

the Florida Exotic Pest Plant Council's 24th Annual Symposium

Weeds of Wrath

May 26-29th, 2009, Delray Beach, Florida



www.FLEPPC.org



Symposium Schedule



Tuesday, May 26th

Florida EPPC Board of Directors & Task Force Meetings

10:00 AM – 5:00 PM, Salon 2

Symposium Early Registration

3:00 – 6:00 PM, Lobby

Wednesday, May 27th

Symposium Registration

7:30 AM – 3:00 PM, Lobby

Vendor Expo

8:00 AM – 5:00 PM, 6:00 – 8:00 PM, Salon D

Many companies in the invasive plant management industry will demonstrate their products and services.

Chair's Welcome Address

8:20 – 8:40 AM, Salon E/F

Florida EPPC Chair, Jim Burney

Keynote Address

9:00 – 9:40 AM, Salon E/F

Biofuel Energy Plants: Are We Cultivating the Next Invader?

Joe DiTomaso, Ph.D., University of California, Davis



This year's keynote speaker is Dr. Joseph DiTomaso, a non-crop weed specialist at the University of California, Davis and Director of the UC Weed Research and Information Center. Dr. DiTomaso's keynote address will explore the intersection of the biofuel industry and biological invasions. The need for viable alternative energy technologies has increased interest in large-scale production of biofuel crops. Many of the characteristics of potential biofuel species—high productivity, perennial, high-density growth, drought resistance, few major pests—are also typical of invasive plants infesting Florida's natural areas. Dr. DiTomaso will share his experiences with biofuels in California and make the case for rigorous risk assessments of candidate biofuel species.

Session I: Invasive Plants & Biofuels: Taking Root in Florida

9:40 – 10:20 AM, Salon E/F

Session Moderator: LeRoy Rodgers, South Florida Water Management District

9:40 – 10:00 AM **Predicted Invasiveness of Several Biofuel Species Proposed for Florida**

Doria Gordon, Crysta Gantz, Kathryn Tancig

10:00 – 10:20 AM **Biofuel Crops for Florida** John Erickson

10:20 – 10:40 AM **Refreshment Break provided by Dow AgroSciences**



Symposium Schedule

Wednesday, May 27th

continued

Session II: Florida's Invaded Landscape: Updates on Mapping and Data Tracking Programs

10:40 - 12:00 AM, Salon E/F

Session Moderator: Jennifer Possley, Fairchild Tropical Botanic Gardens

10:40 - 11:00 AM **Florida Invasive Plants Geodatabase Status** Frank Price and Gwen Iacona*

11:00 - 11:20 AM **WeedUS Plus: Expanded Database of Plants Invading Natural Areas in the U.S.**
Chuck Barger, Jil Swearingen, David Moorhead, and Keith Douce

11:20 - 11:40 AM **Monitoring Invasives with an Unmanned Aerial Vehicle** Jon Lane

11:40 - 12:00 PM **Got Invasives? VirtualTools from the Florida Invasive Species Partnership**
Erin Myers and Chuck Barger

Lunch 12:00 PM – 1:20 PM

Session III: Invasive Plant Management Programs

1:20 – 2:20 PM, Salon E/F

Session Moderator: Roger Clark, Lee County Parks and Registration

1:20 - 1:40 PM **The Central Florida Lygodium Strategy: Drawing a Line on the Vine—an Update on the Work to Date** Rosalind Rowe and Cheryl Millett

1:40 - 2:00 PM **Status of the Demonstration Project on Hydrilla and Hygrophila in the Upper Kissimmee Chain of Lakes** Stacia Hetrick and Kimberly Lawrence

2:00 - 2:20 PM **FIX IT! Invasive Plant Removal in Palm Beach County Natural Areas**
Matthew King and Jeffrey Buck

2:20 – 2:40 PM Refreshment Break provided by **Environmental Management & Engineering, LLC**

Workshops

Creating Invasive Plant Management Plans—Getting Started with Essential Information

2:40 – 5:00 PM, Salon A

Led by Chris Matson, Alison Higgins, and Kristina Serbesoff-King, The Nature Conservancy

Learn the fundamentals of developing effective invasive plant management plans. This workshop will teach you how to identify and prioritize key components of operational plans and provide practical examples of integrated pest management techniques.

Symposium Schedule



Wednesday, May 27th

continued

Herbicide Resistance in Invasive Plant Management

2:40 – 5:00 PM, Salon E/F

Led by Dr. Greg MacDonald, University of Florida/IFAS

Participants will be introduced to herbicide activity and mode-of-action as it relates to those factors involved in the development of resistance. Strategies to prevent or delay herbicide resistance in natural areas management will also be discussed.

Natural Areas Weed Management Preparation Class

2:40 – 5:00 PM, Salon C

Led by Ken Gioeli, University of Florida/IFAS

Individuals planning to take the Natural Areas Weed Management Certified Pesticide Applicator examination should attend this training session. Participants will receive an overview of pest plants and their recommended chemical controls, a review of chemical control methodologies, herbicide characteristics and their behavior in the environment, and methods for herbicide dilution and rate calculations.

Poster Session

6:30 – 7:30 PM, Salon D

Evening Social Event

7:30 – 9:00 PM, Salon D sponsored by **Applied Aquatic Management, Brewer International & Southeastern Chemtreat**

Thursday, May 28th

Vendor Expo

8:00 AM – 12:00 PM, Salon D

Track 1 Note: There are two concurrent sessions on Thursday morning.

Session IV: Cropping up in Florida: Cooperative Invasive Species Management Areas and the Florida Invasive Species Partnership

8:20 – 10:00 AM, Salon E

Session Moderator: Kristina Serbesoff-King, The Nature Conservancy

8:20 – 8:40 AM The Florida Invasive Species Partnership (FISP): Invasive Species Know No Boundaries—Do We?

Greg Jubinsky and Tim Allen, on behalf of the Florida Invasive Species Partnership

8:40 – 10:00 AM Meet Your Local CISMA (Cooperative Invasive Species Management Area)

Updates and panel discussion on CISMA's throughout Florida.



Symposium Schedule

Thursday, May 28th

continued

10:00 – 10:20 AM

Refreshment Break provided by **Dow AgroSciences**

Session V: Control Strategies for Invasive Plants

10:20 – 11:40 AM, Salon E

Session Moderator: *Michelle Hoffman, Seminole Tribe of Florida*

10:20 – 10:40 AM **Strategic Exotics Management Control—Are You Using All Your Tools?**

Alison Higgins

10:40 – 11:00 AM **Multiple Control Strategies for *Lygodium japonicum* (Japanese Climbing Fern) in the Southeastern United States**

Corrie Pieterse, Shibu Jose, Steven Jack, Kaoru Kitajima, Patrick Minogue

11:00 – 11:20 AM **Evaluation of Integrated Methods for the Control of Cogongrass (*Imperata cylindrica* L.)**

Oghenekome Onokpise, Susan Bambo, James Muchovej

11:20 – 11:40 AM **Developments in Herbicide Ballistic Technology**

James Leary, Brian Lavigne, Jim Glatzhofer, John Heier, Bob Eccles

Track 2

Session VI: Biological Control Updates

8:20 – 10:00 AM, Salon F

Session Moderator: *Tom Fusigna, CZR Incorporated*

8:20 – 8:40 AM **Exploratory Surveys in India for Natural Enemies of *Hygrophila polysperma* (Roxb.) T. Anders: Preliminary Results**

Abhishek Mukherjee, Carol Ellison, Matiyar Khan, James Cuda

8:40 – 9:00 AM **Exploration for Natural Enemies of *Hydrilla verticillata* in Africa: A Fishy Story**

William Overholt, Robert Copeland, Dean Williams, Brian Gidudu, Benoit Nzigidahera

9:00 – 9:20 AM **Current Levels of Biological Suppression of Waterhyacinth in South and Central Florida**

Philip Tipping

9:20 – 9:40 AM **Synergistic Effect of Insect Herbivory and Plant Parasitism on the Performance of the Invasive Tree *Schinus terebinthifolius* (Anacardiaceae)**

James Cuda, Veroncia Manrique, William Overholt, and Sharon Ewe

9:40 – 10:00 AM **Distribution and Abundance of *Gratiana boliviana* (Coleoptera: Chrysomelidae), a Biological Control Agent of Tropical Soda Apple (*Solanum viarum*, Solanaceae) in Florida**

Rodrigo Diaz and William Overholt

10:00 – 10:20 AM

Refreshment Break provided by **Dow AgroSciences**

Symposium Schedule



Thursday, May 28th

continued

Session VII: Biological Control Updates (cont.)

10:20 – 11:40 AM, Salon F

Session Moderator: *Jim Cuda, University of Florida*

10:20 – 10:40 AM **Population establishment of and Promising Early Results with the Brown Lygodium Moth, *Neomusotima conspurcatalis*—A Candidate Biological Control Agent of Old World Climbing Fern, *Lygodium microphyllum*** Anthony Boughton and Robert Pemberton

10:40 – 11:00 AM **Biological Control of Brazilian pepper: Results from Foreign Exploration and Host Testing** Greg Wheeler, Fernando McKay, Marcelo Vitorino, Robert Barreto, Dean Williams

11:00 – 11:20 AM **Biological Control of Chinese Tallow: Results of Chinese Foreign Exploration and Preliminary Testing** Greg Wheeler, Ding Jianqing, Matthew Purcell

11:20 – 11:40 AM **Stop Mexican Bromeliad Weevil** Howard Frank, Ron Cave, and Teresa Cooper

Field Trips 12:00 – 5:00 PM

Loxahatchee National Wildlife Refuge & South Florida Water Management District Herbicide Demonstration Plots

This multi-faceted tour will begin with a luncheon program at the Loxahatchee NWR visitor center and conclude with a tour of several SFWMD/USDA demonstration plots for Melaleuca, Java plum and Brazilian pepper, including new biological control agents. Documentation of results will be provided. Water, bathrooms and gift shops available at both ends of the tour. Walking out to the trial plots could be muddy and brushy, but the plots can be viewed from the mowed levee. Bring sunscreen, bug repellent, a hat and your wallet for the gift shops.

Delray Oaks Natural Area: A Working Field Trip Using GPS

The Delray Oaks Natural Area is a remnant sandbar on the northern edge of the historic Yamato Marsh. Now composed primarily of oak hammock, this natural area has ADA and natural trails. The field trip will focus on GPS operations in natural area management, including invasive plant and rare species mapping. We will begin at the hotel for classroom orientation then proceed to the field. Trimble Geo-XT and Garmin GPSmap60 GPS units will be provided. Participants will learn to prepare the units for field work, use a data dictionary, and ID nuisance/invasive plants. Bring hat, comfortable shoes, sunscreen. Water provided.

City of Boca Raton Beachside Parks/Gumbo Limbo Nature Center

Participants will visit four Boca Raton parks (Spanish River Park, Gumbo Limbo, Red Reef and South Beach). Urban natural areas are all “edge”, are usually heavily disturbed, and older parks often contain Florida’s worst landscape choices. Recent acquisitions usually had



Symposium Schedule

Thursday, May 28th

continued

some prior development, including clearing and/or landscaping – a legacy now inherited by the preserve managers. Yet, some rare natives and important communities remain, as well as an opportunity to restore and create habitat islands, and to teach in the process. In addition to exotic plant control efforts, we will view ongoing restoration and community participation projects.

Pondhawk & Yamato Natural Areas

The Yamato Scrub Natural Area is a 217-acre restored scrub habitat located in southern Palm Beach County. Although primarily scrub, a restored wetland basin can be seen by following the accessible part of the trail. Yamato and the 79-acre Pondhawk Natural Areas are dominated by sand pine scrub, scrubby flatwoods, hammock & disturbed marsh communities. Both of the sites are surrounded by large urban areas. Participants will experience the many management challenges posed in this setting. Most large monocultures of exotics have been treated by mechanical and ground control methods, though many small, tough-to-control, species remain. Highlights include a planned and a completed wetland restoration project; and a planned and completed public-use facility.

Symposium Banquet

7:00 – 10:00 PM, South Pool Deck

Friday, May 29th

Session VIII: Trials and Tribulations: The Latest on Herbicide Evaluations

8:20 – 10:00 AM, Salon E/F

Session Moderator: Karen Brown, University of Florida

8:20 – 8:40 AM **Chemical Control of Natalgrass (*Melinis repens*) and Native Plant Tolerance**

Courtney Stokes, Gregory MacDonald, Carrie Reinhardt Adams, Debbie Miller, Kenneth Langeland

8:40 – 9:00 AM **Herbicides for Control of Downy Rosemyrtle, Lead Tree, and Old World Climbing Fern** Elroy Timmer

9:00 – 9:20 AM **Control of Japanese Climbing Fern and Impacts to Non-target Vegetation in Natural Areas of the Florida Panhandle One Year Following Herbicide Application**

Kimberly Bohn, Patrick Minogue, Justin McKeithen, and Anna Osieka

9:20 – 9:40 AM **Monitoring the Effects of Repeated Herbicide Application on *Lygodium microphyllum* and Native Vegetation at Loxahatchee National Wildlife Refuge**

Jeffrey Hutchinson and Kenneth Langeland

9:40 – 10:00 AM **An Update on Clearcast Experimental Use Permit (EUP) Trials** Chris Key

Symposium Schedule



Friday, May 29th

continued

10:00 – 10:20 AM Refreshment Break provided by **Habitat Restoration Resources, Inc.**
(NOTE: Silent auction ends at 10:20!)

FLEPPC Business Meeting

10:20 – 11:00 AM, Salon E/F

Session IX: Research on Biological Invasions

11:00 AM - 12:20 PM, Salon E/F

Session Moderator: *Dennis Giardina, Florida Fish & Wildlife Conservation Commission*

11:00 – 11:20 AM **Physiological Response of Cattails (*Typha* spp.) to High Water Conditions in Stormwater Treatment Areas** Kurt Vollmer, Kathy Pietro, Greg MacDonald, John Erickson

11:20 – 11:40 AM **Three New Weeds for Florida: *Luziola subintegra* Swallen, Feathered Mosquito Fern (*Azolla pinnata* R. Brown), and Wild Sugar Cane (*Saccharum spontaneum* L.)** Mike Bodle

11:40 – 12:00 PM **Testing the New Zealand Aquatic Weed Risk Assessment in Florida**
Crysta Gantz and Doria Gordon

12:00 – 12:20 PM **Production, Accumulation, and Decomposition of *Melaleuca quinquenervia* Litter Biomass in Time and Space** Min Rayamajhi, Paul Pratt, Ted Center

Symposium Adjourns, 12:20 PM

Natural Areas Weed Management Examination

1:30 PM – 3:00 PM, Salon C

Special thanks to our symposium sponsors!



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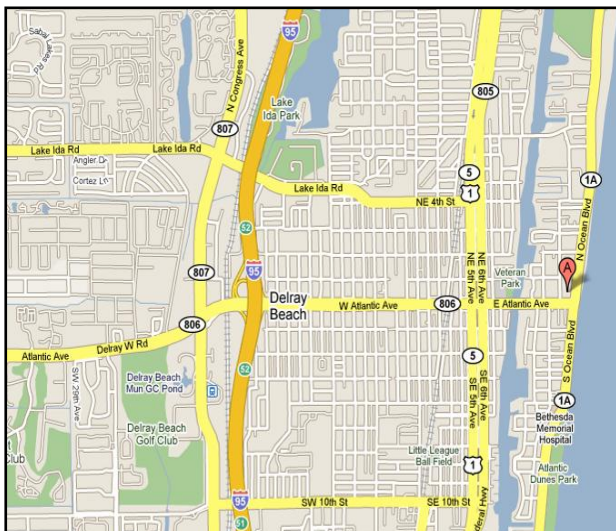




Symposium Information

Hotel Information

Delray Beach Marriott
10 North Ocean Boulevard
Delray Beach, Florida 33483 USA
Phone: 1-561-274-3200
Fax: 1-561-274-3202
Toll-free: 1-877-389-0169



Driving Directions

From I-95: Exit 52, Atlantic Avenue East. Go East to A1A (approx. 2 miles) then make a left. Hotel on immediate left.

From Florida Turnpike: Exit 81, Atlantic Avenue. Go East to A1A (approx. 7 miles) then make a left. Hotel on immediate left.

Silent Auction

Wednesday through Friday, 10:20 AM
Salon D

Members are encouraged to donate items for the Weeds of Wrath Silent Auction. Please contact Todd Olson at 561-719-9488 to donate items. Winning bids will be collected at the registration desk.

Door Prizes

Door prizes will be given away at the beginning of each session

Need a Meeting Room?

FLEPPC has room availability for committee and task force meetings. If interested, contact LeRoy Rodgers (561-662-7205, lrogers@sfwmd.gov) to reserve a one-hour block.

Points of Interest

Pineapple Grove Arts District

N.E. 2nd Avenue north to N.E. 4th Street

Old School Square Cultural Arts Center

NE corner of Atlantic and Swinton

Sandoway House Nature Center

142 S. Ocean Blvd

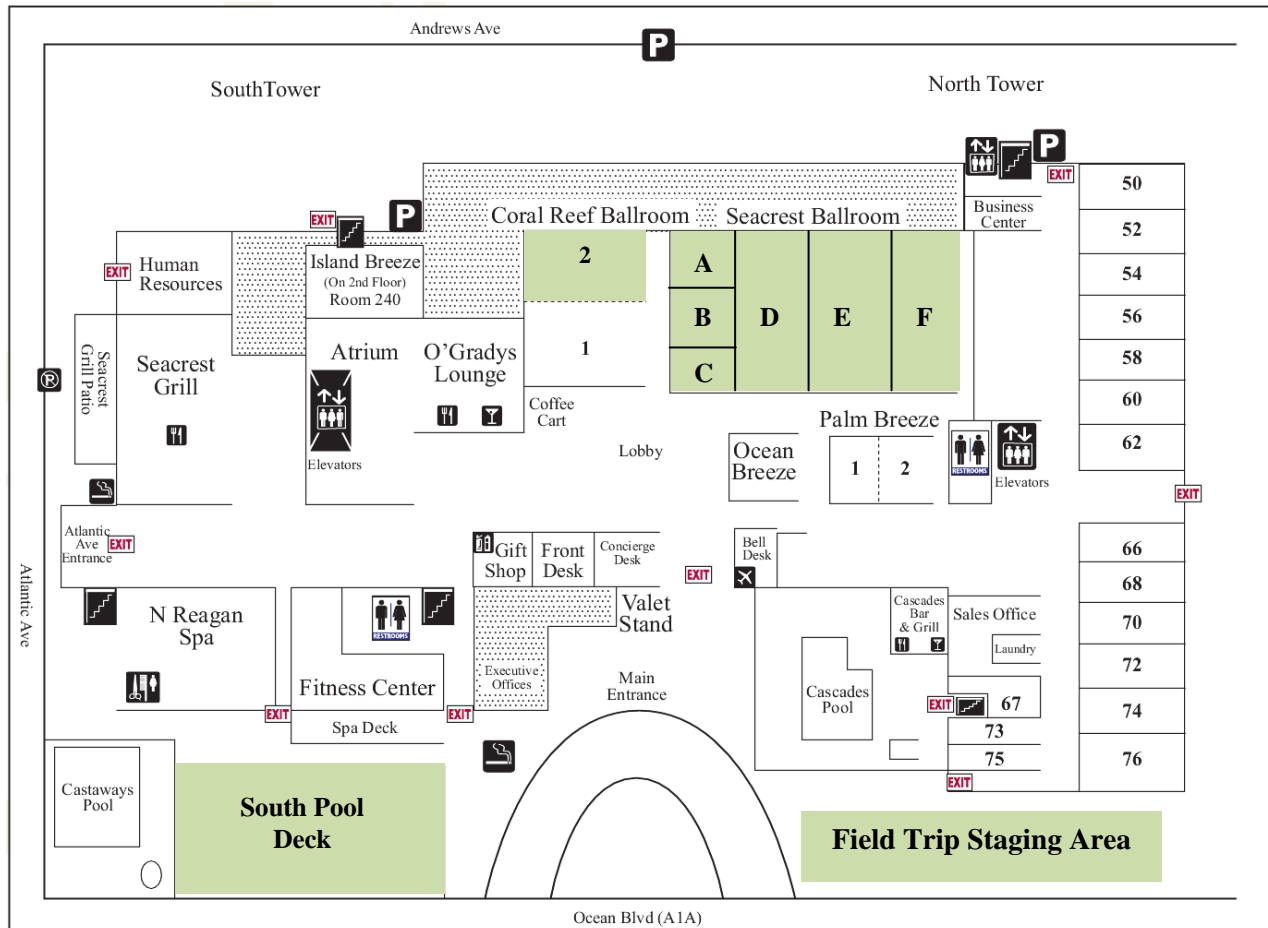
Morikami Museum & Japanese Gardens

4000 Morikami Park Road
(561) 495-0233

Get involved with FLEPPC

We need your help! FLEPPC cannot fulfill its mission without the direct involvement of its members. Several committees are now in need of assistance. A committee volunteer form will be located in Salon D throughout the symposium. Please volunteer today.

Symposium Information



FLEPPC symposium organizers

Chuck Barger—Web Master
Mike Bodle—Local Arrangements
Hillary Burgess—Registration
Jim Burney—Chair, past chair, and everything in between
Scott Ditmarsen—Past Chair
Dianne Owen—Registration
Todd Olson—Vendor Liaison
Tony Pernas—Merchandise
Katy Roberts—CEU Coordination
LeRoy Rodgers—Program Chair
Donna Watkins—Field Trip Coordination

A special thanks to our symposium volunteers!!

Karen Brown
Roger Clark
Jim Cuda
Justin Dee
Rochard Doblas
Jim Duquesnel
Bonnie Edwards
Tom Fusigna
Dennis Giardina
Adam Grayson
Frank Griffiths
Michelle Hoffman
Lisa Jameson

David Johnson
Matthew King
Jon Lane
Chris Lockhart
Salvador Medina
Corrie Pieteron
Jennifer Possley
Takako Sato
Kristina Serbesoff-King
Erick Smith
Elroy Timmer
Michele Walts
Erin Wood



Oral Presentations

WeedUS Plus: Expanded database of plants invading natural areas in the U.S.

Bargeron¹, Chuck, Jil Swearingen², David Moorhead³, and Keith Douce³

¹The University of Georgia - Center for Invasive Species and Ecosystem Health, Tifton, GA, ²National Park Service, Washington DC, ³University of Georgia, Tifton, GA

The WeedUS Database was initiated in 1997 to address the need for current distribution information on exotic invasive plants affecting natural areas and ecosystems in the United States, including Hawaii and Alaska. This information was not readily available or compiled in an accessible manner prior to this effort. In October 2008, a much expanded version of the WeedUS database was launched at www.invasive.org/weedus/index.html. The database was developed by the University of Georgia's Center for Invasive Species and Ecosystem Health (CISEH). For each invasive species in the database, the new WeedUS format provides an individual web page featuring images from the Center's large image database, distribution maps by county or state, and a link to native species alternatives provided by the Lady Bird Johnson Wildflower Center. Native origin also is provided in the database, which can be useful for predicting the potential spread and adaptability of invasive species. Additionally, WeedUS will soon allow users to query invasive plant lists for one or more states, national parks, or listing source. Regular updating will be performed by a designated contact for each listing source (e.g., state Exotic Pest Plant Council (EPPC), federal agency, The Nature Conservancy, etc.) who will be able to log-on to the site and add or remove species from their lists. A list-serve will be created to keep designated contacts and other WeedUS users informed of changes.

Control of Japanese climbing fern and impacts to non-target vegetation in natural areas of the Florida panhandle one year following herbicide application.

Bohn¹, Kimberly, Patrick Minogue², Justin McKeithen¹, and Anna Osieka²

¹University of Florida, West Florida Research and Education Center, Milton, FL, ²University of Florida, North Florida Research and Education Center, Quincy FL

Japanese climbing fern (*Lygodium japonicum*) is a non-native, invasive vine that has been identified as a major threat in many of Florida's forests. It first invades as scattered individuals, but reproduces prolifically from spores and revegetates from rhizomes. It can then form thick, tangled mats that deny growing space for ground vegetation and can overtop shrubs and trees. Because the fern often intermingles with desired vegetation, effective control measures using herbicides must consider the surrounding vegetation, especially on public forests where maintaining native ground cover is critical. The objective of this study

was to evaluate the effect of herbicide applications on both the control of Japanese climbing fern as well as the impact to non-target forest vegetation.

We tested the effects of glyphosate, imazapyr, and metsulfuron methyl at three rates and in combination in two bottomland hardwood forests and two recently disturbed pine stands in northwest Florida. We measured percent cover of Japanese climbing fern before and one year after herbicide treatments, and assessed the impact to other herbaceous and woody vegetation by analyzing changes in percent cover, species composition, species diversity, and phytotoxicity to woody vegetation one year after treatment.

Several herbicide treatments resulted in 90% or greater crown reduction of Japanese climbing fern, including the high rates of glyphosate alone, glyphosate in combination with imazapyr at low rates or in combination with metsulfuron methyl at high rates, and three way combinations. Percent cover of other native vegetation increased by 5 to 20%, and species diversity did not significantly differ one year after any of the herbicide treatments. Native grasses in the hardwood forests responded particularly well following treatments with metsulfuron methyl. The extent of injury to non-target woody seedlings did vary by forest type, selectivity of the herbicide, and percent cover of fern over seedlings. Small woody seedlings draped in fern were injured significantly more when sprayed with glyphosate and/or imazapyr, and pine seedlings showed a lower phytotoxicity response than hardwoods to imazapyr. The relatively minimal impact to native vegetation following herbicide treatment was due in part to the controlled back-pack spray application which directed the herbicide to the invasive plant foliage. There appears to be a variety of herbicides that result in short-term control of Japanese climbing fern, and minimizing impacts to native vegetation will be improved by choosing herbicide types based on selectivity to the native cover present.

Three new weeds for Florida: *Luziola subintegra* Swallen, feathered mosquito fern (*Azolla pinnata* R. Brown), and wild sugar cane (*Saccharum spontaneum* L.).

Bodle¹, Mike

¹South Florida Water Management District, West Palm Beach, FL

Three plants that are recognized as weedy species elsewhere have been newly identified in Florida. The plants are *Luziola subintegra* Swallen (new to Florida and North America), feathered mosquito fern (*Azolla pinnata* R. Brown), and wild sugar cane (*Saccharum spontaneum* L.). In late 2007, *L. subintegra* was found in western Lake Okeechobee forming dense monospecific mats in the lake's Fisheating Bay. *A. pinnata* was also found in 2007 overtaking a private pond in Jupiter, Palm Beach County, and subsequently found infesting the neighboring drainage canal system. *S. spontaneum* was found in early 2009 in western Palm Beach County along the eastern shoreline of Lake Okeechobee. While *A. pinnata* and *S. spontaneum* are listed as Federal Noxious Weeds, it will be argued that neither of these plants seem to seriously threaten Florida's ecological stability, while *L. subintegra* does show tremendous invasive potential. Descriptions of the plants, their growth habits and control methods to date will be outlined.

Population establishment of and promising early results with the brown lygodium moth, *Neomusotima conspurcatalis*—a candidate biological control agent of Old World climbing fern, *Lygodium microphyllum*.

Boughton¹, Anthony J. and Robert W. Pemberton¹

¹USDA-ARS Invasive Plant Research Laboratory, Fort Lauderdale, FL

Old World climbing fern, *Lygodium microphyllum*, is one of the most serious invasive weeds affecting southern and central Florida. Management of this weed using traditional strategies has proved difficult and expensive, with limited long-term success. In early 2008, a new biological control agent called the brown lygodium moth, *Neomusotima conspurcatalis*, was first released against infestations of *L. microphyllum* at three research sites in Jonathan Dickinson State Park in Martin County, Florida. Caterpillars of the moth feed on leaflets of the fern causing browning of leaves and defoliation of entire *L. microphyllum* plants. The life cycle of the moth from egg, through caterpillar and pupa to adult, takes approximately 30 days at 25°C. Female moths lay an average of 136 eggs during their short lifespan. During the first 2-3 months after releases, life stages of the moth remained detectable at release sites and scattered, light-feeding damage was apparent. From 4-6 months, moth populations increased, and noticeable caterpillar feeding damage in the form of browned-out patches of *L. microphyllum* became apparent. By November 2008, 6-10 months after releases were made, substantial caterpillar-induced browning and defoliation of *L. microphyllum* was apparent at each of the three release sites, corresponding to an estimated total area of 14,900 square meters (3.7 acres). In addition, populations of the moth had radiated outwards from defoliated areas into surrounding areas and were feeding on *L. microphyllum* within a larger area estimated at 36,000 square meters (8.9 acres). Within these active feeding zones, 4-second sweep net samples yielded an average capture of 11 adult moths per sample, while quadrat surveys yielded an average density estimate of 660 caterpillars per square meter of *L. microphyllum*. At release sites, linear cover of *L. microphyllum* along four 20-m vegetation transects decreased by an average of 61%, while quadrat-estimated *L. microphyllum* area cover decreased by an average of 64%. At control sites where moths had not been released, linear cover of *L. microphyllum* increased by an average of 1%, while area cover increased by 7%. Although limited regrowth of *L. microphyllum* occurs from dormant lateral buds after caterpillar defoliation, female moths lay eggs on this regrowth. Preliminary observations suggest that the fern may not be able to recover from repeated rounds of defoliation. Although it is too early to declare this new agent a success, these findings are extremely encouraging and bode well for prospects of future biological control of *L. microphyllum*.

Synergistic effect of insect herbivory and plant parasitism on the performance of the invasive tree *Schinus terebinthifolius* (Anacardiaceae).

Cuda¹, James P., Veroncia Manrique², William A. Overholt², and Sharon M. L. Ewe³

¹University of Florida, Gainesville, FL, ²University of Florida/IFAS Biological Control Research & Containment Lab, Fort Pierce, FL, ³Ecology and Environment, Inc., West Palm Beach, FL

Schinus terebinthifolius Raddi (Anacardiaceae) is an introduced tree from South America that has invaded many ecosystems throughout central and south Florida. Exploratory surveys in the plant's native range identified several potential biocontrol agents, including the leaflet rolling moth *Episimus unguiculus* Clarke (Lepidoptera: Tortricidae). The larval stages of *E. unguiculus* tie the plant leaflets together while feeding and can completely defoliate small plants. The native love vine *Cassytha filiformis* L. (Lauraceae) has been found parasitizing *S. terebinthifolius* in Florida. Natural processes such as biological control and plant parasitism

are considered key components of an integrated pest management approach for *S. terebinthifolius* - in Florida. Thus, the objective of this study was to evaluate the combined effects of insect herbivory and plant parasitism on the growth of *S. terebinthifolius*. A factorial design experiment was conducted in the greenhouse to determine the effect of *C. filiformis* parasitism and *E. unguiculus* feeding damage on the growth and biomass of *S. terebinthifolius*. Results showed that several plant parameters, including leaflet biomass, growth rate, and flower production were negatively affected by plant parasitism and insect herbivory. Moreover, the decrease in *S. terebinthifolius* productivity was greater when these two factors were combined, which is indicative of a synergistic relationship. In addition, the combined effect of *C. filiformis* and *E. unguiculus* suppressed plant performance for at least two months after the moths were removed. Therefore, increased control of *S. terebinthifolius* stands may be achieved in those areas where *C. filiformis* is present in Florida (e.g., pinelands, hammock forests) if the biocontrol agent *E. unguiculus* is approved for release.

Distribution and abundance of *Gratiana boliviana* (Coleoptera: Chrysomelidae), a biological control agent of tropical soda apple (*Solanum viarum*, Solanaceae) in Florida
Diaz¹, Rodrigo and William A. Overholt¹

¹University of Florida/IFAS Biological Control Research & Containment Lab, Fort Pierce, FL

A biological control program against tropical soda apple (TSA) (*Solanum viarum* Dunal (Solanaceae)) with the leaf beetle, *Gratiana boliviana* Spaeth (Coleoptera: Chrysomelidae), released 176,643 beetles from 2003 to 2008. The spatial distribution of beetles was clustered with many more beetles released in central/south Florida than farther north. A survey to estimate the distribution and abundance of *G. boliviana* was conducted in the fall of 2008. *G. boliviana* was present at >70% of sites in central/southern Florida between 26° and 29° latitude, but no beetles were found at locations farther north. The presence of beetles and damage caused to TSA by beetles were associated with smaller TSA plants and fewer fruit. The lack of beetles in northern Florida may be due to the fewer number released in that area, but could also be influenced by land cover and climate.

Biofuel crops for Florida.

Erickson¹, John

¹University of Florida, Gainesville, FL

Finite petroleum reserves, domestic energy security, and the desire to mitigate greenhouse gas emissions are contributing to increased production of feedstock crops for biofuels in the U.S. Currently, ethanol from corn grain produced in the Midwest is the dominant biofuel in the U.S., however other cropping systems in other geographic regions will be needed to meet Federal biofuel mandates. Given its favorable climate, Florida figures to be prominently involved in production of feedstocks for biofuel production. Feedstock selection will be dependent on conversion technology. At present, commercial production of biofuels is focused on conversion of simple sugars and/or starch to ethanol or oil to biodiesel. This has led to the emergence of sugarcane (*Saccharum* spp.) and sweet sorghum (*Sorghum bicolor*) as bioethanol crops in Florida and *Jatropha* (*Jatropha curcas*), peanut (*Arachis hypogaea*), soybean (*Glycine max*), and algae as biodiesel crops. These crops tend to have relatively low yields and often compete with food uses, so long-term bioethanol research efforts are focused on conversion of lignocellulosic biomass to ethanol. Potential lignocellulosic biomass crops for Florida include herbaceous crops like energycane (*Saccharum* spp.), elephantgrass (*Pennisetum purpureum*), switchgrass (*Panicum virgatum*), Miscanthus (*Miscanthus x*

giganteus) and *Arundo* (*Arundo donax*) and woody perennial crops like *Pinus* spp., *Eucalyptus* spp., and *Populus* spp. Many of these crops, especially the lignocellulosic crops, are relatively new to Florida and their potential for invasion and impact on ecosystem function and services is not well known in Florida. Thus, research in Florida is looking not only at optimizing species selection for productivity and tissue chemistry but also sustainability and potential environmental impacts of biofuel cropping systems. There are potential shortcomings of each biofuel cropping system and the merits of each will need to be evaluated by the scientific community and policy makers.

Stop Mexican bromeliad weevil.

Frank¹, J.H., R.D. Cave² and T.M. Cooper¹

¹University of Florida, Gainesville, FL, ²University of Florida/IFAS Biological Control Research & Containment Lab, Fort Pierce, FL

Mexican bromeliad weevil, *Metamasius callizona*, is native to southern Mexico and Guatemala. In 1989 it was detected on imported bromeliads at a nursery in Broward County, and in native epiphytic bromeliads in the surrounding area. It spread during the next 20 years, and now occupies almost all counties in southern and central Florida from Collier to Volusia. Adult weevils nibble on bromeliad leaves, but weevil larvae mine the meristematic tissue and kill the plants. Twelve of Florida's 16 native bromeliad species are susceptible, including all that are state-listed as threatened or endangered. Bromeliad populations are being decimated. Loss of bromeliads also deprives specialist aquatic invertebrates of their habitat in water-filled bromeliad leaf axils.

Several *Metamasius* species attack bromeliads in Mexico and Central America. One of them is *Metamasius quadrilineatus* which exists at higher altitudes in Honduras and Guatemala and is attacked by a parasitoid fly, *Lixadmontia franki*. The adult female fly is attracted to weevil-damaged bromeliads, hunts for the opening to a mine made by a weevil larva, and there deposits her own larva (a maggot). This maggot enters the mine, hunts for the weevil larva, and forces its way inside. Once inside, the fly maggot begins to feed on the tissues of the weevil larva, eventually killing it. The fully-grown maggot exits from the dead weevil larva to pupate. When a reliable method for rearing the fly had been devised, flies were presented with larvae of *M. callizona*, which they attacked at least as readily as their usual hosts, *M. quadrilineatus*. They would not attack larvae of *Metamasius hemipterus*, a close relative that develops in palms and sugarcane stems, even when *M. hemipterus* larvae were placed in holes drilled into bromeliad stems.

A culture of the fly is now maintained at the Hayslip Biological Control Research and Containment Laboratory (HBCRCL), Ft. Pierce, using reared *M. callizona* larvae as hosts. Beginning in June 2007, a series of five fly releases was begun at four natural areas, with an interval of three months between releases at any site and with follow-up monitoring at each site. This nominally released 2,000 flies. The culture at HBCRCL fluctuated in time and, when surplus flies were available, they too were released at four additional natural areas with weevil populations. While awaiting evidence of fly establishment at the four monitored release sites, we have explored farther in Guatemala for alternative potential biological control agents.

Testing the New Zealand Aquatic Weed Risk Assessment in Florida.

Gantz¹, Crysta A. and Doria R. Gordon²

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Earlier work has demonstrated that the Australian Weed Risk Assessment system (WRA) modified for use in Florida effectively discriminates between harmful invaders and non-invaders. However, high points assigned to aquatic plant species result in the prediction that virtually all aquatic species will become invasive. Further, several of the WRA questions are not relevant to aquatic species (e.g., fire risk, several dispersal characteristics). For these reasons, we are testing a separate system that has been developed by New Zealand's Biosecurity Program specifically for aquatic species (AqWRA). This system is intended to address marginal emergents, free-floating species, attached-floating species, and submerged species. Scores for a number of biological, historical, and environmental tolerance questions result in a total score for each species. We are comparing the scores obtained from the AqWRA test with the results obtained by assessing the same species using the WRA.

So far, the scoring system with the AqWRA has exhibited a range of 8 to 79 points; as expected, almost all of the WRA outcomes have been "reject". We are collaborating with researchers in the Great Lakes region to make the AqWRA questions applicable to Florida, the Great Lakes region and the United States. Score thresholds have not yet been set to determine the level of invasiveness of species using the AqWRA, but examining *a priori* categories and comparing results with the Great Lakes will guide us in setting these thresholds. This research will examine whether the AqWRA will be a useful tool for screening aquatic plant species for invasiveness in Florida. The comparison of results between Florida and the Great Lakes region will allow evaluation of both the dependence of the AqWRA accuracy on local environmental conditions and whether this tool might be applicable at the national level. The results of this research will facilitate prevention activities within Florida and indicate whether the U.S. Department of Agriculture (APHIS-PPQ) should consider incorporating this tool within the revisions to the plant quarantine regulations (Q-37).

Predicted invasiveness of several biofuel species proposed for Florida.

Gordon¹, Doria R., Crysta A. Gantz², Kathryn J. Tancig³,

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The Australian Weed Risk Assessment system (WRA), modified for Florida, was used to examine the potential invasiveness of 10 species proposed for use as biofuels. Earlier research has demonstrated that this system accurately identified 92% of Florida's major plant invaders and 73% of non-invaders. Eight percent of non-invaders were incorrectly identified as invasive, while the rest required further evaluation. These results are consistent with other accuracy assessments from temperate and tropical, island and continental geographies. The WRA predicted that *Eucalyptus camaldulensis*, *E. grandis*, *Jatropha curcas*, *Leucaena leucocephala*, and *Pennisetum purpureum* are likely to become invasive in Florida. The same conclusion was previously found for *Arundo donax*. In contrast, *Miscanthus x giganteus*, *Saccharum arundinaceum*, and *S. officinarum* are not predicted to become invasive. Further evaluation was required for *Eucalyptus amplifolia* and *Sorghum bicolor* "sweet sorghum". Species predicted to become invasive should only be cultivated in Florida if management practices that would significantly reduce the risk of escape and invasion are identified and implemented.

Status of the demonstration project on hydrilla and hygrophila in the Upper Kissimmee Chain of Lakes.

Hetrick¹, Stacia and Kimberly Lawrence²

¹UF/IFAS Osceola County Extension, Kissimmee, ²Osceola County, Kissimmee, FL

Osceola County was awarded a \$2,881 grant to assess new herbicides, develop new control technology processes or practices, or new uses of technologies, processes, or practices for management of hydrilla (*Hydrilla verticillata* (L.f.) Royle), hygrophila (*Hygrophila polysperma* (Roxb.) T. Anderson) and other exotic aquatic vegetation. The specific objectives of the project are to evaluate the effectiveness of experimental use permit herbicides and biological control agents in the treatment of hydrilla and hygrophila; to evaluate new technology processes or practices, or a new combination or uses of technologies, processes or practices for the control of hydrilla and hygrophila using small-scale field work; to implement and monitor successful practices and processes identified in the previous objectives using large-scale field demonstrations; and to demonstrate the project efforts in alternative technologies to manage hydrilla and hygrophila and disseminate to the public the results of the project. Over the past two years, progress has been made toward accomplishing each of these objectives. This talk will explore the progress that has been made so far and the plans for the future of the project.

Strategic exotics management control: Are you using all your tools?

Higgins¹, Alison

The Nature Conservancy, Summerland Key, FL

South Florida and the Caribbean are hosts to some of the richest biodiversity in the world. The region is also home to some of the most vulnerable landscapes. Increasing the capacity of land managers to foresee, prevent and control threats to their conservation lands before the habitat is compromised is the only recognized method to efficiently and successfully ensure healthy landscapes. Although fire and invasive plant management are typically seen as two separate land management needs, the increase of invasive grasses and other invaders that promote or are promoted by fire, has forced practitioners on both sides to learn the others' tools, although often too late to abate the threat efficiently or effectively. Advancing the needs and tools of both the fire and invasives communities requires a proactive approach that explores the connections between fire and invasives across the greater landscape, while building the capacity of practitioners on the ground. This presentation will highlight revelations gained and objectives set across two Florida landscapes and six Caribbean countries at the recent 1st Florida & Caribbean Fire & Invasives Learning Network meeting.

Monitoring the effects of repeated herbicide application on *Lygodium microphyllum* and native vegetation at the Loxahatchee National Wildlife Refuge.

Hutchinson¹, Jeffrey T. and Kenneth A. Langeland²

¹University of Florida, Dept. of Agronomy, Center for Aquatic and Invasive Plants, Gainesville, FL

In 2005, a four-year project was begun to evaluate the effects of aerial application of glyphosate (2.40 kg a.e./187 l/ha and 4.70 kg a.e./187 l/ha) and metsulfuron methyl (0.08 kg a.i./187 l/ha and 0.17 kg a.i./187 l/ha) to control Old World climbing fern (*Lygodium microphyllum*) and to monitor the response of native plants at the Loxahatchee National Wildlife Refuge. Initial aerial herbicide treatments reduced the coverage of *L. microphyllum*

from >70% to <10%, but also resulted in significant loss of native vegetation. Additional aerial herbicide application would have resulted in the loss of most native vegetation ground cover. In 2006 and 2007, all remaining *L. microphyllum* received foliar treatment by ground applicators at analogous rates mixed in 935 l diluent/ha. During December of 2008, the final evaluation of these treatments was completed. The results of this four-year project will be presented.

The Florida Invasive Species Partnership (FISP): Invasive Species Know No Boundaries—Do We?

Jubinsky¹, Greg and Tim Allen², on behalf of the Florida Invasive Species Partnership

¹Florida Fish and Wildlife Conservation Commission, Tallahassee, FL, ²Florida Department of Transportation, Tallahassee, FL

The Florida Invasive Species Partnership (FISP), originally formed in 2006 under the Invasive Species Working Group as the Private Land Incentive Sub-working Group, is a multi-agency and organizational effort to improve partnership approaches to preventing and controlling invasive species. The health of our production lands, natural lands and wildlife habitats are critically important to us all, and invasive species represent a very real and serious threat. If Florida landowners and land managers wish to achieve long-term success with regards to combating invasive species, it is critical to collaborate with all stakeholders, focusing on prevention as well as treatment. FISP members have developed four goals: **1)** Increase effectiveness and decrease costs by working together; **2)** Build focus on prevention as well as treatment; **3)** Provide tools for unified approach, bridging the gap “across the fenceline” between public and private lands landowners; and, **4)** Encourage development, implementation and sharing of new and innovative approaches.

We have started working towards our goals through two main actions—the creation of a searchable database of private land incentive programs (see FloridaInvasives.org) and fostering Cooperative Invasive Species Management Areas (CISMAs). For the past year, FISP has held monthly meetings for individuals involved or interested in Florida CISMAs. FISP also presented at multiple conferences, land manager meetings and CISMA start-up meetings. In addition, FISP members from Florida Fish and Wildlife Conservation Commission, Invasive Plant Management Section and Florida Department of Transportation have collaborated on decontamination protocols for equipment and personnel as well as invasive plant mapping and joint control. FISP successes are many, but none of them can be attributed to an individual effort. Our strength is truly in the partnership, camaraderie, and conservation ethic that is shared by our members. This is the approach and success that we wish to develop in Florida through engaging private landowners and fostering CISMAs.

An update on Clearcast experimental use permit (EUP) trials.

Key¹, Chris

¹BASF Corporation, Wesley Chapel, FL

BASF sought to utilize a chemistry already used in another BASF market in natural area weed management. In this instance we were able to test the active ingredient Imazamox used in crop protection efforts in over 15 different counties and on many different crops. Utilizing this existing chemistry had a major benefit to BASF—we did not have to go through a Tolerance Exempt testing period because Imazamox had been previously tested on food crops. This

saves time and money for the manufacturer and also reduces the time it takes to bring an effective product to market for the applicator.

This presentation will show that with an already existing chemistry we were able to have significant impact on several different invasive species, allowing land managers the ability to reestablish Florida's natural habitat with an effective, low percentage of Imazamox. The trade name is Clearcast. In this presentation I will show the successful treatments to aquatic as well as terrestrial species such as Water hyacinth, water lettuce, wild taro and Chinese tallow as well as others.

FIX IT! Invasive Plant Removal in Palm Beach County Natural Areas.

King¹, Matthew and Jeffrey Buck¹

¹Palm Beach County Department of Environmental Resources Management, West Palm Beach, FL

In 1991 and 1999, Palm Beach County voters approved a total of \$250 million in bond funds for the purchase of lands for conservation purposes. Palm Beach County Department of Environmental Resources Management now manages more than 31,000 acres of natural areas ranging in size from the 12,800-acre Loxahatchee Slough Natural Area to the 3-acre Jackson Riverfront Pine site on the Loxahatchee River. Besides the outright cost of purchasing these natural areas, the biggest expense on these sites is the removal of invasive non-native vegetation, with the County spending approximately \$3-4 million/year on both heavy equipment/large-scale and intensive ground crew invasive plant removal projects.

The County's coordinated approach has resulted in the majority of our sites under "maintenance" level within a few years after acquisition. This presentation will give an overview how Palm Beach County manages its invasive plant removal program; from funding, to contract development/oversight, staff coordination, scheduling, removal techniques to monitoring.

Monitoring invasives with an unmanned aerial vehicle.

Lane¹, Jon

¹US Army Corps of Engineers, Jacksonville, FL

The U.S. Army Corps of Engineers, in conjunction with an interdisciplinary team of researchers at the University of Florida, have developed the Nova 2 Unmanned Aircraft System (UAS). This small UAS is designed specifically as a low-cost, autonomous, survey-grade tool for ecological research. Unlike most UAS imagery data which are captured primarily for reconnaissance, the Nova 2 UAS generates rapid and accurately georeferenced high resolution imagery suitable for robust statistical analyses while remaining affordable. This presentation will focus on some of the initial results from missions over Lake Okeechobee, which attempt to assess the effectiveness of an aerial application for waterhyacinth and waterlettuce. Additionally, monitoring of colony size and nesting distribution of several wading bird populations in Loxahatchee National Wildlife Refuge will be discussed.

Developments in herbicide ballistic technology.

Leary¹, James, Brian Lavigne², Jim Glatzhofer³, John Heier³, Bob Eccles³

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An important component to all invasive weed management strategies is to efficiently and effectively mitigate the spread of incipient satellite populations from becoming major infestations. However, incipient weed control tends to be less efficient when covering large areas and difficult terrain. Herbicide Ballistic Technology (HBT) is designed to improve the efficiency of incipient weed management with accurate long-range delivery of effective herbicide doses. The recreational paintball industry has contributed to the technological advancements of liquid encapsulation and pneumatic ballistics. These technologies have been adopted in the development of HBT with the basic concept of encapsulating herbicidal aliquots into 0.68 caliber gelatin projectiles that can be delivered to specific weed targets with a pneumatic applicator. HBT is a new technology for assisting field crews with safer pesticide handling, improved application technique and an enhanced management strategy. Encapsulated HBT projectiles are by design ready-to-use and will eliminate the need for handling and mixing liquid pesticides in the field. Furthermore, there is also a reduction in water requirements needed in field operations. The long range accuracy of HBT allows for directed applications to multiple weed targets within a 20 m radius, which improves time efficiency and also reduces disturbance to a site. We have demonstrated the ability to target incipient weed populations residing on steep cliffs and deep ravines, thus expanding the range of weed targets that would otherwise be untreatable and without putting the applicator at risk. We have also successfully demonstrated the use of HBT as a compliment to helicopter spray ball operations, which can contribute to flight safety and lower operating costs. Pilot fatigue can be reduced by diverting application responsibilities to a dedicated HBT applicator, while flight time and fuel costs may be reduced as a result from increasing target efficiency.

Exploratory surveys in India for natural enemies of *Hygrophila polysperma* (Roxb.) T.

Anders: Preliminary results.

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Hygrophila (*Hygrophila polysperma* (Roxb.) T. Anders) is an herbaceous, invasive, aquatic weed in Florida. It is a perennial species originating from the southeastern Asiatic mainland, and is classified as a federal noxious weed, Florida State category II invasive plant and Florida Exotic Pest Plant Council listed category I invasive species. This weed is typically found in flowing fresh water channels and structured shorelines, as a rooted submerged or emergent plant. *Hygrophila* forms dense vegetative stands that occupy the entire water column, affecting navigation, irrigation and flood control activities. A visible increase in the number of water bodies invaded by *hygrophila* since 1990 suggests that current methods employed to control this weed are insufficient. The invasive characteristics exhibited by *hygrophila*, and several of the biological and economic attributes of the plant, make it a good candidate for classical biological control. However, there was little information about natural enemies affecting *hygrophila* in its native range.

In September 2008, exploratory field surveys were undertaken in a range of habitats in India as a part of an ongoing classical biological control project against hygrophila. The major objective of these surveys was to collect and identify natural enemies damaging hygrophila. In total, 34 different survey sites in Assam and West Bengal, India were surveyed. The geoposition and altitude of each survey site were recorded. Several different sampling methods were employed, (e.g. hand picking, sweep and clip vegetation sampling, as well as Berlese funnel extraction) to collect suites of potential natural enemies associated with hygrophila.

Several insects were collected, including two caterpillars (Lepidoptera; families Nymphalidae and Noctuidae) that defoliate emerged plants; one aquatic leaf cutting caterpillar (Lepidoptera, family Crambidae) and a leaf mining beetle (Coleoptera, family Buprestidae). A very damaging aecial rust fungus also was discovered. Detailed soil (% Organic C, available nitrogen, phosphorous and potassium) and water (pH, EC and DO) analyses were conducted to characterize the native habitat of hygrophila. Plant parasitic nematodes associated with the hygrophila rhizosphere also were extracted and identified. Efforts are currently being made to identify the collected specimens to species level.

Got invasives? Virtual tools from the Florida Invasive Species Partnership.

Myers¹, Erin and Chuck Barger²

¹USDA Natural Resources Conservation Service, Gainesville, FL, ²The University of Georgia - Center for Invasive Species and Ecosystem Health, Tifton, GA

In 2008, the Florida Invasive Species Partnership (FISP), working with the University of Georgia Center for Invasive Species and Ecosystem Health (Center) launched a website, FloridaInvasives.org. This website provides invasive species management and prevention "How To's," Cooperative Invasive Species Management Area (CISMA) information, and the "Incentive Program Matrix". The "Incentive Program Matrix" provides an important resource for private landowners and public land managers in Florida through an interactive database of existing federal, state and local funding sources, incentive programs and technical assistance.

FloridaInvasives.org provides tools for a unified approach, bridging the gap "across the fenceline" between public and private lands landowners, focuses on prevention as well as treatment and encourages the development and implementation of new and innovative approaches to invasive species management. FISP provides information in an effort to increase effectiveness and decrease costs through collaboration; we hope to encourage all stakeholders to "Think Locally and Act Neighborly."

Following this effort, FISP members were able to secure additional funding to work with the Center to create websites for individual CISMAs in Florida. The Center had already been working closely with the Everglades CISMA in the development of their website promoting collaborative efforts and providing a system for unified tracking (EDDMapS) and reporting of accomplishments. Working with the Center, FISP hopes to ensure an integrated approach to the development of websites throughout Florida and create a website cookbook which will serve as a tool for future CISMA website development nationally.

Evaluation of integrated methods for the control of cogongrass (*Imperata cylindrica* L.).

Onokpise¹, Oghenekome U. Susan K. Bambo¹, James J. Muchovej¹

¹Florida A&M University, Tallahassee, FL

Cogongrass (*Imperata cylindrica* L.) is an invasive exotics species is altering native plant communities in the southeast US by displacing native species and changing community structures or ecological functions. The study investigated revegetation species that can be used successfully after treating naturally cogongrass infested area with herbicides. Field experiments were conducted between 2007 and 2008 in north Florida. Native grass species, muhlygrass (*Muhlenbergia capillaris* (Lam) Trin.), maidencane (*Panicum hemitomom* Schult.), and switchgrass (*Panicum virgatum* L.) were raised in the greenhouse for eight weeks and field plots were planted with these natives after two weeks of herbicide (glyphosate and imazapyr) applications to natural infested areas. The experiment was a randomized complete block design with three treatments and three replicates. Treatments were applied to suppress cogongrass and these included imazapyr, glyphosate, and control (mowed). Plots were evaluated every four months after field planting for native grass survival and percentage cogongrass re-infestation.

Native species survival varied significantly among treatments, with glyphosate recording the highest survival rate and control being the lowest. No significant differences in survival rate (2 to 40%) were obtained with native species in control plots. Survival rate for switch, maidencane, and muhlygrass were 28 to 67%, 0 to 30%, and 42 to 68%, respective in imazapyr plots, while for glyphosate, survival were 70 to 82%, 0 to 8%, and 84 to 93% for switchgrass, maidencane, and muhlygrass, respectively. Re-infestation was 100% in the control treatment plots, while cogongrass infestation ranged from 0 to 20% and 0 to 3% for glyphosate and imazapyr, respectively. This study reveals that revegetation immediately following glyphosate is best due to its lack of soil activity. Recommended revegetation species are muhlygrass and switchgrass. On the other hand, imazapyr is the best to suppressed cogongrass, but may need longer than two weeks to achieve proper survival of the native species.

Exploration for natural enemies of *Hydrilla verticillata* in Africa: A fishy story.

Overholt¹, William A., Robert Copeland², Dean Williams³, Brian Gidudu⁴, Benoit Nzigidahera⁵

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Hydrilla (*Hydrilla verticillata*) is a submersed aquatic plant which is widely distributed in the Old World, but its true native range is not well defined. Early records from Central/East Africa suggested that Africa may be part of the native range. Thus, exploration for insect herbivores was conducted from 2006-2008 in African lakes to identify potential candidates for classical biological control of hydrilla. Out of 21 water bodies surveyed in Kenya, Uganda and Burundi, hydrilla populations were identified in only five lakes; four in Uganda and one in Burundi. At locations where hydrilla was found, it rarely reached the water surface, the distribution was highly patchy, and the density was low to moderate. A high diversity of chironomid midges was found associated with hydrilla, but most species were not herbivorous. Two midges, *Polypedilum dewulfi* and *Polypedilum wittei*, may be hydrilla herbivores, although their abundance was typically low and conclusive evidence of feeding was not observed. Based on the lack of evidence of damaging levels of insect herbivory, we hypothesized that fish may

be regulating hydrilla in these lakes. Gill nets placed in patches of hydrilla in Lake Bisina, Uganda trapped 41 species of haplochromine fish. Inspection of gut contents revealed that four species had fed on hydrilla. A fish exclusion study is currently underway to estimate the impact of fish herbivory on hydrilla performance.

Multiple control strategies for *Lygodium japonicum* (Japanese climbing fern) in the southeastern United States.

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¹University of Florida, Gainesville, FL, ²Joseph W. Jones Ecological Research Center, Newton, GA, ³University of Florida, North Florida Research and Education Center, Quincy FL

Lygodium japonicum (Japanese climbing fern) is a FLEPPC Category I invasive plant species and is a growing threat in natural areas across the southeastern United States. It is characterized by a climbing growth habit but also grows as a dense groundcover, smothering understory vegetation. Previous studies examined potential control mechanisms, focusing primarily on the efficacy of various herbicides using different application methods and/or different herbicide rates. While some herbicides provided good control over short time periods, eventual regrowth is common. In the present study, two treatment methods for *L. japonicum* were examined: a combination of chemical treatment and prescribed fire for large infestations, and mechanical treatment for smaller populations.

The study was conducted at the Joseph W. Jones Ecological Research Center in southwest Georgia. At the site, *L. japonicum* infestations appeared to be less severe in areas that were burned frequently, though this pattern may also be related to other factors such as proximity to waterways. In the fire-herbicide study, blocks were established in areas of high *L. japonicum* cover and either received a prescribed burning treatment or were protected from burning. Within each block, eight plots were established and received one of eight possible herbicide treatments: glyphosate at a rate of 1%, 2%, or 4%; imazapyr at a rate of 0.5%, 1%, or 2%; a mix of 2% glyphosate and 1% imazapyr; and a control plot treated with water only. Chemical treatments took place during the growing season, followed by prescribed fire treatment in the winter burning season. Initial percent cover and regrowth were measured by photomonitoring prior to treatment and every four weeks following treatment. Two types of mechanical treatment for small infestations (<1m²) were investigated: cutting the rachis at ground level and removing all aboveground biomass; and removing all biomass by removing the roots and rhizomes in addition to removing aboveground foliage. Treatment sites for both types of mechanical removal were monitored for regrowth. In addition, portions of rhizomes and foliage were replanted in pots and subsequent growth was measured in order to assess the implications of incomplete mechanical removal. While this type of mechanical treatment is more labor intensive and more expensive per unit area, it may be an important strategy in treating smaller, outlying populations and therefore in slowing the spread of *L. japonicum*. Use of multiple treatment types may be the best approach for managing this species.

Florida Invasive Plants Geodatabase status.

Price¹, Frank and Gwen Iacona¹

¹Florida Natural Areas Inventory, Tallahassee, FL

The mission of the Florida Natural Areas Inventory (FNAI) is to gather, interpret, and disseminate information critical to the conservation of Florida's biological diversity. In support of this mission FNAI has been collecting information on the status of invasive plants on state

conservation lands since 2004. Currently this effort is supported by funding provided by the Florida Fish and Wildlife Conservation Commission Invasive Plant Management Section. FNAI's goal is to compile a baseline record of the status of invasive plants on Florida's public conservation lands and develop a data collection system that can be used as a tool for monitoring the status of invasives. This presentation will review the data collection system developed by FNAI, summarize the current status of the Florida Invasive Plants Geodatabase, and discuss FNAI's role in the development of the iMapInvasives website, a new tool for submitting, managing and displaying invasive species data.

Production, accumulation, and decomposition of *Melaleuca quinquenervia* litter biomass in time and space.

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¹USDA-ARS, Invasive Plant Research Lab, Ft. Lauderdale, FL

Melaleuca quinquenervia (melaleuca) is highly invasive in various habitats of southern Florida where it has invaded over 200,000 hectares. Some areas have become closed-canopy monocultures with thick layers of leaf litter covering the forest floor. We hypothesized that the dramatic accumulation of thick layers of litter was due to large amounts of annual litterfall coupled with slower decomposition rates. To test this we documented litterfall rates and standing litter biomass in melaleuca stands.

During 1997-1998 total mean annual litterfall values were 4.4 and 7.8 mt/ha within small- and large-tree stands, respectively; over 70% of the total annual litterfall biomass in these stands was comprised of melaleuca leaves. In 1997, total standing litter biomass on forest floors averaged 12.3 mt/ha in small-tree plots and 25.6 mt/ha in large-tree plots; of this 6.1 and 15.6 mt/ha, respectively, was comprised of undecomposed litter (leaves and <2.5 diameter stems). Over 50% of the undecomposed standing litter biomass consisted of melaleuca leaves. Therefore, we investigated melaleuca leaf-mass loss trends over a six-year period. We collected freshly senesced fallen melaleuca leaves from mature melaleuca-forests and senescing *Cladium jamaicense* (sawgrass) leaves from sawgrass stands. We inserted a known mass of each species into separate nylon pouches, placed the pouches on the soils of melaleuca and sawgrass stands, harvested the bags periodically, washed off any decomposed organic matters, dried the remaining biomass to a constant weight and weighed the remaining contents of the pouches.

The rate of mass loss in the pouches between sites (dry vs. wet) and stands (melaleuca vs. sawgrass) was determined based on the time it took to incur 50% loss of the original amount of leaf tissue. Results revealed that the melaleuca leaf mass loss in melaleuca stands was faster in organic soils than in sandy soils. The loss of melaleuca leaf biomass on organic soils in melaleuca stands was 1.5 times faster than in sawgrass stands. Melaleuca leaves decomposed at 1.8 and 2.9 times more slowly than sawgrass leaves under melaleuca and sawgrass stands, respectively. These findings indicate that melaleuca litterfall decomposition is slower than sawgrass regardless of the site. This study also provides insight to the role of rapid accumulation of melaleuca litter on the tree's invasion potential and negative effects on recruitment and establishment of other plants under healthy canopies.

The Central Florida Lygodium Strategy: Drawing a line on the vine—an update on work to date.

Rowe¹, Rosalind and Cheryl Millett¹

¹The Nature Conservancy, Babson Park, FL

The Central Florida Lygodium Strategy (CFLS) is a partnership including The Nature Conservancy (TNC) and other land management conservation groups, federal, state and local governmental agencies, and private landowners. The CFLS was formed initially to create a “lygodium-free” zone across central Florida. This coordination of public and private land owners and managers offers a landscape-level approach through shared work and funding, striving for rapid detection and early response. Through CFLS and a private lands initiative, TNC staff and contractors now have surveyed over 35,000 acres and worked over 2,000 acres on 27 private properties, buffering 25 conservation areas. During 2008, the CFLS focused on working with public land managers and private landowners in Pasco, Polk, Sumter, Lake, Volusia, Seminole and Orange Counties, to locate and control the northernmost infestations of Old World climbing fern (OWCF), drawing a “northern line.”

Direct funds have been awarded through a USDA Cooperative Forest Health Program grant administered by the Florida Division of Forestry, the US Fish and Wildlife Service Partners for Fish and Wildlife Program and Private Stewardship Grant, the National Fish and Wildlife Foundation and the Southwest Florida Water Management District. Equally important are the match funds and in-kind services that have been generated through the Florida Department of Protection Bureau of Invasive Plant Management, the South Florida Water Management District, and a FLEPPC Kathy Craddock Burks Education and Outreach Grant. Working with its partners, CFLS continues the work of defining and treating the northern boundary of the migration of OWCF in central Florida. Successes have included 95%-or-better control on several properties, new discoveries in the accomplishments of partnership, and the beginnings of a definitive picture of the northern extent of this plant coupled with an educational campaign north of suspected infestation areas. Challenges have included plants resisting treatments in certain soils and finding that the confirmation of our northern line requires better data. To address these challenges, CFLS has invited new research work on problematic soils and is preparing for new aerial surveys, further on-the-ground data from public land managers and Florida Natural Areas Inventory surveys, as well as the creation of sentinel sites that provide regular monitoring and reporting of presence or absence of the fern.

Meet your local CISMA (Cooperative Invasive Species Management Area).

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A Cooperative Invasive Species Management Area (CISMA) is a partnership of federal, state, and local government agencies, tribes, individuals, and various interested groups that manage invasive species within a defined area. There are five basic characteristics to successful CISMAs: 1) Definition of a geographical area distinguished by a common geography, invasive species problem, community, climate, political boundary, or land use; 2)

Involvement or representation of the majority of landowners and natural resource managers in the defined area; 3) Establishment of a steering committee; 4) Commitment to cooperation; and 5) Development of a comprehensive plan that addresses the management or prevention of one or more invasive species.

To date, 12 CISMA-type organizations have sprung up in Florida, from Walton County to the Florida Keys. Some have been around for over 10 years, others will be celebrating their one-year anniversary in 2009. However, they all have realized successes and overcome challenges. These CISMAs are working across boundaries, expanding invasive species management efforts across the landscape and building community awareness. These coordinated efforts serve to protect our valuable conservation areas, public lands and private lands from the continuing colonization of invasive species.

In this panel discussion, members of many of the CISMAs in Florida will come together to present the results of their partnerships and share experiences. There will be a discussion following, and audience participation is encouraged. Confirmed CISMAs include the Central Florida Invasive Species Working Group, Everglades CISMA, Keys Invasive Species Task Force, and the Treasure Coast CISMA.

Chemical control of natalgrass (*Melinis repens*) and native plant tolerance.

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Natalgrass (*Melinis repens*) is a short-lived perennial grass that was introduced to Florida from Africa in the 1800s. Originally utilized as forage, this species has persisted in disturbed and natural areas and has recently become a major problem in areas undergoing active restoration. This invasive potential has made natalgrass a primary concern in many natural areas in Florida. The objective of this study was to evaluate various chemical treatments for natalgrass control under natural conditions and observe the impact of these treatments on any coexisting native plants within the natalgrass community. Studies were initiated in July 2008 at the Tenoroc FMA. Treatments consisted of low and high rates of glyphosate (1 and 3 lb-ai/acre), imazapyr (0.125 and 0.25 lb-ai/acre), imazapic (0.25 and 0.5 lb-ai/acre) and hexazinone (0.5 and 1 lb-ai/acre); and single rates of metsulfuron (0.25 lb-ai/acre) and fluzifop (0.25 lb-ai/acre). All treatments were applied in a carrier volume of 15 gallons per acre and included a non-ionic surfactant at 0.25% v/v. Species present at five-foot intervals along each of two line transects spaced evenly in each plot were noted (for a total of 20 observations per plot). This data was used to reflect initial species composition and density; measurements were repeated three months later.

Greater than 98% control of natalgrass was observed with both the low and high rates of hexazinone and the high rate of glyphosate three months after treatment. The lower rate of glyphosate provided only 80% control. All other treatments showed less than or equal to 70% control. Metsulfuron and fluzifop provided very little control. When determining percent decrease in natalgrass from species composition data, glyphosate showed a 13 and 40% decrease in natalgrass, respectively. This discrepancy with the visual evaluation can be explained by the fact that, while glyphosate provided very good control of existing plants, the lack of soil residual activity from this herbicide allowed natalgrass to reestablish from seed. In

evaluating *Eragrostis* spp., glyphosate, hexazinone and fluazifop showed a 100% decrease in density at three months after treatment. Imazapyr, imazapic and metsulfuron showed an increase in *Eragrostis* density; plots treated with the low rate of imazapic demonstrated an *Eragrostis* density six times higher than initial levels. This provides evidence that, although natalgrass control was not as high as that observed with some of the other herbicides, imazapic may have provided enough stunting of natalgrass to allow for the increase in *Eragrostis*.

Herbicides for the control of downy rosemyrtle, lead tree, and Old World climbing fern.

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Downy Rosemyrtle (*Rhodomyrtus tomentosus*) is an invasive shrub to Florida. In Cypress Creek, a natural area of SFWMD near Jupiter, FL, downy rosemyrtle (DRM) occurs as dense infestations, reaching 100% cover and crowding out most other understory vegetation. An initial study of control of DRM was established in December 2005. After 14 months Vanquish was the best treatment both in this experiment and in additional field trials. Another experiment was established in November of 2007 to confirm results, evaluate new treatments and to determine if the Vanquish rate could be reduced. The South Florida Water Management District (SFWMD); University of Florida/IFAS; Florida Department of Environmental Protection, Bureau of Invasive Plants; BASF Corporation, Dow AgroSciences LLC and other entities collaborated to select twenty-two herbicide and herbicide tank mix treatments for a field trial on DRM. BASF and Dow AgroSciences Corporations provided partial funding for the study. Aquatic Vegetation Control, Inc. conducted the study. Each treatment consisted of three 1/100-acre plots. The plots were visually rated for percent control. All treatments were made with 50 gal/acre of spray mixture unless otherwise specified. In this experiment, Arsenal Powerline at 24 oz plus Garlon 4 Ultra at 64 oz/acre looks the best at 93% control. Non-target damage was also high. Vanquish in combination with other herbicides also looks promising with little or no regrowth after one year of evaluation. Vanquish Vista and Overdrive in combination or alone, have little non-target damage. Garlon looks very promising initially but re-growth occurs in about 10 months

Lead Tree, *Leucaena leucocephala* (Lam.) is an invasive tree or shrub which is difficult to control. It is most prevalent in South Florida but also occurs in other parts of Florida, Texas, Arizona, California and Hawaii. At Carysfort Circle in Key Largo Florida, an experiment was initiated in November of 2007 to determine the efficacy and rates of the herbicide Milestone VM for the control of Lead tree. Cut stump, girdling and foliar treatments were evaluated. Milestone VM girdling results were compared to Garlon 4 Ultra. Dow AgroSciences and BASF Corporation provided partial funding for the study. Florida Department of Environmental Protection, Pennekamp Coral Reef State Park provided the site and other valuable help. Aquatic Vegetation Control, Inc. conducted the study. Each treatment consisted of three 1/100-acre plots. The plots were visually rated for percent control. Milestone VM at 14 oz/acre, spot treatment rate, was an effective foliar treatment at 98% control and Milestone VM at 7 oz/acre also was effective at 94% control. Cut stump and girdling rates of Milestone VM that were effective ranged between 2-5% solutions. For both girdling and cut stump, a 2% solution of Milestone control was about 90% and a 5% solution Milestone VM was 100% control. Garlon 4 Ultra at 30% solution was about 90% effective on girdling treatments. Some of the girdling experiments were destroyed.

Old World climbing fern (*Lygodium microphyllum*) is listed as an invasive species by FLEPPC and it is listed by DACS on the Florida Noxious Weed List. In Jonathan Dickinson State Park an experiment was initiated to determine herbicide efficacy of Old World climbing fern. Garlon 3A, Milestone VM, Escort, Clearcast and Rodeo were the herbicides used in the experiment. Dow AgroSciences provided partial funding for the study. Jonathan Dickinson State Park provided the site and other assistance for the experiment. Aquatic Vegetation Control, Inc. conducted the study. Each treatment consisted of three 1/100-acre plots. The plots were visually rated for percent control. All treatments were made at 50 gal/acre spray mixture on December of 2006. Garlon 3A and Rodeo were about equally effective at about 95% control in seven months. Escort was also effective at about 92% in seven months. The other herbicides were much less effective.

Current levels of biological suppression of waterhyacinth in South and Central Florida.

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Waterhyacinth was evaluated at three sites using an insecticide check approach to determine the level of suppression provided by the current suite of biological control organisms. Site one (Lake Alice, Gainesville) was a high fertility site under herbicide management which supported low populations of herbivores. Site two (STA1-West, Loxahatchee) was a high fertility, unmanaged site with large populations of herbivores. Site three (IPRL, Fort Lauderdale) was an unmanaged, low fertility site with large populations of herbivores. Most waterhyacinth variables were negatively affected by the existing biocontrol agents at most sites. For example, herbivory reduced waterhyacinth flowering by 79.4%, 94.1%, and 97.9% at Lake Alice, IPRL, and STA1 West, respectively. In addition, plant biomass was reduced an average of 34.9% across all sites by herbivory. However, percent waterhyacinth cover was lower only in sprayed plots at the low fertility site. These data provide a baseline for waterhyacinth biological suppression prior to the release of the new biocontrol agent, *Megamelus scutellaris*, expected sometime in 2009.

Physiological response of cattails (*Typha* spp.) to high water conditions in stormwater treatment areas.

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Typha spp. (cattails) are a native wetland species that can be found throughout Florida and the United States. An important characteristic of this species is its ability to uptake phosphorous. This has led to the use of *Typha* in large-scale constructed wetlands, called stormwater treatment areas (STAs), to purge phosphorus from nutrient-rich water before it enters the Everglades ecosystem. In addition to filtering out nutrients, STAs also serve as water retention bodies for flood control. The STAs are intensely managed and water levels change constantly. If water levels decline for a substantial period, *Typha* populations will often decline and die. The objective of this project is to identify parameters associated with hydrologic stress in *Typha* imposed by drought conditions to correlate drought stress with *Typha* decline and death. The goal is to elucidate those parameters associated with *Typha* death and the timeframe over which decline occurs. The experiment consisted of a randomized block design with four replications. Plants were placed at three water depths: the surface of the water 1" above soil surface, 12" below surface, and 18" below soil surface.

Plants were harvested after two and four months of drought conditions. After harvest the following biochemical tests were performed to analyze stress response: analysis of total chlorophyll and carbohydrate content, as well as enzyme assays for ABA, glutathione reductase, superoxide dismutase, catalase, and ascorbate.

Biological control of Chinese tallow: Results of Chinese foreign exploration and preliminary testing.

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Chinese tallow is among the worst environmental weeds in Florida and other areas of the southeastern US. This species occupies diverse habitats causing many environmental problems including decreased biodiversity of the infested areas. Although chemical controls are known and used to control this invasive species, biological control presents an attractive alternative when practiced safely. The native range of this species primarily includes central and southern China. The USDA/ARS Invasive Plant Laboratory, colleagues at the Australian biological control lab, and the Chinese Academy of Science have been conducting foreign surveys searching for insects that will be safe and effective at controlling Chinese tallow in the US. Surveys have revealed many new herbivores throughout the native range of these species. These include many new weevil, thrips, psyllid, eriophyid mites and lepidopteran species. Several of these species are, or have undergone preliminary testing to determine suitability for release here. Progress will be presented describing the potential of these herbivore species as potential biological control agents.,

Biological control of Brazilian pepper: Results from foreign exploration and host testing.

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Brazilian pepper is among the worst environmental weeds in Florida and other areas of the southeastern US. This species occupies diverse habitats causing many environmental problems including decreased biodiversity of the infested areas. Although chemical controls are known and used to control this invasive species, biological control presents an attractive alternative when practiced safely. The native range of this species primarily includes eastern Brazil and northern Argentina. The USDA/ARS Invasive Plant Laboratory, colleagues at the South American biological control lab, and the Brazilian university colleagues have been conducting foreign surveys searching for insects that will be safe and effective at controlling Brazilian pepper in the US. Surveys have revealed many new herbivores and testing is underway on a thrips, a leaf miner and a caterpillar. Progress will be presented describing the potential of these herbivore species as potential biological control agents.

Poster Presentations

IFAS assessment of non-native plants in Florida's natural areas.

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The IFAS Assessment of Non-Native Plants in Florida's Natural Areas (hereafter referred to as the IFAS Assessment) is a system that was created to address the growing awareness of the threat posed (especially to threatened and endangered species) by non-native plant species to Florida's natural areas. The purpose of the IFAS Assessment was to develop and provide a definitive system to the faculty and staff within the University of Florida's Institute of Food and Agricultural Sciences (IFAS) that characterizes a common basis for descriptions of, and recommendations for, the use and management of non-native plant species in Florida. It is important to note that the IFAS Assessment is not regulatory and that this process should not to be confused with the formal and complex risk-benefit analysis that is used to determine state regulations prohibiting the use of a species.

The IFAS Assessment is composed of three components: the Status Assessment, the Predictive Tool, and the Intraspecific Taxon Protocol (ITP). The Status Assessment is intended to evaluate only plants that currently occur within the state of Florida and that have persisted for at least 10 years for herbaceous plants and 20 years for woody plants. It is intended to prevent the likelihood of further invasion of natural areas by non-native plants. The Predictive Tool was added to the IFAS Assessment in 2008 and it is intended to examine the invasive potential of non-native plant species to natural areas of Florida. It is applied to plants that are either recent arrivals to Florida (less than 10 years for herbaceous plants and less than 20 years for woody plants) or are known to be pests elsewhere with similar habitats and climates to Florida. The Intraspecific Taxon Protocol (hereafter referred to as the ITP), was also added to the IFAS Assessment in 2008. It is designed to evaluate an intraspecific taxa found in Florida, regardless of whether it is documented in any flora outside cultivation or is only grown in cultivation. Intraspecific taxa consist of cultivars, varieties, and sub-species, which may have different outcomes from the "resident species" (a.k.a. "full species", "wildtype species" "parent species", "type species", or "named species"). Each of the components examines the non-native plant species separately within all three zones (North, Central, South) of Florida (adapted from the USDA Plant Hardiness zone map) and a conclusion statement is determined based on the evidence that has been gathered by the IFAS Assessment Team.

An IPM model for sustainable management of Brazilian peppertree, *Schinus terebinthifolius* (Anacardiaceae), in Florida.

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Brazilian peppertree (*Schinus terebinthifolius* Raddi) is an aggressive, rapidly colonizing invasive weed of disturbed habitats, natural communities and conservation areas in peninsular Florida. Once established, Brazilian peppertree quickly displaces native vegetation, often forming dense monocultures that reduce the biological diversity of plants and animals in the invaded area. Herbicides and mechanical or physical control practices (e.g., cutting, burning and flooding) are routinely used often in combination for controlling

existing Brazilian peppertree stands, but these conventional methods are expensive, labor intensive and provide only temporary control due to the plant's regenerative capacity. Furthermore, non-selective chemical and mechanical controls are unsuitable for sensitive natural areas (e.g., coastal mangrove forests) because they can have negative effects on non-target species and the environment. Minimizing the use of herbicides and other non-selective control practices is needed to maintain the integrity of the Everglades ecosystem. The objective of this research/demonstration project is to provide land managers with a predictable IPM strategy for addressing the Brazilian peppertree problem. A model system was developed that integrates natural processes such as biological control (top-down effect) with interspecific plant competition and allelopathy (bottom-up effect) to provide an environmentally sustainable, cost effective, and permanent solution to the Brazilian peppertree problem in Florida. The overall goal is to shift the successional dynamics of public and privately owned lands dominated by Brazilian peppertree towards more desirable plant communities where the plant is reduced to a minor component of the flora. Adopting this IPM model will minimize herbicide use and improve wildlife habitat in plant communities of the region currently dominated by Brazilian peppertree.

- Critical ecological processes that direct plant community dynamics to the detriment of Brazilian peppertree are identified in the model and can be modified to produce predictable results.
- Natural regulating factors such as competition and allelopathy from the native wax myrtle, *Myrica cerifera* L., can be manipulated to increase their impact on Brazilian peppertree control, and host specific biological control agents will be introduced to restrict seed production and reduce the vigor of new seedlings and regrowth from treated stumps. The stem and flower attacking thrips *Pseudophilothrips ichini* (Hood) was recommended for field release by the federal interagency Technical Advisory Group in May 2007. The naturalized South African seed wasp *Megastigmus transvaalensis* Hussey attacks the drupes of Brazilian peppertree. Seeds that are damaged by the developing wasps fail to germinate.
- The key elements for sustainable management of Brazilian peppertree in Florida are designed disturbance, controlled colonization, and controlled species performance.

Recruitment, growth and survival of the exotic Brazilian pepper (*Schinus terebinthifolius*) at restored mosquito impoundments in Mosquito Lagoon, FL.

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During the 1960s, Mosquito Lagoon marshes were impounded for mosquito control by building dikes with elevated substrate over one meter above mean high tide. Loss of tidal inundation led to drier and less saline soil conditions and facilitated the invasion of the non-native plant, *Schinus terebinthifolius* (Brazilian pepper). Vegetation surveys during the past year found this terrestrial species accounted for over 20% of the flora prior to restoration. Dike removal began in the 1990s by mechanically leveling substrate to marsh elevations and existing *S. terebinthifolius* was removed.

The purpose of this study was to evaluate recruitment, growth and survival of *S. terebinthifolius* at restored mosquito impoundments. We conducted seasonal surveys at restored impoundments, non-restored impoundments, and reference marshes and used manipulative experiments to test tolerances of *S. terebinthifolius* to all combinations of soil

salinities (0, 15, and 30 ppt) and soil inundations (low, medium, and high). Significantly lower abundances of *S. terebinthifolius* were found at restored sites compared to non-restored impoundments. During the growth trials, seedlings continuously submerged under 2 cm of 30 ppt salt water, survived for one month with minimal leaf loss, suggesting *S. terebinthifolius* has at least limited tolerances for complete saltwater submersion. Understanding rates of recruitment of *S. terebinthifolius* at restored sites and the role of abiotic factors in preventing invasion will assist resource managers in controlling this species by predicting areas this non-native may invade, identifying areas in need of chemical treatment, and estimating optimal substrate elevations to for future saltmarsh restoration projects.

Florida Keys CISMA: Successes of a 10+ year cooperative invasives species management area.

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Before the term CISMA was coined, the Florida Keys Invasive Exotics Task Force (Task Force) was addressing the proliferation of invasive exotic plants in the Florida Keys. Since 1996, the mission of the Task Force has been “to coordinate and increase efforts to eliminate invasive, non-native plants by combining programs and resources to develop and implement a long term exotics removal and control plan for the Florida Keys.” These biological pollutants beset the Key’s unique subtropical ecosystem and the flora and fauna supported by it but a great deal of progress toward their control has been achieved. The Task Force is composed of biologists, planners and natural resource managers from local, state and federal agencies, non-profits and public utilities. The goals of the Task Force include documentation of existing populations, prioritization and control of infestations, public education, tracking of relevant legislation and promotion of interagency cooperation. Projects to date include Keys-wide invasives mapping, leveraging State funds for private lands work, limiting invasives sales through the GreenThumb Certified Nursery program, and most recently a python patrol program. Task Force members are confident that the limited geographic area of the Keys, along with the group’s comprehensive interagency approach and sheer determination, will result in an early and lasting victory in the war on invasive exotic plants in the state of Florida. As the Task Force identifies and demonstrates successful strategies it is hoped that agencies, organizations and like-minded groups will learn from, and improve upon, its successes and innovations. Cooperation is the key to winning the war on invasive exotic plants.

Invasion and management of *Melaleuca quinquenervia* alters nutrient dynamics in a sub-tropical forested wetland.

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Many ecosystems depend on regular disturbances, such as seasonal fires, to maintain community structure and function. This is especially true in Florida where many native plant communities depend on seasonal fires to trigger seed release and open canopies. However, many of Florida’s natural areas have been invaded by exotic plants, including the fire-adapted *Melaleuca quinquenervia*, which have altered native fire patterns. Little work has been done to evaluate the effects of fire on nutrient storage and availability in Florida’s invaded and managed ecosystems. This study investigated two main questions: 1) Does the quantity and availability of nutrients varies between native and melaleuca invaded and managed systems?

2) Does the method of treatment of melaleuca alter the systems ability to store nutrients after a seasonal fire?

In March 2007, 75 one-m² plots were established across three areas in the Collier County, Florida. The areas sampled are: Area #1) reproductive melaleuca treated with herbicide, Area #2) reproductive melaleuca treated with biological control, and Area #3) native forest with no melaleuca. The experiment plots were sampled to characterize pre-fire conditions and plots were revisited and measurements were repeated after a destructive fire in April 2007. Measurements include: quantity and nutrient concentration of litter, soil nutrient concentration and storage, and nitrogen and phosphorus availability of surface soils. Results revealed that before the fire both the herbicide and biological control treatment areas stored significantly less carbon and nitrogen compared to the native site. The observed differences were mostly due to the significantly smaller litter nutrient storages. In contrast, post-fire the biological site stored the most carbon and no longer had significantly different levels of nitrogen compared to the non-invaded site. Total storages of phosphorus were not different before the fire. However, every site experienced an increase in phosphorus storage after the fire.

These results and future biogeochemical and microbial analysis will be used to quantify the changes caused by melaleuca invasion and management. Currently there is a need to develop a better understanding of the ecological consequences of exotic species invasion and methods for countering them, particularly in the context of natural disturbance regimes. Elucidation of the extent, duration, and impact of the changes caused by invasion and management of exotic plants will help in developing more effective restoration and management techniques.

This work was partially funded by the Florida Exotic Pest Plant Council's Julia Morton Invasive Plant Research Grant Program.

Treasure Coast Cooperative Invasive Species Management Area: First year accomplishments.

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The Treasure Coast Cooperative Invasive Species Management Area (TC CISMA), which includes northern Palm Beach County, and all of Martin, St. Lucie and Indian River Counties, had its' first year anniversary this past November 2008. During this first year, we met 10 times, and had 14 active participants with representation from the Florida Department of Environmental Protection, Florida Fish and Wildlife Conservation Commission, Indian River County, Martin County, Natural Resources Conservation Service, Palm Beach County, Palm Beach County Solid Waste Authority, South Florida Water Management District, St. Lucie County, The Nature Conservancy, the Treasure Coast Resource Conservation and Development, United States Fish and Wildlife Service, and University of Florida/IFAS.

During our first year we created our name, wrote our mission statement and five goals, determined our boundaries and created a GIS map, submitted a FLEPPC 2008 Poster, wrote a justification statement, expanded and extended our previous cooperative partnership workday MOU within Martin County, submitted and received a \$64,000 USFWS Coastal Program Cooperative Agreement for *Scaevola taccada* removal on both public and private

lands, held a Treasure Coast Regional Invasive Plant Management Workshop, submitted and received a USFWS \$46,000 Challenge Cost Share Agreement for invasive plant removal and restoration on conservation lands in Martin County, coordinated the \$33,000 SFWMD Indian River Lagoon License Plate grants for invasive plant and restoration work on coastal conservation lands in Martin and Palm Beach Counties, and drafted a five-year strategic plan.

The Everglades Cooperative Invasive Species Management Area (ECISMA): Greater than the sum of its parts.

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Recognizing the need for a more defined commitment to cooperation among those engaged in invasive species management in the Everglades, the Everglades Cooperative Invasive Species Management Area (ECISMA) was formed in 2006. ECISMA is a partnership of agencies, tribes, and organizations, with the primary goal of integrating coordination, control and management of invasive species at regional, multi-jurisdictional levels. ECISMA has accomplished many goals towards organizing, defining common goals, and achieving on-the-ground results from cooperative efforts. Since its formation, ECISMA has convened three annual invasive species summits, formed a steering committee and several sub-committees, executed a Memorandum of Understanding between many state and federal agencies, conducted early detection, rapid response efforts, developed a website for outreach and early detection reporting, mapped invasive plant infestations, and other cooperative efforts.

Growth pattern analysis of *Imperata cylindrica*.

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Imperata cylindrica (cogongrass) is a rhizomatous perennial grass native to Southeast Asia that forms expansive and dense impenetrable monocultures which adversely affect habitat quality for many native flora and fauna. It is currently listed as a Category I invasive by FLEPPC, as a noxious weed by other state and federal agencies, and its distribution in Florida spans as many as 60 counties. (USDA PLANTS Database, 2009) Studies have traditionally focused on control efforts involving application of herbicidal and mechanical treatments on single to a few large colonies, yet a basic understanding of growth patterns and the spatial correlation within patches is poorly understood. This should be accounted for because the probability of occurrence of any pest species in any given location is directly dependent upon the distribution of surrounding sources.

A study performed in Rwenzori National Park, Uganda found that grazing reduces the performance of the species and that under natural conditions, fire disturbance and intensive grazing can suppress vegetative spread rates and permit co-existence of a large number of species within a cogongrass stand (Edroma, 1981. African Journal of Ecology. V. 19 pp. 215-233). Old Hopewell, a privately owned reclaimed phosphate mine located in Mulberry, FL, offers a unique opportunity to perform spatial analysis on multiple patches (>8) of varying sizes (36 m² – 1200 m²) in the presence of intense seasonal grazing by cattle. The focus of this study is to determine growth pattern and the strength of spatial correlation between the interior and expanding edges of a patch, and the effects of intense seasonal grazing on patch density and spread rates for comparison to Edroma's 1981 study.

Data collection includes calibrated visual cover estimation at a 2 m² resolution for each patch, monthly over a one year period. Patch boundary analysis will utilize GIS software to perform both Squared Euclidean Distance split-moving window and lattice-wombling analyses to illustrate sharpness, width, shape and sinuosity. Spatial correlation within patches will be analyzed via global spatial statistics (Mantel tests), local spatial statistics (LISA) and interpolation (Kriging). Application of this wide suite of analytical procedures will provide the most comprehensive understanding of the spatial relationship(s) within cogon grass patches, which can be incorporated into future control efforts.

The role of biological control agents in reducing population growth of *Melaleuca quinquenervia*.

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Biological control programs have the goal of reducing population growth and spread of invasive species; yet studies testing to what extent such a goal is achieved are scarce. Since the effects that biocontrol agents have at the individual level do not always scale up to the population level, it is essential to specifically evaluate their effects on demographic rates (survival, growth, and fecundity) that determine population growth rate.

A biological control program started several years ago in South Florida against the invasive tree *Melaleuca quinquenervia* (melaleuca) with the introduction of two insects. Several experimental and field studies have shown that the biocontrol agents negatively impact survival, growth, and reproduction of the tree. However, no studies have focused on evaluating the population dynamics of Melaleuca and determining whether the impacts exerted by the biocontrol agents have resulted in a reduction of the plant's population growth rate.

In 2003, we set up permanent plots of melaleuca in seven sites in South Florida, and two sites in Australia, where the species is native. All individuals within those plots were marked and we recorded its size (diameter) and reproductive status (presence/absence of capsules). We censused the marked populations yearly until 2006 in Australia, and 2007 in Florida. From these demographic data we estimated survival, individual growth and reproduction in each site. Preliminary analyses show that populations in both the native and exotic range have declined between 2003 and 2007 as a result of high per capita mortality and zero or low per capita recruitment. However, in 2005 in Florida, recruitment was higher than mortality and population growth rate was positive.

We will present the results of stage-structured models on population dynamics of melaleuca based on these demographic data. We will also present demographic perturbation analyses, which explore how population growth rate responds to changes in plant survival, growth, and reproduction. Perturbations of matrix entries in the analysis will be based on data on the effects of the biological control agents on different vital rates of melaleuca. If the biocontrol agents are affecting stage transitions that are crucial to population growth, we will be able to confirm the hypothesis that population growth rate has indeed been reduced as a consequence of the negative impacts produced by the biological control agents.

The Treasure Coast Dune Invasive Plant Removal Project.

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The recently formed Treasure Coast Cooperative Invasive Species Management Area (CISMA) was awarded a US Fish and Wildlife Service (FWS) Coastal Program Cooperative Agreement Grant for control of *Scaevola taccada* and associated species on both public and private lands throughout North Palm Beach, Martin, St. Lucie and Indian River Counties. The focus of this discussion will be on the rapid successful organization of the group and the administration of the Treasure Coast Dune Invasive Plant Removal Project which involves public lands managed by several different agencies and private lands managed by both coastal homeowners and condominium associations. The Treasure Coast CISMA established a partnership in November 2007 to address the extensive problems associated with exotic species as a top habitat conservation priority and to cooperatively address the threats of invasive plants and animals. With the mission to implement a comprehensive, cooperative approach across boundaries to address the threats of invasive species within the Treasure Coast CISMA, five goals were established; **1)** Reduce and control the spread of existing invasive species; **2)** Prevent the establishment and spread of new invasive species; **3)** Build working relationships between public and private stakeholders to foster cost-effective control of invasive species; **4)** Provide educational and information exchange about invasive species among stakeholders, and **5)** Promote applied research in invasive species management.

The Treasure Coast CISMA attributes its rapid success to the commitment of the individuals involved with the various agencies and non-profits who were the founding members and to their already existing partnerships such as local work days and other cooperative efforts. Members represent managers of local, state, and federal conservation lands, as well as agencies and organizations working with private conservation easements and other private entities including ranches and other agricultural lands. With this wide range of expertise, Treasure Coast CISMA members felt confident to enter into a cooperative agreement with US Fish and Wildlife Service to improve coastal habitat within the CISMA. The Treasure Coast Dune Invasive Plant Removal Project fits well into FWS's Coastal Program as *Scaevola taccada* and other invasive dune vegetation including *Casuarina equisetifolia* (Australian pine) and *Schinus terebinthifolius* (Brazilian pepper) disrupts dune ecosystems. These plants have crowded out natives that are essential to dune stabilization and critical wildlife habitat. Treasure Coast CISMA has been awarded \$64,000 to be spent in four public areas for invasive removal and on adjacent areas of private lands for education, eradication and replacement plants when necessary. *Scaevola taccada* has been commonly used as a landscape plant which necessitates more complex techniques for eradication on private lands.

***Lygodium microphyllum* distribution in Water Conservation Area 3.**

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In South Florida, tree islands are areas of high biodiversity within the Everglades marsh. The biodiversity of the islands however, is being compromised by the invasion of exotic species such as *Lygodium microphyllum*. The purpose of this study was to survey 72 islands within

Water Conservation Area (WCA) 3 for the presence of invasive exotic plants, specifically *L. microphyllum*. Originally, it was hypothesized that *L. microphyllum* infestations on tree islands would be more commonly encountered in the western boundary relative to the other areas of WCA-3A because of a source population in Big Cypress National Preserve. Secondly, it was also hypothesized that *L. microphyllum* would be more frequently found on the higher elevation islands relative to the lower elevation islands in this WCA. A subset of 40 islands was chosen in a spatially explicit experimental design to address the two hypotheses stated.

Key findings from this study were: **a)** the infestation rates of *L. microphyllum* on WCA 3A were lower than expected (i.e. two islands out of 40 had the exotic fern) and the initial hypotheses could not be tested; **b)** two of the islands which had been previously treated in WCA 3A were re-infested by *L. microphyllum*, indicating that re-treatment and continued monitoring of previously infested islands is needed; **c)** 61.5% of islands in WCA 3B had *L. microphyllum*, significantly greater than originally estimated; the prevalence of *L. microphyllum* in this area is most likely influenced by its proximity to a source population in ENP; **d)** regardless of the hydrology, *L. microphyllum* on most of the islands was found growing on elevated substrates (i.e. stumps, fern tussocks). Some individuals found within the cypress islands appeared tolerant of periods of deep flooding as they appeared healthy despite growing rooted in water > 0.3 m). Invasive exotic plants were visible at a number of islands (31%) from an airboat. Although these islands have exotics on them, none of the exotic species present appeared to be dominant or overwhelming native species. Findings from this work indicate that continued monitoring of the tree islands is needed, regardless of location, size, or elevation of the island as the distribution of *L. microphyllum* (or other exotic species) across WCA 3 cannot be generalized at present.

Restoration of a cogongrass-invaded abandoned phosphate mineland: Multispecies plantings and follow-up invasive species control.

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Cogongrass (*Imperata cylindrica*) is one of the world's top ten worst weeds. It is extremely invasive because of its extensive rhizome structure and ability to grow in dry, nutrient-limited soils. Cogongrass acts as an opportunistic species when native ecosystems become disturbed displacing native, desirable species. It is important to remove cogongrass and revegetate with site-specific native species to restore plant community structure and minimize cogongrass reinfestation. The site selected was heavily infested with cogongrass that was treated with herbicides in 2006. Eighteen months after treatment, most of the cogongrass was controlled, but random patches (4-10m²) remained throughout the study site. Plots were established immediately adjacent to these patches. Plots represented two treatments (herbicide and control) and three structurally diverse planting treatments (high, low, or no planting) in a 2x3 factorial design with four replicates. Native plants were purchased from a local (Davenport, FL) native plant nursery and installed in February 2008. Herbicide treatments (3% glyphosate solution) were applied nine months after plot establishment and efficacy of treatments has yet to be evaluated. Seed bank samples were extracted along the edge, in the planting area, and in the middle of five random plots before and after installing plants to determine the colonizing species after planting. Hairy indigo (*Indigofera hirsuta*) was problematic for native plant growth during summer months resulting in a subsequent herbicide application. Of the species selected for revegetation, purple lovegrass (*Eragrostis spectabilis*)

and wiregrass (*Aristida stricta*) had the highest percent survival and greatest growth rates. Seed bank assays performed for the winter seed bank showed fewer native plants with a greater number of weedy species.

Update on quarantine studies of melaleuca insects and Chinese tallow insects.

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One potential biocontrol agent for melaleuca and two for Chinese tallow are being studied by USDA scientists in the Florida Department of Agriculture and Consumer Services, Division of Plant Industry quarantine facility in Gainesville, FL, USA. *Haplonyx multicolor* (Coleoptera: Curculionidae) is a tip-clipping weevil from Queensland, Australia and was received in quarantine in July 2006. The adults can live a year or more. Females oviposit eggs in tips of young shoots, one egg/tip and then partially sever or clip the stem below. Clipping causes tips to die, reducing growth and reproduction of melaleuca plants. Both tallow insects are from Hubei, China. *Heterapoderopsis bicallosocollis* (Curculionidae: Attelabidae) is a leaf-rolling weevil received in quarantine in July 2008. Females lay eggs in leaves they roll up like burritos. Each egg chamber (called a nidus) contains two to three eggs. Large numbers of adults cause feeding damage to tallow leaves. *Bikasha collaris* (Curculionidae: Chrysomelidae) is a flea beetle received in quarantine in November 2008. Adults feed on tallow leaves while immatures feed on roots, severely damaging and killing small plants. As of May 2009, *H. multicolor* and *H. bicallosocollis* are undergoing host range tests and development of a method of rearing sufficient numbers of *B. collaris* for testing is underway.

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