored to determine their effectiveness, and changes should be made to management activities as appropriate. Managers should have a plan for monitoring relative population levels of selected plant and animal species.	1.4. Prevent degradation of existing preserves containing pine rocklands. Work with Federal, State, county, and municipal agencies and non-governmental organizations to prevent further degradation of existing preserves from exotic plant and animal species (including feral and domesticated pets). 2.4. Control exotic plants and animals. Develop control programs that eliminate, to the extent possible, exotic plants and animals from pine rocklands, including outlying populations. Ensure that control measures are not deleterious to native species. 3.4. Continue to monitor for and control exotic plant and animal species.
Mesic Pine Flatwoods	3. Manage/enhance mesic pine flatwoods on public lands.	3.9. Control exotic plants and animals.
Hydric Pine Flatwoods	3. Manage/enhance hydric pine flatwoods on public lands. 7. Perform additional research on hydric pine flatwoods.	3.9. Control exotic plants and animals. 7.9. Re-examine the "empty-niche" ecotonal theory of melaleuca invasion in southwest Florida, relative to human-altered and natural hydric pine flatwoods.
Dry Prairie	3. Restore existing degraded dry prairies.	3.3. Eliminate or control exotic and off-site species.
Cutthroat Grass Communities	3. Restore existing degraded cutthroat grass communities.	3.3. Eliminate or control exotic and off-site species.

Enclosure

Ecological Communities	Community-Level Restoration Actions	Community-Specific Restoration Actions
Freshwater Marshes and Wet Prairies	3. Support and increase funding for eradication and control of exotic pest species. Funding and support is required to continue to control the expansion of exotic pest species of aquatic plants, trees, and animals in wetlands. In particular, follow-up field studies of the effectiveness of biological control agents for melaleuca will require significant funding. Expanded quarantine facilities to permit more elaborate and detailed evaluations of other biological control agents are severely needed. Finally, some significant effort must be made to coordinate the agencies and inform the public regarding the elimination of exotic species of plants and animals.	
Flowing Water Swamps	2. Manage flowing water swamps within the context of restoration objectives. 3. Maintain flowing water swamps in a natural condition. 4. Re-create flowing water swamps where they have been destroyed by human activities. 5. Create flowing water swamp analogs where they have been destroyed by human activities to the extent that a legitimate natural community can no longer be restored.	2.2. Control exotic plants and animals. Control melaleuca invasion. Aggressively seek out and eliminate infestations of Japanese climbing fern and skunk vine. Control feral hog populations (with consideration for panther food base). Monitor other exotics in flowing water swamps and promptly initiate control programs for those that threaten to become problematic. 3.2. Continue to control exotic plants and animals in perpetuity. 4.2. Restore ecosystem functions by controlling exotics and aggressive native weeds, restoring natural fire regimes, restoring natural biological interactions (food webs, nutrient cycling, etc.). 5.2. Restoration of ecosystem functions would include control of exotics and aggressive native weeds, restoration of hydrologic processes, restoration of fire regimes, and the creation of natural biological interactions (food webs, nutrient cycling, etc.).

Enclosure

Ecological Communities	Community-Level Restoration Actions	Community-Specific Restoration Actions
Pond Swamps	2. Manage pond swamps within the context of restoration objectives. 3. Maintain pond swamps in a natural condition. 4. Restore pond swamps where they have been destroyed by human activities.	2.2. Control exotic plants and animals. Control melaleuca invasion. Aggressively seek out and eliminate infestations of Japanese climbing fern and skunk vine. Control feral hog populations (with consideration for panther food base). Monitor behavior of other exotics in pond swamps and promptly initiate control programs for those that threaten to become problematic. 3.2. Continue to control exotic plants and animals in perpetuity. 4.2. Restore ecosystem functions by controlling exotics and aggressive native weeds, restoring natural fire regimes, and restoring natural biological interactions (food webs, nutrient cycling, etc.).
Seepage Swamps	2. Manage seepage swamps within the context of restoration objectives. 3. Maintain seepage swamps in a natural condition. 4. Restore seepage swamps where they have been destroyed.	2.2. Control exotic plants and animals. Aggressively seek out and eliminate infestations of Japanese climbing fern and skunk vine. Control feral hog populations (with consideration for panther food base). Monitor other exotics in seepage swamps and promptly initiate control programs for those that threaten to become problematic. 3.2. Continue to control exotic plants and animals in perpetuity. 4.2. Restore ecosystem functions by controlling exotics and aggressive native weeds, restoring natural fire regimes, hydrologic processes, and natural biological interactions (food webs, nutrient cycling, etc.).

Enclosure

Ecological Communities	Community-Level Restoration Actions	Community-Specific Restoration Actions
Mangroves	3. Manage and maintain mangrove habitat on public lands. 5. Perform additional research on mangroves.	3.4. Identify and prohibit incompatible public uses that degrade mangrove habitat. Incompatible public uses that disrupt hydrology, pollute, encourage exotic plant or animal invasion should be identified and eliminated. 3.5. Monitor compatible adjacent land uses to protect the ecological function of mangroves. Secondary and cumulative impacts to public lands can result from adjacent development, including loss of habitat, litter, chemical discharges, dumping, and promoting exotic plant and animal invasion. 5.4. Examine the population dynamics by invasive exotics in the understory of mangrove habitat.
Coastal Salt Marsh	3. Manage and enhance salt marsh habitat. 3.1. Manage ecosystem function. 4. Restore salt marshes. 4.4. Restore ecosystem function. 6. Conduct research on salt marshes in South Florida by examining their structure, composition, and ecological processes. 7. Develop a long-term monitoring plan to evaluate status of salt marshes.	3.1.3. Manage for ecological processes. Maintain water circulation and water quality, minimize contaminants, maintain or create transitional areas, and control non-native species. 4.4.3. Restore ecological processes. Restore water circulation and water quality, minimize contaminants, maintain or create transitional areas, and control non-native species. 6.7. Investigate the effects of non-native species on salt marshes. 7.4. Monitor the invasion/removal of exotic species in salt marsh habitat.