



About the cover:

Image taken at Circle B Bar Reserve one not so cold January morning. This individual was one of approximately 20 in the pond that day. *Photo courtesy Brian Manley.*

This program has been approved for Continuing Education Units by the Florida Department of Agriculture and Consumer Services

APPROVED CEUs (maximum per person: 19)

CORE (482 or 487)	4
Aquatic	12.5
Demo & Research	15
Natural Areas	8
Private	12.5
Right-of-Way	5.5

Program committee

Chair: Kris Campbell
Lyn A. Gettys

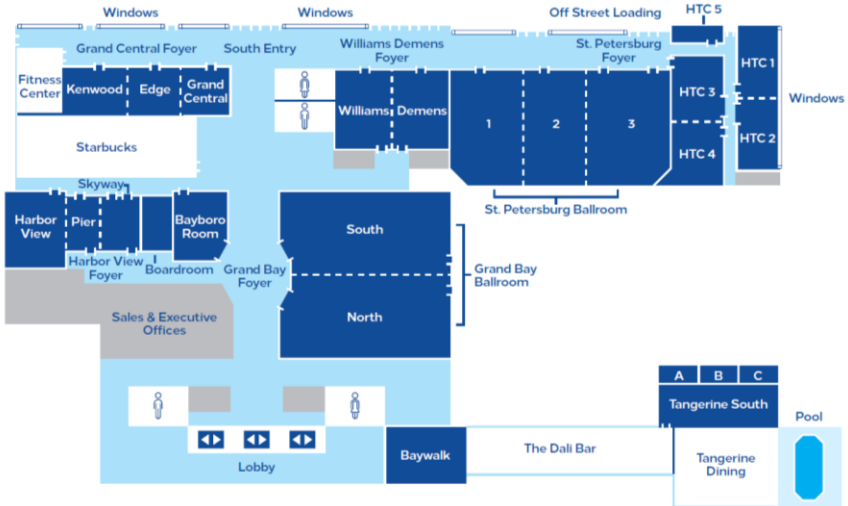
Recommended format for citing abstracts from this program:

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Hilton St. Petersburg Bayfront

Lobby Level



333 1st St SE, St. Petersburg, Florida, 33701-4342

Sponsor exhibits: St. Petersburg Ballroom

Sessions: Grand Bay Ballroom

Awards banquet: Grand Bay Ballroom

Duck races: Poolside

Presidential reception: offsite at Yard of Ale, 260 1st Ave. N. – about a 10-minute walk
Go north on 1st St. S. for about 0.3 mile, then left onto 1st Ave. N. for about 0.2 mile.
Yard of Ale will be on the left.

FLOOR MAP KEY	
■	Meeting/Conference Rooms
□	Amenities
■	Public Space
■	Private
□	Windows

Monday, October 14, 2019

8:00-6:00 *Exhibit/Vendor/Poster Setup – St. Petersburg Ballroom*

2:00-4:00 *FAPMS Board of Directors meeting – Bayboro*

Tuesday, October 15, 2019

8:00-10:00 *Past Presidents Meeting/FAPMS Research and Scholarship
Foundation Meeting –Hilton Training Center 1 (HTC 1)*

Session 1: What's happening in aquatic plant management? (FDACS program # 27913)
Moderator: Kelli Gladding (GRAND BAY BALLROOM)

10:00-10:25 Presidential address, local arrangements, announcements
Kelli Gladding

10:25-10:50 Keynote: The times they are a'changing – really?
Carlton Layne

10:50-11:15 Empirical analyses of water quality, long-term fish and aquatic plant
population data in relation to aquatic plant management actions
Mark Hoyer

11:15-11:40 Florida's aquatic plant management program
Rick Clark

11:40-12:05 Perspectives on recent aquatic herbicide use patterns and future
research directions
Mark Heilman

12:05-1:15 LUNCH (on your own)

Session 2: Aquatic technologies (FDACS program # 27915)
Moderator: Matt Phillips (GRAND BAY BALLROOM)

1:15-1:20 PRIZE DRAWING

1:20-1:40 Can machine learning be used to automate aquatic plant
identification from hydroacoustic data?
Rob Richardson

- 1:40-2:05 Utilizing drone technology in aquatic plant management
Colin Lewis (applicator presentation)
- 2:05-2:25 Aeration: A key tool in aquatic system restoration and management
Patrick Goodwin
- 2:25-2:45 Calibrating hydrilla mechanical harvest operations performance on Lake Tohopekaliga
James Leary
- 2:45-3:00 Diquat Q & A review
Scott Jackson

3:00-3:20 ***BREAK (ST. PETERSBURG BALLROOM)***

Session 3: Terrestrial issues (FDACS program # 27917)
Moderator: Andy Fuhrman (GRAND BAY BALLROOM)

- 3:20-3:25 PRIZE DRAWING
- 3:25-3:45 Management of cat's claw vine (*Dolichandra unguis-cati*) in Florida
Leah Aidif (student presentation)
- 3:45-4:10 The benefits and effects of prescribed burning
Jacky Keller (applicator presentation)
- 4:10-4:35 *Mimosa pigra* – 35 years of containment
Dan Thayer
- 4:35-4:50 Invasions on the horizon? Combining risk analysis and consensus to collaboratively identify future invasive species threats to Florida
Deah Lieurance
- 4:50-5:05 20 years of upland exotic plant management within Florida's conservation lands
Jackie Smith
- 5:05-5:30 Scaling up Brazilian peppertree (*Schinus terebinthifolia*) novel management techniques: Lessons from South Florida
Stephen Enloe

END TUESDAY REGULAR SESSIONS

- 5:30-6:00** ***Poster competition (Just outside of ST. PETERSBURG BALLROOM)***
- 6:00-8:00** ***Presidential Reception (YARD OF ALE: 260 1ST AVE N, ST. PETE)***

Session 4: What is on the horizon for plant managers (FDACS program # 27918)

Moderator: Scott Jackson (*GRAND BAY BALLROOM*)

- | | |
|-------------------|--|
| 8:00-8:05 | PRIZE DRAWING |
| 8:05-8:25 | UPL product update
Justin Nawrocki |
| 8:25-8:35 | Biosafe product update
Tom Warmuth |
| 8:35-8:55 | Dutch aquatic vegetation management techniques
Niels van Elst |
| 8:55-9:05 | Aquatic program process improvements
Jim Schultz (applicator presentation) |
| 9:05-9:30 | New herbicide technologies for management of Old-World climbing fern on tree islands of the Everglades
Jonathan Glueckert (student presentation) |
| 9:30-9:45 | Maintaining professionalism for our industry
Joe Malone (applicator presentation) |
| 9:45-10:05 | BREAK (<i>ST. PETERSBURG BALLROOM</i>) |

Session 5: HABs in Florida (FDACS program # 27920)

Moderator: Keshav Setaram (*GRAND BAY BALLROOM*)

- | | |
|-------------|---|
| 10:05-10:10 | PRIZE DRAWING |
| 10:10-10:25 | Syngenta industry updates
Scott Jackson |
| 10:25-10:35 | Reduction of pesticide applications in waterways using new Microsponge™ technology
Lucia Marshall |
| 10:35-10:50 | Perspective – SePRO industry update
Rory Roten |

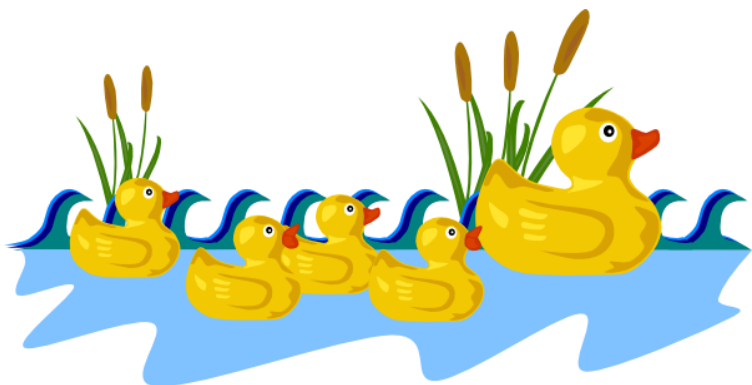
10:50-11:00	Lake & Wetland Management: Trends in living shoreline solutions Brian Fischer
11:00-11:25	2019 State of Florida response to Lake Okeechobee cyanobacteria blooms David Whiting
11:25-11:50	Marine harmful algal blooms (HABs) in Florida: Not all HABs are alike – implications for management Célia Villac
11:50-1:00	LUNCH (on your own)
Session 6: Stay safe out there! (FDACS program # 27921)	
Moderator: Matt Phillips (GRAND BAY BALLROOM)	
1:00-1:05	PRIZE DRAWING
1:05-1:55	Traffic safety briefing Steve Gaskins
1:55-2:20	Vector-borne disease Billy Miller
2:20-2:45	Heat-related illness: Background, risk factors, and prevention Ricky Telg
2:45-3:05	BREAK (ST. PETERSBURG BALLROOM)
Session 7: What will they think of next? (FDACS program # 27923)	
Moderator: Kelli Gladding (GRAND BAY BALLROOM)	
3:05-3:10	PRIZE DRAWING
3:10-3:20	FAPMS Business Meeting Kelli Gladding
3:20-3:45	Field trials of hydrilla management with florypyrauxifen-benzyl Jay Ferrell
3:45-4:10	Understanding risks and benefits of copper-based algaecides West Bishop
4:10-4:35	Field evaluations of herbicide efficacy on invasive <i>Scleria</i> species Alex Onisko (student presentation)

- 4:35-5:00 Using herbicides and grass carp to manage *Hydrilla verticillata* at Hardee Lakes Park
Mike Sowinski
- 5:00-5:25 West Indian marsh grass response to herbicide treatment in saturated and flooded conditions
Kaitlyn Quincy (student presentation)

END WEDNESDAY SESSIONS

5:30-6:30: Duck Races (POOLSIDE)

7:00-9:30: Awards Banquet (GRAND BAY BALLROOM)



Thursday, October 17, 2019

Session 8: Where we've been and where we're going (FDACS program # 27925)

Moderator: Keith Mangus (GRAND BAY BALLROOM)

- 8:00-8:05 PRIZE DRAWING
- 8:05-8:20 What a long strange trip it's been: 35+ years of the Florida Exotic Pest Plant Council—an update
Deah Lieurance
- 8:20-8:35 The University of Florida's new online Weed Science Certificate Program
Candice Prince
- 8:35-8:45 APMS: National society update and request for feedback
Mark Heilman

8:45-8:55	A professional society for growing companies in aquatics Troy Goldsby
8:55-9:20	The history, present, and future of the FWC Invasive Plant Management Section: Research and Outreach Program Sam Yuan
9:20-9:45	What's happening on my lake? Alex Dew
9:45-10:00	<i>BREAK (ST. PETERSBURG BALLROOM)</i>
Session 9: Communication is key (FDACS program # 27926) Moderator: Kelli Gladding (<i>GRAND BAY BALLROOM</i>)	
10:00-10:05	PRIZE DRAWING
10:05-10:30	Conveying concepts about invasive plants through an immersive experience Lara Colley and Jacqui Carson
10:30-10:55	Communication tools and strategies in the social media age Matt Phillips
10:55-11:20	Public communication strategies Lara Colley and Shelby Oesterreicher
11:20-11:45	Comparison of copper based herbicidal toxicity on exotic apple snails Savannah Berger

END OF CONFERENCE

VOTING SLATE FOR PRESIDENT-ELECT AND BOARD OF DIRECTORS

President-Elect: Jeremy Slade

Jeremy graduated from Mississippi State University (MSU) with a Master's of Science in Wildlife and Fisheries Science in 2005. From 2005 to 2008, he worked as a research associate in the Department of Wildlife and Fisheries at MSU, and research scientist contracted by the US Army Engineer Research and Development Center, US Army Corps of Engineers. In 2008, Jeremy accepted a position of senior biological scientist at the Center for Aquatic and Invasive Plants, University of Florida where he evaluated multi-scale herbicide applications for controlling hydrilla performed by the Florida Fish and Wildlife Conservation Commission until the end of 2010. In January 2011, Jeremy joined UPL NA Inc., previously United Phosphorus, Inc., as the Aquatics Accounts Manager for the southeast US covering the Gulf States. Responsibilities in this role included supporting and providing technical assistance of UPL's aquatic products portfolio to ensure proper use resulting in responsible and effective aquatic plant management programs. Most recently Jeremy was promoted to Business Lead of UPL's Aquatics group on April 1, 2019. Jeremy has been involved with several aquatic plant management industry affiliates including holding Board of Director's positions; National APMS (current Treasurer), Midsouth APMS (current Past President), Florida APMS (former Board of Director), AERF (current Gold Member), South Florida APMS and Texas APMS.

Board of Directors: Nancy Healy

Nancy Healy has been employed by Brewer International since 1994, when she began her career as Brewer's Administrative Assistant and Logistics Manager. In 1999, she was promoted to Territory Sales Manager for Florida, Georgia and Alabama. In 2012, Nancy became the Marketing Director for Brewer. Her career responsibility is focused on key account customer service and marketing for the company. Nancy has been a member of FAPMS for most of her career. She attends both regional and national conferences with current and potential customers in the Aquatic, Forestry and Agricultural Markets.

Board of Directors: Telly Smith

Telly has been an active member of FAPMS since he came into the industry in 2001 as a Licensed Applicator for Applied Aquatic Management. Telly conducts surveys of nuisance and exotic vegetation and provides detailed treatment plans and proposals for various City, County and private accounts. Telly has been assigned to numerous large-scale projects throughout his career including projects for the FDEP, USACE, FWC and mitigation maintenance projects throughout the state of Florida.

Board of Directors: Nathalie Visscher

Nathalie Visscher received her Master's degree in 1996 from University of Nice Sophia -Antipolis, France on Ecology and Physiology of aquatic and terrestrial ecosystems. Her first exposure to Invasive Plants was to assist with the discovery, documentation of the extent of *Caulerpa taxifolia* in the Mediterranean Sea and aspects of control. She worked with the Wekiva River Aquatic preserve as a research intern on expansion of Lyngbya within the preserve. She has been a Regional Biologist for Invasive Plant Management Section since July 2000 at that time became a member of FAPMS. She has been covering the Lake County region since 2005. Overseeing the aquatic plant management programs on the Harris Chain of Lakes, the Clermont Chain and the Wekiva River.

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Abstracts: Tuesday, October 15, 2019



Keynote: The times they are a'changing – really?

Carlton Layne (Aquatic Ecosystem Restoration Foundation; clayne@aquatics.org)

The aquatic plant management industry is not immune to seeing history repeat itself. Have we learned from history or are we doomed to repeat the mistakes of the past?



Empirical analyses of water quality, long-term fish and aquatic plant population data in relation to aquatic plant management actions

Mark Hoyer (University of Florida; mvhoyer@ufl.edu)

Multiple long-term data sets available in Florida that can be used to examine relations among aquatic plant and fish population metrics, water quality, and aquatic plant management activities. The Invasive Plant Management section (IPM) of Florida Fish and Wildlife Conservation Commission (FWC) conducts an annual plant survey, which has been continued from other agencies since 1982. The database contains aquatic plants surveyed on 397 lakes from 53 Florida counties and includes information on over 200 species of aquatic plants. However, recent data contains only information on plants (e.g., hydrilla, water hyacinth, and water lettuce) of major management concern. Since 2010, IPM has maintained Plant Management and Accounting Retrieval System (PMARS) data, which records all aquatic plant herbicide management activities. Florida LAKEWATCH, a volunteer water quality monitoring program, was initiated in 1986 yielding over three decades of water quality data. The following parameters have been monitored monthly (> 1,000 lakes): total phosphorus, total nitrogen, chlorophyll and water clarity (color and specific conductance are also measured since 2010). In 1999, Florida LAKEWATCH in cooperation with FWC started a long-term fish monitoring program, that was standardized by FWC in 2006 yielding consistent fisheries data on approximately 30 public lakes for the last decade. These long-term fisheries data include spring time electrofishing data on largemouth bass (LMB), black crappie (BLCR) trawl data, and community sampling data including information on LMB, BLCR, exotic fishes, forage fishes, rough fishes, sunfishes, game fish. Electronic copies of these data set have been obtained and a common lake identifier has been created for each data base so they can be merged for analyses. This presentation will describe preliminary data merging and analyses.



Florida's aquatic plant management program

Rick Clark (Florida Fish & Wildlife Conservation Commission; Rick.Clark@myfwc.com)

Florida has had to adapt to many changing and challenging conditions in order to combat the invasive plant issues in the state. This presentation will highlight the new and innovative approaches Florida will be using to address new management issues. Discussions will include a database and accountability tracking system, advances and standardization of plant mapping and identification protocol, new formulations for herbicide management, as well as new stakeholder engagements. One highlighted stakeholder engagement is a new outreach effort called “What’s Happening on My Lake” geared towards educating, encouraging participation and gaining a better rapport with interested members of the public.



Perspectives on recent aquatic herbicide use patterns and future research directions

Mark Heilman (SePRO; markh@sepro.com)

The last two decades of aquatic plant management with herbicides in Florida have seen a diverse mix of maintaining solid operational methods and modifying/innovating strategies to improve control outcomes. Aquatic resource managers and researchers have had to adjust practices and/or develop alternate herbicide use patterns to address environmental factors ranging from extreme

weather (e.g., hurricanes), new invasive weed introductions, habitat modification from exotic animal introductions such as invasive apple snails, and shifts in weed susceptibility including some cases of documented herbicide resistance. Successful adaptive management and effective research has led to improved use patterns of older herbicides, registration and adoption of new herbicide actives, and improved documentation of herbicide efficacy and selectivity. In this presentation, highlights of recent historical modifications in aquatic herbicide use in Florida will be provided along with ideas for how the next two decades of research, development, and operations may unfold.

Can machine learning be used to automate aquatic plant identification from hydroacoustic data?



Rob Richardson, Andrew Howell, Ramon Leon, Scott Ferguson and Gregory Buckner (North Carolina State University; rob_richardson@ncsu.edu)

Resource managers commonly implement hydroacoustic technology within water body surveys for vegetation detection and quantification. Recent developments in data processing have allowed for rapid transformation of raw hydroacoustic data into heat maps for visualization of vegetation density. While this has greatly improved the ability of managers to track density of submersed vegetation, species identification must still be obtained by time consuming point intercept methods. Therefore, the objective of this project was to evaluate machine learning technologies for automated weed identification from hydroacoustic imaging. Geotagged hydroacoustic imagery of three aquatic plant varieties (hydrilla, cabomba, and coontail) was collected and used to create a software pipeline for subsurface aquatic weed classification and distribution mapping. Employing deep learning, the novel software achieved a classification accuracy of 99.06% after training.



Utilizing drone technology in aquatic plant management *applicator presentation*

Colin Lewis (Lee County Hyacinth Control District; Lewis@LCHCD.org)

Unmanned Aircraft Systems (UAS's), more commonly known as drones, have the potential to revolutionize the way in which aquatic plant applicators manage their waterbodies. As technology continues to improve, UAS's have become more versatile in their functions and can perform a wide array of tasks. Beginning this year, Lee County Hyacinth Control District (LCHCD) has begun integrating drones into their program to aid in plant surveillance, water quality assessment, and aerial herbicide applications. The use of drones in aquatic plant management can allow applicators to see farther, plan smarter, and manage more efficiently.



Aeration: A key tool in aquatic system restoration and management

Patrick Goodwin (Vertex Water Features; Patrick.goodwin@aquaticsystems.com)

This presentation will review the benefits of aeration as a tool in managing lakes and ponds. Aeration improves a lake's ability to adapt to and process nutrient inputs by enhancing the natural processes that facilitate nutrient uptake and storage, and sediment breakdown. Aeration therefore has the potential to increase water circulation, oxygen availability and oxidation reduction potentials, while reducing carbon dioxide, phosphorus, nitrogen ammonia, biological oxygen demand and hydrogen sulfide (odor). The mechanisms for which aeration can improve a lakes ecology will be explained and a brief consideration will also be given to the designing and sizing of lake aeration.

Calibrating hydrilla mechanical harvest operations performance on Lake Tohopekaliga



James Leary, Alex Dew, Ed Harris, Mike Durham, Candice Prince, Dean Jones and Ben Sperry
(University of Florida; learyj@ufl.edu)

Mechanical harvesters are a century-old technology able to cut, lift and remove both submersed and emergent aquatic vegetation. It is generally perceived to be environmentally neutral by the public and can benefit a lake system by removing biomass instead of allowing it to decompose in the water column. However, mechanical harvesting is also considered less efficient and cost-prohibitive when compared to chemical control alternatives. Here we seek new measurements in the capabilities of an operational harvest for better economics in aquatic plant management. A pilot project was established to monitor hydrilla (*Hydrilla verticillata*) harvest operations, from June-Aug 2019, on West Lake Tohopekaliga, in three severely infested plots on the north and south ends (total area: 173 ha), with six Kelpin 800 boat harvesters (Texas Aquatic Harvesting Inc.; Lake Wales, FL). Each harvester was fitted with a GPS tracking device (model: AT-V4 Pro; US Fleet Tracking; Edmond, OK) recording positions on 10 s intervals, offering high resolution spatio-temporal records of operation. Frequent hydroacoustic monitoring was performed with a 20° down scan beam transducer integrated with WAAS GPS (Lowrance Electronics; Tulsa, OK) logging depth measurements that were post-processed with BioBase® (Navico; Egersund, Norway) cloud-based software interpolating biovolume. Here, we will report on the initial calibrations of efficiency and efficacy of harvest operations including: (i) boat speed, (ii) navigational precision, (iii) harvest line accuracy and (iv) pre- and post-harvest change detection in biovolume. These early metrics will guide us towards a longer-term plan to optimize its functions as a cost-effective contributor in a comprehensive aquatic plant management program.



Diquat Q & A review

Scott Jackson (*Syngenta*; scott.jackson@syngenta.com)

This talk will cover the most frequently asked questions centered around the herbicide active ingredient, diquat. This talk will take a practically worded approach to answering important questions about diquat including, use, fate and exposure.



Management of cat's claw vine (*Dolichandra unguis-cati*) in Florida *student presentation*

Leah Aidif and Greg MacDonald (University of Florida; Laidif13@ufl.edu)

Dolichandra unguis-cati, or cat's claw vine, is regarded as a Category I exotic invasive by Florida's Exotic Plant Pest Council. Cat's claw vine populations have been documented throughout multiple counties in Florida. Cat's claw vine is an invasive threat to areas that include river or stream banks, near human habitations, and undisturbed hammocks. The current management recommendations for cat's claw vine suggest the use of glyphosate or triclopyr, either alone or coupled with mechanical cutting and removal. Studies on management focused on post-emergence chemical control have been initiated at the Chinsegut Manor Preserve in Hernando County. For the experiment glyphosate (3 lbs-ai), triclopyr ester (1.5 lbs-ai), triclopyr amine (2 lbs-ai), aminopyralid (0.11 lbs-ai), imazapyr (0.125 lbs-ai), imazapic (0.25 lbs-ai), metsulfuron (0.075 lbs-ai), aminocyclopyrachlor (0.18 lbs-ai), and 2,4-D (2 lbs-ai) were used. Treatments of the chosen herbicides were applied using a backpack sprayer with a minimum of 25 gallons per acre carrier volume and surfactants added as recommended. Plot size was 5 x 10 feet and each treatment was replicated 3 times. Visual evaluations of cats' claw vine efficacy and native species cover was utilized. Preliminary data is showing glyphosate, triclopyr (both formulations), aminopyralid and aminocyclopyrachlor provided good control. Both imazapyr and imazapic showed minimal control, but this could have been due to lower rates used. 2,4-D and metsulfuron-methyl were by far the least active with no control.



The benefits and effects of prescribed burning *applicator presentation*

Jacky Keller and TJ Wilkerson (Palm Beach County Parks & Recreation; jlkeller@pbcgov.org)

We surveyed a pine flatwoods by way of photo monitoring and survey points before and after a prescribed burn. We will discuss the process that goes into preparing an executing a burn, as well as our findings on the benefits and effects of fire on nuisance weeds. Lastly, we will discuss how we incorporate these into integrated pest management and how we moved forward with including fire into our best management practices.



***Mimosa pigra* – 35 years of containment**

Dan Thayer (Florida Fish & Wildlife Conservation Commission; Dan.thayer@myfwc.com)

Mimosa pigra is native to South America and was introduced into Florida in the 1950's as a botanical curiosity or as an unintentional hitchhiker. In the early 1980's, *Mimosa pigra* was discovered naturalized in the Loxahatchee River watershed in Palm Beach and Martin Counties, as well as several other locations around the state. Since its discovery in the wilds of Florida, on-going control operations have been implemented. This paper will update the status of this world renowned weed in Florida.



Invasions on the horizon? Combining risk analysis and consensus to collaboratively identify future invasive species threats to Florida

Deah Lieurance (University of Florida; dmlieurance@ufl.edu)

Nearly 85% of all non-native plants imported to the U.S. enter through one of 30 ports of entry in Florida, suggesting it is the single most important state in the U.S. for the regulation of invasive plants. As international trade continues to expand, so does the frequency of intentional and accidental introductions. Only a small subset of non-native species become invasive, but those species that escape, naturalize, and spread, can be economically and ecologically costly. Current approaches to predict, prioritize, and regulate invasive species in the U.S. happen post-introduction and focus on proven invaders with known significant impacts. There is an urgent need to identify unknown or emerging non-native species that will cause future problems so preventative measures can be swiftly implemented. Horizon scanning is the systematic examination of information to identify potential threats, risks, emerging issues, and opportunities to inform policy, regulations, and decision-making. Currently, the IFAS Assessment is organizing a Horizon Scan to identify potential invaders (all taxa) and the pathways for their arrival. A panel of experts will be assembled to select species for consideration and to couple risk assessment with consensus building to yield a list of tangible future invasion threats. The intent of this list is to inform policy and guide the allocation of resources to research and prevention efforts in Florida. We believe ongoing efforts to predict invaders before arriving will keep the invasive species community on the prevention side of the invasion curve. Subsequent horizon scans will involve adding or subtracting threats based on new information, changes in global trade of non-native species, identification of new pathways for introduction, and engagement of new experts and stakeholders who may benefit from the process. The long-term benefits of this preventative approach will reduce management costs and reduce ecological harm to Florida's vital natural habitats.



20 years of upland exotic plant management within Florida's conservation lands

Jackeline Smith (Florida Fish & Wildlife Conservation Commission; Jackie.smith@myfwc.com)

The Upland Plant Management Section has had its 20-year anniversary. This presentation will discuss the highlights of the past 20 years and our outlook for upland invasive plant management. Included in the discussion will be special projects that we have taken on, web-based upgrades we have made to help with in the field management of projects and research projects that we have pushed forward.



***Scaling up Brazilian peppertree (*Schinus terebinthifolia*) novel management techniques:
Lessons from South Florida***

Stephen Enloe and Mackenzie Bell (University of Florida; sfenloe@ufl.edu)

Brazilian peppertree is one of the top five most expensive weeds to manage in the state of Florida. Given the cost of management and the intensity of individual plant treatments (IPT), our overall goal was to improve IPT approaches for Brazilian peppertree control. To accomplish this, we conducted a series of field studies assessing novel herbicide treatments for IPT such as basal bark and reduced hack and squirt approaches. For the basal bark study, we found multiple low-rate alternatives that controlled peppertree similar to the commercial standard treatment. For the reduced hack and squirt study, we found both aminocyclopyrachlor and aminopyralid provided good control when making a single hack and applying 1mL of a 50% v/v herbicide solution per four-inch diameter stem. From these studies, we scaled up research efforts to replicated 0.5-acre plots and utilized contractor crews to test efficacy of IPT treatments including reduced hack and squirt and basal bark treatment with two formulations of triclopyr. We found that compared to the basal bark applications the reduced hack and squirt approach took a similar amount of time to apply, provided a similar amount of control, and significantly reduced the amount of herbicide applied. These results indicate that there are novel herbicide treatments and techniques that could improve control efforts on Brazilian peppertree. In addition, this unique multi-scale research approach has accelerated our understanding of a novel invasive plant treatment strategy and its implementation in the field.

Abstracts: Wednesday, October 16, 2019



UPL product update

Justin Nawrocki and Jeremy Slade (UPL; Justin.Nawrocki@upl-ltd.com)

UPL products, Aquathol and Hydrothol, are some of the oldest commercially available aquatic herbicides on the market. Despite this fact, these products continue to evolve with elimination all use restrictions (i.e., fishing, swimming, animal consumption), except for potable water; thereby, facilitating broader use patterns with updated label language. UPL is also committed to continually researching new use patterns and rate response profiles for all new invasive aquatic vegetation. UPL continues to strive to offer the best quality products and technical services to our customers while investing in bringing new and much needed products to market.



BioSafe: GreenClean - 2019 product update

Tom Warmuth (TWarmuth@biosafesystems.com)

A brief presentation on the BioSafe line of commercial algaecides and products for surface water management. Label updates, product use and application methods. Current and upcoming projects in the state of FL.



Dutch aquatic vegetation management techniques

Patty de Graaf and **Niels van Elst** (Alamo Group TX; N.Elst@conver.com)

The focus of this presentation will be educating attendees about aquatic vegetation management techniques utilizing various equipment that has been developed over the past 100 years.

Aquatic program process improvements *applicator presentation*



Jim Schultz, Vickie Demerski, Ryan Murphy, Charlie Burn, John Warden, Darryl Wilson, Mike Trammell, Oscar Garcia, Johnny Saldivar and Cornell Tripp (Lake Worth Drainage District; jschultz@lwdd.net)

This presentation will focus on new processes and improvements in chemical inventory, spray reports, and mapping.



New herbicide technologies for management of Old-World climbing fern on tree islands of the Everglades *student presentation*

Jonathan Glueckert and Stephen Enloe (University of Florida; jglueckert@ufl.edu)

Old World climbing fern (*Lygodium microphyllum*) is considered to be one of the most aggressive invasive plants in South and Central Florida. This highly invasive fern smothers native vegetation in mesic upland and forested wetland ecosystems in the Everglades, growing to the canopy of tree islands and dominating the understory community with thick rachis mats. Previous research has shown that newly available triclopyr formulations and florpypauxifen-benzyl provide control on OWCF, so an aggressive herbicide screening program was initiated in the Loxahatchee National Wildlife Refuge which has unique hydrology which limits access during the dry season and provides perfect conditions for OWCF growth and recruitment of spores. Currently, 40 individual tree islands have been treated by contractors by backpack application with triclopyr, florpypauxifen-benzyl, and glyphosate. Applications of triclopyr showed a reduction of OWCF cover to less than 5% at 180 days after treatment. At 365 days after treatment, a flush of sporelings were observed after water had receded from the tree islands in the dry season. However, the overall abundance of OWCF remained below 10%. Florpypauxifen-benzyl ground treatments at rates of 59 g/ha and 87 g/ha show good control of OWCF at 180 days post treatment and will continue to be monitored for regrowth. Moving forward, an additional 80 islands have been selected for monitoring to address retreatment interval and a mesocosm facility is being restored to observe the interaction between herbicide treatments and hydrological variation. These objectives will help to continue to shed light on difficult management complications.



Maintaining professionalism for our industry *applicator presentation*

Joe Malone (Applied Aquatic Management, Inc.; joe@appliedaquaticmgmt.com)

In this presentation I will discuss the increased scrutiny that our industry, our companies, our clients, and we as applicators have faced as of late and now, maybe more than ever, how important it is to be mindful of our actions and responsibilities as professional applicators. This profession we each have chosen comes with great responsibility. As licensed professional applicators we have responsibilities to this industry, the environment, this state, our employers, our customers, and ourselves to be the absolute most professional and knowledgeable applicators we can be.



Syngenta industry updates

Scott Jackson (Syngenta; scott.jackson@syngenta.com)

This presentation will focus on label updates and current use patterns for Syngenta products.



Reduction of pesticide applications in waterways using new Microsponge™ technology

Lucia Marshall (Biosorb; biosorbinc@gmail.com)

With climate change, more algae and invasive aquatic species are entering our water resources. These nuisance species are causing billion dollar economic loss annually to Florida. With natural-based Microsponge™ technology, applicators have another tool to reduce run-off. Using low

toxicity, biological products, and drones are the upcoming smart way to manage waterways. A review of the current chemistry and biological products available for aquatic management will be presented, as well as, the advantages of using the current drone technology.



Perspective – SePRO industry update

Rory Roten (SePRO; roryr@sepro.com)

Perspective is a consistent battle for everyone involved in the aquatics industry. Whether it is the perspective of the homeowner to the applicator, the applicator to industry representatives, or government to everyone, we are all influenced and pulled into many directions. It is the objective of this presentation to share these thoughts holistically and provide quantitative treatment data regarding economic thresholds versus length of control.



Lake & Wetland Management: Trends in living shoreline solutions

Brian Fischer (brian.fischer@lakeandwetland.com)

Several erosion control methods are available for lakes, canals, ponds, rivers, and beaches. But which methods restore the shoreline to a natural sustainable living state? Which lasts longer? Retains the integrity of the shoreline? Which is worth the money? This update reviews options in erosion control and considers project longevity, cost and Best Management Practices.



2019 State of Florida response to Lake Okeechobee cyanobacteria blooms

David Whiting (Florida Department of Environmental Protection;

David.d.whiting@floridadep.gov)

The Florida Department of Environmental Protection, in cooperation with the South Florida Water Management District, the Florida Department of Health, the Florida Fish and Wildlife Conservation Commission, and the Blue-Green Algae Task Force, provided algal bloom sampling, analysis, and public outreach in response to the 2019 cyanobacteria bloom season on Lake Okeechobee. Summary statistics of analytical results, as well as conditions and response unique to the 2019 bloom season, are compared and contrasted to previous bloom seasons.



Marine harmful algal blooms (HABs) in Florida: Not all HABs are alike – implications for management

Célia Villac (Fish and Wildlife Research Institute, Florida Fish and Wildlife Conservation Commission; celia.villac@myfwc.com)

A harmful algal bloom (HAB) is the proliferation of nuisance, at times toxic, microalgal species that may negatively affect wildlife, public health, and/or the economy. Out of 100,000 + known species of marine phytoplankton, about 500 may form harmful blooms and at least 200 of these have been shown to produce toxins. Florida's coastal and adjacent offshore waters are notable for highly diverse oceanographic conditions found on the Gulf of Mexico, the Florida Keys, and the Atlantic Ocean; interconnectivity between these systems is afforded, however, by the Gulf of Mexico Loop Current. Myriad niches are thus available and the phytoplankton, HAB species included, are likewise diverse. This represents a challenge for FWRI's HAB team and their collaborators throughout the state who conduct research, routine monitoring, and event-response to provide timely and accurate information to the stakeholders tasked with managing and mitigating the impacts of HABs in the region. For this presentation, highlights of our current activities on Florida's gulf coast will focus on three species: the dinoflagellates *Karenia brevis* (aka, red tide) and *Pyrodinium bahamense*, and the diatoms belonging to the genus *Pseudo-nitzschia*. Understanding their particular ecophysiological requirements and bloom dynamics are key to guiding monitoring and management activities that help provide information for the development and validation of

forecasting systems that, in turn, loop back into informing sampling strategies, creating a positive feedback structure.



Traffic safety briefing

Steve Gaskins (Florida Highway Patrol; stevegaskins@flhsmv.gov)

This presentation will focus on traffic safety and techniques to minimize risk while driving, including reducing distractions, obeying traffic rules, and being vigilant and aware of your surroundings.



Vector-borne disease

Billy Miller (Florida Fish & Wildlife Conservation Commission Safety; billy.miller@myfwc.com)

This presentation will focus on vector-borne diseases and will include a discussion on tick bites, the effects of tick bites, prevention of tick bites and Lyme disease.



Heat-related illness: Background, risk factors, and prevention

Ricky W. Telg, Rachel Claire Mitchell, Tracy A. Irani, Farah A. Arosemena, Thomas E. Bernard, Joseph G. Grzywacz, Linda A. McCauley, Valerie Mac, Eric Coris, Rebecca M. Lopez, Candi D. Ashley, Michael N. Sawka, Vasubandhu Misra, Beatrice Pierre, and J. Glenn Morris (Southeastern Coastal Center for Agricultural Health and Safety; rwtelg@ufl.edu)

Between 2000-2010, 28.6% of deaths due to HRI in occupational settings occurred in six states in the Southeast. Heat-related illness (HRI) is a major issue affecting outdoor workers. Climate models predict that the number of days per year that achieve temperatures above 95 degrees will increase in the Southeast from 15 days per year from 1971-2000, to over 75 days per year in 2041-2070. HRI is predicted to result in annual productivity losses equivalent to \$47 billion. HRI especially affects outdoor workers, including agricultural workers, athletes, and military personnel. The responsibility for preventing HRI lies both with organizations who employ workers, as well as with workers themselves. On the organizational level, employers can provide appropriate acclimatization periods, work to rest ratio, access to fluid and rehydration, and recognize, treat and manage HRI. On the individual level, factors like chronic diseases and the medications used to treat them have been found to increase the risk for HRI. Conditions like physical fitness and obesity level can also be factors for a worker's susceptibility for being affected by HRI. Finally, individual behaviors can lead to HRI, like lack of hydration, sleep deprivation, and drug and alcohol use. This presentation will describe HRI risk factors and HRI prevention, based on recent research presentations from the Southeastern Coastal Center for Agricultural Health and Safety's State of the Science conference.



Field trials of hydrilla management with florypyrauxifen-benzyl

Jason Ferrell, D. Jones, M. Heilman, K. Gladding, and J. Leary (University of Florida; jferrell@ufl.edu)

Selective management of dioecious hydrilla is an ongoing struggle for many lakes in the southern US. Therefore, learning how to use florypyrauxifen-benzyl at the field level is important to the future of hydrilla management. Fish Lake is a 230-acre lake (5 ft avg) in Osceola County, Florida. Prior to treatment, hydrilla persisted in a near continuous ring with 46% of the lake infested. Florypyrauxifen-benzyl, in the form of ProcettaCOR SC, was applied at the maximum use rate of 48.3 $\mu\text{g ai L}^{-1}$ (5 PDU per acre-foot) on August 14, 2018. The treatment area was a 50-acre U-shaped block on the south end of the lake. Aquatic vegetation response was monitored using hydroacoustics and point-intercept verification. Submersed vegetation in the treatment block declined from a biovolume of 65% with hydrilla dominance at time of application to 15% after 5 months, representing a 77% reduction. The dominant plant at 5 months was *vallisneria*, which increased from 24 to 43% frequency. A significant amount of hydrilla outside the treatment plot

was also affected with hydrilla in the southern two-thirds of the lake declining from 54 to 21% frequency. The floating leaf plants American lotus and fragrant waterlily were negatively impacted within the management area and some untreated areas where hydrilla injury was observed. Spatterdock too was impacted after the application and auxin symptoms were obvious. However, within 5 months of treatment, all new leaves had emerged without symptoms and no rhizomes floated. Dissolved oxygen showed minimal decline following treatment. Herbicide concentrations were measured the day of application and 1, 2, 3, and 7 days after. By day 7, florypyrauxifen-benzyl concentrations were below 1 ppb. In summary, while some floating-leaved species were sensitive and showed injury based on rate and placement of treatment, results indicate that florypyrauxifen-benzyl can be an effective tool for hydrilla management.



Understanding risks and benefits of copper-based algaecides

West M. Bishop (SePRO; westb@sepro.com)

Standard toxicity testing data with copper suggest that typical copper algaecide application concentrations can cause deleterious acute impacts to non-target organisms. These standard studies do not contain measurable amounts of algae or other particulate organic matter and are designed to show a maximum potential for risk, but they are not representative of field scenarios. Copper formulations differ in their impact on non-target organisms as well as affinity and efficacy of toward the target algal species/strain. Few studies have assessed the impact of specific binding of copper to target ligands, and the subsequent alteration of risks to non-targets species. Copper algaecides are often applied directly to an algal bloom and the copper concentration is greatly decreased rapidly in the water column. This needs to be accounted for in order to support realistic risk management decisions in the field. Additionally, the risks of copper algaecides will be placed in context of risks associated with noxious algae and the need for effective management. Information presented herein will assist regulatory personnel and stakeholders to make informed decisions based on accurate risk regarding copper algaecide exposures in field applications and importance of this management tool.



Field evaluations of herbicide efficacy on invasive *Scleria* species *student presentation*

Alex Onisko and Gregory MacDonald (University of Florida and South Florida Water Management District; aonisko@sfwmd.gov)

The genus *Scleria* is one of 17 genera in the Cyperaceae family in Florida. *Scleria* is comprised of 13 species, 4 of which are non-native to Florida. P.J. Bergius (1765). This research focuses on the biology and management of two of the non-native, invasive species of *Scleria*; *Scleria lacustris* and *Scleria microcarpa*. The results from initial herbicide trials on *Scleria microcarpa* and *Scleria lacustris* provide insights into the most effective and selective herbicides that may be used to control each species. Initial trials included ten treatments and a control applied to four replicate 10X20 ft. plots using a backpack sprayer at 20 gallons per acre. A nonionic surfactant was included at 0.25% v/v in all treatments. These initial herbicide trials tested 2,4-D, glyphosate, diquat, penoxsulam, halosulfuron, imazapyr, imazamox, metsulfuron methyl, and florypyrauxifen-benzyl. Efficacy and selectivity were evaluated using visual percent plant cover of *Scleria* spp. and native species within each treatment plot. Plots were evaluated at baseline levels then at 45 days after treatment, 3, 6, and 9 months after treatment and 1 year after treatment. Initial trials suggest *S. lacustris* can be controlled with diquat, glyphosate, imazamox, imazapic, imazapyr, halosulfuron, and penoxsulam. *S. microcarpa* can be controlled with glyphosate, diquat, imazapic, imazapyr, and imazamox. Additional herbicide trials are being implemented to continue to investigate the efficacy and selectivity of the most promising treatments applied at different rates. Preliminary data will be shared with attendees during this presentation. Ongoing research of both species is imperative to develop the best management practices that consider the size of the infestations, stage of growth of the plants, and the natural habitats where the infestations occur.



Using herbicides and grass carp to manage *Hydrilla verticillata* at Hardee Lakes Park

Michael Sowinski, Michael Netherland and Dean Jones (Florida Fish and Wildlife Conservation Commission; Michael.sowinski@myfwc.com)

In 2011, the herbicide bispyribac (trade name Tradewind) was approved for use in aquatics by the U.S. Environmental Protection Agency and Florida Department of Agriculture and Consumer Services. Bispyribac is a slow acting herbicide that inhibits an enzyme responsible for production of certain amino acids. Susceptible plants stop growing immediately; however, it can often take months to achieve control of mature hydrilla. In 2013 we compared the effects of bispyribac alone to the combination of bispyribac and diquat on hydrilla (*Hydrilla verticillata*) and eelgrass (*Vallisneria spiralis*) in Hardee Lakes Park. As pressure increases to rotate herbicide modes of action, the ability to integrate diquat with bispyribac may allow managers to achieve a fast knockdown in high priority zones via the diquat component while achieving lakewide hydrilla control with the slower acting bispyribac component. Since the initial 2013 treatment, hydrilla management has continued using grass carp and a 2018 fluridone treatment.



West Indian marsh grass response to herbicide treatment in saturated and flooded conditions *student presentation*

Kaitlyn Quincy and Stephen Enloe (University of Florida; kquincy@ufl.edu)

West Indian marsh grass (*Hymenachne amplexicaulis* [Rudge (Nees)], or WIMG, is invasive in Florida wetlands that experience frequent flooding. Research suggests water level influences herbicide efficacy on other invasive grasses in Florida wetlands. A mesocosm study was conducted to determine the effect of water depth on control of WIMG with foliar-applied herbicides. WIMG was grown in mesocosms at two water depths: 0 cm (saturated) or 60 cm (flooded). Individuals were treated with the industry standard, glyphosate, or spot treatment or broadcast treatment rates of the grass-specific herbicides flazifop-P-butyl and sethoxydim. Plant response to herbicide treatment was measured using total leaf area and biomass harvests at 30 and 60 days after treatment (DAT). At the time of treatment, plants grown in saturated and flooded conditions had similar biomass. At 30 DAT, plants grown under saturated conditions experienced a higher percent reduction in total leaf area. At 30 DAT and 60 DAT, herbicide treatment was significant for both total leaf area and biomass. The broadcast rate of sethoxydim provided the lowest control, and glyphosate, both rates of flazifop-P-butyl, and the spot treatment rate of sethoxydim performed similarly. At 60 DAT, depth was not significant for percent reduction in total leaf area or total biomass. These results indicate control of WIMG using foliar-applied herbicides is not sensitive to water depth. Further research is needed to determine factors that influence herbicide efficacy on WIMG.

Abstracts: Thursday, October 18, 2018



What a long strange trip it's been: 35+ years of the Florida Exotic Pest Plant Council—an update

Deah Lieurance (University of Florida; dmlieurance@ufl.edu)

Researchers and land managers have been dealing with invasive species in Florida for many years. As a direct result of this long history, the state is also rich in organizations providing resources specific to invasive species (e.g. funding opportunities, management plans, EDRR target lists). The Florida Exotic Pest Plant Council (FLEPPC) is a non-profit, 501-C3 organization officially established in 1984 in response to a need to focus on managing invasive species. Our mission is to support the management of invasive plants in Florida's natural areas by providing a forum for the exchange of

scientific, educational, and technical information. I will provide a brief update about the activities, board members, and our upcoming 2020 meeting in Daytona Beach Shores, FL.



The University of Florida's new online Weed Science Certificate Program

Candice Prince (University of Florida; cprince14@ufl.edu)

The importance of environmentally responsible management of noxious and invasive plants has become increasingly significant over the past 10-20 years, in both agriculture and natural areas. The University of Florida is developing a new Weed Science graduate certificate program to provide individuals with further training on how weed management techniques and environmental science can be integrated into an overall management plan. This certificate program will be offered completely online, providing working professionals the opportunity to further their education on weedy and invasive plant management. This talk will go over what the certificate program entails, including requirements for admission and coursework.



APMS: National Society Update and Request for Feedback

Mark Heilman (Aquatic Plant Management Society; markh@sepro.com)

The national Aquatic Plant Management Society originated in Florida and now entering its 60th year. Over the decades, APMS has evolved to address the technical needs of its membership and the wider discipline of aquatic weed control. Its original focus on water hyacinth management has evolved to address all aquatic invasive and nuisance vegetation in the US and globally. APMS's mission to promote environmental stewardship through scientific innovation and development of technology related to integrated management now has expanded to address harmful and nuisance algae, an evolving environmental problem becoming worse in US aquatic ecosystems each year. APMS has partnered successfully with its current seven regional chapters including FAPMS but looks for regional chapter feedback on how to enhance interactions for mutual society success. This presentation will provide a short update on APMS activities but more importantly provide perspectives to encourage increased dialogue with FAPMS on future collaboration.



A professional society for growing companies in aquatics

Troy Goldsby (Aqua Services Inc.; troyg@aquaservicesinc.com)

The Society of Lake Management Professional was established to nurture and accredit small businesses in the lake Management field. All fields, fisheries, aquatic plant control, stormwater, etc. are included in this society. SLMP focuses on accrediting companies that are striving to shine a positive light on the industry and encourages companies that are struggling, to work towards the accredited level. Along with all pertinent science, the society focuses on small business management and the best way to make an impression in local, regional, and nationwide markets.



The history, present, and future of the FWC Invasive Plant Management Section: Research and Outreach Program

W. Samantha Yuan (Florida Fish & Wildlife Conservation Commission; Samantha.Yuan@fwc.com)

In the last 48 years, the 'State of Florida' Invasive Plant Management has supported over \$34M in contracted research and outreach projects. Research on the biology and management of invasive species (primarily aquatic nuisance species) was traditionally conducted by staff with the Florida Department of Natural Resources (FDNR). As the Invasive Plant Management Program developed, it shifted funds towards plant control operations and focused less on research. In 1970, the Invasive Plant Management Program established a Research Program and we started contracting research projects. Since that time, Invasive Plant Management has transitioned to the Florida Environment

Protection (FDEP) in 1993, and then to the Florida Fish and Wildlife Conservation Commission (FFWCC) in 2008. Currently for fiscal year 19/20, the program budget is \$1.8 M and supports 31 applied projects on mechanical harvesting, herbicide, biocontrol, education, prevention, and ecological monitoring. For more information, check out our new redesigned FWC website for Invasive Plant Management Section myfwc.com/invasiveplants.



What's happening on my lake?

Alex Dew (Florida Fish & Wildlife Conservation Commission; Alex.Dew@myfwc.com)

The *What's Happening on my Lake* map is a one-stop-shop set of maps for a variety of data where users can see what is currently happening on their waterbodies, as well as view historical plant and fisheries data. Several additions and improvements have been made this year and new data is available. The user can now find fishing forecasts, virtual waterbody tours, plant management workplans and schedules of operation, aquatic plant survey data, Long Term Management plant and fisheries data, electrofishing bass data, submersed plant biovolume data, and more! This talk will be a demonstration to outline what is new with *What's Happening on my Lake* and show where the data can be accessed.



Conveying concepts about invasive plants through an immersive experience

Lara Colley and Jacqui Carson (University of Florida; laracolley@ufl.edu)

Florida has 1,400 non-native plant species growing outside of cultivation and of those, 165 are considered invasive. The introduction of some invasive species is largely preventable, especially those which are introduced by way of escaped ornamentals and improper aquarium or aquatic pond disposal. Education can play an important role in the prevention of introductions such as these, as well as promote awareness of invasive species in general. Building support for the management of invasive species begins by educating the public about their impacts. To engage the public about the issues related to invasive species, UF/IFAS Center for Aquatic and Invasive Plants' Education Initiative, hosts an annual Plant Camp, a 5-day invasive plant "boot camp". The primary goals of the camp are to provide educators with tools, confidence, ideas, resources and knowledge to teach their students about invasive plants.



Communication tools and strategies in the social media age

Matt Phillips (Florida Fish & Wildlife Conservation Commission; mattv.phillips@myfwc.com)

Discussion will focus on communications and messaging of agency goals and objectives in the social media age. Specifically, how agencies are trying to message their programs with the "noise" of a very passionate and vocal stakeholder base that is misinformed by self-proclaimed resource specialists that are expressing the Dunning-Kruger effect. Special attention will be given to the tools that can be used to counter some of this misguided passion and focus on the issues of the resource at hand. We will explore several case studies to provide context.



Public communication strategies

Lara Colley and Shelby Oesterreicher (University of Florida; soesterreicher@ufl.edu)

Recently the controversy surrounding aquatic plant management has been heightened in the media and through public meetings. Some applicators struggle to convey how and why they are managing plants to the general public in an effective and noncontroversial way. This presentation will help attendees to convey their message to stakeholders in a cool and confident manner. Participants will develop elevator speeches, learn diffusion tactics and when to engage and when not to. The goal is to equip participants with a few tools needed to effectively communicate with other stakeholders.

Savannah Berger, Colin Lewis and Ernesto Lasso de la Vega (Lee County Hyacinth Control District; lassodelavega@lchcd.org)

Exotic invasive apple snails, *Pomacea maculata*, have been invading Cape Coral canals in South West Florida for the last two decades. Some herbicides, which have copper ions as active ingredient, have shown to be toxic to these snails. An experiment was designed to determine the exact concentration at which different copper based chemicals (Cutrine, Komeen, Natrix and Copper Sulfate) treatments in water becomes lethal to *Pomacea maculata*, using them as an environmental indicator.



Notes

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