

V(A). Planned Program (Summary)

Program # 3

1. Name of the Planned Program

Invasive Species Education and Management

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
112	Watershed Protection and Management	0%		4%	
136	Conservation of Biological Diversity	0%		5%	
204	Plant Product Quality and Utility (Preharvest)	0%		6%	
205	Plant Management Systems	15%		8%	
211	Insects, Mites, and Other Arthropods Affecting Plants	20%		10%	
212	Pathogens and Nematodes Affecting Plants	15%		23%	
213	Weeds Affecting Plants	12%		10%	
215	Biological Control of Pests Affecting Plants	8%		15%	
216	Integrated Pest Management Systems	30%		9%	
312	External Parasites and Pests of Animals	0%		7%	
721	Insects and Other Pests Affecting Humans	0%		3%	
	Total	100%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2012	Extension		Research	
	1862	1890	1862	1890
Plan	5.0	0.0	5.0	0.0
Actual Paid Professional	2.9	0.0	5.3	0.0
Actual Volunteer	1.6	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
118956	0	299817	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
258098	0	842838	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
17961	0	232496	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

Invasive species threaten the quality of agricultural products, the health of farming businesses and the surrounding natural and urban ecosystems. Sound management of agroecosystems in Hawai'i depends on mitigating the effects of alien invasive species. Invasive species threaten our native plant heritage and economically important plants, pastures, rangelands, forests, and critical watersheds. In addition to their economic damages, invasives also threaten conservation efforts for native endangered plants and insects. Invasive biology and conservation biology are opposite sides of the same coin. CTAHR plays a significant role in developing and delivering information and technologies that minimize the negative impacts of invasive species. Increasingly, CTAHR staff are also involved in efforts to conserve threatened native biota.

12,530 students in 350 public school classrooms have participated in a K-12 curriculum project focusing on biology and management of Hawaii's invasive termites, Termite Project: Educate to Eradicate. The college also maintains the University of Hawaii Insect Museum (UHIM), a repository for native and invasive insect species. Over 11,290 specimens from this collection have been placed in a digital database. Invasive fruit flies in the genera *Bactrocera* and *Dacus* are pests worldwide, and over 1,200 photos from the UHIM collection have been organized in a searchable online database: <http://www.herbarium.hawaii.edu/fruitfly/>. In FY2012, UHIM outreach efforts to educate the community on invasive and native insect species included 300 visitors, among them students from five local schools.

In FY2012, efforts continued to mitigate the impact of the coffee berry borer (CBB) in the Kona and Kau regions of the island of Hawaii. This beetle is the most devastating pest of coffee world-wide, and was first found a Kona coffee field by a CTAHR researcher in Fall 2010. Since its discovery, college staff working in collaboration with USDA-ARS researchers have developed a heat treatment technique for disinfesting coffee beans prior to shipment to Oahu for processing, are in the second year of a three year study of the efficacy of entomopathogenic fungi for CBB control, have optimized CBB trap design and placement for maximum trap catch, are evaluating insecticides for registration under the IR-4 program to facilitate minor crop registrations, have established that kaolin (powdered white clay labeled for use in certified organic production) applications to coffee trees decrease beetle infestation rates, and have established the efficacy of plant oils as repellents. Essential oils also hold promise against pickleworm, an invasive moth attacking cucurbits in Hawaii.

The "SWAT team" approach employed in FY2011 to combat the appearance of basil downy mildew on Oahu was used again in FY2012 when onion thrips, normally a pest of round onions, was found on green onions on the Waianae coast of Oahu. An extension agent familiar with the pest in round onions on Maui partnered with Oahu county agents, an extension specialist and researchers to initiate control

research, and deliver grower workshops on best management practices. Workshops and research efforts against basil downy mildew continued as well. Efforts also continued to refine hot water shower disinfestation treatments to more effectively target particular pests and minimize any impact on commodity quality, for both quarantine and export to out of state markets. Other research and extension efforts to minimize applications of conventional pesticides included demonstration that peptide toxins isolated from snail hunting marine gastropods can selectively affect mollusks, serving as models for highly selective pesticides. Also, bee keepers in Hawaii have adopted a formic acid based treatment for varroa mites developed by CTAHR. Vigilance and rapid response are essential in Hawaii, since new invasive pests and diseases are discovered each year. In FY2012, pepper mottle virus (PepMoV) was found in tomato plants in Hawaii, also representing the first report of natural infection in the USA. Plants infected with PepMoV show no impaired growth, but the majority of fruit are unsalable. A field survey of 292 plants representing 14 tomato varieties found an overall virus incidence of 20%, ranging from 5-48% for the different varieties, indicating that this newly discovered virus is a considerable threat to tomato production.

Invasive plants (weeds) are major problems in plant and animal agricultural systems, as well as natural systems, in Hawaii. Herbicide Ballistic Technology (HBT) employing paintball gun technology for targeted applications of very small quantities of herbicide has been readily adopted by federal, state, county, private, and nonprofit agencies concerned with weed control and eradication, since its development in CTAHR. Miconia is the most important invasive plant in Hawaii, particularly in natural systems such as watersheds, and use of this technology has reduced aerial application costs by 50%, while also minimizing or eliminating any impact of applications on non-target plants. In FY2012, efforts concentrated on both application, and training and certification of applicators, with four workshops conducted to introduce standard operating procedures for ground and aerial applications.

Fireweed (*Senecio madagascariensis*) is the major pasture weed problem facing ranchers in Hawaii today. Maui County has sponsored an herbicide prescription program employing HBT and conducted by CTAHR staff to suppress infestations in priority pastures. Due to the cost and difficulty of herbicide treatment, CTAHR, USDA Forest Service and Hawaii Department of Agriculture staff have collaborated on a biological control program to collect, screen against nontargets, rear and release a Madagascan moth, *Secusio extensa*, to suppress this noxious and toxic weed. CTAHR researchers have censused prerelease fireweed populations in order to accurately determine impact of the moth after release, and permits and procedures were put in place in the latter part of FY2012 to allow release in FY2013.

2. Brief description of the target audience

Target audiences include farmers, consumers, and rural citizens who can appreciate reduced pesticide inputs as we come to rely more on biological means of pest control. Scientists who study invasive species, and in particular fruit flies work with extension educators to delivery best management practices to agricultural and residential clientele. Natural resource managers (including those responsible for forestry, rangeland and conservation lands) depend on CTAHR researchers and extension to develop and deliver technologies for improved control and management of invasive plants in Hawaii's landscapes.

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2012	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	4889	7500	1863	358

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

Patent Applications Submitted

Year: 2012

Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2012	Extension	Research	Total
Actual	11	32	43

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of workshops, field days, demonstrations held

Year	Actual
2012	316

Output #2

Output Measure

- Number of grant proposals submitted

Year	Actual
2012	13

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Awareness created
2	Number of agency professionals, including extension agents who implement or install demonstration or similar programs for clientele education
3	Total dollar value of grants and contracts obtained.

Outcome #1

1. Outcome Measures

Awareness created

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	3094

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Residents are not aware of the problems associated with invasive species. Increased awareness of best management practices is the first step in implementing improvements in invasive species control and management.

What has been done

Workshops, demonstrations, field days, presentations and publications make residents aware of the problems associated with invasive species and control practices which are most successful.

Results

Farmers and residents will be more likely to assist in controlling invasive species.

4. Associated Knowledge Areas

KA Code	Knowledge Area
204	Plant Product Quality and Utility (Preharvest)
205	Plant Management Systems
211	Insects, Mites, and Other Arthropods Affecting Plants
212	Pathogens and Nematodes Affecting Plants
213	Weeds Affecting Plants
215	Biological Control of Pests Affecting Plants
216	Integrated Pest Management Systems

Outcome #2

1. Outcome Measures

Number of agency professionals, including extension agents who implement or install demonstration or similar programs for clientele education

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	9

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Residents are unaware of how to control invasive species.

What has been done

Demonstration project have been installed.

Results

Farmers and residents better understand how to control invasive species and Hawaii is better protected from crop destruction and ecosystem damage caused by invasive plants and animals.

4. Associated Knowledge Areas

KA Code	Knowledge Area
211	Insects, Mites, and Other Arthropods Affecting Plants
212	Pathogens and Nematodes Affecting Plants
213	Weeds Affecting Plants
215	Biological Control of Pests Affecting Plants

Outcome #3

1. Outcome Measures

Total dollar value of grants and contracts obtained.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	974375

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Funding is needed to conduct research and extension activities to augment that accomplished with formula funds.

What has been done

Extramural grants have been received and funding utilized.

Results

Hawaii has been able to better accomplish meaningful and comprehensive invasive species control.

4. Associated Knowledge Areas

KA Code	Knowledge Area
136	Conservation of Biological Diversity
205	Plant Management Systems
211	Insects, Mites, and Other Arthropods Affecting Plants
212	Pathogens and Nematodes Affecting Plants
213	Weeds 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.)
- Economy
- Appropriations changes
- Public Policy changes
- Government Regulations
- Competing Public priorities
- Competing Programmatic Challenges

Brief Explanation

- Intentional introductions of invasive species
- Lack of funding/grant proposals don't come through.
- Other agencies and partners are not willing to partner and coordinate efforts

V(I). Planned Program (Evaluation Studies)

Evaluation Results

All projects conducted under this program were peer-reviewed before initiation. Annual progress reports were collected and evaluated by the associate deans for research and extension. Funds are not released for those projects which did not show tangible progress.

Key Items of Evaluation

None.