

# An Explosion in Slow Motion:

## Tracking the spread of *Lygodium microphyllum* in Florida

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*In the early 1990s, the South Florida Water Management District and the National Park Service began using Systematic Reconnaissance Flights (SRF) to monitor invasive plants over large areas of South Florida. Advancements in civilian Global Positioning System (GPS) technologies made SRFs a quick and inexpensive way to get a snapshot of the distribution of target plant species over large and remote areas.*

In 1990, *Melaleuca quinquenervia* was considered “Public Enemy Number 1” in South Florida. The tree was spreading at an alarming rate and threatened to overtake vast areas of the struggling Everglades. The Department of Interior had dedicated but meager programs to control the tree in Everglades National Park, Big Cypress National Preserve and the Loxahatchee National Wildlife Refuge, and the South Florida Water Management District was in the process of launching its operational control program for the Water Conservation Areas.

With Florida EPPC’s 1990 *Melaleuca* Management Plan hot off the press, several proposals were pitched to map *melaleuca* before large scale interagency treatment operations began. These early projects proposed the use of satellite imagery to detect *melaleuca*. Unfortunately, the price tag for these early surveys was prohibitively hefty. The \$500K needed to map *melaleuca* in the Everglades outweighed the amount of money earmarked to control it. Resource managers opted to initiate operational programs without a map and instead, control crews “mapped” the tree’s distribution *post mortem*—taking coordinates as they treated.

Largely to the credit of Florida EPPC, the serious *melaleuca* problem gained notoriety in the early 1990s and a business interest proposed the construction of a power plant that would burn *melaleuca* for energy. Seen as a win-win for the State of Florida, the District agreed to conduct an aerial survey to determine the amount of *melaleuca* fuel in the region. The only

existing large scale assessment for the tree species in Florida had been conducted by the United States Forest Service (USFS) Southeast Forest Experiment Station in 1980.

The USFS consulted with the District in 1992 and proposed the use of aerial transects and GPS technology for the assessment. The USFS has used this assessment technique, termed the Systematic Reconnaissance Flight (SRF) method, to inventory timber in the United States since the 1920s. This method is also commonly used to monitor animal species such as wading birds, deer and marine mammals.

While flying a practice run of one of the 1993 *melaleuca* transects, the aerial observers noted a “weird vine” on a few tree islands in the northern tip of the Loxahatchee National Wildlife Refuge. That weird, isolated vine turned out to be Old World climbing fern (*Lygodium microphyllum*). At the time, it seemed interesting but almost insignificant. Project leaders debated adding this odd species to the *melaleuca* survey. Thankfully, wisdom or maybe dumb luck prevailed and the District survey began tracking locations of *lygodium* regionally.

To conduct a SRF survey, a small, high-winged aircraft (such as a Cessna 182) flies at a fixed height and speed across a study area while observers count targets (plants or animals) in a strip of land on either side of the plane. Occurrence points of the target species are collected on a GPS data recorder from either side of the aircraft. Using the USFS timber cruising

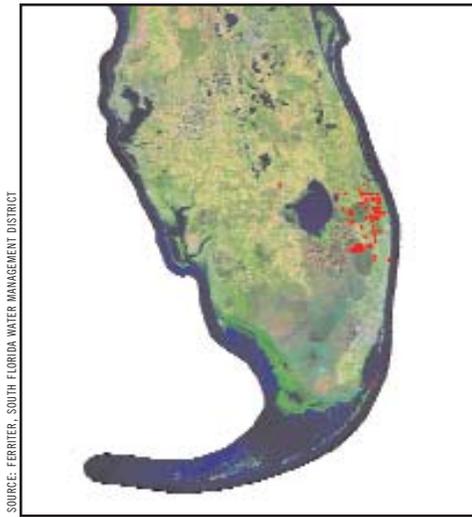
method, these points are tallied and, based on the total number of points collected and the total acres of the study area, each occurrence is given an acreage factor. This acreage factor allows for the calculation of a gross infested acre estimate by species for the region surveyed.

The original survey boundaries extend from the northern tip of Lake Okeechobee, south through the Florida Keys, covering more than 8 million acres. Transects are spaced at 2.5 mile intervals, east/west across the state. The survey is always flown in the winter months in Florida to take advantage of leafless deciduous native tree species, such as cypress. This strategy works well in most cases, but it is suspected that the detection of frost-sensitive *lygodium* has been compromised in some surveys that were flown after a cold weather event.

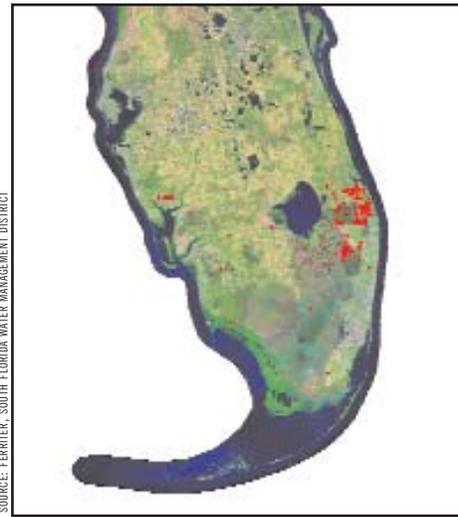
### 1993

J. Beckner first reported *lygodium* as escaped in Florida in the late 1960s. Clifton Nauman and Dan Austin reported escaped populations near the “Cradle of *Lygodium*” in Martin County near Jonathan Dickinson State Park in the late 1970s, saying “the plants occur mostly in small clumps, while toward the center of the distribution near the Loxahatchee River and Loxahatchee Slough, *lygodium* may cover acres.” By the early 1990s, Jonathan Dickinson State Park, the Dupuis Preserve, Corbett Wildlife Management Area and the northern third of the Loxahatchee National Wildlife Refuge were

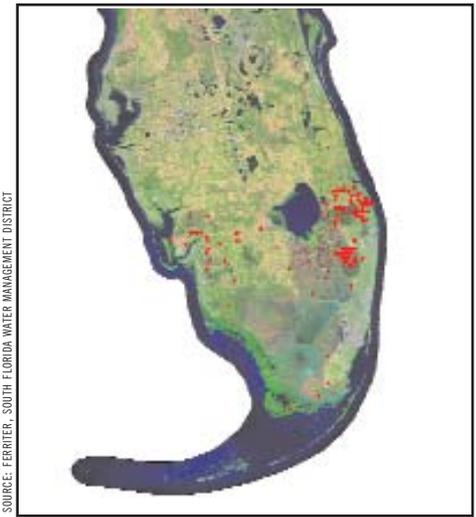
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● Lygodium Distribution 1993



● Lygodium Distribution 1995



● Lygodium Distribution 1997

impacted by the fern, which occupied an estimated 28,152 gross infested acres when these surveys began.

### 1995

Lygodium remained primarily confined to Martin and Palm Beach Counties and these populations were becoming increasingly dense. Several isolated but important populations were spotted along Fisheating Creek, west of Lake Okeechobee in Glades and Hendry Counties, and along the west coast, where populations were infrequent at the time. The estimated gross infested acres in 1995 remained consistent with 1993, totaling approximately 29,970 acres.

### 1997

Lygodium maintained and strengthened its foothold along the Treasure Coast, becoming increasingly dense and spreading southward in the Loxahatchee National Wildlife Refuge in central Palm Beach County. Populations along Fisheating Creek in Glades and Hendry Counties increased and became more common. Isolated populations became more widespread along the west coast in Lee County in 1997, and the estimated gross infested acres totaled approximately 34,034 acres.

### 1999

A dramatic densification of lygodium in Martin County was witnessed in 1999. Populations of the fern spread south and became denser in the Loxahatchee National Wildlife Refuge, occupying and

covering a majority of the tree islands. Outlier populations also were more commonly seen in the interior of the region, such as Hendry County, and lygodium was becoming denser on the west coast in Lee and Collier Counties. The increase in occurrences and spread of the plant into previously uninfested areas of the region brought the total estimated gross infested acres to 120,780 acres.

### 2001

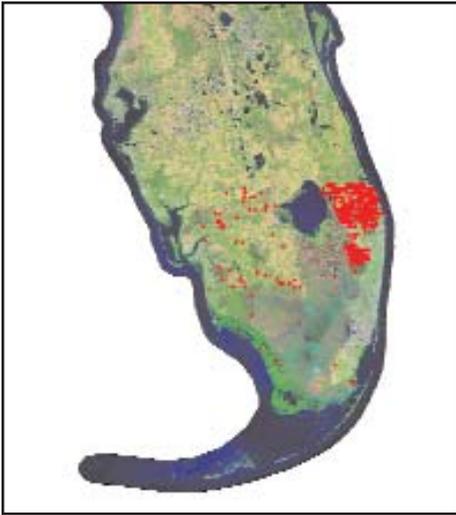
This was a transition year for the survey. Flight lines (originally spaced at 2.5 mile intervals to be consistent with the 1980 USFS survey) were shifted to 4 km intervals to be made compatible with National Park Service Universal Transverse Mercator-based surveys. The observers also varied in 2001. The single most important factor in conducting aerial surveys—for plants and animals—is a consistent, trained observer. Due to what is termed “observer bias” in this case, the new observers classified certain occurrences differently—more conservatively in this case—than previous observers. This underscores the importance of retaining consistent observers both throughout individual surveys and from year-to-year. Record low temperatures in inland areas of South Florida in January, 2001 may also have led to difficulties in detecting lygodium, which is quick to brown during cold weather events. While the shift in flight lines, a change in observers and a potential frost event in the area of interest created a situation

where there were fewer observation points—the estimated gross infested acres only totaled 43,020 acres—the overall trend in this study (‘93-’05) has remained consistent. This applied survey was designed to be flexible, and while the overall scope and purpose of the project—to track broad scale trends in populations that occur over millions of acres—will remain the same, periodic adjustments and unforeseen circumstances should be expected in this type of survey.

### 2003/2005

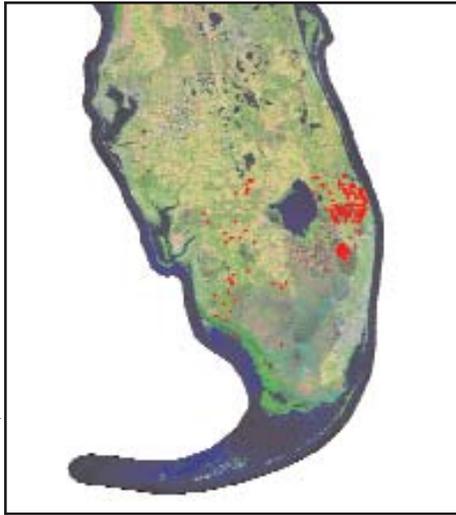
The survey study area was expanded to extend north to Central Florida, covering more than 14 million acres. National Park Service staff began serving as observers for the regional survey in 2003 to minimize observer bias. Due to the logistics of surveying such a large area, the south end of the survey was flown in 2003 and the north end was flown in 2005. The image here depicts both surveys combined to show the entire region for 2003/2005. Lygodium populations in the Loxahatchee National Wildlife Refuge extend into the southern portions of the refuge, and the species now impacts the entire refuge. The expanded survey shows an increase in density of lygodium throughout South Florida, with the gross estimated infested acres for the southern region totaling 120,780 acres. An alarming amount of lygodium is scattered throughout Central Florida, occurring in the entire region south of Pasco, Lake, Orange, and Brevard Counties. Resource

SOURCE: FERRITER, SOUTH FLORIDA WATER MANAGEMENT DISTRICT



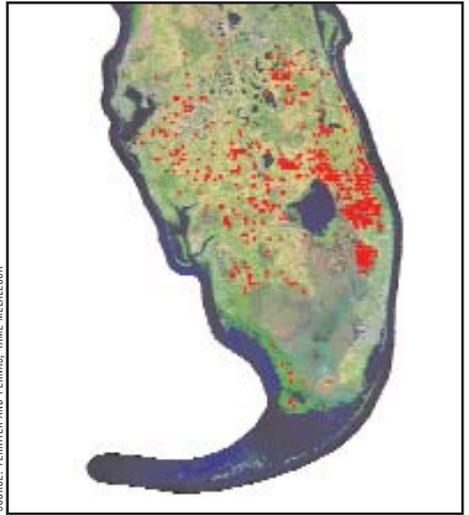
• Lygodium Distribution 1999

SOURCE: FERRITER, SOUTH FLORIDA WATER MANAGEMENT DISTRICT



• Lygodium Distribution 2001

SOURCE: FERRITER AND PERNAS, TAMU MELALEUCA

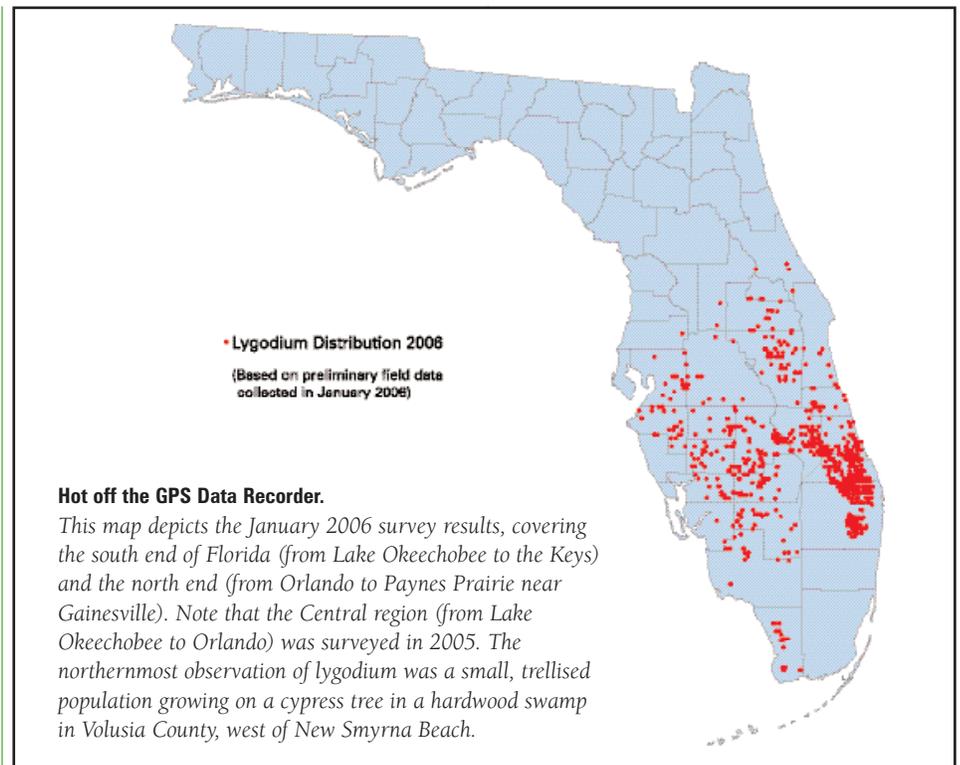


• Lygodium Distribution 2003/2005

managers were reporting lygodium throughout Central Florida with increased frequency, but the magnitude and scope of the infestation was not well understood until this survey was conducted. This is the area of the state where the ranges of *L. microphyllum* and *L. japonicum* meet. While it is not possible to differentiate the two species from the air, the majority of these sightings are most likely *L. microphyllum*, based on reports to the Florida EPPC database. However it is likely that some of them are in fact *L. japonicum*. Regardless of the species, lygodium is estimated to occupy 183,080 acres in the entire South/Central Florida region. If left unchecked, these populations are expected to become larger and denser through time. Given this trend, lygodium threatens to overtake many of Central Florida's forested wetlands, rivers and lake margins.

## 2005

A pilot project using Digital Aerial Sketch Mapping (DASM) technologies was conducted in the Everglades Protection Area to compliment the SRF surveys. This project involves the use of specialized airborne hardware and software to digitize plant populations "on the fly." DASM was originally developed for the USFS for monitoring forest health concerns such as southern pine beetle infestations. The South Florida pilot project plans to use this technology to delineate and track populations of invasive plants in the same way the Forest Service uses it to track invasive insect pests.



## WHAT NEXT?

The most recent SRF surveys (January 2006) show that lygodium has expanded as far north as Volusia County, west of New Smyrna Beach. SRF surveys extended north to Alachua County in an attempt to document the northern extent of lygodium (and melaleuca) in Florida. These long-term surveys are ongoing, and while it is logistically impossible to survey the entire state of Florida every two years, project leaders plan to continue this work, surveying portions of the state at regular intervals. To ensure consistency and

eliminate the possibility of variability in future flightlines, a standard statewide transect map has been generated and will be used for all future surveys. In an effort to refine the SRF acreage estimates, which are derived from USFS timber cruising methods, project leaders are conducting a comparative study of SRF point survey results with more detailed DASM surveys.

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