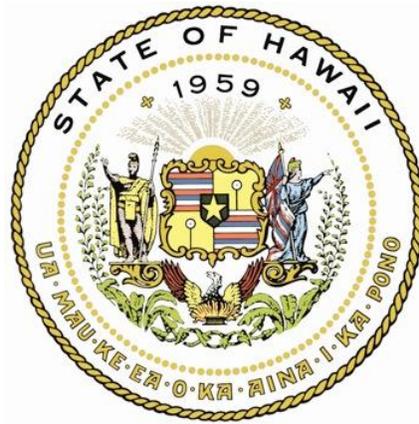


REPORT TO THE TWENTY-SIXTH LEGISLATURE
REGULAR SESSION OF 2012

BUDGETARY AND OTHER ISSUES REGARDING INVASIVE SPECIES



Prepared by:

THE STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
DIVISION OF FORESTRY AND WILDLIFE

In response to Section 194-2, Hawaii Revised Statutes

November 2011

Table of Contents

I. The Hawai'i Invasive Species Council (HISC)	
Purpose of this Report	4
Composition of HISC	4
Background	5
HISC Strategic Plan	6
HISC Meeting Resolutions for FY11	7
II. HISC Prevention Working Group	
Goals and Key Activities in FY11	9
Hawai'i-Pacific Weed Risk Assessment	10
Hawai'i Ant Lab	17
Ballast Water and Hull Fouling Coordinator	24
III. HISC Response and Control of Established Pests Working Group	
Goals and Key Activities in FY11	26
HDOA Biological Control Foreign Exploration	27
Detection and Control of Invasive Species in Kaua'i County	31
Detection and Control of Invasive Species on O'ahu Island	34
Detection and Control of Invasive Species in Maui County: Moloka'i	37
Detection and Control of Invasive Species in Maui County: Maui and Lāna'i	41
Detection and Control of Invasive Species in Hawai'i County	45
Aquatic Invasive Species Program	50
IV. HISC Research and Technology Working Group	
Goals and Past Activities	55
Prevention and Control Technologies in the West Maui Mountains	56
V. HISC Public Outreach Working Group	
Goals and Key Activities in FY11	62
Outreach for Kaua'i County	66
Outreach to the O'ahu Gardening Public	69
Outreach and Education on Invasive Species: Moloka'i	71
Outreach and Education on Invasive Species: Maui and Lāna'i	73
Public Outreach on Invasive Species in Hawai'i County	78
Support of Invasive Species Public Outreach Efforts in Hawai'i	83
Hawai'i Early Detection Network (HEDN): Outreach	85
Video Production: The Impacts of Feral Animals on Hawaiian Forests	87
Plant Pono Website	88
HISC Communications Coordinator	89
Aquatic Invasive Species Media Outreach	93
VI. Hawai'i Invasive Species Council Reports	
Overview of the Invasive Species Problem in Hawai'i	94
Early Detection of Invasive Species	97
Coqui Frog	98
Loss of Funding to Prevent Brown Tree Snake Introduction from Guam	100
Control of Alien Species Affecting Native Forest Ecosystems	101
Introduced Predators	103
Disease Carriers, Disease and Pathogens	104
Biocontrol	105

The need for Improved Interisland Quarantine	106
County Involvement	107
Review of Conflicting Agency Mandates	107
Invasive Species Fines, Penalties, and Regulations	107
VII. Money Spent on Invasive Species Management in Hawai'i: Organizational and Resource Shortfalls	
Money Made Available to the HISC	108
Money Spent by All Agencies in Hawai'i	110
Funding Sources for Invasive Species Management in Hawai'i	112
Organizational and Resource Shortfalls in Hawai'i	113
VIII. Advice to the Governor and Legislature Regarding Invasive Species	
Regarding the Functioning of the HISC	117
Regarding Current Invasive Species Issues	118
Albizia	118
Mosquitoes	118
'Ōhi'a Rust	119
Axis Deer	119
Appendix 1: Chapter 194, Hawaii Revised Statutes: INVASIVE SPECIES COUNCIL	121
Appendix 2: Hawai'i Invasive Species Council Strategy, 2008-13	125

I. The Hawai'i Invasive Species Council (HISC)

Purpose of this Report

Chapter 194, Hawaii Revised Statutes (HRS), Invasive Species Council, establishes the interagency Hawai'i Invasive Species Council (HISC), determines its composition and responsibilities, and gives its member agencies special abilities to enter private or public property to control invasive species (Appendix 1). This HISC is composed of the chairs, directors, or presidents of state departments concerned with invasive species, as well as the University of Hawai'i. HISC's purpose is to coordinate and promote efforts that prevent, eradicate or control invasive species and maintain an overview of the issues related to invasive species in Hawai'i. HISC coordinates the State's efforts to stop the introduction and spread of invasive species in Hawai'i. This report provides an update on progress toward that goal and meets the reporting requirement of Section 194-2, HRS, to annually report to the Legislature on budgetary and other issues regarding invasive species. The headings used in this report are taken from the duties outlined in Section 194-2, HRS, and the HISC Strategy 2008-2013.

Though HISC is an interagency collaboration, Chapter 194, HRS, places HISC within the Department of Land and Natural Resources (DLNR), for administrative purposes only. Section 28 of Act 158, Session Laws of Hawaii (SLH) 2008, requires DLNR to prepare each year, a report on the statewide strategic plan for the invasive species prevention, control, research, and outreach partnership program, and identification of the short- and long-term needs of the program with specific performance outcomes; provided further that the report shall identify all appropriation transfers (state and non-state) to other departments, including a detailed breakdown of matching non-state funds or equivalent services received by source, including dollar amounts, and how the funds expended address the needs of the strategic plan and the strategic plan's performance outcomes.

Composition of HISC

Chapter 194, HRS, designates HISC as being composed of the chairs or designated representatives of DLNR and the Hawaii Department of Agriculture (HDOA), the directors or designated representatives of the Department of Business, Economic Development, and Tourism (DBEDT), the Department of Health (DOH), and the Department of Transportation (DOT), and the president or designated representative of the University of Hawai'i (UH). For the reporting period of July 2010-June 2011, the voting members of HISC changed due to the transition in administration from Governor Lingle to Governor Abercrombie. HISC members under each administration included:

<u>Office</u>	<u>Lingle Administration</u>	<u>Abercrombie Administration</u>
• Chair, DLNR	Laura H. Thielen	William J. Aila
• Chair, HDOA	Sandra Lee Kunimoto	Russell S. Kokubun
• Director, DOT	Michael Formby	Glenn Okimoto
• Director, DOH	Chiyome L. Fukino, M.D.	Loretta J. Fuddy
• Director, DBEDT	Theodore E. Lui	Richard Lim
• President, UH	MRC Greenwood, Ph.D.	MRC Greenwood, Ph.D.

Additionally, Chapter 194, HRS, identifies non-voting participants to be invited to provide advice and assistance to HISC. These participants include four senators, one from each county, and four house of representatives, one from each county. Additional participants may also be invited, and have traditionally represented the Department of Defense (DOD), the Department of Hawaiian Home Lands

(DHHL) and the Department of Commerce and Consumer Affairs (DCCA). For the reporting period of July 2010-June 2011, participants in the proceedings of HISC included:

Lingle Administration

- Sen. J. Kalani English
- Sen. Carol Fukunaga
- Sen. Mike Gabbard
- Sen. Russell S. Kokubun
- Rep. Mele Carroll
- Rep. Hermina M. Morita
- Rep. Barbara Marumoto
- Rep. Clift Tsuji
- Ronald Boyer (Director, DCCA)
- Maj. Gen. Robert G.F. Lee (Adjutant General, DOD)
- Kaulana Park (Director, DHHL)

Abercrombie Administration

- Sen. J. Kalani English
- Sen. Clarence Nishihara
- Sen. Gilbert Kahele
- Sen. Ronald Kouchi
- Rep. Mele Carroll
- Rep. Clift Tsuji
- Rep. Derek Kawakami
- Rep. Mark Hashem
- Keali'i Lopez (Director, DCCA)
- Maj. Gen. Darryll Wong (Adjutant General, DOD)
- Alapaki Nahale-a (Director, DHHL)

HISC and its participants meet at least twice annually to review issues relating to invasive species and to provide direction to the HISC staff (a coordinator housed at DLNR) and working groups. The HISC working groups are led by designated state departments and are comprised of project leaders from various governmental and non-governmental organizations. These working groups include:

- Prevention Working Group, chaired by HDOA
- Established Pests (Response and Control) Working Group, chaired by DLNR
- Research and Technology Working Group, chaired by UH
- Public Outreach Working Group, chaired by DOT.

These working groups assist HISC in fulfilling its legislated responsibility to maintain a broad overview of the invasive species problem in the State. At the direction of HISC, each working group prepares an annual budget proposal consisting of a variety of proposed projects related to invasive species. Upon approval of the budget by HISC, projects are carried out over the following fiscal year to address needs in prevention, response and control, research and technology, or public outreach.

Background



Governor Neil Abercrombie convenes a meeting of the HISC in June 2011. Right to left: Rep. Derek Kawakami (Kaua'i), Alapaki Nahale-a (Director, DHHL), Keali'i Lopez (Director, DCCA), Governor Neil Abercrombie, Gary Gill (Deputy Director, DOH), Sylvia Yuen (Dean, CTAHR, UH), Russell Kokubun (Chair, HDOA), William Aila (Chair, DLNR), Maj. Gen. Darryll Wong (Adjutant General, DOD)

Formal efforts to create a comprehensive invasive species program began with the Coordinating Group on Alien Pest Species (CGAPS), voluntarily formed in 1995 and consisting of senior staff in numerous federal, state, county, and private entities involved in invasive species prevention, control, research, and outreach. CGAPS' actions during its formative years highlighted the need for a legislatively mandated interagency collaboration within the state government to address invasive species issues.

The State Legislature authorized the creation of HISC by way of Act 85, SLH 2003, and stated that "the silent invasion of Hawai'i by alien invasive species is the single greatest threat to Hawai'i's economy, natural environment, and the health and lifestyle of Hawai'i's people and visitors." Hawai'i is one of the first states in the nation that recognized the need for coordination among all state agencies, at a cabinet level, that have responsibility to control invasive species on the ground, as well as regulate or promote the pathways in which invasive species can gain access into the State. In 2006, Act 85, amended by Act 109, SLH 2006, became permanent law in Chapter 194, HRS.

CGAPS continues to operate as a high-functioning partnership of federal, state, county, and private sector representatives. The functions of CGAPS and HISC are complementary, and CGAPS continues to be a close and valued partner to HISC.

HISC Strategic Plan

In 2003, an interim strategic plan was approved by HISC to address alien species in the State. In July 2008, HISC approved the adoption of the HISC Strategy 2008-13 (Appendix 2). This plan identifies the lead agencies responsible for each working group, as well as the objectives, goals, and measures of effectiveness for each working group and for HISC itself.

From July 2010 to June 2011, HISC met twice to review and approve actions related to fulfillment of responsibilities identified by Chapter 194, HRS, and the goals and measures of effectiveness described by the HISC Strategic Plan. The Strategic Plan identifies priority goals and measures of effectiveness as follows.

HISC Goal: To coordinate invasive species management and control programs for county, state, federal and private sector entities by developing a structure for cooperators to work together to share resources and responsibilities to address specific invasive species issues. More detailed goals are provided in the HISC Strategy 2008-2013 (Appendix 2).

HISC Measures of Effectiveness

- Advice and recommendations to Governor or Legislature, detailed in this report.
- Reports to the Legislature regarding invasive species, represented by this report.
- Approval of annual budget, detailed in this report under "HISC Resolutions."
- Meeting reports (including working groups). Detailed at the HISC website, <http://www.hawaiiinvasivespecies.org/hisc/>
- Attendance at meetings of member and collaborating agencies. Detailed at the HISC website.
- Agency adoption of innovative projects, rules and policies against invasive species, as detailed in this report.
- Number of new invasive species detected at ports of entry, detailed in this report under "Prevention."
- Names and numbers of priority pests threatening Hawai'i, detailed in this report under "HISC Resolutions" and "Advice to the Governor and Legislature Regarding Invasive Species."

- Working group goals achieved, detailed in this report under sections for each working group.

HISC Meeting Resolutions for FY11

1) HISC Budget

Since Fiscal Year (FY) 2005, HISC has received a combination of special funds from the Natural Area Reserve Fund (NARF) and, from FY05-FY08, general funds from the State Legislature. On October 27, 2010, HISC approved spending plan for FY11 of \$1,800,000 to address three of the four interrelated plan components outlined by the HISC Strategic Plan and embodied by the working groups:

- Prevention: \$155,266
- Response and Control of Established Pests: \$1,120,282
- Research and Technology: \$0*
- Public Outreach: \$224,818
- HISC Support (includes overhead and Central Service fees): \$287,634

*Funding for Research and Technology has not been provided in recent years due to a sharp reduction in the amount of special and general funds made available to HISC. While HISC previously maintained a robust Research and Technology program, in recent years funds have been diverted to other working groups in order to maintain the prevention, control, and outreach capacity that HISC has built over the years.

HISC Support (\$287,634)		Award
HISC	DOFAW Overhead (3% of \$1.8M)	\$54,000
HISC	Central Services Fee (7% of \$1.8M)	\$98,000
HISC	HISC Coordinator and Grants Manager	\$147,634
Established Pests (\$1,120,282)		
Kaua'i Invasive Species Committee	Detection and Control of Invasive Species in Kaua'i County	\$150,224
O'ahu Invasive Species Committee	Detection and Control of Invasive Species on O'ahu Island	\$122,248
Division of Aquatic Resources	Aquatic Invasive Species Program	\$280,282
Big Island Invasive Species Committee	Detection and Control of Invasive Species in Hawai'i County	\$340,280
Moloka'i/Maui Invasive Species Committee	Detection and Control of Invasive Species in Maui County	\$172,248
Hawaii Department of Agriculture	HDOA Biological Control Foreign Exploration	\$55,000
Public Outreach (\$224,818)		
Moloka'i/Maui Invasive Species Committee	Outreach on Invasive Species: Moloka'i, Maui & Lāna'i	\$24,000
O'ahu Invasive Species Committee	Outreach to Gardeners and Landscapers	\$17,500
Big Island Invasive Species Committee	Public Outreach on Invasive Species in Hawai'i County	\$30,000
Kaua'i Invasive Species Committee	Outreach for Kaua'i County	\$19,800
Pacific Basin Information Node	Hawaii Early Detection Network: Outreach	\$1,188
Hawaiian Ecosystems at Risk Project	Support of Invasive Species Public Outreach Efforts	\$20,000
Coordinating Group on Alien Pest Species	Plant Pono Website	\$3,000
Division of Aquatic Resources	Aquatic Invasive Species Outreach	\$7,000
Hawaii Department of Agriculture	4Ag Hawaii- Buy Local, It Matters PSA	\$15,000
Division of Forestry and Wildlife	Video: the Impacts of Feral Animals on Hawaiian Forests	\$12,000
HISC	Communications Coordinator	\$75,330
Prevention (\$155,266)		
Hawai'i Invasive Species Council	Hawai'i-Pacific Weed Risk Assessment	\$59,970
Division of Aquatic Resources	Ballast Water and Hull Fouling Coordinator	\$37,296
Hawaii Department of Agriculture	Hawai'i Ant Lab	\$58,000
TOTAL		\$1.8M

The funded projects listed here were carried out over FY11 and were coordinated by each of the funded

working groups. The accomplishments of each project are subsequently described in this report, organized by working group (Prevention, Response and Control of Established Pests, and Public Outreach). Minutes for meetings of the Council and the working groups are available at <http://www.hawaiiinvasivespecies.org/hisc/>

2) Council Resolutions regarding HISC and invasive species issues

HISC met on June 27, 2011 in order to close FY11 with the new Council members appointed under the administration of Governor Abercrombie. The Governor convened the meeting and appointed William J. Aila and Russell S. Kokubun as co-chairs of HISC. At this meeting, HISC reviewed a submittal regarding the functioning of HISC, as well as a submittal regarding a number of current invasive species issues. These submittals are presented in full in section VIII, "Advice to the Governor and Legislature Regarding Invasive Species." The following resolutions were passed:

1. **Regarding the functioning of HISC:** HISC directed the staff to draft administrative rules to be promulgated. These administrative rules will be associated with Chapter 194, HRS, and will describe the procedures of HISC. These rules will describe a process by which HISC may create and manage a list of species designated by HISC to be "invasive." The rules will describe the process by which HISC may delegate the authority provided by Chapter 194, HRS, to enter private property for the control of invasive species.
2. **Regarding albizia:** HISC supports the listing of albizia (*Falcataria moluccana*) as a HISC-designated invasive species through an administrative rule process. Albizia, a nonnative tree species with large, brittle branches, poses a health and human safety risk where it grows along roadsides.
3. **Regarding 'Ōhi'a rust and importation of Myrtaceae individuals:** HISC supports the establishment of a rule to restrict importation of plants in the Myrtle family into Hawai'i. HISC supports a program promoting locally grown alternatives to high-risk imports, including members of the Myrtaceae family. These measures will reduce the risk of 'Ōhi'a rust (*Puccinia psidii*) becoming established in Hawai'i. The rule process will be undertaken through HDOA.
4. **Regarding mosquito prevention and monitoring:** HISC supports the HISC working groups to assist DOA and DOH in developing a strategy to prevent and monitor the introduction of new mosquito species into Hawai'i. Certain species of mosquito are vectors for malaria, dengue fever, and other blood-borne illnesses, and as such pose a human health risk. With sharp reductions in staffing to DOH's Vector Control Branch in recent years, new solutions to mosquito prevention and monitoring must be sought.
5. **Regarding axis deer and general transport of introduced wildlife:** HISC and member agencies will pursue statutory and administrative rule changes and administrative actions to effectively control and regulate the introduction and movement of introduced wildlife species. The interisland movement of pest species poses threats to Hawai'i's environment and natural resources. The recent introduction of axis deer (*Axis axis*) to Hawai'i Island has highlighted significant gaps in existing statutes and administrative rules regarding both interisland and intransland transport of introduced species.

II. HISC Prevention Working Group

Prevention Working Group Goals

- Review risks of pest/invasive species entry into the State
- Implement measures and improve Hawai'i's capacity to prevent the entry of new pests/invasive species with shared resources and shared responsibilities of all agencies.
- A more detailed list of goals for the Prevention Working Group is in the HISC Strategy 2008-2013.

Funded Projects for FY11

The lead agency and chair for the Prevention Working Group is HDOA. In FY11, the Prevention Working Group funded three projects, totaling \$155,266:

- 1) *Hawai'i-Pacific Weed Risk Assessment*, proposed by HISC staff: \$59,970.
- 2) *Hawai'i Ant Lab*, proposed by HDOA: \$58,000.
- 3) *Ballast Water and Hull Fouling Coordinator*, proposed by DLNR/Division of Aquatic Resources, \$37,296.

Key Activities in FY11

- 265 new assessments made by the Hawai'i Pacific Weed Risk Assessment (HPWRA), totaling 1142 assessments.
- Use of HPWRA scores by landscapers, farmers, county, state, federal, and international partners.
- Potential eradication of Little Fire Ant on Maui
- Containment of Little Fire Ant infestation on Kaua'i
- Vacancy posted for a Ballast Water and Hull Fouling Coordinator to inspect and monitor marine vessels.



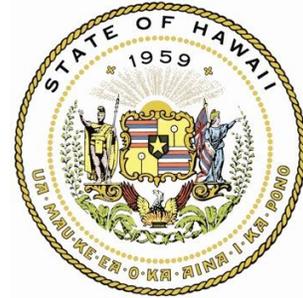
Little fire ant, *Wasmannia auropunctata*

Title: Hawai'i-Pacific Weed Risk Assessment

Organization: Hawai'i Invasive Species Council

Working Group: Prevention

Award: \$59,970



The Hawai'i-Pacific Weed Risk Assessment (HPWRA) System is an internationally recognized biosecurity screening tool that rates the potential of a plant species to become invasive in Hawai'i. The HPWRA project addresses several goals and objectives within the HISC Strategic Plan and increases the capacity and collaboration within the Prevention, Established Pests, and Public Outreach working groups. The project supports goal one of the Prevention working group, *"review risks of pest/invasive species entry into the state"*. The HPWRA improves the capacity of agencies to identify problematic species through a collaborative effort and shared resource. The Prevention objective to *"identify terrestrial and aquatic species that are at high risk of being introduced to the State or being spread within the State"* is supported by HPWRA risk analysis. This objective is identified as a high priority within the Prevention category. Increasing global trade will create new pathways and introduce more species to Hawai'i. The HPWRA System can assist in the identification of invasive species before they can impact Hawai'i's economy, ecology or human health. The HPWRA System also addresses the following Prevention objectives: to *"develop a comprehensive 'approved planting list' to ensure that invasive species are not being planted in state projects or by any state contractors, e.g. screened by the Weed Risk Assessment protocol"* and to *"develop collaborative industry guidelines and codes of conduct, which minimize or eliminate unintentional introductions."* In accordance with these objectives, two Weed Risk Assessment (WRA) Specialists continue to be employed through funding provided by HISC. The HPWRA Specialist, based in the Maui Invasive Species Committee office, has been employed in that capacity from September 2007 to present. The HPWRA Specialist, stationed at the Bishop Museum on O'ahu, has been employed as a WRA Specialist from August 2008 to present.

HPWRA was designed to assess a species by answering background questions about a plant before it is imported or widely cultivated in Hawai'i. HPWRA Botanists use published and on-line information to answer 49 questions about a plant's biology, ecology and invasive tendencies elsewhere. The answers result in a score that predicts whether a plant is likely to cause ecological or economic harm in Hawai'i and other Pacific Islands. Plants rated as "High Risk" may have a history of being invasive in other places, or exhibit traits that make them more likely to spread and threaten agriculture, human health or the natural environment. Plants rated as "Low Risk" are less likely to invade or cause harm, and plants rated "Evaluate" require further information to make an accurate prediction. The globalized economy has increased the risk of biological invasions worldwide, and similar versions of this screening system are now being used in Australia, New Zealand and a growing number of other countries. By preventing importation or cultivation of high risk plants before they become a problem, HPWRA is a cost-effective tool that will save Hawai'i money needed to control and eradicate these potential future pests.

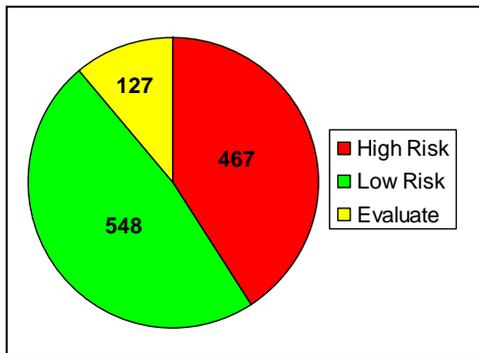
HISC Prevention: Measures of Effectiveness

The principle objective of the WRA Specialists is to complete new assessments and update previously completed assessments with current information, both for the species already present in the Hawaiian Islands, as well as for new species introductions. This information is then summarized and disseminated to the requesting individual or agency via direct correspondence of completed assessments, and to the

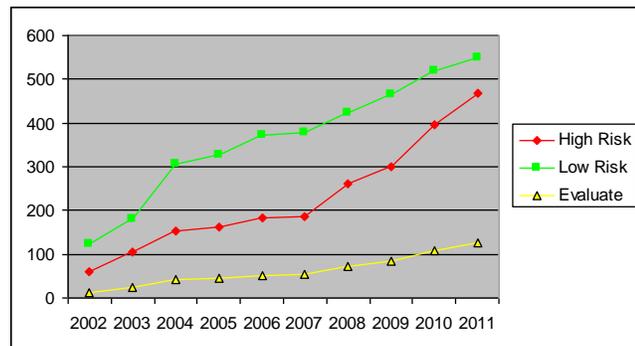
public and land management agencies through technical and general publications, public presentations, and other outreach activities.

Assessments Completed to Date

- As of June 2011, 1142 assessments have been completed and assigned to categories of “High Risk” (i.e. predicted to become invasive in Hawai'i or other Pacific Island ecosystems), “Low Risk” (i.e. not predicted to become invasive in Hawai'i or other Pacific Island ecosystems), or “Evaluate” (i.e. needs further information to make a prediction of invasiveness). A continually revised and updated list of completed assessments, as well as individual assessment reports, are available upon submitting a request to hpwra@yahoo.com.



1142 assessments by risk category

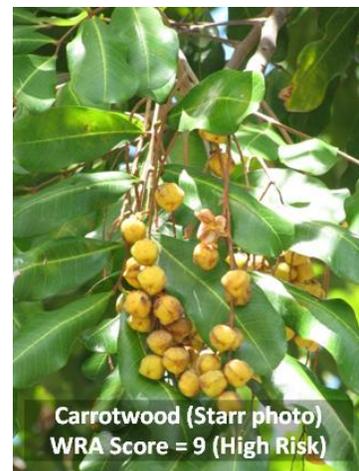


Cumulative assessment total by year and risk category

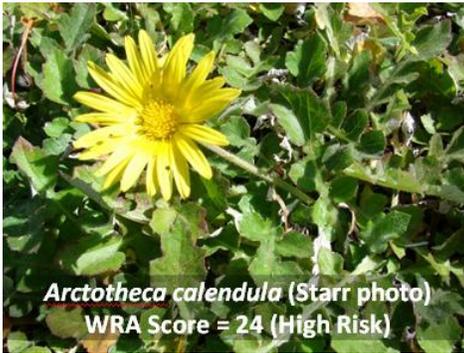
Weed Risk Assessment Requests by Affiliation

During the period of July 1, 2010 and June 30, 2011, HPWRA Specialists received 265 requests to assess potential invasiveness of new plant species or to revise previous assessments. These requests originated from both members of the general public as well as individuals associated with island invasive species committees, county, state and federal government agencies, private businesses, nurseries and botanical gardens, university researchers and extension agents, and international invasive species organizations, among others. The HPWRA website, <http://www.hpwra.org>, hosts the majority of assessments that have been completed to date. The following is a list of highlights and accomplishments during this time period:

- Island Invasive Species Committees (ISCs):** WRA Specialists continue to assess plant species requests from O’ahu (OISC), Kaua’i (KISC), Maui (MISC), Moloka’i (MoMISC) and the Big Island (BIISC) Invasive Species Committees to aid in early detection and prioritization for control of potential invasive plants. Assessments provide scientifically researched information on a species’ potential invasiveness to Hawai'i and other Pacific Islands and a concise, consolidated source of current references useful to assist in management decisions. As an example, the KISC Program Coordinator requested an assessment for *Cupaniopsis anacardioides*, Carrotwood Tree (High Risk), in support of early detection and control efforts on the island of Kaua’i. Incidentally, this High Risk designation also resulted in the removal of this tree from consideration in the Maui County Planting Plan. The assessment and



High Risk designation of *Acacia retinodes*, Water Wattle, completed upon request from MISC program staff, confirmed this species as a priority for control efforts by MISC staff on East Maui.



- **Early Detection and Rapid Response Teams:** HPWRA is regularly utilized as an integral component of plant species prioritization efforts by the Invasive Species Committee's Early Detection teams. The HPWRA Specialists have provided assessments on requests from O'ahu, Maui and Big Island Early Detection staff. Several of the completed assessments include high risk taxa such as *Setaria italica*, *Blutaparon vermiculare*, *Senna artemisioides*,

Cissus verticillata, *Begonia foliosa*, and *Ochroma piramidales* on O'ahu, *Melastoma sanguineum*, *Sideroxylon persimile*, *Verbascum thapsus*, and *Arctotheca calendula* (fertile variety) on Maui, *Phyllanthus reticulatus* and *Buddleja madagascariensis* on the Big Island, *Tabebuia pallida*, *Banksia spinulosa*, *Acacia pycnantha*, and *Anigozanthos flavidus* on Kaua'i, and the low risk or Evaluate species *Ficus virens*, *Clausena lansium*, *Pouteria caimito*, *Inga edulis* on Moloka'i (See <http://www.hpwra.org> for complete assessments).

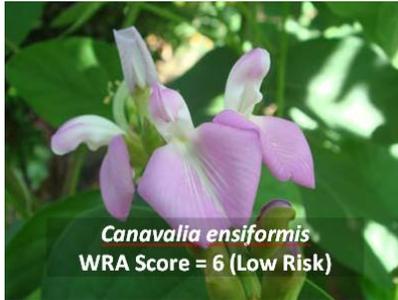
- **Federal and State Agencies:** Federal and state agencies have requested Weed Risk Assessments for plant species that are invading natural areas. Agencies that have requested weed risk assessment include the United States (US) Fish and Wildlife Service, the US Department of Agriculture (USDA)- Forest Service, the USDA Service Center, Kalaupapa National Historical Park, the US Army Garrison Hawaii Natural Resource Program and from the State of Hawai'i's DOFAW. Of particular interest were requests submitted by Jane Beachy, Ecosystem Restoration Program Manager of the O'ahu Army Natural Resource Program in collaboration with the O'ahu Early Detection Team. Notable finds on US Army lands included such notorious invasives as *Chromolaena odorata*, Siam weed (High Risk), and *Miscanthus floridulus*, Giant Miscanthus (High Risk), widespread weeds of Guam and other Pacific Islands, that may have accidentally been introduced through military training activities.



- **Maui County Planting Plan, County of Maui:** WRA Specialists continue to collaborate with Ernest Rezens, retired Maui Community College Professor of Agriculture and planting plan coordinator, to screen species proposed for use in the revised Maui County Planting Plan. The county government, with input from the Maui County Arborist Advisory Committee, has adopted information and followed guidelines provided by the Hawai'i-

Pacific Weed Risk Assessment System to promote the use of non-invasive plants in county landscaping projects, and to avoid planting of high risk, or known invasive species. Using the revised plan, the County of Maui hopes to lead by example in their efforts to encourage responsible planting of non-invasive species in both public, and private landscaping projects, as primarily identified by the weed risk assessment screening system. In addition to the previously

screened species, five newly identified high risk taxa were removed from the plan, and twenty four low risk taxa were added.



- **Other Public and Private Organizations, Individual Plant Growers, and Landscape Professionals:** The HPWRA Program receives information and screening requests from plant growers, landscape professionals, and both public and private individuals and institutions including the Maui Lavender Company, Malama O Puna, Kaua'i Nursery and Landscaping, Honolulu Botanical Gardens, University of Hawai'i faculty and students, and

others to assess a species or lists of species including new development planting lists for known or potentially invasive plant species. Of particular interest was a request submitted by Dr. Ken Grace, CTAHR on behalf of coffee farmers in Kau. The species of interest was *Canavalia ensiformis*, Jack bean (Evaluate), which was designated as Low Risk using the WRA Secondary Screening Decision Tree. Coffee growers expressed interest in using this species as a groundcover to sustainably control the Coffee Berry Borer, but wanted to make sure they were not contributing to a new invasive species problem in the area.

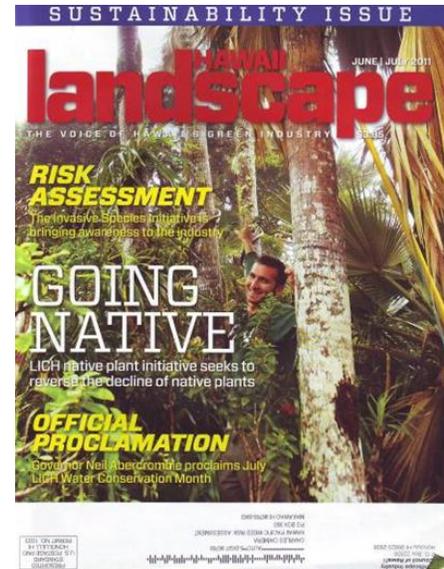
- **International Collaborations:** WRA Specialists continue to collaborate with and provide assessments and information to invasive species groups throughout the world, with a particular emphasis on tropical islands of the Pacific. Such groups as the Pacific Invasives Learning Network (PILN), the Pacific Invasives Initiative (PII) and the International Union for Conservation of Nature Species Survival Council (IUCN SSC) Invasive Species Specialist Group have utilized assessments and other information generated by WRA specialists in their education and prioritization processes. Bill Nagle, Research Fellow/Project Coordinator for PII, states that his organization works "in most (but not all) Pacific countries and territories with a range of agencies..." and that, for both educational and technical purposes, the Hawai'i WRA's "are the most valuable tool we have."



Biofuels Assessments & Publications: The Weed Risk Assessment System continues to be utilized as an objective tool to identify both low and high risk crops proposed for biofuel development in the Hawaiian Islands and other tropical and temperate island ecosystems. WRA Specialists continue to be involved in providing updated information to the public, industry and conservation agencies on the results of biofuel risk assessments and other findings and have attended public meetings, provided technical advice, and have collaborated with the Hawaii Biofuels Foundation, the USDA Biofuels Roadmap, and the Roundtable for Sustainable Biofuels.

HPWRA Outreach: To continue to promote awareness and encourage adoption of the HPWRA System, WRA Specialists have been involved in additional outreach activities with partner agencies, signatories of the Codes of Conduct and other interested parties. The following highlights additional outreach activities and efforts in greater detail.

- **Landscape Industry Council of Hawaii (LICH):** Weed Risk Assessments were featured on the cover of the June/July 2011 issue of *Hawaii Landscape*, LICH's new publication launched in April 2011. The issue featured an article on the industry's adoption of the Voluntary Codes of Conduct, which encourages participating groups such as the Hawaii Island Landscape Association, Kaua'i Landscape Industry Council, Maui Association of Landscape Professionals, and the O'ahu Nursery Growers Association, among others, to discontinue use or sale of high risk and invasive plants as identified by HPWRA.
- **University of Hawai'i Maui College Presentation:** On September 20, 2010, a lecture was presented to the Hawaiian Field Biology (BIO 105) class on the Hawai'i-Pacific weed risk assessment as well as on current and future invasive species threats to native Hawaiian ecosystems.
- **Silent Invasion Update for the Coordinating Group on Alien Pest Species:** A presentation on the Hawai'i-Pacific Weed Risk Assessment and the need for revisions to the state's restricted plant and noxious weed rules was given to the Hawaii State Legislature as part of the 2011 CGAPS Silent Invasion Update.
- **Pacific Invasives Learning Network:** An update on the status and both current and future developments with the Hawai'i-Pacific Weed Risk Assessment was included in the April 2011 edition of PILN Soundbites, the monthly newsletter of PILN reporting on news from the teams and the Pacific Invasives Partnership.
(http://www.sprep.org/piln/topics/documents/PILNSoundbitesApril2011_final.pdf)
- **Project Learning Tree:** On June 11, 2011, a presentation on the Hawai'i-Pacific Weed Risk Assessment was given to participants of a Project Learning Tree workshop at Maui Nui Botanical Garden. Project Learning Tree is an award-winning environmental education program designed for teachers and other educators, parents, and community leaders working with youth from preschool through grade 12.
- **Pacific Island Ecosystems at Risk (PIER):** The new edition of the PIER website provides information on over 1800 invasive and potentially invasive plant species of concern to the Pacific Islands and has incorporated 185 new risk assessments provided by the Hawai'i-Pacific Weed Risk Assessment. There are now over 1700 risk assessments listed. PIER can be accessed at: <http://www.hear.org/pier/>
- **CTAHR Publications:** An orchid publication that examines the naturalization of orchid species in Hawai'i was written in 2011 (in review).



Other technical and professional contributions

In addition to fulfilling assessment requests, both WRA Specialists continue to provide on-call technical information and advice on invasive plant species to both members of the conservation community and the general public.

On O'ahu, the Weed Risk Assessment Specialist communicates invasive species issues to the Botanical Department of the Bishop Museum and to state and federal agencies and members of the horticulture industry and the public. In addition, the specialist continues to collaborate and build capacity within the conservation, agriculture and business communities. A few of these efforts are highlighted below:

- Collaborating with CTAHR to address invasive weed issues and share knowledge from natural areas research and agricultural research
- Addressing biological data standards needs with the Bishop Museum and the US Fish and Wildlife Service (USFWS). Invasive species survey protocol and identification methods, including training methodology are focuses.
- Reviewing and reporting the status of endangered plant species on O'ahu for USFWS's requirement for the Endangered Species Act. Recommended management actions including invasive species (plant and animal) control efforts.
- Working on post-border entry assessment methodology for Hawai'i with the O'ahu Early Detection team.
- Supporting efforts to promote science education for Hawai'i's children, by mentoring high school students through the Hawaii Academy of Science and participating as a judge for the Hawaii State Science Fair.
- Collaborating with the City and County of Honolulu's Community Recreational Gardening Program to educate community gardeners about invasive species.

On Maui, the Weed Risk Assessment Specialist serves as a technical expert for MISC, disseminating information to members of the general public that request information on plant identification and weed control strategies. In addition, the specialist has participated in or contributed to a number of activities pertaining to invasive species and conservation in the Hawaiian Islands, including the following:

- Oral presentation at the 2010 Hawai'i Conservation Conference entitled "Where Have All the Epiphytes Gone? Epiphyte decline on *Psidium cattleianum* in two Hawaiian wet forests" (04 August 2010)
- *Cortaderia jubata* backcountry control trip with MISC staff (30 August – 03 September 2010)
- Collaborated with Dr. James Leary (CTAHR) to set up *Rauvolfia vomitoria* herbicide & seed bank trials on Hawai'i Island (15-17 September 2010)
- Participated as a judge in the Iao School Science Fair for 6th-8th graders (02 December 2010)
- Invasive biofuels presentation to DLNR Honolulu staff (25 January 2011)
- Initiated monitoring in Kanaha Pond State Wildlife Sanctuary to document tsunami impacts on native and non-native coastal vegetation in collaboration with Dr. Fern Duvall (28 March 2011)
- Participated in *Pennisetum setaceum* surveys & conducted a botanical survey of gulch vegetation in collaboration with MISC on Lāna'i (23-25 May 2011)
- Peer review of paper for *Biological Invasions* journal entitled "Bird species richness and visitation frequencies on alien and indigenous shrubs in the South African Cape Floristic Region"
- *Rauvolfia vomitoria* monitoring and seed longevity experiments, and *Falcataria moluccana* herbicide trials (23-25 June 2011)
- Native & non-native vegetation tsunami impact monitoring at Kanaha Pond State Wildlife Sanctuary (29 June 2011)

Current and Future Workload: Individuals, agencies and programs continue to submit plant species for screening on a regular basis, and the WRA Specialists continue to produce new assessments, work on publications, and answer technical questions relating to particular species and their invasive potential. WRA Specialists also directly provide recommendations on utilization of Low Risk alternatives to invasive plants in both public and private landscape and horticultural projects. In addition, previously completed assessments in the Excel spreadsheet format will be revised and entered into the new database as time permits. Both older, as well as future assessments, will be utilized in support of the new "Plant Pono" website currently under development and anticipated to be launched in late 2011. This website will

incorporate HPWRA-generated content in order to promote Low-Risk alternatives to the horticultural and landscaping industries, as well as to the general public.



**SUPPORT TO THE HISC:
HAWAI'I ANT LAB,
SUMMARY OF MAIN ACHIEVEMENTS
2010-2011**



Title: Hawai'i Ant Lab

Organization: Hawaii Department of Agriculture

Working Group: Prevention

Award: \$58,000

Objective: To prevent the entry and spread of invasive ants in Hawai'i.

Highlights

This past year has seen the appointment of two key staff in the Hawai'i Ant Lab (HAL). This has been necessary in order to meet the growing workload of invasive ant management. Together, Ms. Michelle Montgomery (research technician) and Mr. Brent Sheehan (research assistant) bring substantial skills, expertise and capacity to the HAL.

New www.littlefireants.com web page

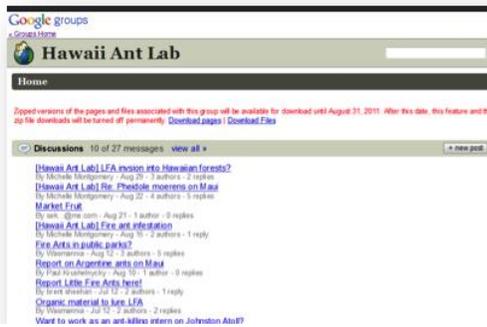
The little fire ant website has been very well patronized and by April 2011, it became apparent that the site had become too complex for the basic software used to create it. As a result, the entire code was re-written using more sophisticated software and migrated to a dedicated hosting service. Between September 2010 and August 2011, a total of 2,307 people visited the site with 4,014 page views (Table 1). Most visits were from the United States (1,828) and within Hawai'i, O'ahu (824) and the Big Island (569) accounted for most visits. Monthly visit numbers increased through the year from 142 in September 2010, to 251 in August 2011 (Figure 1).

Table 1. break-down of visitors to the www.littlefireants.com website (September 2010-August 2011)

category	# visits
total visits	2307
total page views	4014
-visits by country	
United States	1828
French Polynesia	158
Pacific region	68
Australia	55
-within-Hawai'i visits	
O'ahu	824
Big Island	569
Mauai	80
Kaua'i	17



Screen shot of the Hawai'i Ant Lab home



Screen-shot of Hawai'i Ant Lab discussion group and blog

The Hawai'i Ant Lab discussion group

An internet discussion group and blog was started in July 2011. The Hawai'i Ant Lab discussion group allows residents, industry, outreach, research and extension to interact with each other, as well as proving a point of contact to announce various new initiatives and for people to ask specific questions about invasive ants.

<http://groups.google.com/group/littlefireants?hl=en>

Maui Fire Ants Pau?

HAL worked to develop and implement an eradication plan for Little Fire Ants in Maui. Working closely with MISC, Maui County, HDOA and others; the eradication plan includes outreach, survey and eradication activities. To date the infested site has been treated 11 times (October 2009-September 2020). Three post treatment surveys have been conducted since that time and no Little Fire Ants have been detected since February 2010. The results of this work have been published in the Proceedings of the Hawai'i Entomological Society.



Mr. Kyle Onuma of HDOA Plant Pesticide Branch Hilo treating Little Fire Ants on Maui

Little Fire Ants in Kona

LFA were detected in the Kailua-Kona area in January 2010. Since September 2010, one additional site has been discovered. A Kona LFA Taskforce has been established to oversee survey and eradication activities. At this time, each site is being visited regularly and treated if Little Fire Ants are detected.

A grant from USDA will be used to develop and implement a cooperative nursery scheme for retail and landscape nurseries in the Kailua-Kona area. The purpose of the scheme is to encourage nurseries to voluntarily implement best practice management systems that prevent further spread of invasive species.

Acquisition of additional funding sources

The original HISC budget allocation for the State Ant Specialist has been used to lever substantial additional funding:

- US Senate Farm Bill grant \$28,000 (development of nursery pest ant management programs). This award extends the previous farm bill grant of 2010-2011.
- USFS Western Division Competitive Forestry Grant \$200,000 (a multi-nation grant that takes a regional approach to invasive ant prevention and moves some ant risks to Hawai'i off-shore)

- T-STAR research grant \$117,000 – economic impact analysis of LFA in Hawai'i. (co-PI, travel only)
- DOFAW non-competitive grant \$25,000 to conduct a planning workshop for response and management of new ant incursions in the Pacific.

Activities contributing to preventing entry and spread of invasive ants

The salary and associated costs of the State Ant Specialist in 2011 were funded through the HISC Prevention Working Group. As such, all activities fall under the “prevention” category. Preventing the entry and spread of invasive species is the most cost effective approach to invasive species management. Prevention activities include those that might also be associated with outreach, detection, pest management and eradication.

1. Preventing entry of invasive ants

Off-shore risk management



Participants for the invasive ant survey training package in Palau

Shipping and human movements have long been recognized as the main vector for introduction and spread of invasive ants (and many other organisms). “Off-shore” risk management is now considered the starting-point for biosecurity management by New Zealand and Australia who are recognized world leaders in biosecurity systems. Reducing the risk that a vector presents prior to commodities arriving at the border directly influences rates of new introductions. HAL has actively engaged US Affiliate nations in the Pacific to develop a regional response to the threat of invasive ants by developing and implementing detection surveys, response plans for target invasive ant species and strengthening the biosecurity capacity

of Pacific jurisdictions. The funding provided by HISC to the Hawai'i Ant Lab has been used to lever a major grant from USFS (\$200,000) for this purpose. This grant will be used in part to reduce the threat of invasive ants for US affiliates in the Pacific, which in turn reduces Hawai'i's exposure to incursions arising from some of our biggest trading partners. This regional approach has previously been embodied in the Hawai'i Ant Plan and the Pacific Ant Prevention Plan. In the past year, 102 quarantine officers, conservation staff and forestry employees were trained at five locations in Micronesia.

Standardizing ant surveys at points of entry

Standard Operating Procedures have been developed for points of entry and are now used by the Cooperative Agricultural Pest Survey (CAPS) Program. These new operating procedures offer improved survey quality as well as being more efficient. All data are now collected with sample-level global positioning system co-ordinates for direct entry into the CAPS database and to implement rapid responses to new incursions. For the Island of Hawai'i, HAL staff survey each point of entry twice per year to ensure rapid detection of any new threats.

Maintain international networks within the invasive species and biosecurity community

The State Ant Specialist presented a paper at the 2011 Pacific Branch of the Entomological Society of America at their annual conference held in Kona. An extensive network of colleagues in the Pacific region and mainland USA help Hawai'i to keep abreast of latest threats from invasive ants, new chemicals and treatment methods as well as developments in survey techniques.

2. Preventing inter-island spread of invasive ants

The most serious invasive ant present in Hawai'i is LFA. It is devastating natural ecosystems, agricultural enterprises and the lifestyles of residents along the east coast of the Big Island. Preventing the spread of LFA to other islands in the Hawaiian archipelago and the west coast of the Big Island is a high priority. Activities that contributed to preventing this are listed below:

Development of ant management systems for fruit, foliage and cut flowers

Recently, HDOA/Pest Quarantine Branch conducted a "blitz" inspection of agricultural products being shipped from the Big Island to neighbor islands. The outcome of this intensive inspection exercise was that many produce items (fruit, flowers and foliage) were found in LFA. In response, HAL has commenced a large-scale ant management demonstration on a commercial fruit farm near Hilo. New pest management strategies are being developed and tested. The outcome of this research will help develop best-practice guidelines for management of LFA on large-scale farming ventures.



Image showing part of the area on Kauai infested with Little Fire Ants

Training of Moloka'i Invasive Species Committee staff

Following concerns about the potential for spread of LFA from the Big Island to Moloka'i, staff from the Moloka'i Invasive Species Committee traveled to Hilo where a training package on invasive ant awareness was delivered.

Eradication of Little Fire Ants from Kaua'i

A small infestation of LFA has existed on Kaua'i since 2000. It has been kept from spreading by constant (but *ad hoc*) efforts of HDOA staff on the Island. Past efforts have not succeeded in eradicating the infestation, mainly due to access, terrain and non-availability of arboreal control methods. New treatment methods and a breakthrough in access issues have allowed the formulation of an eradication strategy.

Planning for the eradication of this pest from Kaua'i is in its final stages. Difficulties encountered to date include steep terrain over a portion of the site, selection of optimum treatment products, registrant concerns and the proximity of the treatment area to water.

3. Preventing intra-island spread of invasive ants

Preventing spread of LFA from Hilo to Kailua-Kona

The climate and terrain of the Big Island present natural barriers for the spread of LFA between the east (rainy) and west (dry) sides of the island. This is further accentuated by the location of the two major urban centers of Hilo and Kailua-Kona. HDOA and HISC strategies have recognized this and past efforts have focused on preventing the westward spread of this species. Unfortunately, after 10 years, LFA were detected in Kona (January 2010). Since their discovery, the Hawai'i Ant Lab visits each infested site on a regular basis, monitors, and treats if ants are still present.

Preventing jump-dispersal

The most common way that LFA spread from property to property is through “jump-dispersal” a situation where items infested with LFA are carried onto a new site by people. The highest risk materials are plants and organic materials such as soil and mulch. Activities that limit this form of spread included:

- Detection of LFA at the Hilo County green-waste site. LFA were detected at the green-waste center in Hilo. The waste is mulched, then taken by residents to add to their gardens as a soil improver. Infested material would therefore result in many new locations becoming infested. The State Ant Specialist worked with Hawaii County and the contractor to develop a plan and treatment schedule that controlled LFA at this site.
- Assisted major export nurseries by developing nursery eradication programs for LFA. These nurseries together produce millions of plants per year for export and domestic sale.
- Developed and implemented a training package for plant vendors at Makuu farmers market. This package included training on detection of LFA in potted plants as well as appropriate quarantine treatments. It is hoped to expand this program to include all farmers markets.



“Jasmin” from Keaeu, showing the effects of multiple fire ant stings on her eyes

Preventing local spread

The final type of LFA range expansion occurs at the local level – natural spread as colonies become larger and occupy more space. The spread of LFA from one home to a neighbor is becoming more common. Examples of activities in this category included:

- Provided ongoing ant identification services to the public and industry on ad-hoc basis
- Produced fact sheets with detailed instructions on detecting LFA around homes and instructions on how to control infestations (see www.littlefireants.com)
- Training sessions on ant control methods to Hilo licensed pest controllers.

Emerging ant pest threats

Brachymyrmex obscuria (Rover Ants)

This species has been present in Hawai'i for many years, reportedly not common. In the past two years, golf course managers and people living near large areas of turf have noticed large alate swarms of flying ants. These have been severe enough to drive golfers at Hualalai Golf Course Resort off the course. On closer examination, it appears this ant species readily forms mutualistic associations with root homoptera of grasses which enable it to form large, continuous super-colonies below the ground. Aside from the implications for plant health, the ant becomes a pest due to the alate flights experienced in mid-late summer. No research activities were conducted for this species in 2011.

Tapinoma sessile (Maui)

A small infestation of *Tapinoma sessile* has been discovered by Dr. Paul Krushelnycki (UH) on Maui. This species has the potential to become a major pest species with impacts similar to Argentine Ants. No further activities have been conducted for this species in 2010.

Outreach

Outreach activities in FY11 have focused on engaging the public and the green industry and increasing awareness of invasive ants and the key risk pathways. This information has been imparted through presentations to industry groups and direct engagement of individuals who made direct contact with HAL. Over 20 presentations have been delivered to various bodies with an estimated total participation of 1200 people.

- I. Plant growing interest groups:
Hilo Master Gardeners, Hawaii Vireya Society annual conference, Senior Lectures program, Hilo, Hawaii Bamboo Society annual conference, UH Cooperative Extension Service
- II. Community groups
Keauhou Resort Homeowners Association, Kona, Kona Outdoor Circle, Kona,
- III. The green industry
Big Island Association of Nurserymen, Hawaii Export Nursery Association, Big Island Golf Course Superintendent Association, Hawai'i Environmental Health Association, Landscape Industry Council of Hawai'i, Hawai'i Island Landscape Association
- IV. The Pest Control Industry
BEI ant control workshop, Hilo; Crop Production Services annual seminar, Honolulu
- V. Government and NGOs
Kona Farm Bureau, US Customs and Border Protection, Testimony to the Hawaii County Environmental management Committee
- VI. Media coverage
Extensive participation and collaboration in the filming of a documentary on LFA impacts in Hawai'i and Tahiti. In 2010, a total of 34 web pages were published with stories and information on LFA containing the search words "cas vanderwoude" + "fire ants" + Hawai'i.¹

The Department is in the planning phases for an Ant Training Workshop for outreach specialists and other key communicators. The workshop will focus on providing information on the biology of invasive ants, ecosystem and economic damages caused by invasive ants and methods of control. It will consist of lectures, group discussions and site visits

¹ A total of 329 web pages regardless of publication year

Research

- Improved and extended the range of chemicals suitable for control of arboreal ants and ground treatment in high rainfall locations.
- Improved and simplified the adjuvants used in arboreal treatment projects.
- Developed additional application tools that allow bait to be applied to trees without the need for climbing.
- Published in the Proceedings of the Hawaiian Entomological Society describing and documenting the eradication of LFA in Maui.
http://scholarspace.manoa.hawaii.edu/bitstream/handle/10125/19914/PHEs-Vanderwoude-42_23-31.pdf?sequence=1
- Currently evaluating the palatability of commercially available ant baits in Hawai'i.

In progress:

- Co-PI on a study to measure the economic impacts of LFA in Hawai'i (T-STAR grant, no salary)
- Developing and testing new dis-infestation systems for potted plants
- Studying the impacts of LFA on Hawaiian forest ecosystems
- Large-scale demonstration project on controlling LFA in orchards.

Title: Ballast Water and Hull Fouling Coordinator

**Organization: Division of Aquatic Resources,
Department of Land and Natural Resources**

Working Group: Prevention

Award: \$37,296



In FY10, the Division of Aquatic Resources (DAR) lost its Ballast Water and Hull Fouling Coordinator. During FY11 the position was vacant and minimum duties were carried out by the Aquatic Invasive Species (AIS) Program Leader using HISC funds. These minimum duties included evaluating ballast water reports weekly to ensure that compliance was followed by shipping industry; attending California State Lands Commission, Marine Invasive Species Program, and Vessel Fouling Technical Advisory Group meetings where hull fouling regulatory documents are being drafted; and conducting occasional hull fouling inspections partnered alongside representatives from the US Coast Guard (USCG) or the Papahānaumokuākea Marine National Monument (PMNM).

Other duties of this position that have not been conducted include:

- 1) Maintain ballast water database,
- 2) Coordinate the Alien Aquatic Organism Task Force,
- 3) Develop hull fouling management policies and guidelines,
- 4) Maintain equipment for hull inspections.

HISC Strategic Plan:

- Identify and seek to manage possible vectors and pathways of terrestrial and aquatic invasive species into and throughout Hawai'i. Important pathways for introductions include: legal and illegal national and international trade, tourism, shipping, ballast water, fisheries, agriculture, construction projects, ground and air transport, forestry, horticulture, landscaping, pet trade and aquaculture.
- Prevent the movement of known invasive species between islands.
- Minimize aquatic invasive species introductions focusing on the highest risk pathways, e.g., hull fouling.

HISC Prevention: Measures of Effectiveness

Current measures in place to prevent invasive species arrival and establishment:

The DAR Ballast Water and Hull Fouling Program worked to prevent invasive species arrival and establishment through two mechanisms. One mechanism was to maintain and keep track of mandatory ballast water reporting requirements for all eligible vessels. The second mechanism was to conduct hull fouling inspections on vessels entering the PMNM or vessels in state waters deemed to be heavily fouled.

Ballast Water Reporting

All commercial vessels entering state waters must submit a Ballast Water Reporting Form to DAR 24 hours prior to arrival. This report gives details as to where the ship's last port of call was, where they

last exchanged ballast water, and if they plan to release ballast water in state waters. Because the Ballast Water and Hull Fouling Coordinator position was vacant, the AIS Program Leader monitored reports to ensure that compliance of all best management practices were followed. However, the reporting database was unable to be maintained, which caused the program to be unable to keep track how many reports were generated. To date, there are no outstanding reports from known maritime traffic.

Hull Inspections

Hull inspections are jointly carried out by DAR and the PMNM. Since the departure of the Ballast Water and Hull Fouling Coordinator, the Monument has conducted many of the inspections with occasional assistance from the AIS Team. The AIS Team also receives notification from the USCG when they inspect a vessel and observe heavy fouling. Upon notification from the USCG, the AIS Team will further inspect the vessel and obtain samples of the fouling to determine if alien invasive species are present. During FY11, no alien species were detected on any heavily fouled vessels.



Gooseneck barnacles found during hull inspection alongside U.S. Coast Guard. This is not a species of concern.

DAR still maintains all equipment required for the hull inspections. This equipment includes several types of cameras and most notably a remotely operated vehicle.

Funding from HISC has helped maintain inter-agency partnerships and maintain the Ballast Water Program at minimal capacity until the vacant coordinator position is filled.

DLNR is currently trying to fill the Ballast Water and Hull Fouling Coordinator position as a State civil service position, but it has been labeled “no action.” It is not expected to be returned to a civil service position in the near future, so DAR created a temporary position under PCSU to maintain the duties of this position using HISC FY11 funds. Due to delays in encumbrance, interviews for this position were not conducted until April 2011; however none of the candidates were determined to be qualified. The position was posted a second time, and a qualified applicant has now been selected and will begin work in November 2011.

For any questions/comments please contact Jono Blodgett, jb88@hawaii.edu, 808-256-3095.

III. HISC Response and Control of Established Pests Working Group

Response and Control of Established Pests Working Group Goals

- Review priorities for the control of pests already present or recently arrived in the state
- Implement cost effective eradication and control programs against incipient and established pests with shared resources and shared responsibilities of all agencies.
- A more detailed list of goals is given in the HISC Strategy 2008-2013.

Funded Projects for FY11

The lead agency for the Response and Control of Established Pests Working Group (also referred to as simply the Established Pests Working Group) is DLNR. In FY11, the Response and Control of Established Pests Working Group funded six projects, totaling \$1,120,282:

- 1) *HDOA Biocontrol Foreign Exploration*, HDOA: \$55,000
- 2) *Detection and Control of Invasive Species in Kaua'i County*, Kaua'i Invasive Species Committee: \$150,224
- 3) *Detection and Control of Invasive Species on O'ahu Island*, O'ahu Invasive Species Committee: \$122,248
- 4) *Detection and Control of Invasive Species in Maui County*, Moloka'i and Maui Invasive Species Committees: \$172,248
- 5) *Detection and Control of Invasive Species in Hawai'i County*, proposed by the Big Island Invasive Species Committee: \$340,280
- 6) *Aquatic Invasive Species Team*, proposed by DAR, DLNR: \$280,282

Key Activities in FY11

- Evaluation of biological control agents for maile pilau
- Potential eradication of coqui frog from Kaua'i
- Removal of 807 immature miconia plants from O'ahu
- All known fireweed removed from Moloka'i
- Extensive control of coqui frog on Maui
- Development of an Axis Deer Control Strategy on Hawai'i Island
- Completion of 4-year botanical survey on Hawai'i Island
- Staff from island-based Invasive Species Committees trained to respond to an invasion of Brown Tree Snake
- Use of native urchins to control invasive *Kappaphycus* algae on coral reefs in Kaneohe Bay



Miconia, *Miconia calvescens*

Title: Hawaii Department of Agriculture (HDOA) Biological Control Foreign Exploration

Organization: HDOA Plant Pest Control Branch

Working Group: Established Pests

Award: \$55,000



Background

The primary mission of the HDOA Plant Pest Control (PPC) Branch is to provide a favorable environment for agricultural development in Hawai'i and to protect the natural environment from invasive species by eradicating and controlling plant pest populations that have the potential to cause significant economic damage. This is achieved through statewide programs using chemical, mechanical, biological, and integrated control measures for early detection, rapid response, containment, and eradication/control of plant pests, including insects and mites, molluscs, weeds, and plant pathogens.

HDOA's Biocontrol Program has effectively controlled many invasive pests in Hawai'i which were not amenable to control by other means. This proposal requested funding for PPC foreign exploration and operations to address some of PPC's primary biocontrol targets, particularly fireweed, maile pilau, fountain grass, banana aphid, Miconia, and small hive beetle.

Project Objectives

- Two foreign exploration trips for natural enemies of HDOA target species. One trip in Africa (fireweed, fountain grass, and small hive beetle) and one in SE Asia (banana bunchy top disease, melon fly, and maile pilau). Each trip will be approximately 2-3 months in duration and will involve searching for and onsite field evaluation of insect and pathogen natural enemies of the HDOA target pests in those regions.
- Potential candidate natural enemies will be brought back to the HDOA Containment Facilities for further research and evaluation to determine potential effectiveness and host specificity.
- Investigate feasibility of *Ditylenchus* nematodes (currently in the HDOA Containment Facility) and the fungus *Coccidiella miconiae* or other *Coccidiella* species to control *Miconia* and *Clidemia*.

Funding Received

HISC awarded \$55,000 in special funds with an associated \$22,482 in general funds from DOFAW, totaling \$77,482 for FY11 towards this grant request. However HDOA did not receive the funds from HISC until May 2011. This made it impossible to fully meet the objectives, particularly the foreign exploration. As such, \$22,000 was spent and the remaining \$55,000 will be carried over into FY12.

Accomplishments

Foreign Exploration

The HISC funding was not used for foreign exploration due to the fact that the money was received at the end of the fiscal year. However, the HISC funds were used for research and evaluations of natural enemies which were in the containment facility. The HDOA/PPC Exploratory Entomologist traveled to Thailand and Laos from October to December 2010 to search for biocontrol agents of the skunk vine or 'maile pilau' (*Paederia foetida*). An encroaching and invasive weed in Hawai'i, 'maile pilau' smothers shrubs, trees, and native flora in dry to wet forests. Moreover, the weed inhibits the growth of perennial crops and encroaches landscapes readily in moist to wet areas. Several plant-feeding insects and three

pathogens infesting 'maile pilau' and other species of *Paederia* were collected and quarantined at the HDOA Containment Facilities in Honolulu. The insects are the leaf-tying moth (Lepidoptera: Crambidae), hawk moths (Lepidoptera: Sphingidae), herbivorous rove beetle (Coleoptera: Staphylinidae), chrysomelid leaf beetle (Coleoptera: Chrysomelidae), sharpshooter leafhopper (Hemiptera: Cicadellidae), and leaf-sucking lace bug (Hemiptera: Tingidae). The pathogens are *Colletotrichum gloeosporioides*, *Pseudocercospora paederiae*, and *Endophyllum paederiae*. Tests are currently being undertaken to evaluate their efficacy for suppression of the noxious weed and potential risks they may pose to non-target organisms in the natural habitat. (see Figures 1 & 2)

Support for ongoing biological control projects

These HISC funds were also used to culture, disseminate, and conduct post-release field evaluations of natural enemies to control the nettle caterpillar and the erythrina gall wasp.

(a) The stinging nettle caterpillar (*Darna pallivitta*) which was first recorded in September 2001 in Panaewa in Hilo on the Big Island has spread to Maui, O'ahu, and recently, Kaua'i. A pest of high value plants, including ornamental palms, pasture grasses and indigenous flora, it is equally harmful to people who may come in contact with the spiny caterpillar because of skin allergies that may result from its sting, such as, itchy rashes, burning sensation, or welt formations. In 2004, a natural enemy of the nettle caterpillar, a parasitic wasp (*Aroplectrus dimerus*), was collected in Taiwan. Determined to be host specific to the nettle caterpillar, HDOA commenced to liberate the wasp on O'ahu and neighbor islands in April 2010. To date, as many as 10,000 parasitoids have already been propagated at the HDOA Insectary in Honolulu and released on the islands where pest infestations have been detected or reported by nurseries, residents, and other stakeholders. Field evaluation of the biocontrol agent is on-going on 5 experimental sites located in Kipapa Gulch (Central O'ahu) and Waimanalo (East Honolulu), Umauma and Kurtistown (Hilo) on the Big Island, and Maliko Gulch (Ulumalu) on Maui. Foliage crops, such as, *Dracaena*, ti, and areca palms, or guinea grass are cultivated commercially or growing in the wild on the sites. Quantitative information on the larval parasitism of the pest caterpillar as well as moth abundance using traps baited with lures are currently being generated to evaluate the efficacy and performance of *A. dimerus* against the target pest.

(b) The erythrina gall wasp (*Quadrastichus erythrinae*) was accidentally introduced into Hawai'i in April 2005. Gall wasp infestation results in the swelling of tissues and gall formations on young shoots and twigs of affected trees. Consequently, hundreds of erythrina trees including *Erythrina variegata* and *E. crista-galli* as well as the native wiliwili (*E. sandwicensis*) were severely damaged and almost decimated. *Eurytoma erythrinae* is the natural enemy of the erythrina gall wasp that was collected in Tanzania, East Africa in 2006. Quarantined in HDOA Insect Containment Facility in Honolulu, the biocontrol agent was determined to be highly specific to the gall-forming wasp and did not pose potential risks to the native fauna. Subsequently, it was introduced in Hawai'i in November 2008. Currently, the parasitoid has been successfully established in the major island chain including O'ahu, Maui, Big Island, Kaua'i, Moloka'i, Lāna'i and Kaho'olawe. Moreover, as high as 90% mortality of the pest wasp has been attributed to parasitism by the biocontrol agent. From all indications, the eurytomid parasitoid has effectively thwarted the continuous onslaught and near decimation of the erythrina trees and native wiliwili throughout the State. Consequently, trees have commenced to bounce back with lush, robust, green foliage and much reduced galling. In addition, trees have started to flower and produce pod-bearing seeds. Field evaluation and monitoring of the introduced natural enemy is on-going.

Figure 1

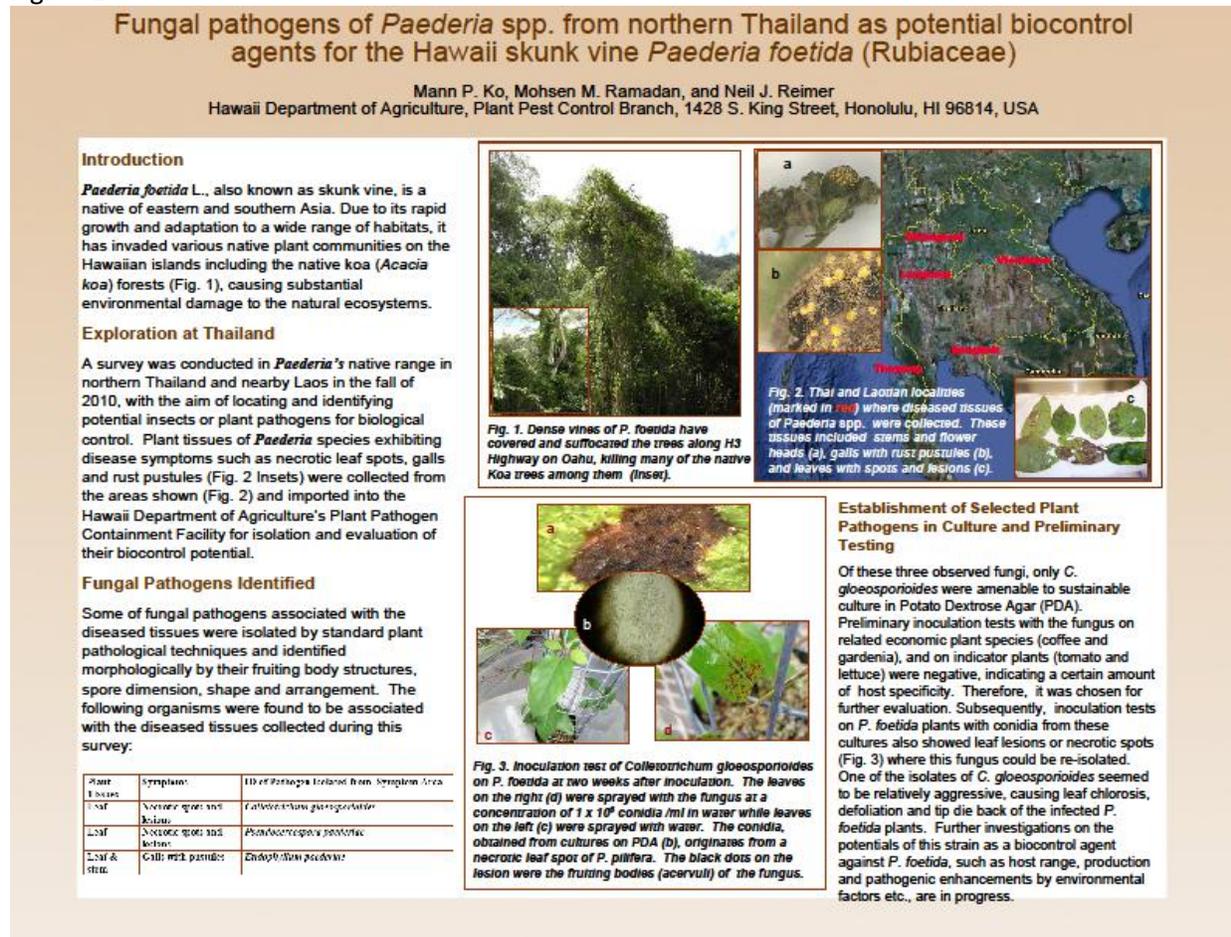


Figure 2



Potential Biological Control Agents of Skunk-Vine, *Paederia foetida* L. (Rubiaceae), Recently Discovered in Thailand and Laos

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The skunk-vine, *Paederia foetida*, also known as *Malle pilae* in Hawaii, is an invasive weed that smothers shrubs, trees, and native flora in dry to wet forests. It disrupts perennial crops and takes over landscaping in moist to wet areas on four Hawaiian Islands. Skunk-vine is considered a noxious weed in southern United States (Alabama and Florida) and also an aggressive weed in Brazil, New Guinea, Christmas and Mauritius Islands. Chemical control is difficult without non-target damage as the vine mixes up with desirable plants.

Foreign Exploration for Natural Enemies

A recent survey in October-December 2016, after the rainy season in Thailand and Laos (survey sites in red), confirmed the presence of several insect herbivores associated with *P. foetida* and three other *Paederia* species. Biological control is thought to be the most suitable option for long term management of the weed in Hawaii and Florida. Skunk-vine and most species of genus *Paederia* are native to tropical and subtropical Asia, from as far as India to Japan and Southeast Asia. There are no native plants in the tribe Paederieae in Hawaii and Florida, and the potential for biological control looks promising.

Potential Biological Control Agents

Seven insects were the most damaging to the vine during the survey period.

Two hawk moths, *Macroglossum* spp., (Lepidoptera: Sphingidae)

A leaf-tying moth, *Gonolophus* sp. *dotyrosus*, (Lepidoptera: Grammbidae)

A sharpshooter leafhopper, *Bothrogonia* sp. *fermaginea* (Hemiptera: Cicadellidae)

A leaf-sucking lace bug, *Dulinius* *coarctatus* (Hemiptera: Tingidae)

A chrysomeid leaf beetle, *Spharocata* sp. *nebulosa*, (Coleoptera: Chrysomelidae) and color forms of adults and immatures.

A herbivorous rove beetle, *Mimatusa* *thailandiformis*, (Coleoptera: Staphylinidae). Adults prefer vine tips and larvae form galls in leaf stalks.

Risk Assessment Evaluation of the Chrysomeid Beetle

The leaf and the rove beetles are being investigated at the HDOA Insect Containment Facility as candidates for biocontrol of *Malle pilae* in Hawaii. The larvae and adults of the leaf beetle are voracious defoliators of *Paederia* spp. in Thailand and Laos. No-choice feeding tests with larvae and adults of the leaf beetle indicated that only two species of *Paederia* were suitable hosts. Larvae and adults did not feed or complete development on 25 species representing 16 genera in 11 tribes of endemic and naturalized Rubiaceae including six native shrubs and trees considered key components of Hawaiian ecosystem.

ACKNOWLEDGMENTS

The Hawaii Department of Agriculture greatly appreciates the assistance provided by the staff of HIGRC and Kasetsart University, Thailand. Funds for this project are provided in part by the Hawaii Invasive Species Council.

Title: Detection and Control of Invasive Species in Kaua'i County

Organization: Kaua'i Invasive Species Committee (KISC)



Working Group: Established Pests

Award: \$150,224

In FY 2011, KISC continued working on goals outlined by the HISC Established Pest Working Group Strategic Plan. Priority was given to island-wide early detection, rapid response, and control of various plants, vertebrates, and insect targets.

KISC's work with control and eradication of Miconia (*Miconia calvescens*) in the Wailua District continues to be a top priority. Strategic planning with partners has resulted in implementing new tactics to survey and treat this watershed destroyer. KISC continues to be the primary responder to new coqui reports; monitoring one wild-land population and quickly dispatching new coqui as they are introduced across Kaua'i. During this year, KISC also conducted an island-wide survey for invasive invertebrates, including Little Red Fire Ant (LFA).

HISC Established Pests: Measures of Effectiveness

Number of species detected and evaluated for feasibility of eradication:

Early detection of incipient invasive species included roadside surveys, private property surveys, as well as surveys at nurseries, ports, green-waste areas and resorts.

- An island-wide survey was conducted for priority invasive invertebrates. Approximately 154 acres were surveyed. During this survey, stinging nettle caterpillar (*Darna pallivitta*) was reported HDOA and seems to be established itself on the east side of Kaua'i. No new infestations of LFA were detected. A full report of this survey can be found at



Dillenia leaves and fruit

<http://www.hawaiiinvasivespecies.org/iscs/kisc/pdfs/kiscinvertsurvey2011.pdf>.

- Approximately 255 acres were surveyed for invasive plants not known or widespread on Kaua'i. One species, Dillenia (*Dillenia suffruticosa*), was discovered opportunistically while surveying for miconia in Wailua Homesteads and immediately removed. This plant is known to be spreading on O'ahu and not known to be elsewhere on Kaua'i.

Number and area of priority invasive species eradicated and/or controlled:

Control and eradication efforts centered on 9 priority plant species and one vertebrate species (coqui frog (*Eleutherodactylus coqui*)).

- Survey and control of Miconia was focused on three primary areas of the Wailua District; Wailua River State Park (WRSP), Wailua Homesteads, and the Game Management Area (GMA) in the Halele'a Forest Reserve. 390 acres were ground surveyed with 1 mature plant and 349 immature plants treated. Eradication strategies dictate the importance of removing plants before reaching maturity; current data suggests that these strategies are working.

- During this reporting period, 914 acres were aerial-surveyed in the GMA, discovering 3 mature plants, and 26 immature plants, all within the known infestation area.
- Partnering with Dr. James Leary, (CTAHR), KISC was able to utilize Herbicide Ballistic Technology (HBT) during two aerial surveys for miconia. 2 mature plants and 26 immature plants were treated. These plants were later ground-surveyed to ensure efficacy of herbicidal treatment and it was discovered that not only were the plants dead, there was no collateral damage in the surrounding vegetation.



Miconia spotted from helicopter in dense uluhe

- Other priority plant targets included Arundo, ivy gourd, fountain grass, false kava, long thorn kiawe, giant salvinia, cattail, and other miscellaneous species. Over 1,700 acres were surveyed and over 6,000 individual plants were treated.
- KISC's priority invasive vertebrate is the coqui frog. Almost 1,500 acres were surveyed during this period.

Prioritization processes identified and in place:

Each year, KISC conducts annual prioritization meetings with the committee as a whole. Target activities are reviewed and new species are evaluated for feasibility of control. There are many factors that dictate prioritization of KISC targets including: acres of infestation, the [Hawai'i-Pacific Weed Risk Assessment](#) (HPWRA) ranking, difficulty of control, number of property owners, and estimated cost of control.

Implementation of the priority response and control actions of plans for the coqui frog, West Nile Virus & Avian Influenza:

- KISC has participated in regular reviews of the statewide management plan for the coqui frog.
- KISC is assisting HDOA by being the primary responder to new coqui reports to the island. During this period 16 reports were made and 12 coqui were captured on private properties as well as new introductions to nurseries. All frogs were suspected of arriving on plant material.
- Kaua'i has one known wild-land population of coqui, introduced in 2001. KISC has been working with HDOA on eradication of these coqui and regularly conduct habitat modification, and preventative citric acid ground-drenches. No frogs have been heard calling at this site since May, 2011.
- Although no funding was allocated during FY11 from either the State of Hawai'i or USFWS toward response and control actions for West Nile Virus or Avian Influenza, KISC continued to support outreach efforts regarding these pathogens. KISC was also on-call throughout the year to respond to native bird die-offs.



Crewmember spraying citric acid

Number and names of species, habitats, ecosystems, agricultural, and managed areas protected because of control efforts:

- Target species are chosen for the threat that they pose to Kaua'i County's high-value natural areas or to agricultural production. According to USFWS, Kaua'i's high rate of endemic plants (224; the highest in the Hawaiian archipelago and quite possibly in the world) make it a biodiversity hotspot of global magnitude. Kaua'i has over 116 endemic species listed as endangered or threatened.
- Priority is given to high-value native ecosystems; such as the Halele'a Forest Reserve where miconia operations take place.
- KISC also works closely with the agriculture community; keeping them informed as to threats to their commodities and what to watch for; such as the stinging nettle caterpillar, and little fire ant.

Other activities:

Additional activities also helped achieve HISC objectives.

Capacity development: One additional field worker was hired with support from USFWS, joining a team focused on early detection of invasive invertebrates. Overall staff capacity was enhanced by participating in the following training events: CPR & 1st Aid classes and certification, Basic Aviation Safety Training, and an Early Detection Workshop at the Bishop Museum.

International information sharing: KISC met with visiting professionals working in conservation across Micronesia. Prioritization of targets, survey techniques, treatment methods, and community outreach were all topics that were shared. Many of the same invasive species currently being worked on across the state of Hawai'i are also pests in many areas of Micronesia.

Partner collaboration: Meeting with Department of Defense Pacific Missile Range Facility Environmental and Base Security personnel, protocols for KISC's ongoing work on Long Thorn Kiawe were developed for Hazmat, Safety, and Security. KISC continued to work closely during FY11 with UH-CTAHR, DLNR-DOFAW, The Nature Conservancy, HDOA, and USFWS.

Title: Detection and Control of Invasive Species on O'ahu Island

Organization: O'ahu Invasive Species Committee (OISC)



Working Group: Established Pests

Award: \$122,248

OISC is a partnership united to protect our island from invasive species that threaten our island's environment, watersheds, agriculture, economy and quality of life. OISC systematically contains or eradicates targeted invasive species, educates the public, and implements early detection programs to find newly introduced invasive species before they "jump the fenceline." In FY11, OISC continued work toward fulfilling the objectives of the HISC Established Pests working group by controlling priority invasive species and detecting and evaluating new incipient species. OISC received \$122,248 from HISC, roughly 16% of its annual budget. In FY11, HISC funds were leveraged with \$590,832 in additional funds.

HISC Established Pests: Measures of Effectiveness

Number of species detected and evaluated for feasibility of eradication:

The O'ahu Early Detection (OED) program, a partnership between OISC and the Bishop Museum, documented 4 new state records, 2 new state records and 4 new naturalized records in FY11. These are species submitted to the program by OISC partners and members of the public. The numbers are lower than in previous years because the OED team did not intensively survey for new species but instead evaluated plant species



Early detection surveys for Cane ti in the Ko'olau Range

previously detected during a comprehensive survey of O'ahu's publicly accessible roads. Since the program's inception, the OED team has detected 85 new island records and 20 new state records. The team also documented 85 naturalized species that had previously only been known to be cultivated.

The assessments prioritized species that were determined to be: 1) present on the island but of low distribution, 2) weedy, and 3) could be scored by the Hawai'i Pacific Weed Risk Assessment. These species were then more thoroughly researched to determine if the species could affect ecological or agricultural systems once naturalized. For example, a weed known to be fire adapted might change the fire regime of a forest, completely replacing the plant species in that ecosystem. Or, a weed toxic to livestock would disrupt a pasture's ability to support cattle.

Of the 56 which could be fully assessed, 15 species were prioritized for delimiting surveys. The OISC field crew has begun mapping the population and controlling these species. There is a possibility that when the population is fully mapped, some species may turn out to be too widespread to be eradicated successfully.

Number and area of priority invasive species eradicated and/or controlled:

OISC field crew controlled 17 different plant species, assisted the HDOA with surveys and control for 3 vertebrate species and participated in the interagency response for *Anopheles spp.*



- Surveys and control for *Miconia calvescens*—considered Hawai'i's worst watershed weed—consumes 50% of OISC's available field time. The OISC field crew removed 807 immature and 2 mature miconia trees over 3,125 acres of steep and rugged terrain throughout the southern Ko'olau Range. An additional 3,409 acres of terrain were surveyed by helicopter.
- OISC discovered a new naturalized population of pampas grass (*Cortaderia selloana*) on the steep, inaccessible cliffs of Ha'ikū Valley in October of 2010. All 14 were successfully treated by helicopter. Another 31 were removed from private property in 'Ewa.
- Surveys and control of Himalayan blackberry (*Rubus discolor*), fountain grass (*Pennisetum setaceum*), false 'awa (*Piper auritum*), and lasiandra (*Tibouchina urvilleana*) continued. A total of 2,395 individual plants were removed over 1,885 acres.
- The field crew also conducted surveys and control of species found as a result of OISC's early detection program: cape ivy (*Delairea odorata*), Mexican feather grass (*Nassella tenuissima*), feathertop fountain grass (*Pennisetum villosum*), Jerusalem thorn (*Parkinsonia aculeata*), Poison Devil's Pepper (*Rauwolfia vomitoria*) and cane ti (*Tibouchina herbaceae*).
- OISC monitored historical sites of yellow Himalayan raspberry (*Rubus ellipticus*), fireweed (*Senecio madagascariensis*) and smoke bush, (*Buddleja madagascariensis*).
- OISC sets priority search areas for each plant species it works on, based on the method of seed dispersal (wind, bird, pig, etc.).
- OISC personnel assisted HDOA with deploying snake traps in response to snake reports from the public.

Prioritization processes identified and in place:

The O'ahu Early Detection team is using a prioritization process based on that used by the New Zealand Department of Conservation that balances the threat to ecosystems posed by a weed, the distribution of the weed, and the willingness of private property owners to cooperate in control. The "ideal" target weed has a population that can be removed in one day by the field crew, has not yet matured and is on property that can be easily accessed. The OISC steering committee reviews OISC's operational plan each year and prioritizes actions for all OISC target species.

Implementation of the priority response and control actions of plans for the coqui frog, West Nile Virus & Avian Influenza:

- OISC personnel assisted HDOA to respond to reports of coqui frog (*Eleutherodactylus coqui*) from the general public. Sixteen frogs were captured by hand at residences around the island. Another 42 were hand captured at nurseries in Waimānalo and Hawai'i Kai.
- After a naturalized population of coqui frogs was reported by residents of Hau'ula, OISC worked with HDOA and DLNR/DOFAW to remove habitat and spray for frogs. All three agencies conducted follow-up monitoring and no frogs have been heard there since September.

- OISC worked with nurseries to show them how make their nurseries less coqui-friendly by keeping greenhouses and benches free of debris and monitoring shipments from the Big Island.
- OISC gave a presentation at the Landscape Industry of Hawaii conference in October of 2010 on best management practices for coqui frog in nurseries.

Number and names of species, habitats, ecosystems, agricultural, and managed areas protected because of control efforts:

- OISC target species are chosen for the threat that they pose to the forests, watersheds, agriculture, economy and quality of life on O'ahu.
- The 100,000-acre Ko'olau Watershed is protected by OISC's efforts. This area includes forest reserves, the O'ahu Forest National Wildlife Refuge, the 19 Na Ala Hele trails in the Ko'olau Range and protected watershed areas.
- There are 184 species listed as threatened or endangered on O'ahu. Because OISC works on an islandwide scale, our activities protect these species and the habitat they depend on for survival.
- OISC's work to prevent coqui frog infestations in residential and natural areas protects O'ahu neighborhoods from noise disturbance and protect endemic invertebrate species that may decline if coqui populations become established.
- Fountain grass is an OISC target because it is highly flammable and brush fires can be more frequent and destructive in areas dominated by this species. OISC's efforts to keep fountain grass off the dry Wai'anae Coast, protect the neighborhoods in that part of the island and the forests of the Wai'anae Range.
- The effort to eradicate Cape Ivy will prevent it from spreading to the high-value natural areas of the Wai'anae Range.



Checking snake traps

Other activities: Additional activities also helped achieve the following HISC objectives.

Capacity development and Infrastructure improvements: With the generous support of the DOFAW O'ahu District Office, OISC acquired its own office and baseyard space. Previously we had been operating out of DOFAW offices on O'ahu, with the support staff in a different location from the field crew. Working out of the same location has increased productivity, efficiency and communication.

Detect high-priority invasive species: Support from the USFWS allowed OISC to conduct surveys for little fire ant (*Wasmannia auropunctata*) on O'ahu. No ants were found during the surveys.

Snake Response: An OISC staff member attended the USFWS sponsored brown tree snake rapid response training on Guam.

Title: Detection and Control of Invasive Species in Maui County: Moloka'i

Organization: Moloka'i/Maui Invasive Species Committee (MoMISC)



Working Group: Established Pests

Award: (included in Maui County funding)

MoMISC focused on achieving the goals and objectives of HISC's Established Pest Working Group as outlined in the HISC Strategic Plan. Priority targets are chosen by the Moloka'i Committee and the Committee reviews work done on all species. MoMISC held four quarterly meetings throughout FY11 to set and review priorities for the control of pests on Moloka'i. MoMISC's partners and committee members provide input and in-kind service contributions. The Maui Invasive Species Committee (MISC) provides fiscal and administrative assistance for MoMISC's work.

HISC Established Pests Working Group: Measures of Effectiveness

Number of species detected and evaluated for feasibility of eradication:

Early detection and rapid response for incipient invasive species included roadside surveys, aerial surveys, nursery surveys and investigations of reports from the public.

- Staff inspected nursery plant shipments arriving from the Big Island for coqui frog and little fire ant. During the surveys, any unusual, exotic or known weedy plants were noted to determine whether additional information was needed. With help from the HISC Weed Risk Assessment Specialists, MoMISC intercepted a cinnamon tree (*Cinnamomun verbasum*) and a vanilla vine (*Vanilla planifolia*). Both species are potentially weedy species and are not known to be naturalized on Moloka'i.
- After conducting delimitation surveys and researching the species invasiveness, the Committee added tree daisy (*Montanoa hibiscifolia*) to MoMISC's priority target list.
- MoMISC and The Nature Conservancy contracted with Resource Mapping Hawai'i to fly over 6,000 acres of forested lands to obtain pictures of targeted areas for Australian tree fern. Using a combination of ultra-high-resolution natural color data and hyperspectral imaging, they detected no positive points for Australian tree fern in areas surveyed. Several suspect points were forwarded to MoMISC for review. Ground-truthing of those points were negative and observations were forwarded to Resource Mapping Hawai'i for further assessment. However, the ground-truthing surveys detected some Australian tree ferns that had not been picked up by the remote-sensing survey. The ferns were removed. These efforts are helping to evaluate and refine new approaches to surveys in high-value and inaccessible natural areas.
- Staff responded to a landowner's report of an unusual weed, which was identified as devil's horsewhip (*Achyranthes aspera*). The Committee decided not to target the species because it was determined to be a low priority weed. Instead, the USDA agreed to work with landowner to explore use of Farm Bill monies for control of devil's horsewhip on the property.



Number and area of priority invasive species eradicated and/or controlled:

Control and eradication efforts were conducted on 20 plant species, two vertebrate species (coqui frog (*Eleutherodactylus coqui*) and green anolis (*Anolis sagrei*)), one plant disease (banana bunchy top virus), one marine invertebrate (mangrove or upside-down jelly fish (*Cassiopea andromeda*)), and one terrestrial invertebrate (little fire ant (*Wasmannia auropunctata*)). The following outlines key accomplishments:

- 10,486 acres were surveyed by air for miconia (*Miconia calvescens*) over remote forested areas in east Moloka'i. No miconia was detected.
- 731 acres were surveyed for banana bunchy top virus in Kualapu'u and Ho'olehua and 179 plants were treated. Recent surveys indicate the virus is still contained to two districts in north central Moloka'i.
- 66 acres were surveyed for rubber vine (*Cryptostegia madagascariensis*) in Kamalō and 'Ualapu'e and 88 plants were controlled.
- 309 acres were surveyed by ground for Australian tree fern (*Cyathea cooperi*) in Kala'e and 19 plants were controlled. In addition, 6,000 acres were surveyed by Resource Mapping Hawai'i over prioritized areas in north central Moloka'i, with no detections.
- 29 acres were surveyed for albizia (*Falcataria moluccana*) in north central Moloka'i and 5 plants were controlled.
- 41 acres were surveyed for bo tree (*Ficus religiosa*) in central Moloka'i and 5 trees were controlled.
- 111 acres were surveyed for tree daisy (*Montanoa hibiscifolia*) in north central Moloka'i and 528 trees were controlled.
- 27 acres were surveyed for Barbados gooseberry (*Pereskia aculeata*) in Hālawa Valley and 79 plants were controlled.
- 199 acres were surveyed for tumbleweed (*Salsola kali*) in central Moloka'i and 1,363 plants were controlled.
- 291 acres were surveyed for fireweed (*Senecio madagascariensis*) in east and north central Moloka'i and 43 plants were controlled.



Tree daisy: a new MoMISC target

Prioritization processes identified and in place:

MoMISCT holds quarterly meetings to review progress on priority species. Targets are approved by the Committee after review of a staff report on the feasibility of eradication based on specific prioritization protocols.

Implementation of the priority response and control actions of plans for the coqui frog:

- MoMISC staff implemented MISC's coqui-free certification program for a newly-opened nursery on Moloka'i. The coqui-free certification project was initially funded by a HISC Research & Technology Grant. Mahana Nursery is the first business on Moloka'i to join 29 other businesses on Maui that are certified as coqui-free. A list of coqui-free nurseries is published on a website maintained by MISC to promote the program: www.coquifreemaui.org.



Surveying a nursery shipment for coqui frogs

Number and names of species, habitats, ecosystems, agricultural, and managed areas protected because of control efforts:

MoMISC worked to control several species in various habitats, ecosystems and managed areas including marine, wetland, native forest, forested watershed, mesic forest and agricultural lands.

- Reports from the public of stinging jellyfish prompted MoMISC to remove mangrove jellyfish (*Cassiopea andromeda*) from the designated swimming area at the Moloka'i harbor to protect human health.
- MoMISC spearheaded an effort to control several mangroves growing on a breakwall at the Kaunakakai harbor. In addition, 495 mangrove seedlings were pulled from the reef adjacent to the breakwall to deter establishment of mangrove species and protect the fringing reef.
- MoMISC continued to control banana bunchy top virus (BBTV) to keep it from spreading throughout the island. Staff helped to stop the spread of BBTV at a banana farm in central Moloka'i and also protected neighboring farms. Targeting BBTV helps to protect an important agricultural food staple and also preserves the Polynesian varieties that still remain in remote areas on the north shore valleys and cliff sides of Moloka'i.
- Control or eradication of the following species helped protect mesic and rainforests and other forested watersheds: mule's foot fern (*Agiopteris evecta*), cat's claw (*Caesalpinia decapetala*), Australian tree fern (*Cyathea cooperi*), albizia (*Falcataria moluccana*), bo tree (*Ficus religiosa*), woodrose (*Merremia tuberosa*), tree daisy (*Montanoa hibiscifolia*), Barbados gooseberry (*Pereskia aculeata*), New Zealand flax (*Phormium tenax*), rose (*Rosa multiflora*), tumbleweed (*Salsola kali*) and palm grass (*Setaria palmifolia*).
- Control efforts focused on rubber vine (*Cryptostegia madagascariensis*) protected several wetland parcels along the south shore of Moloka'i.
- Removal of all known fireweed plants (*Senecio madagascariensis*) protected pastoral agricultural lands that are important for livestock.

Additional HISC Objectives: Accomplishments:

Implement improvements to capacity for detection, eradication & control:

One additional field staff was hired. Staff capacity was enhanced by attending pesticide certification classes and ArcGIS 10 training. Staff assisted the HDOA with bee surveys for small hive beetle and varroa mite. MoMISC staff participated in the statewide data workshop for the Invasive Species Committees.

Other:

Partner collaboration: The Nature Conservancy's Technical Information Specialist continued to provide invaluable support to the MoMISC staff concerning data collection and database use. MoMISC is a project of the Pacific Cooperative Studies Unit – University of Hawai'i.



Controlling Australian tree fern

Title: Detection and Control of Invasive Species in Maui County: Maui & Lānaʻi

Organization: Maui Invasive Species Committee

Working Group: Established Pests

Award: \$172,248



The Maui Invasive Species Committee (MISC) is a project of the Pacific Cooperative Studies Unit - University of Hawaiʻi. HISC funding supported efforts to detect and control invasive plants and animals across the islands of Maui and Lānaʻi. Work on Molokaʻi was conducted by the Molokaʻi Invasive Species Committee (MoMISC) as part of the same grant. Work by MoMISC is reported separately.

Strong partnerships and a supportive community were essential to MISC's successes during FY11. HISC funding was highly leveraged: every state dollar was matched by almost 7 dollars from other sources. Consistent with §194-2(a)(12), HRS, which calls on HISC to support county-sponsored invasive species activities, the County of Maui is a vital MISC partner, providing essential funding and policy support. MISC also received strong support from Haleakalā National Park, the U.S. Forest Service, and USFWS, as well as grants from private foundations and contributions from individuals and private businesses.

Work focused on achieving the goals and objectives established by the Strategic Plan of HISC. MISC, comprised of local resource managers, scientists, and agency representatives, held four meetings to set and review priorities for the control of invasive species in Maui County. Meeting topics focused on early detection/rapid response; outreach; vertebrate species; little fire ant; new technology; and work on Lānaʻi and Molokaʻi. Staff from partner agencies also worked side-by-side with MISC during pampas grass sweeps, on aerial control missions, and during vertebrate and ant control operations.

HISC Established Pests Working Group: Measures of Effectiveness

Number of species detected and evaluated for feasibility of eradication:

Early detection of incipient invasive species included surveys at nurseries and botanical gardens, delimitation surveys, and ant surveys.

- Surveys were completed by MISC's Early Detection Specialists, Forest and Kim Starr, at six nurseries or botanical gardens. A total of 827 taxa were identified during these surveys. An estimated 37% were considered to be weeds by the Global Compendium of Weeds.
- The Starrs submitted several reports for publication to the Hawaiʻi Biological Survey - Bishop Museum. For plants, they documented one new state record, two new island records, nine range extensions, and one new naturalized species. For ants, they documented nine new island records. New arthropod records were submitted for Kahoʻolawe, Lānaʻi, Molokaʻi, and Maui.
- Delimitation surveys were conducted for four species to determine feasibility of control: *Erica lusitanica*, *Salsola tragus* (West Maui), *Nasella tenuissima*, and *Acacia podalyriifolia*. A single



flowering plant of a fifth species, *Rhodomyrtus tomentosa*, was discovered and removed on Lānaʻi; surveys will be conducted to look for other locations in the same vicinity.

Number and area of priority invasive species eradicated and/or controlled:

Survey and control work focused on 20 plant species, two vertebrate species (coqui frog (*Eleutherodactylus coqui*) and veiled chameleon (*Chamaeleo calypttratus*), one plant disease (BBTV), and LFA (*Wasmannia auropunctata*). A total of 64,221 acres were surveyed and 82,246 invasive plants were removed.



- Field work successfully kept miconia (*Miconia calvescens*) out of the native rainforests of East Maui, made serious headway controlling pampas grass (*Cortaderia jubata* and *C. selloana*) in both East and West Maui Watersheds, and kept coqui frogs from spreading on the Island of Maui.
- Over 33,552 acres were searched for miconia during ground and aerial operations, during which a total of 72,909 plants were removed, including 1,342 mature plants. Staff worked with Dr. James Leary from UH-CTAHR to test experimental herbicide application techniques for miconia and pampas grass.
- Pampas grass operations covered 20,568 acres. Persistent efforts at the remote Honomanū site saw an 83% decline in the number of mature pampas plants over the last three years. Results from work on pampas grass were presented at the 2010 Hawaiʻi Conservation Conference.
- Highlights for other plant species included a multi-agency response to discovery of common mullein (*Verbascum thapsus*) near the summit of Haleakalā, and thorough fountain grass surveys centered on a flowering plant discovered at the entrance to the Auwahi dryland forest restoration site.
- Work on Lānaʻi focused on two plant species: ivy gourd (*Coccinia grandis*) and fountain grass (*Pennisetum setaceum*). A total of 195 fountain grass plants were removed, including 47 mature plants. Ivy gourd and fountain grass appear to be on target for eventual eradication on Lānaʻi.
- No veiled chameleons were detected or turned in during this fiscal year.
- Staff responded to two separate reports of feral rabbits. In one instance, the pet animals were successfully recaptured; at the other site, the landowner removed two rabbits.
- Efforts to control BBTV were funded by Maui County. A total of 3,250 sites were surveyed for BBTV, with the disease found at 199 sites. No BBTV has ever been detected during MISC's annual survey of over 300 properties on Lānaʻi.
- The only known population of the little fire ant on Maui has apparently been eradicated by the HDOA. MISC assisted with survey activities at the site and continued to conduct surveys across



the island for LFA. Surveys concentrated on high-risk sites, with special emphasis on businesses that receive shipments from the Island of Hawaiʻi. Staff conducted surveys at 89 sites and taught school children how to conduct surveys as part of MISC's education program. Classroom-based surveys covered an additional 60 sites. Almost 5,500 vials were baited with peanut butter and examined for the presence of the little fire ant, with none detected. Little fire ant surveys will be an ongoing MISC activity because the growing population on Hawaiʻi Island creates a high risk of re-introduction to Maui.

Prioritization processes identified and in place:

MISC's prioritization process is based on protocols established in New Zealand. It is adaptive, allowing new species to be added during the year if information indicates that immediate action would help prevent costly containment in the future. Staff participated in the statewide Early Detection workshop which was designed to establish a uniform process for adopting incipient species as new targets.

Implementation of the priority response and control actions plans for the coqui frog and West Nile virus:

- MISC surveyed 11 population centers on Maui where coqui have been eradicated and moved another two sites toward eradication status. Three nurseries continue to receive coqui frogs in shipments from the Island of Hawaiʻi, highlighting gaps in our inter-island quarantine system.
- Most coqui work focused on the Māliko Gulch infestation, which now encompasses a 3.5-mile stretch of the gulch. Māliko is the most challenging active control site in the state. Much of the infestation is on state land. MISC's three-pronged control effort consists of high-volume sprinkler stands, a PVC-pipe system with spray valves for fire hoses installed down the center of the gulch, and aerial control, all using a citric acid solution.
- A USFWS-funded project is studying the efficacy of MISC's different control strategies in the gulch. MISC helped orient project staff from Utah State University and secured access to the site for the study. A total of 50 monitoring plots have been established.
- Staff also assisted Dr. Francis Benevides in testing sound pressure levels as a possible monitoring tool for coqui frog density estimates.
- Staff conducted surveys at all "Coqui-free" businesses -- those that have met the standards established by MISC's coqui-free certification program. A total of 29 Maui businesses are now participating in the program. A list of coqui-free nurseries can be viewed at: www.coquifreemaui.org.
- No reports were received for dead feral chickens or dead birds. MISC continued to promote public awareness of the issue during outreach events.



Number and names of species, habitats, ecosystems, agricultural, and managed areas protected because of control efforts:

- Target species are chosen for the threat posed to Maui County's high-value natural areas or to agricultural production. The Island of Maui has 79 federally-listed threatened and endangered plant species and at least as many additional candidate species and species of concern. The island of Lāna'i has 37 endangered or threatened plant species.

- MISC's work occurs in residential areas where many introduced species first become established, but also involves ground and aerial surveys over remote inaccessible areas of the East and West Maui Watersheds. MISC's work helps protect the unique resources of Haleakalā National Park, the only intact summit-to-the-sea reserve in the State of Hawai'i.
- Work on banana bunchy top virus is protecting both agricultural and domestic production, and also preserves Polynesian varieties that are found on Maui.

Additional HISC Objectives: Accomplishments

Implement improvements to capacity for detection, eradication & control:

- Four temporary positions were filled to assist with work in Māliko Gulch. MISC also hosted three AmeriCorps interns for the summer, two with the Hāna miconia operation and one in Makawao.
- Staff participated in a review of statewide with the other Invasive Species Committees to review and update statewide data standards.
- Staff trainings included: helicopter manager & water-ditching protocols, Hazard Analysis and Critical Control Point management system to prevent vectoring invasive species, and wilderness first aid. Staff also attended a statewide symposium on watersheds and the 2010 Hawai'i Conservation Conference.
- MISC fostered increased capacity on a regional level by hosting Tavita Togia, who is working on invasive species with the National Park Service in American Samoa. As part of the educational campaign on the little fire ant, staff met with the Tahitian Minister and Director of the Ministry of the Environment during a trip to Tahiti.

Support development of management plans for widespread vertebrate pests:

- In concert with the Maui Farm Bureau and Hawaiian Commercial and Sugar Company, MISC helped initiate formation of the *ad hoc* Maui Axis Deer Working Group, comprised of ranchers, farmers, hunters, and agency staff. The goal of the working group is to develop a long-term management plan in response to the growing axis deer population. MISC staff serves in a facilitation capacity and will likely take a leadership role in developing the plan.



Double-fisted brown tree snakes: Guam

Develop capacity to conduct effective coordinated response to all snake sightings:

- The MISC Operations Manager and MISC Vertebrate Crew Leader attended a three-week long brown tree snake training in Guam. This significant commitment of staff resources helped to almost double statewide capacity to respond to snake reports.
- MISC helped organize and participated in a snake training workshop held in August 2010. The workshop was co-sponsored by Maui County, HDOA, and DLNR.

Establish clear agency responsibilities and criteria for rapid response activities:

- MISC developed and lead a workshop focused on identifying gaps in the statewide system for early detection and rapid response.

**Title: Detection and Control of Invasive Species in
Hawai'i County**

**Organization: Big Island Invasive Species Committee
(BIISC)**



Working Group: Established Pests

Award: \$340,280

Over the past year, BIISC has focused on three adaptive management priorities; 1) Early detection of new nonnative species, 2) Rapid response to incipient species and new locations of existing invasive species, and 3) Education and outreach. BIISC also remains “on call” for crisis management as new priorities emerge – in 2011 we were able to rapidly and efficiently refocus operations to prioritize axis deer as an emergent target.

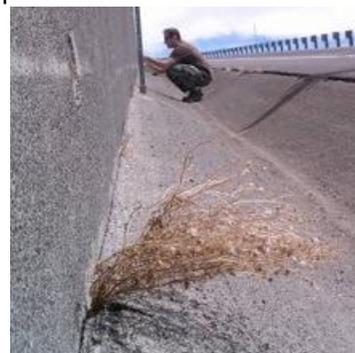
BIISC’s work has been strongly focused on achieving the Established Pests goals and objectives of the HISC’s Strategic Plan. The committee, which oversees BIISC priority setting, met two times during this reporting period, less than normal as energies were focused on management of the newly formed *ad hoc* Big Island Axis Deer working group – which met four times. In response to axis deer becoming the priority species, BIISC was able to transition its coqui control team to a vertebrate early detection and survey team. Following extensive training and capacity building BIISC is now the primary responder for deer and numerous other vertebrate species. In keeping with BIISC’s mission we have also been working on control of several priority established plant populations, including 1) *Miconia* (*Miconia calvescens*), and 2) Poison Devil’s Pepper (*Rauvolfia vomitoria*). Table 1 outlines BIISC performance on 2011 established control targets.

BIISC Established Pests: Measures of Effectiveness

Number of species detected and evaluated for feasibility of eradication:

After nearly 4 years of roadside surveys, nearly the entire island has been covered by BIISC Early Detection team. The addition of a staff botanist has been a boost for identification of new plants.

- BIISC’s Early Detection Team is close to completing the first-ever island-wide survey of major, secondary, and residential roads for new incipient naturalized plant species. During the funding year, 1,200 miles of roadside botanical surveys were conducted in the districts of Hāmākua, North Hilo, South Hilo, and Lower Puna. Specimens from 34 species were collected, including one new state record, four new records of naturalization, 11 new island records, eight pending determinations from Bishop Museum, and one unknown species.
- A total of seven species, thus far, have been identified as targets for eradication. Further priority assessments will be conducted this year on all new species found during the surveys. The species will be ranked according to weediness score, abundance and distribution, and feasibility of control. The BIISC field crew has controlled all *Buddleja madagascariensis* (Smokebush) populations in the Waimea region, and is currently working on eradicating *Pereskia aculeata* (Barbados gooseberry), while continuing to control local populations of priority species and mapping



BIISC Botanist surveying Mauna Kea summit, dead fireweed in

distributions.

foreground

- Site surveys are botanical surveys of discrete targeted locations and were conducted at the following sites: Kohala Ranch Private Subdivision (naturalized *Erythrina crista-galli* collected), Floribunda Palms Nursery, Mauna Kea Summit (fireweed, *Senecio madagascariensis* at 13,000 feet), Kapapala Ranch, Hawaii Tropical Botanical Garden (over 2,000 species cultivated).

Number and area of priority invasive species eradicated and/or controlled:

Control and eradication efforts on priority plants centered on Miconia, Poison Devils Pepper, Plume Poppy (*Bocconia frustescens*) and Rubber Vine (*Cryptostegia madagascariensis*), while priority vertebrate control efforts have focused on coqui (*Eleutherodactylus coqui*) and axis deer (*Axis axis*). Ongoing surveys continue to uncover new established pests, however additional control targets means the need to source additional resources.

- Two populations of Miconia have been targeted for control on the Big Island. Leeward populations south of Kona are targeted for local eradication while Hāmākua populations are being controlled to prevent spread to the Kohala Mountain area.
- Containment of Poison Devil's Pepper along southern (high elevation) and western (natural area) population limits, and surveys of numerous gulches along eastern limit (controlling over 10,000 plants). An aerial survey of *Rauvolfia vomitoria* was performed to determine extent of range. Extensive herbicide trials (together with CTAHR) to determine the most effective and lowest dose of herbicide necessary to contain *Rauvolfia vomitoria*.
- Plume Poppy was been identified in Manukā State Park as well as surrounding public and private properties. BIISC surveyed over 500 acres and treated approximately 250 plants to locally eradicate the population.
- Rubber vine has been named "Australia's worst weed" and was identified as being in the Ka'u, North Kona, South Kohala and North Kohala districts of Hawai'i Island through the efforts of the BIISC Early Detection team. During this reporting period control efforts have covered 2.6 acres and encompassed 146 person hours. A total of 18 *Cryptostegia* have been treated.
- BIISC was invited by the Pi'ihonua community to lead a campaign and investigation on the impacts of *Albizia* in rural neighborhoods – resulting in a new mapping technique and increased awareness of the threats caused to human safety and infrastructure. Results indicate imminent threats to Hilo Medical Center, evacuation routes and to people and property living near these looming giants, which are already over 100 feet tall in places.
- Responded to reports of feral European rabbits (*Oryctolagus cuniculus*) in Pahala and Na'alehu ranches. Seven rabbits were recovered by the ranchers, while one or more remain at large. Efforts continue to capture any remaining rabbits.



Albizia trees loom over much of Hilo now and are a daunting threat to people and infrastructure.

Prioritization processes identified and in place:

Every year BIISC reviews its priority species list together with committee members and local experts. In 2011 BIISC hired a botanist, and completed a comprehensive island wide roadside survey. Thus the Department looks forward to moving from an ad hoc to a systematic prioritization process for both plants and animals.

Implementation of the priority response and control actions of plans for the coqui frog, West Nile Virus, and Avian Influenza:

- BIISC has treated a total of 37 acres of high-value natural areas on government (state, county, federal) and private (Kamehameha Schools) land with citric acid chemical. Twenty-six acres were in Pu'u Maka'ala NAR and Ola'a Forest Reserve, which contain critical habitat for *Drosophila mulli*.
- Worked with researcher from the UH Hilo, Utah State University, USDA Forest Service and USDA Animal and Plant Health Inspection Service (APHIS), supplying them with information, area infestation maps, and field help when requested.
- Helped train residents in Ka'u and Waimea to detect, hand capture and treat coqui frogs as well as steps necessary to prevent reinfestation. BIISC continues to play a role in the organization and management for the successful elimination of coqui in neighborhoods that have active community groups.
- Developed and published a brochure targeted for residents of Hawai'i Island with information that includes appropriate chemicals to use, how to find and catch coqui by hand, and steps to take to prevent infestation or reinfestation of frogs.

Number and names of species, habitats, ecosystems, agricultural, and managed areas protected because of control efforts:

- Target species are chosen for the threat that they pose to Hawai'i County's high conservation value natural areas or to agricultural production.
- Plume Poppy was removed from Manukā State Park.
- BIISC surveys along transportation corridors leading into Hawai'i Volcanoes National Park ensures that no new target weeds infest the park.
- Population surveys of the Hawaiian Coot (*Fulica alai*) and the formation of the Lokowaka Community partnership help ensure a future for this endangered species. The Lokowaka coot population is experiencing reproductive failure due to a suite of invasive carnivores, and further actions are needed to prevent its extirpation.
- Our "line in the sand" strategy for Miconia along the Hāmākua Coast has kept this weed out of the Kohala Mountain ecosystem.
- Surveys of axis deer have determined the extent of the population and the threat this species poses to local ranching and agricultural livelihoods island-wide. Over 666 man hours were spent along roads, trails and high-vantage points that covered a survey area of over 7,970 acres in search of axis deer (*Axis axis*). Axis deer have been reported in most districts of Hawai'i Island, including Puna, Ka'ū, South Kona, South Kohala, and North Kohala. Only one district has a confirmed sighting (Ka'ū), however signs of scat, rubbings and tracks may have been found in North Kohala.

Other activities:

Additional activities also helped achieve HISC objectives.

Capacity development: The formation of a BIISC vertebrate team has resulted in extensive capacity building of staff and partners. BIISC staff has received training in the following areas: ATV/UTV, hunter safety education, forward looking infrared (FLIR), night vision, and use of live-animal traps. In addition, plant staff has received certification in safe application of controlled herbicides in 1) Agriculture, 2) Forestry and 3) Aquatic environments.

Axis Deer Control Strategy: Following reports of axis deer being illegally smuggled to the island BIISC formed an axis deer working group, developed a control strategy and eradication budget and received funds to initiate surveys and local control efforts. Four working group meetings have been held, and support from partners ensured that BIISC crew had the best available tools and technology to conduct an initial assessment of the situation. BIISC also hosted two axis deer training workshops to educate partners and colleagues to successfully identify deer signs and address problem animals. Deer training focused on detection but also on techniques to sample for infectious disease.



BIISC training partners to take blood samples from deer to detect bovine tuberculosis.

Snake Response: Two BIISC personnel spent three weeks in Guam to train on the searching, trapping and handling of brown tree snakes (*Boiga irregularis*). Trainee's received an estimated 120 hours of training and may be part of any rapid response to brown tree snakes in Hawai'i.

Table 1: BIISC deliverables are invasive species prevention and control, in this case 1) eradication, 2) containment and/or 3) exclusion of areas for a suite of target species. Summary of deliverables and goals for 2010, many of which will be continued in 2012:

BIISC target species	Goal	Current Status	2010 Strategy
1. Poison Devils Pepper (<i>Rauvolfia vomitoria</i>)	Containment in Kohala, Hawai'i Island.	BIISC is working closely with Kohala Watershed Partnership to contain the infestation from 10,000 acres to a core area of 1,000 acres over the next two years.	Complete map of area of occupancy, form working group, build partnership and target peripheral populations along the perimeter to begin containment process.
2. <i>Miconia calvescens</i>	Exclusion from Kohala and high elevations, eradication from leeward side.	BIISC is working closely with Kamehameha Schools to acquire permissions to access lease lots in South Kona – and with Forest Solutions to coordinate control efforts. BIISC aims to eradicate the leeward population over the next 5 years.	Survey and remove all plants from gulches along Hāmākua Coast from Laupāhoehoe to Honokaa. Ensure the plant does not cross Waipi'o Valley to Kohala Mt. ecosystems.
3. <i>Bocconia frutescens</i>	Containment in Kau District. Evaluate as possible eradication target.	All known populations from Manukā have been controlled.	Remove all populations from Manukā and Honomalino areas.
4. <i>Cryptostegia grandiflora</i>	Containment to Kau	BIISC has completed a regional survey and is currently working to control all known populations, focusing on control efforts in and around high value conservation landscapes.	Focus removal from Hawai'i State Parks
5. <i>Buddleia davidii</i>	Containment to Waimea/Kohala area	BIISC has completed a regional survey and is currently working to control known populations, focusing on control efforts in and around high value conservation landscapes.	Together with partners focus on removal of known populations and increase survey work.
6. <i>Rhizophora mangle</i>	Eradication	The permitting process has been influenced by a lawsuit and while this is being sorted BIISC has conducted an island wide survey of mangrove populations. When permits can be obtained control can continue.	Conduct environmental assessment; then manual control of population in Alula Bay.
7. <i>Eleutherodactylus coqui</i>	Exclusion	BIISC coqui team has been reformed to take a more comprehensive approach to incipient animal control. Coqui work is not focused on high conservation value forest areas.	Contain the spread of <i>Eleutherodactylus coqui</i> in areas of critical habitat for ESA listed species and where it threatens high conservation value forest (together with DOFAW).
8. Invertebrates	Detection and eradication or containment	BIISC is working with HDOA on little fire ant outreach and makes itself available in case of any major outbreaks. BIISC is working with coffee growers in Ka'u to contain and eradicate Coffee Berry Borer.	Work with Hawai'i Department of Agriculture to identify established invertebrate pests that BIISC can help to control (Little Fire Ant, Naiti Thrips, etc.)

Title: Aquatic Invasive Species Program

Organization: Division of Aquatic Resources (DAR)

Working Group: Established Pests

Award: \$280,282



The DAR Aquatic Invasive Species (AIS) Program worked to detect, prevent, and control the spread of alien invasive algae throughout the Main Hawaiian Islands. Energy was mainly focused in Kaneohe Bay, O'ahu, as this has been determined to be an area with the most likelihood of success. The AIS Program strived to maintain positive working relationships with other governmental, private, non-profit, and university members in order to help each other work towards a common goal of reef restoration.

FY11 Proposed Activities and Measures of Success

1. Use of mechanical removal suction devices ("Super Sucker") in conjunction with sea urchin bio-control experiments in an effort to control alien algae on coral reefs in Kaneohe Bay.

Reef 16

In August of 2010, adult urchins that had been on Reef 16 for one year were relocated from the Windward half of the reef to the Leeward half. The previous year's study determined that with prior mechanical removal of algae by the Super Sucker, the urchins were able to maintain the algae at approximately 3%, where the non-urchin side re-grew to almost 35%. The urchins were relocated to the Leeward half to test whether or not they would be able to control the growth of algae without the assistance of prior mechanical removal.

The AIS team determined that the urchins were able to reduce the biomass of algae significantly; however, due to a large loss of the population to predation and other unknown reasons, the results were not as significant as the previous year.

Reef 15

Reef 15 has never been fully cleared of algae and surveys have shown consistent heavy coverage of *Kappaphycus/Eucheuma* sp. This made the reef suitable as an experimental site for our captive raised urchins from the Anuenue Fisheries Research Center sea urchin hatchery.

- In January 2011, with help from the Kaneohe Bay Canoe Club, the AIS team released 1130 juvenile *Tripneustes gratilla* sea urchins (Fig.1), ranging in size from 20-40mm, onto Reef 15. Since the initial release, another 3000 juvenile urchins have been transplanted from the hatchery to Reef 15.



Fig. 1: Release of juvenile urchins.

- At the start of February the average benthic coverage of *Kappaphycus/Eucheuma* sp. was over 28%. In the months since, the algal coverage decreased to 10% as more urchins were added. With the abundance of available food, the juvenile urchins grew as large as 115mm by July.

- Efforts to count and survey the mortality of urchins is difficult because of the abundance of hiding spots on a highly rugose reef. In June 2011, the AIS team counted only 877 urchins and found only 18 tests as evidence of direct predation on the juveniles. Human collection is also a concern.

He'eia Fringing Reef

Although the AIS team faced many setbacks due to personnel changes and many instances of equipment failure; over 2,700 man hours, (equaling 5 ½ months of in-water removal time by a team of four) was spent on mechanical removal of the alien invasive algae *Kappaphycus*. Removal was conducted on the fringing reef outside He'eia Fishpond. This species of *Kappaphycus* is only located in select regions of Kaneohe Bay and is believed to be a slower growing species. The AIS team set out to remove as much as possible and monitor its re-growth.

Even though the AIS team was only able to access a small portion of the fringing reef; from July 2010 to June 2011, approximately 99,660 pounds of *Kappaphycus* algae were removed from this area. This large amount of algae was given to local farmers in the Kaneohe Bay area to be used as compost and fertilizer for their taro, sweet potato, corn, and flowering plant crops. The alga is high in nutrients and farmers say their crops are growing better than ever.

2. Implementation of sea urchin culture at Anuenue Fisheries Research Center (AFRC) for use as bio-control agents.

FY11 saw the first full year of production in the DAR sea urchin hatchery. Hatchery methods and techniques continue to evolve and improve with each larval run. Among the major production accomplishments of the year were:

- 15 induced spawning events yielding 20 larval populations.
- A system of metrics was developed to determine larval competency for settlement.
- 12 of the 20 larval runs were successfully reared to metamorphosis.
- A total of 372,000 *Tripneustes gratilla* larvae were reared to metamorphosis.
- During movement from the larval hatchery to the urchin nursery, the population sizes ranged from 2700 – 81,000 individuals per tank (Fig.2).
- 4023 hatchery raised sea urchins were successfully raised to a transplantable size and released during FY11.

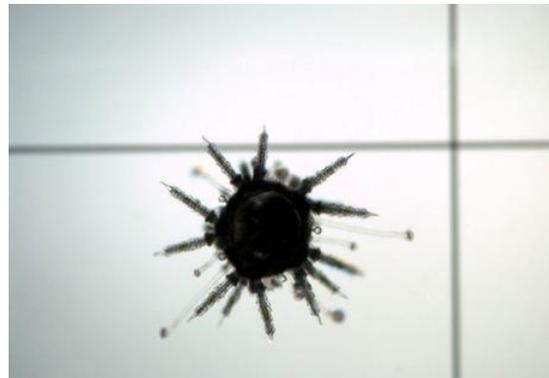


Fig. 2: Newly settled urchin larvae, 34 days old.

Significant bottlenecks were identified in the post-settlement nursery phase of sea urchin production. Mortalities are believed to be a result of overcrowding and insufficient water flow. New nursery systems were designed to facilitate increased water flow and to spread out young sea urchins during this critical four month period. The first juvenile urchins reared in this modified system are ready for outplanting.

During FY10 the old microalgae lab was renovated and repurposed to accommodate the planktonic species appropriate for larval urchin culture. In FY11 further renovations were made with the addition of

new culture vessels and a carbon dioxide infusion system. These improvements have increased food quality and quantity, as well as overall system reliability.

A reservoir was added to the hatchery water supply system to aerate and raise the pH of incoming seawater. The reservoir also serves as a settling tank reducing stress on hatchery filter system.

3. Continue AIST surveys and mapping for alien species.

Approximately 100 algae/benthic distribution maps were generated in FY11 by the AIS team and approximately 15 sites were surveyed for the first time or resurveyed.



Fig. 3: Upgrades made to microalgae lab.

Comprehensive Patch Reef Mapping Interpolations, Kaneohe Bay, O'ahu:

All the invasive algal distribution data conducted by the AIS team for the 54 Patch Reefs in Kaneohe Bay from 2007 to 2010 was interpolated for each reef and then compiled into a cumulative document. The values from interpolation were then converted into square meters of coverage for each reef per density. Based on average weights by species per density, a table was created to display the square meter coverage and estimated mass of invasive algae on each reef. This cumulative interpolation report and table were used by DAR to create a reference to calculate mitigation crediting for "in lieu fee" type of restoration efforts

Marker 12 Fringe Reef, Kaneohe Bay:

Conducted algae surveys with snorkel and GPS and mapped distribution of *Kappaphycus/Eucheuma*, *Gracilaria salicornia*, *Acanthophora spicifera* and other invasive algae on Marker 12 Fringe Reef (Fig.4) in order to obtain 2010 coverage values as a reference for a rate of spread from earlier surveys conducted in 2007 and 2009. These "rate of spread values" were used as a reference for the possible spread of invasive algae at damaged/impacted sites such as hull groundings, and to calculate mitigation crediting for "in lieu fee" type of restoration efforts.

Patch Reefs 26, 27, and 29 in Kaneohe Bay, O'ahu

The AIS team conducted algae surveys with snorkel and GPS to map the distribution of *Kappaphycus/Eucheuma*, *Gracilaria salicornia*, *Acanthophora spicifera*, and other native and invasive algae on patch reefs 26, 27, and 29 in order to obtain 2011 coverage as baseline for future removal.

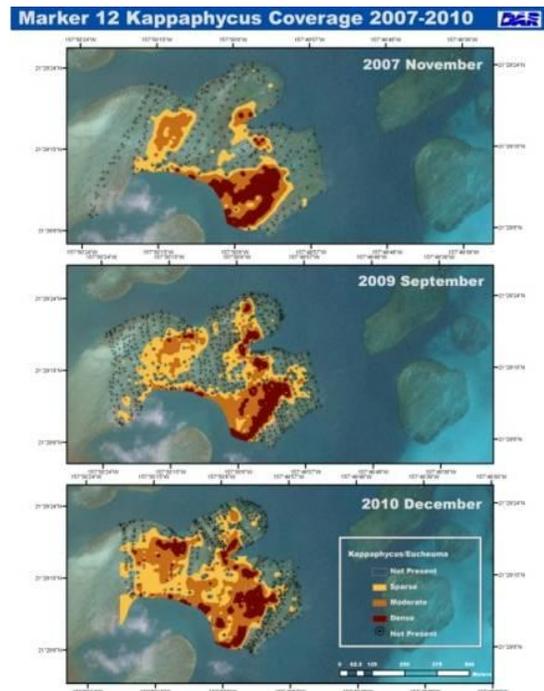


Fig. 4: Spread rate of invasive algae on Marker 12 fringe reef.

Ma'alaea Bay, Maui:

Conducted snorkel/jet-ski tow surveys with GPS and mapped distribution of live coral and invasive with a primary focus on *Hypnea musciformis* and *Ulva reticulata* (native) (Fig.5). These surveys were aimed at creating baseline algae distribution data in order to protect coral colonies that are currently impacted by invasive algae.

4. Partnership with UH researchers to examine role of increased nutrients into Kaneohe Bay.

Assisted University of Hawai'i researchers to conduct nutrient and water chemistry sampling in Kaneohe Bay to determine if land based nutrient input plays a factor on invasive algae growth and how it may vary in different sections of the bay. Sampled four fringe reefs and five patch reefs in different sections of Kaneohe Bay for macroalgae tissue samples and distribution, bottom type, water depth, salinity, temperature, dissolved oxygen, total suspended solids, dissolved nutrients, ambient light, chlorophyll-a, and pH.

5. Continue participation in recreational/commercial hull inspections & ballast water program which acts to help prevent movement of potential AIS.

Hull inspections are jointly carried out by DAR and the Papahānaumokuākea Marine National Monument. Since the departure of the Ballast Water and Hull Fouling Coordinator, the Monument has conducted many of the inspections with assistance from the AIS Team. The AIS Team also receives notification from USCG when they inspect a vessel and observe heavy fouling. Upon notification from USCG, the AIS Team will further inspect the vessel and obtain samples of the fouling to determine if alien invasive species are present. During FY11, no alien species were detected on any heavily fouled vessels.

6. Increase public awareness of AIS issues.

The AIS team has taken extensive measures to educate the public about the threats alien invasive algae can play on the reefs and fisheries of our local waters.

- The juvenile urchins have been a gateway for the community to get involved with the AIS team and work in Kaneohe Bay. The Kaneohe Canoe Club collaborated with the team to release juvenile urchins in January. In the following months, members from the canoe club have returned to the reef to check on urchin growth and see the changes they have made on the reef. Being that the canoe club is in the bay on a daily basis, this will help to create a greater sense of stewardship towards the reefs in Kaneohe Bay.
- A lecture was given to a University of Hawai'i environmental class to teach the students about the threats of aquatic invasive species and how DAR is working to control the issues. Majority of the class deals with terrestrial issues, so the students expressed that it was good to hear about what problems are taking place on the marine side and what is being done to control and prevent their spread.
- A Facebook page, "Hawaii Super Sucker" has been created so that the public can stay up to date on the progress the Super Sucker has made in the fight against invasive algae.

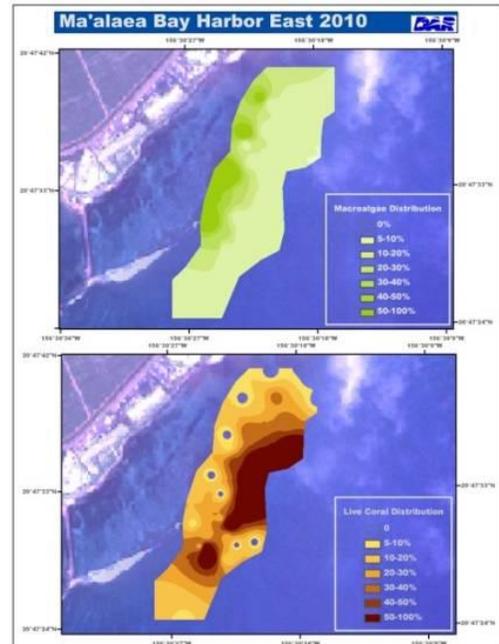


Fig. 5: Mapping of invasive algae in Ma'alaea Bay, Maui

- “Stop Aquatic Hitchhiker” signs (Fig.6), (FY10 funding), were mounted at all harbors where there is an increased chance of invasives to be spread. These signs help to remind boaters to rinse their boats, anchors, gear, etc before leaving the harbor to reduce the spread of invasives to other watersheds.
- “Stop the Invasion” brochures were made and distributed to dive shops across O’ahu to get out further information about the problems of spreading alien invasive algae.



Fig. 7: AIS team member with Super Sucker display board.

- The AIS team helped to foster community stewardship by participating in Alien Algae Cleanups in Waikiki (Fig.7). In events sponsored by University of Hawai’i Manoa, team members, students, and public volunteers worked to manually remove over 1,000 lbs of Gorilla Ogo from the reef off the Waikiki aquarium. DAR also worked in conjunction with SeaGrant and UH to educate the community about the need for the event and the threat that invasive algae poses to the reefs.



Fig. 6: Signs posted at harbors rinse stations

Other activities:

Additional activities also helped achieve HISC objectives

Capacity development: Staff capacity was enhanced by planning and implementing the following training events: the AIS Program Leader was certified as a Nitrox Instructor to allow in-house certifications and dive approvals of future divers; diving skills for the team were refreshed and updated with drift dives in Maunalua Bay, training rescue dives outside the shipping and Sampan Channels in Kaneohe Bay, and deep dives and tech dives including navigation and lift bag exercises in Waianae. The team also took the PADI O₂ Provider, PADI Enriched Air course, Emergency First Response and CPR with Primary and Secondary Care with AED with Child and Infant Care.

Infrastructure improvements: Infrastructure improvements included the refurbishing and redesign of the main pump used on Super Sucker; replaced old and rotten deck on 18’ Whaler used to conduct algae surveys; upgrades to the microalgae culture room; and the fabrication of new sea urchin mobile nursery tanks.

For any questions/comments please contact Jono Blodgett, jb88@hawaii.edu, 808-256-3095.

IV. HISC Research and Technology Working Group

Research and Technology Working Group Goals

- Encourage researchers to address the problems created by invasive species.
- Encourage the development and implementation of new technology to prevent or control the establishment of invasive species.
- Develop effective, science-based management approaches to control invasive species.
- Effectively communicate and apply the results of research to the field.
- Promote interagency collaboration and stimulate new partnerships.
- More detailed goals are outlined in the HISC Strategy 2008-2013.

Funded Projects for FY11

The lead agency for the Research and Technology Working Group is UH. In FY11, the Research and Technology Working Group did not receive funding. During its first fiscal years, the HISC offered a robust research and technology program by providing a Request for Proposals for projects related to invasive species. As HISC annual funding has dropped from \$4,000,000 in FY05 to \$1,800,000, funds have not been provided for the Research and Technology Working Group and have instead been used to maintain the capacity that the HISC has built in its Prevention, Established Pests, and Public Outreach working groups. Should the HISC budget increase in the future, there may be funds provided to the Research and Technology Working Group.

A project funded by the HISC as part of the FY09 funding cycle is continuing to use moneys awarded during that period in an ongoing project to investigate prevention and control technologies. An update on that project, coordinated by the West Maui Mountains Watershed Partnership, is given in this report.

Past Activities

From 2005 to 2008, \$2,100,000 was awarded through a variety of research and technology grants. For all grants, a 1:1 match was required between state and non-state funds. Examples of past projects include:

- Development of a biocontrol agent for miconia: \$235,346
- Development of a biocontrol agent for *Tibouchina* species: \$37,275
- Development of a Super Sucker barge for control of aquatic invasives: \$252,797
- Attractants for detecting brown tree snake: \$91,560
- Development of control methods for coqui frogs: \$161,872
- Evaluation of the impact of 'Ōhi'a rust: \$84,810
- Evaluation of the impact of invasive ants: \$201,085
- Development of a pheromone lure for nettle caterpillar: \$70,000
- Evaluation of rodenticides for controlling rat populations: \$69,700



Title: Invasive Species Management using Prevention and Control Technologies in the West Maui Mountains

Organization: The West Maui Mountains Watershed Partnership

Working Group: Research and Technology (FY09)

Award: \$27,620 (FY09 funds)



The West Maui Mountains Watershed Partnership has continued its progress assessing the locations of target weeds and evaluating the use of high resolution aerial photography. Although in our proposal we organized our deliverables in phases, through the process we have found that some of these phases are actually happening at different points in time than originally planned. At this point we have completed Phase 1 – Image collection. Data Management Standards (Phase 2) continues with more Data Hui meetings and we are beginning phases 4 and 5 (Technical Report and Planning, respectively). We have also greatly increased our removal of individual weed target on the ground found through our assessments (Phase 6, Implementation).

Phase 3 (Analysis) using the Resource Mapping Hawaii imagery has proved to be difficult. Large swaths of our imagery were unusable due to turbulence and technical difficulties in the aircraft over the rugged West Maui Mountains. We have been able to salvage some areas that are marginally resolute by using the United States Geological Survey (USGS) imagery that was provided to us (Quickbird and World View II) to aid our on-the-ground and aerial analysis for these species, but so far our Resource Mapping Hawaii (RMH) imagery has unfortunately not achieved specified resolutions for this project. We are currently assessing the possibility of using remaining monies toward a new improved platform on a helicopter (for more stability), or focusing on one of the species that we have not analyzed at this time, Australian Tree Fern (ATF) in West Maui, with both options depending on the availability of Resource Mapping Hawaii and the ability of their pilots and aircraft to fly in the extreme topography of West Maui.

Measures of Effectiveness

PHASE 1: Image Collection

As reported in the last report (Oct 2010), we have collected 4,443 acres of imagery of the 8,500 acres that was original proposed, much of which was un-usable (especially in the upper reaches and more extreme topography areas where we were hoping to get upper limits of these weeds). Talks with Resource Mapping Hawaii are currently underway to determine if new imagery would be possible to collect in past areas or in new areas all together.

PHASE 2: Data Management

Data Hui meetings have continued with partner organizations. In total we have held 4 meetings since the beginning of this grant.

- Meeting held on November 18, 2010: We reviewed the Hui goals and objectives, and continued work on updating the data standards for both weeds and fences (in particular, standards for Strawberry Guava data collection). We also completed a round robin of current projects that groups were doing in order to stay up to date with on-going progress in various groups.

- Meeting held on August 10, 2011: Stephanie Tom from The Nature Conservancy (TNC) on O‘ahu participated in this meeting and talked about current TNC projects and the uses of ArcGIS online. We discussed the possibility of offering data over the internet in real time but realize our limitations to this tool.

PHASE 3: Analysis

WMMWP staff continued analysis of the RMH imagery using a gridded system to keep track of areas that we have analyzed, in addition to aerial helicopter surveys and ground surveys.

- We were able to use the RMH imagery up to about 3,400 feet before the imagery got too blurry to use. The higher area was flown at a different date and under more trying conditions. After some preliminary tests it was evident, because of the quality of imagery, that understory species (*Tibouchina herbaceae* and *Clidemia hirta*) would be next to impossible to pick out, so we decided to focus on strawberry guava (*Psidium cattleianum*). We picked target areas, mostly on ridge tops, and started searching from higher elevations to lower elevations. Preliminary analysis lent us 296 potential points for strawberry guava. We were able to reach 61 points on the ground to check their validity, of which 43 points were in fact strawberry guava and 18 were a different species, giving us a success rate at identifying strawberry guava using the imagery of 70%, which for preliminary results are good (See Map A.). There are still 235 points that we have not visited on the ground for verification and many of these are in areas where we know there are large stands of strawberry guava. Inaccuracy of ortho-rectified images and even small inaccuracies of ground GPS units makes it difficult in densely populated target areas to confidently determine if individual plants were specifically identified in the imagery.

PHASE 4: Technical Report

WMMWP is just beginning to combine data and information to begin to write this technical report and will be further along once all analysis is completed. We are also waiting to finish this deliverable to see if any new image collection will occur or if new species will be addressed.

PHASE 5: Planning

We have begun the process of creating a 5 Year Weed Management Plan for WMMWP. In order to collate knowledge from all of our landowners and cooperating land managers, we developed a Map Book and a form for participants to draw the ranges and specific locations of weeds on a map. The results of this Mapbook will be compiled and then discussed at a meeting on Thursday, September 8th with multiple land managers with knowledge of the area. We will set priority species and areas and then develop an action plan for work over the next 5 years. We hope to have a draft of the Plan by the end of 2011.

PHASE 6: Implementation (mostly funded through other grants)

Control of weeds that we found during this project was covered by other grant monies; however we did survey a total of 220.6 acres using the RMH imagery. This imagery then helped us to focus our control areas on the mountain, leading to the following treatment numbers: (*Acacia mearnsii* and *Cinchona* species were not originally specified in the grant proposal, however due to increasing concern by land managers we have begun to control these species). (See Maps B – C for each species’ control efforts).

- Number of Plants Controlled or Treated (**funded by other grants**):
 - Strawberry guava (*Psidium cattleianum*): 3,899
 - Koster’s curse (*Clidemia hirta*): 695
 - Black wattle (*Acacia mearnsii*): 7
 - Quinine (*Cinchona* sp): 7

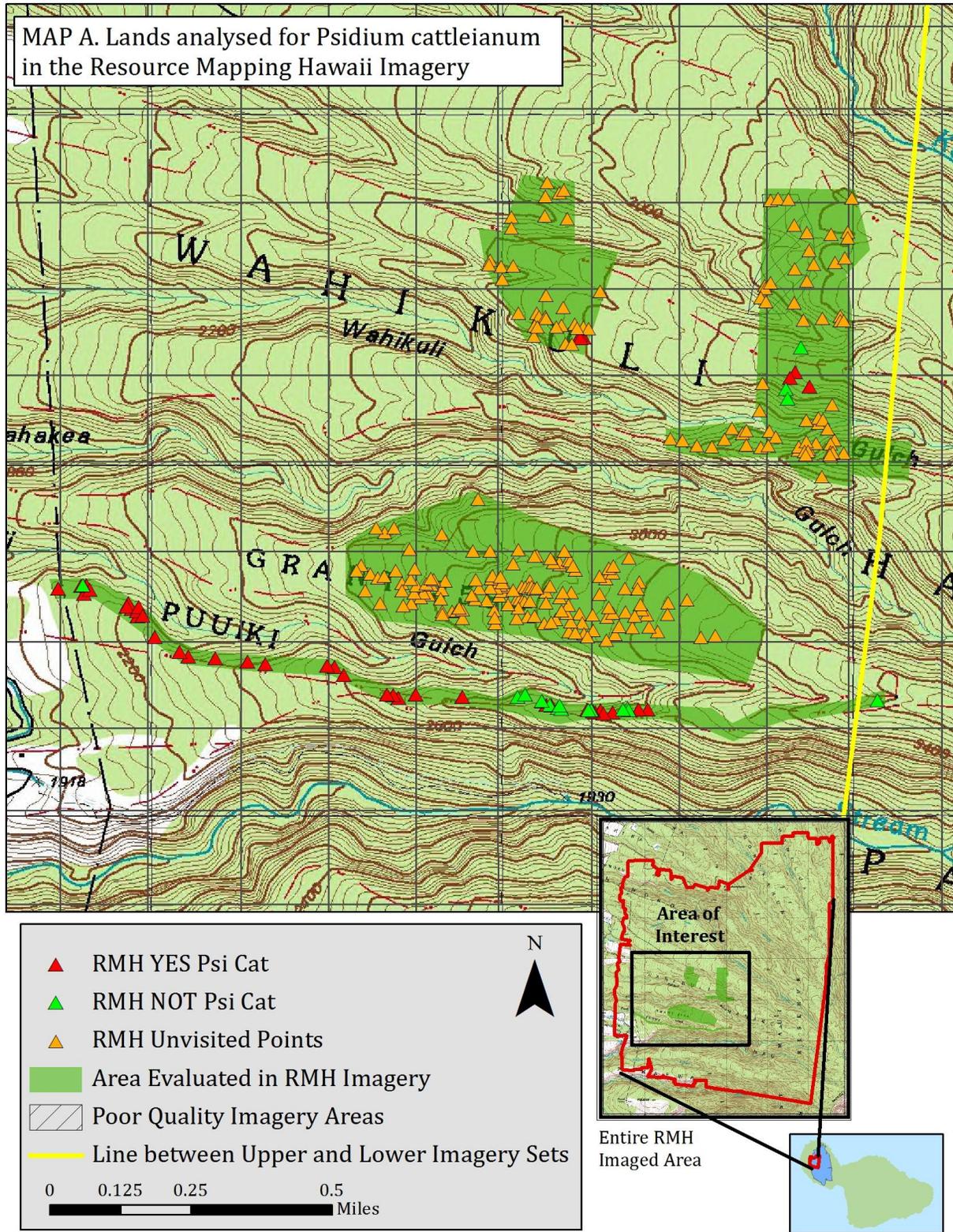
- Cane tibouchina (*Tibouchina herbacea*): 50
- Acres Surveyed:
 - RMH Imagery: **(This grant)** 220.6 acres
 - Aerial Surveys: **(funded by other grants)**(Psi cat only) 1,340.74 acres
- Ground Acres Swept and Controlled: **(funded by other grants)**
 - Strawberry guava (*Psidium cattleianum*): 85.2
 - Koster's curse (*Clidemia hirta*): 52.9
 - Black wattle (*Acacia mearnsii*): 5.6
 - Quinine (*Cinchona* sp): 6.2
 - Cane tibouchina (*Tibouchina herbacea*): 3.6

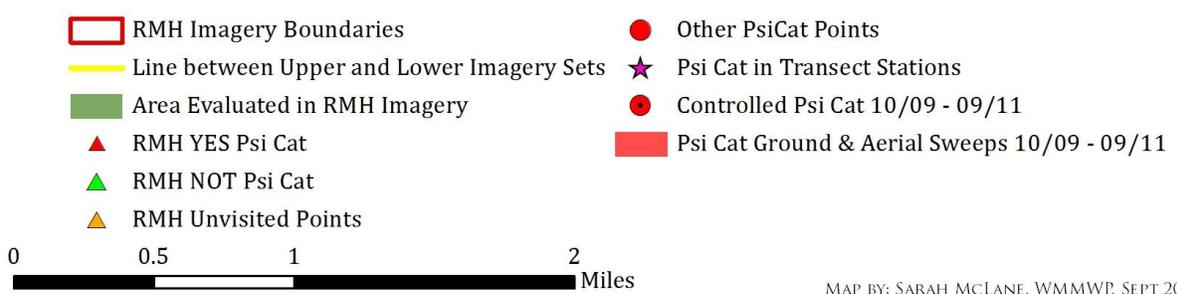
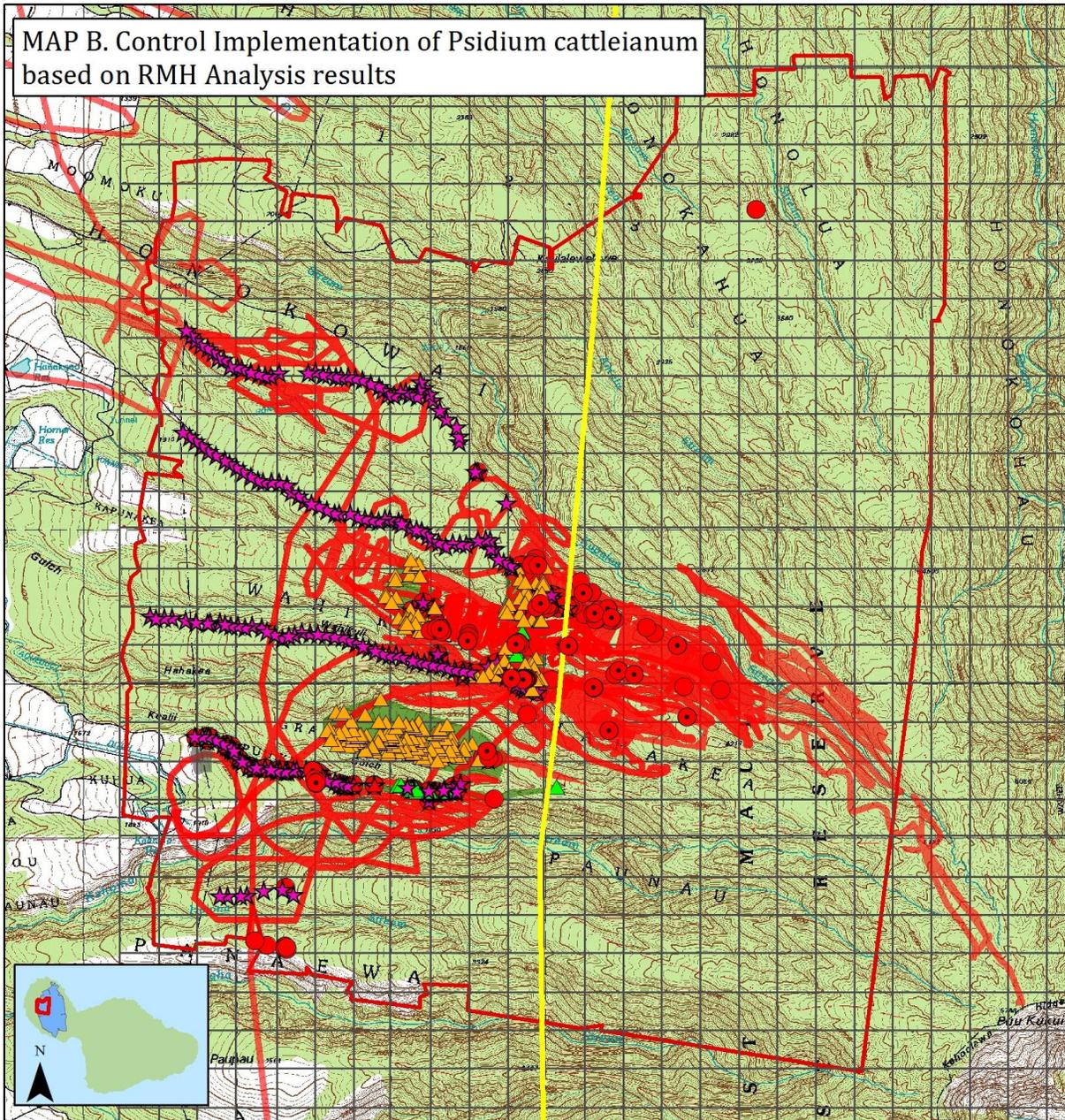
Other activities:

Additional activities also helped achieve HISC objectives.

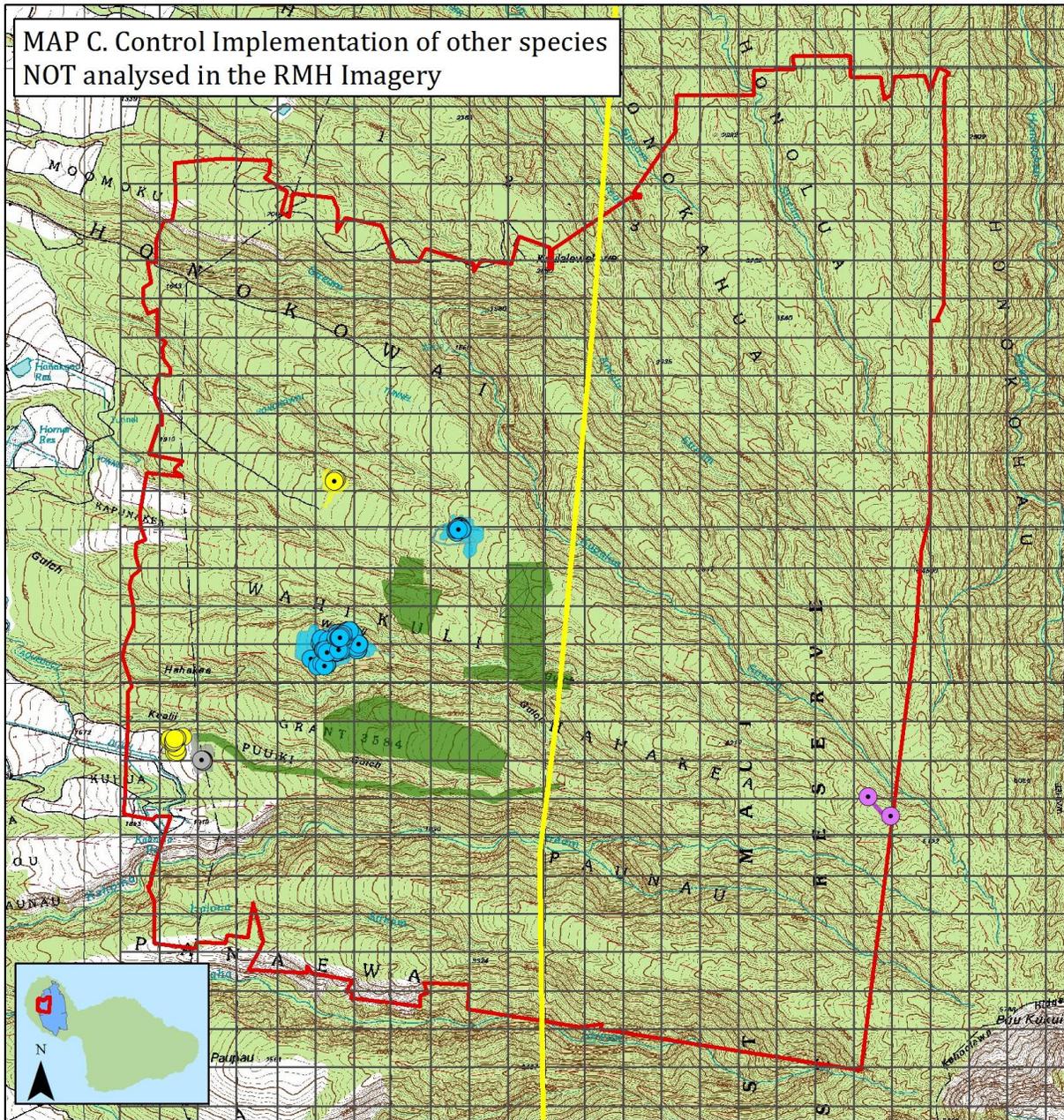
Capacity development: Three additional field workers were hired with support from the State, ARRA funding and Maui County Office of Economic Development, which allowed us to cover more ground and aerial survey acreage. Staff capacity was enhanced by planning and implementing the following training events: recertification of CPR and First Aid and B-3 Helicopter training for new staff.

Note: In the following Maps (A-C), Psi Cat = strawberry guava, CliHir = Koster's curse (*Clidemia hirta*), Acamea = black wattle (*Acacia mearnsii*), TibHer = Cane tibouchina (*Tibouchina herbacea*), and Quinine refers to *Cichona* sp.



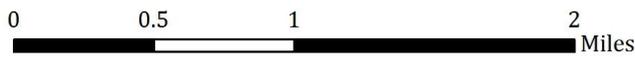


MAP BY: SARAH MCLANE, WMMWP, SEPT 2011



MAP C. Control Implementation of other species NOT analysed in the RMH Imagery

- Quinine Controlled 10/09 - 09/11
- Tib Her Controlled 10/09 - 09/11
- Cli hir Controlled 10/09 - 09/11
- Other CliHir Points
- Other AcaMea Points
- Aca Mea Controlled 10/09 - 09/11
- Aca Mea Sweeps 10/09 - 09/11
- Tib Her Sweeps 10/09 - 09/11
- Clidemia Sweeps 10/09 - 09/11
- Area Evaluated in RMH Imagery
- RMH Imagery Boundaries
- Upper/Lower Imagery Divide



MAP BY: SARAH MCLANE, WMMWP, SEPT 2011

V. HISC Public Outreach Working Group

Public Outreach Working Group (POWG) Goals

- Educate the public and private sector about invasive species to positively affect perception, action, and funding for control and prevention.
- Foster awareness and concern in the general public about invasive species.
- Increase public and private support.
- Seek measurable changes in behavior.
- Promote priority messages in HISC Strategy.
- Reach out to priority audiences in HISC Strategy.



Students help to remove invasive algae during the 'Aina Ho'ola o Ma'ilikukahi Youth Conference on Conservation and Agriculture co-organized by HISC.

Funded Projects for FY11

The current lead agency and chair for POWG is DOT. In FY11, POWG funded 11 projects, totaling \$224,818:

- 1) *Public Outreach for Kaua'i*, KISC: \$19,800.
- 2) *Outreach to the O'ahu Gardening Public*, OISC: \$17,500
- 3) *Outreach and Public Education on Invasive Species for Maui, Moloka'i, and Lāna'i*, MISC: \$24,000.
- 4) *Big Island Education and Outreach*, BIISC: \$30,000.
- 5) *Hawaiian Ecosystems at Risk Project Technical Assistant*, Hawaii Ecosystems at Risk Project: \$20,000.
- 6) *Hawaii Early Detection Network Outreach/Display Materials*, Pacific Basin Information Node and the Maui Invasive Species Committee: \$1,188.
- 7) *Video Production: The Impacts of Feral Animals on Hawaiian Forests*, Watershed Partnerships, DOFAW, DLNR: \$12,000.
- 8) *Plant Pono Website*, Coordinating Group on Alien Pest Species: \$3,000.
- 9) *HISC Communications Coordinator*, HISC staff: \$75,330
- 10) *Buy Local, It Matters PSA-Import Replacement*, 4 Ag Hawaii: \$15,000.
- 11) *Aquatic Invasive Species Outreach*, Aquatic Invasive Species Program, DAR, DLNR: \$7,000.

Key Activities in FY11

With 11 different projects implemented in every county, POWG delivered priority HISC messages to the general public and targeted audiences in communities across the state. The true impact of community outreach and public relations efforts can often be immeasurable, but POWG does track specific numbers to demonstrate effectiveness and the scope of work.

- Over 50 articles were authored by HISC-supported outreach staff about invasive species issues in a variety of publications, such as Maui's ongoing "Kia'i Moku" column in *The Maui News*.

- Nearly 9,000 educational materials about invasive species, such as brochures and posters, were designed, produced and distributed on every island, including Early Detection postcards to engage the public in reporting pests.
- Approximately 45,000 people were directly reached with invasive species information through presentations, educational displays, and at community events.
- The HISC partner website www.hawaiiinvasivespecies.org received over 750,000 hits in FY11.

POWG is a very active collaboration. POWG met quarterly in FY11 on the following dates:

- August 2, 2010: Discussion on budget proposals for FY11 funds
- October 21, 2010: Legislative workshop held at the State Capitol in partnership with the Hawaii Public Access Room
- January 19, 2011: Presentations and discussion about aquatic invasive species followed by opening day at the legislature
- March 21, 2011: Strategic planning session to identify priorities for FY11

POWG Project Changes and Encumbrance Challenges

The original FY11 budget approved by HISC included an award to DOH for \$3,000 to support a project entitled Perils in Paradise. After the approval of the budget, the focus of the Perils in Paradise project changed and the funding was no longer needed. POWG unanimously agreed to use the \$3,000 to support the Plant Pono project, which is outlined in the outreach reports section below. Both the “Buy Local, It Matters” public service announcement (PSA) and the Aquatic Invasive Species Outreach projects were not able to encumber their FY11 funds due to various issues in procurement. The PSA project identified the challenge of transferring funds to non-profit organizations from the HISC, which led to a revision of the HISC FY12 budget proposal guidelines to focus funding on proposals from state agencies and the University of Hawai‘i. The funds for the Aquatic Invasive Species Outreach project were not encumbered in time due to staff shortages in both DAR and the continued vacancy of the Invasive Species Project Manager for DLNR. Additionally, the HISC Coordinator was not hired until near the end of the fiscal year. The Aquatic Invasive Species team at DAR did pursue some outreach activities with funding received via the Established Pests Working Group, and those projects are described in this report under Section III. Additionally, members of POWG collaborated with DAR on a media outreach day regarding aquatic invasive species. That effort is described in this section.

Measures of Effectiveness for the Public Outreach Working Group

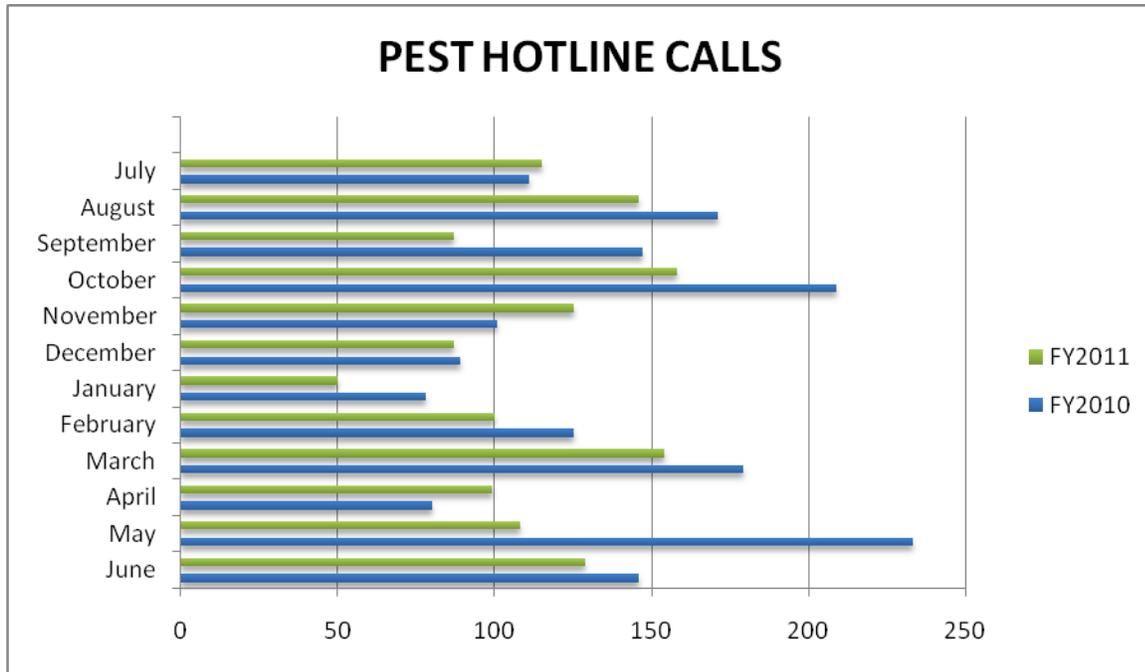
Pest Hotline

The original set-up charges for the Pest Hotline (643-PEST, a statewide direct-dial number that is routed to the local office of HDOA) were funded by HISC, and POWG continues to promote this number as a reporting tool for the public. This year, POWG promoted the number through a variety of outreach efforts,

including presentations, early detection workshops, articles, materials, and events. Staff continued to giveaway pens and stickers branded with the logo. In the HISC Strategic Plan, “Report Pests to 643-PEST” is a priority public education message, and one of the measures of effectiveness is “Numbers of callers



on the pest hotline.” In FY11, the Pest Hotline received 1358 calls down from 1669 total calls in FY10. It is imperative that HDOA has adequate staffing to respond to pest hotline calls from the public.



***Total Calls from July 1, 2010 to June 30, 2011= 1358**

HISC Website

“Number of Hits to the Invasive Species Web Pages” is another measure of effectiveness for the POWG. The site, www.hawaiiinvasivespecies.org, hosts the pages for HISC, CGAPS, the Invasive Species Committees, and general invasive species information.

The HISC website is frequently updated and several new pages have been added. The invasive species Listservs administered through UH continue to be a key communication vehicle for interagency coordination.

STOPPING THE SILENT INVASION
LEADERSHIP, COORDINATION, AND ACTION
PROTECTING HAWAII FROM INVASIVE SPECIES

643-7378 PEST
Protect Hawaii With One Call
Call the Pest Hotline to report invasive pests.

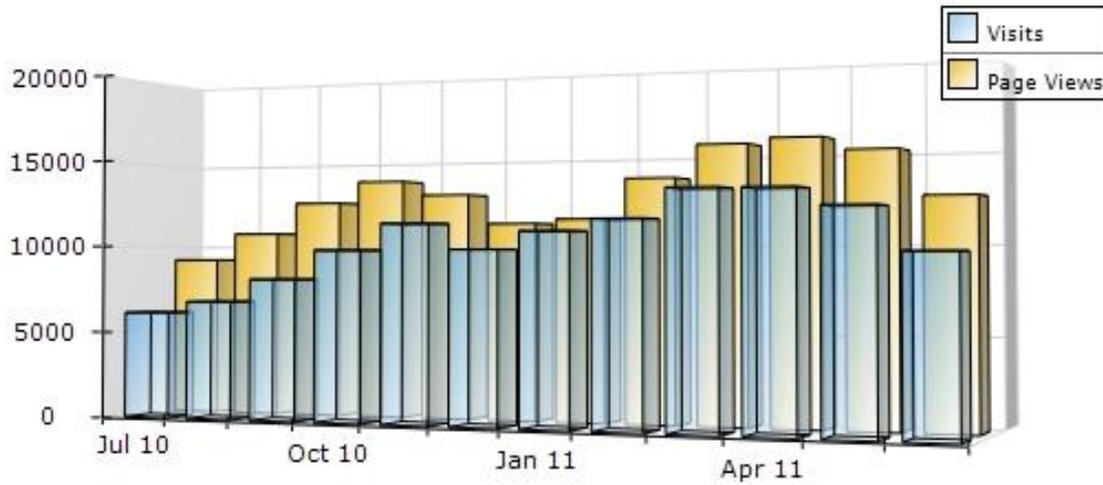
Strawberry guava invades native forests
Introduced to Hawaii from Brazil in 1825, strawberry guava is an invasive species that many enjoy. People eat the fruit fresh or in jam, or use the wood for smoking meat. However, strawberry guava's potential damage may outweigh its utility. Strawberry guava has no natural enemies or competitors in Hawaii. It forms dense thickets replacing native Hawaiian plants, and damages the watershed services that diverse forests provide. Its spread over thousands of acres is beyond the possibility of control by existing methods. These are just some of the reasons why there is a public conversation about the proposed introduction to Hawaii of a scale insect that is the natural population control of strawberry guava in Brazil. Learn more about [strawberry guava and biocontrol](#) and the [facts and fiction about strawberry guava control](#) (pdfs). Further information is provided by the Institute of Pacific Islands Forestry: [Biological Control of Strawberry Guava in Hawaii](#)
[Native Hawaiian forests vs. strawberry guava. \(video\)](#) HEM

Hawaii Invasive Species Council (HISC) Cabinet-level work on invasive species	Coordinating Group on Alien Pest Species (CGAPS) Management-level coordination and initiatives	Invasive Species Committees of Hawaii (ISCs) Island-based response and control programs	Hawaii's high-profile invasive species
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In the absence of funding for media services, such as PSAs, and production of educational materials, the website’s importance has increased as a venue to provide free videos, brochures, and links to detailed country-based and statewide information. Additionally, with the greater public interest in online resources, especially the younger demographic, the website is a valuable outreach tool. The Invasive

Species Committees and other HISC programs are also using Facebook pages as a way to tap into social media marketing.

In FY11, the logged number of website “hits” totaled 750,696, which is an increase from FY10’s total of 698,561, and FY2009’s total of 10,596. There was an average of 62,558 hits per month, with the highest number in April with 80,395 hits. POWG promotes the HISC website, as well as individual pages, during all outreach activities. The graph below shows the breakdown of total visitors and page views during the months of FY11. There were 155,108 total page views and 121,586 total visits in FY11.



Title: Outreach for Kaua'i County

Organization: The Kaua'i Invasive Species Committee (KISC)



Working Group: Public Outreach

Award: \$19,800

In FY11, KISC Outreach continued working on goals outlined by the HISC Public Outreach Working Group Strategic Plan. Priority was given to educating the community regarding the importance of Early Detection and providing them with ways to report new species sightings. KISC also participated in various education programs and community events across Kaua'i, highlighting not only statewide invasive species concerns, but KISC local priority targets as well. KISC works on raising awareness, building participation and partnerships, and connecting with community on a grassroots level.

HISC Public Outreach Working Group: Measures of Effectiveness

Number of people reached through talks and displays:

KISC presentations and displays targeted priority audiences of the HISC strategic plan: the general public and students. All presentations and displays were developed to raise awareness of invasive species issues on the island, educating the public about target species as well as Early Detection species.

- KISC presented to public schools and rotary clubs across the island. Students and public reached: 140
- KISC provided library displays to inform the local community members about target species in their community. Estimated public reached: 2,000
- KISC developed partnerships with local nurseries as well as big-box stores to display plant point-of-purchase coqui outreach. Estimated plant buyers reached: 10,000



Giant LFA for interactive outreach



KISC booth at Farm Bureau Fair

Number of invasive species educational programs and community events implemented by staff:

KISC participated in various educational programs and community events around the island targeting multiple Priority Audiences of the HISC strategic plan: special interest groups, students, and the general public. Special interest groups included plant sellers and growers, environmental professionals, and state workers. Programs focused on gaining public support on invasive species issues as well as education on identification of KISC target species.

- KISC participated in the Kaua'i Farm Bureau Agriculture Awareness day with both lectures

and display booths. Presentations to the elementary students focused on introducing the impacts of invasive species to the students and raising their awareness. Estimated students and teachers reached: 400

- KISC displays were present at community events across the island including: Kaua'i Farm Fair, Garden Fair, Arbor Day, Banana Poka Roundup, and Kaua'i Community College Earth Day. Estimated Public reached: 5,700
- As part of the Hawaii Early Detection Network, KISC continued to promote and hold workshops on Kaua'i. Early Detection workshops were geared towards different Special Interest Groups including Neighborhood Associations and Conservation partners. Estimated reached: 90

Number of educational materials produced:

Educational materials, take-away items and “prizes” are some of the best forms of public outreach. KISC continued to promote the messages in the Strategic Plan.

- KISC produced posters promoting the messages: “Plant Native Species”, “Don’t Buy a Pest”, “Protect Hawai’i”, and “Don’t Plant a Pest”. Estimated public reached: 2,000
- Priority species informative postcards were given at events and to targeted landowners. Estimated public reached: 800
- KISC also handed out multiple “prizes” promoting the Pest Hotline and invasive species awareness. Estimated public reached: 2,000
- KISC produced and published a Keiki Activity Book focusing on agricultural pests. Estimated students reached: 600
- KISC produced and e-published its annual newsletter “Kia’i moku”



Go Native! Banner

(<http://www.hear.org/kisc/newsletter/pdfs/kiaimoku2011v4n1.pdf>). Estimated public reached: 500

Specific Proposal Deliverables:

Display materials for two top priority species: coqui frogs and little fire ant.

Coqui frogs and little fire ant awareness was the priority of KISC educational displays this year. A larger-than-life replica of the LFA was created to draw public interest to the species. KISC maintained a partnership with local nurseries and developed partnerships with Big-box stores to display plant point-of-purchase coqui outreach materials.



Materials with Pest Hotline

Take-away items for public to help them remember that there is a way to report pests (to statewide Pest Hotline)

All items given to the public include information on reporting invasive pests to both KISC and the statewide Pest Hotline.

Continue to develop KISC’s Early Detection program through

workshops with community members, partners, and students.

KISC continued to promote and develop KISC’s Early Detection

program. Early Detection workshops were held for DOFAW and environmental professionals from conservation groups working in Kaua'i's remote forests. These workshops focused on identification of early detection species and priority species to watch out for in the field. Early Detection workshops were also held for public groups focusing on KISC targets and early detection species.

Title: Outreach to the O'ahu Gardening Public

Organization: The O'ahu Invasive Species Committee and the Hawai'i Pacific Weed Risk Assessment



Working Group: Public Outreach

Award: \$17,500

The O'ahu Invasive Species Committee (OISC) is a multi-agency partnership dedicated to protecting O'ahu from invasive species that may harm the environment, agriculture, watersheds, economy and quality of life on O'ahu. The Hawai'i-Pacific Weed Risk Assessment (HPWRA) program assesses plant species for invasive potential, using a science-based scoring system. HPWRA assesses species submitted by landscaping professionals, natural resource managers and the general public.

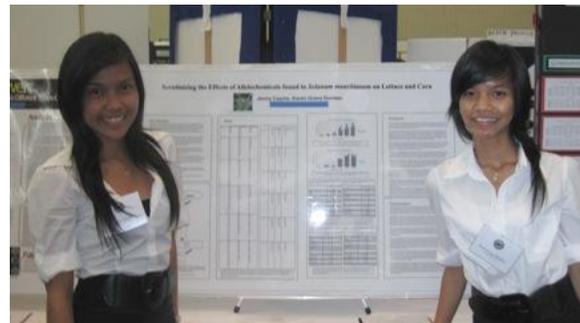
HISC Public Outreach Working Group:

Measures of Effectiveness

Number of people reached through talks and displays:

This project targeted a priority audience of the HISC strategic plan—Special Interest Groups that play an important role in introducing, promoting, or observing invasive species.” Master Gardeners are an information conduit to the general public and play an important role in helping the public decide which species to plant. Making sure they have the tools to be able to answer the public’s questions about which species will not harm Hawai'i is an important part of making sure new, invasive species are not introduced to Hawai'i and that already harmful species are not spread.

- In cooperation with CTAHR, the WRA Specialist developed a draft invasive species curriculum for the Master Gardeners program. In past years, the WRA Specialist has researched and written CTAHR publications on fruit trees and fragrant flowers that are low-risk. The publications also promote the use of HPWRA. These publications were included in the curriculum for the Master Gardeners. Estimated public reached: 35
- The WRA Specialist presented the draft curriculum to O'ahu Master Gardeners at one of their training sessions. The presentation included information on HPWRA and resources about invasive species. Public reached: 35
- OISC and the WRA Program presented information about the HPWRA System to garden enthusiasts at the Urban Garden Center's Second Saturday, Garden Event in Pearl City, O'ahu. OISC set up an educational booth and gave classes to the general public about how to use the HPWRA to choose non-invasive plants for the garden. Estimated public reached: 150



Waipahu seniors with their poster on an invasive weed at the Hawai'i State Science Fair.

- The WRA Specialist partnered with the Hawai'i Academy of Science and mentored two Waipahu high school students for their AP Biology science project. The research focused on testing an invasive plant species, wild tobacco (*Solanum mauritianum*), for allelopathic effects on other plant species. The students presented at regional science fairs and progressed to the Hawai'i State Science Fair where their research poster was displayed. Estimated public reached: Over 500 students participate in the Hawaii State Science Fair.

Specific Proposal Deliverables:

Produce publications on low risk plant species similar to the "Fragrant Flowers and Fruit Trees" publications.

The WRA Specialist collaborated with CTAHR to produce a publication on invasive and naturalizing orchid species in Hawai'i. It is currently being reviewed and will be published on the CTAHR website in October. The publication identifies invasive traits in orchids and promotes the use of the HPWRA System to identify potential invasive orchid species. The publication will be available for free on the CTAHR website and has the ability to reach any orchid enthusiast that has web access.

Support for the data to populate the new "Plant Pono" website that will emphasize planting low risk plant species.

The WRA Specialist collaborated with CGAPS to identify a webpage format that is user-friendly and communicates information about invasive plant species and alternative non-invasive plant species. The specialist also recommended low risk species as alternatives for invasive plant species. New species assessed by the WRA Specialist were recorded into the database.

Outreach to the Million Trees of Aloha Project to ensure trees chosen to be planted are low-risk.

The WRA Specialist continued as a committee member to communicate invasive species risks at Million Trees of Aloha Project meetings. The project currently promotes planting native koa (*Acacia koa*), other native trees and shrubs and non-invasive trees or shrubs. The Million Trees of Aloha project is promoted on the Kanu Hawaii website. Over 700 people committed to planting non-invasive trees via the website. An additional 50 people were informed of invasive species issues during the projects meetings.

Title: Outreach and Education on Invasive Species: Moloka'i

Moloka'i Invasive Species Committee

Working Group: Public Outreach

Award: (Included in Maui County funding)



The Moloka'i Invasive Species Committee (MoMISC) works to prevent new pest species from becoming established on Moloka'i. The Committee prevents and controls incipient pest infestations through local communication, coordination and planning. Central to that goal is the need to educate the community and private sectors about invasive species. An educated community serves as an extension of MoMISC's eyes and ears. Through outreach and education activities, MoMISC has become known as an information center and rapid response agency. Developing positive public relationships has led to direct benefits including access to private properties to control pests and early reports of new pests.

HISC Public Outreach: Measures of Effectiveness

Agency adoption of rules and policies against invasive species:

MoMISC's Field and Outreach Coordinator regularly attends community planning meetings and was successful in getting private and government projects to incorporate invasive species protocols into their projects. Several residential and commercial building projects have incorporated best management practices for invasive species as result of MoMISC's recommendations. MoMISC worked with DOT and DLNR on invasive species mitigation for a proposed \$5 million harbor improvement project on Moloka'i.



Coqui-free sign at Mahana Nursery

Adoption of Codes of Conduct by businesses:

A newly opened nursery on the island has agreed to incorporate a "Code of Conduct" related to shipments of live plants. With agreement of the owner, MoMISC staff will inspect every shipment of arriving plants for coqui frogs and little fire ants. MoMISC also screens for exotic and unknown plants. When staff detects unknown or questionable plants, staff calls a HISC HPWRA specialist for an immediate evaluation as MoMISC has only two days to work with the nursery owner before plants may be released to the public. The HPWRA specialists are a critical component in the early detection of harmful pests arriving on Moloka'i. The nursery volunteered to join the "Coqui-free" certification program. The certification program began in 2008 on Maui and participants must adhere to a set of preventative codes of conduct that are designed to help in the early detection of coqui frogs. Given the few avenues on Moloka'i for importing landscape material, the cooperation of this business is a significant success.

Track number of print and broadcast media mentions:

Articles on invasive species and MoMISC's work are reported in TNC's quarterly "Nature's Newsflash." Several articles in the *Moloka'i Dispatch* mentioned invasive species issues, including one titled, "No Pest Zone: MoMISC connects with culture." The article, published on August 8, 2010, highlighted MoMISC's work on albizia and the inclusion of cultural protocols as part of the work.

Number of educational materials produced:

MoMISC provides updates and pest information at ports of entry, public events and community billboards. This year, MoMISC produced the following materials, many of which can be downloaded at MoMISC's website (www.momisc.org):

- 25 pest flyers, including new target species and other pests of concern
- 10 PowerPoint presentations for public and private outreach groups
- 3 sets of invasive species materials for workshops at UH Maui College's botany class on Moloka'i
- 1 interactive invasive species display for the Moloka'i Earth Day
- 1 invasive species display for the 2nd annual Moloka'i Agricultural Fair
- 6 invasive species displays for Moloka'i Airport kiosk
- 4 invasive species displays for Young Brothers pier office



Interacting with the public

Number of people reached through talks and displays:

In FY11, MoMISC reached over 3,000 people through public and private displays and presentations. Staff is regularly invited to give educational talks to public and private groups. MoMISC had displays at the following community events: Moloka'i Earth Day, Moloka'i Agricultural Fair, Moloka'i Airport kiosk, Young Brothers' pier office, three Moloka'i post offices and over 10 community billboards throughout the island. Staff gave talks or presentations at the following venues: UH Maui College botany class, The Nature Conservancy's (TNC) Moloka'i Advisory Board, Monsanto, Moloka'i Community General Plan, and the Gifted and Talented Youth Program.

Number of invasive species educational programs and community events implemented by staff:

MoMISC was a member of the Moloka'i Earth Day planning committee.

Number of volunteers recruited and/or referred to invasive species projects:

MoMISC prioritizes its time to foster long-standing relationships with other conservation partners and their professional trained staff. Through these partnerships, MoMISC's small staff receives needed help for carrying out its mission.

- MoMISC partners contributed over 279 hours.

Additional HISC objectives:

MoMISC staff remains flexible when called upon by the Moloka'i community and partner agencies for help. MoMISC truly "fills the gap" in responding to pests that threaten the island's environment and community. MoMISC's timely and conscientious response to a wide variety of pest issues has proven advantageous in fostering a positive reputation and sense of trust within the community and partner agencies.

- The Moloka'i Land Trust is a new partner agency joining MoMISC. Its Executive Director serves as the new MoMISC Chair.
- MoMISC established a new relationship with Kualapu'u Ranch to control pests on their lands.

Title: Outreach and Education on Invasive Species: Maui and Lānaʻi

Organization: Maui Invasive Species Committee (MISC)



Working Group: Public Outreach

Award: \$24,000

The outreach goal for HISC is to educate public and private sectors about invasive species in order to positively affect perception, action and funding for invasive species. MISC's strategic plan for engaging the public includes a comprehensive media program, participation in community events, involvement with the landscape industry, and a strong education program. Outreach has been crucial for developing county support and for gaining access to private property. Outreach and education activities for Molokaʻi are reported separately but were covered by the same grant.

HISC Outreach Working Group: Measures of Effectiveness

Agency adoption of rules and policies against invasive species:

- MISC staff continued to work with the Maui Conservation Alliance to develop a mechanism to address recalcitrant landowners – those who refuse to allow access to private property for invasive species work. During meetings with the Maui County Council, council members reacted positively to the concept of developing a county ordinance that would provide access for high-priority species. The ordinance would be the first of its kind in the state.
- Staff participated in a HISC-sponsored legislative workshop and meeting, which focused on understanding the legislative process and identifying future legislative priorities.
- As appropriate, MISC provided information on invasive species issues to the Legislature and Maui County Council.

Adoption of Codes of Conduct by businesses:

- The Maui Association of Landscape Professionals (MALP) has already adopted a Code of Conduct for plant sales. MISC's outreach professionals regularly attended meetings and participated in MALP events.
- In 2003, MISC initiated an annual award to recognize individuals and businesses involved in the landscape industry who work to stop the spread of invasive species. In cooperation with the County of Maui and MALP, MISC presented the 8th annual Mālama i ka ʻĀina award to entomologist Mach Fukada for his years of early detection work and commitment to protecting Maui County from invasive species.
- One of the HPWRA Specialists is housed at MISC's headquarters. MISC regularly fields calls from the public, including members of the landscape industry, about which plants might be invasive. The HPWRA Specialist is an excellent onsite resource for meeting this public need.



Entomologist Mach Fukada received the 2010 Mālama i ka ʻĀina award

- 29 Maui plant growers and providers are now considered coqui-free under MISC's Coqui-free Certification Program.

Track number of print and broadcast media mentions:

Print Media: There were 22 articles in *The Maui News* or local newsletters mentioning invasive species, MISC targets, or MISC. Additionally, MISC staff and committee members authored 11 articles for the Kia'i Moku column in *The Maui News* for a total of 33 mentions during FY11.

- "Biological enemy to stinging caterpillar to be set free on Maui." Kia'i Moku column: *The Maui News*, July 11, 2010.
- "Aquarium fish bill advances in council: Measure aims to add transparency to trade that lacks regulation." *The Maui News*, July 15, 2010.
- "Wasps used to control pesky caterpillars: Parasitic insects released in Haiku to eradicate invasive stinging larvae." *The Maui News*, August 4, 2010.
- "Noxious tumbleweed rolls on Maui." Kia'i Moku column: *The Maui News*, August 8, 2010.
- "State makes progress removing invasive seaweed." *The Maui News*, August 20, 2010.
- "Brown tree snake detection workshop offered." *The Maui News*, August 24, 2010.
- "Ulupalakua Cares set for Sept. 5." *The Maui News*, August 25, 2010.
- "Government partnership smells a rat and wants action." *The Maui News*, August 30, 2010.
- Pampas grass is an invasive, prolific plant." Kia'i Moku column: *The Maui News*, September 12, 2010.
- "Used in reforestation, albizia now poses threat." Kia'i Moku column: *The Maui News*, October 10, 2010.
- "Little fire ant infestation eradicated: new bait kills off dangerous pest." *The Maui News*, October 11, 2010.
- Ad soliciting nominations for Mālama i ka 'Āina award. *The Maui News*, November 7, 8, 13, 14, 2010.
- "Rauvolfia vomitoria: a growing problem." Kia'i Moku column: *The Maui News*, November 14, 2010.
- "MALP seeks nominations for 'Āina awards." Hawai'i Landscape, November / December, 2010.
- "Haleakala park supporters honored." *The Maui News*, December 1, 2010.
- "Archive planned at national park: Superintendent gives public update on upcoming plans." *The Maui News*, December 5, 2010.
- "Keep an eye out for predatory veiled chameleons." Kia'i Moku column: *The Maui News*, December 12, 2010.
- "Public encouraged to report invasive species." Letter to the Editor: *The Maui News*, December 13, 2010.
- "Man who identified little fire ants wins association honor." *The Maui News*, December 24, 2010.
- "Red-vented bulbul can alter ecosystems." Kia'i Moku column: *The Maui News*, January 9, 2011.
- "MISC is helping to protect Maui County." Letter to the Editor: *The Maui News*, January 31, 2011.
- "New gardens director to infuse more native culture." *The Maui News*, February 7, 2011.

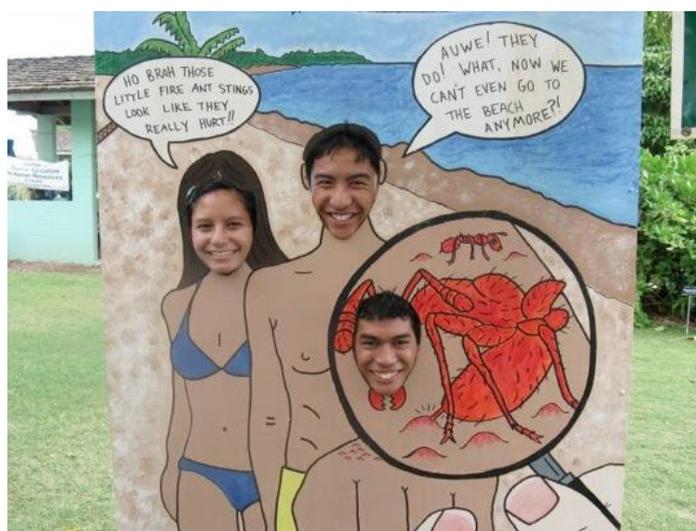


"Release of pet birds poses threat to ecology."

- "Banana bunchy-top virus poses threat to plants in Hawaii." Kiaʻi Moku column: *The Maui News*, February 13, 2011.
- "Release of pet birds poses threat to ecology." Kiaʻi Moku column: *The Maui News*, March 13, 2011.
- "Battle begins to prevent dengue fever." *The Maui News*, April 8, 2011.
- "Rats run amok on isles." Kiaʻi Moku column: *The Maui News*, April 10, 2011.
- "Suspected dengue cases up." *The Maui News*, April 14, 2011.
- Thank-You Letter. *The Maui News*, May 1, 2011.
- "Banana bunchy top virus." Maui Master Gardener Newsletter, May 1, 2011.
- "Rodent threat continues in Hanawi reserve area." Kiaʻi Moku column: *The Maui News*, June 12, 2011.

Broadcast Media:

- MISC is working with videographers Masako Cordray and Chris Reickert to produce an educational video and Public Service Announcements to educate the public about the threat posed by the little fire ant. Footage has been produced from the Hawaiʻi Island, Maui, and Tahiti.
- Staff worked with a video team from JITNOT Productions, which is creating pro-bono 60-second and 30-second PSAs about Miconia. Footage was obtained from Hāna work sites and narration was provided by Richard Hoʻopiʻi.



Little fire ant photo op for fairs

Number of "hits" on invasive species web page:

- MISC developed and launched a statewide informative website about the little fire ant: www.lfa-hawaii.org

Number of education materials produced:

- Approximately 1,000 copies of the MISC newsletter were mailed, emailed, or hand-distributed. The newsletter highlighted the work of MoMISC, with special emphasis on efforts to control albizia.
- Twenty ant detection kits were distributed to residents on Lānaʻi.
- MISC promoted the Hōʻike o Haleakalā website and curriculum project with a listing in the Maui Family Magazine Teacher's Field Trip and Resource Guide. An estimated 2,000 copies were distributed on the island.

Number of people reached through talks and displays:

- Audience for presentations: 411. Informational presentations were given to the Orchid Society, Mālama Hamakua Community Watershed Action Group, and the Hāna community. A presentation on pampas grass was given at the Hawaiʻi Conservation Conference and a separate poster featured work on fountain grass on Lānaʻi.

- Community events: 5,732 people. MISC participated in ten community events across the island, including: the Makawao Fourth of July parade, Maui Swap Meet, 'Ulupalakua Cares, Maui County Fair and Parade, Arbor Day, MALP Lawn & Garden Fair, Milagros' fundraiser, Maui Agricultural Festival, and the East Maui Taro Festival.

Number of invasive species educational programs and community events implemented by staff:

- MISC's educational program reached 1,694 students during classroom visits. Educational activities occurred at 13 schools, two community centers, the Keiki Eco-Conference, and the Hāna Digital Bus. Students ranged in age from 1st grade through community college.
- MISC continued to develop and promote the Maui-based Hō'ike o Haleakalā science



Teaching the teachers: workshop at MISC

curriculum. A professional development workshop on the curriculum attracted seven teachers. The teachers were required to create a portfolio documenting that they used the curriculum to teach six lessons. Development of a new module, which is focused on invasive species, is progressing. A separate workshop based on the draft curriculum solicited input from teachers on proposed activities; one activity requires students to create a timeline showing the rate of introduction of invasive species, and another requires use of Google Earth to model the spread of the *Erythrina* gall wasp.

- Workshop training: 130 participants. In cooperation with the County of Maui, HDOA, and DLNR, MISC helped provide community training on how to identify and report sightings of snakes and invasive vertebrates.

Number of volunteers recruited and/or referred to invasive species projects:

- Volunteer activities varied in length from one day to one week with a total of 112 participants. In November 2010, students from Seabury Hall helped control invasive species in the Waikamoi area, and in February 2011, a different group of Seabury Hall students participated in the Hāna miconia winterim trip. A group of 15 interns from Haleakalā National Park assisted with fire ant surveys.
- Individuals occasionally volunteered on regular work days, most often controlling miconia or working on coqui frogs.
- Several members of the community regularly assist with coqui frog control efforts by loaning their equipment, mowing infested areas, or providing storage facilities for citric acid.

Additional HISC objectives:

Staff promoted the following key outreach messages:

- Protect Hawai'i - this is a common theme throughout MISC's monthly newspaper articles in *The Maui News*.
- Report a Pest (643-PEST) - this number is included on MISC's little fire ant outreach materials.
- Don't sell or buy a pest - newspaper articles typically include this message.
- Keep pets contained - one newspaper article focused specifically on not releasing pet birds.

- Plant native species - MISC's latest display for public events highlights the use of native plants as an alternative to planting invasives.
- Biocontrol messages were incorporated into presentations and outreach displays and biocontrol was the feature of an article on stinging nettle caterpillar.

MISC's outreach program effectively targeted all priority target audiences:

- Decision makers: Personal visits to Maui County legislators and county council members helped ensure they have relevant information about invasive species issues. One legislator even published his own handout about invasive species for dissemination to his constituents using information from MISC.
- Special Interest Groups: MISC has developed positive working relationship with members of the landscape industry through the Maui Association of Landscape Professionals and by having a regular presence at community events. MISC is strengthening its connection to the farming and ranching communities by participating in the Axis Deer Working Group.
- Students: The Hōʻike curriculum has provided a natural pathway for "teaching the teachers" about invasive species issues and also for direct interactions with Maui's students.
- General Public: In addition to MISC's extensive presence in the community via events, newspaper articles, and presentations, one of MISC's most effective ways of communicating about invasive species occurs during field work in the community. Much of MISC's work takes place on private residences, which, by necessity, often includes an educational component. For banana bunchy top virus work alone, staff visited over 3,000 properties. Maui County residents exhibit a high degree of awareness about invasive species.



Not-so-little fire ant visits the Maui Orchid Society

MISC and MoMISC are projects of the Pacific Cooperative Studies Unit - UH. In addition to HISC funding, activities outlined in this report were supported by funding from the County of Maui, USFWS, National Park Service, U.S. Forest Service, private foundations and individuals.

Title: Public Outreach on Invasive Species in Hawai'i County

Organization: Big Island Invasive Species Committee (BIISC)



Working Group: Public Outreach

Award: \$30,000

The FY11 BIISC POWG award supported the outreach specialist salary. Priority projects and methods are described below.

Citizen Eyes and Ears Early Detection and Reporting

The project encouraged and trained citizens for early detection reporting in Waimea and Volcano. These two communities were chosen as gateway areas to vital natural areas, including lands within the Kohala Watershed Partnership and the Three Mountain Watershed Alliance and Hawaii Volcanoes National Park. This project aims to extend the Eyes and Ears Network first started on Maui by Elizabeth Speith, USGS Pacific Basin Information Node, to the Big Island. Citizens are encouraged to use their www.reportapest.org website as a resource and reporting location, in conjunction with the BIISC hotline (808-961-3299).

- In addition to general outreach at Farmers Markets and Community Association meetings, targeted training workshops were held in each community, highlighting species of concern.
- Brochures were produced emphasizing the species of concern for each community. These species include species common in other districts of the island, but not known to be present around these communities.
- Mailing of Early Detection brochure by Waimea Outdoor Circle, 200 recipients
- Hardboard POWG invasive species display placed at Hilo's Pana'ewa Zoo

Education about biocontrol

- Poster (Biocontrol Outreach Challenges in Hawaii) accepted for Sept 2011 International Conference Biocontrol of Weeds.
- Biocontrol brochures are displayed at all outreach events

Education of landscape and nursery industry

Plant sellers can be a serious transport pathway for invasives. The Big Island has over 300 identified nursery operators, in addition to numerous unlicensed backyard operators. Activities in FY11 included:

- Presentation provided to the Big Island Landscape Architects (BILA) Association and info booth provided at Nov 2010 conference
- Significant progress was made during this period with an invitation to provide monthly updates on invasive species to the Board of the Big Island Nurserymen's (BIAN) Association. Several of the BIAN board members are also involved with the newly formed Hawaii



Kau Coffee Festival

Floriculture and Nurserymen's Association (HFNA), which provides an opportunity for BIISC to extend outreach and newsletter articles to this new group.

- Information booths were staffed at numerous farmers markets and plant sales

Piihonua Albizia Control Project Team

This project was initiated by a neighborhood in Hilo which became concerned that their homes access route could be blocked by Albizia (*Falcataria molucca*) growth and decay. The Piihonua Community Association contacted their elected officials for assistance. Under the leadership of the then Senator Dwight Takamine, multi-agency meetings were held to find a resolution to the communities concerns and brainstorm the wider problems of Albizia growth and threats to public safety, such as hospital access. These meetings also sparked efforts to change policy, such as the county tree-trimming ordinance and the Hawai'i noxious weed rule.



- BIISC contributed both outreach assistance and educational material development, and remote sensing analyses.
- This mapping work was submitted as a poster for the Hawai'i Conservation Conference 2011 and won honorable mention in the Society for Conservation GIS map contest.
- Continuing volunteer efforts from the community, in partnership with Dr. James Leary, Weed Management Specialist, CTAHR, are collecting valuable treatment data on labor, chemical methods and amounts, and timing.

Axis Deer

Preliminary outreach materials and meetings have been produced by existing BIISC staff. The scale of this issue will require dedicated outreach staff in the future.

Partnering with the Big Island Beekeepers Association (BIBA)

The arrival of the varroa mite and small hive beetle on the Big Island provided a partnership opportunity to draw attention and educate people on invasive pathways and concepts around an issue that concerns many people (the loss of honey bees and pollination services).

- Co-staffed event booths
- Participated in BIBA meetings with policy makers

Astronomy Related Outreach

Due to the presence of world class astronomy facilities on the Big Island, and the cultural importance of stars in canoe navigation, BIISC outreach has the opportunity to participate in well-funded astronomy outreach events.

- Astroday (thousands of people attend) occurs at the beginning of May and BIISC has an information booth relating space themes to invasives.
- Onizuka Science Day, held in January 2011, offers students a number of interactive workshops. BIISC linked the discussion of the potential for life in space and planetary protection methods to invasive species concepts. Workshop tasks included designing a space life form and

characterizing it as invasive or non-invasive, identification of science fiction movies with invasive themes, and a remote sensing tutorial on the ablizia project.

improving publications and Internet presence

- BIISC webpage (hosted by Hawaiian Ecosystems at Risk) Outreach goals include constant updating of the website with brochures on new target species, pest alerts, and other information
- good progress on improving exhibit materials, with the addition of a prize wheel, custom printed vinyl photographic banners, banner display stands, and new foam board displays
- BIISC maintained a Facebook presence.

Measures of Effectiveness

Agency adoption of rules and policies against invasive species.

BIISC has been working to educate policy makers on the policy gaps for inter-island transport and quarantine. BIISC worked with beekeepers to support legislation that resulted in passage of Senate Bill 866 and House Bill 1568. BIISC met with Big Island elected officials to educate them on *Rauvolfia vomitoria* and the policy gaps that enable such species to arrive. This resulted in legislation introduced by Representative Cindy Evans. BIISC has been working at the County level to assist with drafting of a proposed revision to a county ordinance to enable invasive trees to be eliminated during roadside clearing (currently cannot be cut to less than 15' high).

Adoption of Codes of Conduct by businesses.

Due to the economic downturn and the consequent burden on nursery operations, BIISC outreach focused on education, new pest alerts, and issue education. This approach was felt to be more likely to succeed than asking businesses to commit to BMP that would have required more time and labor than nurseries could afford.

Track number of print and broadcast media mentions.

BIISC published two columns in the gardens news of the West Hawaii today, a blog article about staff snake response training, four articles in the Kohala Mtn news, two articles in the Hawaii Floral and Nursery Assc. newsletter. As part of the publicity about axis deer, BIISC has been mentioned several times.

Number of "hits" on invasive species web page.

BIISC is not able to track the number of hits on our webpage hosted by HEAR. BIISC has approximately 150 monthly active users on Facebook.

Number of callers on pest hotline.

The BIISC hotline averages one call per week.

Number of education materials produced.

Eight new large format exhibit displays were produced and 6 new brochures.

Number of people reached through talks and displays.

BIISC reached 8000 people during events which had a total attendance of 38,000.

Results from a public awareness survey.

No surveys were conducted by BIISC.

Number of invasive species educational programs and community events implemented by staff.

BIISC participated in 75 events during this fiscal year.

Number of volunteers recruited and/or referred to invasive species projects.

In cooperation with *Malama o Puna*, a non-profit and BIISC partner, 50 volunteers participated in mangrove control. Fifty other individuals were referred to groups in their area which have regular volunteer days.

Two individuals provided significant volunteer service to BIISC, and were later hired as staff. The first, Logan Berner, provided remote sensing expertise to the Piihonua Albizia project. The second, Jake Muise, led the design of the axis deer response effort and spent many hours in the field.

Title: Support of Invasive Species Public Outreach Efforts in Hawai'i

Organization: Hawaiian Ecosystems at Risk project (HEAR)

Working Group: Public Outreach

Award: \$20,000



This year, the HEAR Invasive Species Information Technician (the position that this funding supported) provided direct support to the Hawai'i Invasive Species Partnership (HISC/CGAPS/ISCs) website, provided direct support to creation of a Hawai'i-centric biocontrol website, provided quality control for HPWRA "sources" data, and provided direct support for outreach efforts of the HEAR Project.

Utilizing the HEAR Technical Assistant, HEAR provided consistent, stable support for key invasive species outreach efforts in the state, focused on direct support to agency invasive species public outreach goals. In particular, HEAR provided direct support for the Hawai'i Invasive Species Partnership website (www.hawaiiinvasivespecies.org), which includes subsites for HISC, CGAP), and the island-based Invasive Species Committees (ISCs). Additionally, the HEAR Technical Assistant provided direct support for the creation and maintenance of a Hawai'i-centric biocontrol website (www.hear.org/biocontrol/hawaii), provided support for quality control of Weed Risk Assessment source information, and provided direct support for outreach efforts of the Hawaii Ecosystem at Risk project (www.hear.org). Strong partnerships provided the foundation for successful efforts during FY11.

Direct Support to the Hawai'i Invasive Species Partnership Website

HEAR hosted, maintained, and updated the Hawai'i Invasive Species Partnership (HISP) website (www.hawaiiinvasivespecies.org) with direction from HISC, CGAPS and the ISCs. This process included maintenance of existing content and providing new content on specific web pages for HISC, CGAPS, and the ISCs, including organization-specific information (e.g., meeting announcements, minutes, etc.) and summary information about priority pest species as determined by the various partners.



Direct Support to a Hawai'i-centric Biocontrol Website

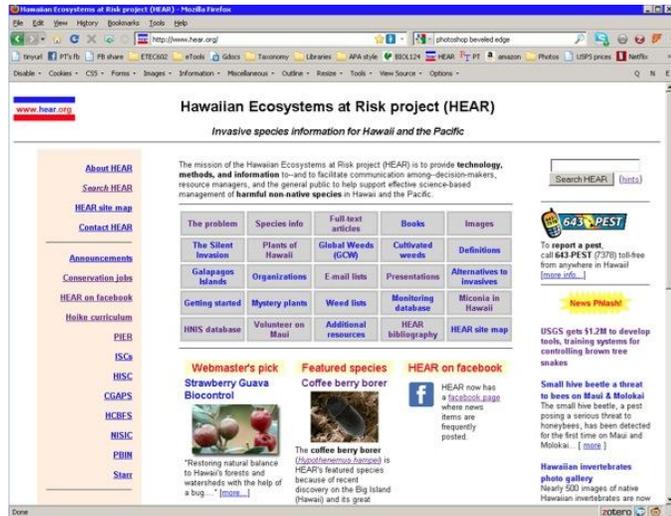
HEAR created a new Hawai'i-centric biocontrol website (www.hear.org/biocontrol/hawaii), utilizing the HEAR technical assistant.

Quality Control for the Hawai'i-Pacific Weed Risk Assessment Sources Data

The HPWRA System is a methodology designed to identify high-risk species (likely invasive pest plants), allowing us to make informed decisions that will reduce the economic and ecological harm caused by invasive plants in Hawai'i and on other Pacific Islands. Due to the completely unstandardized nature of data that had been entered by HPWRA personnel over the years, it was not possible to import this data into relational database format in any meaningful way using automated conversion. The HEAR Technical Assistant provided quality control and entered several thousand source data records.

Direct Support to HEAR Outreach Efforts

The HEAR Project has supported the invasive species community in Hawai'i for many years. Some of the most relevant support functions relate to general technical support, the content created and maintained on the HEAR website (www.hear.org), and management of the web-based outreach and inter-agency communication efforts of HISC, CGAPS and ISCs. The HEAR Technical Assistant was crucial to this year's success in these efforts, including maintenance of dozens of relevant e-mail lists (www.hear.org/hearlists) which facilitate critical interagency communications; keeping current the very-well-utilized announcements and jobs listings (www.hear.org/announcements, www.hear.org/jobs) (as well as other partner-related information); and assistance to the HEAR Webmaster with creation and dissemination of important invasive species information on the HEAR Website.



Title: Hawai'i Early Detection Network (HEDN): Outreach

Organization: Pacific Basin Information Node

Working Group: Public Outreach

Award Amount: \$1,188



HEDN is the expansion of an outreach component of statewide early detection survey and eradication programs that is administered and managed by the Hawai'i Cooperative Studies Unit at UH- Hilo and the USGS Biological Informatics Program (BIP).

HEDN's focus is on:

- fostering and supporting active community surveillance for island-specific early detection targets by conducting in-depth species identification training workshops throughout the state;
- providing on-going support to "eyes and ears" surveillance teams;
- developing and maintaining web materials (www.reportapest.org) including identification information for early detection targets on Kaua'i, Maui, Moloka'i, Lāna'i, and Hawai'i;
- and supporting rapid identification and assessment support via an online web-reporting form and a multi-user, queryable database.

HEDN work supports the Response & Control, Research & Technology, and Public Outreach goals and objectives of the Hawai'i Invasive Species Council's Strategic Plan. Specifically, HEDN addresses the following goals: improving the capacity for detection, eradication, and control for terrestrial and aquatic invasive species; developing new tools for effective early detection and monitoring; and educating the public and private sector about invasive species to positively affect perception, action and funding for control and prevention.

HISC Response and Control: Measures of Effectiveness

Number of species detected and evaluated for feasibility of eradication.

Early detection and rapid response to incipient invasive species included the technical support to the reportapest.org online invasive reporting system. The system employs a technical component (online reporting web page and report assessment database), as well as screening component (reports are assessed for validity and completeness before being forwarded to the appropriate response agency).

- The reportapest.org reporting tool assessment process referred 17 reports to response agencies (ISCs, HDOA, DAR) and closed 6 reports internally. Internal reports are usually not forwarded for response action due to misidentification of the reported pest or the widespread nature of the pest reported (i.e. mongoose [except for on Kaua'i and Lāna'i], greenhouse frogs, etc.) Forwarded reports included miconia (*Miconia calvescens*) in Nahiku on Maui to MISC, stinging nettle caterpillar (*Darna pallivitta*) range expansion on Maui to HDOA, algal bloom in Mauna Kea Beach on Hawai'i to DAR, and axis deer (*Axis axis*) on the Island of Hawai'i to BIISC.

HISC Outreach: Measures of Effectiveness

Track number of print and broadcast media mentions:

- The Hawaii Early Detection Network was mentioned in 5 newspapers articles, 3 of which were focused entirely on the network, and in 4 blog articles this year.

Number of “hits” on invasive species web page.

- The HEDN website, www.reportapest.org, had 11,406 visits and 20,024 page views by 9,553 visitors, predominantly (61%) from Hawai’i. The most popular pages were the [reportapest.org](http://www.reportapest.org) home page, the pest identification quiz, Banana Bunchy Top Virus identification, Hawaii Islands Early Detection Pest List, Invasive Algae identification, Little Fire Ant identification, Stinging Nettle identification, Downy Rose Myrtle identification, and Veiled Chameleon identification.

Number of education materials produced.

- 2000 Hawaii Early Detection Network postcards (500 each for Kaua’i, O’ahu, Maui Nui, and Hawai’i). These postcards will be distributed in collaboration with the ISCs.
- The remaining \$645 awarded to HEDN (though MISC) to create early detection themed banners and stands has not been spent yet due to programmatic changes and constraints at the USGS. It is expected that these monies will be spent before 12 December 2011 or returned to the Public Outreach Working Group.



Front and back of the HEDN postcards

Number of people reached through talks and displays.

Number of invasive species educational programs and community events implemented by staff.

- HEDN presented 5 early detection invasive species identification workshops to 125 people. These workshops taught the importance of community surveillance in early detection and rapid response, identification of key early detection invasive species targets, and how to report invasive species.



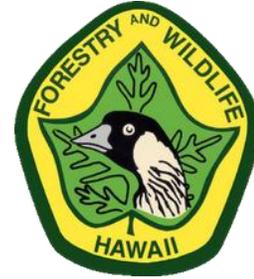
Workshop participant learning to survey for little fire ant

Title: Video Production: The Impacts of Feral Animals on Hawaiian Forests

Organization: DOFAW Watershed Partnerships Program

Working Group: Public Outreach

Award: \$12,000



A request for quotes (RFQ) was issued in December of 2010 for the video production. The lowest quote was received from Cal Hirai of Dive and Trek, LLC, who has worked on other productions for HISC and HDOA. Based on a recommendation from HISC staff, a purchase order for the entire amount of the grant was issued in January 2011. According to the RFQ the production was to be completed in 28 weeks. A list of potential interview subjects was provided by HISC and Watershed staff to the contractor. We assisted him in contacting potential subjects to arrange interview dates. Eight days of shooting on Kaua'i, O'ahu, Maui, and the Big Island resulted in 28 interviews with some B-roll footage. The shooting stretched out in July as it was difficult to coordinate the outer island trips to make sure we interviewed everyone on the same days. Not all the targeted interviews were completed for O'ahu as the contractor began to question the total number of interviews, although this had been discussed in many meetings from January through July.

The RFQ specified that the contractor was then to select the interview segments to use to create the draft script, with DOFAW and HISC reviewing and approving. The contractor, however, was not able to complete this requirement on his own and began to request DOFAW staff assist in these tasks. Due to other obligations, it was difficult to spend the significant amount of time required to review the many hours of footage and select appropriate sound bites from each interview. It seemed the contractor was not capable of completing the project as outlined in the RFQ and due to another project starting in October it looked like he would not continue to work on the project beyond the end of September.

Hence, a decision was reached to pay the contractor \$6,000 for the time he has spent so far to obtain the footage. The remainder will be spent to hire a different subcontractor to complete the editing. Mary Ikagawa, of OISC, has agreed to help with reviewing the footage and writing the script. In addition, a new intern will be coming on board in October who has video experience and we plan to involve her in the project as much as possible. We have located a potential subcontractor and we will begin to work on it again in October when time allows.

Project Lead/Contact:

Lisa Ferentinos, Watershed Partnerships Program Planner, Division of Forestry and Wildlife
808-586-0917, email: Lisa.Ferentinos@hawaii.gov

Title: Plant Pono Website

Organization: Coordinating Group on Alien Pest Species (CGAPS)

Working Group: Public Outreach

Award: \$3,000

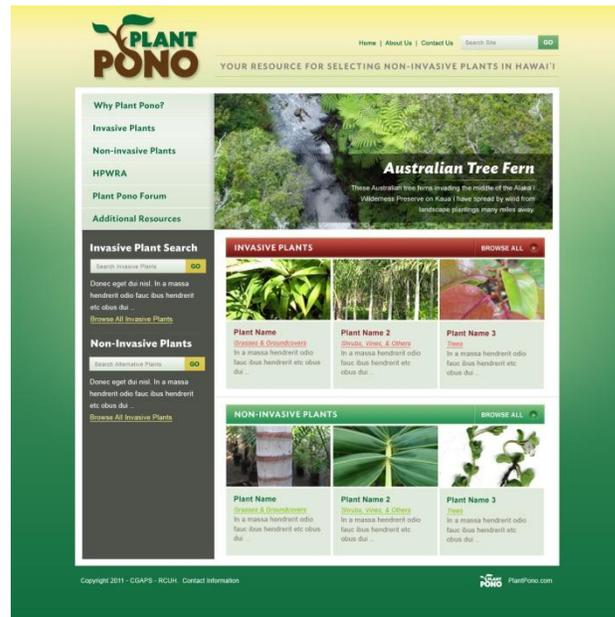


One of the biggest gaps in invasive species prevention laws is the absence of functional laws to identify and restrict the importation and sale or distribution of invasive plants. Therefore, POWG has identified the commercial and botanical garden plant industry, and the planting public as a priority audience for outreach. One long-term project identified as a priority by POWG has been to support a CGAPS project to develop a new website titled “Plant Pono”. HISC funds are matched more than two to one by federal dollars to support this project, now in active development.

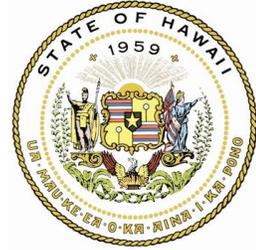
The Plant Pono website will provide the planting public and plant professionals with information on the problem of invasive plants in Hawai’i, non-invasive planting choices with planting information, and user-friendly access to the Hawai’i-Pacific Weed Risk Assessment (HPWRA) information and data. This website will also feature a discussion board and direct access to the HPWRA screeners.

2011 HISC funds supported a contract to hire respected horticulturist Heidi Bornhorst as the horticulture researcher/writer. She provided planting information on 60 non-invasive and native plants recommended for planting, along with images for each. The website is scheduled to launch by the end of 2011, with public testing and adjustments in 2012.

(The image is the proposed layout for the Plant Pono homepage)



Title: HISC Communications Coordinator
Organization: Hawai'i Invasive Species Council
Working Group: Public Outreach
Award: \$75,330



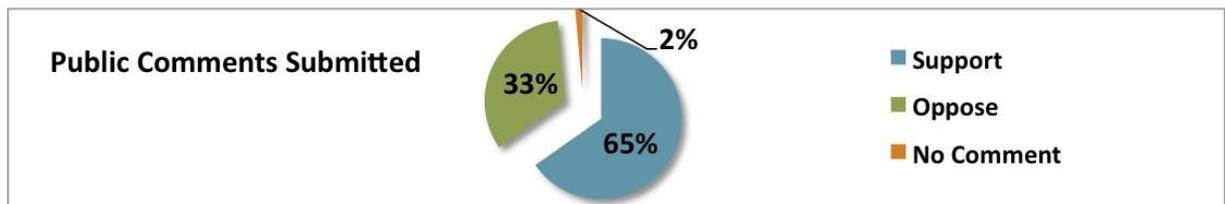
The HISC Communications Coordinator was created in FY10 as a response to the reduction of statewide public outreach staff supported by HISC due to budget constraints. The position is dedicated to the coordination and implementation of internal and external communications for the HISC member agencies and partners, as well as assisting with the collaborative initiatives of the Public Outreach Working Group. The Communications Coordinator serves as the main point of contact for HISC on public education and community outreach regarding statewide issues, such as biocontrol and rodent control.

Without a HISC Coordinator for most of FY11, the HISC Communications Coordinator assumed many of the overall coordination duties for the HISC. The Communications Coordinator implemented and continued to participate in several of the public outreach projects listed in the FY10 proposal, but the position has evolved to directly serve the needs of HISC functions, and therefore, was recommended to be moved from the Public Outreach Working Group to HISC Support for the FY12 budget.

HIGHLIGHTED ACTIVITIES OF FY11

Biocontrol Outreach

The HISC Communications Coordinator worked in partnership with HDOA, the USDA Forest Service, TNC, CGAPS, and the Invasive Species Committees to educate the public about biological control as a HISC-supported tool to manage invasive species. Specific attention was given to communicating the results of the public comments that were submitted in response to the Environmental Assessment on the Biocontrol of Strawberry Guava. Nearly two letters of support were submitted for every letter of opposition. Letters were sent by individual citizens, such as cultural practitioners, foresters, hunters, ranchers, hikers, farmers, land managers, property owners, artists and biologists, and on behalf of various organizations and agencies.



In collaboration with TNC, the HISC Communications Coordinator co-reconvened and facilitated the statewide Biocontrol Working Group, which had not met in several years, as the first step to strengthening the communication network in Hawai'i.

Transition packages for the new Council

The HISC Communications Coordinator worked with the Public Information Officer from CGAPS to produce a briefing document on the history, function, and needs of the Hawai'i Invasive Species Council that was included in a full transition package for the new HISC Co-Chairs. As recommended by the former Council, the Co-Chairs were briefed after the legislative session in May. At this briefing, it was decided to work with the Governor's Office to hold the inaugural HISC meeting with the full Council in June.

Rodent Control Outreach

The HISC Communications Coordinator is an active member of the Partnership to Protect Hawaii's Native Species, which is dedicated to the public education and community outreach efforts regarding statewide rodent control. This year, the partnership produced a video about rodent impacts on natural and cultural resources, agriculture, and human health.



Hawai'i Invasive Species Council

Mission
"The Hawai'i Invasive Species Council (HISC) was established for the special purpose of providing policy level direction, coordination, and planning among state departments, federal agencies, and international and local initiatives for the control and eradication of harmful invasive species infestations throughout the State and for preventing the introduction of other invasive species that may be potentially harmful." HRS 194-2 (a).

History
Senate Concurrent Resolution No. 45, H.D. 1 (2001) requested the Legislative Reference Bureau to conduct a study on the issue of invasive species in Hawai'i. The 2002 "Filling the Gaps in the Fight Against Invasive Species," included policy recommendations, funding needs and options, which lead to then-Governor Benjamin Cayetano's issuance of Executive Order No. 2002-03 establishing the Hawai'i Invasive Species Council in June, 2002. In 2003, the HISC was authorized by past Governor Lingle under Act 85, SLH 2003, and HRS Chapter 194 defines its purpose, composition, and responsibilities, and gives its member agencies the authorization to enter private or public property to control invasive species with proper notification.

Composition and Purpose
To ensure policy level direction, coordination, and planning, the HISC is composed of the president of the University of Hawai'i, or the president's designated representative; the director, or the director's designated representative, of each of the following departments: Business, Economic Development, and Tourism (DBED); Health (DOH); and Transportation (DOT); and the chairperson, or the chairperson's designated representative of the Department of Agriculture (HDOA); and Department Land and Natural Resources (DLNR). Although not specified in the HRS, the HISC is co-chaired by the chairpersons of DLNR and HDOA. The HISC is placed within DLNR for administrative purposes.

Programs and scope
Four multi-agency working groups provide an added level of coordination and communication on prevention, control of established pests, public outreach and research needs. An additional working group on Resources assists with the annual budget. These working groups help identify gaps in information and infrastructure, and relay those needs to the HISC for funding or other support needs.

The HISC Strategic Plan has been funded annually through General funds and/or Special funds via the Natural Area Reserve Fund (NARF) as follows: \$4M in FY05 (\$2M each from General and NARF); \$4M in FY06 (\$2M each from General and NARF); \$2M in FY07 (all from NARF); \$4 M in FY 08 (\$3M from NARF and \$1M from General); \$4M in FY09 (\$1M from General and \$3M from the NARF); \$2M in FY10; and \$1.4M in FY11 (both years from the NARF).

Projects and an annual budget are recommended by the HISC working groups to support efforts to support the tasks, goals, objectives, and measures of effectiveness described in the 2008-2013 HISC Strategic Plan. The Resources Working Group facilitates the budget process and presents a proposed balanced budget to the Council for a final decision.



The video will be available on the website www.removeratsrestorehawaii.org and will be shown at public and community meetings.

Buy Local Message and Target Audience Outreach

In FY11, the HISC Communications Coordinator focused on building partnerships with and reaching out to the agricultural community, especially through shared priority messages like "Buy Local." The Communications Coordinator was an invited panelist at the Fall 2010 Agriculture Conference and presented on the connections between conservation and agriculture in the effort to prevent and manage invasive species. The presentation emphasized the importance of agricultural inspectors and that both farm and forest benefit from a strong biosecurity and invasive species management program. The HISC Communications Coordinator worked with several community-based organizations and businesses in the agriculture and food sectors to once again help to plan the annual 'Aina Ho'ola o Ma'ilikukahi Youth Conference. Through presentations and service projects, the high school students learned about the impact of invasive species on watersheds and food security.

This HISC Communications Coordinator also worked with HDOA, Kōkua Hawai'i Foundation, CTAHR, and several other organizations and businesses to plant the New Day Garden at the Governor's residence. It proved to be an incredible outreach opportunity to build HISC partnerships and educate the public on the importance of buying local and growing food to reduce the risk of invasive species through imports. The story was posted by the Governor's office at <http://hawaii.gov/gov/newsroom/in-the-news/the-new-day-garden>.



Support of the Public Outreach Working Group

In response to requests from HISC members, the HISC Communications Coordinator organized topic-focused Public Outreach Working Group meetings. In October, with the help of TNC and the Public



Access Room, the POWG offered a daylong legislative workshop to learn about state legislative processes and brainstorm legislative priorities for the HISC. Representative Marcus Oshiro, Chair of the House Finance Committee, and Representative Clift Tsuji, Chair of the House Agricultural Committee.

In partnership with DAR and TNC, POWG convened a session devoted to discussion about outreach efforts and needs for aquatic invasive species issues, which included presentations from Malama Moanalua, Maui County's Roi Roundup, and Eyes of the Reef.

Finance Chair, Marcus Oshiro, goes over the state budgeting process with Public Outreach Working Group participants.

Participation in National and Regional Invasive Species Networks

In February, the HISC Communications Coordinator was sponsored by the National Invasive Species Council (NISC) to attend the National Invasive Species Awareness Week in Washington D.C. with the intent of engaging Hawaii in the national discussion on invasive species with other state and regional networks and projects.



The Global Island Partnership (GLISPA) also sponsored the HISC Communications Coordinator for an additional week in D.C. as a member of the multi-sector task on green growth in Hawaii to talk with Hawaii's Senators and Representatives, as well as the U.S. State Department about Hawaii's efforts in natural resource management, invasive species management, energy, and food security. The HISC Communications Coordinator participated in GLISPA's annual strategic planning session with representatives from islands around the world that share similar challenges with invasive species. The goal is to strengthen the international partnerships and exchange between Hawaii and other islands on best management practices, biosecurity systems, and communications.



From left to right: Phil Andreozzi (National Invasive Species Council), Jacqueline Kozak Thiel (Hawaii Invasive Species Council), Representative Sablan (Saipan), and Roland Quitugua (Guam Association of Conservation Districts) at a meeting about the Micronesian Biosecurity Plan

Title: Aquatic Invasive Species Media Outreach

Organizations: Division of Aquatic Resources, HISC Public Outreach Working Group members, OC16

Working Group: Public Outreach

Award: Non-funded (Voluntary)

Although planned outreach products and projects on aquatic invasive species did not commence, POWG participants assisted DAR staff and the DLNR Public Information Officer on planning and implementing media outreach on several projects using native sea urchins in controlling alien algae in Kāneʻohe Bay. A media day hosted television and print news journalists as DAR biologists and a local canoe club released captive-bred native sea urchins on a patch reef. Videographer Cal Hirai was contracted to produce a video news release that was supplied to television news stations, and B-roll was taken and edited into an *Outside Hawaiʻi* segment on OC16.



Jonathan Blodgett explained to media the importance of restoring balance to the bay

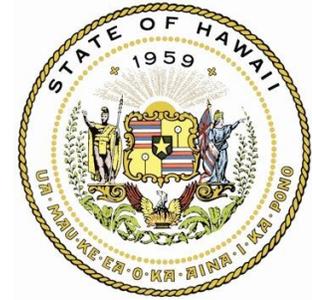


KITV 4's Dick Algire interviewing Dave Cohen, DAR's native urchin hatchery manager.

VI. Hawai'i Invasive Species Council Reports

Overview of the Invasive Species Problem in Hawai'i

The silent invasion of Hawai'i by insects, disease organisms, snakes, weeds, and other pests is the single greatest threat to Hawai'i's economy, natural environment and to the health and lifestyle of Hawai'i's people. Pests already cause millions of dollars in crop losses, the extinction of native species, the destruction of native forests, and the spread of disease, but many more harmful pests now threaten to invade Hawai'i and wreak further damage. Even one new pest, like the brown tree snake or the red imported fire ant, could forever change the character of our islands. Stopping the influx of new pests and containing their spread is essential to Hawai'i's current and future well-being.

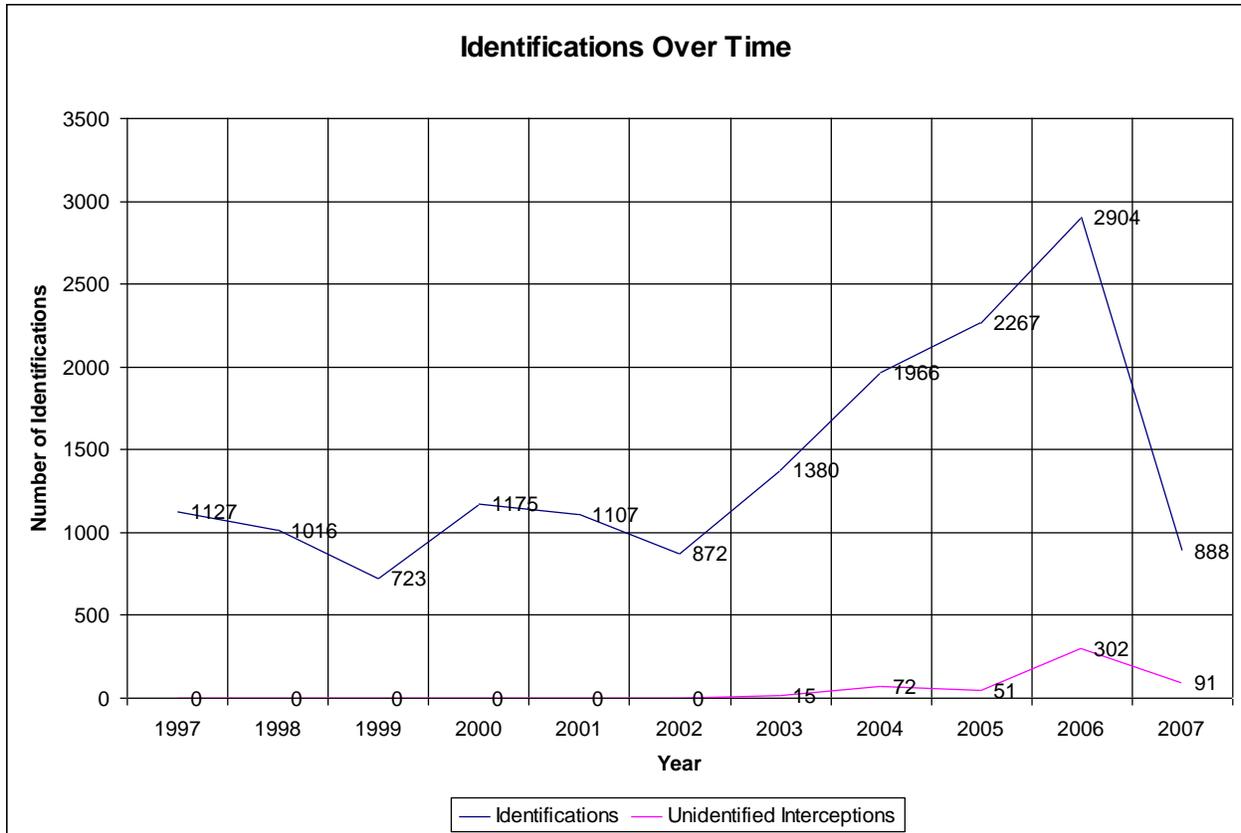


Despite the efforts of state, federal, and private agencies, unwanted alien pests are still entering Hawai'i at an alarming rate. In 1993, the Federal Office of Technology Assessment declared Hawai'i's alien pest species problem the worst in the Nation. Hawai'i's evolutionary isolation from continents and its modern role as the commercial hub of the Pacific make these islands particularly vulnerable to destruction by alien pests. Much progress has been made lately but gaps remain in current pest prevention systems and a lack of public and institutional awareness exacerbates the problem.

For example, approximately 3,400 insects, spiders or mites are confirmed established in Hawai'i. More may be present in Hawai'i but there are few entomologists with the ability to find and identify insects. At least 15 species establish every year and a proportion of those are likely to be considered nuisance species. Hundreds and sometimes thousands of arthropod species are detected every year in goods shipped to Hawai'i.



Fireweed (*Senecio madagascariensis*) grows along a horse pasture, with ironwood (*Casuarina equisetifolia*) in the background. The fireweed is nonnative and invasive, and is on the DOA's Noxious Weed List. The ironwood is nonnative and naturalized (established in the wild), but is not on any state lists for noxious or invasive plants. The horse is also nonnative, but is not naturalized.



This graph shows the number of arthropod species intercepted in incoming freight (DOA). Spikes in interceptions reflect risk assessment work, some of which was funded by HISC.

At least two serious arthropod pests have arrived every year from 1997-2007 and more have been discovered since. To prevent further introductions, more needs to be done to manage pathways, including building inspection and treatment infrastructure into Hawai'i's ports, inspections and treatment of at risk goods, and research into risk abatement strategies.

Some invasive arthropod pests documented as new to Hawai'i (1997-2007)

- White Peach Scale – 1997
- Sago Palm Scale – 1998
- Little Fire Ant – 1999
- Citrus Leafminer – 2000
- Nettle Caterpillar – 2001
- Giant Whitefly – 2002
- Pickleworm – 2003
- Cardin's Whitefly – 2003
- Papaya Mealybug – 2004
- *Aedes japonicus* (Type of Mosquito) – 2004
- Large Orange Sulfur – 2004
- Glassy-Winged Sharpshooter – 2004
- Macadamia Felted Coccid – 2005
- *Erythrina* Gall Wasp – 2005
- *Thrips Parvispinus* – 2006
- Asian Citrus Psyllid – 2006
- Varroa Mite – 2007
- Whitefly Parasitoid – 2007
- Thrips, *Dichromothrips smithi* – 2007
- Scarabaeid Beetle, *Cyclocephala pasadenae* – 2007
- Scarabaeid Beetle, *Temnorhynchus retusus* – 2007

More than 10,000 flowering plants have been introduced into Hawai'i from the temperate or tropical zones of every major continent and about 1,215 have established wild populations in Hawai'i, roughly

equivalent to the number of native vascular plant species in Hawai'i. New species continue to be introduced by plant collectors, gardeners and the nursery industry. Formerly cultivated species are "jumping the fence" and establishing self-sustaining populations.

Only a subset of the nonnative species introduced to Hawai'i are considered "invasive," as they pose a significant threat to human health, the environment, and natural or cultural resources. Of the 1,215 established nonnative plant species, 107 species are considered serious invaders occupying space and competing with native plants in natural areas. Many form the principal dominant canopy species in some situations. Of these, more than 91% were intentionally introduced to Hawai'i as ornamentals, forestry trees, medicinal plants, food sources or other uses. Many arrive and fail to find the right combination of circumstances to allow establishment in the wild and persist only in cultivation. Weed risk assessment systems have been developed in recent years that allow us to predict which species are likely to cause problems. In particular, the Hawai'i-Pacific Weed Risk Assessment (HPWRA) was developed at the University of Hawai'i and continues to be utilized by HISC staff and partner agencies.

At least 19 alien mammals are established in the wild. A few feral species have far reaching impacts in natural areas altering forest composition and structure; damaging and consuming rare species that occur only in Hawai'i. Many act as vectors of diseases that affect people and domestic animals. Rats, mongoose, feral goats, sheep, deer, pigs, and cats impact native ecosystems and bring threatened species closer to extinction. Other terrestrial vertebrate species, including birds (55 species), reptiles (24 species) and amphibians (six species), are established in Hawai'i in surprising numbers; they impact natural area values and the economy. In 2011 axis deer (*Axis axis*) were discovered on Hawai'i Island, where they had not previously been found. The transportation of axis deer to Hawai'i Island from Maui and/or Moloka'i presents a serious threat to Hawai'i Island's native forests and associated species. Priority and urgency should be given to the eradication of incipient populations of feral ungulates, island-wide eradications of vertebrates, and finally management of areas with high native biodiversity, cultural, social or economic value.

A number of diseases are common around the world and have not arrived in Hawai'i. Avian influenza and West Nile Virus, for example, are vectored by insects and animals. Prevention and monitoring for insects and animals that may transmit such diseases are critical to protecting human and environmental health in Hawai'i.

Early Detection of Invasive Species

Efforts are expanding to detect new invasive species in the initial stages of establishing in Hawai'i. One example of an established detection program has been HDOA's efforts to survey for new pest insects and new plant and animal diseases of significance to agriculture. Occasional funding has allowed for specific surveys for new snail species, ants or other taxa, usually as a stand-alone project and not as an ongoing effort. Detecting species when they are limited to a few individuals or cover less than 10 acres increases the likelihood of an eradication effort by several orders of magnitude.

In 2006, early detection projects for new invasive plant species that may have been introduced via arboreta, nurseries or residential plantings were initiated on O'ahu, the Big Island and Kaua'i. Maui completed roadside surveys in 2002 and is ready to resurvey and evaluate rapid response targets following the success of their first round of island-wide eradication efforts. Lāna'i and Moloka'i have also had complete roadside surveys. OISC maintains the O'ahu Early Detection Project (OED), which completed a three-year roadside survey of O'ahu and has utilized the Hawai'i-Pacific Weed Risk Assessment to score newly discovered plants and prioritize incipient species for control efforts. KISC contracted the OED in 2009 to complete a roadside survey on Kaua'i. BIISC maintains an Early Detection Program that is in the final stages of a four-year roadside survey and has similarly utilized HPWRA to assess the threat of establishment and prioritize control efforts. Where possible, these early detection teams have expanded their survey areas from roadsides to include nursery inventories, botanical gardens, and parks. Lists of incipient species are managed by each group and, when assessed using the HPWRA, are included in a database maintained by the USGS's Pacific Basin Information Node.

Coqui Frog

The Puerto Rican tree frog, *Eleutherodactylus coqui*, has the potential to change native forest ecosystems. Population densities in some areas of Hawai'i have been recorded to be as high as three times the density found in Puerto Rico. Their nightly mating choruses can reach levels as high as 73 db, which is comparable to moderate to heavy vehicle traffic. Economic effects on the Big Island, stemming from their nightly choruses, have been felt through declining property values and a reduction of plant sales from nurseries. The ecological effects are not fully realized though negative effects have been documented via research funded by HISC. A high priority for management is to prevent their establishment into high value natural areas and keep them off islands where they are not yet established.



Coqui frog, *Eleutherodactylus coqui*
Photo: AH Hara, University of Hawai'i

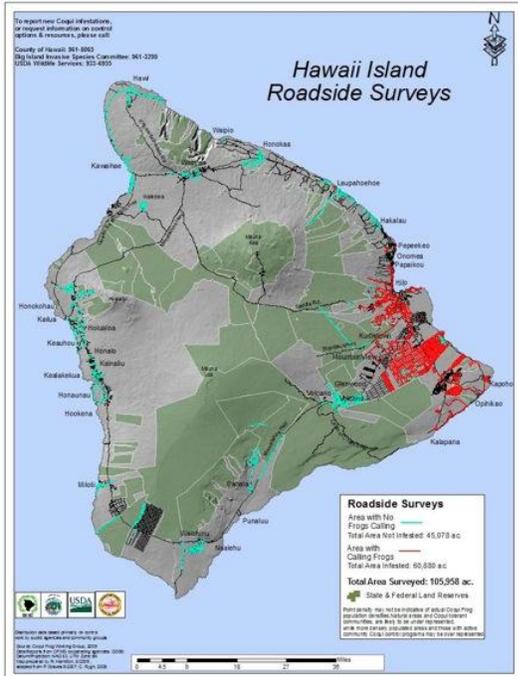
A coordinated approach to coqui frog management is outlined in Hawai'i's Coqui Frog Management, Research and Education Plan:

<http://www.hawaiiinvasivespecies.org/hisc/pdfs/20071217coquiplandraft.pdf>.

During the legislative session in 2008, Chapter 194, HRS, the law for HISC, was modified to include (underlined below) references to systematic management of coqui frogs on public lands near residential communities:

Section 192-2 (a) (4) After consulting with appropriate state agencies, create and implement a plan that includes the prevention, early detection, rapid response, control, enforcement, and education of the public with respect to invasive species, as well as fashion a mission statement articulating the state's position against invasive species; provided that the appropriate state agencies shall collaborate with the counties and communities to develop and implement a systematic approach to reduce and control coqui frog infestations on public lands that are near or adjacent to communities, and shall provide annual reports on the progress made in achieving this objective.

This part of the HISC report documents that a systematic and collaborative approach has been employed to control frogs on the Big Island, Maui, O'ahu, and Kaua'i.



Hawai'i Island: By far, the worst coqui frog problem is on the Big Island. The main goal on the Big Island is to keep pristine natural areas free of the frogs, and to help the community control frogs around residential areas. With so much land on the Big Island infested (see map), the efforts to control frogs are only practical in a limited number of sites. Coqui frogs infested 60,000 acres on the Big Island in 2009.

While a recent Associated Press article declared that “Coqui frogs win battle for Hawai'i Island,” (Honolulu Star Advertiser, August 22 2011), conservation groups on Hawai'i Island continue their work to limit the range of coqui frog and control or eradicate populations where possible. BIISC maintains a coqui response team within its Vertebrate Program. This team responds to coqui calls and treats infested areas with citric acid spray. The team focuses its work on high value natural areas, including Natural Area Reserve System (NARS) lands, Forest Reserves, and designated critical habitat. BIISC also

collaborates with the National Park Service, as coqui frogs have infested Hawai'i Volcanoes National Park. The BIISC team is working with communities to empower them “take back the night” on their own, through locating and mitigating coqui frog infestations in residential areas.

Maui: MISC has successfully eradicated a number of isolated, satellite populations of coqui, though a handful remain across the island. MISC work on the coqui frog now focuses on a large, long-established population in Maliko Gultch, a long, steep-sided gultch on the island's north shore. A large-scale operation has been mounted to address this heavily infested area, utilizing a network of pipes and sprinklers to deliver citric acid to various parts of the gultch. Manned hoses are also used to treat infestations from the bottom of the gultch. MISC has maintained excellent relationships with landowners in the area surrounding Maliko Gultch.

O'ahu and Kaua'i: Coqui frog reports on O'ahu came from a variety of locations around in island in FY11. HDOA and OISC collaborate to respond to coqui frogs as quickly as possible. The reduction in staffing at both HDOA and OISC in recent years has limited the number of staff available to respond to coqui reports. On Kaua'i, KISC has collaborated with local branches of state agencies to address an isolated population of frogs.

Interisland Shipments: HDOA, counties and the ISCs work together to control populations on all islands and limit interisland movement of frogs by treating goods that originate from the Big Island, when possible. Due to lack of funding, staffing, and difficulty in finding all frogs in interisland shipments, frogs continue to be shipped interisland, particularly through horticulture. Most frogs arrive in shipments of nursery plants that come via the Big Island. A hot water treatment method, which was developed by a nurseryman on O'ahu using funds from HISC's Research and Technology Working Group, is now in use for this purpose. Typically, HDOA and ISCs maintain close contact with nurseries to prevent establishment or export of frogs. The continued interisland transport of coqui frogs from Hawai'i Island, especially through the horticulture trade, continues to be a major concern for the HISC. Interisland pest movement, including coqui frogs, little fire ants, and others, will be a focus of discussion for HISC in FY12.

Loss of Funding to Prevent Brown Tree Snake Introduction from Guam

Since invading Guam, the brown tree snake has spread across the entire island and has exterminated 9 of 11 native species of birds. Recent plans to move the entire military base at Okinawa to Guam will lead to the creation of whole new towns in Guam. A large increase in the movement of people and cargo to and from Guam is expected to exceed the capacity of current inspection teams. USDA is working with DOD to manage the issue and increase prevention efforts.

A representative from USDA APHIS attended the June 27, 2011 meeting of the HISC and reported that 9-12,000 snakes are intercepted from the perimeter of the 5 major ports of exit on Guam (airports, seaports, and important fence lines). He estimated that roughly 12 snakes per year were detected in cargo leaving Guam, meaning that the snakes had already passed undetected through all other safety measures. This number does not include snakes that might stowaway on aircraft leaving the island.

USDA APHIS was previously funded through a federal earmark to maintain a Brown Tree Snake Interdiction Program in Guam, preventing the accidental transport of brown tree snakes from Guam to Hawai'i. This earmark program ended in 2011, leaving the program unfunded. The program now faces an uncertain future and may be shut down in FY12.



Brown tree snake, *Boiga irregularis*

Control of Alien Species Affecting Native Forest Ecosystems

The control of widespread pests to protect valued high priority sites and resources can provide significant measurable benefits and can now be implemented either island-wide or over large watershed scale areas. Control of widespread species usually implies long-term investment since reinvasion is continuous and maintaining target species at levels below which their impacts are felt is often costly.

Habitat Modifiers: Invasive Plants and Ungulate Grazers and Browsers (From: Hawaii's Comprehensive Wildlife Conservation Strategy, October 1, 2005)



Fountain grass, *Pennisetum setaceum*

One of the major threats to Hawai'i's native species and forests is the uncontrolled spread of many invasive non-native plants. These plants displace Hawai'i's distinctive native flora, resulting in a loss of species diversity and eventually in more pronounced and permanent changes to ecosystem function, such as alteration of primary productivity and nutrient cycling. Many invasive species completely replace native vegetation resulting in total loss of native habitats. Invasive plants such as fire-adapted fountain grass (*Pennisetum setaceum*) and orchard grass (*Dactylis glomerata*) provide fuels for fires and often increase in abundance after fires. A short list of invasive plant species that pose a significant threat to native plant communities and require aggressive management include miconia (*Miconia calvescens*), firetree (*Morella faya*), fountain grass (*Pennisetum setaceum*), banana poka (*Passiflora tarminiana*), blackberry (*Rubus argutus*), mangrove (*Bruguiera gymnorhiza* and *Rhizophora mangle*), strawberry guava (*Psidium cattleianum*), and golden crown-beard (*Verbesina encelioides*); there are many other invasive plants that degrade and destroy native habitat. Because the seeds of many invasive plants persist for years, eradication is exceedingly difficult after the plant is established and

control requires an ongoing effort to prevent further spread. However, control operations are expensive; for example, the current expenditures to control miconia on Maui alone are \$1 million a year.

Established ungulates (hooved animals) are another major threat to native habitat. Ungulates in Hawai'i include pigs (*Sus scrofa*), goats (*Capra hircus*), sheep (*Ovis aries*), mouflon sheep (*Ovis musimon*), deer (*Odocoileus hemionus* and *Axis axis*), and to a lesser extent, feral cattle (*Bos taurus*). Ungulates directly and indirectly affect native ecosystems in a variety of ways. These effects include damaging vegetation by grazing and browsing, trampling seedlings and aquatic invertebrates, spreading non-native plant seeds, disturbing soil, and increasing erosion. These activities can affect the amount of light and moisture levels within forests, as well as nutrient cycling, and result in modified or destroyed plant and animal communities, decreased water retention of soils, erosion, and decreased water quality. In addition, pigs have been observed destroying the nests of ground-nesting birds (e.g., nene) and have been linked to the spread of mosquito-borne avian disease (i.e., pig wallows creating mosquito breeding habitat). Because Hawaiian plants only recently have been exposed to the effects of grazing, as they lack common defenses such as thorns or toxins. Thus, grazing and browsing animals often prefer native plants over non-native plants. Grazing and browsing can result in the extirpation of native plant populations, but even low intensity browsing can affect the species composition of habitats and encourage a shift in dominance from native toward non-native species. Non-ungulate herbivores, such as rabbits (*Oryctolagus cuniculus*), can have the same impact. Soil disturbance by rooting animals (typically pigs) occurs throughout Hawai'i and favors the germination and establishment of alien plant

species, many of which are adapted to such disturbances and may require disturbance to complete their life cycle. Conversely, native species are not adapted to such disturbances and tend to be negatively affected. This in turn affects the composition of plant communities, which indirectly affects the animals that depend on the community; effects on native invertebrates may be particularly acute. Removal of ungulates is often the first step in ecosystem restoration and usually results in the recovery of native habitat, as well as the decline of particular alien plants.

The distribution of ungulates varies across the landscape. Subalpine communities have been and continue to be affected by feral goats, mouflon sheep, and feral pigs. Montane and lowland mesic forests on Kaua'i and Maui are impacted by the spread of axis deer. Dryland forests have suffered greatly because of cattle and goats. Feral pigs typically affect wetter communities, and their effects are widespread throughout the Islands. Control of animal populations is difficult and expensive, given high rates of reproduction and the ability of these animals to hide.

Invasive algae species have become a threat in recent years. These organisms can out-compete and overgrow native algae species and kill corals, altering the structure of local coral reef communities. Nearshore eutrophication (water pollution caused by excessive nutrients that stimulate excessive plant growth) from non-point source pollution or leaking cesspools and sewage systems may contribute to the explosive growth of these algae. Leeward areas of Maui and areas in Kaneohe Bay, O'ahu and Waikiki, O'ahu have experienced algal blooms or have growing invasive algae populations. Another marine invasive, snowflake coral (*Carijoa* sp.), out-competes and overgrows native coral species, possibly including the precious black corals found in deeper waters off Maui.

Introduced Predators

Hawaiian terrestrial animals evolved in the total absence of mammalian predators and are extremely vulnerable to predation by these introduced species, especially rats (*Rattus* spp.) and feral cats (*Felis silvestris*), and to a lesser extent, mongooses (*Herpestes auro punctatus*). All of these species prey on eggs, nestlings and adult birds, limiting populations. Rats have been implicated in the decline in native bird populations in the early 1900s. Rats are ubiquitous throughout Hawaiian habitat and while rats are commonly known to prey on seabirds, waterbirds and forest birds, even climbing into trees to prey upon canopy-nesting species, they are also known predators of native tree snails and other native invertebrates. Rats also eat the seeds of a large number of native plant species, limiting their regeneration. Feral cats are extremely skilled predators and have been responsible for the extinction of birds on other islands. In Hawai'i, cats are widely distributed and are found throughout bird habitat on all of the Main Hawaiian Islands (MHI) from sea level to high elevation. While a single cat can have a devastating effect on a breeding seabird colony, "cat colonies" pose an even greater threat to bird populations because of their concentrated sheer numbers. Although less arboreal than rats, mongooses are efficient predators. With few rare exceptions, populations of nene (Hawaiian goose), waterbirds and seabirds do not persist long in areas where mongooses are present. Presently, high densities of feral cats, rodents, and mongooses are a major cause of mortality among native birds and may place similar pressures on native terrestrial invertebrates. In general, Hawaiian bird species have low reproduction rates, so increased predation can be particularly problematic. Other predators that pose ongoing threats to native bird species include feral and unleashed dogs (*Canis familiaris*), cattle egrets (*Bubulcus ibis*), barn owls (*Tyto alba*), frogs and pigs. Fortunately, snakes have yet to become established in the Islands. Given that the brown tree snake (*Boiga irregularis*) effectively caused the extinction of Guam's avifauna, it is expected that the successful establishment of predatory snakes in Hawai'i would have equally devastating consequences.

Introduced fishes have been documented to prey on native freshwater fishes and invertebrates, while introduced frogs, such as the coqui, prey on aquatic and terrestrial invertebrates. Anchialine ponds are threatened by introduced fishes and shrimps that prey on the native shrimp and alter the habitat structure. Over the last 200 years, introductions of invertebrates, including ants, snails and wasps, have been extensive throughout the archipelago. Many of these species prey on, or parasitize, native invertebrates. Biologists have long suspected that these introductions caused declines in native insects and snails and had indirect community-level effects. Scientists in the last century, for example, noted extensive declines in native moths after introductions of predatory arthropods. These declines were followed by declines in native birds that preyed on the native moths.

More recently, studies have documented the effects of introduced ants and vespid wasps on native arthropod fauna and on nesting birds; for example, introduced ants have been documented killing nestlings.

Disease Carriers, Disease and Pathogens

The introduction of mosquitoes (*Culex quinquefasciatus*) to the Hawaiian Islands in 1826 had a profound effect on native forest birds and continues to affect the distribution and abundance of many bird species. By serving as vectors for avian malaria (*Plasmodium relictum*) and avian poxvirus (*Poxvirus avium*), mosquitoes effectively spread these diseases throughout lowland areas. Many species of introduced birds now present in Hawai'i may provide effective reservoirs for these diseases, allowing them to persist and spread widely. For Hawaiian birds that had evolved in the absence of these diseases for millions of years, the impacts were severe. Over the next 150 years, many bird species became extinct. Today, most of the remaining native forest birds persist at elevations above 1,600 meters (5,000 feet), where few mosquitoes can survive.

In recent years, a few species have begun to recolonize lower elevations where avian malaria and poxvirus are common, indicating that at least some species may have developed resistance to these diseases. However, global warming could enable transmission of poxvirus and malaria to higher elevations, threatening remaining populations of endangered birds. New vectors of such diseases are also of concern. On the Big Island, the recent establishment of *Aedes japonicus*, the state's first truly temperate mosquito, may extend the range of mosquito-borne disease into currently mosquito-free high elevation forests.



A bird killed by West Nile Virus

Other diseases impact native wildlife. For example, avian botulism is the most prevalent disease in Hawai'i for native waterbirds. The introduction of West Nile Virus (WNV) could have even more devastating impacts. Threat by disease is not limited to terrestrial fauna, however. Recent work has shown that many species of corals have diseases that, in some cases, are on the increase and may be caused by introduced species. Honu (*Chelonia mydas agassizi* [green sea turtles]) in most areas suffer from fibropapilloma, which may also be caused by an introduced disease. With little natural resistance to disease, the Hawaiian fauna is expected to be highly susceptible, and prevention of the establishment of new diseases is a top priority need.

Biocontrol

USDA and HDOA are the two primary agencies in Hawai'i researching and utilizing biocontrol. In FY11, HISC supported HDOA's biocontrol efforts by providing funding for foreign exploration for new biocontrol agents. Biocontrol has high up-front costs since researchers must ascertain the agent's specificity and safety. However, the control of target organisms is continuous once an agent is successfully established in Hawai'i, and the method is cost effective, removes the need to use harmful pesticides, and allows us to better live with invasive species and pests that are present in Hawai'i.

Biocontrol is one of the least understood tools for the control of invasive weeds and other pests yet it can be one of the most successful means of controlling widespread invasive species throughout its range. Myths and misconceptions that have been nearly impossible to dispel (i.e., that the mongoose and cane toad were introduced into Hawai'i, with disastrous results, as part of biocontrol programs) offsets the very successful track record of biological control in Hawai'i dating back to the reign of King David Kalakaua. A successful biological control program reduces or, in some cases, removes the need for conventional methods of control for an invasive species. It is targeted to a particular species or group of closely related species (usually plants or invertebrates) and, once established, the agents continue to provide benefits with no external inputs. The comprehensive testing systems now available allow us to select agents that are highly specific to the targeted invasive species.

In Hawai'i, two principles of biocontrol are followed: classical biocontrol and augmentative biocontrol. Classical biocontrol involves the identification use of natural enemies (either insects or diseases) within the native range of a pest for release into the environment the pest has established itself in. This process either requires exploration or collaboration. At the present time, foreign exploration is limited to one exploratory entomologist in the state of Hawai'i. HISC has funded exploratory projects conducted by HDOA and UH. The second form of biocontrol, augmentative biocontrol, involves the collection and release of biological control agents already established but of limited distribution. HDOA conducts projects such as this for newly established pests with natural enemies that are already established. One recent and successful augmentation project is the biocontrol of the papaya mealybug, a severe pest of papaya and plumeria in Hawai'i. In 2010, HDOA released a tiny parasitic wasp, *Aroplectrus dimerus*, as a biocontrol agent for the invasive stinging nettle caterpillar (*Darna pallivitta*).



Nettle caterpillar, *Darna pallivitta*

Not all pests are suitable targets for biological control. Generally, targets for biological control are intractable or difficult to manage with other techniques. Targets for biological control include such pests as fireweed, strawberry guava, miconia, ivy gourd, *Erythrina* gall wasp, nettle caterpillar and others. These pests are wide spread and difficult or impossible to control through either chemical or mechanical means. High costs are seen on exploration and identification of potential control agents; however, the total financial costs of biocontrol are far more affordable than traditional control methods as once an agent is released and established no additional inputs should be required. The usage of chemicals for control of pests can lead to several long-term issues including chemical contamination of the ground and/or water, development of chemical resistance, and potential non-target effects of the chemical being used. Even mechanical methods can have similar secondary effects. In contrast, the standards adhered to by modern day practitioners has seen the development of agents with no known non-target effects. When biocontrol is an option, it is by far the safest and most financially affordable control technique.

The need for Improved Interisland Quarantine

Often invasive species arrive to one particular island in Hawai'i and become problems there but may not be transported to neighbor islands for years. Varroa mite, a parasite of honey bees, was found on the Big Island mid-year 2008 after being detected on O'ahu more than a year earlier. The pathway for this introduction was most likely from the interisland movement of goods from O'ahu. The queen bee and honey businesses are worth several million dollars a year on the Big Island, and this serious bee pest will have severe negative impacts on that industry. Interisland movements of cargo increase the risk of moving materials and products that spread invasive species. This highlights the need for increased inter-island quarantine to prevent the introduction of known pests to uninfested islands from all sources.

The risk posed by the interisland movement of vessels, vehicles and materials can be mitigated. Additional quarantine inspectors are needed to effectively screen the volume of interisland cargo. A review of current authorities is needed to ensure that action can be taken to mitigate the risk posed by all vehicles and materials moved inter-island. Infrastructure improvements at ports can provide both inspection areas and the facilities for treating products (e.g., a car wash) prior to moving materials between islands. Consistently utilizing the natural barriers between islands to prevent the spread of invasive species will help reduce the impacts of invasive species statewide. HISC provides a forum for the agencies involved in transportation, regulation, and conservation to coordinate their efforts to achieve the most effective level of protection for Hawai'i's agricultural production, environment and human health.

The continued interisland transport of pests including coqui frog, little fire ant, and axis deer has been a focus of discussion for HISC in FY11. One of the primary problems with preventing interisland transport of pests is that it requires a large amount of inspection capacity to be provided by HDOA. With roughly half of HDOA's 95 agricultural inspectors laid off in 2009, the ability to inspect interstate and interisland shipments has been severely reduced. In FY10, HISC provided \$600,000 to HDOA to retain a portion of its inspection staff and capacity. In 2011, Governor Abercrombie restored 10 inspector positions at Honolulu International Airport. This will increase the ability of the department to detect pests in interstate imports arriving by air to O'ahu. Additional inspection capacity will need to be provided for seaports and on islands other than O'ahu. In particular, interisland nursery and horticultural shipments leaving the Big Island are known to carry pests such as coqui frog and little fire ant. A greater focus on potential solutions to interisland movement of pests will be a focus of discussion for HISC in FY12.

County Involvement

In FY11 HISC supported detection, control, and outreach projects by the island-based ISCs in all counties. Increased support from county governments is a priority for HISC and its partner agencies. Maui County and Kaua'i County have demonstrated support for invasive species work through funding provided to MISC and KISC. Increased participation by county representatives in discussions of HISC is a priority for FY12. The mayors of each county are invited participants in all meetings of HISC.

Review of Conflicting Agency Mandates

There have been no programmatic reviews of conflicting agency mandates during the last 12 months.

Invasive Species Fines, Penalties, and Regulations

Each member agency or HISC working group has carried out reviews of laws and regulations on an ad-hoc basis.

A HISC priority for FY12 will be supporting policy changes related to the interisland and intrainland movement of introduced wildlife. To that end, HISC staff has begun working with agency staff at DOFAW on proposed administrative rule changes that could potentially institute a penalty schedule for the transport and release of introduced wildlife. The need for this policy change was highlighted by the discovery of interisland transport of axis deer (*Axis axis*) from Maui and/or Moloka'i to Hawai'i Island.

VII. Money Spent on Invasive Species Management in Hawai'i: Organizational and Resource Shortfalls

Money Made Available to the HISC

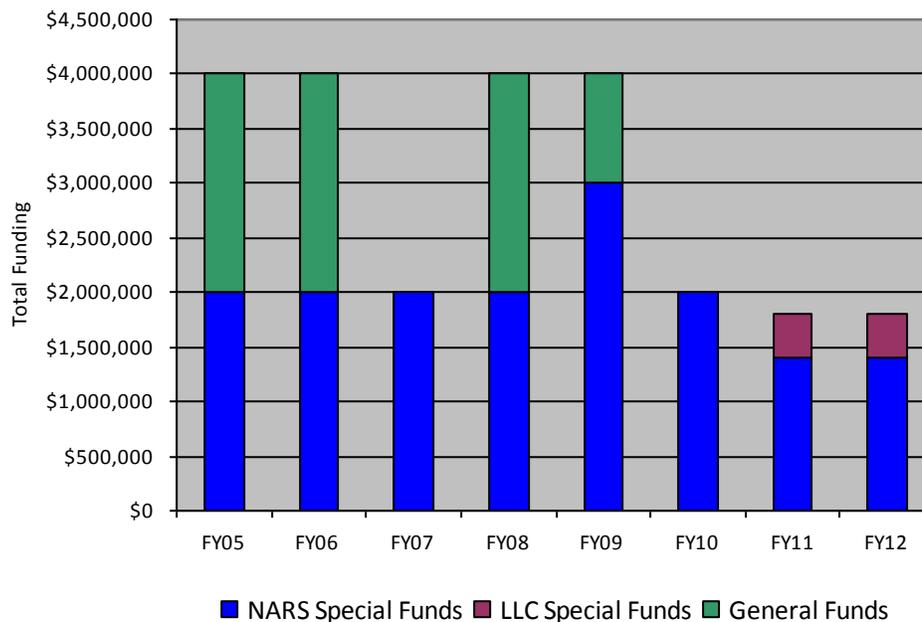
The Hawai'i Invasive Species Council (HISC) has received a combination of special and general funds from the State of Hawai'i since FY05. The special funds are provided to the HISC through the Natural Area Reserves System (NARS), which derives funding from the conveyance tax. In FY11 and FY12, decreases in the amount of special funds directed specifically to the HISC were partially offset by special funds from the Legacy Land Conservation program (LLC), which also derives funding from the conveyance tax.

General funds provided from the State Legislature were historically provided at roughly \$2,000,000 annually, but this amount was reduced to \$1,000,000 in FY09 and to \$0 beginning in FY10.

Table 1: Total amount of funding made available to the HISC through special and general funds, by fiscal year.

FY05	\$4,000,000
FY06	\$4,000,000
FY07	\$2,000,000
FY08	\$4,000,000
FY09	\$4,000,000
FY10	\$2,000,000
FY11	\$1,800,000
FY12	\$1,800,000

Figure 1: Funding for the HISC, separated by source and fiscal year.



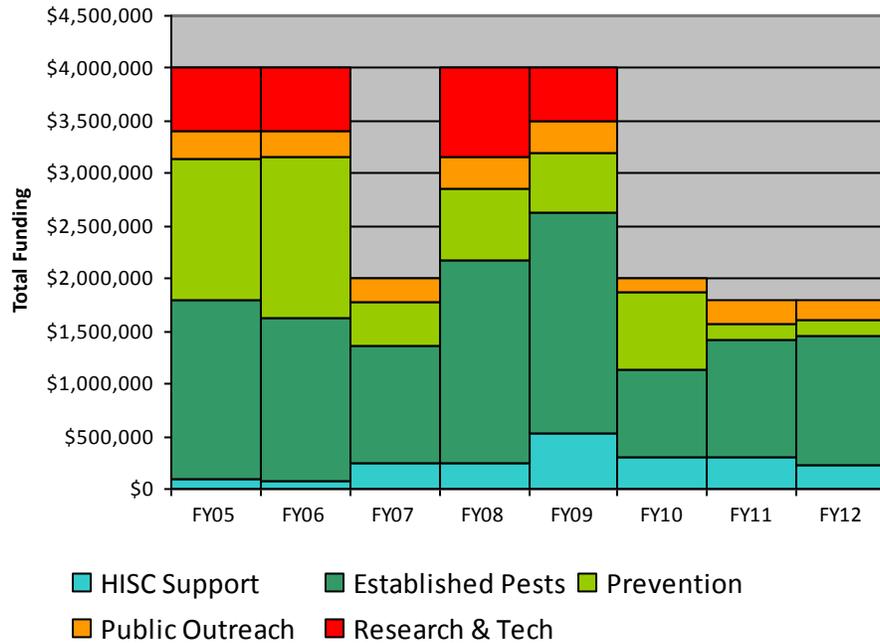
The total amount of annual funding available to the HISC has varied widely by year. While the FY05 and FY06 budgets were at \$4,000,000, the FY07 budget was cut in half to \$2,000,000. This was due in part to the state's decision to provide money directly to the County of Hawai'i for the eradication of coqui frog, rather than utilizing the HISC. The HISC budget returned to \$4,000,000 in FY08 and FY09, but decreased again to \$2,000,000 in FY10, due in large part to the economic downturn in late 2008. This economic downturn likely had an impact on the availability of general funds, which had been provided at roughly \$2,000,000 annually by the state legislature, but were decreased to \$1,000,000 in FY09 and discontinued thereafter. The economic downturn also likely impacted the amount of money available to the NARS, the traditional funding source for the HISC. Because the NARS derives its funds from the conveyance tax on property sales, the sharp reduction in property sales seen after the economic downturn likely reduced the amount of money made available to the HISC from the NARS.

The large variance in the amount of funds available to the HISC each year has impacted the funding of projects. In particular, the Research and Technology Working Group did not receive any funds in FY07, FY10, FY11, or FY12, due to reductions in the budget and the need to maintain capacity built through the other working groups.

Table 2: Total HISC funds separated by fiscal year and working group.

Working Group	FY05	FY06	FY07	FY08	FY09	FY10	FY11	FY12
Prevention	\$1,340,000	\$1,516,535	\$410,000	\$675,000	\$565,400	\$740,000	\$155,266	\$155,465
Established Pests	\$1,700,000	\$1,560,000	\$1,115,000	\$1,930,000	\$2,100,700	\$820,000	\$1,120,282	\$1,215,213
Research & Tech	\$599,788	\$600,000	\$0	\$850,000	\$500,000	\$0	\$0	\$0
Public Outreach	\$260,000	\$248,465	\$230,000	\$300,000	\$312,200	\$130,000	\$224,818	\$194,757
HISC Support	\$100,212	\$75,000	\$245,000	\$245,000	\$521,700	\$310,000	\$299,634	\$234,565
Total	\$4,000,000	\$4,000,000	\$2,000,000	\$4,000,000	\$4,000,000	\$2,000,000	\$1,800,000	\$1,800,000

Figure 2: Total HISC funds separated by fiscal year and working group.



Money Spent by all Agencies in Hawai'i

There has not been a resurvey of spending and resource shortfalls for all Hawai'i agencies involved in invasive species since 2008. Results of that survey are detailed here, though the amount of funding has likely decreased following the economic downturn of late 2008, similar to the decreasing trend in the amount of funding made available to HISC from FY09-FY12.

2006 spending on invasive species management in Hawai'i was significant at about \$40.8 million for government-projects and up to \$153 million total spending on invasive species and pests; actual costs to our economy could be higher as few estimates of that take into account lost productivity and lost opportunity (e.g., access to markets for Hawaiian products).

The 2002 Legislative Reference Bureau study, *Filling the gaps in the fight against invasive species*, reported annual spending of approximately \$7 million on invasive species in Hawai'i. The same study cited that in addition to current expenditures, an additional \$50 million is needed to deal with principal threats to Hawai'i's economy, natural environment and people's health and lifestyle. Last year's legislative report identified about \$40.8 million of mainly state and federal funds spent in Hawai'i on invasive species in 2006.

Hawai'i is well known for its invasive species problem and in recent years scientists, resource managers and regulatory agencies have taken significant steps toward addressing the problem. Projects developed with HISC funding have greatly enhanced these efforts, and these lessons and actions are well regarded among experts in the field, both nationally and internationally. However, HISC funding and the matching funds that have been leveraged are not institutionalized, and there are many other functions that remain beyond the capacity of this state to protect Hawai'i in a comprehensive and consistent manner.

In 2008 a survey was carried out by HISC staff to determine the principal organizational and resource shortfalls, including infrastructure, capitol improvements, staffing, research and other needs. This survey identified approximately \$145 million in unaddressed needs. The survey was thorough (although not exhaustive) and amounts are estimated in most cases. It is recognized that \$145 million is a large amount. This information-gathering exercise has produced a list of needs that may be prioritized so that funding particularly effective efforts, such as quarantine measures, would result in avoidance of the costs and impacts of pests that would arrive and spread without an adequate biosecurity system. In addition, partial progress can be made on multiple projects even with less funds.

In short, prioritization is needed. A balance is needed between the seriousness of the threat posed by invasive species and the adequacy of the response to mitigate that threat.

What is needed:

- Better laws and rules to prevent the arrival, establishment and spread (both interisland and intransland) of invasive species;
- Comprehensive prevention and detection measures for both terrestrial and marine invaders not yet present in Hawai'i;
- Better small mammal control to protect native birds;
- Better pig, deer, sheep, goat, and other ungulate control in high value native forest areas;
- Biocontrol for widespread pests;
- More control methods to address newly naturalizing pests already present in Hawai'i; and,
- Public awareness, understanding of invasive species issues, and support for prevention and

control projects.

Resource shortfalls for invasive species management in Hawai'i	Millions of dollars	
	Annual	Set up costs
Modern Biosecurity System	\$4.0	\$54.0
Biocontrol	\$3.1	\$10.0
Restoration and Site Management to Protect Watersheds and Biodiversity	\$10.5	\$10.4
Rodent and Predator Control To Protect Native Biodiversity	\$4.0	\$20.5
Brown Tree snake	\$10.0	
Invasive Species Committees	\$3.2	
WNV	\$0.4	\$3.0
Some Agricultural Pest Control Needs	\$3.2	
State of Hawaii Department of Transportation S.N.I.P.P. Statewide Noxious/Invasive Plant Program	\$6.0	
Emergency Response Fund		\$3.0
	\$44.4	\$100.9

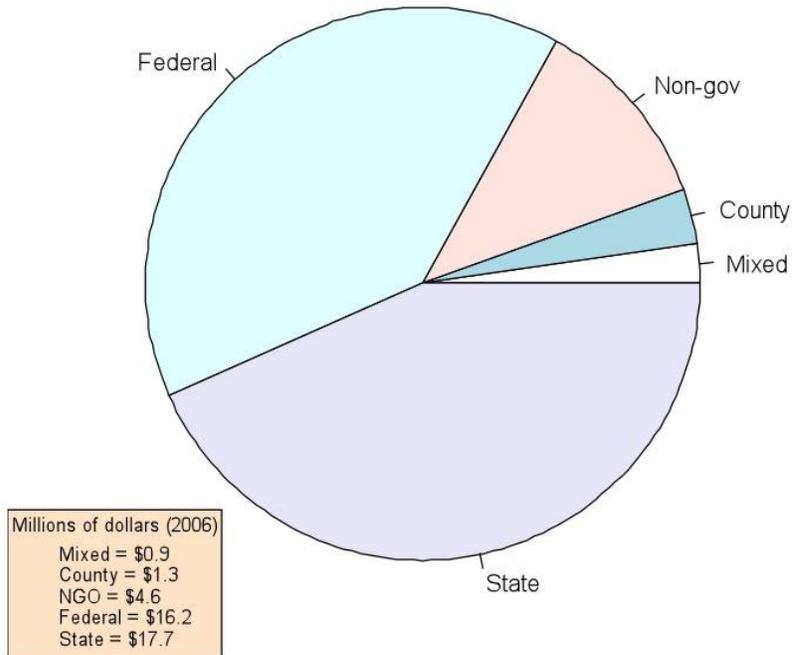
Many conservation and invasive species efforts are soft funded. Financial security is lacking, job security is often poor and pay is lower than similarly technical or difficult jobs in the private sector. In the case of eradication programs, where the aim is to eradicate every last individual of an incipient population, success ultimately depends on early detection, fast response and continuous political and financial support to complete the job and follow-up efforts are needed to delimit and control all individuals (e.g., control of varroa mites and nettle caterpillars). Dealing with species like miconia and coqui frogs, which are widespread in some areas, requires research into more effective ways to control or even eradicate them. Funding for these initiatives must be institutionalized.

Inflation, rising fuel and other costs impact many programs as the cost of operating increases. For example, much of the invasive species work involves the use of helicopters to access remote sites, search for invasive species or control target organisms. This is an effective tool for managers, although costs may soon make these methods impossible. The State must find a way to fund these important programs, even in difficult economic times, or too much ground is lost along with the window of opportunity.

HISC has preferentially supported with its funds innovative projects that target gaps in capacity, rather than the simple augmentation of existing invasive species management capacity.

Funding Sources for Invasive Species Management in Hawai'i

In 2006 HISC staff compiled a report on spending on government-supported invasive species management projects in Hawai'i that were sourced from USDA, USFWS, DOD, National Park Service, HISC, DLNR and HDOA. Individually most projects relied on funds from both state and federal sources, though county and non-governmental organizations contributed. Mixed funding sources means that the reporting agency often did not distinguish where funds were from, but is generally state and federal sources.



Organizational and Resource Shortfalls in Hawai'i

1) Modern Biosecurity System

Many invasive species that are not yet present in Hawai'i pose a serious threat should they arrive and become established. Species, such as the red imported fire ant, brown tree snake, West Nile Virus, avian influenza, and many others, have the potential to seriously impact the economy, natural environment, and the health and lifestyle of Hawai'i's people and visitors. The impact of red imported fire ant alone was estimated to reach \$200 million annually within 10 years of introduction because of its impact on tourism, infrastructure and quality of life. Meanwhile, brown tree snake impacts could double. Investing in a modern biosecurity system would stop or postpone these costs for years. Money saved in costs avoided easily justifies a significant investment in such a program.

HISC has already contributed to this need by providing HDOA with funds for carrying out risk assessments at ports, where extra thorough inspections allowed HDOA to assess the risk posed by various pathways and commodities imported into Hawai'i from mainland ports.

To conduct an adequate level of inspection on imported cargo, new facilities at sea and air ports are needed on all islands. Joint federal-state facilities are planned so that USDA and HDOA officers can carry out inspection, treatment and handling of cargo and prevent pest movement from domestic and foreign ports, and between islands. All such facilities need to be staffed and operated. Maui Airport recently had such a facility put in place. Conditions are much improved and inspections more effective. Some ports completely lack inspection buildings, and other ports are open-air and ill-lighted. Research about treatment methods and risk management are needed. Sophisticated manifest tracking databases are needed to identify high-risk cargo prior to inspection, and track effectiveness.

Estimated cost for inspection and treatment facilities in place on all islands over 6 years: **\$54 million**
Operating: **\$3-4 million annually**
Research: **\$1-3 million annually**

2) Rodent and Predator Control to Protect Native Biodiversity

a) Offshore islets

Offshore uninhabited islets are excellent refuges from multitude of invasive species that plague the large islands, and these islets are the last refuge for many rare coastal species, including 22 species of seabirds. Eight threatened and endangered seabird species are currently found on the islets and 8 additional federal species of concern are present. The islets are home to large numbers of endemic (species found only in Hawai'i) plants, insects, birds and marine creatures. Major threats to the success of these species include rats, cats, invasive insects and plants. Rats and cats are now known to be eradicable from offshore islands. After removal of rats from Mokolii islet (Chinaman's Hat) nesting wedge-tailed shearwater came back from 0 birds to over 200 in one season. Native plants and seeds also rebound, and even shoreline marine species become more abundant. Compared to the larger islands inhabited islands where control of non-native mammals is costly and managers must deal with continuous reinvasion, eradication of pests on offshore refuges is a cost investment with clear gains in the species that respond.

Rats (*Rattus exulans*) were present on Mokapu, an islet off of Moloka'i, until they were eradicated in February 2008 by the application of rodenticide pellets by helicopter. Rats are notorious for eating the fruit and seeds of plants as well as seabird eggs, causing declines in both. Biologists will continue to monitor the island to make sure all the rats are gone. Similar successes can be repeated on other islets, and plans are in the works in 2008 to restore Lehua Island off of Niihau. HISC outreach staff helped to

involve the community in that effort.

The use of helicopters and the logistical difficulties of getting to the islets can make each operation costly. Meanwhile, Kahoolawe could be one island in which eradications could be attempted on a larger scale, potentially creating the biggest refuge for native seabirds and plants in the Main Hawaiian Islands.

b) Predator-proof fences in high value biodiversity sites

On the main islands small predators, such as dogs, rats, mice, cats and mongoose, are known to kill ground-nesting birds and the small mammals with tree-climbing skills are able to prey on forest birds, chicks and eggs. Many endemic forest birds and invertebrates are preyed upon by cats, rodents, mongoose and mice. Ground-nesting seabirds are vulnerable at coastal and mountain sites. Many native plants have their flowers, fruit, seeds, stems and seedlings eaten by rodents, degrading the native forest and impacting resources for native birds. Predator control in such sites is usually done using rodenticides in bait-stations, or by trapping, usually in areas where endemic birds are known to exist. Such efforts are costly due to the effort necessary, and require multiple efforts each year due to re-invasion from surrounding areas. Similar techniques to those used in offshore islets would be able to show their return within a few years by demonstrating greater nesting success in key bird species, and less plant predation.

Predator proof fences are costly to build, but allow managers to undertake complete removal of predators from within the fenced area. These have been tested in New Zealand and elsewhere with good results. This is particularly useful for protecting birds from predator impacts. As native bird populations grow, such fenced areas could become eco-tourism sites in addition to providing safe sites for native biodiversity. One such fence is planned for Kaena Point on O'ahu to protect albatross and petrel nesting sites that have been subject to continuous predation over many years. The current estimate of costs is for demonstration purposes and could allow the fencing of a 500 acre area divided between one or more sites. Predator-proof fences would also keep out feral ungulates, although fencing specifically for excluding species like pigs and sheep are covered in a separate section.

Offshore islets invasive species removal: **\$10 million**

Kaho'olawe invasive species removal and restoration: **\$10.5 million**

Predator control: **\$4 million annually**

Proof-of-concept predator-proof fences: **\$2.4 million**

3) Restoration and Site Management to Protect Watersheds and Biodiversity

Invasive species control in pristine and near pristine sites and watersheds requires "boots on the ground" to protect biodiversity values. Invasive plants negatively impact aquifer replenishment, and surface water, with native forest providing up to 30% more water than strawberry guava forests. Ungulates, including pigs, deer, sheep, antelope and goats, are managed in key areas to protect biodiversity, watershed values and to mitigate vectored diseases. Typically, ungulate management involves fencing off areas and removing all animals within the fence. New fencing is needed and the cost of maintaining currently installed fences is significant, with annual damages by tree falls, wear and tear, and storms. New developments in remote sensing technology allow natural resource managers to identify, locate, map and monitor native plants, invasive plants, animal impacts and management efficacy. This remote sensing technology may cost only \$2-3 per acre but watershed management areas are in the thousands of acres. The ridge to reef restoration paradigm can protect both terrestrial and reef ecosystems, but it requires much more work to be carried out in the lower areas of the island, which typically receive less attention because they more degraded by competing land uses and invasive

species.

Field crews: **\$3.5 million annually**

Remote sensing techniques for natural resource management: **\$3.3 million**

Ungulate fencing **\$6.1 million** and control **\$1 million annually**

Ridge to reef restoration: **\$6 million annually**

4) Biocontrol

The USDA-Forestry Service and HDOA are the only two agencies with capacity in this area at present and, to a lesser extent, UH. The building of a new state biocontrol containment and testing facility is needed, as the two current facilities are inadequate to combat widespread species for which chemical and mechanical control is not cost effective. Biocontrol has high up-front costs since researchers must ascertain the biocontrol's specificity and safety via years of testing prior to being released. However, the control of target organisms is continuous once a biocontrol species is successfully established. Modern biocontrol is cost effective and environmentally safe, and it removes the need to use pesticides while reducing the impact of widespread invasive species.

New facility: **\$10 million**

Research/Operating costs: **\$3.1 million annually**

5) West Nile Virus

HISC has funded DOH to undertake early detection work for WNV for the last 5 years. WNV has yet to arrive in Hawai'i, but it could arrive and it has the potential to infect people and devastate bird fauna. This year's efforts are reported elsewhere in this report, in relation to prevention efforts. Such work should ideally be funded separately so that HISC funds can be used to support innovation and fill key gaps in the effort to protect Hawai'i from invasive species. However, a concerted effort to eradicate the disease will be needed wherever the disease might be detected. Due to the fact that we are an island archipelago, the disease could possibly be eradicated using aerial mosquito control operations such as those used to keep mosquito populations down near urban areas of southern mainland states where the disease is now prevalent. Two aspects need to be funded are: annual early detection efforts and an emergency fund in case the disease is detected. A number of other pests and diseases not yet in Hawai'i could also warrant an emergency fund to respond to newly detected infestations.

WNV early detection: **\$350,000 annually**

WNV rapid response contingency fund: **\$3 million**

6) Island-based Invasive Species Committees

ISCs focus on the objectives of early detection, containment and eradication of priority high risk invasive species for which these objectives are feasible. They are heavily linked with state and county agencies and these agencies are often committee participants (see above for information about their current programs). Due to limited resources their work is leveraged and HISC funds typically provide between 20% and 90% of their funding. Work is carried out using soft money sourced from a variety of state, federal and county agencies. ISCs provide the only early detection capability for new invasive plants—there are no agencies that are tasked with this work. In addition, many of ISCs provide the only trained crew that works consistently on major invasive pests, such as Miconia.

The work mainly involves hard work in the field searching for and controlling between 10 and 25 main target species that have been prioritized and assessed for feasibility of success. Early detection crews

search for new targets at the earliest stages of invasion to maximize the probability of eradication before species are well established. Baseyards are often shared with other natural resource managers and require upkeep or, in some cases, facilities are on loan from agencies. Field crews may have to travel for much of the day or camp out in sites remote from the main baseyard, often accessing sites by helicopter. On Maui and the Big Island some crews are needed to work in specific geographical areas. GIS experts track field work progress; training safety and vehicle operations are growing costs. Helicopter contracts are an expensive and necessary part of the work. As one species is eradicated or contained this may allow other lower priority species to become targets. Currently identified funding needs are based on the assumption that current levels of funding continue, a situation that could be changing in these tough economic times of budget restrictions.

Invasive Species Committee needs: **\$3.2 million annually**

7) Brown Tree Snake

As mentioned above, the shift of a military base from Okinawa to Guam has increased the risk of introducing brown tree snakes to Hawai'i. Complete inspections are needed in Guam and Hawai'i to ensure the brown tree snake is not accidentally introduced to Hawai'i, and this again underscores the need for new joint inspection facilities at ports.

Brown tree snake interdiction in Hawai'i: **\$10 million**

8) State of Hawaii DOT- S.N.I.P.P. (Statewide Noxious/Invasive Plant Program)

SNIPP is a statewide effort to maintain and control noxious/invasive plant species at a manageable level along Hawai'i's state roads, protect conservation, scenic and native habitat areas and early detection of high priority invasive species. Roads act as vectors for many invasive species and some may have conservation, aesthetic and safety impacts.

Roadside invasive plant control: **\$6 million annually**

9) Some Agricultural Pest Control Needs

Staff from the Hawaii Agricultural Resource Center identified needs in the area of controlling key pests of agriculture, such as fruit flies, birds that prey on seed crops, fireweed in pastures and Napier grass in cane fields.

Agricultural pest control needs: **\$6.8 million annually**

10) Emergency response fund

WNV, avian influenza, red imported fire ant, and brown tree snake, as well as any number of less famous invasive species, diseases or pests could warrant a full and rapid response in the event that they are detected in Hawai'i. In the case of red imported fire ant and brown tree snake the costs to Hawai'i, should those species establish, have been estimated in the hundreds of millions of dollars in direct and indirect costs.

Emergency response fund: **\$3 million**

VIII. Advice to the Governor and Legislature Regarding Invasive Species

THISC reviewed two submittals provided by HISC staff at their June 27, 2011 meeting. The first submittal, regarding the functioning of the HISC, was approved unanimously. This submittal highlights the need for HISC to function as a leading agency on invasive species prevention, control, and outreach. The recommendation of the Council regarding this submittal will result in the creation of new administrative rules that will assist in the functioning of HISC and will allow HISC to designate species as “invasive.” HISC may then create and manage a list of HISC-designated invasive species, which will allow HISC to utilize the authority for private property entry for invasive species control provided by Chapter 194, HRS.

The second submittal, regarding current invasive species issues, was approved unanimously, but with the modifications outlined below. This submittal details current issues related to albizia (*Falcataria moluccana*), the need to prevent and monitor mosquito populations, the need to restrict imports of plants from the Myrtle family to reduce the threat of ‘Ōhi’a rust (*Puccinia psidii*), and the transportation of introduced wildlife, including axis deer (*Axis axis*).

Regarding the Functioning of HISC

SUBJECT: Requesting the promulgation of administrative rules for the implementation of Chapter 194, HRS, HISC.

HISC was established for the special purpose of providing policy level direction, coordination, and planning among state departments, federal agencies, and international and local initiatives for the control and eradication of harmful invasive species infestations throughout the State of Hawai‘i and for preventing the introduction of other invasive species that may be potentially harmful (Section 194-2, HRS).

Senate Concurrent Resolution No. 45, House Draft 1 (2001) requested the Legislative Reference Bureau to conduct a study on the issue of invasive species in Hawai‘i. The 2002 “Filling the Gaps in the Fight Against Invasive Species” included policy recommendations, funding needs and options, which lead to then-Governor Benjamin Cayetano’s issuance of Executive Order No. 2002---03 establishing the Hawai‘i Invasive Species Council in June, 2002. In 2003 HISC was authorized by past Governor Lingle under Act 85. Act 85 codified into a statute in 2005, and Chapter 194, HRS, defines its purpose, composition, and responsibilities, and gives its member agencies the authorization to enter private or public property to control invasive species with proper notification.

Recommendation: HISC directs the HISC staff to draft administrative rules to be promulgated by the Council. (*Unanimously approved*)

Regarding Current Invasive Species Issues

SUBJECT: Briefing on the role of HISC to address current invasive species issues to prevent the introduction and spread of invasive species, with recommendations for follow-up actions.

HISC was established for the special purpose of providing policy level direction, coordination, and planning among state departments, federal agencies, and international and local initiatives for the control and eradication of harmful invasive species infestations throughout the State of Hawai'i and for preventing the introduction of other invasive species that may be potentially harmful (Section 194-2, HRS). The HISC Strategic Plan outlines the HISC priorities in the Working Group areas of prevention, response and control, public outreach, and research and technology for FY2008-2013.

The measures of effectiveness for HISC outlined in the strategic plan include advice and recommendations given to the Governor or legislature, member agency adoption of rules and policies against invasive species, and Working Group goals achieved. Each Working Group has its own tasks and measures of effectiveness laid out in the strategic plan. One of the key objectives of the Prevention Working Group is to prevent the movement of known invasive species between islands. A key objective for the Response and Control of Established Pests Working Group is to determine what species are invasive to trigger access provisions onto private lands.

Several current and pressing issues have emerged that highlight the need for HISC to provide additional authorities to agencies by officially designating key species as invasive for the purposes of control, and to support efforts to prevent the introduction and interisland transport of pests by identifying and pursuing rule changes that will address gaps in the biosecurity system and the ability to effectively manage pests.

a) Albizia

Albizia is native to Indonesia, Papua New Guinea, and the Solomon Islands. It is a fast growing species capable of reaching 40 m in height and is difficult and costly to remove once established. Albizia associates with nitrogen-fixing bacteria in the soil, altering local soil composition and impacting the growth of native species. The tree often grows along roadways and produces brittle branches that easily break and fall, causing a threat to cars and other property below.

The County of Hawai'i has requested that albizia (*Falcataria moluccana*) be designated by the HISC as an invasive species. Like many other places in state, the County of Hawai'i has found albizia to be a nuisance. Agencies statewide need additional authorities to remove these trees where they are identified as being a threat to human safety and the environment.

Recommendation: The Council supports listing albizia as a HISC-designated invasive species through an administrative rule process. (*Unanimously approved*)

b) Mosquitoes

Mosquitoes were introduced to Hawai'i in the mid-1800s and may transmit diseases such as yellow fever, dengue fever, or malaria. There are 6 known species of mosquito present in Hawai'i. However, we do not have the mosquitoes known to transmit malaria or the species that best transmits dengue fever. Hawaii DOA is responsible to prevent the entry of mosquitoes in cargo, through inspection, and the diseases they carry into the State. DOH is responsible for monitoring for mosquitoes around ports, identifying and monitoring mosquito populations, and addressing

outbreaks of mosquito-borne diseases. Due to reductions in budget, these programs have been severely reduced or eliminated throughout the state.

Recommendation: We recommend that the Council support HDOA and DOH programs in preventing and monitoring for new mosquito species in Hawai'i, and that the Council support, as a high priority, restoring the capacity of DOH's Vector Control Branch to prevent and control disease outbreaks.

(Unanimously approved as modified: HISC supports the HISC working groups to assist the HDOA and DOH in developing a strategy to prevent and monitor the introduction of new mosquito species into Hawai'i.)

c) 'Ohi'a Rust

'Ohi'a rust (*Puccinia psidii*), also known as guava rust, is a disease that can kill 'ohi'a trees and other plants in the myrtle family. 'Ohi'a rust can enter Hawai'i by hitchhiking on imported plants and plant parts in the myrtle family. Agriculture inspectors have intercepted 'ohi'a rust on common myrtle in imported flower bouquets, although any plant material in the myrtle family, including eucalyptus foliage and wax flowers, could also bring in the rust.

Like the flu virus, there are different strains of 'ohi'a rust. One strain of the rust has already arrived in Hawai'i and it quickly killed rose apple trees across the state, while 'ohi'a and other local Myrtaceae showed lesser susceptibility. However, additional arrivals of any strains of this rust could pose a very real threat to the survival of 'ohi'a trees, which comprise 80% of Hawai'i's native forest (nearly 1,000,000 acres). To protect 'ohi'a and the water that is provided by a healthy ecosystem, the Hawaii Department of Agriculture will be proposing new rules restricting the importation of myrtle family plants, produce, and cut flowers via the rulemaking process.

Recommendation: HISC supports the establishment of a rule to restrict importation of plants in the Myrtle family into Hawai'i. The Council also supports a program promoting locally grown alternatives to high-risk imports, including members of the Myrtaceae family. *(Unanimously approved)*

d) Axis Deer

Axis deer (*Axis axis*) were introduced to Moloka'i, Lāna'i, and Maui, where they are hunted for recreation and food. The Maui axis deer population started with ten animals in 1959 and has grown to an estimated 12,000 animals today due to a lack of natural predators and natural environmental controls such as extreme weather or population-culling diseases, as well as the limited capacity to control population size through hunting. Axis deer have had devastating impacts on local agriculture, costing more than \$1 million in losses to vegetable crops, cattle, grapes, and sugarcane on Maui last year. Axis deer also threaten watershed forests and native species. Axis deer can jump or circumvent most existing ungulate fences that were built to exclude feral pigs. The presence of axis deer requires farmers, ranchers, and conservation agencies to retrofit or install taller fences (8') to protect food crops, endangered and threatened species, sensitive natural areas, and watershed forests from deer impacts.

The recent discovery of axis deer on Hawai'i island has highlighted significant gaps in existing Administrative Rules regarding the interisland and intransland movement of restricted species, the release of game species, and access to controlling or eradicating HISC-designated invasive species.

Recommendation: HISC and member agencies will pursue statutory and administrative rule changes and administrative actions to effectively control and regulate the introduction and movement of introduced wildlife species. *(Unanimously approved)*

General Recommendation: That HISC issue a statement of support for the control of invasive species and the prevention of their importation and interisland transport with the commitment to pursue the necessary rule changes that are critical in effective biosecurity and management. *(The Council directed HISC staff to produce a position paper)*



The HISC, with Governor Abercrombie, addresses a rapt audience at a public Council meeting in June 2011.

Appendix 1: Chapter 194, Hawaii Revised Statutes: INVASIVE SPECIES COUNCIL

Section

- 194-1 Definitions
- 194-2 Establishment of council; duties
- 194-3 Lead agencies; accountability
- 194-4 Relation of chapter to other laws
- 194-5 Entry; private property
- 194-6 Entry; public property
- 194-7 Rules

Cross References

- Coqui frog; designation as pest, see §141-3.
- Landowners liability for access to control invasive species, see chapter 520A.
- Noxious weed control, see chapter 152.
- Plant, animal, and microorganism, etc., imports, see chapter 150A.

[§194-1 Definitions.] As used in this [chapter], unless the context requires otherwise:

“Council” means the [invasive species council].

“Department” means any entity that is a member of the [invasive species council] established under section [194-2(a)]. [L 2003, c 85, §2; am L 2004, c 10, §16; am L 2006, c 109, §2].

[§194-2 Establishment of council; duties.] (a) There is established the invasive species council for the special purpose of providing policy level direction, coordination, and planning among state departments, federal agencies, and international and local initiatives for the control and eradication of harmful invasive species infestations throughout the State and for preventing the introduction of other invasive species that may be potentially harmful. The council shall:

- (1) Maintain a broad overview of the invasive species problem in the State;
- (2) Advise, consult, and coordinate invasive species-related efforts with and between the departments of agriculture, land and natural resources, health, and transportation, as well as state, federal, international, and privately organized programs and policies;
- (3) Identify and prioritize each lead agency's organizational and resource shortfalls with respect to invasive species;
- (4) After consulting with appropriate state agencies, create and implement a plan that includes the prevention, early detection, rapid response, control, enforcement, and education of the public with respect to invasive species, as well as fashion a mission statement articulating the State's position against invasive species; provided that the appropriate state agencies shall collaborate with the counties and communities to develop and implement a systematic approach to reduce and control coqui frog infestations on public lands that are near or adjacent to communities, and shall provide annual reports on the progress made in achieving this objective;
- (5) Coordinate and promote the State's position with respect to federal issues, including:
 - (A) Quarantine preemption;
 - (B) International trade agreements that ignore the problem of invasive species in Hawaii;
 - (C) First class mail inspection prohibition;
 - (D) Whether quarantine of domestic pests arriving from the mainland should be provided by the federal government;

(E) Coordinating efforts with federal agencies to maximize resources and reduce or eliminate system gaps and leaks, including deputizing the United States Department of Agriculture's plant protection and quarantine inspectors to enforce Hawaii's laws;

(F) Promoting the amendment of federal laws as necessary, including the Lacey Act Amendments of 1981, Title 16 United States Code sections 3371-3378; Public Law 97-79, and laws related to inspection of domestic airline passengers, baggage, and cargo; and

(G) Coordinating efforts and issues with the federal Invasive Species Council and its National Invasive Species Management Plan;

(6) Identify and record all invasive species present in the State;

(7) Designate the department of agriculture, health, or land and natural resources as the lead agency for each function of invasive species control, including prevention, rapid response, eradication, enforcement, and education;

(8) Identify all state, federal, and other moneys expended for the purposes of the invasive species problem in the State;

(9) Identify all federal and private funds available to the State to fight invasive species and advise and assist state departments to acquire these funds;

(10) Advise the governor and legislature on budgetary and other issues regarding invasive species;

(11) Provide annual reports on budgetary and other related issues to the legislature twenty days prior to each regular session;

(12) Include and coordinate with the counties in the fight against invasive species to increase resources and funding and to address county-sponsored activities that involve invasive species;

(13) Review state agency mandates and commercial interests that sometimes call for the maintenance of potentially destructive alien species as resources for sport hunting, aesthetic resources, or other values;

(14) Review the structure of fines and penalties to ensure maximum deterrence for invasive species-related crimes;

(15) Suggest appropriate legislation to improve the State's administration of invasive species programs and policies;

(16) Incorporate and expand upon the department of agriculture's weed risk assessment protocol to the extent appropriate for the council's invasive species control and eradication efforts; and

(17) Perform any other function necessary to effectuate the purposes of this chapter.

(b) The council shall be placed within the department of land and natural resources for administrative purposes only and shall be composed of:

(1) The president of the University of Hawaii, or the president's designated representative;

(2) The director, or the director's designated representative, of each of the following departments:

(A) Business, economic development, and tourism;

(B) Health; and

(C) Transportation; and

(3) The chairperson, or the chairperson's designated representative, of each of the following departments:

(A) Agriculture; and

(B) Land and natural resources.

(c) Representatives of federal agencies, the legislature, and members of the private sector shall be asked to participate or consulted for advice and assistance. Representatives of the legislature shall consist of eight members, as follows:

(1) Four senators, one from each county, to be selected by the senate president; and

(2) Four representatives, one from each county, to be selected by the speaker of the house of representatives.

(d) The council shall meet no less than twice annually to discuss and assess progress and recommend changes to the invasive species programs based on results of current risk assessments, performance standards, and other relevant data. Notwithstanding any law to the contrary:

- (1) A simple majority of voting members of the council shall constitute a quorum to do business; and
- (2) Any action taken by the council shall be by a simple majority of the voting members.

(e) The council shall submit a report of its activities to the governor and legislature annually. [L 2003, c 85, §3; am L 2004, c 10, §16; am L 2006, c 109, §§1, 2; am L 2008, c 160, §1]

[§194-3 Lead agencies; accountability.] A state department that is designated as a lead agency under section [194-2(a) (7)], with respect to a particular function of invasive species control, shall have sole administrative responsibility and accountability for that designated function of invasive species control. The lead agency shall:

(1) Coordinate all efforts between other departments and federal and private agencies to control or eradicate the designated invasive species;

(2) Prepare a biennial multi-departmental budget proposal for the legislature forty days before the convening of the regular session of the legislature in each odd-numbered year, showing the budget requirements of each of the lead agency's assigned invasive species function that includes the budget requirements of all departments that it leads for that species, as well as other federal and private funding for that invasive species;

(3) Prepare and distribute an annual progress report forty days prior to the convening of each regular session of the legislature to the governor and the legislature that includes the status of each assigned function; and

(4) Any other function of a lead agency necessary to effectuate the purposes of this [chapter]. [L 2003, c 85, §4; am L 2004, c 10, §16; am L 2006, c 109, §2]

(C) Transportation; and

(3) The chairperson, or the chairperson's designated representative, of each of the following departments:

(A) Agriculture; and

(B) Land and Natural Resources.

(c) Representatives of federal agencies, the legislature, and members of the private sector shall be asked to participate or consulted for advice and assistance. Representatives of the legislature shall consist of eight members, as follows:

(1) Four senators, one from each county, to be selected by the Senate president; and

(2) Four representatives, one from each county, to be selected by the speaker of the House of Representatives.

(d) The Council shall meet no less than twice annually to discuss and assess progress and recommend changes to the invasive species programs based on results of current risk assessments, performance standards, and other relevant data. Notwithstanding any law to the contrary:

- (1) A simple majority of voting members of the council shall constitute a quorum to do business; and
- (2) Any action taken by the council shall be by a simple majority of the voting members.

(e) The Council shall submit a report of its activities to the governor and legislature annually. [L 2003, c 85, §3; am L 2004, c 10, §16; am L 2006, c 109, §§1, 2]

[§194-4 Relation of chapter to other laws.] Notwithstanding any other law to the contrary, and in addition to any other authority provided by law that is not inconsistent with the purposes of this [chapter], a department is authorized to examine, control, and eradicate all instances of invasive species identified by the Council for control or eradication and found on any public or private premises or in any aircraft or vessel landed or docked in waters of the State. [L 2003, c 85, §5; am L 2004, c 10,

§16; am L 2006, c 109, §2]

[§194-5 Entry; private property.] (a) Whenever any invasive species identified by the Council for control or eradication is found on private property, a department may enter such premises to control or eradicate the invasive species after reasonable notice is given to the owner of the property and, if entry is refused, pursuant to the court order in subsection (d).

(b) If applicable, a duplicate of the notice so given shall be left with one or more of the tenants or occupants of the premises. If the premises are unoccupied, notice shall be mailed to the last known place of residence of the owner, if residing in the state. If the owner resides out of the state or cannot be expeditiously provided with notice, notice left at the house or posted on the premises shall be sufficient.

(c) The department may instead cause notice to be given, and order the owner to control or eradicate the invasive species, if such species was intentionally and knowingly established by the owner on the owner's property and not naturally dispersed from neighboring properties, at the owner's expense within such reasonable time as the department may deem proper, pursuant to the notice requirements of this section.

(d) If the owner thus notified fails to comply with the order of the department, or its agent, within the time specified by the department, or if entry is refused after notice is given pursuant to subsection (a) and, if applicable subsection (b), the department or its agent may apply to the district court of the circuit in which the property is situated for a warrant, directed to any police officer of the circuit, commanding the police officer to take sufficient aid and to assist the department member or its agent in gaining entry onto the premises, and executing measures to control or eradicate the invasive species.

(e) The department may recover by appropriate proceedings the expenses incurred by its order from any owner who, after proper notice, has failed to comply with the department's order.

(f) In no case shall the department or any officer or agent thereof be liable for costs in any action or proceeding that may be commenced pursuant to this [chapter]. [L 2003, c 85, §6; am L 2004, c 10, §16; am L 2006, c 109, §2].

[§194-6 Entry; public property.] (a) Whenever any invasive species is found on state or county property or on a public highway, street, lane, alley, or other public place controlled by the state or county, notice shall be given by the department or its agent, as the case may be, to the person officially in charge thereof, and the person shall be reasonably notified and ordered by the department to control or eradicate the invasive species.

(b) In case of a failure to comply with the order, the mode of procedure shall be the same as provided in case of private persons in section [194-5]. [L 2003, c 85, §7; am L 2004, c 10, §16; am L 2006, c 109, §2]

[§194-7 Rules.] The invasive species council may adopt rules pursuant to chapter 91, to effectuate this [chapter]. [L 2003, c 85, §8; am L 2004, c 10, §16; am L 2006, c 109, §2]

Appendix 2: HISC Strategy, 2008-13