

Quarterly Progress Report: Fourth Quarter FY 2011

Grant ID: X7-96433105 (Hydrilla/ Hygrophila Demonstration Projects - Osceola County, FL)

Project description and Goals:

This project is a combination of studies that will result in improved water quality and natural habitat in Osceola County lakes. Hydrilla and Hygrophila are exotic invasive weeds that are dominating the lakes aquatic ecosystem, shading out natural vegetation, reducing oxygen level, increasing the amount of sediments, and impacting flood control in lakes and canals. The project objectives are to evaluate the effectiveness of Experimental Use Permit herbicides, biological controls and application methods of herbicides in the treatment and control of Hydrilla and Hygrophila using small-scale fieldwork, large-scale field demonstrations and public outreach on the progress and findings.

Participants: Hilda Hatzell, EPA Project Officer, Region 4
Eleanor Foerste, Project Manager, Osceola County

Reporting period: 4th Quarter, EPA Fiscal Year 2011 July 1 – September 30, 2011

Project activities during reporting period:

□ **What work was accomplished for this reporting quarter?**

The EPA Project Manager approved a workplan modification and budget adjustment (July 14, 2011) to reallocate existing grant funds. Work was approved for two additional activities. One is a continuation of Element 3 Task 2, Foreign Exploration for Natural Enemies of Hygrophila, and includes efforts to import a rust fungus that has potential as biocontrol pathogen against hygrophila and to investigate its life cycle and potentially conduct host range studies. In addition, existing funds were allocated to Element 2: Evaluation of Currently Registered Herbicides for Control of Hydrilla for water quality sampling to identify how chemical hydrilla management is influencing nutrient cycling and hydrilla growth in Lake Tohopekaliga in the Kissimmee Chain of Lakes (KCOL). The Quality Assurance Project Plan (QAPP) for Element 5, Deep Water Mechanical Harvesting of Hydrilla as well as water quality monitoring related to Element 2 was approved on August 22, 2011. Osceola County staff have been trained in water quality sampling procedures and software applications for reporting to the South Florida Water Management District.

Element 1

- A draft manuscript outlining the effect of irrigation water containing topramezone, a newly registered herbicide, on turfgrass is being developed.

Element 2

- Dr. Netherland and Dean Jones are cooperating with private industry to refine methods and develop standard operating procedures (SOP's) for data collection, data analysis, and standardized reporting using hydroacoustics to evaluate the status of SAV (submersed aquatic vegetation) in large lakes. The transfer of this technology to managers, biologists, and other stakeholders will significantly enhance their ability to

collect quality data and produce timely reports that can be used to facilitate discussions on aquatic plant management.

- Results from the hydrilla sampling suggest that while large-scale fluridone has not been applied to the Kissimmee Chain of Lakes for over 7 years, the fluridone resistant strains of hydrilla continue to dominate the hydrilla populations found in all four lakes where samples were evaluated.

Element 3 Task 1

- Dr. Mark Heilman, SePRO, provided the project manager with a final narrative and budget report on Element 3, Task 1 during 2011 Quarter 2. Work was discontinued on this element due to unsuccessful commercial scale trial production of Mt fungus.

Element 3 Task 2

- Abhishek Mukherjee defended his dissertation successfully and was awarded the PhD degree. Mukherjee was a graduate student of Dr. Jim Cuda and his dissertation is entitled “Prospects for classical biological control of the aquatic invasive weed *Hygrophila polysperma* (Acanthaceae)”.

Element 3 Task 3

- Work on this Element is complete as of September 2010 and a final report will be on time.
- Dr. Overholt was involved in submitting three (3) publications. Two are in press and one has been submitted.

Element 4

- The element coordinators gave a total of four (4) oral presentations and two (2) poster presentations at professional meetings, nine (9) presentations to the local community, and two (2) presentations at various other meetings/trainings. Two (2) scientific publications were published, one (1) has been submitted and is in review and three (3) are in press. Seven (7) other publications have been published.
- An 8-page full-color educational pamphlet entitled “Florida Under Siege: Invasive Species Threaten Florida’s Ecosystems” was published and included as an insert in the Orlando Sentinel and El Sentinel (a Spanish version).
- An interactive website for the project continues to be served by CAIP with signs of increased traffic. The total number of visits to the Osceola Demonstration Website significantly increased from 433 in Quarter 3 to 1,641 in Quarter 4 and the average time spent on the site also increased slightly. Additionally, there was a 25% increase in first-time visitors to the site.
- The Invasive Plant Student Video Challenge is inspiring other educators to coordinate their own video projects with students – thus furthering our goal of using new outreach strategies to raise awareness about invasive aquatic plants.
- Three awards were received by state and national associations for the Invasive Student Video Challenge and a multi-media presentation related to the project.

Element 5

- The Quality Assurance Project Plan for Element 5, Deep water harvesting of hydrilla has been approved. The Osceola County procurement agreement with Texas Aquatic Harvesting has been executed. Osceola County is finalizing the permit application for submittal to the Florida Department of Environmental Protection and U.S. Army Corps of Engineers for the deep water harvesting process. The harvesting operation is scheduled to commence next quarter immediately upon permit approval.

□ **Significant Findings this Quarter?**

Element 1:

We did have a student intern working on the effects of topramezone, an EUP herbicide, on turfgrasses. Results indicate that St. Augustinegrass is very susceptible to topramezone in irrigation water, with an EC-10 (the concentration of herbicide that reduces biomass of St. Augustinegrass by 10% compared to untreated plants) of only 3.5 ppb over 8 irrigations during a 4 week period. This clearly indicates there will be irrigation restrictions on water use if finally labeled for aquatic use.

Element 2:

The sampling efforts indicate that while a large-scale treatment with fluridone has not been applied to the KCOL in over 7 years, the hydrilla spread throughout this 70,000 acre system is still largely tolerant to this herbicide. This finding suggests there is not a strong fitness penalty for fluridone resistance in hydrilla. Research in combination with private industry on the use of commercial fathometers continues to progress and the ability to rapidly process this data will be very useful to managers who desire rapid analysis of survey information in order to present real-time transect data or up to date basic vegetation maps for public meetings or treatment plans.

Element 3, Task 2:

- Four potential biological control agents -two caterpillars (one terrestrial and one aquatic) that defoliate the plants, a leaf mining beetle, and a very damaging rust fungus- were collected during native range surveys.
- The genetic analysis study demonstrated that the introduction of hygrophila in the USA is the result of a single introduction event.
- In Florida, hygrophila experiences very little herbivore damage and no host specific insects were collected.

Element 4:

- As a result of our efforts on the Invasive Plant Student Video Challenge, we have discovered that by providing supporting materials and additional training, teachers can be inspired to initiate their own video outreach project with students.

□ **Is the project work on schedule? Yes.**

- **This quarter? Yes.**

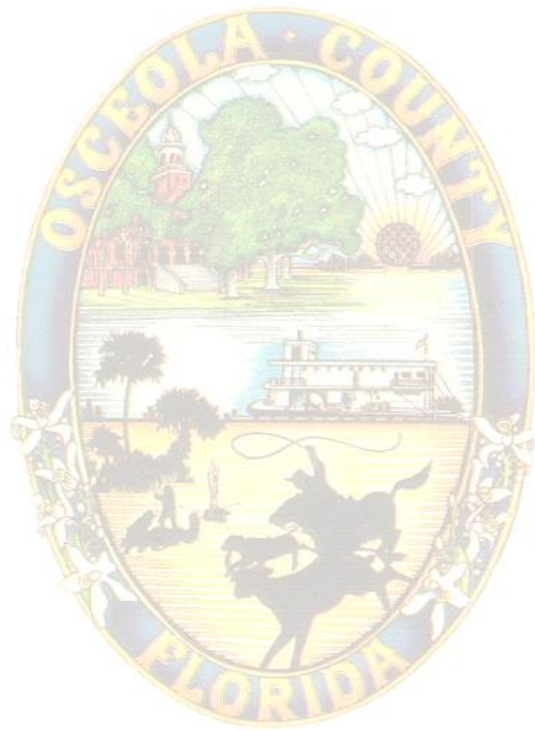
- **For the project? Yes.**

□ **Does the new schedule require a time extension? No.**

□ **Is there a change in the Grantee's Authorized Representative or any of the key contacts? No.**

Project spending for reporting period:

\$52,224.07 was expended this quarter, with total project costs as of 9/30/2011 totaling \$2,624,088.26. Project balance is \$2,881,000.00 - \$2,648,269.67 = **\$256,911.74.**



**EPA Demonstration Project on Hydrilla and Hygrophila
in the Upper Kissimmee Chain of Lakes
EPA Grant #X796433105**

Reporting period: 4th Quarter, EPA Fiscal Year 2011 June 30 – September 30, 2011

Person Reporting: Dr. William T. Haller and Lyn Gettys, University of Florida

Element: Element 1: Development and Testing of New Aquatic Herbicide

Project activities during reporting period:

□ What work was accomplished for this reporting quarter?

Active research has concluded and we are working on the final report with a target date of March 2012. We certainly appreciate the opportunity to turn in our reports in the form of manuscripts that can then be submitted for possible publication. We will have several.

Most pond work has been completed and final evaluations are being made on treatments conducted last summer/fall (2010).

□ What Milestones have been met for your Element?

All milestones have been met and data analysis is underway, boiling the information down and developing tables for the final report.

□ Were there any significant problems encountered? No.

□ Is the project work on schedule?

Yes. The final deliverables should be ahead of schedule, with our final report targeted for March 2012.

□ Are there any significant findings this quarter?

We did have a student intern working on the effects of topramezone, an EUP herbicide, on turfgrasses. Results indicate that St. Augustinegrass is very susceptible to topramezone in irrigation water, with an EC-10 (the concentration of herbicide that reduces biomass of St. Augustinegrass by 10% compared to untreated plants) of only 3.5 ppb over 8 irrigations during a 4 week period. This clearly indicates there will be irrigation restrictions on water use if finally labeled for aquatic use.

□ What is the future direction of the work?

Manuscripts and final reports will be written. Several ponds are being considered for one additional treatment. These ponds are being monitored to determine optimal timing of treatment.

□ Is there a change in the key contacts for this element? No.

EPA Demonstration Project on Hydrilla and Hygrophila
in the Upper Kissimmee Chain of Lakes
EPA Grant #X796433105

Reporting period: 4th Quarter, EPA Fiscal Year 2011 June 30 – September 30, 2011

Person Reporting: Dr. Michael D. Netherland, US Army Engineer Research and Development Center

Element: Element 2: Evaluation of Currently Registered Herbicides for Control of Hydrilla

□ **What work was accomplished for this reporting quarter?**

- Due to extensive hydrilla coverage on the Goblet's Cove area of Lake Tohopekaliga, an endothall application of ~140 acres was initiated in August 2011 to create a navigation channel. Endothall was applied utilizing LittLine® technology. A boat mounted pump and metering equipment applies the herbicide through long trailing hoses allowing the product to be directed to the lower part of the water column. Water samples and water quality parameters were collected at numerous sites both within and outside of the treatment zone and vertically through the water column in the treated area. A series of fathometer transects was collected throughout the cove to determine pre-treatment and post-treatment hydrilla coverage. Monitoring will continue through the fall of 2011 to document efficacy and longevity of this treatment.
- Dean Jones, Eleanor Foerste, and Stacia Hetrick attended a South Florida Water Management District (SFWMD) Water Quality Sampling training session in West Palm Beach, Florida. SFWMD personnel provided a two day hands on training for collecting water quality samples for analysis of phosphorus, nitrogen and chlorophyll A. These parameters are being monitored on the Kissimmee Chain of Lakes (KCOL) in conjunction with Element 2 and Element 5, Deep Water Harvesting. Baseline samples for Lake Tohopekaliga were collected in August and additional samples were collected in August and September in conjunction with an endothall treatment in Goblet's Cove (described above). Continued sampling is planned through the fall, winter, and spring to evaluate the impact of different densities of hydrilla on water column nutrients and chlorophyll levels.
- Hydrilla and submersed native plant biomass were sampled from established grids in September 2011 on Lakes Tohopekaliga, Cypress, Hatchineha, and Kissimmee. These grids were established in September 2008 and March 2010 (Cypress) prior to the initial large-scale treatments of December 2008 (Tohopekaliga), January 2009 (Kissimmee and Hatchineha), and June 2010 (Cypress). Biomass samples have been collected approximately every four months (spring, summer, and fall) during this project. This long-term sampling efforts allows us to compare the response of hydrilla and native vegetation to different intensities of management.
- Due to various restrictions placed on recent treatments in the KCOL and after discussions with the EPA project manager, we have taken the opportunity to sample behind large-scale hydrilla treatments in public water bodies from neighboring counties. Monitoring new use patterns of newly registered herbicides or combinations of herbicides in large

public water bodies of nearby counties fits under the mission of Element 2 of this demonstration project. Plant survey, biomass sampling, herbicide residue monitoring and fathometer transect data was collected on a number of additional waters in central Florida receiving demonstration or large-scale hydrilla treatments. Those lakes include Istokpoga in Highlands County, John's Lake in Lake County, the Butler Chain of Lakes (Down, Butler, Louise, Isleworth, Tibet, Blanche, Sheen, Pocket and Chase) in Orange County, Lake Harris and Eustis in Lake County, and Lake Thomas in Polk County.

- Fathometer transects that were established prior to the large-scale herbicide applications in December 2008 and January 2009 were run in September for Lakes Tohopekaliga, Cypress and Hatchineha in the Upper KCOL. These assessments allow us to determine the long-term trends of hydrilla recovery.
- Hydrilla was collected and assayed for Element 2, Task 4: The Temporal and Spatial Sampling on the Kissimmee Chain of Lakes to Evaluate the Susceptibility of Hydrilla to Three Registered Herbicide Modes of Action (fluridone, penoxsulam, and endothall). Plants were collected throughout the 70,000 acre chain of lakes in September representing a summer data set. To date, results indicate that a large percentage of the hydrilla on the KCOL remains tolerant to fluridone. The level of tolerance can range from a slight increase to very high levels of tolerance depending on the sample site. In contrast, the response to both penoxsulam and endothall has shown the plants to be consistently susceptible to both herbicides across all sample sites and times.
- Dean Jones presented "Benefits and Limitations Using Fathometers to Monitor Herbicide Treatments for Submersed Plant Control" at the Aquatic Plant Management Society (APMS) annual meeting in Baltimore, Maryland on July 27, 2011. Aquatic plant managers and researchers from around the country received an update of new technologies and methodologies developed as part of this grant for monitoring submersed aquatic vegetation populations in conjunction with aquatic plant control operations.
- Dr. Netherland and Dean Jones have been working with private industry cooperators to develop methods and standard reporting formats for processing hydroacoustic transect data that has been collected throughout this project. The ability to rapidly process this acoustic data and produce an immediate report on the status of the vegetation, such as hydrilla, will be of value to numerous aquatic managers and other stakeholders. This technology is developing rapidly and future work will focus on providing managers with Standard Operating Procedures (SOP's) for data collection and analysis using methods developed under this project.
- Dr. Netherland and Dean Jones conducted a field training course on September 28, 2011 for FWC Regional Biologists on utilizing Lowrance HDS technology to collect transect and mapping data. The purpose of this training was to teach the new technologies and methodologies for monitoring submersed aquatic vegetation (SAV) communities such as hydrilla. SAV communities can change rapidly and significantly in conjunction with aquatic plant control operations and natural environmental changes. These monitoring techniques allow for relatively quick data collection and analysis. We also participated in a conference call with Dr. Nancy Rybicki from the US Geological Survey the same day and discussed incorporating our monitoring methods on her work determining the status of SAV on the Chesapeake Bay.
- Dr. Netherland presented a talk and chaired a session on "Hydrilla and the Potential For Ecosystem Services" at the APMS meeting in Baltimore, Maryland on July 26, 2011.

This session included several invited speakers and it represented an effort to improve dialogue between researchers and stakeholders who hold differing views on the negative and positive impacts that hydrilla can have on various water bodies throughout the United States.

- Dr. Netherland presented a talk and chaired a session on “Herbicide Resistance in Aquatic Plant Management” at the APMS meeting in Baltimore, Maryland on July 26, 2011. This session included three invited speakers and the focus was to learn from past experiences with herbicide resistance and focus on how to detect resistant populations and develop management plans to avoid resistance.
- Dr. Netherland and Dean Jones assisted with out of state aquatic plant management data collection and training of state biologists from Minnesota Department of Natural Resources in August. Techniques utilized extensively in the Osceola County Hydrilla and Hygrophila Demonstration Project including point intercept survey, biomass sampling and acoustic surveys using a recordable fathometer were demonstrated prior to a major operational Eurasian water milfoil treatment on Lake Minnetonka in Minnesota. One of the main goals and most important benefits of the project are to disseminate results and techniques generated throughout the demonstrations to interested parties including local, state and federal government agencies. A summary of the results to date were presented at the Lake Minnetonka Conservation District quarterly BOD (Board of Directors) meeting.
- With hydrilla treatments being significantly scaled back in some areas, this offered the opportunity to better compare the dynamics of hydrilla growth and spread in managed versus unmanaged areas of the KCOL. A point intercept survey focusing on the status and condition of hydrilla on Lake Tohopekaliga was repeated in August (the first survey was initiated in May 2011). With a lakewide survey consisting of 900 points, the goal is to document changes in hydrilla distribution and density on a large scale through time. An additional sampling effort is planned in November 2011.
- Dr. Netherland participated in a September conference call with hydraulic engineers from the South Florida Water Management District and the US Army Corps of Engineers Jacksonville District to discuss the relation between extensive hydrilla growth and the potential for increased risks of flood control. The focus of the talks was Water Control Structure S-61 on Lake Tohopekaliga and Water Control Structure S-65 on Lake Kissimmee. The engineers have started projects to develop numeric models to simulate impacts of different levels of hydrilla coverage on the conveyance capacity of these structures. This cooperative effort will continue into the fall.

What Milestones have been met for your Element?

The majority of our work includes ongoing monitoring efforts, but we are on schedule in terms of meeting milestones in the workplan.

Were there any significant problems encountered? No.

Is the project work on schedule? Yes.

Are there any significant findings this quarter?

The sampling efforts indicate that while a large-scale treatment with fluridone has not been applied to the KCOL in over 7 years, the hydrilla spread throughout this 70,000 acre system is still largely tolerant to this herbicide. This finding suggests there is not a strong fitness penalty for fluridone resistance in hydrilla. Research in combination with private industry on the use of commercial fathometers continues to progress and the ability to rapidly process this data will be very useful to managers who desire rapid analysis of survey information in order to present real-time transect data or up to date basic vegetation maps for public meetings or treatment plans.

□ **What is the future direction of the work?**

We will continue to focus on developing methods and SOP's for technology transfer of the hydroacoustic survey data to managers and other stakeholders. We will also continue to document the spread of hydrilla on the KCOL and will initiate significant sampling efforts following upcoming large-scale treatments planned for October and November 2011. Water sampling for nutrient analysis and plant sampling to determine herbicide sensitivity are also planned.

□ **Is there a change in the key contacts for this element? No.**

**EPA Demonstration Project on Hydrilla and Hygrophila
in the Upper Kissimmee Chain of Lakes
EPA Grant #X796433105-1**

Reporting period: 4th Quarter, EPA Fiscal Year 2011 June 30 – September 30, 2011

Person Reporting: Dr. Mark A. Heilman, SePRO Corporation

Element: Element 3 Task 1: Demonstration of Hydrilla Control in Osceola County, Florida using *Mycoleptodiscus terrestris* (Mt), a new contact bioherbicide, for Aquatic Plant management.

Project activities during reporting period:

□ **What work was accomplished for this reporting quarter?**

- Dr. Mark Heilman, SePRO, provided the project manager with a final narrative and budget report on Element 3, Task 1 during 2011 Quarter 2. Work was discontinued on this element due to unsuccessful commercial scale trial production of Mt fungus.
- The following manuscript has been published this Quarter:

Jackson, M.A., C.A. Dunlap, J.F. Shearer, M.A. Heilman and D.E. Palmquist. 2011. The impact of temperature on the production and fitness of microsclerotia of the fungal bioherbicide *Mycoleptodiscus terrestris* , Biocontrol Science and Technology, 21:5, 547-562. To link to this article: <http://dx.doi.org/10.1080/09583157.2011.564728>

EPA Demonstration Project on Hydrilla and Hygrophila

in the Upper Kissimmee Chain of Lakes
EPA Grant #X796433105

Reporting period: 4th Quarter, EPA Fiscal Year 2011 June 30 – September 30, 2011

Person Reporting: Dr. James P. Cuda, University of Florida

Element: Element 3 Task 2: Foreign Exploration for Natural Enemies of Hygrophila

Project activities during reporting period:

□ **What work was accomplished for this reporting quarter?**

Element 3, Task 2: Milestones:

Activity 1 Milestone:

Foreign exploration for natural enemies on *Hygrophila* spp.:

This activity is complete and is reported in detail in the previous quarterly report. A manuscript is in preparation to be submitted in the proceedings of the recently concluded XIII International Symposium on Biological Control of Weeds, held in Hawaii during 11-16 September, 2011.

Activity 2 Milestone:

Domestic survey to identify insects associated with hygrophila

Surveys were conducted in Florida (n = 7 sites, Figure 1) in August 2009 to catalog arthropods associated with hygrophila in its invasive range. Two sampling methods, sweep net and clipped vegetation sampling, were employed during this survey. As hygrophila can grow both as a terrestrial and a submerged plant, both types of plants were collected during each sampling event.

Insects collected from Florida include three beetle species in three families (Coleoptera: Chrysomelidae, Curculionidae and Elmidae), three plant hopper species (Hemiptera: Cicadellidae) and two moth species in two families (families Crambidae and Noctuidae) (Table 1).

All the beetles were found in Berlese funnel extractions. No direct feeding damage was observed for any of these species. The weevil, *Perigaster cretura* Herbst (Coleoptera: Curculionidae) collected in this study was known to feed on *Ludwigia* spp. (Onagraceae) and was considered as a potential biological control agent for water primrose (Freedman et al., 2007). Similarly, the frond-feeding weevil, *Stenopelmus rufinasus* Gyllenhal (Coleoptera: Curculionidae) collected during this study was released as a biocontrol agent of *Azolla* spp. (Azollaceae) (Hill, 1998).

The aquatic crambid moth *Synclita oblitalis* Walker was found to cause substantial damage to submerged hygrophila plants and was collected from all locations surveyed in Florida.

This insect causes complete defoliation of hygrophila (Habeck and Cuda 2008). Like most members of the subfamily Acentropinae, the larva makes a leaf case and feeds from inside the case. However, this insect is polyphagous and is known to feed on nearly 60 plant species (Habeck and Cuda 2008). Therefore, it cannot be considered as a potential biological control agent of hygrophila.

The hemipteran insects were collected in sweep nets (Table 1). The leaf hopper *Draeculacephala inscripta* Van Duzee (Hemiptera: Cicadellidae) is known to feed on water lettuce (*Pistia stratiotes* L., Araceae) and *Ludwigia peploides* (HBK) Raven (Onagraceae).

Activity 3 Milestone:

Genetic analysis of *Hygrophila polysperma* using microsatellite primers

Applications of molecular techniques to understand patterns of genetic diversity of an invasive weed can aid in tracing the invasion history by identifying source populations, and facilitate collection of closely adapted natural enemies. As a part of our ongoing efforts for biological control of hygrophila, the genetic variation of hygrophila was analyzed across native and invasive habitats (n=144 plant samples) using a combination of chloroplast (n = 4 intergenic regions, psbM-trnD, rpl16, trnS-trnG and trnL-trnF) and microsatellite (n = 15) DNA markers. This study demonstrated that no phylogenetically informative variation exists in chloroplast DNA regions across the invasive and native populations of hygrophila. Structure simulations with microsatellite data from both invasive and native ranges clearly demonstrated that the invasive populations of hygrophila are genotypically identical, suggesting that the invasive population may have originated from a single source followed by subsequent secondary invasions (Figure 1). Considering the history of invasion of hygrophila, this result provided initial evidence that US populations could be the source for introduction to Australia and Mexico.

Activity 4 Milestone:

Effect of simulated herbivory on growth and biomass of hygrophila

This activity is complete. The manuscript is under review for publication in the journal Biological Control.

- Were there any significant problems encountered?** No.
- Is the project work on schedule?** Yes.
- Are there any significant findings this quarter?**
 - Four potential biological control agents -two caterpillars (one terrestrial and one aquatic) that defoliate the plants, a leaf mining beetle, and a very damaging rust fungus- were collected during native range surveys.
 - The genetic analysis study demonstrated that the introduction of hygrophila in the USA is the result of a single introduction event.

- In Florida, hygrophila experiences very little herbivore damage and no host specific insects were collected.
- **What is the future direction of the work?**
 - Study biology and conduct host range testing of the natural enemies of hygrophila collected from India.
- **Is there a change in the key contacts for this element? No.**



Table 1. Insects collected from hygrophila during surveys in Florida.

Taxonomy	Approx. Abundance ¹	Trophic level ²	Methods of collection ³
Coleoptera			
Chrysomelidae			
<i>Paria</i> sp.	R	Leaf feeder	Berlese
Curculionidae			
<i>Perigaster cretura</i> Herbst	U	Leaf feeder	Berlese
<i>Stenopelmus rufinasus</i> Gyllenhal	U	Leaf feeder	Berlese
Elmidae			
<i>Dubiraphia vittata</i> Melsheimer	U		Berlese
Hemiptera			
Cicadellidae			
<i>Hortensia similis</i> Walker	C	Sap feeder	Sweep
<i>Draeculacephala inscripta</i>	C	Sap feeder	Sweep
<i>Draeculacephala robinsoni</i>	R	Sap feeder	Sweep
Lepidoptera			
Crambidae			
<i>Synclita oblitalis</i> Walker	C	Leaf feeder	Hand coll.
Noctuidae			
<i>Spodoptera frugiperda</i> Smith	U	Leaf feeder	Hand coll.

¹Approximate Abundance: R = Rare-collected 3 times or less; U = Uncommon-collected 4-10 times; and C = Common-collected regularly

²Trophic level information for herbivorous species does not imply that species included on this list were actually observed using hygrophila as a food source

³Methods of collection: Sweep = Sweep net sampling; Berlese = Berlese funnel extraction and Hand coll. = larva collected from field and reared to adult

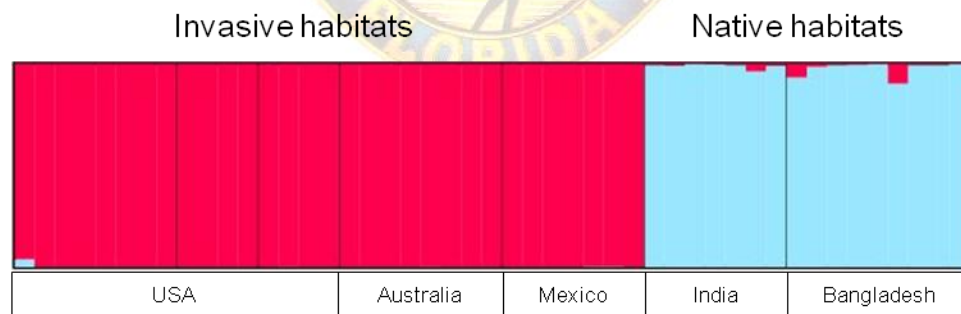


Figure 1. Assignment of hygrophila individuals collected from invasive and native habitats into district clusters ($K = 2$), inferred from Structure simulations. Note each color represents a destiny genotypic cluster.

**EPA Demonstration Project on Hydrilla and Hygrophila
in the Upper Kissimmee Chain of Lakes
EPA Grant #X796433105**

Reporting period: 4th Quarter, EPA Fiscal Year 2011 June 30 – September 30, 2011

Person Reporting: Dr. William A. Overholt, University of Florida

Element: Element 3 Task 3: Collaborative effort to search for natural enemies of hydrilla in East Africa (Project Ongoing)

Project activities during reporting period:

- **What work was accomplished for this reporting quarter?**
 - Work on this Element is complete as of September 2010 and a final report will be submitted on time.
 - Dr. Overholt was involved in submitting three publications, two are in press and one has been submitted. See Element 4, Task 7.

**EPA Demonstration Project on Hydrilla and Hygrophila
in the Upper Kissimmee Chain of Lakes
EPA Grant #X796433105**

Reporting period: 4th Quarter, EPA Fiscal Year 2011 June 30 – September 30, 2011

Person Reporting: Stacia Hetrick, UF/IFAS Osceola County Extension
Karen Brown and Amy Richard, Center for Aquatic and Invasive Plants (CAIP)

Element: Element 4 Demonstration and Outreach

Project activities during reporting period:

- **What work was accomplished for this reporting quarter?**

Stacia Hetrick:

Meetings:

 - Shared information about the project at a variety of meetings including:
 - UF/IFAS Osceola County Natural Resources Advisory Committee Meeting.
 - Lake Toho Nutrient Reduction Plan Meetings.
 - Kissimmee Chain of Lakes Aquatic Plant Management Public Meeting and Interagency Meeting.

Presentations/Exhibits:

- Delivered a presentation at the Extension Professional Associations of Florida Annual Meeting. Title: “Implementing an Educational Campaign: New IPM Strategies for Hydrilla Management.”
- Displayed an exhibit at the Extension Professional Associations of Florida Annual Meeting. The exhibit was entitled “Getting Students Engaged: The Invasive Plant Student Video Challenge.”
- Invited to display an exhibit entitled “Natural Resource Careers” at the St. Cloud Middle School Career Fair for 130 students.
- Appeared on the “Solutions for Your Life” segment on the Kissimmee FYI TV show on the Access Osceola channel which is a local channel that is broadcast in Osceola and surrounding counties (Viewership=30,000). The topic of the interview was “Biological Solutions for Managing Aquatic Weeds.”
- Delivered a presentation entitled “Hydrilla, Snail Kites, and Lake Toho” during a field tour for the Community Vision “I Can” Event. The event is designed for at-risk teenagers to increase their awareness about local environmental issues.
- Delivered a presentation and conducted an aquatic plant identification activity for the Florida Native Plant Society Pinelily Chapter entitled “Aquatic Plant Discovery and Update on the Hydrilla and Hygrophila Demonstration Project.”
- Invited speaker at the Aquatic Plant Identification Workshop hosted by the Central Florida Cisma (Cooperative Invasive Species Management Area). She delivered a presentation entitled “Invasive Aquatic Animals” and assisted with the Aquatic Plant ID session.
- Delivered a presentation for school children during a GPS Camp entitled “Geocaching: Snail Kites and Hydrilla Travel Bugs.”
- Delivered a presentation entitled “Aquatic Plant Discovery” for the Osceola County Master Gardeners and conducted an associated plant identification activity.
- Delivered a presentation for the Osceola County Community Development Staff Meeting entitled “Florida Under Siege and Hydrilla and Hygrophila Demonstration Project Update.”
- Conducted a site visit and delivered a presentation for the Celebration Garden Club entitled “Aquatic Plants, Ponds and Management in Celebration.”
- Showcased an exhibit at the Osceola County Back to School Expo entitled “Aquatic Weed Awareness and Resources for Teachers.”
- Invited to be a presenter for a group of Japanese high school students that were conducting a tour of Lake Toho to learn about environmental issues in the United States. The presentation was titled “Hydrilla, Snails and Snail Kites.” The students were from Niigata Minami Super Science High School and came to the United States with the purpose of expanding the student's knowledge and interest in various fields in the Sciences and Mathematics while also introducing career possibilities related to these fields. Their school has been granted the "Super Science" title by the Japanese Ministry of Education, Culture, Sports, Science and Technology because Niigata Minami has an advanced curriculum focusing on math and science.

Field Activities:

- Assisted Dean Jones in conducting plant surveys and water quality sampling on Lake Tohopekaliga.

- Partnered with Florida Fish and Wildlife Commission to collect aquatic plants and fish for an Aquatics Workshop.

Miscellaneous:

- Elected to the Board of Directors for the Florida Aquatic Plant Management Society (FAPMS). She also serves as Chair of the Education and Outreach Committee.
- Stacia Hetrick and Amy Richard received the following awards:
 - Silver Outstanding Educational Award from the [Association of Natural Resource Extension Professionals \(ANREP\)](#) for Innovative Program for the Invasive Plant Student Video Challenge.
 - 2nd Place Outstanding Educational Award from FANREP for Innovative Program for the Invasive Plant Student Video Challenge.
- Stacia Hetrick and Kate Wilson (UF Center for Aquatic and Invasive Plants) received the following award:
 - 1st Place Outstanding Educational Award from the Florida Association of Natural Resource Extension Professionals (FANREP) for Slide Set/Computerized Graphic Presentation for the presentation “Know Your Stuff: A Brief History and Guide for Getting Information.”
- An 8-page full-color educational pamphlet entitled “Florida Under Siege: Invasive Species Threaten Florida’s Ecosystems” was published and included as an insert in the Orlando Sentinel and El Sentinel, (Spanish version; distribution 62,500). See Task 6 discussion below for more information.

Task 1, Year 5 –4th Quarter

Demonstration field days and media events to keep stakeholders informed on the progress of hydrilla and hygrophylla management work.

Four Field Day events have been conducted for the project.

Task 2, Year 5 - 4th Quarter

An interactive website will keep citizens/agencies informed of the various stages of research and allow citizens to communicate directly with researchers and county officials with questions and/or concerns.

The following edits were made to the Osceola Demonstration website this quarter:

- Started design/organizational overhaul.
 - Visual – revamped visuals (colors, layout, logos, et.c) and made more consistent across site.
 - Organizational – re-arranged sections/pages for more intuitive grouping and ease of use.
- Added dynamic image banner to showcase 5 main topics/pages on homepage (see Figure 2 for comparison between homepage before and after edits).
- Additions/changes to the Events & Meetings page.
- Changes to Publications page (added new publications and linked to homepage banner).

- Moved Student Video Challenge to “For Teacher” category in main navigation area.
- Updated information on “Contact Us” page.
- Optimized back-end coding/design template for more consistent appearance across every page and to improve cross-browser compatibility.

Google Analytics data for this time period (4th Quarter, EPA Fiscal Year 2011 July 1, 2011 – September 30, 2011) shows that the total number of visits significantly increased from 433 in Quarter 3 to 1,641 in Quarter 4 and the average time spent on the site increased slightly from 1:51 to 2:10 minutes compared to last quarter (see Figure 3).

In Q3, roughly half of all visitors were first-time visitors compared to 73% first-time visits in Q4. A large majority of users reach the site via search engines (63%) compared to direct traffic (25%) and referring sites (10%; see Table 2). After the homepage, the next highest number of visits is still the Student Video Challenge page.

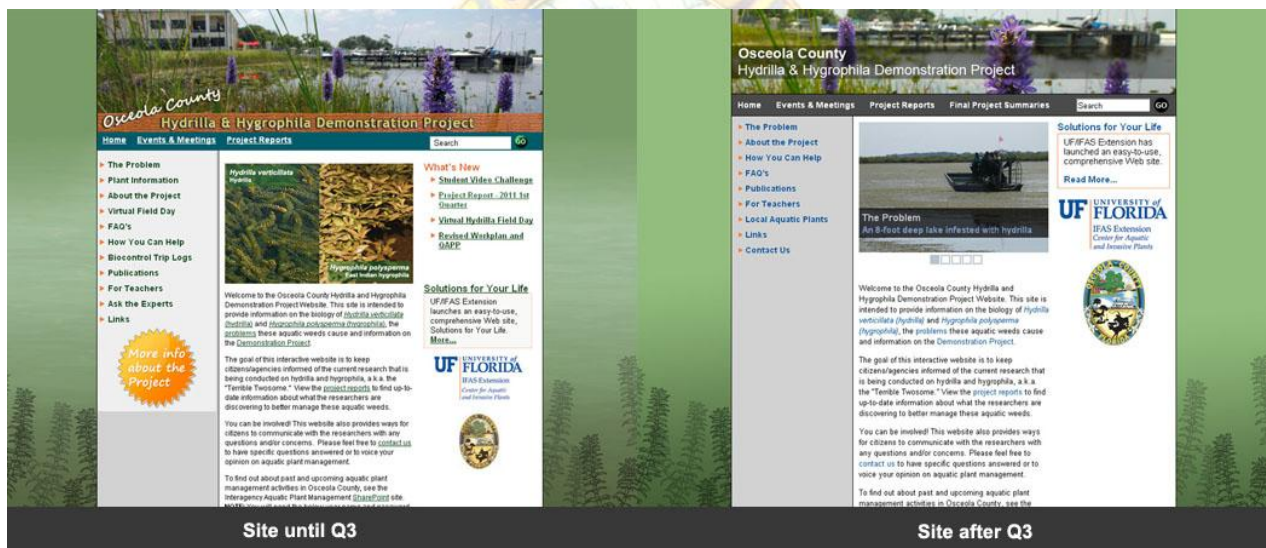


Figure 2. Screenshots of the homepage before and after edits.

Table 2. Page views, average time on site, and percentage of new visits for the project website.

Q3 vs Q4	Q3 – 2011	Q4 – 2011
Visits	433	1641
Page Views	762	4662
Avg. Time on Site (min)	1:51	2:10
Percentage of New Visits	55%	73%

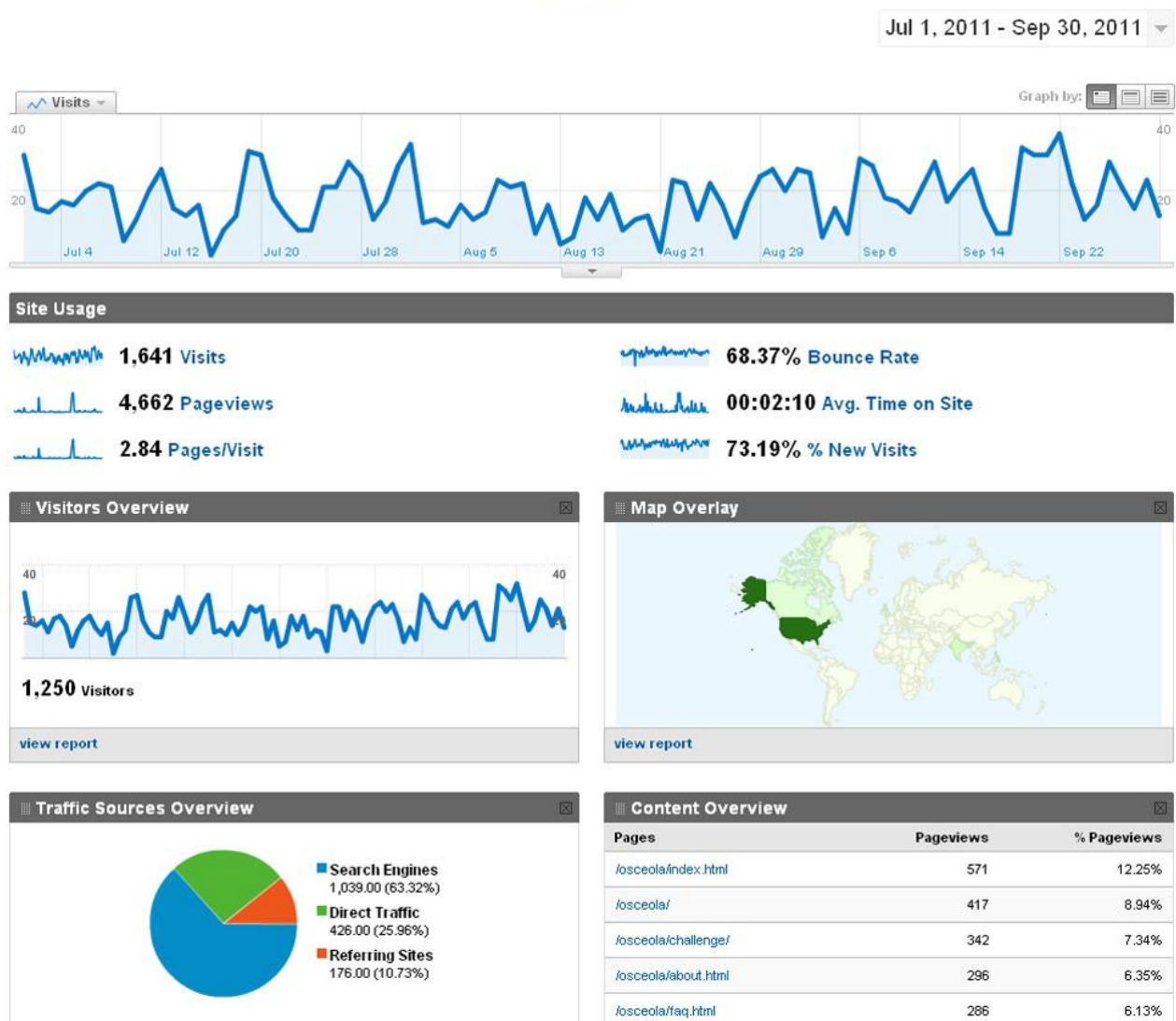


Figure 3. Google Analytics data for this time period (June 30, 2011 – September 30, 2011) for the project website.

Task 3, Year 5 – 4th Quarter

Database development.

Citations from the APIRS database (i.e., information on hydrilla and hygrophila control) are available online for citizens and researchers in Osceola County, and new citations are added as they are received (http://plants.ifas.ufl.edu/osceola/search_strings.html). All publications (except those that are copyright protected) are available from the CAIP Information office.

Task 4, Year 5 – 4th Quarter

Develop portable Aquatic Plant Management Displays/ Kiosks that can be used for local events such as the County Fair, Earth Day, Great Outdoors Days, scientific conferences and at various public areas such as boat ramps, parks, libraries and county offices.

This task has been completed. Additional displays may be created as needed in the future.

Task 5, Year 5 – 4th Quarter

Development of interactive science curricula for Osceola County teachers.

This task has been completed. Analysis of the Invasive Plant Teacher workshop, held in late April, is incomplete. We're behind schedule on this and will complete this task in the next quarter (2012 Quarter 1).

Task 6, Year 5 – 4th Quarter

Development of additional demonstration and outreach strategies.

An 8-page full-color educational insert entitled 'Aquatic Invaders' was included in our local newspaper, the Orlando Sentinel (distribution 62,500). Stacia Hetrick worked with element coordinators, representatives from the Center for Aquatic and Invasive Plants (CAIP), South Florida Water Management District, University of Florida/IFAS Osceola County Extension, and the Florida Fish and Wildlife Conservation Commission to compile a variety of articles related to invasive aquatic weeds. Eleanor Foerste and Stacia Hetrick contributed several articles. A Spanish language version of the pamphlet was also included in the El Sentinel (Spanish language version of the Orlando Sentinel). The publication can be accessed on the project website at http://plants.ifas.ufl.edu/osceola/pdf/Invaders_Pamphlet_2011_Final.pdf

Distribution of press releases and a concerted effort to advertise the recently completed Student Video Challenge have been delayed this quarter due to other urgent deadlines on the new CAIP Plant Management Website (<http://plants.ifas.ufl.edu/mange>), which was launched Oct 1. The website visits for the Student Video Challenge webpage are shown in Figure 4.

Plans are in place for picking up this task again in the next quarter. The timing will be better in the long run, as most teachers don't teach the topic of "plants" until the spring and the closer we are to that timeframe the better. This should give us time to get our ducks in a row to prepare for advertising these videos and encouraging others to do the same.

Amy Richard recently received various communications from teachers inspired to launch their own video project(s) as a result of the Osceola County Invasive Plant Student Video Challenge. This is precisely what we were hoping for by providing supporting “how to” materials and also the video training component of our teacher workshops – all of which began with this Osceola County pilot project.

- Lins, Judy - West Port High School
- Mrs. Sarah Temple / Chemistry & AP Environmental Science Teacher at Doral Academy Preparatory School
- Kim Rex – Polk County Environmental Education Center (who works with thousands of students each year)

Also, several teachers from CAIP’s Invasive Plant Education Initiative recently requested copies of the Hydrilla Game – also developed by the Osceola County Demonstration Project.



Figure 4. Webpage viewings for this time period (June 30, 2011 – September 30, 2011) for the Student Video Challenge webpage on the project website.

Task 7, Year 5 – 4th Quarter

One paper and one poster per year to share research progress and management technology, to be published on EDIS and presented at meetings.

o **Oral Presentations at Professional Meetings:**

Hetrick, S.A., J. Bradshaw, J. Cuda, K. Gioeli, and J. Gillett-Kaufman. 2011. Implementing an Educational Campaign: New IPM Strategies for Hydrilla Management. Extension Professional Associations of Florida Annual Meeting. 29 August- 1 September, Lake Buena Vista, FL.

Jones, K.D., J. Slade, and M.D. Netherland. 2011. Benefits and Limitations Using Fathometers to Monitor Herbicide Treatments for Submersed Plant Control. 51st Meeting of the Aquatic Plant Management Society. 24-27 July, Baltimore, MD.

Netherland, M.D. 2011. A Session to Provide Different Perspectives on Invasive Aquatic Plants and Potential for Ecosystem Services. 51st Meeting of the Aquatic Plant Management Society. 24-27 July, Baltimore, MD.

Netherland, M.D. 2011. Herbicide Resistance in Aquatic Plant Management from 2000 to 2010: Changes and Challenges. 51st Meeting of the Aquatic Plant Management Society. 24-27 July, Baltimore, MD.

o **Oral Presentations- Other**

Mukherjee A. 2011. PhD defense seminar: Prospects of classical biological control of hygrophila. Entomology and Nematology Department, University of Florida. 8 July, 2011.

o **Poster Presentations**

Mukherjee, A., C. A. Ellison, J. P. Cuda, and W. A. Overholt. 2011. Biological control of hygrophila: Foreign exploration for candidate natural enemies. 13th International Symposium on Biological Control of Weeds, 11-16 September, Waikoloa, HI.

Hetrick, S.A., J. P. Cuda, W. Haller, K.D. Jones, A. Mukherjee, M.D. Netherland, and W.A. Overholt. 2011. Search for New Management Techniques for Hydrilla and Hygrophila. 51st Meeting of the Aquatic Plant Management Society. 24-27 July, Baltimore, MD.

o **Scientific Publications:**

Copeland, R. S., E. Nkubaye, B. Nzigidahera, J. P. Cuda and W. A. Overholt. 2011. The African burrowing mayfly, *Povilla adusta* (Ephemeroptera: Polymitarcyidae), damages *Hydrilla verticillata* (Alismatales: Hydrocharitaceae) in Lake Tanganyika. Florida Entomologist 94(3) (in press).

Copeland, R. S., E. Nkubaye, B. Nzigidahera, J. H. Epler, J. P. Cuda and W. A. Overholt. 2011. The diversity of Chironomidae (Diptera) associated with *Hydrilla verticillata* (Alismatales: Hydrocharitaceae) and other aquatic macrophytes in Lake Tanganyika, Burundi. Annals of the Entomological Society of America (in press).

Copeland, R. S., B. Gidudu, F. Wanda, J. H. Epler, J. P. Cuda and W. A. Overholt. Chironomidae (Insecta: Diptera) associated with *Hydrilla verticillata* (Alismatales: Hydrocharitaceae) and other submersed aquatic macrophytes in Lake Bisina and other Ugandan lakes, with a new country list. Journal of East African Natural History (submitted).

Jackson, M.A., C.A. Dunlap, J.F. Shearer, M.A. Heilman and D.E. Palmquist. 2011. The impact of temperature on the production and fitness of microsclerotia of the fungal bioherbicide *Mycoleptodiscus terrestris*, Biocontrol Science and Technology, 21:5, 547-562. To link to this article: <http://dx.doi.org/10.1080/09583157.2011.564728>

Mukherjee, A. 2011. PhD dissertation: Prospects for classical biological control of the aquatic invasive weed *Hygrophila polysperma* (Acanthaceae). Submitted to the Graduate School, University of Florida.

Netherland M.D. 2011. Comparative Susceptibility of Fluridone Tolerant and Susceptible Hydrilla to Four ALS Inhibiting Herbicides Under Laboratory and Greenhouse Conditions. *J. Aquat. Plant Manage.* 49 (in press).

o **Other Publications:**

Hetrick, S.A. 2011. "Florida Under Siege: Invasive Species Threaten Florida's Ecosystems." *Orlando Sentinel* educational pamphlet. 31 July 2011. 8 pages. http://plants.ifas.ufl.edu/osceola/pdf/Invaders_Pamphlet_2011_Final.pdf

Hetrick, S.A. 2011. "Florida Esta Siendo Asediada: Especies Invasoras Amenazan los Ecosistemas de Florida." *El Sentinel* educational pamphlet. 30 July 2011. 8 pages. http://plants.ifas.ufl.edu/osceola/pdf/Invaders_Pamphlet_2011_FINAL_Spanish.pdf

Hetrick, S.A. 2011. The Amazing Alligatorweed Flea Beetle. *Solutions for Your Life* Newsletter, July-September.

Hetrick, S.A. 2011. Invasive Plant Student Video Challenge. *Solutions for Your Life* Newsletter, July-September.

Hetrick, S.A. 2011. The Amazing Alligatorweed Flea Beetle. *Marsh Rider Airboating* Magazine. August- September.

Hetrick, S.A. 2011. Osceola County's Hydrilla and Hygrophila Demonstration Project. *Osceola County Community Development Newsletter*. September.

Hetrick, S.A. 2011. Endangered Birds, Invasive Snails, and Aquatic Weeds. *Airboating* Magazine. September- October.

□ **What Milestones have been met for your Element?**

Completion of the Invasive Plant Student Video Challenge constitutes a milestone for Element 4 Task 6 (*Develop and implement at least 2 additional strategies to help demonstrate and educate stakeholders regarding hydrilla and hygrophila management strategies.*). The 8-page full-color educational pamphlet entitled "Florida Under Siege: Invasive Species Threaten Florida's Ecosystems" was published as an additional outreach strategy.

□ **Were there any significant problems encountered? No.**

□ **Is the project work on schedule? Yes.** The follow-up on the video project and the teacher workshop will be completed during 2012 Quarter 1. They are behind schedule due to conflicting deadlines with other CAIP responsibilities.

□ **Are there any significant findings this quarter?**

As a result of our efforts on the Invasive Plant Student Video Challenge, we have discovered that by providing supporting materials and additional training, teachers can be inspired to initiate their own video outreach project with students.

□ **What is the future direction of the work?**

Teachers who attended Osceola County trainings will be included in a long-term education/outreach effort by the UF/IFAS CAIP office, with regular periodic updates and communication. We will continue to support teachers who want to help spread the message about invasive species... particularly invasive aquatic plants.

Presentations will continue to be delivered to the local community and at professional meetings and publications will continue to be created.

A University of Florida/IFAS EDIS (Electronic Data Information Source) publication is being created regarding hydrilla management in Florida's public waterbodies.

□ **Is there a change in the key contacts for this element?** No.

**EPA Demonstration Project on Hydrilla and Hygrophila
in the Upper Kissimmee Chain of Lakes
EPA Grant #X796433105**

Reporting period: 4th Quarter, EPA Fiscal Year 2011 June 30 – September 30, 2011

Person Reporting: Dr. William T. Haller, University of Florida

Element: Element 5: Deep water mechanical harvest of hydrilla

Project activities during reporting period:

□ **What work was accomplished for this reporting quarter?**

The Quality Assurance Project Plan for Element 5, Deep water harvesting of hydrilla has been approved. Osceola County procurement agreement with Texas Aquatic Harvesting has been executed. Osceola County is finalizing the permit application for submittal to the Florida Department of Environmental Protection and U.S. Army Corps of Engineers for the deep water harvesting process. The harvesting operation is scheduled to commence next quarter immediately upon permit approval.