

V(A). Planned Program (Summary)

Program # 3

1. Name of the Planned Program

Global Food Security and Hunger - Strategic Research for the Management of Invasive Pest Species

Reporting on this Program

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
135	Aquatic and Terrestrial Wildlife				25%
211	Insects, Mites, and Other Arthropods Affecting Plants				25%
215	Biological Control of Pests Affecting Plants				25%
216	Integrated Pest Management Systems				25%
	Total				100%

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2013	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.0	0.0	4.0
Actual Paid Professional	0.0	0.0	0.0	2.0
Actual Volunteer	0.0	0.0	0.0	0.0

2. Actual dollars expended in this Program (includes Carryover Funds from previous years)

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
0	0	0	225712
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	0	0	56449
1862 All Other	1890 All Other	1862 All Other	1890 All Other
0	0	0	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

Offshore research: Offshore research on seven high risk species (Planococcus lilacinus, Rhyncophorus ferrugineus, Rhyncophorus cruentatus and Rhyncophorus palmarum, Oxycarenus hyalinipennis, Tuta absoluta, and Anastrepha grandis) was carried out or initiated in Trinidad, Dominican Republic, Curacao and Aruba, Bahamas, Jamaica and Panama with a view to generate data on biology, ecology, surveillance and control. These pests are listed as high priority threats by USDA APHIS. Research activities were conducted in collaboration with several international partners.

Onshore research: Biological control of Hydrilla verticillata. A survey of the upper 1.5 miles of the river of the Wacissa Springs Group was conducted. A descriptive scale of 0-3 was used with 0 indicating Hydrilla undetected and 3 completely choked. Survey results of the Wacissa River indicated varying levels of Hydrilla infestations. Thus, for mitigation purpose, cultures of Hydrilla were established in the laboratory from Wacissa Big Blue Spring, Wacissa #2 and Garner Spring. The Hydrilla tip mining midge, Cricotopus lebetis were reared in the laboratory for release into Wacissa River to assess its effectiveness in controlling Hydrilla. This project is conducted in collaborations with colleagues at the University of Florida.

Benefits and risks of biological control: The effectiveness of risk communication activities for entomophagous biological control agents were compiled. Data on classical and fortuitous biological control were collected for use to populate existing or new databases. These data allow the testing on hypothesis relating to safety issues.

2. Brief description of the target audience

The target audience include: federal and state biosecurity agencies, farmers, general public, extension workers and pest management specialists. For instance, the information on the invasive weed Hydrilla will be used by target fishermen and general public (who use the aquatic resources for recreation), water resource managers and private industry such as bottled water enterprises. The work on offshore pests is aimed at safeguarding US Agriculture, farmers, food and ornamental growers, the nursery industry and government agencies

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2013	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	200	500	50	1500

2. Number of Patent Applications Submitted (Standard Research Output)

Patent Applications Submitted

Year: 2013
 Actual: 2

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2013	Extension	Research	Total
Actual	3	7	10

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Electronic identification keys/tools/resources developed.

Year	Actual
2013	2

Output #2

Output Measure

- Knowledge generated on specific target pests and used for the development of contingency plans.

Year	Actual
2013	6

Output #3

Output Measure

- Analyses conducted on key issues regarding safety and specific target biological control agents studied to determine safety.

Year	Actual
2013	2

Output #4

Output Measure

- Target biological control agents introduced and established against specific insect pest or weed targets.

Year	Actual
2013	28

Output #5

Output Measure

- Undergraduate and graduate students trained through mentorship and involvement in research programs.
Not reporting on this Output for this Annual Report

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Digital identification keys/tools/resources for the identification of invasive species utilized.
2	More effective strategies for the identification, prevention or management of invasive species.
3	Integrated pest management approaches adopted by farmers leading to greater profitability.
4	The introduction and spread of IAS minimized.
5	More effective management of aquatic weeds in first order springs.
6	Trade between the US and partners is safer through implementation of strategies to mitigate the introduction of invasive insect pests and weeds.
7	Well trained undergraduates and graduates contribute to the effective management of native and non-native pests

Outcome #1

1. Outcome Measures

Digital identification keys/tools/resources for the identification of invasive species utilized.

Not Reporting on this Outcome Measure

Outcome #2

1. Outcome Measures

More effective strategies for the identification, prevention or management of invasive species.

2. Associated Institution Types

- 1890 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	3

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Florida faces a disproportionate risk from invasive pests which are a major threat to agriculture and the environment. Farmers, the general public, ornamental industry, and various state and federal agencies involved in efforts to mitigate the threats of invasive pests are concerned with these threats.

What has been done

Offshore studies are being conducted to generate knowledge that is critical for the development of mitigation measures against several pest threats. Studies on the red palm weevil (RPW), *Rhynchophorus ferrugineus*, in Curacao focused on development of optimal methods for operating pheromone traps and acoustically assessing infestations in individual trees. In addition, offshore studies on the coffee mealybug in the Dominican Republic provide useful insights for the development of the management strategy for *Planococcus lilacinus*.

Results

From a country-wide survey of 131 locations in 19 provinces in the Dominican Republic, eleven (11) species of invasive mealybug were identified along with the parasitoid *Leptomastix dactylopii* and the predators, *Cryptolaemus montrouzieri* and *Cycloneda sanguinea*.

Bucket traps with pheromone lures and a molasses food-bait mixture captured RPW adults reliably for about eight days. A portable, user-friendly acoustic sensor system enabled identification of larvae in individual infested trees through the use of signal processing analyses that screened out bird and wind noise. This information will assist future efforts to monitor, control, or eradicate RPW in Curacao, Aruba and nearby islands and the United States, should the pest gain entry.

4. Associated Knowledge Areas

KA Code	Knowledge Area
211	Insects, Mites, and Other Arthropods Affecting Plants
216	Integrated Pest Management Systems

Outcome #3

1. Outcome Measures

Integrated pest management approaches adopted by farmers leading to greater profitability.

Not Reporting on this Outcome Measure

Outcome #4

1. Outcome Measures

The introduction and spread of IAS minimized.

Not Reporting on this Outcome Measure

Outcome #5

1. Outcome Measures

More effective management of aquatic weeds in first order springs.

2. Associated Institution Types

- 1890 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
------	--------

2013

1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Hydrilla, an invasive and noxious weed is considered the second most important aquatic weed world-wide behind water hyacinth. Currently, many springs and first order streams in Florida are infested with this weed. As a result, the ecosystem has degraded, and the spring and river's ecological and recreational value has drastically diminished. Thus, the understandings of the risk of spread of Hydrilla to non-infested bodies of water and methods to mitigate the risk are needed. A range of stakeholders including: fisherman, canoeists, kayakers, boaters, swimmers, scuba divers, water resource managers, private industry is affected.

What has been done

Surveys of the Wacissa River indicated varying levels of Hydrilla infestations.

A web site was established to disseminate knowledge to these groups. An awareness campaign has been mounted using brochures and other paraphernalia such as, hats, and rulers.

Results

The Hydrilla tip mining midge, *Cricotopus lebetis* is being reared in the laboratory for release into Wacissa River to assess its effectiveness in controlling Hydrilla.

The web site is active and is providing knowledge to these groups. Public awareness materials have also been disseminated to stakeholders.

11

4. Associated Knowledge Areas

KA Code	Knowledge Area
135	Aquatic and Terrestrial Wildlife
215	Biological Control of Pests Affecting Plants
216	Integrated Pest Management Systems

Outcome #6

1. Outcome Measures

Trade between the US and partners is safer through implementation of strategies to mitigate the introduction of invasive insect pests and weeds.

Not Reporting on this Outcome Measure

Outcome #7

1. Outcome Measures

Well trained undergraduates and graduates contribute to the effective management of native and non-native pests

2. Associated Institution Types

- 1890 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	26

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

A safe agricultural system is critical to national security but U.S. crops, a cornerstone of our nation's economy, are vulnerable to attack. Events at the beginning of the new millennium further complicated issues relating to bio-security. More than ever, a plethora of actions are required in order to effectively safeguard our nation. Thus, more innovative and scientific programs must be developed in order to increase the number of well trained professionals to fill critical positions in research and regulatory functions in various agencies

What has been done

A central component of our work on invasive species is to train both graduate and undergraduate students to undertake such professional careers. These students are involved in experiential learning, attending and presenting their research results at professional meetings.

Results

During the 2013 academic year, eight graduate students received their M.S .degree and two other students received the B.S. degree.

4. Associated Knowledge Areas

KA Code	Knowledge Area
135	Aquatic and Terrestrial Wildlife
211	Insects, Mites, and Other Arthropods Affecting Plants
215	Biological Control of Pests Affecting Plants
216	Integrated Pest Management Systems

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Natural Disasters (drought, weather extremes, etc.)
- Public Policy changes
- Government Regulations

Brief Explanation

Government regulations regarding globalization of trade and transport has multiplied concerns of introduction of invasive species. This threat has increased as trade has grown and so have the complexities of trade especially in agricultural products. Increase in temperature improves the 13 survival and rapid spread of arthropods pests to new environment where they become very destructive and difficult to control.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

The overall implementation of the research program in the Center for Biological Control was evaluated by the Center Advisory Council in December 04, 2013 and found to be progressing satisfactorily.

The Coffee mealybug, *Planococcus lilacinus* is particularly a serious threat because of its wide range of host plants. A country-wide survey in the Dominican Republic revealed the following species of mealybug: *Dysmicoccus boninsis*, *Dysmicoccus brevipes*, *Dysmicoccus neobrevipes*, *Ferrisia virgata*, *Hypogeococcus pungens*, *Paracoccus marginatus*, *Planococcus citri*, *Planococcus minor*, *Pseudococcus jackbeardsleyi*, *Puto barberi* and *Saccharicoccus sacchari*. The parasitoid *Leptomastix dactylopii* was found attacking mealybugs in several genera including *Dysmicoccus*, *Planococcus*, *Paracoccus* and *Puto*. In addition, insect predators such as *Cryptolaemus montrouzieri* and *Cycloneda sanguinea* were also present in the areas surveyed, as well as the predatory Dipteran larvae: *Syrphidae*. Fortunately, the destructive species of mealybug, *P. lilacinus* was not found during the country wide survey.

Red palm weevil: Studies on *Rhyncophorus ferrugineus* were continued in Aruba and Curacao with efforts being targeted on development of trapping methods. The preliminary results of the acoustical analyses for *R. ferrugineus* indicated that early instar larvae were detectable in the field. This information is useful should the pest become introduced into the United States. In addition, data indicated that no *R. cruentatus* or *R. cruentatus* were captured in the survey in Aruba and these two species did not appear to be current threats to palms on the island

Hydrilla; The development of a biological control strategy for the invasive weed, *Hydrilla verticillata* was continued. Surveys of the Wacissa River indicated varying levels of *Hydrilla* infestations. For this purpose, the *Hydrilla* tip mining midge, *Cricotopus lebetis* was reared in the laboratory for release into Wacissa River to assess its effectiveness in controlling *Hydrilla*.

Key Items of Evaluation

Coffee mealybug: This invasive species (*Planococcus lilacinus*) is serious threat to US agriculture because of its wide range of host plants. It is a very detrimental pest in the Caribbean and its introduction in the US will have detrimental consequences. As a result, there is an urgent need to study the biology and dynamics of the pest populations and design management strategies.

Red palm Weevil: The red palm weevil is a major threat to the United States. Knowledge from this program will be beneficial to prevention/management programs. This is particularly relevant given the current concerns about the possible introduction of this pest in California.

Hydrilla: This study not only evaluates the efficacy of biological control agents for control and the management of the invasive aquatic weed in the Wacissa Springs and Wacissa River, but also, it provides experiential learning opportunities for students.