SOUTH FLORIDA ECOSYSTEM RESTORATION
"EXOTIC PLANT INDICATOR" DEVELOPMENT OF AN INVASIVE EXOTIC PLANT METRIC

Science Coordination Group (SCG) & Restoration Coordination and Verification (RECOVER)

SOUTH FLORIDA ECOSYSTEM RESTORATION
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Overview and Purpose:

Cross-scale interactions challenge the ability of ecologists to understand and predict system behavior at one scale based on information obtained at either finer or broader scales. Under some conditions, fine scale processes can propagate nonlinearly to influence broader scale dynamics while under a different set of conditions broad scale drivers can overwhelm fine scale processes.

Invasive exotic species illustrate this well. A newly introduced exotic species initially may distribute relatively small numbers of propagules to remote locations. The fine scale processes (soil type, soil moisture, ph, etc.) in that location must be conducive to germination and recruitment in order for the species to establish. Once established, over time as the species matures and reproduces, additional propagules are released and recruit into new sites. In the early stages of spread the establishment sites may be widespread. As more propagules are produced and distributed more propagules are released over larger regions and time-spans providing a greater opportunity for more propagules to encounter the right fine-scale conditions helping to create greater spatial connectivity. It is at this point where the interactions between numbers of propagules, propagule distribution, and finer-scale site conditions interact with larger-scale patterns (e.g. landscape heterogeneity, weather patterns, hydrology, rainfall, etc.) that may lead to the exponential increase in spread rates such as we now see with *Lygodium microphyllum*.

Thus, understanding processes at a single scale or even multiple scales requires consideration of the interactions across-scales. Cross-scale interactions often result in "surprises" with severe consequences for the environment (e.g., wildfire, pest outbreaks) and human welfare (e.g., spread of infectious diseases). Alternatively, cross-scale interactions can be used to accelerate recovery of vegetation following fire or removal of exotic species. Spatial heterogeneity in the environment often structures the outcome of cross-scale interactions by governing the nature and scales of particular processes (e.g., fire spread as affected by fine-scale fuel connectivity, wind parameters as affected by topographic position, exotic species invasion establishment and spread as affected by initial site conditions or propagule pressure).

The purpose of this document is to develop an "Exotic Plant Indicator" for use in helping determine the status of invasive exotic plants in south Florida and how invasive species are affecting (at different scales) and being affected by South Florida Ecosystem Restoration and the various exotic plant management efforts (at different scales). Because thresholds caused by these nonlinear interactions and feedbacks across spatial scales are common features of ecological and physical systems, a synthetic approach to cross-scale interactions and spatial heterogeneity is needed for many ecological and restoration

questions. This would also provide a general framework and illustrative example to improve our understanding of cross-scale interactions and spatial heterogeneity to predict system dynamics of exotic species invasion as a propagating event with enormous ecological consequences.

No “indicator” currently exists for invasive exotic plants in southern Florida, and no single extant invasive exotic plant research or monitoring program appears to fulfill the major elements for the development of such an indicator.

Background:

The South Florida Ecosystem Restoration Task Force directed the Science Coordination Group (SCG) to develop a “suite” of ecological indicators for the Task Force to use to help them determine whether restoration resulting from the CERP—and other restoration efforts beyond CERP (including invasive exotic plant management programs)—is being achieved. This “suite” is intended to reflect a set of system-wide ecological indicators and restoration compatibility indicators for “built system” projects, for the South Florida Ecosystem Restoration Initiative. This suite of system-wide indicators will be integrative and incorporate several important “cross-scale features” of the Everglades, including bio-geographic regions (identified as modules see Figure 1), vegetation mosaic and exotic interactions, landscape characteristics, and numerous physical and biological properties. This indicator is one of the suite of ecological indicators.

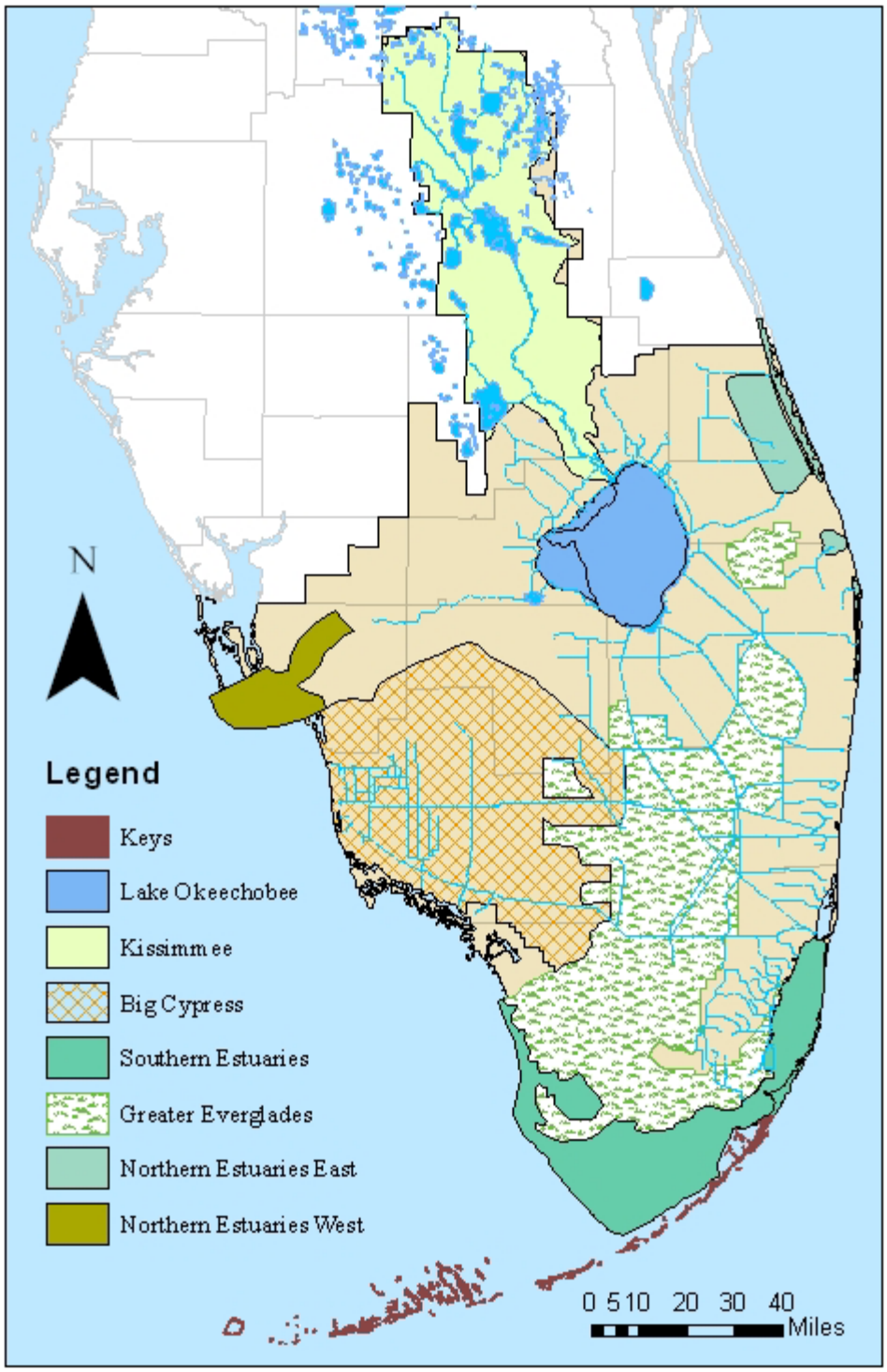


Figure 1. Map of South Florida Ecosystem Restoration area by regional modules.

The Science Coordination Group (SCG) reviewed existing sets of indicators including those developed by RECOVER (2005) and has selected thirteen ecological indicators (see Table 1) that will help evaluate restoration success through assessment and integration of the individual and collective performance of these system-wide ecological indicators for the natural system restoration goals (South Florida Ecosystem Restoration Task Force 2004).

	Indicator	Source
1	Periphyton-Epiphyton	RECOVER
2	Fish & Macroinvertebrates	RECOVER
3	Big Wading Birds (Woodstork, White Ibis, Roseate Spoonbill)	RECOVER
4	Eastern Oysters	RECOVER
5	Juvenile Pink Shrimp	RECOVER
6	Florida Bay Algal Blooms	RECOVER
7	Florida Bay Submerged Aquatic Vegetation	RECOVER
8	Lake Okeechobee Littoral Zone	RECOVER
9	Crocodilians: American Alligator & American Crocodile	RECOVER
10	Exotic Plants	SCG/RECOVER
11	Vegetation Pattern/Mosaic (including uplands & wetlands)	SCG/RECOVER

Table 1. List of Ecological Indicators approved by the Science Coordination Group (SCG) with source of indicator.

Nine of the eleven indicators are existing RECOVER indicators and are included in the RECOVER Interim Goals and Targets Report (2005) and the RECOVER Monitoring Assessment Plan (MAP II) (2006). Two additional indicators are not currently included as RECOVER indicators but are noted as important by RECOVER. These are being developed as indicators as noted in Table I. They are: Invasive Exotic Plants, and Vegetation Pattern/Mosaic (to include uplands and wetlands). Invasive exotic plants are considered to pose such a significant threat to the South Florida environment that if they are left uncontrolled they may threaten the goals of the entire CERP program and restoration in general.

An “indicator” for invasive exotic plants is not similar in nature or context to the other indicators (see Table 1) because exotic species do not make good indicators of ecological function, process or structure, especially for restoration. In addition, measurements of their biological “performance” do not provide any insight into how they may or may not impact other biological functions or restoration. While invasive exotic plants may result in changes in ecological function and structure they do not necessarily indicate anything regarding ecological condition, or restoration except as pertains to their level of invasion and adverse impacts on the ecosystem and biota.

While research indicates that there is a relationship to disturbance and invasion by exotics, that relationship is poorly understood and little or no functional ecological links are yet quantitatively described to provide significant predictive capability (Hengeveld 1987, Levin and D'Antonio 1999). The vast number of possible disturbance sources, including superimposition of anthropogenic and natural perturbations, further complicates attempts to identify clear links between disturbance, habitat invasibility and exotic species invasiveness. Additionally, invasive species are documented to invade undisturbed habitats (Lonsdale 1999, Cronk and Fuller 1995). To date, the best predictor of invasiveness is whether or not the species is invasive in other similar habitats and in similar climatological zones. (Reichard 1997)

However, without control and management of exotic species there is the potential that restoration would fail since exotics have the capacity to drastically alter the natural environment (Mack et al. 1999, Mack et al. 2000). Therefore, this "indicator" is being developed with the need in mind to be able to report regularly on the status, progress and outlook of invasive species and the restoration initiative (see figure xx).

Elements of useful descriptions of the status, progress, and outlook for invasive exotic species and their management includes the following:

1) The number of different invasive exotic plant species present
2) The number, abundance and frequency of new exotic plant species in the ecosystem
3) The number and abundance of extant invasive exotic plant species found in "new" locations
4) The locations and density of invasive exotic plants (particularly in relation to native plant communities)
5) The rate of invasive exotic plant spread (especially as may relate to restoration activities; e.g. removal of canals or levees)
6) The effectiveness of control actions/programs for invasive exotic plants (generally measured as a decrease in spatial extent of a species).

Method:

While the development of an assessment program specifically designed for this purpose would be ideal, the development effort for the exotic plant indicator is currently constrained to using existing monitoring/research programs that already collect information needed for invasive exotic plant assessment. The Science Coordination Group is developing this indicator as part of a suite which has a final completion date of April 2006 for this initial set. Thus, this indicator may be viewed as the "first-cut" version for exotic species (animals are important to include in any future work) and this "indicator" may be improved and refined as appropriate.

In reviewing the possible existing measures and monitoring programs for invasive exotic plants it is clear that no single program provides a comprehensive, rigorous and geographically broad database that will help

respond to the six general elements noted above. The Science Coordination Group has instead identified a sub-set of current exotic vegetation assessment/monitoring programs that collectively provide adequate information on invasive exotic plants to reasonably assess, both spatially and temporally, their status and condition. Collectively, these four projects consider landscape-level and habitat-level spatial scales, native vegetation patterns/mosaic, geo-reference requirements, species, habitat/vegetation classifications (Rutchey et al. 2006), and statistical rigor. The approach presented here uses the cumulative information from the four programs, each with different attributes and functional aspects and collectively evaluates the results of these four programs provide an integrated and complimentary evaluation of the status of invasive exotic plants. By utilizing this synergy of multiple monitoring programs, an assessment can be developed that produces a more reliable "indicator" for trends in exotic plant invasion and control than a single program is able to do. This indicator will be developed and included as one of the System-wide Indicators for use by the South Florida Ecosystem Restoration Task Force for assessing Restoration goals. The Science Coordination Group is also working with the RECOVER teams to develop this indicator as part of the vegetation "group" of indicators for RECOVER.

In monitoring for invasive species it is critical to understand that the asymmetry in the presence versus absence of a species relates to methodology. A key concern in monitoring exotic species relates to the absence of a species. A species can be absent from a sampling program either because it is actually not there or because it was not detected—i.e. the sampling program may not be capable of detecting the plant, or the detection method itself may not be designed to detect a species in certain situations. For example, a particular life stage may be too small to detect (e.g. seedlings), or the location of a plant may prevent its detection (e.g. under tree canopies). What is critical when sampling for invasive exotic species is to ensure that the sampling methods being used are likely to determine that when a species is absent in the data, that species is actually absent in the area being surveyed and not just being missed because of the survey method or study design. Each of the four invasive exotic species monitoring programs being used here brings a set of metrics and methods that when integrated and reported collectively will help to provide a greater rigor to an assessment of invasive species than any of the programs would do individually. By employing this approach, we enhance our accuracy and precision in reporting the presence and location of invasive exotic plants.

Using the four projects noted below does not preclude incorporating additional exotics monitoring/assessment programs and metrics into this "indicator" in the future. As previously noted, this indicator is being developed under both time and cost constraints and may be viewed as a "first cut" and can be refined or improved with additional monitoring or assessment needs. This includes identifying gaps in the monitoring that might require either new funds, modifications to existing programs, integration of additional existing programs, or new programs to augment the existing indicator.

The following four exotic plant monitoring and assessment programs appear to meet the basic requirements noted above. In addition they are already part of existing integrated programs including the CERP program or other restoration programs.

1. EPA REMAP vegetation survey
2. SFWMD, NPS & USFWS Systematic Reconnaissance and Sketch-mapping Flights
3. RECOVER vegetation mapping project
4. SFWMD Tree Island Exotics Survey

REMAP

The Environmental Protection Agency's REMAP project covers the central Everglades within the Greater Everglades Module (see Figure 2) (RECOVER 2005) (http://www.epa.gov/emap/remap/index.html). This project provides four key elements toward the development of an exotic plant "indicator". First the sample protocols incorporate a rigorous statistical design using stratified random plot locations and incorporate several visual samples for exotic species presence as well as quantitative subplot censuses. This design provides the ability to detect (using a rigorous statistical approach) "new" species presence (especially individual and seedling plants) and species locations. It provides predictive capability relating to frequency of species finds, temporal and spatial aspects to species numbers (how many new species how often and rates of spread), and species locations in relation to natural habitats being invaded. Finally, the sampling census design provides virtually 100% accuracy in ground-truthing plant species presence and location. Because of the spatial dominance of open marsh habitats, however, the sampling design of this project does not provide sufficient information on hammocks and tree island for exotics monitoring protocols.

REMAP METRICS

1. GPS location of sites and quadrats (see map of sites – Figure 1)
2. Presence of Lygodium, Melaleuca, Casuarina, Neyraudia, Pennisetum, and Typha surrounding sample area using a visual survey of the site from a helicopter.
3. Presence of Lygodium, Melaleuca, Casuarina, Neyraudia, Pennisetum, and Typha within each quadrant of a visual circle; NE, SE, SW, NW from the ground at the sample site.
4. General abundance of each species listed in #2 within each quadrant (1, 2-10 or >10 plants)
5. The four most common (whether native or exotic) species by visual cover in the general site
6. Photographs of site (360^{o})
7. Visual observation of disturbance or other human influence (e.g. proximity to trails, evidence of fire, etc.)

8. Visual survey of all exotic species within a 10 X 10 m quadrat – using belt transect
    a. Presence of each exotic species
    b. Position and extent of exotic species
9. Detailed plant census including exotic species along a 10 meter transect using five 1-m^2 plots along the length of the transect with each plot subdivided into 0.25-m^2 quadrats.

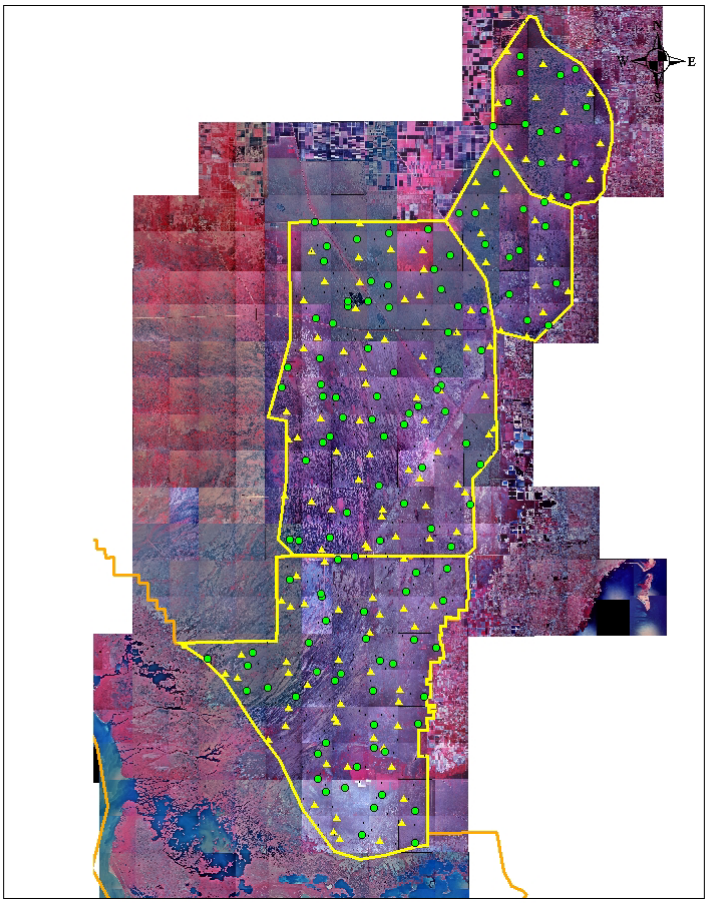


Figure 2. Map of REMAP vegetation sites: green = fall samples; yellow = spring samples).

Systematic Reconnaissance Flights (SRF)

The South Florida Water Management District's Systematic Reconnaissance Flight (SRF) Survey for invasive exotic plants covers virtually the entire southern Florida area (see Figure 3). This program provides the largest spatial coverage of any monitoring program in south Florida. The seven most widespread and serious exotics are included in the survey. This survey is conducted biennially providing good spatial, temporal and species density information across the entire region. Results from this survey have been used to document invasive exotic species spread rates and effects of region-wide control

programs. This program offers a landscape-scale assessment for the exotics considered the most serious in south Florida and for those with active control programs are in place. The temporal maps and calculated acreages will provide ecosystem scale evaluations of species increases or decreases both spatially and temporally (see Figure 4).

SRF METRICS

1. Geo-referenced flight lines (see map figure 3) every 4 kilometers
2. Continuous visual observations along flight lines with species ID for Lygodium microphyllum, Schinus terebinthifolius, Melaleuca quinquenervia, Casuarina spp., Neyraudia reynaudiana, Pennisetum purpureum, and Paederia foetida
3. Density Categories for exotic species along flight line (dense, sparse, outlier)
4. Acreage cover estimates from flight line data (post survey analysis)

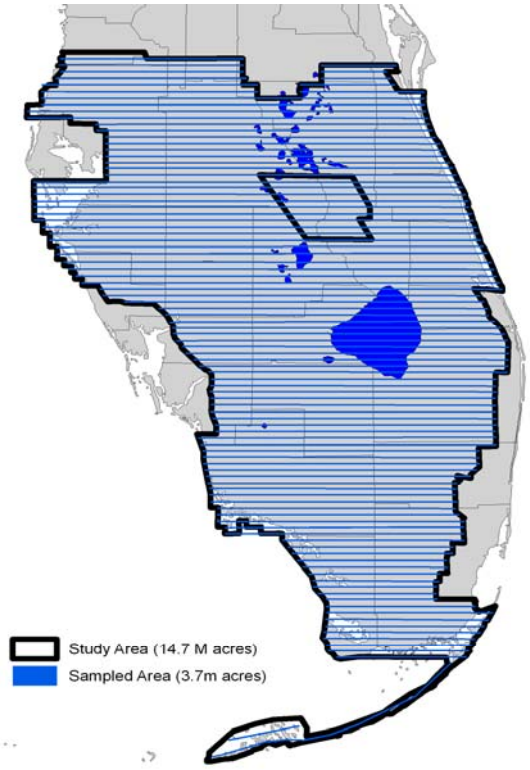


Figure 3. Map showing flight lines and area covered by SRF surveys.

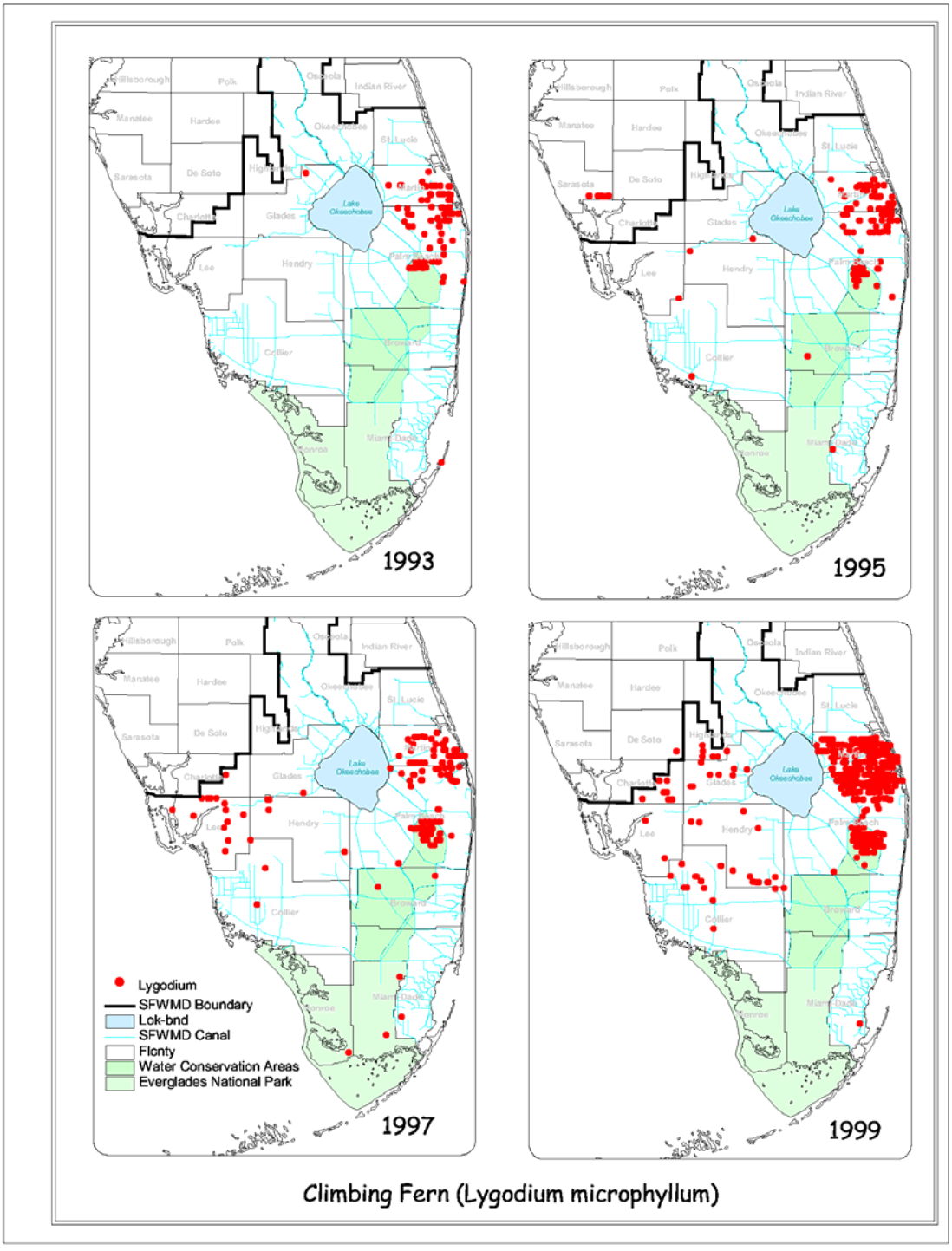


Figure 4. Map of *Lygodium microphyllum* from SFWMD SRF survey showing spatial extent and spread.

RECOVER Vegetation Classification and Mapping

The RECOVER Vegetation Classification and Mapping program is a complete vegetation mapping effort that will cover a large region of the natural Everglades (see Figure 5). This project will classify vegetation community coverage including exotic species using the classification system "Vegetation Classificaiton System for South Florida Natural Areas" developed by Rutchey et al. (2005unpublished) that was based on an earlier south Florida vegetation classification system (Jones, et al. 1999). This program utilizes false color infrared photography and stereoscopic photo-interpretation with a ¼ hectare minimum mapping unit. This project will provide a large scale data set that identifies exotics and surrounding native vegetation communities. This data set serves as a vegetation GIS layer upon which data from the EPA REMAP and Tree Island survey may be superimposed, allowing for additional evaluations of which native plant communities may be more vulnerable to invasion by exotics. If differences in invasion rates are documented this tool may also serve to provide information for managers as to which habitats are most susceptible to invasion by exotic species thus saving control program resources. The National Park Service is funding the Western Big Cypress section.

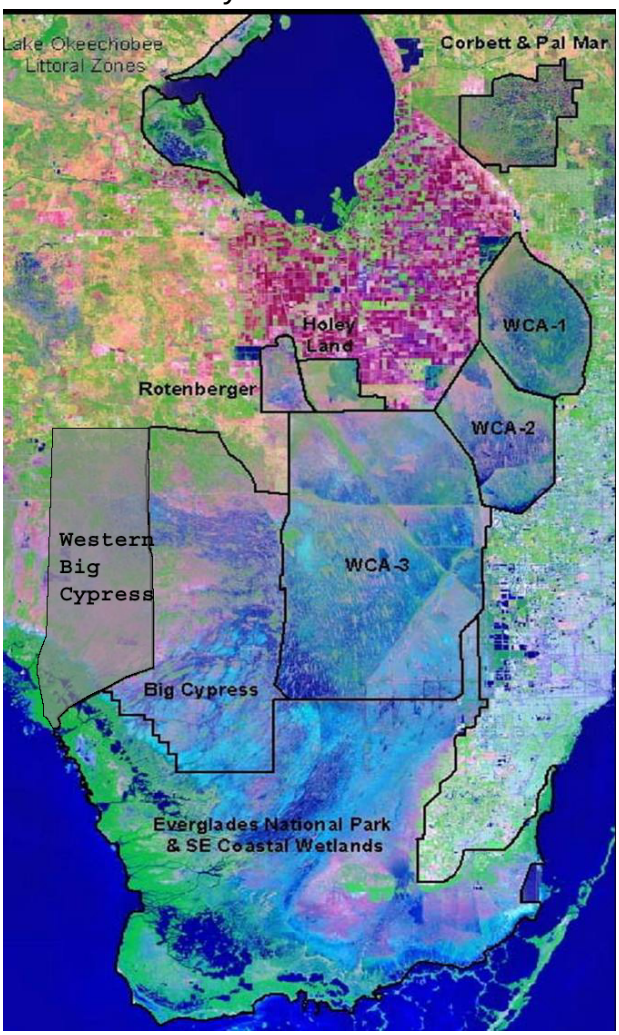


Figure 5. Map showing areas (outlined in black) being included in RECOVER vegetation mapping project.

RECOVER VEGETATION MAPPING METRICS

1. Geo-referenced mapping of vegetation classes using ¼ ha minimum mapping unit & Vegetation Classification System for South Florida Natural Areas (Rutchey et al. 2005) (see map figure 3)
2. Exotic species identified and classified as (monotype, >90% cover; dominant, 50 – 89% cover; or sparse 10 – 49% cover) for each ¼ ha mapping unit

Tree Island Exotic Plant Survey

The survey of tree islands is a SFWMD funded project to evaluate the extent of Lygodium microphyllum spread and impact, as well as the presence of other exotic plant species on tree islands throughout Water Conservation Areas 2B and 3A (see Figure 6). This project provides information on the presence and movement of invasive exotic plant species in understory tree island habitats that are not monitored adequately in any of the other three survey methods. Because exotic species are difficult if not impossible to detect under canopies from aerial surveys, this project will provide key information on a habitat this is difficult to monitor and not reflected in more remote survey approaches.

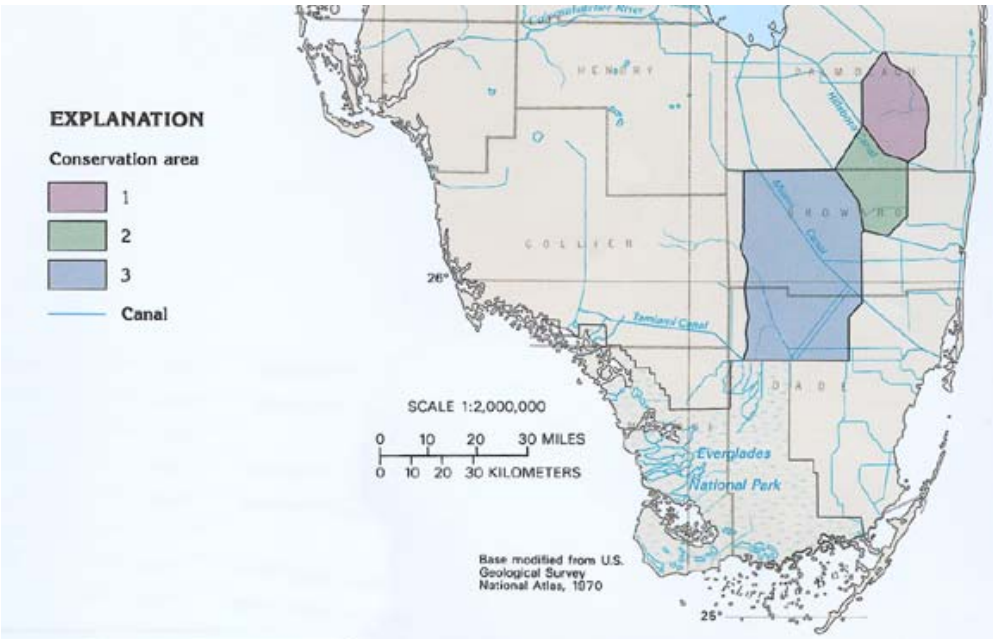


Figure 6. Map of SFWMD Water Conservation Areas 1, 2, and 3.

Hammocks and tree islands are often the least surveyed sites because of the difficulty of access and inhospitable site conditions, as well as their overall spatial extent in the landscape. Often, however, these sites are the most impacted with invasive exotic plants and may serve as the first invasion sites for species spread and establishment. The Tree Island Exotic Plant Project will survey 400 randomly selected tree islands and record UTM locations of each tree island, size of each tree island, dominant species, and exotic species presence.

TREE ISLAND SURVEY METRICS

1. Individual tree island locations
2. Individual tree island sizes
3. Dominant tree island species
4. Exotic species present on each tree island

Discussion

REMAP sampling is designed using random site locations and numerous plots in order to provide statistical rigor and predictive capability as the time series develops. This is the first year for exotic plant sampling in the REMAP program. After looking at the preliminary REMAP data and comparing it with the SRF data two patterns were apparent. First, the SRF data show broad patterns of distribution of species that are wide-spread and in some cases rapidly expanding (e.g. *Lygodium microphyllum*). Looking only at the SRF data one might conclude that things are looking hopeless. However, the SRF data show over time that even widely spread species, when adequately addressed, can be controlled (e.g. *Melaleuca*). When the REMAP data are added we also find that no other species of exotic (i.e. new species) are being found in the central Everglades (Greater Everglades Module) offering some indication that while the problem with existing species may be difficult, they are not intractable, and invasion by new species may not be as serious a threat as one might think.

The Tree Island Survey adds value by providing information on the occurrence of invasive exotic species in locations that are not adequately monitored using the other methods. The other projects are not able to view species under canopies or are not likely to sample tree island–hammock vegetation sufficiently. In addition, the tree island survey will provide an idea of new species occurrences in forest habitat that REMAP is not likely to capture, and, like REMAP, the statistical approach used to design the project will allow predictions.

The RECOVER Vegetation Mapping Project will provide an extensive look at the patterns of native vegetation and native vegetation changes (such as cattail invasion). Overlaying the invasive exotic species information from the three projects in addition to the RECOVER Vegetation Mapping exotic information will provide a first look at how invasive species and native communities relate in terms of species presence, abundance and cover and may provide insights into differences in native community vulnerabilities or habitat preferences of exotics.

Limitations and Gaps

We clearly recognize the limitations of this proposed “indicator”. Since the four programs currently selected are at different spatial and temporal scales, different levels of precision and accuracy, and different geographic coverages a “unified” indication of invasive exotic plants across all modules or regions, habitats and time is not currently possible. Also, given that the geographic coverage for the four programs intersects predominantly in the Greater Everglades Module, species occurring in other modules may be un- or underrepresented. In modules that are either not covered by these programs or only partially covered in geographic coverage or in program coverage, the limitations of those results will be discussed and represented in the assessment. A lack of information regarding invasive exotic species is considered to be a serious deficit in our ability to manage these species and an understanding of where we lack information (i.e. a monitoring and assessment program) will assist

us in developing a more comprehensive and strategic program for invasive species that may be considered for implementation through CERP or other agency programs.

In spite of these limitations these programs offer an opportunity to develop a methodology that can be used to assess the extent and spread of invasive exotic species. These programs also (and any additional programs that are later utilized to assist in assessing the status of invasive exotic plants) provide an opportunity to test the effectiveness and benefits of an invasive species "indicator" that will assist in developing a more strategic approach for their assessment, identify the "gaps" in this effort that may seriously limit our ability to assess and manage invasive exotic plants, and assist us in further refining or expanding these individual programs and assessment methods in the future as part of the RECOVER adaptive management process and the RECOVER MAP. In addition, the integrated use of the results from these projects provides an opportunity to further coordinate and adapt these four projects. It also encourages the kind of synergy that will be critical among invasive exotic species projects as no agency has the individual resources or programs to effectively assess or manage invasive exotic species.

In addition assorted species do occur in the other modules and some of these species are not being monitored in any of these projects (this includes marine algae and plants some of which are serious invaders in coastal and marine systems throughout the world).

However, given the stipulation that existing programs must be used since no funding is available to develop a specific monitoring / assessment program and indicator for invasive exotic plants, is the alternative no indication of the status of invasive species for restoration? Each year the South Florida Water Management District produces the South Florida Environmental Report, an annual status of the Everglades Restoration Program from the SFWMD perspective. The 2005 report provides a fairly comprehensive evaluation of invasive exotic species, both plants and animals. The report also catalogues the plant species identified by the land managers as the highest priorities for management and control. Because individual modules may often have over 50 individual exotic plant species, for most of which little information is available making any assessment difficult if not impossible for those species, this indicator will use the list of species identified in the annual South Florida Environmental Report for the assessment. Any project that is able to provide additional information on other existing species will be provided as part of the discussion in the biennial assessments.

As noted earlier, this indicator is intended to develop and begin the use of a "first-cut" assessment process for key invasive exotic plants in key regions and an evaluation of their impact on restoration. It is important that this indicator be incorporated into the RECOVER indicators and RECOVER MAP to ensure the refinement and continuity of invasive exotic plant assessment. As this indicator continues to be used experience may not only assist us in developing a better invasive species monitoring process to include funding requests, but may also

help guide the further development and refinement of the individual assessment programs being used for this “first-cut indicator”.

THE METRICS THE QUESTIONS AND THE “INDICATOR”

It is important to remember that this assessment of invasive exotic plants is only a synthesis of what we know or are able to know from existing sources of information. The questions and their application toward assessing restoration in relation to invasive exotic plants are designed with this in mind and are unable to answer any questions outside of these parameters.

Using the four different set of measures from each of the monitoring and survey projects detailed above, the goal is to utilize the collective set of metrics from these program to use as the “indicator” for assessing the status of invasive exotic species. Each species would be assessed by Everglades’ bioregional module (see Figure 1), using the following set of questions and weightings – and the metric used to answer the question - to evaluate and report the status of invasive exotic species. Because the data collected by each program varies spatially, temporally and in precision each data set will have to be evaluated individually using the questions below and then after an individual evaluation an integration of the results would follow.

NUMERICAL RATINGS AND RANKING

The numerical ratings used in each of the questions do not represent actual data or measurements or any absolute valuation. They are used as a relative valuation for helping expert panel members coalesce the individual parameters of the four different programs. Positive numbers indicate a positive finding regarding the status, progress or outlook for the environment related to exotics, a negative number indicates a negative environmental status in relation to exotics. The worse the problem with an exotic and the less we are doing to control it, the more negative the relative cumulative ranking, and *vice versa*. These questions and their relative numerical ratings are simply an aid to the expert panel members (who will do the biennial assessments using the results from the four programs) in merging the results of the four different data sets.

MODULE LEVEL QUESTIONS (These apply to species that have been identified as high priorities for control based on the information in the South Florida Environmental Report (SFWMD 2006) by module. Results from these three questions are reflected in the module level results in Table 2.

1. How many species identified as high priority for control have been identified as being in this module?
   - 1.1. one – two = -1
   - 1.2. three – five = -2
   - 1.3. six – ten = -3
   - 1.4. more than ten = -4

2. How many previously undetected species (new species never found in this module before) have been found within this module?
   2.1. None = 2 points
   2.2. Can't determine = 0 points
   2.3. 1 - 3 = - 1 points
   2.4. 3 - 5 = - 2 point
   2.5. > 5 = - 3 points

3. Have any "new" location sightings within the module been found for existing species already known to be within the module? NOTE: A No determination is made using negative results from all four data sets collectively; a Yes determination is made using a positive result from any one of the four data sets.
   3.1. No = 4 points
   3.2. Can't determine = - 1 points
   3.3. Yes = - 2 points

SPECIES LEVEL QUESTIONS (These questions apply to each species known to be present within the module. All four monitoring programs do not collect information on all the species in the Category I and II lists so these results are based on the cumulative of the data sets and the annual South Florida Environmental Report.) Results from these questions are reflected in the species level results in Table 2.

1. How many acres (by species) within the module are infested?
   1.1. Cannot determine = - 1 point
   1.2. too small an area to detect = 0 points
   1.3. less than 10 acres = - 1 point
   1.4. less than 100 acres = - 2 points
   1.5. 100 - 1000 acres = - 3 points
   1.6. 1000 – 10,000 acres = - 4 points
   1.7. 10,000 – 100,000 acres = - 5 points
   1.8. over 100,000 acres = - 6 points

2. Are the acres of the species in the module increasing, decreasing or static?
   2.1. Documented to be increasing exponentially = - 5 points
   2.2. Documented to be increasing linearly = - 3 points
   2.3. Increase is documented but rate undetermined = - 2 point
   2.4. Static = 0 points
   2.5. Decreasing = 3 points
   2.6. Can't be determined = - 2 point

3. If the population is static (as determined through the use of these monitoring/assessment projects) can it be determined that this is due to having reached a "maintenance control" phase (as defined by FLDEP) resulting from an active management program.
   3.1. Yes = 4 points

3.2. Don't know or can't tell = 0 points
3.3. No, because there is no program = - 2 points

4. If the population is decreasing in coverage of the species can this be documented to be the result of an active biocontrol or chemical / mechanical control program? (If both the points are additive)
   4.1. Yes (biocontrol) = 5 points
   4.2. Yes (chemical / mechanical) = 3 points
   4.3. Don't know or can't tell = 0 points
   4.4. No, because there is no program = - 2 points

GOOD OR BAD?

The Greater Everglades' Module is being used as the test example. High priority species included in the module are: *Ardisia elliptica* (shoe button Ardisia), *Casuarina* spp. (Australian pine), *Lygodium microphyllum* (Old World climbing fern), *Melaleuca quinquenervia* (melaleuca), *Schinus terebinthifolius* (Brazilian pepper), *Colubrina asiatica* (lather leaf).

Module Level Question 1.	None	=	- 3
Module Level Question 2.	None	=	2
Module Level Question 3.	Yes	=	- 2
TOTAL FOR MODULE QUESTIONS		=	- 3

Species Level Question 1.

Ardisia elliptica	1000 – 10,000	=	- 4
Causarina spp.	100 – 1000	=	- 3
Lygodium microphyllum	1000 – 10,000	=	- 4
Melaleuca quinquenervia	1000 – 10,000	=	- 4
Schinus terebinthefolius	> 100,000	=	- 6
Colubrina asiatica	1000 – 10,000	=	- 4

Species Level Question 2.

Ardisia elliptica	2.3	=	- 2
Casuarina spp.	2.5	=	3
Lygodium microphyllum	2.1	=	- 5
Melaleuca quinquenervia	2.5	=	3
Schinus terebinthefolius	2.3	=	- 3
Colubrina asiatica	2.6	=	- 2

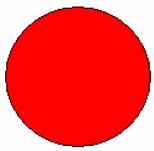
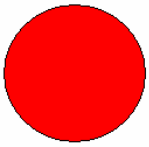
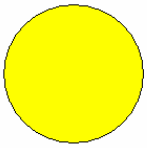
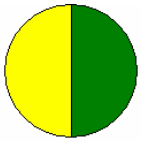
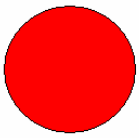
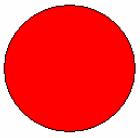
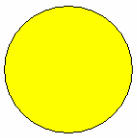
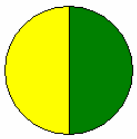
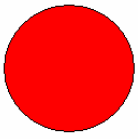
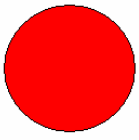
Species Level Question 3.

Ardisia elliptica	NA
Casuarina spp.	NA
Lygodium microphyllum	NA
Melaleuca quinquenervia	NA
Schinus terebinthefolius	NA
Colubrina asiatica	NA

Species Level Question 4.			
Ardisia elliptica	NA		
Casuarina spp.	4.2	=	3
Lygodium microphyllum	NA		
Melaleuca quinquenervia	4.1 + 4.2	=	8
Schinus terebinthefolius	NA		
Colubrina asiatica	NA		

Table 2. This Table is an Example Rating for the Greater Everglades Module where:

Red = Severe Negative Condition, or one is expected in near future, with out of control situation that merits serious attention
Yellow/Red = Problem was previously localized or not too severe but is or appears to be progressing toward a Severe Negative Condition generally due to inaction. Without attention and resources the situation may develop or become Red
Red/Yellow = Currently a Negative Condition but there are reasonable control efforts underway. However, without continued or improved efforts this species may revert to a severe situation or become a future serious invader and revert to yellow/red or red
Yellow = Situation is improving due to reasonable control program and either is stable or moving toward stabilizing, or the species is still very localized but is expected to spread if sufficient resources or actions are not continued or provided. The situation could still reverse
Green/Yellow = Situation is generally good and under control but still needs regular, even if low-level, attention to continue progress to Yellow/Green or Green
Yellow/Green = Significant progress is being made and situation is moving toward good maintenance control and is expected to continue improving as long as resources are maintained
Green = Situation is under control has remained under control for several years, particularly where biocontrol is found to be effective. Where chemical maintenance control is in place continuation of control efforts is essential to maintain Green status

TABLE 2	CURRENT STATUS		1-2 YEAR PROGNOSIS	
GREATER EVERGLADES MODULE **(results here reflect only the 3 module level questions not species level questions)**	Lygodium and Schinus still wide spread and serious threats to ecosystem. Continued rapid spread of these two species with little results from control efforts. Still several other species present with little or no control effort or effectiveness.		Good control of Melaleuca and Casuarina. Biocontrol for Melaleuca showing effectiveness. First biocontrol releases for Lygodium; new biocontrol for Schinus under study. Other species still localized, no new serious invaders detected.	
Ardisia	Was a localized problem in ENP & SE Everglades. Has started spreading north into other wetlands in Shark Slough and Loxahatchee.		No significant control program, no biocontrol effort underway. Now found in Loxahatchee Tree Islands, poses a serious threat. May be entering exponential spread phase. Difficult to monitor remotely.	
Casuarina	SE ENP, DRTO, BISC, SFWMD canal banks and coastal areas east and west coast.		Chemical control effective, most natural areas clear or clearable with modest effort. Biocontrol research underway.	
Colubrina	Localized to coastal ENP, BISC & SE Coastal areas, spread slow, but threatens rare coastal habitats and species.		No significant control efforts or effectiveness, no biocontrol effort underway.	
Lygodium	Serious invader, rapid spread throughout SFL, invades most habitats, very destructive. Chemical control ineffective in reducing invasion rate.		No effective control yet but biocontrol release made with additional release expected 2006. Chemical control studies continuing.	
Melaleuca	Still abundant on private lands but biocontrol reducing cover and spread and agents establishing throughout SFL.		Chemical control effective on most public lands, biocontrol agents effective and additional spread of existing agents and new agents expected 2006.	
Schinus	Serious invader, with rapid spread throughout SFL, invades most habitats, very destructive. Chemical control ineffective in reducing spread so far.		No effective controls yet, chemical control program very limited. New biocontrol agents under study for future release 2007-2008.	

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