



Everglades Cooperative Invasive Species Management Area

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Newsletter

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The total eradication of brightly colored panther chameleons from a Broward County site was one of this year's success stories. (Photo courtesy Pat Howell, Broward County Parks)

Rapid Response success for nonnative wildlife

by Jennifer Ketterlin Eckles

FISST puts the hammer down!

The Florida Invasive Species Strike Team (FISST) is the field team under the Everglades Cooperative Invasive Species Management Area's (ECISMA) Rapid Response Subcommittee that is deployed to respond to new sightings of primarily nonnative wildlife within ECISMA's footprint. The team is comprised of a number of ECISMA partners with response capabilities and is directed by the affected land management agency for any given response.

The team has had a number of rapid response successes over the past year. Two significant rapid responses were the removal of a Nile crocodile from Everglades National Park (ENP) and the discovery and possible eradication of panther chameleons on a Broward County property.

Nile crocodile

In February of this year, while searching for Burmese pythons, members of the Swamp Apes, a volunteer group with ENP, spotted and photographed an odd crocodilian in the Chekika area of the park. The animal was identified as a Nile crocodile based on the photo and the identification was later confirmed by FISST. With permission from ENP, the University of Florida (UF) led an interagency team comprised of ENP rangers, Florida Fish and Wildlife Conservation Commission (FWC) staff and members of the Swamp Apes to remove the animal. On Sunday, March 9, 2014, the FISST team began the operation to remove the animal alive or dead. After several hours of using nets to corral the crocodile into a small section of a canal, the animal was harpooned and captured alive. Based on physical markings, the crocodile was identified as the same individual that eluded FWC and UF after it had been sighted two years earlier. The animal grew

over two and a half feet since it was last seen and due to the rapid response efforts of the FISST interagency team, the five and a half foot-long Nile crocodile was successfully identified and removed.

Panther chameleon

Last July, a Broward County employee reported removing an adult panther chameleon from a county owned property on the Early Detection and Distribution Mapping System (EDDMapS) website (www.eddmaps.org). After receiving this report, staff from UF and FWC searched the property the following night and found a juvenile panther chameleon. Subsequent surveys over the next few weeks resulted in the removal of a third juvenile chameleon. During this time, the group also received reports of three more animals from different residents of the neighborhood, including one adult that was removed and two of unknown age found dead on the road. It is not known whether this represents a breeding population or the release of multiple age classes. The team has since conducted follow-up surveys to determine if there is a breeding population established in the area, but no chameleons have been found or reported since late July. More follow-up surveys will be conducted in 2014 but the team is hopeful that this population has been extirpated. ♦



This Nile crocodile eluded authorities for two years, but was finally identified and removed from Everglades National Park this year. (Photo courtesy of Michael Rochford, University of Florida)

The long and winding road toward *Lumnitzera* eradication: common questions and answers

by Jennifer Possley, Fairchild Tropical Botanic Garden



The green, capsule-like fruit of *Lumnitzera racemosa* floats and contains a single seed. (Photo by Jennifer Possley, Fairchild Tropical Botanic Garden)



Flowers of *Lumnitzera racemosa*. (Photo by Dennis Giardina, FWC)

2014 marks the sixth year in the Everglades Cooperative Invasive Species Management Area (ECISMA) effort to eradicate *Lumnitzera racemosa* from the mangroves surrounding Fairchild Tropical Botanic Garden and Matheson Hammock Park. This Asian mangrove escaped from cultivation at Fairchild and produced tens of thousands of seedlings that went unnoticed for decades, in part because *Lumnitzera* looks very similar to the native white mangrove.

On January 24 and March 13 of 2014, ECISMA held additional volunteer workdays, during which more than two dozen hard-working volunteers came from seven agencies to survey for outliers and remove hundreds of stems from the infested area.

Lumnitzera eradication does not depend on volunteer efforts alone. Thanks to the Florida Fish and Wildlife Conservation Commission (FWC), funding was provided to employ private exotic plant control contractors in 2010, 2012 and 2014. The strategy has been to use contractors for the heavily infested areas near Fairchild's northern border, and to use staff and volunteer surveys to remove outliers beyond the main infestation.

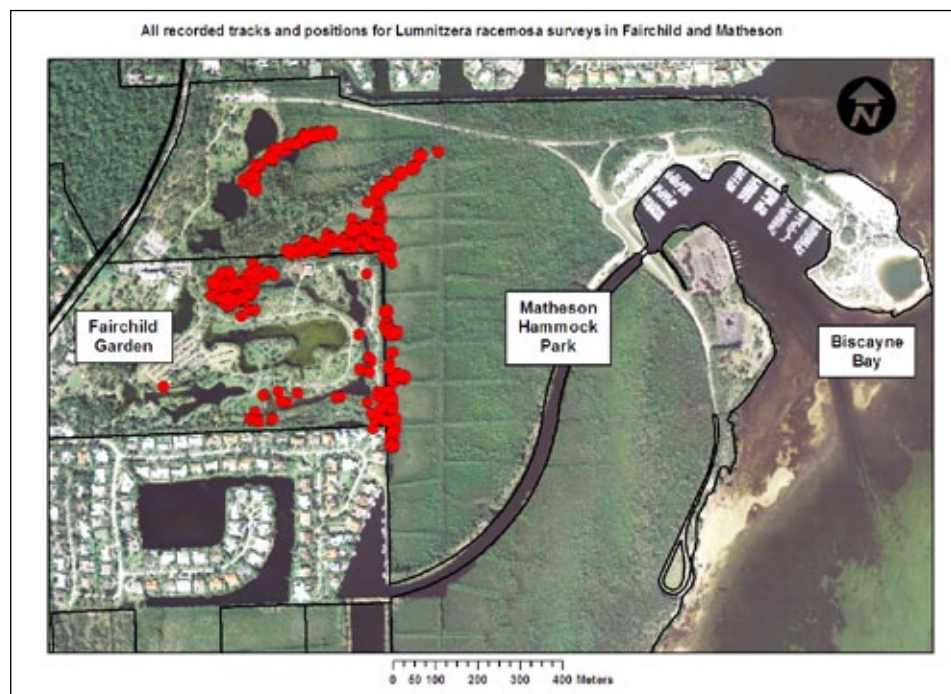
The struggle to eradicate this extremely aggressive invader has been tougher than the group expected, and has

drawn interest from numerous plant biologists and ecologists, both local and out-of-state. Below are the five most commonly asked questions:

1. What do the fruit/seeds look like, and how are they dispersed?

Lumnitzera flowers are small, white,

five-petaled, and emerge in the fall. The fruits are buoyant, single-seeded green capsules which look similar to those of the native white mangrove. Unlike the native black, white, and red mangrove species, *Lumnitzera* fruits are not viviparous (seedling development



This map shows many of the locations where *Lumnitzera* has been found and removed since 2008. ECISMA has conducted searches of unoccupied areas surrounding each cluster, and in March 2014, expanded the survey areas even further to the east and south to ensure there are no other occurrences. (Map by Jennifer Possley, Fairchild Tropical Botanic Garden)

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LUMNITZERA (CONTINUED FROM PAGE 2)



A handful of *Lumnitzera* seedlings removed from a dwarf mangrove stand in Matheson Hammock in January 2012, two years after the last known reproductive trees were removed. At this stage, seedlings are very difficult to distinguish from those of the white mangrove. The most noticeable differences between the two are that *Lumnitzera* has alternate leaves while the white mangrove has opposite leaves, and *Lumnitzera* leaves lack a true petiole (the stalk attaching the leaf blade to the stem) and the leaf margin tapers gradually to the stem. (Photo by Jennifer Possley, Fairchild Tropical Botanic Garden)

does not begin while the fruit is still attached to the tree). This lack of vivipary in *Lumnitzera* may unfortunately contribute to its ability to form a seed bank. *Lumnitzera* fruits float and are water-dispersed, though it is easy to imagine that a hurricane could also blow the lightweight ripe fruit significant distances, which may explain the patchy distribution observed today.

2. Where are all the seedlings coming from?

Although the group believed that they removed the last reproductive *Lumnitzera* trees four years ago, they continue to find thousands of seedlings. Some scientists insist that the explanation for this phenomenon is that the ECISMA group must have left reproductive trees, because mangroves do not have seed banks (whereby dormant seeds remain viable in the soil for years). While it is possible that the group may have left a reproductive tree or two, they have not found any despite searches. Furthermore, a few reproductive trees cannot possibly explain the volume of new *Lumnitzera* seedlings that

searchers find emerging from the soil every year adjacent to an area where a large stand of reproductive *Lumnitzera* once stood. The consensus of the ECISMA group whom have been working on this eradication effort is that there must be a seed bank, and the seeds definitely persist for at least 4 years or longer.

3. How does ECISMA know it hasn't spread further?

ECISMA doesn't know whether *Lumnitzera* has spread further. There is hope that it is contained within the boundaries of Matheson Hammock Park. Over the past six years, dozens of knowledgeable biologists have scoured the area to try to determine the extent of the infestation, and have only found plants within 400 meters of Fairchild Garden. It seems that for the most part, *Lumnitzera's* floating seeds have been contained by the network of mosquito ditches that criss-cross the mangroves. Thankfully, repeated surveys of the Biscayne Bay shoreline by canoe or kayak have not turned up any *Lumnitzera*. Fingers are crossed... and biologists keep looking.

4. Should *Lumnitzera* be on Early Detection and Rapid Response (EDRR) lists all over Florida?

This is a tough question. The short answer is "no." *Lumnitzera racemosa* looks very similar to the native white mangrove, *Laguncularia racemosa*. Sounding the alarm state-wide for what is a highly localized problem could result in mistaken identities and removal of the protected native mangroves. To date, ECISMA has spent hundreds of survey hours by foot, canoe and kayak searching for *Lumnitzera* beyond the 19-acre area where it has already been documented, and the group will be conducting many more surveys. All indications are that it is a localized problem. However, (going back to that asterisk), if ECISMA finds reproductive *Lumnitzera* beyond the original eradication area at any future date, there will likely be a call for this species to be placed on EDRR lists throughout southeast Florida.

5. Is *Lumnitzera* is here to stay?

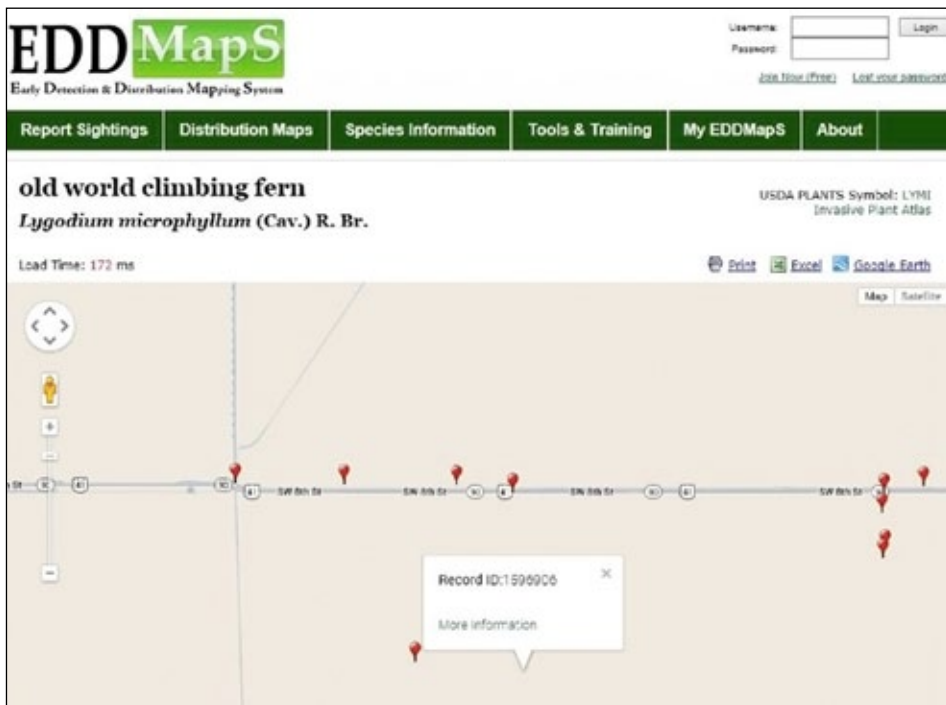
ECISMA continues to believe that *Lumnitzera* can be eradicated. It is increasingly clear, however, that eradication will need to be a long-term effort. At some point, the seed bank will become depleted, but biologists will need to keep surveying for years to find any plants that were missed, or the occasional seed that managed to survive in the soil longer than the others. The group holds the vision that in a few years from now, they can conduct annual surveys with ECISMA volunteers and remove only a few dozen seedlings during each survey. Thanks to all of the ECISMA partners and plant contractors for sharing in the efforts, and their continuing support. ♦



ECISMA needs more dedicated volunteers like Alex Cunningham from USDA-APHIS-PPQ who can really sink their teeth into the *Lumnitzera* eradication effort. Contact Jennifer at jpossley@fairchildgarden.org to participate next time! (Photo by Dennis Giardina, FWC)

IveGot1 App: easy and efficient reporting app has expanded capabilities

by Karan Rawlins and Chuck Bargeron



Data collected by the IveGot1 app is currently reported as a single point. (Image courtesy EDDMapS.org)

The IveGot1 app makes collecting and reporting information on invasive plant and animal species in Florida quick, easy and accurate.

It allows users to see images and read descriptions of the invasive species and view distribution maps of existing infestations.

Most importantly, the app makes it easy for users to submit invasive species observations directly from the field from any smart phone. These reports are automatically uploaded to the Early Detection and Distribution Mapping System (EDDMapS) and e-mailed directly to local and state verifiers for review.

When users in the field report sightings of invasive animals and plants, researchers can better assess the extent of the infestations and make better management decisions to treat new infestations before they become firmly established, the way species such as Melaleuca trees and Burmese pythons have in the past.

The goal of IveGot1 is to make identification and reporting as easy and efficient as possible.

Technology is always advancing and the IveGot1 app is keeping up. As new software and hardware become available, the information technology

professionals at Bugwood Center for Invasive Species and Ecosystem Health are hard at work keeping the app up to date.



A polygon map provides data on invasive species on a tree island in the Everglades. (Image courtesy EDDMapS.org)

The updates for IveGot1 are available free of charge for download to any Apple iPhone, Apple iPad, Android phone or Android tablet.

Two exciting updates will be available for the IveGot1 app in the near future. One update will provide the ability to map negative data. Users will be able to survey a trail and report that it is free of a specific invasive species. Negative data gives land managers a more complete picture of the areas they manage.

Currently, users can report an infestation as point data, using just one set of GPS coordinates that correspond to just one point on earth. Another update in the works will allow users to report an infestation as a polygon rather than a point. A polygon is a two dimensional figure with straight sides and angles, for example, a triangle, square or octagon. The ability to report and read data as an area rather than a single point is a powerful tool for researchers and land managers. It more accurately reflects the reality on the ground for large problem areas, for example, a field infested with tallow trees. ♦

Redwing: another EDRR species in Miami's "Redland" area

by Jennifer Possley, Fairchild Tropical Botanic Garden, and Jane Dozier, Miami-Dade County Parks, Recreation and Open Spaces Department, Natural Areas Management Division

(Photos by Jennifer Possley, Fairchild Tropical Botanic Garden)



The infructescence (cluster of fruits) of redwing appears in the winter.

Redwing is a woody vine native to Mexico, Central and South America. It climbs into the forest canopy and its flowers and fruits are often out of reach. Flowers and fruits are present during winter months, making it much easier to find. The fruits of redwing are called "samaras" and look similar to the "helicopters" that fall from maple trees. They are deep red, hence the name "redwing." The taxonomy for redwing is complicated. All of the major taxonomic authorities use different scientific names, including *Heteropterys beecheyana*, *Heteropterys brachiata*, *Banisteria beecheyana*, *Banisteria brachiata*, *Banisteria sanguinea* and others. The common name "redwing" is easier to use and remember.

Herbarium labels at Fairchild Tropical Botanic Garden indicate that redwing was introduced to south Florida from Colombia and Guatemala by David Fairchild, and was planted in Fairchild (where it has since been removed, presumably for weedy tendencies) as

well as at the University of Florida Tropical Research and Education Center in Homestead, Florida.

Today, redwing has only been documented in two places in Florida, both of which are in Miami-Dade County. One is The Barnacle Historic State Park, a nine-acre park in Coconut Grove. The other location is the vicinity of Castellow Hammock, where infestations have been documented in three separate Environmentally Endangered Lands (EEL) preserves and six adjacent private parcels, in an area spanning approximately 100 acres. While redwing has likely been in this area for at least 20 years, it was first collected there in 2004.

The effort to combat redwing began in November 2011, when Miami-Dade County and Fairchild biologists held a small workday to removed hundreds of redwing seedlings from Chernoff Hammock. The efforts were repeated during an Everglades Cooperative



Redwing's woody vines are similar to that of jasmine in color, size, and coiling, but they lack the corky furrows found in *Jasminum* species.

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REDWING EDRR (CONTINUED FROM PAGE 5)

Invasive Species Management Area (ECISMA) work day in late 2013. Miami-Dade County Natural Areas Management crews, with assistance from EEL preserve managers, have recently begun to treat redwing in other county-owned parcels in the area.

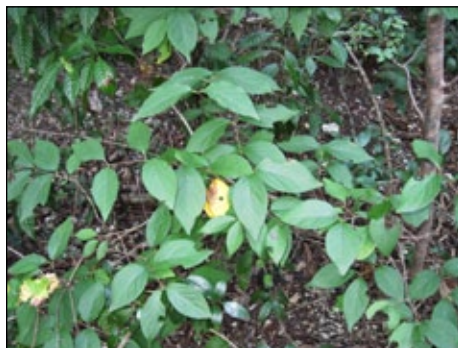
Battling pest plant invasions on public lands is only half the battle. Suspecting that redwing had a strong foothold on adjacent private properties, the group conducted windshield surveys and contacted private landowners to access their properties. To date, the group had direct contact with three of the six private property owners with known or suspected infestations. The group treated a small infestation at one property, and instructed the owners of a second property how to treat the infestation themselves, by hand-pulling seedlings, removing ripe fruit within reach, cutting large stems and applying an herbicide containing triclopyr.



Close-up of redwing flower and fruit.



Dennis Giardina applies Garlon to the stump of a large redwing vine.



Redwing has ovate (broader at the base), opposite leaves.

The group found more than it bargained for at the third property, where redwing covered almost six acres. In half of that area and despite the property owner's attempts since 1999 to fight the invasion, redwing had smothered all vegetation with a habit reminiscent of kudzu or Old World climbing fern. Such a frightening vision caused the group to realize how truly invasive redwing is and resulted in a revision of the eradication strategy.

It has become evident that eradicating redwing from the Castellow Hammock area is going to

be a long-term effort. The immediate priority is to remove all infestations from county preserves. The secondary objectives are to contact all private landowners and work with them to remove small infestations. Finally, the group has its eyes on the horizon for a very large volunteer effort or an appropriate source of funding to treat the core infestation on private land.

Based on these recent findings, there are plans to petition the Florida Exotic Pest Plant Council (FLEPPC) to add redwing to its list of invasive plants. ♦



This massive redwing infestation on private property near Castellow Hammock preserve has a habit reminiscent of highly invasive species such as kudzu or Old World climbing fern.

Exotic Pet Amnesty Program continues to assist in placement of exotic pets throughout Florida by Liz Barraco, FWC

Since the first event in 2006, the Exotic Pet Amnesty Program has increased its reach steadily over the years. In 2013, seven Exotic Pet Amnesty Day events were held in Florida, two of those within the Everglades Cooperative Invasive Species Management (ECISMA) footprint. Exotic Pet Amnesty Day events provide opportunities for pet owners to surrender their exotic pets, no questions asked. All healthy, surrendered animals are available for adoption by pre-approved adopters the same day. The Exotic Pet Amnesty Day events serve as opportunities to educate the public on exotic species in Florida and responsible pet

ownership. In addition to the Exotic Pet Amnesty Days events held throughout the year, people can contact the 888-lveGot1 hotline for assistance in finding a new home for their exotic pet. In total, 340 animals were placed into new homes through the Exotic Pet Amnesty Program in 2013. Of the animals placed, 188 were surrendered during Exotic Pet Amnesty Day events while 152 were placed through calls to the 888-lveGot1 hotline. For more information about the Exotic Pet Amnesty Program, visit MyFWC.com/Nonnatives or call the Exotic Species Hotline at 888-lveGot1 (888-483-4681).
♦

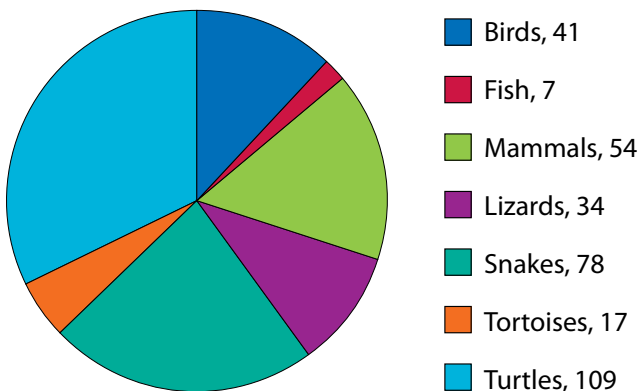


Dr. Frank Ridgely from Zoo Miami examines a bearded dragon surrendered at Exotic Pet Amnesty Day in Broward County. (Photo by Ashley Taylor, FWC volunteer)

Animal Surrenders by CISMA in 2013

Cooperative Invasive Species Management Area (CISMA) Name	# of Events	Number of Animals Surrendered		
		Event	Hotline	Total
Apalachee Regional Stewardship Alliance CISMA	0	0	2	2
Central Florida CISMA	0	0	9	9
East Coast CISMA	0	0	16	16
Everglades CISMA	2	94	50	144
First Coast Invasive Working Group	0	0	19	19
Heartland CISMA	0	0	9	9
Lake County CISMA	0	0	1	1
Marion County Invasive Species Mgmt. Council	0	0	1	1
Nature Coast CISMA	0	0	10	10
North Central Florida CISMA	1	7	7	14
Six Rivers CISMA	1	15	7	22
Southwest Florida CISMA	2	30	6	36
Suncoast CISMA	1	42	13	56
Treasure Coast CISMA	0	0	1	1
Out of State	0	0	1	1
Total	7	188	152	340

Types of Animals Placed in 2013



Murray Stanford (FWC) introduces the public to non-native fish at Exotic Pet Amnesty Day at Zoo Miami. (Photo by Jennifer Ketterlin Eckles, FWC)

The other exotic mangrove: *Bruguiera gymnorrhiza* at Kampong National Tropical Botanical Garden

by Dennis J. Giardina, Florida Fish and Wildlife Conservation Commission



Buds of *Rhizophora mangle* (left) and *Bruguiera gymnorrhiza* (right). (Photo by Dennis Giardina, FWC)

On a morning in March 2014, a group of Everglades Cooperative Species Management Area (ECISMA) partners visited the Kampong Tropical Botanic Garden. After a brief meeting in the living room of what was once David and Marian Fairchild's home, Kampong curator David Jones and Harvard Professor Emeritus and mangrove expert Barry Tomlinson led the group outside and down the slope of the backyard on Biscayne Bay to a small strip of land between two man-made boat basin canals where in 1940, two specimens of the non-native mangrove species *Bruguiera gymnorrhiza* were planted.

Bruguiera gymnorrhiza is native to the diverse mangrove forests of East Africa, Asia, Australia and the Western Pacific.

The two specimens came from a collection made in Sulawesi, Indonesia. In his memoirs, David Fairchild wrote that he hoped his *Bruguiera* trees would eventually fruit and spread along the coast line, brightening it with their red flowers.

In 2008, after *Lumnitzera racemosa*, another species of exotic mangrove, was found to be invading the native mangrove forests of Fairchild Tropical Botanic Garden and neighboring Matheson Hammock County Park, a review of the records of the other



Saplings side by side, *Bruguiera gymnorrhiza* (left) and *Rhizophora mangle* (right). (Photo by Dennis Giardina, FWC)

non-native mangrove species planted at both Fairchild and Kampong Botanical Garden prompted an inspection of their collections.

Of the fourteen documented exotic mangroves that were planted at Fairchild, five remained. Interestingly, out of a total of 14 *Bruguiera gymnorrhiza* trees planted there between 1952 and 1971, none remained.

Of the two *Bruguiera* trees that were planted at the Kampong, one was found to be alive and well, along with at least 86 more of them in the understory. A local survey was carried out and a 21 by 21 meter research plot

was established around the remaining mature tree to determine the seedling density and rate of spread of the population. As the group walked along the pathway in the middle of the forested peninsula, they were able to spot the specimen tree, which was almost 75 years old, pretty quickly. The bark was very dark and the structure of the tree reminiscent of a mature sweet bay magnolia.



Bruguiera gymnorrhiza propagule showing characteristic ribs that look a bit like okra. (Photo by Dennis Giardina, FWC)



Bruguiera gymnorrhiza flower calyx (the outer whorl of sepals that cup the petals of a flower). (Photo by Dennis Giardina)

Bruguiera gymnorrhiza is a close relative of the native red mangrove, *Rhizophora mangle*, and it took a while for the group to be able to distinguish the smaller *Bruguiera* from red mangroves of the same size. Their foliage is strikingly similar and when they are seedlings and saplings, they look a lot alike.

EXOTIC MANGROVE (CONTINUED FROM PAGE 8)



The ECISMA group with Dr. Barry Tomlinson (left to right - Robin Gray, Dennis Giardina, Andrew Derksen, Barry Tomlinson, Jennifer Possley, Gwen Burzycki and Dallas Hazelton). (Photo by David Jones, Kampong Tropical Botanic Garden)

The leaves of *Bruguiera* have much more prominent drip tips. The petioles (leaf stalks) and buds have a distinctive reddish color. The propagules of the two species are similarly shaped but unlike the smooth exterior of red mangrove propagules those of *Bruguiera* are subtly ribbed, appearing a bit like okra.

As the group became better at identifying *Bruguiera*, they flagged the ones they came across that did not bear tags from the 2008 plot. During the survey, the ECISMA group was able to verify that *Bruguiera* persists in the three separate polygons where they were originally mapped.

The group felt somewhat relieved that *Bruguiera gymnorrhiza* population at the Kampong did not appear to be as aggressively invasive as the other exotic mangrove, *Lumnitzera racemosa*. After the survey, the ECISMA group and David Jones committed to reconvening in April to



Peninsula at Kampong with red circles indicating where *Bruguiera gymnorrhiza* was mapped in 2008. (Photo by Dennis Giardina, FWC)

resample the 2008 plot and do a much more exhaustive survey at the Kampong and along the coastline in the vicinity, especially in the pockets of mangroves to the north.

It is reasonable to expect that the original tree has been reproductive for at least half a century and that the inshore current has potentially carried away many *Bruguiera* propagules over the years. *Bruguiera* seedlings are remarkably shade tolerant and it is possible that they could have established over time in the dark interior of native mangrove stands if high tides and storm events were repeatedly able to deposit enough of them there.

The ECISMA partners who have participated in the five-year-long effort to eradicate *Lumnitzera racemosa* are understandably wary of exotic

mangrove species. They had hoped to be able to declare *Lumnitzera* gone, but after hundreds of man-hours and tens of thousands of dollars spent by the Florida Fish and Wildlife Conservation Commission, surveyors are still finding thousands of seedlings per acre per year at Matheson Hammock, four years after it was believed that the last reproductive tree was removed. Those involved in the ongoing effort agree that it is very fortunate that the *Lumnitzera* infestation is the result of an introduction from a single site.

For most invasive species, there is a “lag phase,” a period of time between introduction and “critical mass,” when an invasive species population explodes and begins to impact ecosystem composition, structure and function. For some species like *Lumnitzera*, that period is short.

Certainly other related mangrove species have proven to be invasive, including the native red mangrove, *Rhizophora mangle*. In 1902, red mangroves from South Florida were planted on Molokai in the Hawaiian Islands, which, because of their remoteness, never had any endemic mangrove species. By 1917, it was recorded on neighboring Oahu and now it has been documented throughout the archipelago, negatively impacting native plant and animal communities and proving very difficult to control. At least five other mangrove species were introduced to Hawaii during the early 20th Century. While none of those have spread like red mangrove, two of them have developed into self-sustaining populations. One is another south Florida native, buttonwood, *Conocarpus erectus*. The other species is *Bruguiera gymnorrhiza*. ♦



Jennifer Possley with *Bruguiera gymnorrhiza* seedlings. (Photo by Dennis Giardina, FWC)

“Mangroves as Alien Species: The Case of Hawaii” by James A. Allen: <http://bit.ly/mangHawaii>

“Are mangroves in the tropical Atlantic ripe for invasion? Exotic mangrove trees in the forests of South Florida”
<http://bit.ly/mangfla>

For everything you always wanted to know about mangroves * but were afraid to ask, download the United Nation’s Food and Agriculture Organization paper “The world’s mangroves 1980 – 2005”
<http://bit.ly/everythingmang>

Python Patrol: FWC's newest Early Detection and Rapid Response program

by Jenny Novak, FWC



Python Patrol graduating class photo, January 2014, Port Charlotte. (Photo courtesy of FWC)

Python Patrol is an Early Detection/ Rapid Response (EDRR) training program that recruits and trains natural resource workers, outdoor enthusiasts and concerned citizens. The three elements of the program are python detection and identification, hands-on experience in the safe and humane capture of exotic constrictors and accurate data reporting. Created by The Nature Conservancy, Python Patrol is now administered by the Florida Fish and Wildlife Conservation Commission (FWC) with the program headquartered in Homestead.

Recent data analysis by the University of Florida shows that the population of Burmese pythons (*Python molurus bivittatus*) in south Florida is moving north and west out of Everglades National Park. Increasing the number of people looking for, reporting, and removing pythons is a critical component of preventing the establishment of pythons in new areas. Pythons are hard to find, and detection rates for pythons have been shown to be significantly higher for people that have received training or have experience looking for pythons. Providing trainings that teach detection skills will allow more citizen scientists to effectively participate in stopping the spread of this invasive species.

The goal for 2014 is to host training workshops in south and southwest Florida, with special emphasis on conservation areas in Collier, Lee and Broward Counties. The primary target audience includes law enforcement officers, natural resource workers for state, local, federal and tribal governments, and outdoor recreationalists. FWC offers two types of free Python Patrol workshops:

- **Detector Workshop**

Detector workshops include information on Burmese pythons in Florida, rules and regulations, python detection, species identification and data reporting. There is no hands-on component. This training is for people who do not wish to capture snakes, but want to learn about pythons, how to identify them and what information to collect and report should they see one.



Captain Jeff Fobb of Miami-Dade Fire Rescue's Venom Response Unit teaches safe and humane capture and handling techniques. Fobb explains constrictor behavior while a Burmese python demonstrates coiling during a recent class. (Photo courtesy DOI)



Workshop participants get hands-on experience in a recent Responder workshop in Davie. (Photo courtesy FWC)

- **Responder Workshop**

Responder workshops cover everything addressed in the Detector workshops and include information on the associated permitting process and safe capture techniques. Participants also receive hands-on experience catching wild Burmese pythons. This training is for people who work or recreate outdoors, are likely to encounter pythons, and are interested in learning how to safely and humanely capture them. People who take the responder workshop can join a network of FWC volunteers to help look for and remove pythons reported to the agency through the Exotics Species Hotline (888-lve-Go11). ♦

Groups of eight or more people are encouraged to contact the Python Patrol Coordinator (Jenny at 305-224-4282 or Jenny.Novak@myfwc.com) to inquire about scheduling their own workshops. Up to two Responder Workshops or three Detector workshops can be scheduled for the same day.

For more information, visit: <http://myfwc.com/wildlifehabitats/nonnatives/python/python-patrol/>

Giant brake fern in the Everglades

by Tony Pernas, Christen Mason and LeRoy Rodgers



The tiny, dark sori (spore-producing reproductive structures) are borne along the inrolled margins (edges) on the underside of the pinnules (smaller "leaflets" in a compound leaf). (Photo by Christen Mason, FWS)

Giant brake (*Pteris tripartita*) is a large fern native to tropical Asia. This large ornamental fern has very stout stems with tall, three-parted fronds. The petiole (leaf stalk) is straw to reddish brown colored and can grow to be one to one and a half meters long. The large leaf blades are deltoid (triangular) in shape and pinnate-pinnatifid (remaining sufficiently connected to each other that they are not separate leaflets). The pinnule (leaflet) margins are entire (smooth) to finely toothed. The sori (spore-producing structures) are borne along the revolute (inrolled) margins on the underside of the pinnules.

Giant brake has naturalized in the West Indies, Central America, South America and is one of four *Pteris* species that has escaped cultivation in Florida. It is found in low, moist habitats and appears to require continually saturated soils.

In a 1957 article on cultivated ferns in the American Fern Journal, C.V. Morton states that giant brake was sold by Royal Palm Nurseries of Oneco, Florida beginning in 1896. The species was described as "reaching a height of 6 feet, forming a magnificent specimen." Morton describes the species escaping cultivation and said that it was common in various locations in the Pompano, Florida area by 1928. Giant brake was first vouchered in Florida in 1928 by John K. Small in a cypress swamp west of Pompano. "Vouchered" means that a specimen has been collected and pressed, and sent to a herbarium to verify the species and document a finding. It

usually represents a new record for an area. In 1959, it was recorded and vouchered by Frank Craighead in Miami-Dade County on Old Cutler Road. It has since been vouchered in Desoto, Hillsborough, Martin, Palm Beach, Polk and Volusia counties.

Giant brake is found in a variety of Florida habitats including wet flatwoods, cattail stands, floodplains, hardwood swamps, cypress swamps and hardwood hammocks.



Giant brake fern thrives in shaded areas. (Photo by David Black, SFWMD)

Giant brake was found growing in a tree island in Water Conservation Area (WCA) 3B (Broward County) during the 2013 Everglades digital aerial sketch mapping (DASM) flight. Subsequent ground visits revealed that roughly two acres of the tree island understory contained scattered to dense patches of giant brake. The plant was found in both dense shade and open canopy gaps within the tree island.

Giant brake was spotted again during the 2014 DASM flights. This time, the plant was observed growing in the southwestern part of the Arthur R.

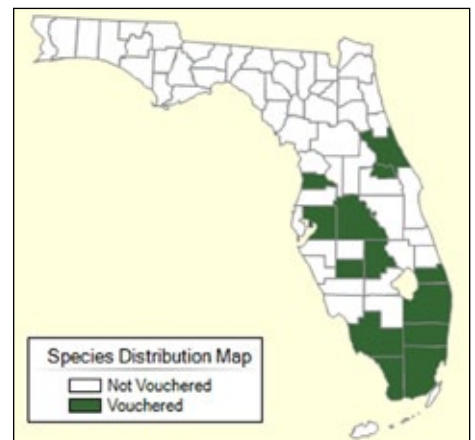


The growth habitat of giant brake fern is somewhat stunted in open, sunny areas. (Photo by Christen Mason, FWS)

Marshall Loxahatchee National Wildlife Refuge (LNWR). Scattered patches were spotted within a roughly 60-acre area, with a total of no more than eight acres of infestation. The giant brake occurred on floating peat mats and openings in dense cattail stands and appeared stunted and chlorotic (pale and yellow). Giant brake was already known to occur in the cypress strands on the east side of the refuge. While there have been no records documenting significant invasiveness of this species, land managers are reluctant to leave it untreated in these areas of recent establishment.

Treatment of the fern has been completed in WCA 3B, with a follow up treatment planned, if necessary. Giant brake locations in the refuge are within a current treatment unit and ground crews have been instructed to treat the fern when it is encountered. The fern has not been documented on tree islands within the refuge and it is hoped that this early eradication effort will prevent tree island establishment in Water Conservation Area 1.

A sample of the fern has been pressed and laminated for future training purposes, to aid land managers in identification. It is possible that the giant brake has established in other natural areas and hasn't been reported. Future decisions and actions could be influenced by the extent of this fern's distribution. ♦



Giant brake fern has been documented and verified in several counties in Florida. (Map from www.florida.plantatlas.usf.edu/Plant.aspx)

The South Florida Ecosystem Restoration Task Force

by Carrie Beeler, DOI



The South Florida Ecosystem Restoration Task Force (SFERTF)

consists of members who are top level policy makers, representing tribal, federal, state, and local government, working together on the largest ecosystem restoration project in the world: the greater Everglades ecosystem.

Invasive exotic species threaten our environment, economy, culture, and human health. Combating invasive exotic species is integral to successful South Florida Ecosystem Restoration and the sustainability of South Florida.

The stakes are high

The SFERTF has been concerned about invasive exotic species and their impacts on South Florida's ecosystem for more than a decade. The South Florida Ecosystem is ecologically unique and imperiled by numerous threats. The South Florida Ecosystem is also home to:

- a culturally diverse population of almost 8 million residents, including two Indian tribes
- world renowned recreational opportunities, and
- strong agricultural and tourism-based economic engines

A Framework

In July 2013, the South Florida Ecosystem Restoration Task Force directed its Working Group and Science Coordination Group to develop a *Strategic Action Framework (Framework)* on invasive exotic species. The Department of Interior's Office of Everglades Restoration Initiatives coordinated the drafting of the Framework in collaboration with an extensive and diverse set of partners, including members of the Task Force, Working Group, Science Coordination Group, and the Everglades

Vision:

The South Florida Ecosystem, including America's Everglades, its environmental, economic, and cultural values and human health, is protected from the harmful effects of invasive exotic species.



Cooperative Invasive Species Management Area (ECISMA).

The SFERTF, along with members of the ECISMA and other partners, are developing this Framework in order to enhance our collective ability to combat invasive exotic species

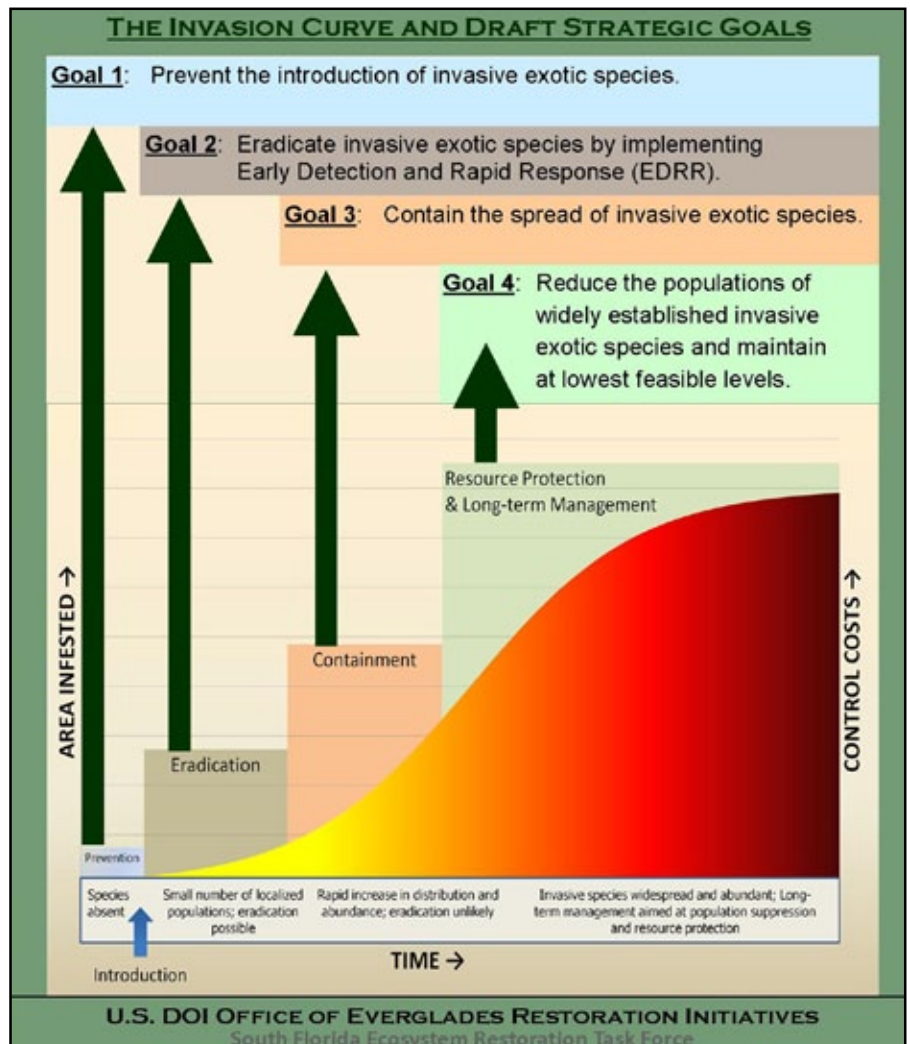
This framework aims to:

- Help decision-makers understand the connections between goals, strategies and tactics
- Maximize the extent to which the current capacity for partnership is leveraged to meet common goals
- Help decision-makers make wise and timely investment decisions in the battle against invasive exotics and
- Define success and provide for accountability

The Invasion Curve as the organizing principle

The Framework initiative has developed four goals organized around the invasion curve. The curve depicts, at a glance, the ability to combat invasive exotic species in terms of time, resources, and likelihood of eradication or containment.

The left-hand side of the invasion curve represents the best chance for long-term success. Since eradication of widely established invasive species is rarely achieved, a long-term commitment to controlling established species is required to protect natural resources. Long-term suppression of these established species is a challenge and is costly. Thus, early detection and control of new invasive species results in lower overall environmental impact and economic cost along with a higher likelihood for eradication. ♦



Dalechampia vine continues to present challenges

by Pat Howell, Natural Resources and Land Management Section, Broward County Parks



Dalechampia is a twining vine with three-lobed leaves and stinging hairs on all parts of the plant. Two large, showy bracts (modified or specialized leaves) hug the flowers. (Photo by Pat Howell, Broward County Parks)

Dalechampia scandens is an invasive vine native to East Central Africa and the Cape Verde Islands, the Arabian Peninsula, Mexico, Central and South America including the West Indies.

The first documented location for this vine in the United States was at Anne Kolb Nature Center in Hollywood, Florida in 2000, where it showed up near the butterfly garden.

Dalechampia is the larval host of the *Hamadryas* or "cracker" butterflies. The male butterflies produce an unusual "cracking" sound as part of their territorial displays. At this time, the pale cracker (*Hamadryas amphichloe*) only occasionally strays into Broward County from the West Indies or Cuba.

Dalechampia is a twining vine with three-lobed leaves and stinging hairs on all parts of the plant, with the possible exception of the root. Two large, showy bracts (modified or specialized leaves) hug the flowers. When the mature flower capsule dries, the seeds rupture explosively, dispersing the seeds several meters from the parent plant.

In 2006, *Dalechampia* was found in Tradewinds Park in Coconut Creek, Broward County. The park is more than 626 acres, and is divided by Sample Road (a six-lane highway), and is bounded by the Florida Turnpike to the east. This plant was observed growing into the tops of south Florida slash pine (*Pinus elliotii*) on the northeast corner and into the cypress domes on the southwest corner of the park.

A vine removal project in Tradewinds Park in 2010 and 2011 was unsuccessful in removing *Dalechampia*. On January 24, 2014, the Everglades Cooperative Invasive Species Management Area (ECISMA) Early Detection Rapid Response (EDRR), team located and marked *Dalechampia* locations with GPS throughout Tradewinds Park. Three of the cypress domes on site are currently being treated.

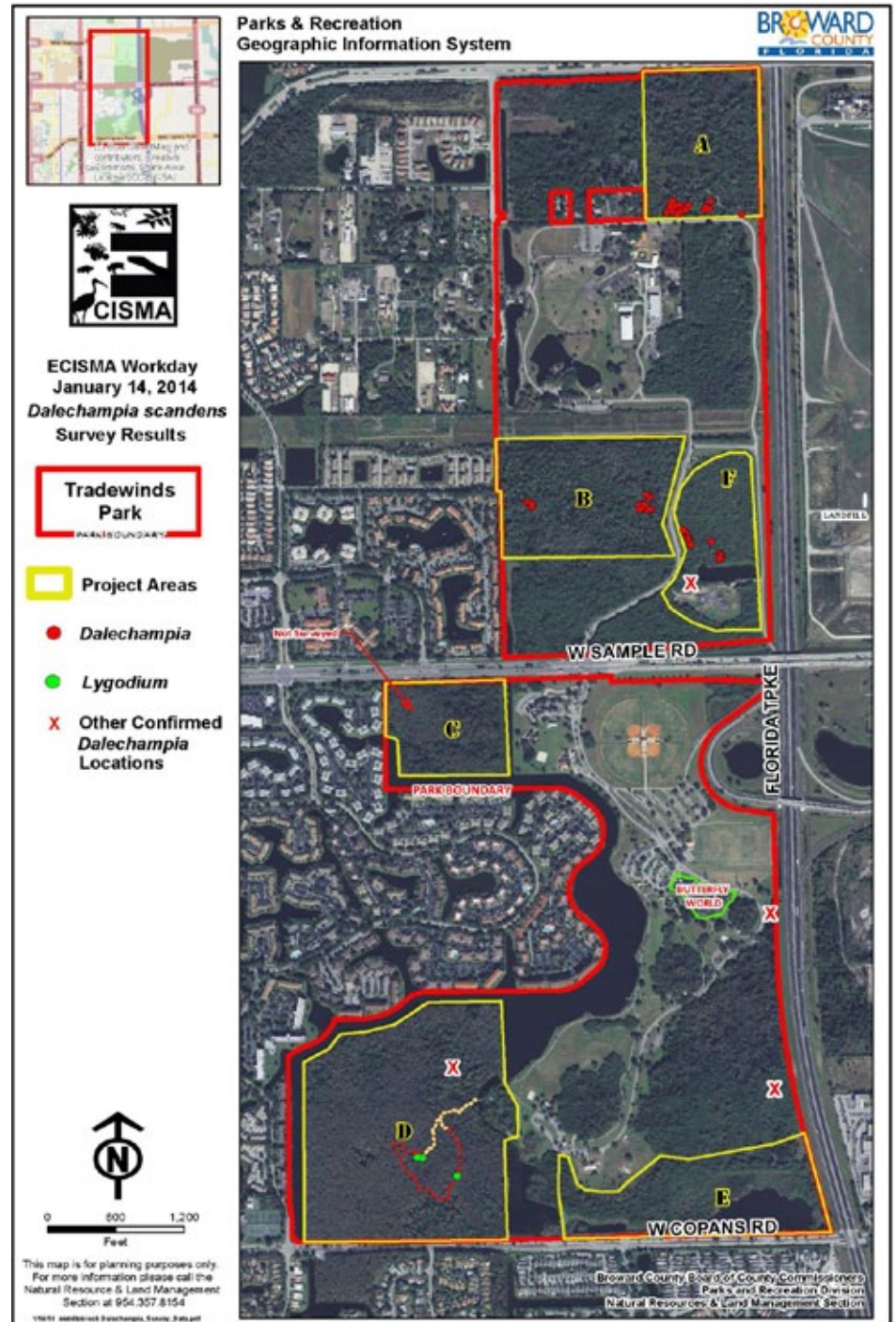
In 2006, *Dalechampia scandens* was found along the firebreaks of the Military Trail Scrub Site, also in Broward County. Despite a 2010 a wildfire and multiple chemical treatments, the population at this site has not yet been successfully removed.

The plant has been found growing in pine flatwoods, sand pine scrub, cypress domes, and adjacent to mangrove swamps and the Intracoastal Waterway. Currently, all

three sites in Broward County are undergoing chemical treatments.

Dalechampia scandens plant was more recently found in the University of South Florida's Botanical Garden in Tampa.

View herbarium specimens of *Dalechampia scandens* on the Atlas of Florida Vascular Plants Institute for Systematic Biology Website: <http://bit.ly/dalechamp> ♦



Distribution *Dalechampia scandens* within Tradewinds Park in Broward County. (Map courtesy Michael Middlebrook, Broward County Parks)

Large snails and tiny pink eggs: new research suggests invasive snail eggs may be best left alone

story and photos by April S. Ostrom, Palm Beach Atlantic University



Shell of the large invasive snail, *Pomacea maculata* (formerly known as *Pomacea insularum*).

A non-native freshwater snail species of the *Pomacea* genus *Pomacea maculata* (formerly known as *Pomacea insularum*) has become established in Florida, Texas and Hawaii. The snails were native to South America, and were probably introduced to the United States from aquarium release or "aquarium dumping." This non-native snail feeds on aquatic plants and invertebrates and a single female can lay approximately 2,000 to 4,000 bright pink eggs each week. This snail is a threat to agriculture and native wetland ecosystems in the United States. Moderately effective methods of control include biological control, pesticides and draining heavily infested areas followed by manual removal.

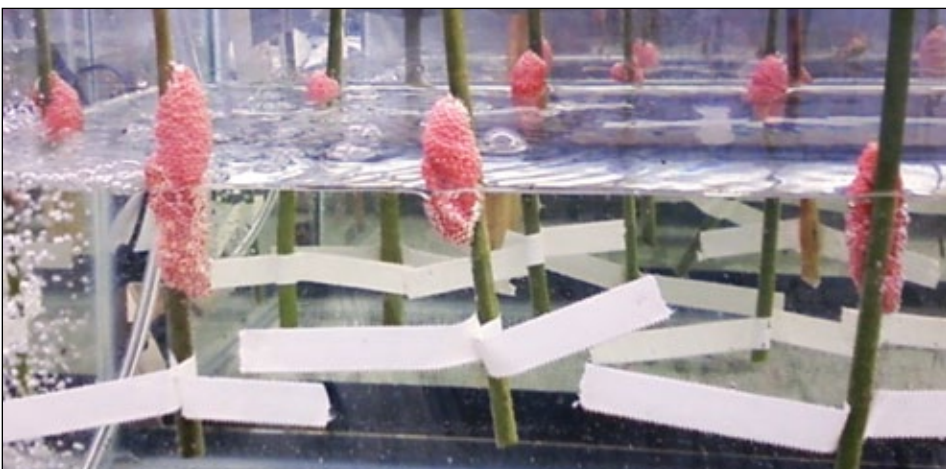
A study was done to investigate two other proposed methods of control, dislodging or flooding the eggs. The objectives of the study were to

compare the hatching success of unsubmerged egg clutches with the hatching success of partially submerged egg clutches, compare the growth rates and determine if snails hatched in submerged conditions are viable to a shell length that exceeds 25 millimeters (one inch), the average size of an adult snail of reproductive age.

During the study, researchers observed that eggs in unsubmerged conditions had an average hatching success of 47 percent. Eggs in partially submerged conditions had an average hatching success of 43 percent and floating eggs (which had been dislodged from the vegetation where they had been deposited) had an average hatching success of 30 percent. A moderate estimate of a 10 percent hatching viability to reproductive age in partially submerged eggs could result in 60 to 80 snails per clutch. With an average of 2,064 eggs per clutch, 60 to 80 snails could potentially produce more than 12,000 viable offspring in one week.



Adult non-native snails measuring 30 millimeters (slightly larger than an inch) in size.



The egg clutches of invasive snails are distinctive, with many tiny pink eggs. They look much different than those of the native apple snails, which have fewer, larger white eggs and are sensitive to inundation by water.

Pink eggs – leave them alone?

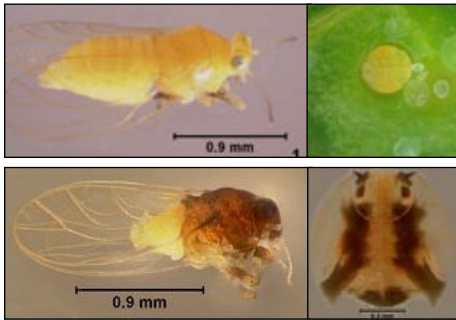
Due to the plight of the endangered Snail Kite, it is fairly common knowledge that the white eggs of native apple snails are sensitive to inundation by water. Recent research suggests that the idea of knocking the bright pink egg clutches of invasive apple snails into the water to try to get rid of them may not be such a good idea. In the study, invasive snail eggs still had a moderate reproductive success rate even if they were partially submerged or floating. Since the eggs may still be viable, it is possible that "knocking down" pink eggs into the water (despite the best intentions) may actually facilitate dispersal and make thousands of tiny eggs even more difficult for predators to find and eat.

Non-native *Pomacea* species have become the most serious apple snail pests, attacking a wide range of crops, with impacts in South-East Asia, Thailand, Vietnam, Malaysia, Indonesia, China, Taiwan, Japan and Philippines. *Pomacea* species infestations in 1990 cost the United States \$28 to 45 million. A thorough understanding of this species is crucial to be able to control this ongoing invasion.

Read the complete study: **An Assessment of Submersion as a Mechanical Control Technique of *Pomacea insularum* eggs in Southern Florida, USA**, by April S. Ostrom, Thomas C. Chesnes published in *Natural Resource and Conservation*: <http://bit.ly/pinkeggs> ♦

Gall-forming psyllids: promising biological control agents for Brazilian peppertree

by James Cuda, Rodrigo Diaz, Veronica Manrique, Alissa Berro, Patricia Prade, Marcelo Vitorino and William Overholt, UF/IFAS



Adult and nymph of *Calophya latiforceps* (top) and *Calophya terebinthifolii* (bottom). Note contrasting dark and light regions on *Calophya terebinthifolii*. (Photos by Lindsey Christ, UF/IFAS)

Brazilian peppertree (*Schinus terebinthifolia*) is an aggressive, rapidly colonizing woody shrub of disturbed habitats, natural communities and conservation areas in southern California, Florida, Hawaii, Texas and several Caribbean islands

Introduced into Florida from South America as a landscape ornamental in the late 19th century, Brazilian peppertree escaped cultivation and is widespread throughout the ecosystems in central and south Florida, most notably the Everglades. This invasive shrub grows rapidly, displaces native vegetation, tolerates a wide range of environmental conditions and is a prolific seed producer.

Direct contact with the plant may cause irritation to sensitive people. Ingestion of the berries may intoxicate birds and mammals, and is sometimes toxic to livestock, especially horses. For example, several flocks of Cedar Waxwings (*Bombus cedrorum*) recently died in California from trauma after gorging on the overripe berries and colliding with hard objects.

Brazilian peppertree also contributes to other invasive species problems. For instance, it is an important alternate host for the naturalized Caribbean root weevil (*Diaprepes abbreviatus*), a major pest of commercial citrus, ornamental plants and some agricultural crops in Florida and California. In southwest Florida, the invasive black spiny-tailed iguana (*Ctenosaura similis*), introduced from Latin America, survives on the leaves of Brazilian peppertree during the winter months.

The rapid growth and spread of Brazilian peppertree is due in part to hybrid vigor, its ability to chemically and physically exclude other plants. A lack of natural enemies was the rationale for initiating a classical biological control program in Hawaii in the 1950s, and in Florida in the mid-1980s.

The goal of biological control is to introduce a complex of natural enemies into Florida that are capable of selectively attacking and reducing the invasiveness of Brazilian peppertree. Several arthropod natural enemies that occur in South America were identified that are capable of restricting seed production and reducing the vigor and growth rate of seedlings and young plants. Biological and host range studies were initiated for several of these natural enemies to determine their suitability for release in Florida. Two of these natural enemies that have biocontrol potential are leaflet galling psyllids of the genus *Calophya*. *Calophya terebinthifolii* was described as a new species in the last decade, and *Calophya latiforceps* was only recently described. Both psyllids attack Brazilian peppertree in South America.

Nymphs developing within pit galls (circular depressions) on the leaflets cause extensive foliar pitting, cessation of growth and defoliation. The rationale for using *Calophya* species as biological control agents is based on a similar, although unintentional, introduction of a related species into California that caused widespread damage to the commonly planted ornamental Peruvian peppertree, *Schinus molle*. The invasive psyllid *Calophya schini* which was first discovered in California in 1984, caused extensive damage to Peruvian peppertree. However, in California where Brazilian peppertree often co-occurs with *Schinus molle*, field observations indicated that Brazilian peppertree was immune to attack by this psyllid. This finding confirmed the high degree of host specificity exhibited by these *Calophya* psyllids. A laboratory colony of *Calophya terebinthifolii* has been established, and host range testing of *Calophya latiforceps* was completed. A petition for field release of *Calophya latiforceps* will be submitted to the Technical Advisory Group for Biological Control Agents of Weeds in 2014. Acquisition of the two *Calophya* psyllids was made possible via licenses issued by the Brazilian Institute of Environment and Renewable Natural Resources (IBAMA), which is Brazil's equivalent to the Environmental Protection Agency EPA in the United States.

Research on Brazilian peppertree biological control is supported by grants from Florida Fish and Wildlife Conservation Commission (FWC) and the Florida Industrial and Phosphate Research Institute. ♦



Leaflets of Brazilian peppertree galled by *Calophya latiforceps* (left) and *Calophya terebinthifolii* (right). (Photos by Rodrigo Diaz, UF/IFAS)

Update on operational activities for nonnative reptiles

by Jennifer Ketterlin Eckles



UF and FWC are conducting spectacled caiman surveys and removals of in Miami Dade and Broward Counties. (Photo courtesy UF)

Numerous agencies and their contractors continued management activities within the Everglades Cooperative Invasive Species Management Area (ECISMA) footprint for several populations of reproducing nonnative lizards and one crocodylian in 2013. Staff from Florida Fish and Wildlife Conservation Commission (FWC), South Florida Water Management District (SFWMD), University of Florida (UF), Miami-Dade County Parks, Recreation, and Open Spaces (MDC PROS), Everglades National Park (ENP), the National Park Service (NPS) and United States Geological Survey (USGS) coordinated on surveying, trapping, and removing animals in order to maximize efforts.



Joy Vinci (UF) and Jake Edwards (FWC) excavate a nest located via their female tegu telemetry project. (Photo courtesy FWC)

ECISMA partners used remote camera traps, live traps, and driving surveys to monitor distribution and collect biological data on Argentine tegu lizards in southern Miami-Dade County during the 2013 tegu trapping season and the same operations are underway in 2014. FWC and UF are partnering to conduct a telemetry study on female tegus in 2014. For this study, radio transmitters will be surgically implanted in female tegus

and their location and movements will be tracked every other day. This study will help managers learn more about nesting behavior and female dispersal patterns which can be used to make decisions on future control efforts.

FWC and UF are conducting spectacled caiman surveys, coupled with removal in Miami-Dade and Broward counties. In addition, FWC, UF and SFWMD staff are conducting Nile monitor surveys in Palm Beach and Broward counties in order to determine the distribution of animals in Palm Beach County and to confirm or deny a breeding population in Broward County.

Finally, under contract with FWC, UF is leading ECISMA partners to conduct Oustalet's and veiled chameleon surveys in on-going efforts to eradicate Oustalet's chameleons and to get a better handle on the distribution of separate veiled chameleon populations throughout Miami-Dade County.

The following table summarizes the number of each of these species removed from breeding populations within the ECISMA footprint in 2013, in order of species priority. ♦

Species	County	Number Removed	Primary Participants
Argentine black and white tegu	Miami-Dade	183	FWC, UF, MDC PROS, ENP, NPS, & USGS
Nile monitor	Palm Beach	7	UF, FWC, SFWMD
spectacled caiman	Miami-Dade	42	UF, FWC, SFWMD
Oustalet's chameleon	Miami-Dade	85	UF, FWC, ECISMA
veiled chameleon	Miami-Dade	32	UF, FWC, ECISMA



Tegu eggs excavated from a nest made of vegetation on an elevated patch of marsh in Miami-Dade County. (Photo courtesy FWC)



Jake Edwards (FWC) with 18 eggs removed from the tegu nest. The eggs are hard like bird eggs. (Photo courtesy FWC)

Mikania micrantha 2013: eternal vigilance?

by Andrew Derksen, FDACS/DPI and Jane Griffin Dozier, Miami-Dade County PROS

(Photos by Jane Griffin Dozier, Miami-Dade County PROS)



The distinctive leaf of *Mikania micrantha*.

2013 was the fourth full year of surveys and management for the exotic climbing vine, *Mikania micrantha*, in the Redland Agricultural Area. While its total range has not expanded and few new properties have been added in the last two years, the vine continues to persist in many areas in spite of management efforts. Currently over a hundred parcels of land are infested with *Mikania micrantha*, a decline of almost forty parcels since peak observations were detected by surveys in 2011.

The majority of the *Mikania* infested parcels continue to be those owned and managed by commercial nurseries, which represent slightly less than half of all infestations detected. Greater awareness of the vine and

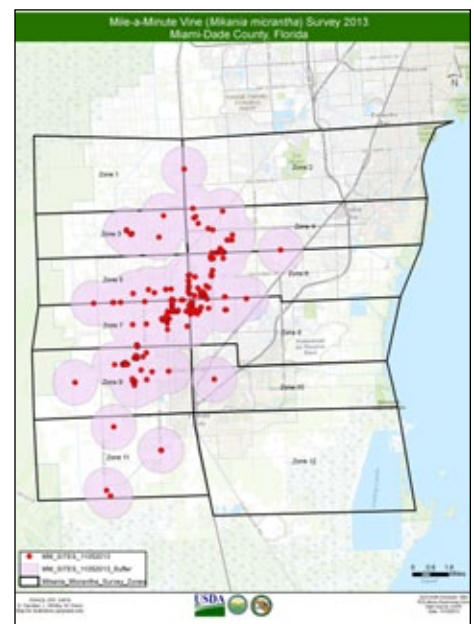
aggressive control efforts by nursery owners resulted in the removal of almost thirty nurseries from the list of affected properties in the last two years.

In spite of regular management efforts and inspections by Florida Department of Agriculture plant inspectors, many infestations persist. Contaminated blocks will continue to be placed under quarantine until vine removal is witnessed by Plant Inspection staff. Infested nurseries will then remain under compliance agreement and subject to biannual inspection until such time as the Redlands are declared *Mikania*-free.

With a recovering economy, the number of unregulated, "out of business" commercial properties and

abandoned homes have declined. Many of the new home and business owners do not appreciate the climbing vine's rampant growth over structures and they remove it. Abandoned properties that remain usually contain the largest and densest infestations and when this weed goes unchallenged, it runs amok. These properties also serve as a reservoir for re-infestation, and at least a third of all infested properties share a border or are in close proximity to one of these "bad actors."

Another continuing concern is the occurrence of *Mikania* in Miami-Dade County-managed natural areas. To date, the vine has been detected in and around five preserves, and in one non-preserve park. The County's management efforts conducted by the Parks, Recreation, and Open Spaces Department's Natural Areas Management (NAM) and the Department of Environmental Resources Management's Environmentally Endangered Lands (EEL) programs, have greatly reduced these infestations, and apparently eliminated the *Mikania* populations on two of the properties. However, to the frustration of county crews and biologists, two new areas were discovered in 2013 and early 2014. One occurred at a park where treatment has been ongoing, and there was another entirely new occurrence at a



Mikania micrantha was found in the locations marked on red on this map showing the 2013 survey area. (Map courtesy of USDA)



Leslie Johnson, part of the Natural Areas Management (NAM) crew, treats *Mikania micrantha* at "ground zero" where the plant was first positively identified.



A crew hand-pulls *Mikania* at Camp Owaissa Bauer, a county park, to avoid impacts to the native plant community, including two endangered and imperiled species of passionflower.

county preserve. In some areas, crews must rely exclusively on hand-pulling, due to the close proximity of two native, endangered passionflower species.

At least twenty parcels of land that had been reported as *Mikania*-free over the last two years had new infestations reported within forty feet of their first detection. The largest of these "new" and resurgent parcels were found along the railroad tracks that cut between nurseries in the Homestead area.



Odinor Jean-Baptiste sprays *Mikania* seedlings.

While the persistence of this weed in heavily managed areas and its ability to survive below detection thresholds remain a cause for concern, there is hope. The overall size and density of individual patches of *Mikania micrantha* have diminished considerably in the last three years. Infestations that used to cover acres of property now exist as small patches.

Most importantly, in spite of regular surveys outside of the known infested range in the Redlands, this vine has yet to be detected west of SW 217 Avenue and only once was it found north of SW 184 Street. Only one population has been identified east of U.S. 1, and none beyond the Florida Turnpike.

Though surveys and management of the exotic climbing vine *Mikania micrantha* must continue, the road ahead still looks like a long, slow path to victory. ♦

Rotala rotundifolia: a new canal invader in south Florida

by Lyn A. Gettys, UF/IFAS FLREC and Phil Tipping, USDA/ARS IPRL



Inflorescence of *Rotala*. (Photo courtesy Lyn Gettys, UF)

Description

Rotala (*Rotala rotundifolia*), also known as dwarf *Rotala* and roundleaf toothcup, is an introduced freshwater aquatic weed that persists year-round in south Florida. The species has both submersed (completely underwater) and emergent (originating underwater and emerging past the surface) forms, which differ in a number of ways. The leaves are small (less than 2 centimeters long) and arranged in groups of two or three around hot-pink stems in both forms, but emergent *Rotala* has fleshy, bright-green, rounded leaves and submersed *Rotala* has darker green or reddish leaves that are thin and lanceolate (sword-shaped). Growth habit differs between the forms as well. Low-growing populations of emergent *Rotala* creep along shorelines and banks, with plant height rarely exceeding 15 centimeters. Submersed plants form tight, mounded colonies in water as deep as 2 meters, but eventually grow to reach the surface of the water, where they form dense mats that block light penetration and impede water flow. *Rotala* produces spikes of small, bright pink-to-fuchsia flowers, but plants tips must be aerial (out of the water) for flowering to occur.

ROTALA ROTUNDIFOLIA (CONTINUED FROM PAGE 18)

Emergent (top) and submersed (bottom) vegetative growth on *Rotala*. (Photos courtesy Lyn Gettys, UF)

Invasion history and habitat

Rotala was introduced through the aquarium and water garden industry due to its attractive stems, leaves and flowers and ease of cultivation. The species is a relative newcomer to Florida and was first found in Coral Springs in Broward County in 1996. It has since established large but mostly isolated populations throughout south Florida and is especially problematic in canals in Lee and Collier counties. The extremely dense submersed populations and large, thick surface mats produced by *Rotala* greatly reduce ecosystem quality because oxygen level and light penetration are hampered. In addition, water flow is restricted due to the excessive growth of the species. Many infested canals are part of the south Florida flood control system and the ability to move large volumes of water quickly is critical, so management of this aquatic weed is a major concern for resource managers and water managers alike.

Control

Herbicides: Only a few aquatic herbicides that have been tested thus far provide an acceptable level of control of *Rotala*. Topped-out emergent growth can be "burned back" with glyphosate, but does not result in long-term control. Endothall and flumioxazin do not cause measurable damage to the species, and diquat (at 400 parts per billion) provides only around 80 percent control. On the other hand, applications of triclopyr and 2,4-D (either product at 2 parts per million) can be expected to result in total or near-total control of *Rotala*. Both of these herbicides are organo-auxins, which mimic naturally occurring plant hormones that regulate growth. These products kill weeds by causing unusual growth (such as growing too quickly and depleting the plant's reserves needed for normal growth) in target weeds but they are known to cause significant damage at very low concentrations to sensitive species as well. Therefore, many auxins have lengthy irrigation restrictions, meaning water treated with these products cannot be used to water crops, lawns, landscapes or greenhouse plants until the concentration of auxin falls below a level stated on the herbicide label. The effects of all labeled aquatic herbicides on *Rotala* are currently being evaluated in the hopes of identifying other products that may control the species with shorter irrigation restrictions.

Mechanical harvesting: Although mechanical harvesting is used as a management tool to reduce populations of a number of aquatic weeds, using this technique for *Rotala* control is challenging for a number of reasons. *Rotala* is heavier than many submersed weeds such as hydrilla and this puts additional stress on machinery and necessitates more trips between the infested site and the offload location. Also, offloading harvested material onto the canal bank may be an effective practice when mechanical harvesting is used to control hydrilla, but it can actually spread populations of *Rotala* along the canal bank because the species grows quite well as a shoreline plant. As a result, plant material should be transported far from water or hauled to a landfill, which can be prohibitively expensive. In addition, *Rotala* propagates mostly by vegetative means, so the fragments that are produced during mechanical harvesting may result in spread of the species.

Biocontrol: Organisms that feed on plants are classified as "host-specific" or "generalist" herbivores. Host-specific herbivores attack only a single species of plant and will not damage other species, while generalist herbivores attack and damage many species. Host-specific herbivores can sometimes be introduced from a weed species' native range and used as biological control (or "biocontrol") agents because they can help to control the target weed without endangering desirable native plants. In fact, organisms that are being studied for their use as biocontrol agents must be host-specific or they cannot be released in the U.S. Biological control with insects has not been considered to date. The first step in initiating this process would be to conduct a feasibility study in order to evaluate the pros and cons and guide future actions. A close relative of *Rotala*, purple loosestrife (*Lythrum salicaria*), has been successfully managed in the northeastern U.S. with four species of weevils. Although *Rotala* is currently only a problematic weed in south Florida, its range will probably expand and make it a more visible target for biological control efforts. It is also a weed in Australia where the U.S. Department of Agriculture Agricultural Research Service (USDA-ARS) Australian Biological Control lab could play a leading role (as they did with melaleuca) should any decision be made to initiate a control project. In Australia, *Rotala* has become naturalized in areas of New South Wales and Queensland and is recognized as an invasive species.



Rotala infestation in a flood control canal in Naples. (Photo courtesy Lyn Gettys, UF)



Rotala infestation after treatment with glyphosate. (Photo courtesy Lyn Gettys, UF)

Although it cannot be shipped to Western Australia or Tasmania because of quarantine restrictions, other states still allow its importation. Scientists there expect this will change as the weed expands its range and increases its impact. Informal consultations have already taken place between the Invasive Plant Research Lab in Ft. Lauderdale and the Australian Biological Control Lab in Brisbane about conducting informal surveys in Asia as part of other projects.

There are generalist insect herbivores such as *Synclita oblitalis* that attack the plant in Florida, but they do not seem to be suppressing the plant to any useful extent. Triploid grass carp, another generalist herbivore, has been evaluated on a small scale for *Rotala* control, but there is no evidence thus far that these fish actually eat the species.

Summary

Rotala is a new and noxious weed in south Florida and causes significant problems for resource managers. Although mechanical methods can be used to manage *Rotala*, this technique is expensive and can foster spread of the species. Two aquatic herbicides provide good control of *Rotala*, but both are organo-auxins with significant irrigation restrictions, which precludes their use in many of south Florida's infested canals. The University of Florida's Institute of Food and Agricultural Sciences Fort Lauderdale Research and Education Center and the USDA are working to develop additional recommendations for



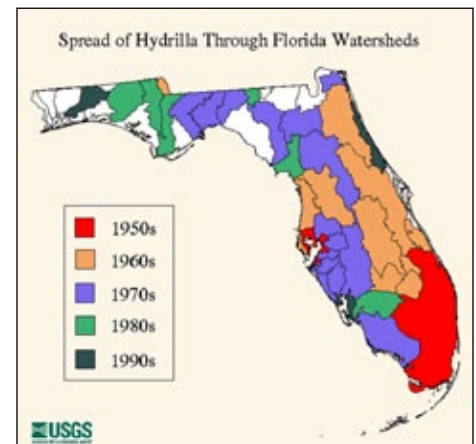
Mechanical harvesting (top) and regrowth (bottom) of *Rotala*. (Top photo courtesy Ellen Allen, SFWMD; lower photo courtesy Lyn Gettys, UF)

control of the aquatic weed *Rotala* in canals and hope to identify other treatment options that can be employed to control *Rotala* without the irrigation restrictions associated with organo-auxin herbicides. Biological control may be an option but a feasibility study remains to be done. ♦

UF/IFAS Hydrilla Integrated Pest Management

by James P. Cuda, Jennifer L. Gillett-Kaufman, Ken T. Gioeli, Verena-Ulrike Lietze and Emma N.I. Weeks

Hydrilla (*Hydrilla verticillata*), an invasive submerged aquatic plant, has spread to almost every county in Florida and has been in the Everglades since the 1950s. When left unmanaged, this aquatic weed causes damaging infestations that choke out native vegetation, clog flood control structures, impede navigation and recreation, and are costly to manage.



Spread of *Hydrilla verticillata* infestations in Florida since the introduction of this aquatic plant in the 1950s. The counties marked in white have not reported an occurrence of *Hydrilla*. (Map courtesy of the U.S. Geological Survey, Department of the Interior)

The invasive aquatic plant *Hydrilla* arrived in Florida through the aquarium trade in the early 1950s. Its accidental release and the absence of natural enemies, which regulate *Hydrilla* in its native range, enabled this aggressive submerged plant to spread to nearly every freshwater body in the state. By the early 1990s, *Hydrilla* populations occupied more than 140,000 acres of Florida's lakes and rivers. Heavy reliance on herbicides to control these infestations has led to increasing incidences of herbicide-resistant biotypes.

Research scientists and extension specialists at the University of Florida's Institute of Food and Agricultural Sciences (UF/IFAS), the Florida A&M University, and the U.S. Army Corps of Engineers are tackling the issue of herbicide-resistant *Hydrilla*. The mission

HYDRILLA (CONTINUED FROM PAGE 20)



Hydrilla infestation in a canal between East Lake Tohopekaliga and Lake Tohopekaliga, Kissimmee, Florida. (Photo by Emma Weeks, UF/IFAS)

is to find economical and environmentally friendly control strategies to reduce management costs and ultimately create more favorable recreational areas on lakes and rivers that have become almost unusable because of dense *Hydrilla* infestations.

For detailed information, visit: <http://entomology.ifas.ufl.edu/hydrilla>

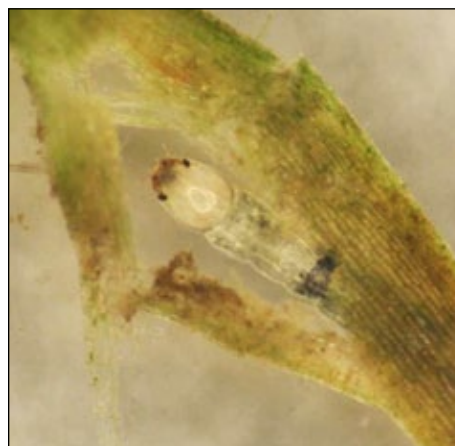
Scan the QR code to link directly to the UF/IFAS *Hydrilla* IPM Project website:



The team of the U.S. Department of Agriculture (USDA)-funded UF/IFAS *Hydrilla* Integrated Pest Management (IPM) Project is investigating the hypothesis that the integration of an herbivorous insect, the *Hydrilla* tip-mining midge (*Cricotopus lebetis*), with a fungal plant pathogen (*Mycocleptodiscus terrestris*) and/or low doses of the herbicide imazamox is a viable strategy for long-term sustainable management of *Hydrilla*.

Watch a short narrated learning lesson about the *Hydrilla* tip mining midge: <http://bit.ly/GHYIt0>

As part of the extension efforts, the UF/IFAS *Hydrilla* IPM Project team has developed educational platforms to help resource managers understand



Larva of the *Hydrilla* tip-mining midge inside a damaged shoot tip of *Hydrilla*. (Photo by Dana Denson, Reedy Creek Improvement District)

how new control strategies can fit into an Invasive Pest Management (IPM) plan for *Hydrilla* in Florida.

During 2014, the team partnered with Florida LAKEWATCH to deliver seminars to Florida citizens who have access to lakefronts and are involved actively in citizen science by performing water quality assessments.

Pesticide license holders can earn a continuing education unit (CEU) by taking the *Hydrilla* IPM online course and sending a small fee for processing. To learn more (even if CEUs are not needed) visit the UF/IFAS *Hydrilla* IPM website where the *Hydrilla* IPM CEU Course workbook can be downloaded for free: <http://entomology.ifas.ufl.edu/hydrilla>



Branched stem (top) and root (bottom) of *Hydrilla*. (Photo by Lyle Buss, UF/IFAS)

Subscribe to the quarterly UF/IFAS *Hydrilla* Integrated Pest Management (IPM) Newsletter: <http://bit.ly/1g2v7Fu>

The team would like to acknowledge the financial support provided by the U.S. Department of Agriculture, National Institute of Food and Agriculture, Risk Avoidance and Mitigation Program (grant 2010-02825).

The UF/IFAS *Hydrilla* IPM Project Extension Team

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Friends of Everglades CISMA, Inc. provides flexible funding for rapid response

by Joseph Ryan Steele, President and Executive Director of Friends of Everglades CISMA, Inc.

Invasive species are a growing threat to the Everglades ecosystem. The Everglades Cooperative Invasive Species Management Area (ECISMA) is a formal partnership of federal, state, and local government agencies, tribes, individuals and various interested groups that work together to manage invasive species in south Florida.

Once established, invasive species become difficult, if not impossible to fully eliminate, and management becomes a necessary and often expensive procedure. Early Detection and Rapid Response (EDRR) is an effective method to combat these

FRIENDS OF



Everglades Cooperative Invasive Species Management Area

species by eliminating individuals and populations before they become established. New invasive threats are constantly emerging, and it can be a challenge to request and find funding for new projects quickly when budgets are typically dedicated to specific projects in advance.

Friends of Everglades CISMA, Inc. (FOE) is a nonprofit organization designed to raise funds for Everglades CISMA. Some of these funds are used as a quick, flexible funding source for projects that require immediate response. FOE recognizes the importance of EDRR as well as continued mitigation efforts, which include research and removal of current invasive threats.

FOE incorporated on May 6, 2013, and has received exemption from Federal income tax under 501(c)(3) of the Internal Revenue Code. Donations to

FOE, Inc. are tax deductible. Activities are governed by a board of directors including Joseph Ryan Steele (President), and ECISMA co-chairs Tony Pernas (National Park Service) and Dennis Giardina (Florida Fish and Wildlife Conservation Commission).

Friends of Everglades CISMA is currently seeking donations for projects including Brazilian peppertree removal, laurel wilt research and mitigation, *Mikania micrantha* removal, educational program and EDRR funds for newly emerging invasive species. If you would like to make a donation to help fight invasive species in south Florida, please go to the Friends of Everglades CISMA Web page at www.friendsofecisma.org. ♦



Old World Climbing fern.
(Photo courtesy NPS)



Follow us on Twitter @ECISMA
<https://twitter.com/ECISMA>

"Like" Everglades CISMA on Facebook
<http://bit.ly/ECISMAFB>



Agency/Organization Abbreviations

DOI - Department of Interior
 ECISMA - Everglades Cooperative Invasive Species Management Area
 EDDMapS - Early Detection and Distribution Mapping System
 EDRR - Early Detection and Rapid Response
 EEL (Miami-Dade County) - Environmentally Endangered Lands
 FDACS/DPI - Florida Department of Agriculture and Consumer Services Division of Plant Industry
 FISST - Florida Invasive Species Strike Team
 FOE - Friends of Everglades CISMA, Inc.
 FWC - Florida Fish and Wildlife Conservation Commission
 FWS - U.S. Fish and Wildlife Service
 NPS - National Park Service
 PROS (Miami-Dade County) - Parks, Recreation, and Open Spaces
 SFWMD - South Florida Water Management District
 UF - University of Florida
 USDA - U.S. Department of Agriculture
 USGS - U.S. Geological Survey



Everglades Cooperative Invasive Species Management Area

ECISMA was created to formalize cooperation among land management agencies to improve the effectiveness of exotic species control by sharing information, innovation and technology across borders through a memorandum of understanding with the ultimate goal of helping to ensure the success of the Comprehensive Everglades Restoration Plan.

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