REPORT TO THE TWENTY-SIXTH LEGISLATURE
REGULAR SESSION OF 2011

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
and
Section 19 of Act 162, Session Laws of Hawaii, 2009
December 2010

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PURPOSE

Chapter 194, Hawaii Revised Statutes (HRS), Invasive Species Council, establishes the interagency Hawaii Invasive Species Council (HISC), determines its composition and responsibilities, and gives its member agency's special abilities to enter private or public property to control invasive species (Appendix 3). 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 Hawaii. HISC coordinates the State's efforts to stop the introduction and spread of invasive species in Hawaii. 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.

Additionally, Section 19 of Act 162, Session Laws of Hawaii (SLH) 2009, requires the Department of Land and Natural Resources (DLNR) to prepare reports to the Legislature prior to the convening of the 2010 and 2011 Regular Sessions 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 reports 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 addressed the needs of the strategic plan and the strategic plan's performance outcomes.

BACKGROUND

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 actively involved in invasive species prevention, control, research, and public outreach programs.

The Legislature authorized the creation of HISC under Act 85, SLH 2003, and stated "the silent invasion of Hawaii by alien invasive species is the single greatest threat to Hawaii's economy, natural environment, and the health and lifestyle of Hawaii's people and visitors." Hawaii 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.

HISC members include the chairs or directors of DLNR, the Department of Agriculture (HDOA), the Department of Business, Economic Development, and Tourism (DBEDT), the Department of Health (DOH), the Department of Transportation (DOT), and the President of the University of Hawaii (UH). Additionally, directors from the Departments of Hawaiian Home Lands (DHHL), Commerce and Consumer Affairs (DCCA), and Defense (DOD) have been invited to participate.

HISC provides the institutional framework for leadership and coordination for a statewide invasive species prevention and control program. DLNR is the administering agency for HISC.

In 2006, the inclusion of eight members from the Legislature, to serve in an ex-officio and non-voting advisory capacity provided a stronger link to the Counties. One member from each legislative body, four senators and four (House) representatives represent their respective counties and help guide the decisions of HISC.

Lead agencies chair interagency working groups meetings that focus on different program areas; HDOA chairs the Prevention Working Group, DLNR chairs the Established Pests Working Group, UH chairs the Research and Technology Working Group, DOT chairs the Public Outreach Working Group, and DBEDT chairs the Resources Working Group.

HISC STRATEGIC PLAN (included as Appendix)

- In 2003, an interim strategic plan was approved by HISC to address alien species in the State, and to guide HISC implementation of its responsibilities.
- In July 2008 the HISC approved the adoption of the HISC Strategy 2008-2013.
- Lead agencies are identified in the HISC Strategy 2008-2013

COORDINATION OF INVASIVE SPECIES EFFORTS

HISC Goals
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 provided in the HISC Strategy 2008-2013 (Appendix).

HISC Measures of Effectiveness
- Advice and recommendations to Governor or Legislature.
- Reports to the Legislature regarding invasive species.
- Approval of annual budget.
- Meeting reports (including working groups).
- Attendance at meetings of member and collaborating agencies.
- Agency adoption of innovative projects, rules and policies against invasive species.
- Number of new invasive species detected at ports of entry.
- Names and numbers of priority pests threatening Hawaii.
- Working group goals achieved.

HISC Meeting Resolutions
On September 18, 2009, HISC approved a spending plan for Fiscal Year (FY) 2010 for a budget of

$2,000,000 that addresses three of the four interrelated plan components:

- Prevention $740,000
- Response and Control of Established Pests $820,000
- Research and Technology $0*
- Public Outreach $130,000
- HISC Support (includes central services fee and contingency fund) $310,000

(More detail is provided in HISC Budgetary Matters.)

*The funding for Research and Technology was reduced to $0 in order to maintain staff in the other components. Future restoration of Research and Technology funding was recommended even under continuing budget restrictions.

HISC WORKING GROUPS

Areas of Accomplishment

Accomplishments within HISC program areas (Prevention, Response and Control of Established Pests, and Public Outreach) are included in the subsequent pages for each program. Measures of effectiveness are reported in each program/project report and correspond to those outlined in the HISC Strategy 2008-2013. (The HISC Strategy 2008-2013 is included in this report as the Appendix).

Budget Item	**S-10-314-522**
PREVENTION	
Weed Risk Assessment	$60,000
Ant coordinator	$40,000
Ballast Water and Hull Fouling Program	$40,000
West Nile Virus	$0
HDOA Inspectors	$600,000
Total Prevention	**$740,000**
RESPONSE AND CONTROL	
BIISC	$100,000
MISC & MoMISC	$200,000
OISC	$190,000
KISC	$90,000
HDOA Biocontrol	$0
AIS	$240,000
Total Response & Control	**$820,000**
RESEARCH AND TECHNOLOGY	
Total R&T	**$0**
OUTREACH	
Staff	$115,000
Materials & Travel	$15,000
Total Outreach	**$130,000**
HISC SUPPORT	
DOFAW Overhead (3%)	$60,000
Central Services Fee (7% of 2 M)	$140,000
Support Staff	$110,000
Total HISC Support	**$310,000**
	$2,000,000

Details of the budget summary presented above, including program descriptions, are presented in this report beginning on Page 4.

LINDA LINGLE
Governor

SANDRA LEE KUNIMOTO
Chairperson, Board of Agriculture

DUANE K. OKAMOTO
Deputy to the Chairperson

State of Hawaii
DEPARTMENT OF AGRICULTURE
1428 South King Street
Honolulu, Hawaii 96814-2512

August 14, 2010

To: HISC Prevention Working Group

From: Carol Okada, Manager
Plant Quarantine Branch

Subject: Final Report: Reimbursement of Payroll Expenses for Department of Agriculture, Plant Quarantine Inspectors with Hawaii Invasive Species Council (HISC) Funds.

Numerous Plant Quarantine Inspector positions statewide were identified during the FY10 reduction in force process as part of the Department's initiative to balance the executive budget. In an effort to maintain the Hawaii Biosecurity Program, the Hawaii Invasive Species Council (HISC) approved funds to assist in supporting (22) twenty-two of these important positions, which were strategically placed as follows:

LOCATION	NUMBER OF POSITIONS
HAWAII (Hilo)	5
HAWAII (Kona)	3
KAUAI (Lihue)	1
MAUI (Kahului)	3
OAHU (Honolulu)	10

In accordance with the HISC funding approval, the following was accomplished in FY10 by the Department of Agriculture, Plant Quarantine Branch:

- Although no interim air cargo consolidation facility at Honolulu International Airport has materialized to date, the Department continued to identify possible sites near the airport environs. In an effort to deal with this shortcoming, airport operations continues to be reprioritized by ensuring inspectional capabilities for the inspection and clearances of late night domestic cargo arrivals, maintaining foreign clearances, and conducting priority parcel inspections in the Lagoon Drive area throughout the morning period. Domestic cargo inspection and passenger/baggage inspection are maintained in the afternoon and evening periods that cover both Ewa and Diamond Head corridors, while interisland inspections for restricted plants and non-domestic animals for transport are conducted throughout the day and night;

- Maritime inspectors continued to be utilized in the morning to clear maritime container inspections at eleven premise inspection sites on a daily basis, and then assist with air arrivals or transitional facility inspections in the afternoon;
- A Cooperative Agreement remained in effect for a major produce importer as a transitional facility that addresses about 20-percent of incoming produce, and discussions with other entities have been on-going to also participate in the transitional facility program;
- The pilot-project for the Certified Seed Producer program has been developed and is readied to be implemented, which will reduce the inspection and clearance of imported seed crops, and will allow for the interisland movement of locally produced seed crops that have been grown under proper sanitation standards and practices to further reduce pest movement intrastate;
- Several public meetings have been conducted and discussions are on-going with the Hawaii Department of Transportation – Harbors to identify inspection, quarantine, and treatment facility areas in and around the harbor environs with the future port expansion planning at Hilo, Kawaihae and Kahului Harbors;
- Readied to implement the electronic manifest reporting system with Matson Navigation Company, which will greatly enhanced the identification of high-risk commodities prior to entering the State, resulting in the capability of intensified inspection of selected commodities that would warrant any treatments, if necessary, and provide timely clearances of imported articles; and
- Continued to evaluate and revise port operations by relocating personnel, adjusting operational periods, and marshaling resources to improve program efficiencies with maximizing coverage with limited personnel as a direct result of the reduction in force.

Amount of Payroll Expenses Expended:

- FY2010, 1st Quarter: none expended
- FY2010, 2nd Quarter: $147,637.28
- FY2010, 3rd Quarter: $312,637.07
- FY2010, 4th Quarter: $138,725.65
- TOTAL ……. $600,000.00

The much needed HISC funding in FY 10 provided the program with adequate funding support to continue the Hawaii Biosecurity Program during the State's economic downturn. During the State Legislature of Hawaii 2010 session, the Department of Agriculture was able to realize key legislative initiatives. From July 1, 2010, any violations for failure to pay, or bill and remit inspection service fees for imported freight were subject to a fine of $50 or two times the amount of net weight, whichever is greater, and the implementation of higher application fees for plants, animals and microorganisms requiring permits, or for microorganisms that require a letter of authorization or registration. In addition, there will be fees imposed effective on October 1, 2010 for specified inspections conducted by the department as well. These sweeping legislative changes will go a long way to support the growth of the Hawaii Biosecurity Program that was previously funded by the HISC grant in FY 10. Mahalo!

Support to the HISC

State Ant Specialist –
Summary of main achievements in 2009-2010

Objective: prevent the entry and spread of invasive ants in Hawaii.

Highlights

Development and launching of www.littlefireants.com

A web page dedicated to invasive ant species in Hawaii has been developed and launched. The website contains a wealth of information ranging from invasive ant biology/ecology, impacts, management options, mitigation activities in Hawaii, extensive bibliography, and downloadable info sheets on all aspects of ant control and detection. The website has received well over 1000 hits since the launch.

Little Fire Ants in Maui

The State Ant Specialist has worked to develop and implement an eradication plan for Little Fire Ants (LFA) in Maui. Working closely with the Maui Invasive Species Committee (MISC), Maui County, HDOA and others; the eradication plan includes outreach, survey and eradication activities. Later in September 2010, the treatment component will be complete. With no LFA found on-site since February, prospects for a successful eradication are very good. Outreach, survey and monitoring activities continue – coordinated by MISC.

Detection of Little Fire Ants in Kona

LFA were detected by the State Ant Specialist in the Kailua-Kona area in January 2010. Since that time additional infested sites have been discovered, and these are all being treated. A Kona LFA Taskforce has been established to oversee survey and eradication activities.

Successful development of new ant baits and application equipment

A paste bait and associated application equipment have been developed by the State Ant Specialist, and is currently being investigated for commercialization by a major multi-national chemical company. The new bait is more effective than existing products, can be applied to trees and vegetation where LFA nest, and is much more rain-fast (therefore much more suitable for tropical conditions)[1]

Successful acquisition of additional funding sources

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

- **County of Hawaii Research and Development Grant** (used to support the Hawaii Invasive

[1] These activities were funded through a HISC R&T grant

Species Council (HISC), Research and Technology (R&T) grant for bait research)
- **United States (US) Senate Farm Bill Grant** $67,000 (development of nursery pest ant management programs)
- **United States Forest Service (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 Hawaii off-shore)
- **Tropical and Subtropical Agriculture Research (TSTAR) Research Grant** $117,000 – economic impact analysis of LFA in Hawaii. (co-PI, travel only)

Activities contributing to prevention of entry and spread of invasive ants

The salary and associated costs of the State Ant Specialist 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.

Preventing entry of invasive ants

1. Off-shore risk management

Traditional biosecurity models begin at the quarantine barrier and focus on preventing the entry of new pests and diseases through inspection of commodities prioritized by risk. These models rely heavily on rapid response to incursions, post-border detection but must take account of "slippage" which is the rate of contaminated commodities not detected at points of entry. Recent attention has shifted to off-shore risk reduction – reducing the rates of contamination of commodities at source points. This new approach has had dramatic positive results for some countries and is rapidly being adopted as the gold standard in biosecurity.

The funding provided by HISC to the ant project has been used to lever a major grant from USFS ($200,000). This grant will be used in part to reduce the threat of invasive ants for US affiliates in the Pacific, which in turn reduces Hawaii's exposure to incursions arising from some of our biggest trading partners. This regional approach has previously been embodied in the Hawaii Ant Plan and the Pacific Ant Prevention Plan.

2. Standardizing ant surveys at points of entry

Standard Operating Procedures (SOP) 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. They include the collection of spatial data suitable for entry to the CAPS database and Geographic Information System (GIS) systems.

3. Development of a response plan for invasive ant incursions

A rapid response plan has been developed for use when an incursion of new invasive ant species is detected in Hawaii. The plan details response procedures and all components of an operational plan:

- Pre-incursion planning
- Initial detection and response

- The Emergency Response Management Committee
- Delimiting survey
- Draft management plan
- Response components
    - Surveillance
    - Treatment
    - Communications
    - Movement controls
    - Research priorities
    - Organizational structure.
- Protocols
    - Collection and identification of ant specimens
    - Standardized surveillance and monitoring methods
    - Data capture and management procedures
    - Guidelines for preparation of a management plan
    - Area Freedom/Pest Freedom
- Treatment options
    - Red Imported Fire Ants
    - Little Fire Ants
- SOP: Containment of an exotic ant infestation
- SOP: Distribution of granular ant baits
- SOP: distribution of paste baits

4. Maintain international networks within the invasive species and biosecurity community

The State Ant Specialist presented papers at the 2009 Biosecuity Conference in Queenstown New Zealand and the 2010 International Invasive Ant Management Workshop in Darwin Australia. He maintains an extensive network of colleagues in the Pacific region and mainland USA to keep abreast of latest threats from invasive ants, new chemicals and treatment methods as well as developments in survey techniques.

Case study – Little Fire Ants on Maui

Late in 2009, LFA were discovered on a single property on Maui. The State Ant Specialist developed and implemented a treatment plan for the site using new formulations and application methods developed under a HISC Research and Technology grant. Treatment was conducted through an experimental use permit issued by the HDOA. To date, the treatments appear to have been very successful with no LFA detected since February 2010. Treatment is not yet complete but at this time, the project is on-track for successful eradication.

A short video of the new technique is available at:
http://docs.google.com/leaf?id=0B61oU9xUD-DMODUwZDQxMjktMzAxOS00MDY2LWIxNjUtMzBlYzU5NjNiOTk2&hl=en_GB&authkey=CPHgiNQP

Preventing inter-island spread of invasive ants

The most serious invasive ant present in Hawaii is the 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:

1. Development of computerized tools for quarantine treatments of nursery stock

The HDOA approved quarantine treatment for nursery plants infested with LFA are taken from the United States Department of Agriculture (USDA), Animal and Plant Health Inspection Service (APHIS), Red Imported Fire Ant treatment standards. However the label for the approved product (Talstar) is very difficult to interpret. A computerized "ready reckoner" has been developed for use by HDOA staff in recommending the correct rate of product to use. Previously, no concrete recommendation could be made. While most contaminated plants are simply not exported, large shipments or high-value shipments still are. This reckoner allows appropriate recommendations to be made for quarantine treatments for those commodities.

Detection case study – Pahala LFA

In June 2010, a resident of Pahala called the State Ant Specialist to report she had purchased some potted plants while on a recent trip to Hilo, and they were covered in small yellow ants. She had read in the local media about LFA and thought the ants in her plants fitted the description. Pahala is 60 miles south-west of Hilo and 60 miles south-east of Kailua-Kona and an LFA infestation there would represent a significant range expansion.

The State Ant Specialist immediately drove to the site which bordered Kau State Forest, treated all the plants and took the most severely infested ones back to Hilo for destruction. This activity has prevented the establishment of a significant outlying LFA infestation within 100 feet of Kau forest reserve.

This case study demonstrates how appropriate outreach can raise community awareness of invasive species issues and rapid technical response contributes to the prevention of new outbreaks of invasive species.

2. Development of an LFA management and detection plan for Maui

LFA were detected on a single property on Maui in September 2009. The State Ant Specialist worked with MISC, HDOA, the Maui County and United States Geological Survey (USGS) to develop an operational plan to eradicate this incursion. The plan included delimiting (local and island-wide), trace-forward/back, public outreach, site-eradication and follow-up monitoring. The eradication component was undertaken as a joint HDOA-Pacific Cooperative Studies Unit (PCSU) activity and to date appears to be successful. The plan can be downloaded here - http://docs.google.com/fileview?id=0B61oU9xUD-DMZmZiM2M4ZjAtYTQ0ZS00MDUwLTlmZGEtYjNkYjlhYTM5ZmNm&hl=en_GB&authkey=COnw0ZgE

3. Trained MISC bunchy top survey team on LFA detection and survey

Banana plants are on of the favored LFA habitats in Hawaii. Virtually any property that has bananas and infested with LFA, will have LFA in the bananas. Therefore, a check of banana plants on any property will provide a high-confidence of LFA presence or absence. As part of the wider delimiting survey for LFA on Maui, the State Ant Specialist trained the MISC Bunchy Top Survey team in basic detection techniques. The team flew to Hilo and had an opportunity to see LFA infestations in Bananas. This allowed the survey team to simultaneously survey for bunchy top and LFA without adding to survey costs.

Case study – training Maui Invasive Species Committee Bunchy Top survey team

Little Fire Ants were discovered on Maui late in 2009. In collaboration with the Maui ISC, a broader delimiting survey had been designed. LFA are especially fond of nesting in bananas and generally, if LFA are present on a site, some will be nesting in any bananas present. MISC has a survey team actively looking for banana bunchy top virus throughout Maui. The State Ant Specialist developed a training class for these surveyors so they could detect the presence of LFA as part of the bunchy top survey. The team traveled to Hilo where they learned how to identify LFA in the field, and specifically, how to visually survey bananas for this pest.

4. Eradication of Little Fire Ants from Kauai

A small infestation of LFA has existed on Kauai 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 break-through in access issues has allowed the formulation of an eradication strategy.

In July 2010, and following on from the apparently successful treatment program on Maui, a plan to eradicate LFA has been initiated. Currently this is awaiting regulatory approval for the treatment method.

Preventing intra-island spread of invasive ants

There are three main forms LFA spread within the Big Island:

1. Spread from east (Hilo) to west (Kailua-Kona)
2. Jump dispersal
3. Local spread

1. Preventing spread of LFA from Hilo to Kailua-Kona

The climate and terrain of the Big Island present a natural barrier for 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, efforts have been made to eradicate local infestations and limit spread as much as possible.

a. Where infestations exist, joint HDOA-PCSU treatments are occurring
b. 2 plant sellers are infested – the State Ant Specialist is working with these nurseries to implement quarantine treatments and eradicate the pest from the sites
c. Established and participated in community-driven detection plan for Kona including establishment of Kona LFA Taskforce. This Taskforce is led by the Kona County Farm Bureau.
d. Currently, developing a cooperative nursery participation project that helps nurseries guard against LFA and provide consumers with buying choices.
e. For an estate infested with LFA, provided training to home owners for conduct of community driven eradication program.
f. Prepared a community-driven LFA detection plan for Kailua-Kona and grant application to fund it (app pending)
g. Provided formal survey training to members of the Kona LFA Taskforce.

2. 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:

a. 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.

b. Assisted four major export nurseries by developing nursery eradication programs for LFA. These nurseries together produce around a million plants per year for export and domestic sale.

Prevention case stud – discovery of LFA at Hilo greenwaste center

The Hilo green-waste center recycles green-waste disposed by residents from around Hilo. The waste is chipped into a fine mulch-like material which is then given away to any residents who require it. This material is a popular mulch and soil additive with many tons of the material processed each month. Due to the nature of the material, it is a high-risk vector for the movement of LFA through the island. The State Ant Specialist surveyed the site and found LFA which threatened the continued operation of the facility. Hawaii County considered closing the facility and redirecting the material to the main landfill area even though this would significantly shorten the life-span of the landfill. The State Ant Specialist worked with the County and the contractors to develop a risk management plan which included site treatment, risk reduction through changed hygiene practices and outreach materials to residents who collected the material. As a result, the green-waste center was able to continue operations.

Selected websites featuring this story:
http://www.hawaiizerowaste.org/recycle/greenwaste
http://kohalacenter.org/schoolgardensblog/
http://www.hawconews.com/hawaii-county-news/2009/4/10/little-fire-ants-found-near-mulching-facility.html
http://www.kohalacenter.org/pdf/LFAInfo/HILO%20LFA%20flyer%202009-04-06%20-%20web.pdf

map showing positive LFA detections at Hilo green waste center.

c. 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.

3. 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:

a. Providing ongoing ant identification services to the public and industry on ad-hoc basis

b. Producing fact sheets with detailed instructions on detecting LFA around homes and instructions on how to control infestations (see www.littlefireants.com)

c. Training sessions on ant control methods to Hilo licensed pest controllers

d. Training Panaewa Zoo staff on LFA control for the zoo.

e. Outreach activities 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 the State Ant Specialist. 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
Keaehou Resort Homeowners Association, Kona, Kona Outdoor Circle, Kona, Waihe`e Community Association, Maui, Kona Town Hall meeting, Community meeting Yano Hall, Captain Cook

iii. The Green Industry
Big Island Association of Nurserymen, Hawaii Export Nursery Association, Big Island Golf Course Superintendent Association, County of Hawaii Greenwaste and Environmental staff

iv. The Pest Control Industry
BEI ant control workshop, Hilo; Crop Production Services annual seminar, Honolulu

v. Government and Non-governmental organizations (NGO)
Kona Farm Bureau, US Customs and Border Protection, Testimony to the Hawaii County Environmental Management Committee

vi. Media coverage
Community Television talk show – Lance Holter's Crossroads, Maui; Extensive participation and collaboration in the filming of a documentary on LFA impacts in Hawaii; A total of 66 web pages with stories and information on LFA containing the search words "cas vanderwoude" + "fire ants" + Hawaii; >6 newspaper articles in local newspapers

Emerging pest ant threats

Rover Ants (*Brachymyrmex obscuria*)

This species has been present in Hawaii 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 on the Big Island off the course. On closer examination, it appears this ant species readily forms mutualistic associations with root homoptera of grasses which enables 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. This phenomenon was examined by the State Ant Specialist at Hualalai Golf Course, and preliminary recommendations for control have been formulated.

Case study – Brachymyrmex obscuria, a new pest ant species

Over the past 2 years, golf courses on Oahu and the Big Island have experienced large numbers of nuptial flights by Rover Ants (Brachymyrmex obscuria). These flights are sufficiently large to drive golfers from the course and demand a refund of their green fees. Once rarely found in ant surveys around Hawaii, they now appear to have exploded in numbers. The problem had become so bad, at least one golf course was spraying entire holes with pesticides (to no avail). The State Ant Specialist and Dr Arnold Hara investigated this phenomenon and the State Ant Specialist has begun research trials to develop solutions.

Image: Mr Earl Sanders, head green keeper at Hualalai Resort inspecting Rover Ant nests with Dr Hara and others looking on.

***Tapinoma sessile* (Maui)**

A small infestation of Tapinoma sessile has been discovered by Dr Paul Krushelnycki (UH). This species has the potential to become a major pest species with impacts similar to Argentine Ants.

Research

- Conducted experiments that resulted in development of a new bait specifically for LFA in arboreal situations and ground application in high rainfall locations.
- Developed a broad variety of new application tools that allow bait to be applied to trees without the need for climbing.
    - A reprint of a paper published in the Proceedings of the Hawaiian Entomological Society is available here: http://scholarspace.manoa.hawaii.edu/handle/10125/14460
- In progress:
    - Determine the most attractive commercial ant bait available in Hawaii
    - New passive monitoring/detection systems
    - Co-Principal Investigator on a study to measure the economic impacts of LFA in Hawaii (T-Star grant, no salary)
    - Developing and testing new dis-infestation systems for potted plants

Ballast Water and Hull Fouling Highlights

DLNR's Division of Aquatic Resources Ballast Water and Hull Fouling Program is responsible for the management of the introduction of invasive species through ballast water and hull fouling. Hawaii Administrative Rules (§13-76) require that all eligible vessels carrying ballast water on board submit a report for ballast water management. These reports are crossed checked with arrival reports from the Department of Transportation for compliance. In addition, all vessels entering waters of the Papahanaumokuakea Marine National Monument are required to pass a hull inspection for marine organism fouling under permitting requirements. These inspections are jointly conducted by the Division of Aquatic Resources (DAR) and the Papahanaumokuakea Marine National Monument.

HISC Prevention: Measures of Effectiveness

Current measures in place to prevent invasive species arrival and establishment:
The Division of Aquatic Resources 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 all vessels entering the Papahanaumokuakea Marine National Monument.

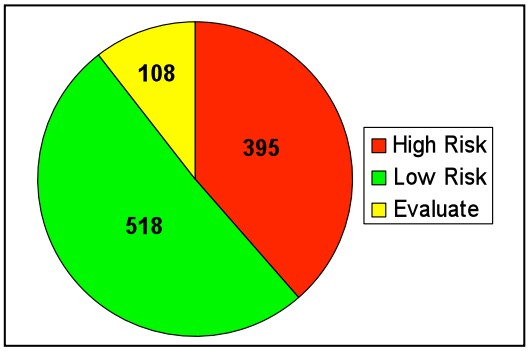
Ballast Water Reporting
During the course of the year, the Ballast Water and Hull Fouling Coordinator position became vacant. Duties for the reporting maintenance were covered by the Aquatic Invasive Species Team. However, this shortage and transition did not allow the reporting database to be maintained. This deficiency did not allow the program to track how many reports were generated. Instead, the maintenance of the reporting forms simply checked for compliance. To date, there are no outstanding reports from known maritime traffic.

Hull Inspections
Hull inspections are jointly carried out by the DAR and the Papahanaumokuakea Marine National Monument. Since the departure of the Ballast Water and Hull Fouling Coordinator, the Monument has conducted many of the inspections with occasional assistance by the Aquatic Invasive Species Team. However, the 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 the HISC has helped maintain the partnership between agencies and maintain a minimal capacity of the program until the vacant coordinator position can be filled.

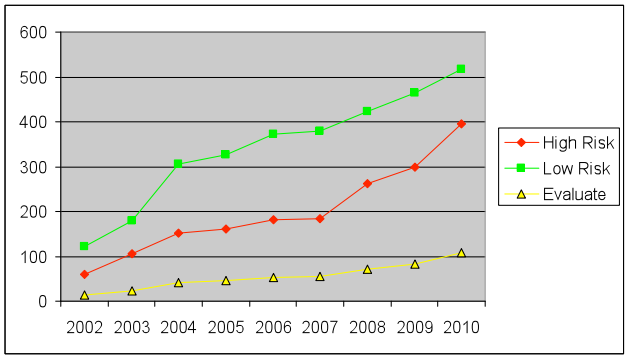
HAWAII-PACIFIC WEED RISK ASSESSMENT (HPWRA)

Two continuing objectives of the HISC Strategic Plan for 2008-2013, highlighted in previous HPWRA legislative reports, are to (1) "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 (2) 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 are presently employed through funding provided by the HISC. Charles Chimera, based in the MISC office on the Island of Maui, has been employed in that capacity from September 2007 to present. Patricia Clifford, stationed at the Bishop Museum on the Island of Oahu, has been employed as a WRA Specialist from August 2008 to present.

The primary focus of the WRA Specialists is to complete new assessments and update previously completed assessments with current information, both for the 10,000+ species already present in the Hawaiian Islands, as well as for new species introductions. As of September 2010, 1021 assessments, assigned to categories of "High Risk", "Low Risk", or "Evaluate", have been completed. 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.



1021 assessments by risk category

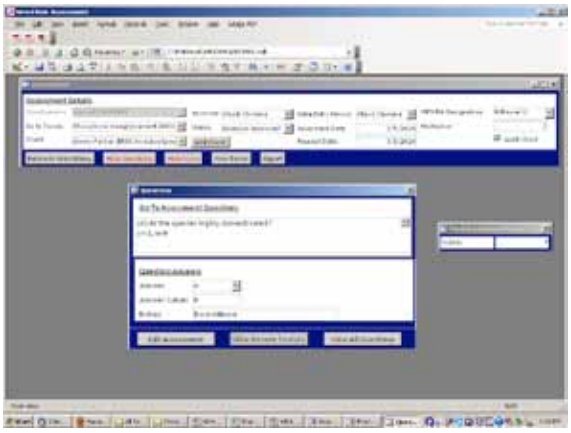


Cumulative assessment total by year and risk category

The following is a list of highlights and accomplishments from the period of July 1, 2009 through June 30, 2010:

WEED RISK ASSESSMENT DATABASE

In 2008, a research and technology grant was awarded to and administered by Sky Harrison, Pacific Basin Information Node (PBIN) Content Manager, to develop a database for the HPWRA System. The database was considered necessary for a reorganization and systemization of the data gathered in the process of undertaking WRAs, as well as to facilitate more consistent



WRA database user interface

data collection, and improve the management of the process. In fulfillment of this contract, Sam Aruch, database designer, worked on its development from October 2009 through March 2010, in close collaboration with WRA Specialists Clifford and Chimera, who provided input and feedback on design, database structure, and technical issues that have arisen throughout the development process. To facilitate the project, Chimera also participated in the Research Corporation of the University of Hawaii (RCUH) tuition reimbursement program by completing a course at Maui Community College (ICS 360: Database Application & Design) during the Fall 2009 semester. Formerly, each risk assessment had been stored in a separate spreadsheet, which made retrieval of specific information tedious and time consuming. As of March 2010, however, new assessments are being entered into the database, which will ultimately provide easier access to data content and allow for trait and question-specific queries previously unavailable in the spreadsheet-based format.

WRA Requests By Agency and Organization

Maui County Planting Plan, County of Maui

In an effort to promote the use of low risk, or non-invasive plants in county landscaping projects, and to avoid planting of high risk, or invasive species, the county government, under the guidance of the Maui County Arborist Advisory Committee, has adopted information and followed guidelines provided by the HPWRA System. In coordination with Ernest Rezents, retired Maui Community College Professor of Agriculture and planting plan project coordinator, WRA Specialists have provided numerous new assessments, including 36 in 2010, for the revised Maui County Planting Plan, last updated in 1994. 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. The new planting plan is expected to be ready in late 2010 or early 2011.

Island Invasive Species Committees (ISCs)

WRA Specialists continue to screen requests from Oahu (OISC), Kaua`i (KISC), Maui (MISC) and the Big Island (BIISC) Invasive Species Committees to aid in early detection and prioritization for control of potential invasive plants. Assessments provide a concise and consolidated source of current references useful in implementing management decisions. As an example, early detection botanist James Parker requested an assessment for *Rhizophora mangle*, Red mangrove, in support of control efforts on the Island of Hawaii. An assessment for *Macaranga tanarius* (WRA Score = 12), completed upon request for BIISC early detection efforts, is also the target of control efforts by MISC staff on East Maui.

Red Mangrove (F. & K. Starr photo)
WRA Score = 8 (High Risk)

Early Detection and Rapid Response Team – Bishop Museum

HPWRA continues to be an integral part of plant species prioritizing efforts by the Early Detection Team of the Bishop Museum and of the Big Island Invasive Species Committee (BIISC) and has provided assessments on requests from Oahu, Maui and Big Island early detection staff. Several of the completed assessments include such high risk species as *Flueggea virosa* (WRA = 7), *Linaria dalmatica* (WRA = 17), *Melochia umbellata* (WRA = 7), *Tithonia diversifolia* (WRA = 17) and *Tradescantia fluminensis* (WRA = 16) on Maui, *Ficus religiosa* (WRA = 7), *Chrysobalanus icaco* (WRA = 12), and *Setaria italica* (WRA = 9) on Oahu, and *Euphorbia tirucalli* (WRA = 11), *Jatropha multifida* (WRA = 8), *Piper auritum* (WRA = 15), *Hoya australis* (WRA = 8), *Gmelina asiatica* (WRA = 13), *Cestrum aurantiacum* (WRA = 15), *Anredera cordifolia* (WRA = 19), *Arenga pinnata* (WRA = 7), *Banksia integrifolia* (WRA = 5), *Boehmeria nivea* (WRA = 12), and *Morella cerifera* (WRA = 19) on the island of Hawaii.

Federal & State Agencies

Assessments have been completed and technical information provided for federal government agencies including the US Fish and Wildlife Service (USFWS), the USFS, the National Park Service, the Pōhakuloa Training Area Ecosystem Management Program, and from the State of Hawaii's Division of Forestry and Wildlife (DOFAW). Of particular interest were requests submitted by and completed for Heather Eijzenga, Landscape/Fauna Research Workgroup Facilitator, in support of a weed management plan for Kalaupapa National Historical Park on the Island of Molokai. Several assessment requests were submitted by Jason Hanley, US FWS Invasive Strike Team Leader to prioritize species' control and to support the implementation of the Laysan Island Ecosystem Restoration Plan.

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 several requests from Kauai Nursery and Landscaping, Honolulu Botanical Gardens, the Nature Conservancy of Hawaii, University of Hawaii (UH) faculty and students, and others to assess individual species as well as new development planting lists for known or potentially invasive plant species. Of interest was a request submitted on behalf of a private landscaping contractor who believed a client's property was being invaded by an ornamental cactus. Research during the assessment process identified the true culprit as the pencil tree, in the Euphorbiaceae (*Euphorbia tirucalli*, WRA = 11), and the misidentified look-alike as the currently lower risk mistletoe cactus, *Rhipsalis baccifera* (WRA = 0).

BIOFUELS ASSESSMENTS & PUBLICATIONS

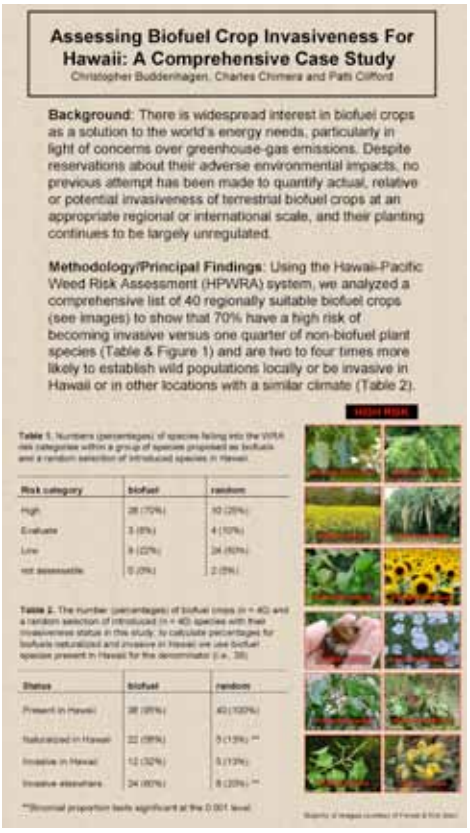
The WRA System is utilized as an objective tool to identify both low and high risk crops proposed for biofuel development in the Hawaiian Islands and other tropical and temperate island ecosystems. WRA Specialists are actively involved in providing updated information to the public, industry and conservation agencies on the results of biofuel risk assessments and other findings. These include a poster on biofuel risk assessments presented by Chris Buddenhagen, Charles Chimera and Patti Clifford at the 2009 Hawaii Conservation Conference (Citation: Buddenhagen C, Chimera CG, and Clifford PM (2009) Assessing Biofuel Crop Invasiveness for Hawai'i: A Comprehensive Case Study. 2009 Hawai'i Conservation Conference; Hawai'i in a Changing Climate. July 28-30, 2009, Honolulu, HI). Charles Chimera also wrote an article for the Maui News entitled "Introducing biofuel plants: it isn't all good", published in the August 2009 edition of the monthly newspaper column Kiai Na Moku O Maui Nui (Guarding the Islands of Maui County)".


Introducing biofuel plants: It isn't all good


Review

Biofuels : the risks and dangers of introducing invasive species

As a result of these efforts, Charles Chimera, Chris Buddenhagen and Patti Clifford were invited to write a review on the risks of biofuel crop invasiveness, which includes a comprehensive analysis of biofuel crop species appropriate for tropical and temperate regions, for a forthcoming (2010) issue of the international, peer-reviewed journal *Biofuels* (Citation: Chimera CG, Buddenhagen CE and Clifford PM (2010). Biofuels : the risks and dangers of introducing invasive species. *Biofuels* 1(5): 785-796). As stated on the publication website, the journal "provides a forum for all stakeholders in the bioenergy sector, featuring review articles, original research, commentaries, news, research and development spotlights, interviews with key opinion leaders and much more, with a view to establishing an international community of bioenergy communication" (http://www.future-science.com/loi/bfs). In addition to biofuel proponents in Hawaii, this publication also has the potential to reach and positively influence a much broader national and international audience concerned with invasive species use in biofuel development.



Assessing Biofuel Crop Invasiveness For Hawaii: A Comprehensive Case Study

Christopher Buddenhagen, Charles Chimera and Patti Clifford

Background: There is widespread interest in biofuel crops as a solution to the world's energy needs, particularly in light of concerns over greenhouse-gas emissions. Despite reservations about their adverse environmental impacts, no previous attempt has been made to quantify actual, relative or potential invasiveness of terrestrial biofuel crops at an appropriate regional or international scale, and their planting continues to be largely unregulated.

Methodology/Principal Findings: Using the Hawaii-Pacific Weed Risk Assessment (HPWRA) system, we analyzed a comprehensive list of 40 regionally suitable biofuel crops (see images) to show that 70% have a high risk of becoming invasive versus one quarter of non-biofuel plant species (Table & Figure 1) and are two to four times more likely to establish wild populations locally or be invasive in Hawaii or in other locations with a similar climate (Table 2).

HIGH RISK

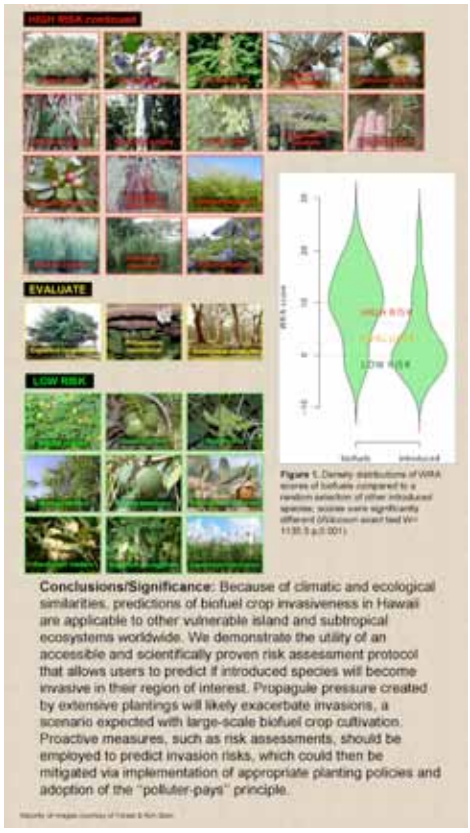
Table 1. Numbers (percentages) of species falling into the WRA risk categories within a group of species proposed as biofuels and a random selection of introduced species in Hawaii.

Risk category	biofuel	random
High	28 (70%)	10 (25%)
Evaluate	3 (8%)	4 (10%)
Low	9 (22%)	24 (60%)
not assessable	0 (0%)	2 (5%)

Table 2. The number (percentages) of biofuel crops (n = 40) and a random selection of introduced (n = 40) species with their invasiveness status in this study, to calculate percentages for biofuels naturalized and invasive in Hawaii we use biofuel species present in Hawaii for the denominator (i.e., 32).

Status	biofuel	random
Present in Hawaii	32 (80%)	40 (100%)
Naturalized in Hawaii	22 (69%)	5 (13%) **
Invasive in Hawaii	12 (32%)	5 (13%)
Invasive elsewhere	24 (60%)	8 (20%) **

**Binomial proportion tests significant at the 0.001 level.



HIGH RISK continued

EVALUATE

LOW RISK

Figure 1. Density distributions of WRA scores of biofuels compared to a random selection of other introduced species; scores were significantly different (Wilcoxon exact test W= 1130.5, p<0.001).

Conclusions/Significance: Because of climatic and ecological similarities, predictions of biofuel crop invasiveness in Hawaii are applicable to other vulnerable island and subtropical ecosystems worldwide. We demonstrate the utility of an accessible and scientifically proven risk assessment protocol that allows users to predict if introduced species will become invasive in their region of interest. Propagule pressure created by extensive plantings will likely exacerbate invasions, a scenario expected with large-scale biofuel crop cultivation. Proactive measures, such as risk assessments, should be employed to predict invasion risks, which could then be mitigated via implementation of appropriate planting policies and adoption of the "polluter-pays" principle.

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. As one example of a recent outreach tool, a new Facebook page was created in 2010 to convey the results of current assessments to a broader target audience. The following highlights additional outreach activities and efforts in greater detail.

LICH Newsletter: Jackie Kozak, HISC public relations and outreach specialist, featured and promoted use of the weed risk assessment program in an article written for the March-April 2010 issue of the Landscape Industry Council of Hawaii (LICH) newsletter. Kozak's regularly scheduled articles have and will continue to feature landscape and horticultural plants identified as low risk by the HPWRA, particularly those included in Patti Clifford's series of publications for the College of Tropical Agriculture and Human Resources (CTAHR).

CTAHR Publications: To facilitate communication between HISC and CTAHR, Clifford participated in the RCUH tuition reimbursement program by completing a course at the UH, Manoa (TPSS654: Communications in the Sciences) during the Fall 2009 semester. As a result of this course, Patti Clifford and Dr. Kobayashi, CTAHR are collaborating to develop publications promoting the use of plant species that have received a low risk rating from the HPWRA. The publications describe the HPWRA System, characteristics of invasive plant species, and promote species that are low risk for invasiveness. The first publication highlights fragrant flowers (available at http://www.ctahr.hawaii.edu/Site/Info.aspx) and the second publication focuses on fruit trees (in press).


College of Tropical Agriculture and Human Resources
University of Hawai'i at Mānoa

Ornamentals and Flowers
Feb. 2010
OF-46

Non-invasive Landscape Plants with Fragrant Flowers

Patti Clifford[1] and Kent Kobayashi[2]
[1]Hawai'i Invasive Species Council, [2]CTAHR Department of Tropical Plant and Soil Sciences

Weeds are not friends to our gardens. They cause many trials and displease the farmer, or vegetables that I am trying to grow. But I do understand that in our multicultural world, a weed to one person may be a medicine, food, or ornamental to another. Plants have many uses to humans, that is why we transport them with us as we traverse the planet.

In Hawai'i, many of the native plants are endemic—they are not found anywhere else in the world. This rarity has made them vulnerable to impacts from non-native species. Some of the plants introduced here from other regions become weeds and displace the native plants. While invasive weeds may cause trouble in our gardens, they create havoc in Hawai'i's delicate native ecosystems.

Hawai'i's natural ecosystems have one of the worst weed problems in the world. To help understand and cope with this problem, scientists developed a system, the Hawaii-Pacific Weed Risk Assessment (HPWRA), which can predict a plant's ability to become a weed here. This system is based on the plant's biological and ecological characteristics (its natural history, performance in its native environment, and behavior in other parts of the world). By considering the information the system has assembled, we can predict how the decision to plant a particular plant may affect the native Hawaiian environment.

Preventing invasive species from becoming established in Hawai'i is the most economically and environmentally efficient method of dealing with non-native weeds. The plants in this publication have been screened by the HPWRA. They are considered to be of low risk for invasiveness to Hawai'i's agricultural systems and native environment. For more information on the HPWRA, visit www.hear.org/wra.

To have a plant screened by one of the Hawai'ian Species Council's weed risk assessment specialists, e-mail hpwra@yahoo.com.

Characteristics of invasive plants

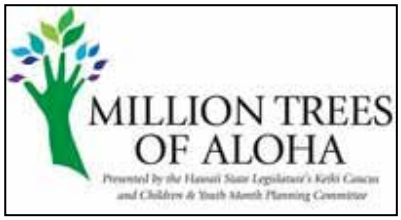
Most of the attributes that we appreciate in our garden and landscape plants contribute to their ability to invade natural and agricultural ecosystems. These include

- rapid growth
- early maturity
- heavy seed production
- vegetative reproduction (i.e., pieces of roots, stems, or leaves can break off and grow into new plants, this can happen when green waste or plant trimmings are discarded)
- tolerance of dense shade (conferring ability to spread into the understorey of native forests)
- having non-specific pollinators
- having a "seed bank" (i.e., seeds last for a long time in the soil and may germinate many years later, or they can accidentally be moved around with the soil)

HOW TO USE THIS PUBLICATION

This document gives a brief outline of the characteristics of seven plant species with fragrant flowers. Because of their low risk of invasiveness, they are suitable for planting in Hawai'i landscapes. Resources for in-depth information on these taxa are included in the references section. The HPWRA is a predictive tool based on current knowledge about a plant species. The system correctly classifies 81–85% of non-pest/low-weedy species. If one of the species described in this publication starts to exhibit invasive characteristics, please contact hpwra@hear.org.

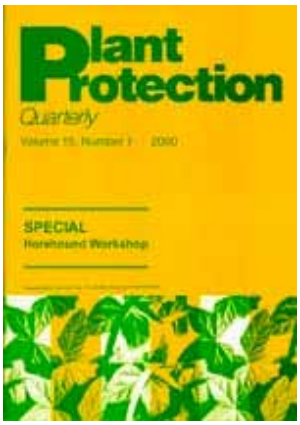
Million Trees of Aloha:



The Million Trees of Aloha project was launched in April 2010 by the Keiki Caucus of the Hawai'i State Legislature and the Children and Youth Month Planning Committee. The goal of the project is to plant one million native, non-invasive or fruit bearing trees by October 2010. Patti Clifford joined the efforts in March 2010 to promote the use of non-invasive tree species. She introduced the group to the HPWRA process and continues to communicate to members of the group and the public on the usefulness of HPWRA to encourage responsible planting of tree species in Hawaii.

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. Patti Clifford has been utilizing her extensive technical expertise and knowledge of global positioning systems and GIS in the development of a training manual for both Bishop Museum and USFWS staff on the Island of Oahu. She has also provided field training and has accompanied members of each organization on field work and training excursions in the Koolau Mountains, and in particular, has supported USFWS staff in botanical monitoring of the Oahu Forest National Wildlife Refuge (NWR). She also co-developed a field guide to assist in the identification of rare, threatened, endangered, and invasive plant species in the Oahu Forest NWR.



Charles Chimera fields calls to the MISC office from members of the general public requesting information on plant identification and weed control strategies. He has also contributed to the development of a native plant demonstration garden and has provided native and non-native plant identification training to members of the MISC staff. In August 2009, he gave a talk to high school science teachers on island biota as part of MISC's Ho`ike environmental curriculum. In addition, he has served as a consultant for the East Maui Watershed Partnership to screen entrants for their annual conservation art exhibit to ensure that contributors do not submit work featuring non-native species.

After attending the second International Weed Risk Assessment Workshop (IWRAW) in Perth, Australia in 2007, Chimera contributed to standardized protocols for answering the 49 weed risk assessment questions. The results of that process were published in 2010 in Plant Protection Quarterly (PPQ), an Australian journal with an international circulation that publishes original papers on all aspects of plant protection (Citation: Gordon DR, Mitterdorfer B, Pheloung P, Ansari S, Buddenhagen C, Chimera C, *et al*. (2010) Guidance for addressing the Australian Weed Risk Assessment questions. *Plant Protection Quarterly* 25(2): 56-74). He also reviewed a manuscript on invasive geophytes submitted to PPQ and published original research on germination of weed seeds in a forthcoming issue (Citation: Chimera, CG, Drake DR (2010) Effects of pulp removal on seed germination of five invasive plants in Hawaii. *Plant Protection Quarterly* 25(3): 137-140).

In 2010, Chimera was invited to review research papers submitted to the journals Plant Ecology, the European Journal of Wildlife Research, and Biological Invasions, and has submitted or published papers featuring research on the invasive tree *Bocconia frutescens* (an assessment request from Pōhakuloa Training Area staff) for the journals Biotropica and Biological Invasions (Citations: Chimera CG, Drake, DR (2010) Patterns of seed dispersal and dispersal failure in a Hawaiian dry forest having only introduced birds. *Biotropica* 42(4): 493-502 and Chimera CG, Drake, DR (In Review) Could Poor Seed Dispersal Contribute to Predation by Introduced Rodents in a Hawaiian Dry Forest? *Biological Invasions*).

CURRENT AND FUTURE WORKLOAD

Most of the individuals, agencies, and programs previously mentioned, 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, there are over 700 assessments previously completed using the old spreadsheet format which will be 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. This website is a HISC Public Outreach Working Group priority for FY10-11 and will incorporate and is dependant upon WRA-generated content in order to

promote low-risk alternatives to the horticultural and landscaping industries, as well as to the general public.

Due to continuing budget restrictions and economic concerns, only one WRA position has been funded beyond December 2010. WRA collaborators and staff are actively pursuing additional sources of funding so that core productivity is maintained at current levels. Other avenues and alternative, non-HISC sources of funding continue to be sought.

Aquatic Invasive Species (AIS) Highlights:

During FY2010, the AIS Team focused on surveying, detecting, and controlling invasive marine algae, fostering community involvement, and building the knowledge and capacity needed to implement large scale restoration. Early detection surveys were conducted on both Molokai and Oahu to establish the limits of spreading invasive algae. Algae cleanups were coordinated on both Molokai and Oahu with several community groups. Control work in Kaneohe Bay on Oahu using the supersucker was ongoing throughout the year. The priority focus for the year was the replenishment of native grazing sea urchins as a natural biocontrol for invasive algae. DAR has developed and implemented a pilot project for this replenishment on a patch reef in Kaneohe Bay. The results for FY2010 indicate that the replenishment of native grazers is a highly successful tool in the fight against invasive algae. The next stage of the project is captive culture of the urchins in order to provide a sufficient number to restore impacted coral reefs in Kaneohe Bay. When sufficient capacity is achieved, the project is anticipated to expand to other areas of the Bay and possibly other sites throughout the state.

HISC Response and Control: Measures of Effectiveness

Number of Species Detected and Evaluated for Feasibility of Eradication

Early detection of invasive species included extended surveys of the coast of Oahu and Molokai to identify the spreading distribution of established invasive algae. These surveys included a repeat of surveys conducted in 2007 as well as additional surveys of expanded edge zones. On Molokai, the survey indicated that the range of the invasive alga *Gracilaria salicornia* has extended westward four miles past its previously determined boundary.

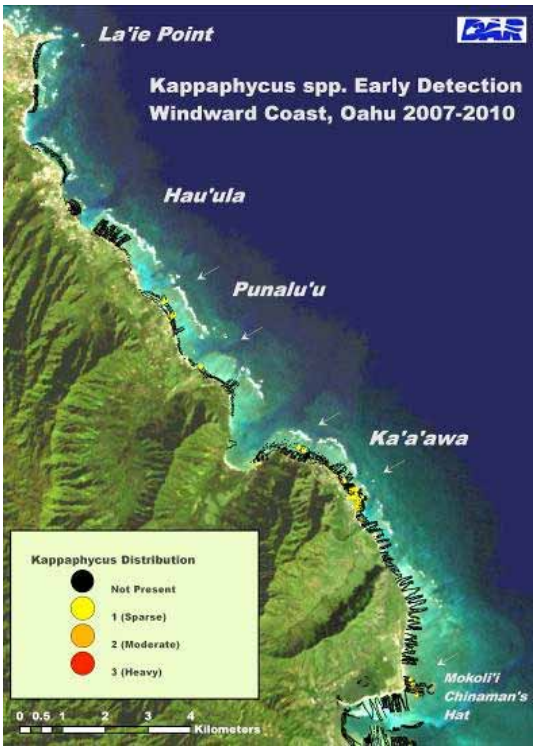
Number and Area of Priority Invasive Species Eradicated and/or Controlled

Control efforts focused on mangrove, jellyfish, and several species of invasive algae.

- On Molokai, the AIS team worked with community volunteers to remove over 1,000 red mangrove propagules and over 44,000 pounds of invasive algae
- In Kaneohe Bay, the team removed over 30,000 pounds of invasive algae.
- On Kaneohe Bay reef #16, which serves as the pilot project for the restoration of native grazing sea urchins, the team monitored the urchins and charted their efficacy at controlling the invasive algae on the reef.

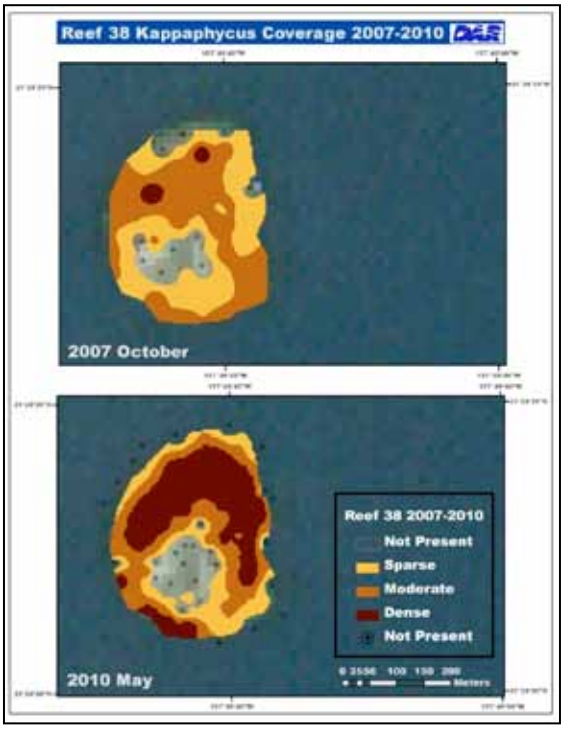
Implementation of the Priority Actions of Aquatic Invasive Species Plan

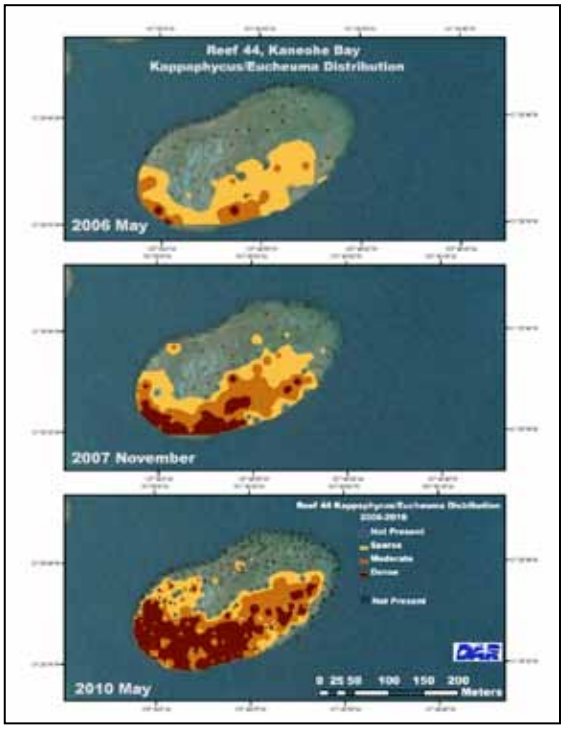
- **Early Detection and Monitoring Surveys**



The AIS Team continued early detection surveys for invasive algae along the windward coast of Oahu above Kaneohe Bay (ground zero for Kappaphycus/Eucheuma). Four miles of fringe reef areas outside of Punalu'u and north to Lai'e Point were surveyed by snorkelers with GPS units and algae distribution was mapped. Seven incidences of Kappaphycus were observed on the fringing reef outside of Punalu'u. Two of these samples were sent to the University of Hawaii's Phycology Lab, and were identified as Kappaphycus Clade B.

To provide the information required for informed prioritization of control actions, the team resurveyed Kaneohe Bay reefs #33,34,38 and 44. The results of the surveys indicated that invasive algae have increased in both coverage area and in density.





To detemine the spreading distribution of Gracilaria salicornia on Molokai, the AIS Team surveyed the coastline and discovered that the algae had spread to an area four miles west of the previously determined boundary.

Circled areas represent *G. salicornia* populations.

- **Develop a comprehensive approach to controlling invasive algae by utilizing mechanical removal and the reintroduction of native species**

  In accordance with the State's AIS Management Plan, DAR has continued to develop a program to reintroduce the native sea urchin *Tripneustes gratila* to Kaneohe Bay as a biocontrol for invasive algae. This ongoing venture began in 2009 with a pilot project to determine the efficacy of the urchins as algae control, and has grown to incorporate the development of a full time urchin culturing facility. Additional detail about the pilot project and hatchery is discussed later in this report.

Prioritization Process

Criteria for prioritizing target species of invasive algae include:

- The current level of threat posed to high value coral reefs and the potential for recovery of those reefs.
- The geographic distribution and possibility for containment (*Kappaphycus/Eucheuma sp* in Kaneohe Bay).

Priority and target location are chosen by:

- Feasibility of accessing and working in the affected habitat. The AIS Team can work in any areas that can be safely accessed on foot, snorkel, and SCUBA. The three mechanical vacuuming barges (super suckers senior, junior, and manini) make it feasible to work in a variety of habitats from fish ponds to open water.
- Anticipated successful outcome. DAR has prioritized urchin replenishment in Kaneohe Bay because it is expected to reduce the need for manual removal of invasive algae, and is also anticipated to be applicable to other areas in the state that are suffering from an overgrowth of invasive algae.
- Public interest, community involvement, and available partnerships. A longstanding partnership with The Nature Conservancy (TNC) has resulted in the prioritization of the area surrounding the He'eia Fishpond on Oahu, where TNC has an ongoing project of upland restoration and where strong community support has sustained regular public algae cleanups both inside and outside the fishpond wall. Community interest and concern was integral to the success of invasive plant control on Molokai. By prioritizing areas that have strong public involvement, DAR is able to supplement team efforts with community support and ensure that control actions will continue after the AIS Team as concluded their work in the area.

Number and Names of Habitats, Ecosystems, and Managed Areas Protected Because of Control Efforts

- Kaneohe Bay has a variety of habitats that are benefiting from AIS Team control work. The many coral reefs that exist in patches of the bay are being monitored and prioritized for work. He'eia Fishpond and its surrounding fringe habitat have also received regular attention.
- Monitoring also includes the area north of Kaneohe Bay and the z-modules off of Waianae, on Oahu.
- Molokai received significant control efforts focused on Kaunakakai Harbor, Kalokoeli Fishpond, and Ualapue Fishpond.

Other Activities

Urchins used as Bio-Control for Hawaii Institute of Marine Biology, UH (HIMB) projects:

The AIS Team collected and facilitated deployment of collector urchins for an HIMB project designed to protect a rare and endangered species of coral in Kaneohe Bay. Due to the effectiveness of collector urchins as biocontrol agents, the AIS Team was requested to provide urchins to graze down on a *Montipora dilatata* coral colony being over taken by the kappaphycus/ eucheuma species complex. Approximately 300 urchins were collected and distributed on the reef by AIS Team members and HIMB Marine Biology undergraduates. The students will further monitor the reef and urchins and analyze data on the effectiveness of the biocontrol method.

Presentations and Demonstrations:

The AIS Team conducted presentations and demonstrations throughout the year in order to educate, gain feedback and insight from vested counterparts of the community, and to demonstrate the capabilities of the Super Sucker Barge. These events included facilitating an Urchin Workshop at HIMB, presentations at Hawaii Conservation Conference and Kaneohe Bay Civic Club, and Super Sucker Barge demonstrations for the National Oceanic and Atmospheric Administration (NOAA) congressional representatives, Local Action Strategy (LAS) coordinators, and potential funders for TNC. Public relation activities included providing information about invasive algae removal for an article in Honolulu Star Bulletin, a short segment for KITV Channel 4 News, interview on The Mike Buck Show, and an extensive photo-story for the local fishing magazine Lawai'a. DAR also participated in public workshops for the "Eyes on the Reef" monitoring group.

Public Outreach:

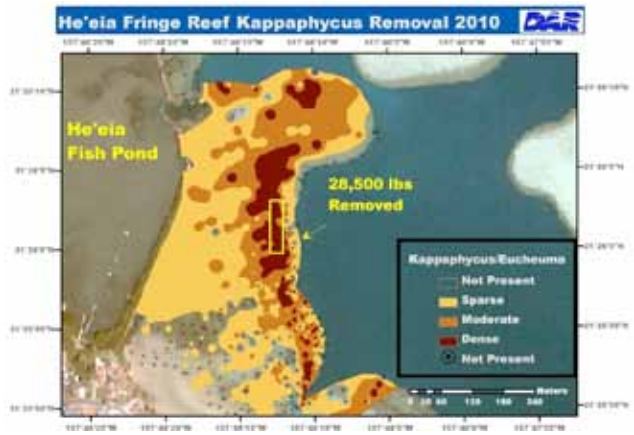
The AIS Team participated in public outreach activities in many locations on both Oahu and Molokai. The Team travelled to Molokai several times to work with community and school groups, providing information and assistance regarding invasive algae control in the harbor and fishponds. On Oahu, the AIS Team consulted for invasive algae issues in Moli'i Pond at Kualoa

Ranch and provided trucks and ground support at algae removal events in Heeia Fishpond that included high-school students from Kamehameha Schools. New partnerships were formed with local farmers for additional algae drops sites for compost production. These sites included 400 acres of wetland being converted to lohi (taro) patches directly behind He'eia Fishpond in the same watershed. This partnership contributes to the rehabilitation of the traditional Hawaiian ahupua'a by connecting the coastline and fringe reef to farmland and mountain watershed.

PHOTO BY BRUCE LUM, COURTESY OF KAMEHAMEHA SCHOOLS © COPYRIGHT 1996-2007

Super Sucker Algae Removal:

In an effort to eradicate one of the two clades of Kappaphycus in Kaneohe Bay and contribute algae to He'eia ahuapua'a and Waihole watersheds for compost, the AIS Team concentrated their removal efforts on the fringe reef outside Heeia Fishpond. More than 28,500 lbs of Kappaphycus Clade B were removed and delivered to farms during 2010. This area is one of the only two areas thought to sustain Clade B, the other being Coconut Island, Oahu. The removal effort will continue until the entire fringe reef has been cleared.



Super Sucker Improvements:

The AIS Team recently added two outboard engines to the Super Sucker barge that allows it to be more efficient and mobile throughout Kaneohe Bay independently. Prior to this, it was necessary for the barge to be towed by a secondary vessel, which decreased its maneuverability and increased the demand for staff due to safety issues. Speed rails were added around the perimeter of the barge as well to increase safety and prevent staff from falling overboard.

Molokai:

The AIS Team held community cleanup events at Kaunakakai Harbor, Kalokoeli Fishpond, and Ualapue Fishpond. The events focused on invasive algae removal, but also provided control of Cassiopeia jellyfish and Red Mangrove seedlings. The Team worked with volunteers, school groups, and stewardship organizations. On April 16th the AIS Team participated in Molokai's Earth Day Event.

Utilizing Native Grazers for Invasive Algae Control

Objective 4D of the State of Hawaii AIS Management Plan is to "*continue to develop and implement a comprehensive approach to remove and control the spread of non-native algae AIS by utilizing mechanical removal, native grazers, and the reintroduction of native species".* In 2009 DAR initiated a project to use the native sea urchin *Tripneustes gratila* as a biocontrol for invasive algae in Kaneohe Bay. This broad scale project has required several complex stages to achieve success. The pilot project on patch reef #16 required an initial translocation of urchins from another site and follow-up monitoring of both the donor and recipient sites. The pilot project has thus far been successful, and further implementation requires a reliable source of cultured urchins. To that end, DAR has planned and built an urchin hatchery at the Anuenue Fisheries Research Center, on Oahu. The landscape scale implementation of urchin replenishment in Kaneohe Bay will require many years of continued effort.

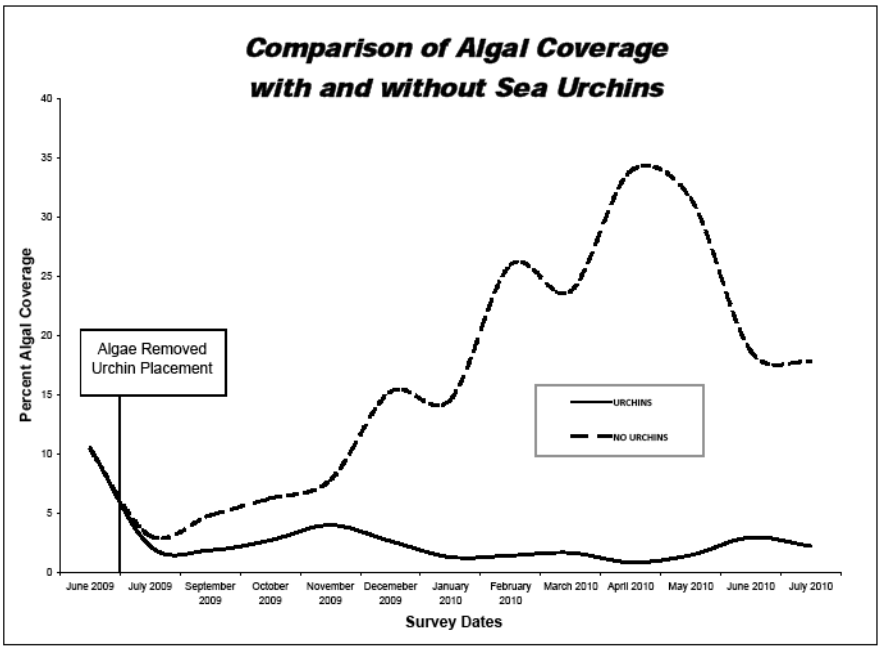
Translocation of *Tripneustes gratila* to Kaneohe Bay

While the native sea urchin *Tripneustes gratilla* is found within Kaneohe Bay, their numbers are not at the levels necessary to be utilized in our pilot study as a bio-control agent against invasive algae. Therefore, the AIS Team collected urchins from the artificial Z-blocks located off the Waianae Coast. The Z-blocks provide a healthy habitat for new corals, fish, and urchins.

- The AIS Team conducted a baseline survey of the area to determine the population density and average size of urchins. It was necessary to collect approximately 1300 urchins for the pilot study, which would place nearly one urchin per square meter.
- Two areas were established to prevent the over-collection from one area. Within those two areas, take and control sections were created, in addition to a reef section to monitor urchin populations adjacent to the z-blocks.
- Following the removal of 1315 urchins, the AIS Team returned to Waianae monthly to monitor the urchin's recovery to the area. The urchin's were counted and measured according to size: 0-5, 6-10, and 11-15cm. There was a steady increase in the numbers of urchins every month, with over 90% being in the 6-10cm size class. Within one year, their numbers were back to baseline levels.

Reef 16 Pilot Study

In 2010, the AIS Team completed the first phase of a two year long benthic and fish monitoring project on the Kaneohe Bay Reef 16 Pilot Study. The Super Sucker Barge was used to remove invasive algae from a small patch reef once in 2008, and again in 2009. After monitoring results confirmed mechanical removal provided only temporary reduction in algae, the removal effort in 2009 was supplemented with the transplantation of 1200 collector urchins (Tripneustes gratilla) onto one-half of the reef in order to conduct a bio-control agent experiment post mechanical removal. After one year, the AIS Teams benthic monitoring effort verified that use of native herbivores as a bio-control method was successful and feasible. The data collected demonstrated that the reef half that was stocked with urchins yielded less than 5% benthic algal coverage for 12 consecutive months. In comparison, the reef half that was not stocked with urchins and left as a control, yielded rates of between 15%-34% of benthic algal coverage over the 12 months. The 2nd phase of the project was initiated in July 2010 by transplanting the urchins to the control side of the reef in order to observe the impact of the native herbivores without the aid of mechanical removal. This phase will continue for 12 months in order to measure the effects of using bio-control agents not supplemented by the efforts of the Super Sucker Barge. The Team also continues to analyze and process two years of data on fish abundance and coral regrowth coverage on Reef 16.



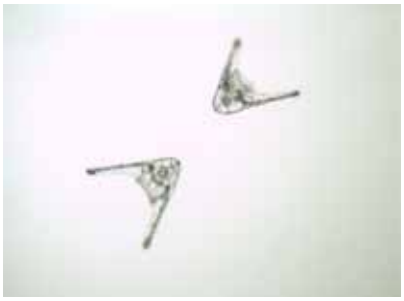
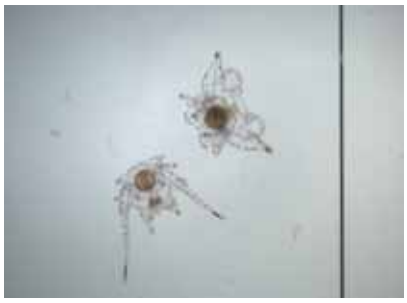
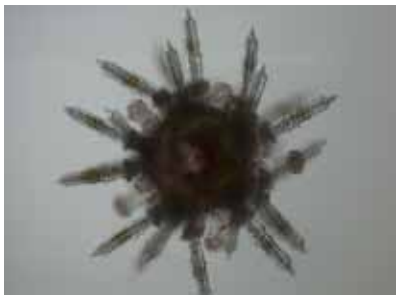
Developing Capacity for Restoration using Cultured Urchins

The success of the pilot project on reef 16 has highlighted a clear need for the availability additional urchins in order to expand the use of this biocontrol to other areas of the Bay. Kaneohe Bay is far too large to even consider stocking with translocated grazers. A steady supply of locally cultured urchins is critical to the implementation of continued algae control. To make these native grazers available in sufficient quantity, DAR initiated development of a sea urchin hatchery at the Anuenue Fisheries Research Center (AFRC) in Honolulu. The hatchery will culture *Tripneustes gratila*, the "collector urchin", which has been researched, tested and found to be effective at controlling invasive algae. The hatchery is capable of yielding large quantities of sea urchins that will allow the AIS Team to utilize a combination of supersucker mechanical removal with the reintroduction of native grazers to finally realize long-term recovery of coral reefs that are infested with invasive algae.

In FY2010, the DAR Sea Urchin Hatchery was initiated and completed, and is currently housing the first successful yield of post larval animals.

- Two full time staff members, an aquaculture specialist and a hatchery technician, were hired to research, design and run a *Tripneustes gratilla* sea urchin rearing facility.
- The design of the hatchery was adapted from research and from knowledge of existing hatcheries in Japan and Australia.

- AIS Team researched, developed and tested larval rearing techniques that were adapted from standard hatchery methods with guidance from community members. Information was synthesized and then applied to develop a set husbandry techniques that were site appropriate for the facility.

- AIS Team developed a repeatable system for rearing urchin larvae: Techniques were applied to three different cohort groups with similar results. In all cases larvae survived to metamorphosis and settlement occurred. Juvenile urchins are presently growing at the AFRC Sea Urchin Hatchery.
- An older, insufficient microalgae lab was renovated and repurposed to accommodate the planktonic species appropriate for larval urchin culture.
- AIS Team developed appropriate macroalage production techniques to feed juvenile sea urchins: Commercial seaweed culture techniques were adapted to suit the available facilities. The procedures developed were used to grow species appropriate for feeding juvenile sea urchins.

The re-introduction of native urchins into Kaneohe Bay has the potential to dramatically improve the health of the bay by facilitating large scale control of invasive algae. Coupled with the reduction of land-based sources of habitat degradation, this project is poised on the verge of full implementation of landscape scale restoration for a complex marine ecosystem.

Big Island Invasive Species Committee (BIISC) Highlights

During the FY2010 reporting period, BIISC focused a substantial portion of its efforts on response and control of established pests; focusing on red mangrove (*Rhizophora mangle*), Poison Devil's Pepper (*Rauvolfia vomitoria*), Miconia (*Miconia calvescens*) and Rubber vine (*Cryptostegia madagascariensis*). During this reporting period, BIISC received $90,000 from HISC and leveraged approximately $250,000 in additional funds. An additional $157,000 was received from the American Recovery and Reinvestment Act (ARRA). However a funding deficit resulted in a significant loss of staff during this period. Despite this setback, BIISC made significant progress towards completion of an island wide early detection survey, control and containment of several established pests and eradication of a number of rapid response targets.

HISC Response and Control: Measures of Effectiveness

Number of species detected and evaluated for feasibility of eradication
The BIISC Early Detection Team surveyed an estimated 650 miles of road in the districts of South Kona, South Kohala, North Kohala, Hamakua and North Hilo. During this reporting period, BIISC collected and identified 2 new state records, 3 new records of naturalization, and 7 new island records as determined by the Bishop Museum Herbarium, with 12 new records pending determination. In addition, the Early Detection Team surveyed approximately 30 miles of road and trails within the Bond Historic District in coordination with the New Moon Society in North Kohala, resulting in 5 new records.

Implementation of the priority response and control actions of the Aquatic Invasive Species, West Nile Virus, coqui frog and red imported fire ant plans.
BIISC is currently hosting the county wide DOFAW funded Coqui Coordinator, and the field crew have been assigned to him periodically over the summer (warm) months in 2010. During this funding period, BIISC crew supported the Coqui Coordinator for a total of nine nights. In addition, BIISC has partnered with DOFAW to assess the impact of invasive species on the Endangered Hawaiian Coot population on Lokoaka Fish Pond, and made the determination that a suite of control targets would be necessary to address the population decline: including cats, mongoose, rats, algae, grass carp, tilapia, and numerous invasive plants. Further actions beyond this scoping phase are dependent on external funding sources.

Number and area of priority invasive species eradicated and/or controlled
BIISC surveyed for and controlled 14 different plant species, controlling 23,717 individuals over a total survey area of 2,739 acres (* signifies rapid response targets below):

Scientific name	Common name	Number controlled	Area Treated (acres)
Rhizophora mangle	Red Mangrove	10,922	7
Rauvolfia vomitoria	Poison Devils Pepper	8931	1246
Psidium cattleianum	Strawberry Guava	1520	3
Miconia calvescens	Miconia	1099	1227
Morella cerifera	Wax Myrtle	550	64
Clidemia hirta	Costers Curse	414	3
*Cryptostegia madagascariensis**	Rubber Vine	181	85
*Rosa laevigata**	Cherokee Rose	40	8
*Jasminum polyanthum**	Pink Jasmine	32	1
*Paulownia tomentosa**	Empress Tree	10	2
Bocconia frutescens	Plume Poppy	8	69
*Buddleja madagascariensis**	Butterfly Bush	8	2
*Parkinsonia aculeata**	Jerusalem Thorn	2	4
Cortaderia jubata	Pampas Grass	0	18

In addition, BIISC, in partnership with Kohala Watershed Partnership – have conducted helicopter delimitation surveys and high resolution fixed wing remote sensing surveys to map the extent of occurrence of *Rauvolfia vomitoria* from the air. This information is critical for developing an action plan to contain this species over the next few years.

Prioritization processes identified and in place.
Due to the size of the island and number of roadways, BIISC has still not been able to complete even a single island-wide early detection survey. However our goal is to finish by 2011 so that we can make progress towards a comprehensive rapid response strategy. BIISC hosted a day-long meeting to discuss priority setting for targets, but partners could not agree on a methodology for an incomplete survey. In the meantime, using an ad-hoc method, BIISC has 10 possible targets for eradication, with a formalized process pending the development of a state-wide rapid response target protocol.

Number and names of species, habitats, ecosystems, agriculture and managed areas protected because of control efforts.
During this funding period, significant progress was made to eradicate Miconia from the Wao Kele O Puna Forest Reserve, a new protected area which currently is in the planning stages. In addition, although eradication of red mangroves are currently on hold pending a lawsuit – work to date has greatly improved native coastal habitats and fishponds in South Hilo and Puna districts. Ongoing containment of Poison Devil's Pepper not only is restoring a private forest refuge, but is also making invaded agricultural lands available for cultivation in North Kohala. The ongoing containment of this invasive tree will ensure that several regional endemic plants do not become extinct; including *Gardenia remyi, Clermontia drepanomorpha* and *Pritchardia lanigera.* Finally, BIISC's hope is that the scoping exercise for Hawaiian Coot will result in progress towards recovery goals for the species in 2011, and prevent local extinctions which seem imminent due to juvenile survivorship problems associated with a suite of invasives.

Kaua‘i Invasive Species Committee (KISC): Highlights

In FY 2010, KISC continued working on goals outlined by the HISC Response and Control Working Group. Priority was given to early detection, response, and control of various plants and insect targets. KISC received $90,000 from HISC and leveraged $137,000 in additional funds. ARRA funding of $166,000 was also distributed to KISC. An island-wide roadside survey for early detection of invasive plants was completed and delimiting surveys are determining the extent of some of the priority plants identified. Mature miconia plants were discovered during aerial and ground surveys and KISC was able to rapidly respond to dispatch them. KISC is also the primary responder to new coqui reports across the Island and also is working to eliminate the one known wildland coqui population in Lawa‘i. KISC also conducted outreach events across the island educating the public about the threats of invasive species.

HISC Response and Control Measures of effectiveness
1) Number of species detected and evaluated for feasibility of eradication.
2) Prioritization processes identified and in place.

Molucca raspberry discovered on roadside survey

KISC was able to utilize the expertise of the O‘ahu Invasive Species (OISC) Early Detection Team as they conducted a new island-wide early detection survey for new invasive plants. Approximately 793 miles of roadside were surveyed. The results of this survey are under review, however, a few priority species were identified and KISC has ground-surveyed 288 acres to identify and delimit their extent. KISC was able to respond and treat 9 early detection species with a total of 917 plants treated.

This roadside survey was also intrumental in identifying 4 of KISC’s priority target species outside of their known range which the crew has continued responding to.

HISC Response and Control Measures of Effectiveness
1) Number and area of priority invasive species eradicated and/or controlled.
2) Number and names of species, habitats, ecosystems, agricultural, and managed areas protected because of control efforts.

Between September 1, 2009 and August 31, 2010, KISC surveyed for and controlled 14 different plant, vertebrate, and invertebrate species, and two pathogens, covering over 7,700 acres. Species activity highlights are described below:

- KISC crews completed 1,051 acres of miconia ground-surveys during this period and removed 568 trees, saplings, and sprouts from the Halelea Forest Reserve and the Wailua River State Park. Seven of these trees were mature, three of them found during aerial surveys. Aerial surveys covered 1,888 acres. All plants found were within the known infestation buffer.

KISC crewmember spraying citric acid

- Coqui control work continued to be a priority for KISC this year. KISC is not only the primary responder to all new coqui reports on Kauaʻi, but also conducts all of the control work at the one infestation site in Lawaʻi near Aepo Reservoir. During this reporting period KISC crews treated 2,171 acres and expended 1,929 person hours. During this period there were approximately 13 frogs confirmed and killed outside of this Lawaʻi site as new arrivals to Kauaʻi.
- KISC partnered with the Pacific Missile Range Facility working on Long Thorn Kiawe removal with contracted machinery. Throughout the year, approximately 5,375 plants were treated and 673 acres surveyed.
- In an effort to preserve wetlands as well as agricultural lands in Makaweli Valley, Waimea District, KISC worked in partnership with local taro growers to survey over 293 acres for cattails (*Typha latifolia*), removing 2,942 plants.

HISC Response and Control Measures of Effectiveness

1) Implementation of the priority response and control actions of the Aquatic Invasive Species, West Nile Virus, coqui frog, and red imported fire ant plans

In partnership with the HDOA, KISC did the following during 2010 to keep public lands and residential areas on Kaua`i free coqui frogs, West Nile Virus, and various agricultural pests.

- Monitored nurseries and residential areas for little fire ant, and coqui frogs. Although no new infestations of little fire ant were detected, 13 coqui frogs were detected and eliminated.
- Assisted HDOH and USFWS in distributing educational information to the community of Kauaʻi for West Nile Virus and Avian Influenza.

Other activities

- Organized and implemented a Service Learning Project with 4th graders at Eleʻele Elementary School. This project taught keiki to differentiate between native and invasive species, the scientific process of collecting data, and species identification.
- KISC participated in the ARRA AmeriCorps Program by having a year-long intern participate in all KISC activities; learning about field protocols, general invasive species threats, and participating in educational events.
- Quickly responded to and assisted with removal of a new roadside weed introduced to Kokeʻe: wheat. This weed-seed was intermixed with hydro-mulch sprayed following road construction.

Maui Invasive Species Committee (MISC): Established Pest Working Group Highlights

MISC detects and controls invasive plants and animals across the Islands of Maui and Lānaʻi and provides administrative oversight for work by the Molokaʻi/Maui Invasive Species Committee (MoMISC).

The HISC's Strategic Plan identifies two key goals for the response and control of established pests: review priorities for the control of pests already present or recently arrived in the State; and implement effective eradication and control programs against incipient and established pests with shared resources and shared responsibilities of all agencies.

MISC is one of the most engaged in the State, meeting bi-monthly to review priorities for control of identified targets. Committee members set priorities for target plants and vertebrates, reviewed progress on miconia (*Miconia calvescens*), and identified gaps and priorities for early detection and rapid response. As a science-based, data-driven operation, MISC is constantly evaluating its eradication and control programs. The take-home message from MISC's presentation at the February 2010 international conference on "Islands and Eradications" was that MISC has succeeded in eradicating a total of seven plant species from Maui and two from Lānaʻi. The veiled chameleon (*Chamaeleo calyptratus*), a larger and more aggressive relative of the Jackson's chameleon, has been reduced to below-detectable levels.

Strong partnerships and a supportive community form the foundation for MISC's success. MISC's partners continued to provide significant financial support, making state dollars provided to Maui County the most highly leveraged of all counties. Efforts against the entrenched population of coqui frogs in Māliko Gulch intensified this year with strong support from the County of Maui, DLNR, and USFWS. Funding from USFWS also helped initiate county-wide surveys for the little fire ant (*Wasmannia auropunctata*), which was detected on Maui in October 2009.

Response and Control: Measures of Effectiveness

Number of species detected and evaluated for feasibility of eradication:
Effective early detection and assessment offer the opportunity for a cost-effective response to incipient invasive species.

- Early detection specialists conducted botanical surveys at six sites on Maui to complete a project for early detection of weeds at landing zones.
- During botanical surveys elsewhere on the island, botanists discovered one new island record, one new record of naturalization, one range extension, and a possible new state record.
- The first known larval site in the U.S. for a potential pest moth was discovered.

Non-native grass seed on helicopter boots

- Surveys for LFA were conducted at 209 sites; a total of 4,524 vials or other samples have been inspected to determine what species are present. New island records for other species of ants were recorded during these surveys: Lānaʻi (one new species), Molokaʻi (four), and Kahoʻolawe (four).

Number and area of priority invasive species eradicated and/or controlled:
Control and eradication work focused on 13 plant species, two vertebrate species, and one plant disease.

- The highest priority plant species were miconia and pampas grass (*Cortaderia jubata* and *C. selloana*). Ground and aerial operations focused on keeping these two ecosystem-modifying weeds out of the native rainforests of East and West Maui.
- Approximately 53,885 acres were searched for miconia during ground and aerial operations; a total of 65,682 plants were controlled, including 1,096 mature trees. Increased pampas grass operations in portions of East Maui have resulted in a demonstrable decrease of plants. Pampas grass surveys covered 20,562 acres and controlled 6,856 plants. Both the miconia and pampas operations benefited from the substantial involvement and support of Haleakalā National Park.

Pampas grass removal in East Maui Watershed

- No detections of the veiled chameleon were made during searches of 35 properties in suspect areas over 5 different nights.
- Efforts to control banana bunchy top virus (BBTV) took place across the Island. Trained staff visited 2,994 sites and controlled BBTV at 185 properties. No BBTV was detected during the annual survey of over 700 properties on Lānaʻi.
- Detection and control efforts on Lānaʻi focused on ivy gourd (*Coccinia grandis*) and fountain grass (*Pennisetum setaceum*). A total of 599 fountain grass plants were removed, including 100 mature plants.

Prioritization processes identified and in place:

- Each year, MISC conducts prioritization meetings to review strategies and progress on the current list of target species, following general protocols established in New Zealand. A review of target plant species occurred during the June 2010 meeting, vertebrate and invertebrate targets were reviewed in October 2009, and a review of early detection and rapid response strategies occurred in April 2010.

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

- Successful coqui frog (*Eleutherodactylus coqui*) control operations in localized areas have resulted in eradication of 11 of 17 population centers. Two of the remaining sites are on target for eventual eradication, three are sites of recurring introductions, and the last – Māliko Gulch – has become the center of major control efforts.
- Work in Māliko Gulch included installing high-volume citric acid sprinkler stations, lining portions of the lower gulch with PVC pipe to deliver citric acid to infested areas, and initiating aerial drops of citric acid. This project continued to require developing and maintaining positive relationships with local landowners to ensure cooperation. Much of the infestation in the gulch is on state land.
- The Coqui-Free Certification Program currently has 28 participating and certified nurseries or plant providers. The list of coqui-free nurseries continues to be available at: www.coquifreemaui.org.
- Staff responded to reports of dead birds. State funding to analyze birds for West Nile Virus was eliminated; staff is only responding to reports of dead feral chickens.

High-volume sprinkler stand in Māliko Gulch

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

- 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. Protection of the East and West Maui Watersheds and the Lāna‘ihale Watershed are top priorities.
- Successful control operations also help protect the unique resources of Haleakalā National Park, state forest reserves, state natural area reserve lands, and local ranch and agricultural lands.
- Work on banana bunchy top virus (BBTV) is protecting agricultural and domestic banana production and also preserves Polynesian varieties found on Maui.
- Surveys for the LFA, which resource professionals believe may exist undetected on the island, are intended to protect Maui’s natural and cultural resources, broad economic interests, and quality of life.

Other activities:
The following activities addressed additional HISC objectives related to Established Pests.

- **Implement improvements to capacity for detection, eradication & control.** With training from the HDOA, MISC expanded its capacity to implement widespread surveys for the LFA, which was detected on Maui in 2009.
- **Support development of management plans for widespread vertebrate pests.** Management staff is participating in an Ungulate Working Group with the Maui Conservation Alliance to address widespread vertebrate pests in Maui County.
- **Develop capacity to conduct effective coordinated response to all snake sightings.** A full day of inter-agency workshops focused on snake identification occurred on Maui on August 25, 2010. The workshop was co-sponsored by Maui County, HDOA, DLNR and MISC. Planning for the workshop included clarifying the response system. MISC developed a wallet-sized card with contact and response information for all attendees.
- **Establish clear agency responsibilities and criteria for rapid response activities.** MISC is coordinating an interagency workshop on this topic to be held in October 2009.

Wallet-sized snake response card

Moloka‘i/Maui Invasive Species Committee (MoMISC): Established Pests Working Group Highlights

Funds from HISC supported detection and control of established pests on the Island of Moloka‘i. MoMISC continued its successful efforts toward eradicating eight priority target species: albizia, giant reed, Australian tree fern, Barbados gooseberry, fountain grass, New Zealand flax, rubber vine and tumbleweed. Field staff detected no giant reed or fountain grass during surveys. MoMISC will continue to prioritize maintenance and monitoring of target species towards eradication. MoMISC also prioritized responding to reports from the public, addressing a wide variety of pest issues affecting human health and the environment.

Response and Control: Measures of Effectiveness

Number of species detected and evaluated for feasibility of eradication:
Any considerations for adding a species to MoMISC’s target list is determined through an evaluation process by the MoMISC committee.

- Fireweed (S*enecio madagascariensis*) was a recent and unwelcome discovery on Moloka‘i. MoMISC detected four mature fireweed plants at four separate locations across the Island. These first detections were found in fairly remote areas that have limited access. MoMISC continues to investigate the possible pathway for fireweed and will work to continue early detection and control of this toxic weed.
- During a survey for Barbados gooseberry (*Pereskia aculeata*) in Hālawa Valley, a specimen from a large-leafed tree was collected and sent to Bishop Museum for identification. Botanists at the museum identified the plant as *Garcinia xanthochymus*, also known as gourka or false mangosteen. Consultation with plant experts supported controlling the trees. MoMISC cut down and treated approximately 25 trees and will monitor for re-growth.
- An introduction of the wasp specific to pollinating the bo tree *(Ficus religiosa)* is causing trees on Moloka‘i to produce viable seeds, which are now being spread by birds. Roadside surveys for bo tree found a total of seven large mature trees in central and east Moloka‘i. Three of the seven trees have been cut down and MoMISC is currently working to secure permission and funding to remove the four remaining trees.

Gourka specimen

Control of bo tree on private ranch with assistance from partners

- Investigation of a public report about water hyacinth turned out to be water lettuce *(Pistia stratiotes*) growing in stagnant water on the side of a highway. MoMISC removed a truckload of the water plants to deter the public from accessing it and spreading it to other waterways.

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

- Maintenance and monitoring work concentrated on eight priority species for eradication. Over 520 acres were surveyed for priority species and 3,543 priority plants were controlled. An additional 16 plant, plant pest, or animal species were also surveyed for or treated. Over 1,657 acres were surveyed for other pests and over 51,000 other pests were controlled.
- Monitoring continued for albizia (*Falcataria moluccana*). Of the 885 mature trees initially treated in 2009, only four trees needed re-treatment. Over 35 acres were surveyed and 130 seedlings were controlled.

DOFAW staff cuts trail through fallen albizia; MoMISC staff treats albizia on a slope.

- The numbers of rubber vine (*Cryptostegia madagascariensis*) plants continued to decline. Over 39 acres were surveyed and 89 immature plants were controlled. No fountain grass or giant reed was detected.

- Expanded surveys were conducted for Barbados gooseberry. Over 40 acres were surveyed and 12 mature and more than 2,500 immature plants were controlled.
- Over 17 acres were surveyed for New Zealand flax (*Phormium tenax*) and five mature and 23 immature plants were manually removed.
- Surveys and monitoring for Australian tree fern (*Cyathea cooperi*) continued. Over 326 acres were surveyed by air and ground. A single mature Australian tree fern was removed from a residence and another 10 immature trees from the core infestation site in north central Moloka‘i.
- MoMISC secured permission to survey a working quarry where tumbleweed *(Salsola kali*) was suspected to be present. Over 49 acres were surveyed and 758 plants were detected and controlled.

MoMISC staff prepping for herbicide treatment

Prioritization processes identified and in place:
MoMISC holds quarterly meetings where updates are given to members on all current species being controlled. The MoMISC Field and Outreach Coordinator prepares reports to the Committee on any new species of concern. The Committee evaluates and directs MoMISC staff to target any new species considerable feasible to eradicate.

Implementation of the priority response and control actions of plans for Aquatic Invasive Species, West Nile Virus, coqui frog, and red imported fire ant:

- Staff monitored the designated swimming area at the Kaunakakai Harbor for upside-down mangrove jelly fish *(Cassiopea andromeda).* Reports from the public in 2009 of being stung by jelly fish-like organisms prompted MoMISC to take action to protect human health. A total of 140 mangrove jelly fish were removed from the Kaunakakai pier.
- MoMISC also assisted the DAR with removal and outreach for gorilla ogo (*Gracilaria salicornia*).
- MoMISC initiated a rapid response to a report from a business that a coqui frog (*Eleutherodactylus coqui*) jumped out of a potted fruit tree that had been shipped to Moloka‘i with 180 other trees from the Big Island. MoMISC responded by spraying the entire shipment with citric acid. A single coqui frog was captured and controlled. The shipment was contained in a warehouse, observed for several days, and then released to the business to be sold to the public.
- A survey for little fire ant (*Wasmannia auropunctata*) was done for the shipment with the coqui frog and the business’ property as well. There were no detections of red imported fire ant or little fire ant.

Number and names of species, habitats, ecosystems, agricultural, and managed areas protected because of control efforts:
MoMISC applies a common-sense feasible response to protect the island's people, native forest, wetlands, ocean and agriculture.

- MoMISC partnered with TNC, DOFAW, and USDA's Plant Quarantine Branch to target pests that threaten the island's native forest. MoMISC controls a population of wood rose (*Merremia tuberose*) and cat's claw (*Caesalpinia decapetala*) that border the state Forest Reserve. MoMISC also controls and surveys for New Zealand flax, multiflora rose (*Rosa multiflora*), Australian tree fern, mule's foot fern (*Angiopteris evecta*) and albizia in the Forest Reserve.
- To protect agriculture and horticulture, MoMISC records and tracks data for the early detection of light brown apple moth and nettle caterpillar. With help from MISC, MoMISC has been successful in keeping BBTV from spreading throughout the entire island by surveying for and treating infected trees. Approximately 2,000 properties were checked and over 1,264 acres surveyed. A total of 495 plants were controlled and 318 hours spent treating banana bunchy top disease.
- MoMISC's efforts against the upside-down jellyfish are keeping this pest species overrunning the area most frequented by recreational users. Work on rubber vine occurs in a wetland in East Molokaʻi. After successful control of rubber vine in the area, native *akulikuli* (*Sesuvium portulacastrum*) has re-established itself and is flourishing and spreading throughout the areas cleared of the noxious vines.

Other activities:
MoMISC works to accomplish as much work as possible with the resources available. The need to convey invasive species information and establish strong working relationships is critical to success. Also important are MoMISC's connections to community, partners and funders. During this time period, MoMISC accomplished the following additional activities:

- Participated in meetings of the HISC Public Outreach Working Group, the Coordinating Group on Alien Pest Species, The Nature Conservancy - Molokaʻi, the Invasive Species Committees, and MoMISC.
- Provided testimony to county budget hearings
- Supervised four interns from the Youth Conservation Corps.
- Attended the Hawaiʻi County of Planning Officials conference focusing on GIS applications.
- Provided invasive species briefings to the Hawaiʻi State Legislature.
- Maintained staff capacity through trainings for pesticide and CPR recertification.

Working with students from Nā Pua Noʻeau Program in Hālawa Valley

O‘ahu Invasive Species Committee (OISC): Highlights

OISC surveyed public and private lands across the Island to locate and remove high-threat invasive plants. OISC worked cooperatively with partners and private landowners to prevent coqui frogs from establishing on the Island and to increase public awareness of the threat as part of an ongoing outreach program. Outreach continues to pay dividends as residents report pests and the Committee follows up, sharing information and tasks with HDOA, as needed. Partners and volunteers contributed valuable field time, allowing more acreage to be surveyed. OISC’s Early Detection Team continued its surveys and risk assessments of introduced plants to reduce future impacts of highly invasive species. The Team also traveled to Kauai in a cooperative effort with KISC. OISC continued to develop its data collection and analysis capabilities to make the most of every field hour, and to share results with others. State funds provided the needed match for successful fundraising from other sources. As a result, no staff had to be let go, although budget cuts did force a reduction in staff through attrition.

HISC Response and Control: Measures of Effectiveness

Number of species detected and evaluated for feasibility of eradication:
The O‘ahu Early Detection (OED) Program, a joint effort between OISC and the Bishop Museum, is finishing up an island-wide survey of all publicly accessible roads. Support from HDOT is funding surveys on state-managed roads. During the reporting period the team found 33 plant species not on record at the Bishop Museum’s Herbarium Pacificum. These include submissions by OISC partner agencies that OED identified and confirmed.

Six hundred and eighty-two species have undergone preliminary assessment. Full assessment has been completed on 14 species. Removal of some of these has already begun. *Melinis nerviglumis* and *Pennisetum villosum*, two ornamental grass species new to O‘ahu, were removed by the owners of the property where they were found. Honolulu Botanical Gardens de-accessioned *Rauvolfia vomitoria* and *Parkinsonia aculeata*, two species of invasive trees not on record as being on O‘ahu.

OISC and KISC collaborated to send the OED Team to Kaua‘i to do early detection there. This gave the OED Team a chance to test their methods on another island. Results of the surveys can be found in the KISC section of the report.

OISC also worked together with the O‘ahu Army Natural Resources Program (OANRP) and the Natural Area Reserve System (NARS) to coordinate eradication efforts of cane ti (*Tibouchina herbacea*). This plant is a serious forest pest on the Islands of Maui and Hawai‘i, but is known from only one location—the summit of Poamoho Trail—on O‘ahu.

Number and area of priority invasive species eradicated and/or controlled:
In FY10, the OISC field crew conducted surveys and control work for 24 priority species. These included plants found during the early detection surveys, coqui frog (*Eleutherodactylus coqui*),

and West Nile Virus, for which dead birds are retrieved for testing.

- Fifty-six percent of the field crew's time was spent surveying for and controlling miconia *(Miconia calvescens*). Miconia remains OISC's top priority because it could so easily take over the forests of the Koʻolau Watershed, which would increase runoff and erosion and decrease the island's water supply. OISC surveyed 5,035 acres of the southern Koʻolau Range for miconia. Helicopters were used to cover 1,764 of those acres because the terrain was too steep for ground surveys. The crew removed 3,724 immature miconia trees. No mature trees were found during the reporting period. OISC's strategy is to survey 800 m around historical mature tree locations and another 800 m by helicopter to look for outlier trees. These parameters are based on the dispersal capabilities of bulbuls, which on Oʻahu are the most likely dispersers of miconia seeds. Surveys must be repeated every 3 years until the seed bank is exhausted, to catch seedlings before they mature.

Surveying for miconia

- The OISC Crew continued its efforts to eradicate Himalayan blackberry (*Rubus discolor*) in Pālolo Valley. During the reporting period, the crew treated 2,594 plants. The number of plants found during surveys is beginning to decline. However, the Pālolo Valley resident that introduced this species to the Valley has been seen with Himalayan blackberry in his possession and may be continuing to plant the species.
- The Crew removed several tons of pampas grass (*Cortaderia selloana*) from private property on Oʻahu, including two golf courses. The Crew removed or treated 359 plants; the majority of these were from two private golf courses.
- Several species discovered by the OED Team were controlled during the reporting period. These include *Cissus repens*, *Delairea odorata,* and a second individual (in addition to the Honolulu Botanical Gardens specimen) of *Parkinsonia aculeata*.

Prioritization processes identified and in place:
The OED 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 accessed by the field crew. The species recommended for removal by the OED Team and mentioned above had high potential to become naturalized, but were very limited in distribution.

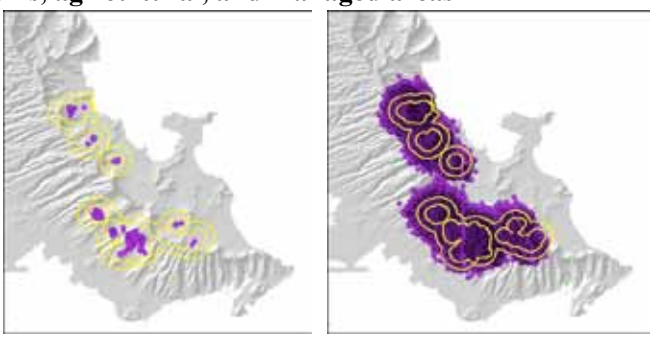
OISC also reviews its plan for the year and priority actions for its "legacy" species. Legacy species are those such as miconia and fountain grass (*Pennisetum setaceum*) that OISC has been working on since before the start of the early detection program. Last year, due to budget cuts and a resulting smaller staff, first priority was given to *Miconia calvescens*. However, OISC did not have enough available field hours to cover the number of acres that needed to be surveyed in 2010 in accordance with the OISC Strategy, so survey areas were prioritized with the approval of OISC.

Implementation of priority response and control actions for coqui frog, West Nile virus, and avian influenza:
OISC participates in the Coqui Frog Working Group (CFWG) that also includes the Plant Quarantine and Plant Pest Control branches of HDOA, DOFAW, and Oahu Army Natural Reserve Program (OANRP). This group meets regularly to coordinate actions on coqui frog eradication on O‘ahu. OISC personnel respond to reports from the public, monitor high-risk areas and conduct control operations when coqui are discovered.

- As part of the CFWG, OISC responded to a naturalized population of coqui frog in Hau‘ula. The frogs were reported after a news report about another frog in Mānoa, highlighting the need for continued public outreach.
- OISC continued to work with infested nurseries to assist them in treating their coqui frog infestations. This work included monitoring and spraying infested areas with citric acid.
- OISC responded to reports of dead feral chickens and other dead birds and submitted them for testing for avian influenza and West Nile Virus.

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

- The behavior of miconia, Himalayan blackberry, pampas grass and fountain grass in other areas invaded by these species indicates that they all have ecosystem-changing effects and can permanently change O‘ahu’s native forest ecosystems. The graphic at right shows the potential spread of *Miconia calvescens* through the Ko‘olau Range if not controlled.
- Poamoho Trail, regarded as one of the finest trails on O‘ahu, is being protected from the spread of cane ti by the collaborative efforts of OISC, OANRP and NARS.
- Neighborhoods and natural areas across the island are being protected from disturbance by coqui frog.



The map on the left shows where OISC has removed miconia in the past. At right, miconia density resulting from the current seed bank if no control takes place for 10 years. Predicted spread is based on known miconia biology. Miconia seeds can survive in the soil for 16 years or more, so without continued survey and control work, miconia can still take over the Ko`olau Range. Figures are based on a model developed by OISC GIS Analyst Jean Fujikawa.

Other activities:
Additional activities also helped achieve HISC objectives.

Mentoring: OISC participated in the AmeriCorps Service Learning Program and provided experience and mentoring for students. OISC was also a host organization for the Hawaiian Internship Program (HIP) that aims to give kama‘aina college-age students work experience with a conservation program. Both the AmeriCorps students and HIP interns had specific projects and were mentored by OISC staff.

Develop and share knowledge and expertise: OISC's GIS Analyst, Coordinator and Field Supervisor continued the ongoing development of in-house data management capabilities. In addition to exchanging information with other islands' Invasive Species Committees, OISC participated in various broader forums. These included presenting a poster at the Hawaii Conservation Conference, working with OANRP to prepare a report presented at the Island Invasives Eradication and Management Conference in Auckland, and sending the OISC GIS Analyst to the ESRI International User Conference in San Diego.

Public Outreach Working Group FY2010 Summary

In FY2010, the HISC Public Outreach Working Group (POWG) faced a 66% reduction to its budget. In FY2009, POWG was given $382,000 to support county-based and statewide specialist staff, outreach programs, community projects, and educational materials. The reduced FY2010 budget totaled $130,000, which meant a loss of positions and support for programs.

POWG agreed to devote the funds to maintaining staff capacity as much as possible. Three fulltime positions were reduced to one, and a lower level of support was given to county-based outreach specialists within the Invasive Species Committees. POWG also decided to allocate $20,000 for a part-time position that allowed for continued website support.

After the final budget approval for FY2010, the POWG Chair assembled an advisory committee of HISC members to direct the priorities and necessary staff reorganization. Major objectives were identified, and a statewide position with a coordinating role was created in order to address new gaps and needs that arose due to reductions of staff and project support.

Despite the 66% budget reduction, the staff and partners have continued to be a very committed working group. POWG met seven times in FY2010 to make progress on and accomplish the goals set by the Advisory Committee. These goals include increased plant grower outreach, collaborative public education and partnership building for biocontrol, priority pest projects, and installation of port displays.

POWG meetings were held on the following dates:

- July 27, 2009: Discussion on biocontrol outreach needs and staff activities
- September 14, 2009: Submission of POWG proposals and budget request for FY2010
- September 23, 2009: Review of budget approved by HISC
- December 1, 2009: Strategic session on goals set by advisory committee
- January 19, 2010: Discussion on plant grower outreach objectives
- March 19, 2010: Software training to enhance in-house design of educational materials
- May 19, 2010: Status of FY10 priority POWG projects

In addition to the efforts made towards meeting specific FY2010 goals, POWG-supported staff also continued their ongoing efforts to promote the priority messages to the audiences described in the HISC Strategic Plan while using the Plan's measures of effectiveness to gauge their work. The staff directly reached over 32,000 people through presentations, community events, school visits, and workshops. However, the impact of outreach is not easily articulated with numbers alone. In addition to providing these quantitative measures, the following reports also share images and narratives that give a sense of the creative efforts that have been carried on successfully by POWG with a small budget.

The current economic climate reminds us that the sustainability of our programs rely upon public support. It is imperative to engage our communities in the collaborative statewide efforts to protect Hawaii's environment, health, agriculture, cultural resources, and economy from the negative impacts of invasive species. Raising public awareness about this issue and encouraging

behaviors that aid the prevention, detection, reporting, and management of invasive species will rely upon an active and well-supported POWG.

HISC Communications Coordinator

Due to budget reductions, it was necessary to reorganize the statewide POWG-supported staff. The Advisory Committee decided to create a new position, the HISC Communications Coordinator, which would be dedicated to the internal and external communications for the HISC, coordinate statewide and county-based public education initiatives, work on priority POWG projects, and assist HISC member agencies and HISC-funded programs with outreach. The position was filled in March.

One of the top goals identified by the POWG Advisory Committee for FY2010 was to assist with public education on biocontrol in collaboration with the HISC chair agencies, HDOA and DLNR. On March 18, the HISC Communications Coordinator planned a Biocontrol Communications Session at Bishop Museum that brought together researchers, natural resource managers, agency employees, non-profit partners, HISC-supported staff, and outreach specialists with representation from every island. The presentations and facilitated discussion focused on a review of biocontrol in Hawaii and an assessment of current communications needs. A Biocontrol Outreach Working Group was formed and partnership efforts have continued.

Incorporating messages that resulted from the brainstorming discussions at the Biocontrol Communications Session, the HISC Communications Coordinator worked with the HDOA, POWG, and others to develop an educational brochure about biocontrol in Hawaii. The brochure can be found online and 5000 were printed and distributed to outreach specialists, agency offices, and partners across the state. The online link is at the newly created website, www.strawberryguavabiocontrol.org where it is found under "State biocontrol programs in Hawaii."

The HISC Communications Coordinator also worked on the production of two educational videos. These videos interviewed people and shot footage around the State on the issues of biocontrol and varroa mite. The biocontrol vignettes focused on the recovery of wiliwili after HDOA's release of a natural predator for the Erythrina gall wasp. Cultural practitioners, scientists, ranchers, and students were among those interviewed about the significance of wiliwili and success of the biocontrol. The varroa mite vignettes focused on the importance of the queen bee and honey industry in Hawaii and how they are both being impacted by pests like the varroa mite.

Molokai YCC students talk about wiliwili

The video highlights beekeepers from Hilo to Kauai. Eight vignettes on these topics were shown on OC16's Outside Hawaii TV program. Over 20,000 people watch the show as it airs seven times each week. Additionally, the vignettes can be viewed online at http://www.oc16.tv.

The HISC Communications Coordinator served on the steering committee for the Aina Hoola o Mailikukahi (Hands Turned to Soil) 2010 Conference in June. The theme of this conference supported the priority message to "Buy Local" in the HISC Strategic Plan. This event primarily reached out to the agricultural community, Native Hawaiians, and youth with over 250 participants.

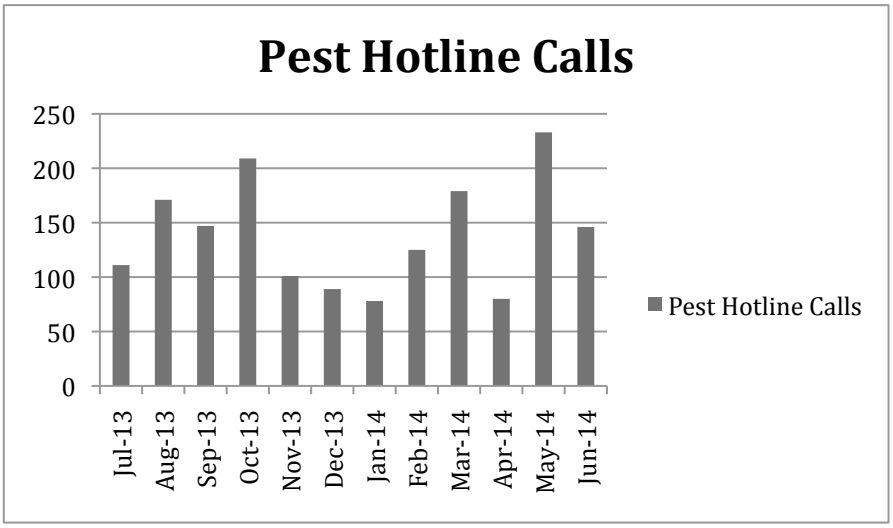
The horticultural trade continues to be a priority audience for outreach. The HISC Communications Coordinator serves on the Board of Directors for the Landscape Industry Council of Hawaii and participated in their strategic planning, invasive species initiatives, and educational campaigns for their membership. In March, the HISC Communications Coordinator submitted an article to *Hawaii Landscape* entitled "The Hawaii-Pacific Weed Risk Assessment: A Free Service for the Green Industry." This was the first of a now ongoing feature in each issue of the publication that highlights a low risk species to the trade and promotes the use of the Weed Risk Assessment as part of the Voluntary Codes of Conduct. Low risk flowering plants and fruit trees were featured in FY2010.

The HISC Communications Coordinator participated in the Partnership to Protect Hawaii's Native Species, which is an outreach working group on statewide rodent control. The federal and state inter-agency group directed a contractor to produce educational materials, presentations, and resources, including a website at www.removeratsrestorehawaii.org.

In the short time from when the new position was filled in March until the end of FY2010, the HISC Communications Coordinator was able to make significant headway on POWG priorities, such as biocontrol, serve as a point of contact for partnerships, such as the outreach working group on statewide rodent control, assist outreach specialists with support for and coordination of county-based initiatives, and assist the HISC member agencies with internal and external communications needs.

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) was funded by HISC, and the HISC 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, and events. Staff continued to giveaway pens and stickers branded with the logo below.



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 FY2010, the Pest Hotline received 1669 calls, up from 1427 total calls in FY2009.

HISC Website

"Number of Hits to the Invasive Species Web Pages" is another measure of effectiveness for POWG. The site, www.hawaiiinvasivespecies.org, hosts the pages for the HISC, Coordinating Group on Alien Pest Species (CGAPS), the Invasive Species Committees (ISC), and general invasive species information.

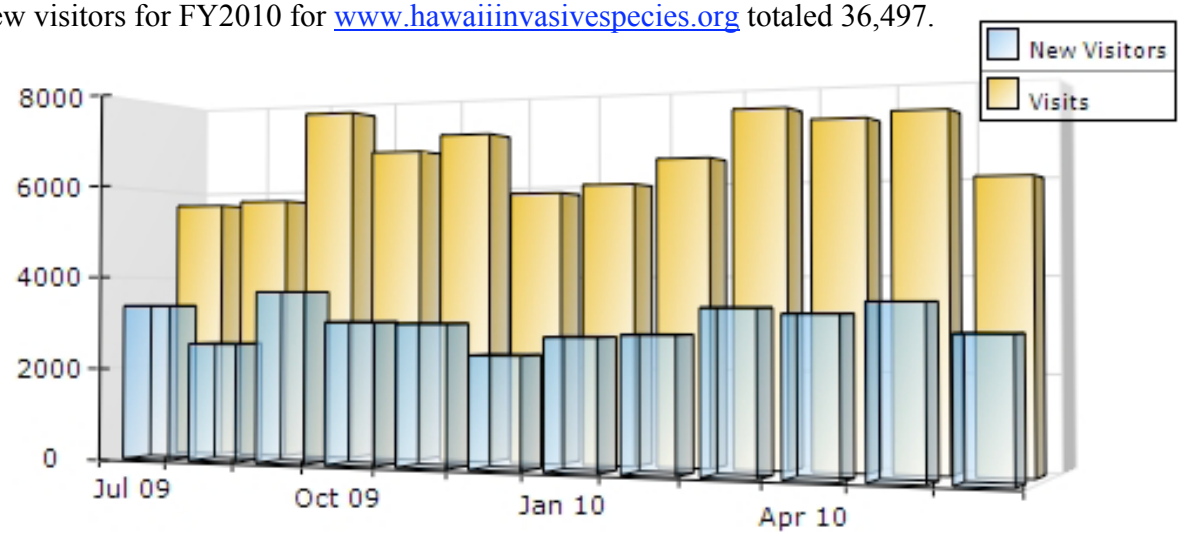
In FY2010, POWG funded a part-time position to fulfill the following duties:

- Maintenance of www.hawaiiinvasivespecies.org
- Creation and maintenance of a website on biocontrol
- Creation of a website on the Hawaii-Pacific Weed Risk Assessment (HPWRA)
- Updating pages for POWG outreach specialists, HISC working groups, and each ISC
- Maintenance of invasive species community email lists that facilitate inter-agency communication

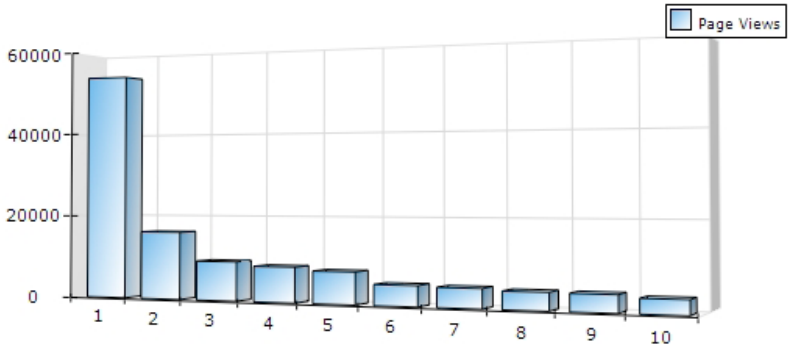
The HISC website is frequently updated and several new pages have been added. A website to provide information about and access to the Environmental Assessment on the proposed biocontrol for Strawberry Guava was created and is found at www.strawberryguava.org. A URL was secured for the user-friendly site on the HPWRA (www.plantpono.org). The invasive species Listservs continue to be a key communication vehicle for inter-agency coordination.

In the absence of funding for media services, such as Public Service Announcements, 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 ISCs and other HISC programs are also using Facebook pages as a way to tap into social media marketing.

In FY2010, the logged number of website "hits" totaled 153,918, which is a significant increase from FY2009 that recorded a total of 10,596. POWG promotes the HISC website, as well as individual pages, during all outreach activities. The annual website analytics also help to inform communications strategies by documenting which pages have the most popularity with visitors. For example, the page on "high-profile pests" received the highest number of hits. The graph below shows the breakdown of total visitors and new visitors during the months of FY2010. The new visitors for FY2010 for www.hawaiiinvasivespecies.org totaled 36,497.



This graph depicts the number of views for the top ten most popular pages. For example "1" represents the page on "high-profile pests" and "4" represents the homepage for the HISC. The total number of page views for FY2010 was 123,822.



BIISC Outreach: FY2010 Highlights

BIISC outreach has been very busy traveling island-wide to 55 events and meetings to promote invasive species awareness, particularly at green industry venues like farmers markets, seed exchanges, and plant sales. The Outreach Specialist was also awarded a scholarship to attend a seed symposium to learn about seed collection. Detection and prevention of LFA has been a priority message, particularly on the Kona side of the Big Island. Beekeepers have been an outreach target, due to recent critical pest arrivals, and the important role of bees as pollinators. BIISC is developing a citizen Eyes and Ears network in cooperation with the USGS Maui Eyes and Ears program. The outreach specialist also attended a pesticide awareness course and subsequently tested for and received a certified pesticide applicator license. Goals are to develop pesticide displays to reduce public fears of pesticide applications by ISCs.

HISC Public Outreach: Measures of Effectiveness

Agency adoption of rules and policies against invasive species:

- Worked with Three Mountain Alliance and Kohala Watershed Partnership on invasives policy
- Attended meetings of the Harbor Master 2030 Planning Process to encourage consideration of invasive species facilities and inspections needs at harbors
- Attended meetings of the Hawaii County Agricultural Plan Update

Adoption of Codes of Conduct by businesses:

- Attended 15 green industry events such as plant sales and farmers markets with displays promoting codes of conduct and best management practices for invasive species. Approximately 6000 people attended these events, with 1850 actively studying booth materials
- Worked with the HISC Ant Specialist, to promote his Farm Bill funded project developing an LFA Best Management Practices manual and LFA awareness
- Discussed certification programs with members of the Kona LFA Taskforce
- Makuu Farmers Market, Puna, Hawaii, required vendors to be little fire ant free and undergo mandatory detection and prevention training


BIISC's Early Detection Team hits the road to prevent new weeds from spreading out

Number of print and broadcast media mentions:

- *Action on Invasive species: Part 1 Focus on LFA.* www.westhawaiitoday.com *July 2010*
- *Community Early detection of invasive species.*www.**westhawaiitoday**.com *July 2010*
- *Don't Say Uncle to Little Fire Ants. By Page Else and Ty McDonald*
  www.**westhawaiitoday**.com/articles/**2010**/03/07/features/features04.txt

- *Little Fire Ant In Kona Hawaii Agriculture Bulletin April 2010*
- *Little Fire Ant In Kona Hawaii Landscape Bulletin April 2010*
- *Plume Poppy work in Kau Forest Reserve Kau Calendar November 2009 (http://www.kaucalendar.com/news/11_09p17.html)*
- *Kona Rubber Vine Eradication*. September 2009. West Hawaii Today http://www.westhawaiitoday.com/articles/2009/09/20/features/features01.txt
- *Article about tree poppy (Bocconia frutescens) on the big island* http://www.westhawaiitoday.com/articles/2009/09/06/features/features05.txt
- *Article in Hawaii Landscape about BIISC's Early Detection Team*
- *Kona Outdoor Circle Little Fire Ants April 2010 Ka Leo TV broadcast*
- *Kona Town Hall Meeting Little Fire Ants March 9, 2010 Ka Leo TV broadcast*
- *Community Forum KPUA Radio 670 AM 1/13/2010 Mangrove Eradication Project*

Number of "hits" on invasive species web page:

- BIISC added a Facebook page
- On the HEAR hosted webpage there is a new early detection page, other pages have been updated and reports added

Number of callers on pest hotline:

- Advertised the importance of reporting at all events attended
- Maintain the BIISC hotline which gets approximately 15 calls per month.
- Worked towards publicizes http://www.reportapest.org
- Worked with MISC, Kona LFA Taskforce, and Hawaii Island Landscape Industry to get LFA placards on bus that advertise pest hotline

Number of education materials produced:

Supply budget was non-existent during this reporting period so products were produced cheaply in house with limited printing

- Early detection brochure, event exhibits on WiliWili Biocontrol, Mosquito Impacts, Green Industry Invasive Prevention Tools, Speed of Invasives Spread, Insect Biology, Biocontrol Successes, Astronomy related (planetary protection policy, astrobiology, space technology and invasive spread detection). Wao Kele o Puna Project Site,
- Exhibit on Cultural Importance of Native Hawaiian insects developed by BIISC PIPES intern

Number of people reached through talks and displays:

- BIISC attended 55 total events having 36,200 people present, and 11,300 actively studying booth materials.
- BIISC has an outreach opportunity not present on the other islands in participating in astronomy outreach events. Astroday, held yearly at the beginning of May, brings over 10,000 people to learn about astronomy. BIISC focused exhibits for that day include discussions of the potential for invasives in space, planetary protection policy, and space technology detecting invasives on Earth. In addition, an astronomy block party celebrating the International Year of Astronomy held in October 2009 attracted over 1500 people.

- For the first time, BIISC and other conservation agencies participated in the Merry Monarch Parade in April 2010. Staff marched behind floats holding conservation displays.
- The discovery of LFA in Kona created much educational buzz. A presentation at the Kona Town Hall meetings was also televised.
- An educational presentation was given to a Montessori preschool in which kids decorated a large box as a lava tube in a native forest threatened by invasives.

New educational programs and community events

- Worked with the Waimea Community Association and Volcano Community Association to develop community Eyes and Ears programs
- Worked with East Coast college students on mangrove removal
- Worked with Hilo High School students on field days for Miconia control
- Worked with Malama o Puna on B-Wet grant materials
- The Waikola Outdoor Circle sponsored their first annual Wili-Wili festival, featuring their dryland forest restoration efforts. This was a good opportunity to publicize the success of the gall wasp biocontrol.
- BIISC met the Kokua Farm Lots Association Board to discuss access issues for one of our control projects.
- BIISC hosted an intern from the UH PIPES program for Native Hawaiians. Part of the interns duties were assisting with outreach, particularly in cultural settings and strengthening BIISC connections to cultural practices. The intern wrote an oli aloha for BIISC staff to use, based on interviews with staff.

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

Total number of volunteers for ISC projects.

- 100

Total number of partnership projects that involved volunteers.

- **5**

Total number of volunteers referred to other invasive species projects

- **20**

Additional activities that also helped achieve HISC objectives:

New partnerships formed.

- Kona LFA Taskforce
- Beekeepers
- Malama o Puna B-wet grant partnership
- BIISC attended many events sponsored by the Green Industry. This helps get out our information, and builds a contact network and relationships essential for further progress.

BIISC attended meetings with green industry representatives and CGAPS to help publicize the Plant Pono project.

- BIISC attended beekeepers association meetings to help spread information on taxonomic supergroup pests like the varroa mite, small hive beetle, and little fire ant.
- Articles were written on early detection and outreach materials developed.
- Biocontrol educational materials were included at most events and was featured in the Hilo High School and Lyman museum oral presentations. Staff also attended the biocontrol outreach training session at the Bishop Museum.

HISC Annual Report
Kaua`i Invasive Species Committee Outreach Report

KISC Outreach: 2010 Highlights

Outreach efforts this year focused on getting tangible educational materials to the community. Enhancing work done by the KISC crew was also achieved by further developing Early Detection materials and ways for the public to help report pests. In an ever-increasing digital age, emphasis was also placed on electronic versions of outreach materials as well as increasing the ease in which it is accessed.

HISC Public Outreach: Measures of Effectiveness

Adoption of Codes of Conduct by businesses:

- KISC has a continuing relationship with the Kaua`i Landscape Industry Council, introducing new members to the Hawai`i Pacific WRA and Voluntary Codes of Conduct.

Track number of print and broadcast media mentions:

- *Reported snake just a kid's toy*, July 4, 2009, *Garden Island Newspaper*
- *It all boils down to water*, September 14, 2009, *Garden Island Newspaper*
- '*Protecting today for tomorrow'*, October 5, 2009,*Garden Island Newspaper*
- *Students Tag Invasive Species*, April 19, 2010, *Garden Island Newspaper*
- (Image and caption), KISC Mongoose model, April 22, 2010, *Garden Island Newspaper*

Number of "hits" on invasive species web page:

- The KISC website has been completely updated this year www.kauaiisc.org . The home page features links to KISC funders and partners.
- Property access permission to remove the invasive species miconia was streamlined this year with easily accessible online forms for property owners within the known miconia buffer (http://www.hawaiiinvasivespecies.org/iscs/kisc/miconiasurvey.html).
- KISC Early Detection webpage includes current roadside survey reports so that the public can access information as to interesting plant pests found in their neighborhoods (http://www.hawaiiinvasivespecies.org/iscs/kisc/ed.html). Also, the new Kaua'i Field guide can be found as a link to the Hawai`i Early Detection Network (http://www.hawaiiinvasivespecies.org/iscs/kisc/pdfs/kiscfieldguide2010.pdf) as well as information on attending workshops and reporting pests.
- The KISC Public Outreach Page features printable pest alerts and posters (http://www.hear.org/kisc/kisc_target_species) (http://www.hear.org/kisc/posters).
- KISC joined the Facebook network this year gathering 123 fans and posting weekly/monthly updates. This link can also be found on KISC's website.

Number of callers on pest hotline:

- A "Species Response Matrix" was developed and distributed to all KISC partners as well as other agencies that may receive reports of unusual species. This document outlines responding entities by species. The Pest Hotline number was also featured on this document to help decrease response time.
- KISC partnered with Pacific Basin Information Node (PBIN) to add Kaua`i to the Hawai`i Early Detection Network, allowing people to report new and suspected invasive species for identification and agency response (www.reportapest.org). This website promotes the pest hotline as well as online and walk-in reporting.

Number of education materials produced:

- Take-away materials and "prizes" are one of the best forms of public outreach. KISC now has an updated pest alert on every target species. Pest alerts have also been made for selected early detection species discovered on a recent roadside survey. Calling cards, featuring the Pest Hotline are accessible on coqui frog nursery displays. KISC also has a new temporary tattoo for our "weed warrior" kids.
- A Field Guide to the Early Detection of Invasive Plants and Animals on Kaua`i (51 pages) was published (qty 900) and will be given to Early Detection workshop attendants.
- A coqui replica (1600% larger than an actual coqui) was constructed and displayed inviting people to sign it. This coqui-awareness campaign provided a way to measure outreach efforts regarding the threats that this species pose.
- KISC continues to utilize a taxidermied example of a small Indian mongoose commonly found on neighboring islands.

Taxidermied Indian mongoose

- "KISC's Most Unwanted" poster (qty 12) was updated with current target-species. Reduced-sized flyers (qty 100) were given away at events and presentations. (http://www.hawaiiinvasivespecies.org/iscs/kisc/pdfs/kiscposter_mostunwanted201006.pdf)
- "Invasive Species Impacts" poster (qty 15) featuring a map of target-species and their impacts was developed and printed. Reduced-sized flyers (qty 100) were given away at events and presentations. (http://www.hawaiiinvasivespecies.org/iscs/kisc/pdfs/kiscposter_invasivespecies201006.pdf)
- Miconia brochures (qty 510) were delivered to targeted residential audiences (http://www.hear.org/kisc/pdfs/kisc_miconiaflyer.pdf).
- Ivy Gourd brochures (qty 40) were delivered to targeted residential audiences.
- Arundo Pest Alerts (qty 50) were given at events and to targeted landowners.
- Cattail Pest Alerts (qty 50) were given at events and to targeted landowners.
- False Kava Pest Alerts (qty 50) were given at events and to targeted landowners.
- Fountain Grass Pest Alerts (qty 50) were given at events and to targeted landowners.
- Molucca Raspberry Pest Alerts (qty 12) were given at events and to targeted landowners.
- Mules Foot Fern Pest Alerts (qty 12) were given at events and to targeted landowners.

- Pampas Grass Pest Alerts (qty 50) given at events and to targeted landowners.
- False Kava informative postcards (qty 100) were given at events and to targeted landowners.
- 643-PEST Bumper stickers (qty 200) were given at events and presentations.
- 643-PEST Key chains (qty 500) featuring the coqui were given away at events and presentations.
- 643-PEST Pens (qty 500) were given away at events and presentations.
- Weed Warrior tattoos (qty 200) were given away at events and presentations.
- Got Coqui? Fly-swatters (with 643-PEST) (qty 500) were given away at events and presentations.
- Coqui Calling Cards (with 643-PEST) (qty 100) were given out at events and presentations.
- Potted Pest Prisoners (live, potted invasive targets) were used as educational displays.

Coqui nursery display

Number of people reached through talks and displays:

- Talks (100 people): Presentations to schools and Rotary Club.
- Plant point-of-purchase coqui outreach is vital in stopping the spread of coqui on Kaua`i. KISC has designed and built a weather-proof display that is featured in the plant area at local nurseries on the Island. The best time to inform plant buyers about coqui and how to report them is when they are buying the plants.

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

- KISC formed a new partnership with Ele`ele Elementary School beginning a yearly service learning project with 4th grade students. The project includes invasive species education through hands-on experience. The students learned to identify and tag invasive species for removal. A field guide (15 pages) was created to help the students identify the invasive pests on the trail head. This project has inspired additional interest from other Kaua`i elementary schools.


Replica coqui for public awareness campaign

- Early Detection Workshops were implemented this year where participants are trained to identify target ED species and are given an Early Detection Field Guide.
- Displays: Over 4,000 booth visitors at Kaua`i events including Kaua`i Farm Fair, Garden Fair, Arbor Day, Seed Exchanges, Banana Poka Roundup, Kaua`i Community College Earth Day, Agriculture Awareness Day at CTAHR, and Kaua`i Community College Market.

- The Kaua`i Farm Fair is KISC largest event, bringing more than 1300 visitors to the booth. This year's crowd-drawers included the giant coqui public awareness signature campaign, an informal interactive poll asking if Kaua`i residents if they are adequately informed regarding the threats that invasive species pose to the environment, as well as an Invasive Art Gallery. Children were especially interested in our live captured coqui and stuffed mongoose.

Additional activities that also helped achieve HISC objectives:

Kaua`i Field Guide

- KISC has produced Kaua`i's first Early Detection Field Guide. KISC has joined with the PBIN to introduce the Hawai`i Early Detection Network to Kaua`i. The Hawai`i Early Detection Network was created to increase public awareness of invasive species and engage communities in the monitoring of their own neighborhoods. This project seeks to engage the public in the early detection of new alien pest and provide them with a system to report their findings. The public can find out how to help protect the environment of Kaua`i by participating in the **Eyes and Ears Team** and attending educational workshops educating them about invasive plants and animals to watch for on Kaua`i. Other types of Early Detection Workshops are geared towards conservation groups and environmental professionals to inform them about early detection species to watch for in the field. The website www.reportapest.org contains information about early detection species and provides a tool to report possible pests on Kaua`i. Reported pests will be identified and forwarded to the correct agency for control or recording.

Maui Invasive Species Committee (MISC): Outreach: 2010 Highlights

The public outreach goal for the 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. MISC's outreach program has been essential in helping to maintain strong support from the County of Maui and for detection and control of invasive species. Support from private individuals has continued, both in direct and in-kind contributions.

Efforts over the last year have also included a heightened focus on raising awareness about LFA as a result of its detection on Maui in October 2009. School programs, early detection workshops, public events, and trainings with landscape and nursery industry professionals have reached over 1,000 people, with an emphasis on identification and reporting of suspect ants. This major campaign has included installing posters on county buses, posting flyers at nurseries and businesses, and creating a website about LFA. Anecdotal reports from the public during community events indicated a heightened awareness of the issue.

HISC Public Outreach: Measures of Effectiveness

UH Maui College Agriculture Professor Ann Emmsley received the 2009 Mālama i ka ʻĀina award

Agency adoption of rules and policies against invasive species:

- The November 2009 meeting of MISC focused on identifying regulatory and enforcement gaps in Hawaii's legal system that impede progress on control of invasive species.
- MISC staff are working with other members of the Maui Conservation Alliance to address issues related to recalcitrant landowners – those who deny access to private property. An ordinance will be developed over the next year for consideration by the Maui County Council to address property access for high-priority species. Such an ordinance would be the first of its kind in the state.
- As appropriate, MISC provided testimony related to invasive species regulation before the State Legislature.

Adoption of Codes of Conduct by businesses:

- Support from the business community depends on developing and maintaining a positive relationship with affected industries. MISC outreach professionals attended meetings and

participated in events of the Maui Association of Landscape Professionals. MISC also has developed a positive relationship with the Maui Cattlemen's Association.
- Continued recognition of proactive members of the landscape industry through the Mālama i ka ʻĀina award program.
- Presented information to landscapers, nursery owners and golf course staff about early detection of the LFA.
- Twenty-eight businesses participated in MISC's Coqui-Free Certification Program for 2010.

Track number of print and broadcast media mentions:
There were 20 articles in the Maui News mentioning invasive species, MISC targets, or MISC in the past year. Additionally MISC staff and committee members authored 10 articles as part for the Kiaʻi Moku column in the Maui News for a total of 30 mentions in the last year.

- "Kiaʻi Moku: Residents urged to report unusual stinging fire ants," November 8, 2009, The Maui News.
- "MCC agriculture professor wins landscapers' Mālama award," December 6, 2009, The Maui News.
- "Kiaʻi Moku: 'Gambinos' of the plant world must be stopped," December 13, 2009, The Maui News.
- "Kiaʻi Moku: Fireweed has gotten a foothold," January 10, 2010, The Maui News.
- "Little Fire Ants spread across Big Island," January 28, 2010, The Maui News.
- "Teams make gain in little fire ant fight," February 12, 2010, The Maui News.
- "Kiaʻi Moku: New technology pivotal amid fight against invasive weeds" February 14, 2010, The Maui News.
- "OHA funds will help endangered seabirds," February 14, 2010, The Maui News.
- "TAT partnership at risk," February 21, 2010, The Maui News.
- "Invasive species talk topic," March 10, 2010, The Maui News.
- "Imported wasp saving the wiliwili," March 11, 2010, The Maui News.
- "Kiaʻi Moku: A most unwanted neighbor—coqui frogs," March 14, 2010, The Maui News.
- "Plant quarantine inspectors may get back on job," March 16, 2010, The Maui News.
- "Sacrifices needed from all—Mayor on budget," March 16, 2010, The Maui News.
- "State wins against gall wasp," March 27, 2010, The Maui News.
- "MISC official to speak to Rotary," April 4, 2010, The Maui News.
- "House kills coqui frog eradication bill," April 7, 2010, The Maui News.
- "Kiaʻi Moku: Imported wasp saving the wiliwili ," April 11, 2010, The Maui News.
- "Council confronts nonprofit cuts," April 11, 2010, The Maui News.
- "Kiaʻi Moku: Nothing wrong with eradication," May 9, 2010, The Maui News.
- "Tiny insect used in fight against nettle caterpillar," June 10, 2010, The Maui News.
- "Kiaʻi Moku: Maui naio could face threat from thrips," June 13, 2010, The Maui News.
- "Fire, water, and air," June 12, 2010, The Maui News.
- "Plant control plan comments sought," June 28, 2010, The Maui News.
- "Kiaʻi Moku: Biological enemy to stinging nettle caterpillar to be set free on Maui," July, 2010, The Maui News.
- "Wasps used to control pesky caterpillars," August 4, 2010, The Maui News.
- "Kiaʻi Moku: Noxious tumbleweed rolls on Maui," August 8, 2010, The Maui News.

- "Brown tree snake detection workshop offered," August 24, 2010, The Maui News.
- "Ulupalakua Cares set for Sept. 5," August 25, 2010, The Maui News.
- "Government partnership smells a rat and wants action," August 30, 2010, The Maui News.

OTHER MEDIA

- Interview about invasive species in *Ho'okele Wa'a: Turning the Canoe* Screened June 17, 2010, Maui Film Festival.
- Efforts to combat coqui in Maliko, June 29, 2010, Hawaii Public Radio.

Number of "hits" on invasive species web page:.

- Developed www.fireantfreemaui.org website in partnership with USGS-PBIN.

Number of education materials produced:

- 1,500 copies of the MISC newsletter on the findings of the 2009 International Miconia Conference. Approximately 750 have been distributed, of which 500 were mailed directly to funders, attendees, and the general public.
- 500 11"x17" LFA posters printed—150 distributed
- 2,500 LFA postcards for identifying and reporting small stinging ants-approximately 1,500 distributed.
- 1,044 LFA kits distributed (contains card, detection stick & instructions).
- 30 LFA posters to outfit all Maui buses.
- 500 revised / updated copies of the Maui County Early Detection Guide.

Little Fire Ant posters detailing the impacts, identification, and reporting of suspicious ants are on all Maui busses.

Little Fire Ant display at the Maui Swap Meet, we handed out 160 ant detection kits consisting of a card with identifying characteristics and instructions for baiting, material for baiting labeling, and reporting

Number of people reached through talks and displays:

- Audience for presentations: 356. Presentations to rotary clubs and community groups covered information about little fire ants, biological control, and impacts to the watershed and reef from invasive species.
- A display at the Kahului Airport featured hitchhiking pests: stinging nettle caterpillar, banana bunchy top virus, and the LFA.

- Community events: 2,655. Ten community events included the Maui County Fair, Maui County Agricultural Festival, East Maui Taro Festival, and Maui Swap Meet. MISC was present at events throughout the Island, from central Maui to Ulupalakua and Hana.
- MISC has become a regular participant in local parades and participated in three parades with total audience of approximately 5,000.

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

- Educational program reached 2,114 students through classroom visits by MISC staff. Schools throughout Maui County including Hāna, Lāna‘i, and Moloka‘i were visited.
- Classroom visits focused on little fire ants reached 754 students.
- Professional development workshops for public school teachers trained 15 teachers on use of the Hō‘ike o Haleakalā curriculum. To receive professional development credits, each teacher must teach 6 lessons from the curriculum.
- Continued development of a new module of the Hō‘ike o Haleakalā curriculum focused on invasive species.

MISC’s float for the 2010 Paniolo Parade featured an oversized coqui keeping a sleepy person awake.

Teachers participating in the Hō‘ike o Haleakalā professional development workshop watch an i‘iwi feed on an ‘ōh‘ia blossom

Students at St. Anthony grade school replicate the impacts of invasive species in the water shed.

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

- Volunteer activities varying in length from one day to one week had 224 participants.

Additional activities that also helped achieve HISC objectives:

- Three articles authored by MISC staff discussed the use of biocontrol for specific pests.
- Biocontrol messages were incorporated into presentations and outreach displays.
- Early Detection: Trained 234 individuals through Early Detection Workshops on invasive species in Maui County.

Moloka‘i / Maui Invasive Species Committee (MoMISC): Outreach: 2010 Highlights

MoMISC worked to educate public and private sectors about invasive species and helped to positively affect public perception and action on invasive species. Through outreach and education activities, MoMISC has become known in the community as an information center and rapid response agency. Creating a positive public perception has led to direct benefits, including persuading local landowners to allow removal of cherished landscape plants, such as the bo tree.

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, where feasible, was successful in getting several private and government projects to incorporate invasive species protocols in their projects. Several projects from residential to commercial buildings have incorporated some best management practices for invasive species as result of MoMISC’s recommendations. MoMISC is currently working with DOT and DLNR on invasive species mitigation for a proposed $5 million dollar harbor improvement project.

MoMISC Coordinator with Maui County Council Chair, Danny Mateo

Adoption of Codes of Conduct by businesses:
As a result of MoMISC’s rapid response to a recent introduction of coqui frog in a shipment of trees for sale at a local farm cooperative, MoMISC was able to convince the importer to incorporate “a code of conduct” to screen for and respond to shipments of live materials. 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:
A number of articles on the subject of invasive species have been reported by MoMISC in The Nature Conservancy’s “Nature’s Newsflash” and the Moloka‘i Dispatch.

Number of educational materials produced.
MoMISC provides updates and pest information to the community at the Young Brothers pier office and at public events. MoMISC has produced the following products, many of which can be downloaded off MoMISC’s website at www.momisc.org

- Over 40 MoMISC pest flyers, including new target species and other pest of concern.
- Several power point presentations for educational outreach for public and private groups.
- Invasive species workshop materials for Maui Community College’s botany class on Moloka‘i.

Number of people reached through talks and displays.

- In FY2010, MoMISC reached over 3,000 people through public and private displays and presentations. In partnership with the USDA's Plant Quarantine Officer, MoMISC maintains pest information at the Molokaʻi Airport, Molokaʻi post offices and several other locations island-wide. An invasive species display was created for the annual Earth Day event.

Number of invasive species educational programs and community events implemented by staff:
MoMISC staff attended several community meetings and events to maintain an awareness of community issues and to ensure a positive reputation for its work.

- Educational workshop for Maui Community College's botany class on Molokaʻi.
- Member of the Molokaʻi Earth Day planning committee; display for annual Molokaʻi Earth Day event.
- Booth at the 1st annual Molokaʻi Ag Fair where little fire ant and agricultural pest were featured.
- Invasive species workshop for Monsanto field crews focusing on identifying pests in the field.
- Participated with the Nā Pua Noʻeau Gifted and Talented Youth Program to teach youth leaders the importance of resource protection from invasive species.
- Hosted Steven Ogata from HDOA for a presentation on pesticide safety.

Outreach at 1st Annual Molokaʻi Ag Fair

Number of volunteers recruited and/or referred to invasive species projects.
MoMISC prioritizes its time in working 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 614 hours.

Additional activities that also helped achieve HISC objectives:
MoMISC staff remains flexible when called upon by the Molokaʻi community and partner agencies for help. MoMISC truly "fills the gap" in responding to pests that threaten Molokaʻi'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 Molokaʻi Land Trust is a new partner agency joining MoMISC.
- MoMISC established a relationship with the Hālawa Valley *kalo* growers and *kupuna* (elders).
- MoMISC joined the efforts of the Molokaʻi community in a newly formed ʻAha Kiole Advisory Council. The purpose of the Advisory Council is to provide community-based feedback to agencies on a range of community-based issues focusing on resource protection and management.

Students at Aka'ula School learning about little fire ants

OISC Outreach: 2010 Highlights

During the reporting period, OISC reached 1,333 people through talks and displays and had assistance from 54 volunteers. OISC did not have a full time outreach specialist on staff during the past year due to the inability to fund a full-time position. OISC split outreach activities among other staff and prioritized events and presentations to schools, volunteer events and presentations to priority audiences such as nurseries and gardeners. OISC was therefore able to maintain a presence in the community and communicate key invasive species messages to the public despite the loss of outreach staff.

HISC Public Outreach: Measures of Effectiveness

Agency adoption of rules and policies against invasive species:

- Worked with Kiewit Pacific employees to implement the invasive species specifications included in HDOT's North-South Road project.

Adoption of Codes of Conduct by businesses:

- OISC personnel visited retail nurseries and home improvement stores with information about coqui frog and pest hotline materials.

Track number of print and broadcast media mentions:

- Interview about invasive species and OISC, May 19th, 2010, Think Tech Hawai'i.
- Article about removing pampas grass from golf courses, May/June 2010, Landscape Hawai'i.

OISC volunteers hiking out to the worksite along the Lanipō trail.

Number of education materials produced:

- OISC re-vamped its display to sharpen its message at public events. The display aims to explain to the public the ecosystem effects of invasive species such as increasing brush fires and erosion. Previous displays were very species-specific; the current display teaches the public how invasive species can affect their everyday lives. The display also incorporates the HISC priority messages, especially "Protect Hawai'i" and "Report a Pest to 643-PEST (7378)".

Number of people reached through talks and displays:

- 1,333 people reached through talks and displays.
- OISC personnel staffed an educational display at 10 different events, including the Makahiki Maoli Festival, Agricultural Awareness Day in Waimānalo and the launch of the Million Trees of Aloha project.
- OISC personnel gave 12 presentations about invasive species topics to elementary school students, college classes and the North Shore chapter of the Outdoor Circle. The

presentation to the North Shore chapter of the Outdoor Circle specifically incorporated the "Don't plant a pest" priority message by introducing the Weed Risk Assessment to the group.

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

- OISC Outreach Specialist participated in annual watershed educational event at ʻAiea Intermediate School. OISC led a short hike and talked to students about watershed issues and invasive species.
- OISC participated in two talk story sessions organized by Hui o Koʻolaupoko—a nonprofit organization whose mission is to improve watershed health for the protection of ocean resources from Makapuʻu to Kualoa.

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

OISC recruits volunteers to accompany the field crew on invasive species surveys.

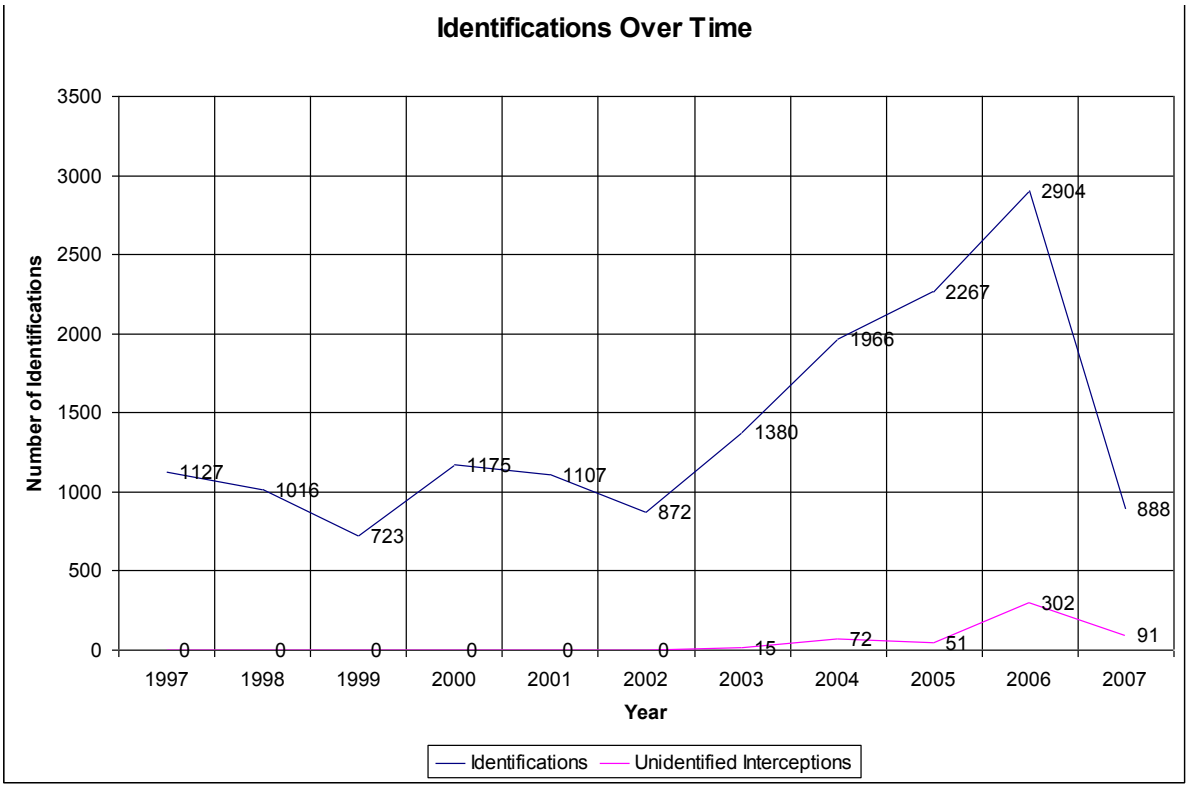
- During the reporting period, OISC had help surveying for and removing invasive species from 54 volunteers. Several of these volunteers regularly accompany the field crew on miconia surveys. In total, volunteers contributed 600 hours to OISC field operations.

OVERVIEW OF THE INVASIVE SPECIES PROBLEM IN HAWAII

The silent invasion of Hawaii by insects, disease organisms, snakes, weeds, and other pests is the single greatest threat to Hawaii's economy, natural environment, and to the health and lifestyle of Hawaii'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 Hawaii 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 Hawaii's future well-being.

Despite the efforts of state, federal, and private agencies, unwanted alien pests are still entering Hawaii at an alarming rate. In 1993, the Federal Office of Technology Assessment declared Hawaii's alien pest species problem the worst in the Nation. Hawaii's 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 Hawaii. More may be present in Hawaii 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 Hawaii.



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 for the last 10 years and more may be discovered. To prevent further introductions, more needs to be done to manage pathways, including building inspection and treatment infrastructure into Hawaii's ports, inspections and treatment of at risk goods, and research into risk abatement strategies.

Some Invasive Arthropod Pests Documented New to Hawaii (1997-2007)

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

More than 10,000 flowering plants have been introduced into Hawaii from the temperate or tropical zones of every major continent and about 1,215 have established wild populations in Hawaii. 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. A subset of 107 plant species is 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 Hawaii 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 (WRA) systems have been developed in recent years that allow us to predict which species are likely to cause problems.

At least 19 alien mammals are established in the wild in Hawaii. 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 Hawaii. 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 Hawaii in surprising numbers; they impact natural area values and the economy. Priority and urgency should be given to the eradication of incipient populations, 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 Hawaii. Avian influenza, dengue and West Nile Virus (WNV) are examples, all vectored by insects and animals.

Early Detection of Invasive Species

Past efforts to detect new invasive species as they are in the initial stages of establishing in Hawaii have been limited. 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.

Systematic island-wide surveys for new species that are carried out frequently enough to allow an effective response have been lacking especially for species other than those mentioned previously. The most comprehensive effort to resolve this gap has been to build on several limited-term projects that focused on identifying the locations and extent of populations of plants known to have been planted in Hawaii that have been identified by a WRA process to pose a threat to native ecosystems. These surveys covered specific areas once, specifically for vascular plants, creating a framework of agencies and data management that will ensure that they become incorporated as regular monitoring that is tied to an effective rapid response capability.

In 2006, early detection projects for new invasive plant species that may have been introduced via arboreta, nurseries or residential plantings were initiated on Oahu, the Big Island, and Kauai. 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. Lanai and Molokai have had complete roadside surveys in the past two years. The Big Island is currently conducting these surveys. 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. Early detection and roadside survey programs for plants have been implemented on all islands and work will continue to determine which species may become invasive and if they may be eradicable.

Future directions for this program will include; increasing taxonomic capacity to improve the identification of new species, creating a reporting system to link agencies and track the response to create better accountability, increasing the resources put toward surveying for insects, vertebrates and diseases, and increasing the training and preparedness for interagency response to newly established invasive species.

Prevention (Quarantine) Improvements to Reduce the Frequency of Harmful Introductions

Preventing invasive species introductions is considered a priority. At present, responsibilities for preventative measures fall on HDOA and USDA. There is a great value in preventing the introduction of a new invader, pest or disease because the cost of its impacts and management can be avoided. It is widely agreed that prevention is cheaper than controlling a given invasive species or living with its impacts. Typically the responsibility of prevention falls with government as specific authority is needed to regulate trade. This public effort is needed because the harmful effects and costs of an invasive species are borne by everyone even if the introduction of a species could be traced back to one individual or business. Individuals or businesses are unlikely to self regulate, due to a lack of awareness or an inability to predict the invasiveness of a species, and that the negative impacts of the species introduced by their actions may not affect them directly.

Improvements to the prevention systems in Hawaii provides the greatest opportunity to reduce number and frequency of invasive species introductions, as well as confining the impacts of established invasive species to one or a few islands instead of allowing them to spread statewide. Recent doubling in inspection staff at HDOA per the biosecurity effort first funded for $2,400,000 in 2006 should lead to improvements. The value of increased prevention is the avoidance of costs associated with the invaders should they arrive.

Control of Alien Species Affecting Native Forest Ecosystems

Widespread pest control 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.

From: Hawaii's Comprehensive Wildlife Conservation Strategy, October 1, 2005

Habitat Modifiers: Invasive Plants and Ungulate Grazers and Browsers

One of the major threats to Hawaii's native species and forests is the uncontrolled spread of many invasive non-native plants. These plants displace Hawaii'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 gymnorrhiza* 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 Hawaii 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, 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 Hawaii 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 Kauai 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, Oahu and Waikiki, Oahu 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 auropunctatus*). 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 Hawaii, 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 treesnake (*Boiga irregularis*) effectively caused the extinction of Guam's avifauna, it is expected that the successful establishment of predatory snakes in Hawaii 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 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 Hawaii 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.

Other diseases impact native wildlife. For example, avian botulism is the most prevalent disease in Hawaii for native waterbirds. The introduction of 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 fibropappiloma, 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 only two agencies with capacity in this area at present, with UH to a lesser extent. The building of biocontrol containment facilities is needed. Current facilities are inadequate to combat widespread species for which chemical and mechanical control is not cost effective. Biocontrol has high up-front costs because researchers must ascertain the agent's specificity and safety. However, the pest control is continuous once an agent is successfully established, and the method is cost effective, removes the need to use harmful pesticides.

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. Misconceptions that have been nearly impossible to dispel (i.e., that the mongoose and cane toad were introduced into Hawaii, with disastrous results, as part of biocontrol programs) offsets the very successful track record of biological control in Hawaii dating back to the reign of King David Kalakaua. A successful biological control program reduces or 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 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 Hawaii, 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. HISC has funded exploratory projects conducted by HDOA and UH. The second form of biocontrol, augmentative biocontrol, involves the collection and releasing for distribution, 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 Hawaii.

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.

Growing Awareness of the Need for Improved Inter-island Quarantine

Invasive species often arrive to one particular island in Hawaii 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 Oahu more than a year earlier. The pathway for this introduction was most likely from the interisland movement of goods from Oahu. 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 inter-island movement of vessels, vehicles and materials can be mitigated. Additional quarantine inspectors are needed to effectively screen the volume of inter-island 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 Hawaii‘s agricultural production, environment and human health.

Increased Threat of Brown Treesnake from Guam

Efforts in Guam to prevent the introduction of brown treesnakes to Hawaii and other islands were at risk when budget arrangements for paying the USDA inspectors‘ salaries fell through early in 2007. The problem was averted later in the year. However, recent activities to expand the military presence in Guam will also increase the threat of tranport of the brown treesnake. 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.

Coqui Frogs

The Puerto Rican tree frog, *Eleutherodactylus coqui,* has the potential to change native forest ecosystems. Population densities in some areas of Hawaii have been recorded to be as high as three times the density in Puerto Rico and 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. 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.

A coordinated approach to coqui frog management is outlined in the Hawaii's Coqui Frog Management, Research and Education Plan:
http://www.hawaiiinvasivespecies.org/hisc/pdfs/20071217coquiplandraft.pdf.

By far, the worst coqui frog problem is on the Big Island, but Maui has a long-established population in a limited area. HDOA, the Counties, and the ISCs work together to control populations on all islands and prevent interisland movement of frogs by treating goods that originate from the Big Island. Away from the Big Island, 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 Oahu using HISC research and technology funds, is useful for this purpose. Typically, HDOA and ISCs maintain close contact with nurseries to prevent establishment or export of frogs.

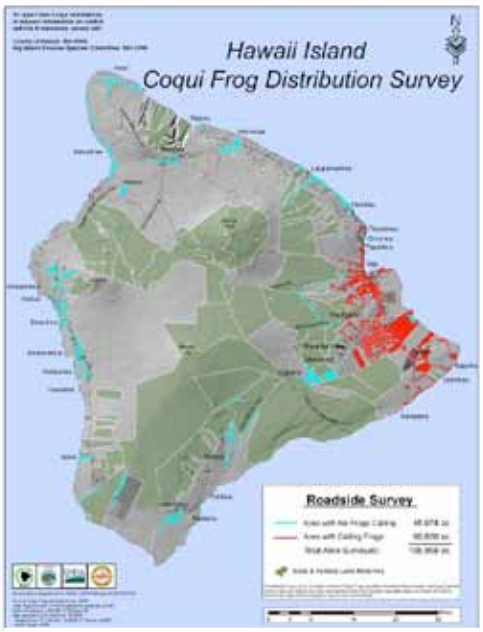
During the Legislative Session in 2008, Chapter 194, HRS, the law for HISC, was modified to include (underlined below) references to systematic management of coqui frogs on public lands near residential communities:

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 and Maui and prevents establishment on other islands. Clearly, with so much land on the Big Island infested, the efforts to control frogs are only practical in a limited number of sites.

The Big Island Coqui Control Program

The Puerto Rican treefrog, *Eleutherodactylus coqui*, was accidentally introduced to Hawai‘i sometime in the late 1980’s, likely through the plant trade industry. Hawai‘i and Maui were the first islands to become invaded, and therefore have the biggest and densest populations. In 2001, *E. coqui* was established as an agricultural pest by the Hawaii Board of Agriculture, and the 2006 Hawai‘i Session Laws Act 108, established HDOA’s authority to access a coqui-infested property after significant efforts have been made to contact the owner.



Road surveys were used to map out coqui infestations across the island.

It is acknowledged that the Big Island’s coqui infestation is too large (over 60,000 acres in 2009) to eradicate, however geographically isolated and high-value natural areas at higher elevations can still be kept coqui free. The Big Island Coqui Control Program targets such areas to stem the tide of coqui establishment, however recent budget shortfalls meant that the contracted coqui control crew could not be retained, and therefore, 11 months have gone by without significant coqui control efforts, allowing isolated coquies to become populations, and areas with a controlled population to expand.

Despite the lack of control work, the coqui program has made accomplishments in other areas. Due to loss of funding for other agency coqui programs (Hawai’i County and CTAHR), THE program made efforts to fill in the gaps by working with community groups to ensure closer bonds, giving community presentations, and developing a new brochure with information for the typical Hawaii resident.

Coqui Control Priorities

The Big Island Coqui Control Program was limited in man power this year. The contract agreement with the USDA/Wildlife Services (WS) to control coqui frogs expired in September 2009, and the Data/GIS Technician was let go in October, 2009. Despite the lack of manpower, the coqui control program was still able to treat 8.9 acres across the Big Island.

High-value natural areas: High-value natural areas, such as lands near *Drosophila mulli* critical habitat, were prioritized. To prevent the establishment of coqui Pu‘u Maka‘ala NAR, Ola‘a Forest Reserve, and Upper Waiakea Forest Reserve, was surveyed and treated (with citric acid or hand capture) whenever coquies were heard.

- A total of 340 man hours was spent controlling coqui in areas adjacent to *D. mulli* critical habitat treating a total of 7.53 acres, and an additional 138 hours were spent surveying these areas for new frogs.

High elevation areas: Coqui biology limits calling, and therefore mating, activities during cool and dry periods. This limitation makes it possible to deter coqui establishment in high-elevation areas where temperatures regularly dip below 60 degrees at night.

- High elevation areas include areas that are above 2,500 ft elevation. A total of 296 man hours were put into treating 3.3 acres, and an additional 190 hours surveying.

State Parks: People parked at coqui infested state parks have the ability to accidentally introduce coquies into uninfested areas. To minimize the chance of vectoring coqui, effort was made to treat the parking lot areas of state parks with citric acid solution.

Partnering With Other Agencies

Partnerships are integral to tackle large problems. This year, the coqui control program was without a large capacity sprayer but was able to borrow a 100 gallon sprayer from Hawaii County, and the USDA/WS donated two 400 gallon sprayers. The Coqui Control Program has partnered with county, federal and private agencies to meet the goals outlined in the State Management, Research, and Education Plan.

- Conducted a coqui frog working group meeting. With HDOA, UH professors, USDA, CTAHR, BIISC and community groups Malama o puna and Coquistadores in attendance.
- Some accidental arrivals of coquies to areas not infested by coqui can be traced to County owned transfer stations. Worked with the County of Hawaii to treat infestations at or near transfer stations.
- Worked with the Hawaii Volcanoes National Park to survey and treat coqui frogs in their area. Of main concern is an established population of coqui at the Kilauea Iki overlook.
- Shared information of current information, research, and maps with UH, Utah State University, USDA and graduate student researchers.

Surveying the small coqui population below the Kiliauea Iki overlook

- Worked with Kamehameha Schools, Wung's Ranch and other private land owners to gain access to treat coqui in sensitive areas.

Community Support and Outreach

A single agency cannot control the coqui problem island wide. Because of the large infestation on the Big Island, the Coqui Control Program has been working closely with community groups

to help eradicate or control coqui in their areas. Attending community meetings, speaking with representatives from each group, and updating them on new information is important to ensure extended hands are kept grasped.

- Enlisted help from Malama O Puna, Volcano Coquistadores, Hamakua Individuals Joining Against Coqui (HIJAC), Kohala Coqui Coalition, and the Honaunau Ke'ei Coqui Watch to help update the new Coqui Frog Working Group's "Coqui Control for Hawaii Island Residents" Brochure.
- Worked with O Ka'u Kakou to develop a response team to their emergent coqui outbreaks.
- Answered coqui hotline calls and questions, and networked callers to the proper agency.

Other Activities:

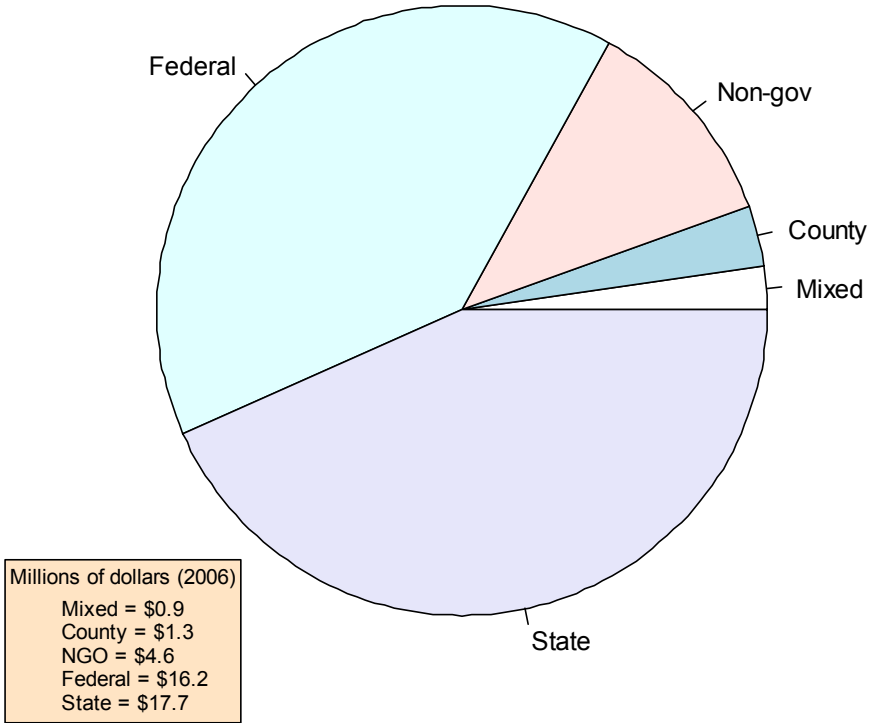
Developed "Coqui Control for Hawaii Island Residents" Brochure- The previous brochure was developed by CTAHR in cooperation with the Coqui Frog Working Group in 2006. A lot of coqui related programs and information has since changed and an update was overdue. The new brochure highlights what a resident of Hawaii can do to prevent the introduction and spread of coqui and how to control a coqui infestation if they become established. It contains information on how the coqui affects the environment and also connects the public with community groups and government agencies that can help them.

Updated the Statewide Coqui Management, Research and Education Plan- The State Coqui Management, Research and Education Plan was first drafted in 2007 as a means to collectively summarize the ongoing research and status of the coqui invasion, and outline management options statewide. This document is updated every year using information gathered from each ISC on their respective islands.

Emergency response fund: $3 million

FUNDING SOURCES FOR INVASIVE SPECIES MANAGEMENT IN HAWAII

There has not been a resurvey of spending by Hawaii agencies involved in invasive species since 2008. Results of that survey are reported in detail in the 2009 legislative report. In that report, spending on government-supported invasive species management projects in Hawaii 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 that source is generally state and/or federal sources. Little change in the relative sources of funding is likely since 2006.



MONEY SPENT ON INVASIVE SPECIES MANAGEMENT IN HAWAII

As shown in the 2007 report, 2006 spending on invasive species management in Hawaii was $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).

Organizational and Resource Shortfalls

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 Hawaii. The same study cited that in addition to current expenditures, an additional $50 million is needed to deal with principal threats to Hawaii's economy, natural environment and people's health and lifestyle. The 2008 legislative report identified about $40.8 million of mainly state and federal funds spent in Hawaii on invasive species in 2006.

Hawaii 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 Hawaii in a comprehensive and consistent manner.

The Resources Working Group was charged with identifying organizational and resource shortfalls in the area of invasive species management (Section 194-2, HRS). In 2008 a survey was carried out by 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 support effective enforcement action to prevent the arrival, establishment and spread of invasive species;
• Comprehensive prevention and detection measures for both terrestrial and marine invaders not yet present in Hawaii;
• Better small mammal control to protect native birds;

- Better pig and ungulate control in high value native forest areas;
- Biocontrol for widespread pests;
- More control methods to address newly naturalizing pests already present in Hawaii; and,
- Public support.

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

	Millions of dollars	
Resource shortfalls for invasive species management in Hawaii	**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 Treesnake	$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

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, rapid response, and continuous political and financial support to complete the job. Follow-up efforts are also 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, invasive species work often 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.

Modern Biosecurity System

Many invasive species that are not yet present in Hawaii pose a serious threat should they arrive and become established. Species, such as the red imported fire ant, brown treesnake, WNV, avian influenza, and many others, have the potential to seriously impact the economy, natural environment, and the health and lifestyle of Hawaii'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. 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 Hawaii 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. 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 on all islands over 6 years: $54 million
Operating: $3-4 million annually
Research: $1-3 million annually

Rodent and Predator Control to Protect Native Biodiversity

Offshore islets

Offshore uninhabited islets are excellent refuges from invasive species that plague the large islands. 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 eight additional federal species of concern are present. The islets are home to large numbers of endemic (species found only in Hawaii) 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 eradicable from offshore islands. After removal of rats from Mokoli`i Islet (Chinaman's Hat) on Oahu, nesting wedge-tailed shearwater came back from 0 birds to over 200 in one season. Native plants and seeds also rebounded, and even shoreline marine species become more abundant. Compared to the larger, 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 Molokai, 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. Continued monitoring of Mokapu show that the eradication was a success.

At the end of 2008 efforts to restore Lehua Island off of Niihau were implemented. HISC outreach staff helped to involve the community in that effort. Outreach related to subsequent terrestrial and aquatic species monitoring continue. Recent monitoring of Lehua turned up evidence of rats. Research is being done to determine if these rats are new introductions or remnants of the population in place prior to the eradication 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 (MHIs)

Offshore islets invasive species removal: $10 million
Kahoolawe invasive species removal and restoration: $10.5 million

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. 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 Oahu 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.

Predator control: $4 million annually
Proof-of-concept predator-proof fences: $2.4 million

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.". 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

Biocontrol

The USDA-Forest Service and HDOA are the only two agencies with capacity in this area at present and, 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 may precludes the need for pesticides while reducing the impact of widespread invasive species.

New facility: $10 million

Research/Operating costs: $3.1 million annually

WNV

HISC funded DOH to undertake early detection work for WNV for the 5 years. WNV has yet to arrive in Hawaii, but it could arrive and it has the potential to infect people and devastate bird fauna. 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 Hawaii from invasive species. However, a concerted effort to eradicate the disease will be needed wherever the disease might be detected. Because Hawaii is 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 in need of funding 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 Hawaii 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

ISCs

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. 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 fieldwork 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 change in with current budget restrictions.

Invasive Species Committee needs: $3.2 million annually

Brown Treesnake

The shift of a military base from Okinawa to Guam has increased the risk of introducing brown treesnakes to Hawaii. Complete inspections are needed in Guam and Hawaii to ensure the brown treesnake is not accidentally introduced to Hawaii, and this again underscores the need for new joint inspection facilities at ports.

Brown treesnake interdiction in Hawaii: $10 million

State of Hawaii DOT - Statewide Noxious/Invasive Plant Program (SNIPP)

SNIPP is a statewide effort to maintain and control noxious/invasive plant species at a manageable level along Hawaii'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

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

Emergency Response Fund

WNV, avian influenza, red imported fire ant, and brown treesnake, 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 Hawaii. In the case of red imported fire ant and brown treesnake the costs to Hawaii, should those species establish, have been estimated in the hundreds of millions of dollars in direct and indirect costs.

HISC 2009-2010 Fiscal Year Budget

The invasive species budget initiative calls for the expenditure of $2 million in state special funds for FY10 to provide support for both the operations of HISC and its cooperating partners to develop and implement a partnership of federal, state, county, and private entities for a comprehensive state-wide invasive species prevention, detection and control program. This amounts to a 50% reduction in funding from FY09 which had been funded at $3 million in state special funds and $1 million in general funds.

Although this budget is under DLNR, it includes and involves programs and projects through multiple departments, the four counties and federal and private partners. HISC funding in previous years was targeted to support the development of innovative approaches that address gaps in capacity and build new cooperative programs. The long term goal of this funding continues to be the integration of successful new programs that better protect Hawaii from invasive species into agency operations. Given the current economic climate, however, and pending reductions in force of inspectors at HDOA, the 2010 fiscal year budget was allocated with the inclusion of funding to maintain inspectors of the HDOA who provide the first line of defense in protecting Hawaii's environment, economy, and way of life.

This budget was developed under the direction of the DBEDT-chaired Resources Working Group. Projects were proposed in public meetings of all of the working groups and selected for consideration. The Resources Working Group then met with working group chairs in a public meeting on September 17, 2009, to allocate funds to the program areas based on the project requests.

The overall goals of the HISC budget are to:

- Advise the Governor and Legislature on budgetary/other issues regarding invasive species.
- 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.
- Educate the public and private sector about invasive species to positively affect perception, action and funding for control and prevention.
- Review risks of pest/invasive species entry into the State; and implement measures and improve Hawaii's capacity to prevent the entry of new pests/invasive species with shared resources and shared responsibilities of all agencies.
- Review priorities for the control of pests already present or recently arrived in the state; and implement cost-effective eradication and control programs against incipient and established pests with shared resources and shared responsibilities among private, not-for-profit, county, state and federal agencies.

The State funding is broken into four integrated programs, as well as a separate administrative budget. The Resources Working Group, the group tasked with balancing the HISC budget, agreed upon the following budget broken-out by program:

	Recommended Funding	% of ($2M)
Prevention	$740,000	37.0%
Response & Control	$820,000	41.0%
Research & Technology*	$0	0.0%
Outreach	$130,000	6.5%
HISC Support	$310,000	15.5%
Total HISC Funding	$2,000,000	

*The funding for Research and Technology was reduced to $0 in order maintain staff in the other components. Future restoration of Research and Technology funding was recommended even under continuing budget restrictions.

The working group chairs received more than $3 million in proposals. The majority of the projects proposed were already requesting conservative amounts given the reduced funding. Given the needs of HDOA, however, budgets in Response and Control, Public Outreach, and Research and Technology were significantly reduced.

This budget request was aligned with both the HISC Strategic Plan and the HISC working group structures to assure not only compatibility with existing efforts but also accountability with specific measures of effectiveness. Lead HISC members administered program components and HISC working groups and assured funding addressed priority statewide issues and fit into HISC member and cooperating partner operational programs.

On September 18, 2009, HISC approved the proposed FY10 budget allocation as presented above and summarized below to implement the State of Hawaii's Strategy for Invasive Species Prevention, Control, Research, and Public Outreach.

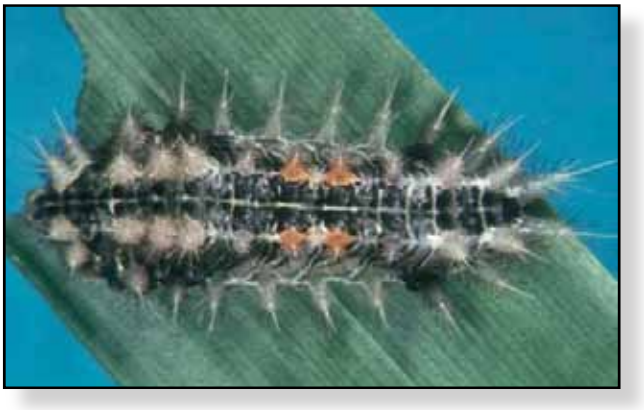
HISC 2009-2010 Fiscal Year Budget

Budget Item	**S-10-314-522**
PREVENTION	
Weed Risk Assessment	$60,000
Ant coordinator	$40,000
Ballast Water and Hull Fouling Program	$40,000
West Nile Virus	$0
HDOA Inspectors	$600,000
Total Prevention	**$740,000**
RESPONSE AND CONTROL	
BIISC	$100,000
MISC & MoMISC	$200,000
OISC	$190,000
KISC	$90,000
HDOA Biocontrol	$0
AIS	$240,000
Total Response & Control	**$820,000**
RESEARCH AND TECHNOLOGY	
Total R&T	**$0**
OUTREACH	
Staff	$115,000
Materials & Travel	$15,000
Total Outreach	**$130,000**
HISC SUPPORT	
DOFAW Overhead (3%)	$60,000
Central Services Fee (7% of 2 M)	$140,000
Support Staff	$110,000
Total HISC Support	**$310,000**
	$2,000,000

Distribution of HISC funds fiscal years 2005-2010

Fiscal Years	*2006*		*2007*		*2008*		*2009*		*2010*	
Working Groups	**Allocated**	**% funds**	**Allocated**	**% funds**	**Allocated**	**% funds**	**Allocated**	**% funds**	**Allocated**	**% funds**
Prevention Subtotal	$1,516,535	38%	$410,000	21%	$736,400	18%	$573,400	14%	$740,000	37%
DOA	$755,000		$0		$0		$84,200		$640,000	
DOH	$455,135		$350,000		$375,000		$307,300		$0	
USDA/APHIS/WS	$186,000		$0		$0		$0		$0	
(DLNR)	$120,400		$60,000		$331,400		$181,900		$100,000	
Pacific Island Learning Network	$0		$0		$30,000		$0		$0	
Established Pests Subtotal	$1,560,000	39%	$1,115,000	56%	$1,754,500	44%	$2,092,700	52%	$820,000	41.00%
Aquatic Invasives (DLNR)	$300,000		$315,000		$395,000		$411,400		$240,000	
DOA	$0		$0		$0		$65,000		$0	
Invasive Species Committees	$1,260,000		$800,000		$1,359,500		$1,616,300		$580,000	
Research & Technology Subtotal	$600,000	15%	$0	0%	$700,000	18%	$500,000	13%	$0	0.00%
Research & Tech. Grants	$600,000		$0		$700,000		$330,000		$0	
Bishop Museum	$0		$0		$0		$160,000		$0	
USDA/DOA	$0		$0		$0		$10,000		$0	
Public Outreach Subtotal	$248,465	6%	$230,000	12%	$312,000	8%	$312,200	8%	$130,000	7%
Staff & Admin. (DLNR)	$135,465		$230,000		$262,000		$210,000		$115,000	
Outreach Projects (DLNR)	$113,000		$0		$50,000		$102,200		$15,000	
Administration, Restrictions, Central Services Fee	$75,000	2%	$245,000	12%	$497,100	12%	$521,700	13%	$310,000	15.50%
TOTAL	$4,000,000	100%	$2,000,000	100%	$4,000,000	100%	$4,000,000		$2,000,000	

HAWAIʻI INVASIVE SPECIES COUNCIL
Strategy 2008-2013



The stinging nettle caterpillar, Darna pallivitta*, packs a painful sting when it comes in contact with the skin. More serious symptoms may occur In some cases. Infestations impact local nurseries as this invasive species defoliates ornamental nursery stock and has been found feeding on more than 45 species of plants, including palm and coffee. HISC and the Dept. of Agriculture ask the public and nurseries to report sightings of this invasive species to the state's Pest Hotline at 643-PEST (643-7378).*
—photo courtesy HDOA

Prepared by the Hawaiʻi Invasive Species Council

June 2008

HAWAI'I INVASIVE SPECIES COUNCIL

Strategy 2008-2013

The Hawai'i Invasive Species Council (the Council or 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 Hawaii] and for preventing the introduction of other invasive species that may be potentially harmful **HRS 194-2 (a).**

For administrative purposes the Council, or HISC, was placed within the State of Hawai'i Department of Land and Natural Resources. The HISC's purpose and other duties are outlined in statute and are to be achieved via an interagency Council whose voting members include the chairpersons of the Department of Agriculture (HDOA), and the Department of Land and Natural Resources (DLNR). Voting members include the directors of the Departments of Health (DOH); Business, Economic Development and Tourism (DBEDT); Transportation (DOT); and the president of the University of Hawai'i (UH).

Ex-officio members include four state senators and four representatives. Invited participants include non-profits, mayors from each county, and members of federal agencies, including USDA, DOI and DOD. HISC meetings are to take place no less than twice a year HRS 194-2 (d).

The Council oversees and supports the implementation of this strategic plan. It preferentially supports new and innovative projects, and those that target gaps in capacity, rather than the simple augmentation of existing invasive species management capacity. The Council may choose to make recommendations about organizational and resource shortfalls and the need to augment existing capacity.

The red imported fire ant, Solenopsis invicta*, sets siege on any creature in its path with a powerful burning sting that gives this invasive species its name. Omnivorous, it also attacks plants, feeding on young saplings, seeds, buds and fruit. This invasive species will probably find its way to Hawai'i via shipped cargo from California, according to a study by Hawai'i researchers.*
—artwork courtesy of Hawaiian Ecosystems at Risk

Following its legal mandate an interim strategic plan was approved by the Council in 2003. It was to guide the HISC toward meeting its responsibilities.

This document updates the previously approved interim plan (2003), emphasizes legal mandates in HRS 194, and draws on changes made by the working groups.

It reprioritizes work areas based on work already accomplished and seeks to address current issues, highlighting the connection among priorities for Prevention, Response and Control, Research and Technology, and Outreach.

For each of these priorities a working group has been formed and has been more or less active since 2004. Working groups are guided by the Council and inform it of current issues and concerns, set budgets, plan projects and make recommendations with the aim of improving invasive species management. The HISC accomplishes this via public meetings that meet Sunshine Law requirements. Working groups also follow a similar format.

The implementation of projects funded by the Council are carried out by member agencies that may, via agreement, work with collaborators in the public and private sectors.

How to get an issue considered by the Council or its Working Groups

Working group chairs and other members may make recommendations to the Council via submittals, but the inclusion of these items in the Council's agenda requires approval of the co-chairs.

The submittal should be in the form of a concise letter addressed to the HISC, and contain a subject, background, justification and recommendations.

Anyone attending a working group meeting, be they member agency staff, collaborators or the public, may suggest issues for consideration by the Council. Whether the working group chair presents this to the Council via a submittal will depend on the working group reaching agreement and approval of the submittal by the HISC co-chairs.

Anyone may present their ideas, express their concerns or give their support to the Council under the public comment section of the HISC agenda.

Investing to protect Hawai'i from invasive species: budget planning process guidelines

Increasing capacity and innovation in all project areas in accordance with the strategy

The Council and its working groups will oversee and support the implementation of this strategic plan. It will preferentially support innovative projects and those that target gaps in capacity, rather than the simple augmentation of existing invasive species management capacity.

The breakdown of the budget between the Council's four program areas, including Prevention, Response and Control, Research and Technology, and Outreach, is flexible in so far as it allows the goals of the strategic plan to be met in the most effective manner. Unless circumstances demand an exception it is expected that some funds will be directed toward priority projects in each of the main program areas. Exceptions might include outbreaks of new invasive species, or large changes in the budget allocated by the legislature for HISC invasive species efforts.

The transition from HISC funds

The longterm goal is that successful innovative projects will eventually be adopted by lead agencies within their budgets. This was demonstrated by the Department of Agriculture's biosecurity initiative which was initially supported via HISC funds and later was adopted and directly funded by the legislature.

The budget setting process

1. The HISC will meet and working group chairs will present current issues and past successes for consideration. The Council will give guidance to the working groups in regards to operational priorities for the year. (Late in second quarter of state fiscal year)

2. All working group chairs work with members to solicit project proposals, and to schedule a meeting to consider the proposals of agencies, collaborators and the public. (Third quarter of state fiscal year)

3. Working group chairs make prioritized budget recommendations with alternatives to the Resources Working Group and the chairs of all the working groups attend the meeting to work out overall priorities and balance the budget. In this context the Resources Working Group will carefully consider the impact of funding one area of work or project over another, especially if redirecting funds will cause capacity losses or previously supported work to become untenable. (Fourth quarter of state fiscal year)

4. The chair of the Resources Working Group presents the budget recommendation to the HISC and the Council reviews and approves the budget. (First month of fiscal year or first month after budget is set)

Conventions used in this document

The use of italics for bulleted points under goals means that the particular goal is mandated in HRS 194, the law that describes HISC duties.

Boxes that surround text indicate areas that are of particular high priority, though changing circumstances could make other goals more important.

Hawai'i Invasive Species Council

Voting members: DLNR, HDOA, DOH, DBEDT, DOH, UH
Non-voting members: One Representative and one Senator from each County
Invited: Federal agencies, Non-government organizations, Counties

Hawai'i Invasive Species Council Goals: 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.

- *Maintain a broad overview of the invasive species problem in the State* HRS 194-2 (a) (1).
- Provide support and direction to HISC working groups.
- *Advise the governor and legislature on budgetary and other issues regarding invasive species* HRS 194-2 (a) (10).
- *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* HRS 194-2 (a) (13).
- Provide annual reports on budgetary and other related issues to the legislature twenty days prior to each regular session.
- *Identify and prioritize each lead agency's organizational and resource shortfalls with respect to invasive species* HRS 194-2 (a) (3).
- *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* HRS 194-2 (a) (4).
- *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* HRS 194-2 (a) (7).
- Develop a comprehensive and timely invasive species listing process for use by all state agencies.
- *May adopt rules pursuant to chapter* 194-7.

HISC
Measures of Effectiveness

- Advice and recommendations to governor or legislature.
- Reports to the legislature regarding invasive species.
- Approval of annual budget.
- Meeting reports (including working groups).
- Attendance at meetings of member and collaborating agencies.
- Agency adoption of innovative projects, rules and policies against invasive species.
- Number of new invasive species detected at ports of entry.
- Names and numbers of priority pests threatening Hawai'i.
- Working group goals achieved.
- Results from a public awareness survey.

Resources

(Chair of working group: DBEDT)
(Participating HISC members: DLNR, DOA, DOT, DOH, UH, Counties)

Resources Goals: (1) Determine levels of resources spent on invasive species (2) Determine resource needs statewide (3) Seek public and private sector funding for invasive species management and control programs to support priority programs; and (4) Share knowledge and expertise.

HISC Resources Working Group Tasks

- Annually *identify all state, federal and other monies expended for the purposes of managing the invasive species problem in the State* HRS 194-2 (a) 8.
- Promote the transition of projects from HISC to agency funds.
- Identify all county, state, federal and private funds *available to fight invasive species and advise and assist state departments to acquire these funds* HRS 194-2 (a) 9.
- Develop dedicated funding sources for invasive species prevention and control programs (e.g., Island Invasive Species Committees, biocontrol).
- Every five years, or prior to a revision of this plan, *identify and prioritize each lead agency's organizational and resource shortfalls with respect to invasive species* HRS 194-2 (a) (3).
- Together with the chairs of the other working groups, review their budget proposals and recommend a balanced budget to the Council.
- *Support county-sponsored activities to address invasive species* HRS 194-2 (a) (12).

Resources
Measures of Effectiveness

- Reports to the legislature regarding invasive species spending and resource shortfalls.
- Approval of annual budget for recommendation to the Council.
- Attendance at meetings of member and collaborating agencies.
- Agency adoption of innovative projects initiated through HISC.

The coqui frog (Eleutherodactylus coqui) *infests residential communities, resorts, nurseries, parks and lowland forest habitats throughout Hawai'i.* —*photo by Hans Sin*

Prevention

Chair of working group: DOA
(Participating HISC members: DLNR, DOT, DOH, UH, DCCA, DOD, Counties)

Goals: (1) Review risks of pest/invasive species entry into the State; and (2) 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.

Preventing the introduction of alien invasive species is the cheapest, most effective and most preferred option and is a high priority.

Prevention Objectives

- 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.
- Identify terrestrial and aquatic species that are at high risk of being introduced to the State or being spread within the State.
- Minimize aquatic invasive species introductions focusing on the highest risk pathways, e.g., hull fouling.
- Put in place legal controls and a risk assessment system for intentional introductions. These should only take place with authorization from the relevant agency or authority. Authorization should require comprehensive evaluations based on economic, human health, standard of living and biodiversity considerations (ecosystem, species, genome).
- *Review the structure of fines and penalties to ensure maximum deterrence for invasive species-related crimes* HRS 194-2 (a) (14).
- *Support county-sponsored activities to address invasive species* HRS 194-2 (a) (12).
- *Incorporate and expand upon the Department of Agriculture's Weed Risk Assessment protocol to the extent appropriate for the Council's invasive species prevention, control and eradication efforts* HRS 194-2 (a) (16).
- Develop collaborative industry guidelines and codes of conduct, which minimize or eliminate unintentional introductions.
- 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.
- *Coordinate and promote the State's position with respect to federal issues, including:*
  - *Quarantine preemption;*
  - *International trade agreements that ignore the problem of invasive species in Hawai‘i;*
  - *First class mail inspection prohibition;*
  - *Whether quarantine of domestic pests arriving from the mainland should be provided by the federal government;*
  - *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 Hawai‘i laws;*
  - *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.*

Prevention
Measures of Effectiveness

- Number of new invasive species detected at ports of entry.
- Current measures in place to prevent invasive species arrival and establishment.
- Names and numbers of priority pests threatening Hawai‘i.
- Current status of priority pests for which there is an established prevention program.

Response and Control
Established Pests

Chair of working group: DLNR
(Participating HISC members: DOA, DOT, DOH, DHHL, DOD, Counties)

Goals: (1) Review priorities for the control of pests already present or recently arrived in the state; (2) implement cost effective eradication and control programs against incipient and established pests with shared resources and shared responsibilities of all agencies.

Where it is achievable, eradication is the best management option for dealing with alien invasive species when prevention has failed. It is much more cost effective financially than ongoing control, and better for the environment. Technological improvements are increasing the number of situations where eradication is possible, especially on islands. One of the most important improvements has been in "Early Detection." This means that we consistently and systematically survey for newly establishing species, identify these species correctly and use mapping and data management to identify where all known individuals are located. Successful eradication is only possible with support from early detection that includes taxonomic experts, agency and public awareness and documentation to ensure accountability.

Response & Control Established Pests Objectives:

- Implement improvements to capacity for detection, eradication and control, e.g., increased staffing, training and infrastructure to respond to both terrestrial and aquatic invasive species.
- Detect and immediately target high priority invasive species that are candidates for eradication in all or part of their range, e.g., coqui frogs on O'ahu and Kaua'i.
- *Include and coordinate with the counties to increase resources and funding and to address county-sponsored activities that involve invasive species* HRS 194-2 (12), e.g., the county-based invasive species committees, mayors' offices.
- Eliminate known invasive plant species from public projects and contracts.
- *For those species that do arrive in Hawai'i, identify and record all introduced and invasive species present in the State* HRS 194-2 (a) (6).
- Develop and implement a decision-making protocol for targeting species for eradication and or control efforts.
- Review and update DLNR's injurious wildlife list and DOA's Noxious Weed List as needed in a timely manner.
- *Identify and prioritize each lead agency's organizational and resource shortfalls with respect to invasive species* HRS 194-2 (a) (3).
- Determine what species are invasive to trigger access provisions onto private lands.
- Review and revise regulations governing the introduction of biological control agents.
- Support development of management plans for widespread vertebrate pests.
- Develop capacity on each island to conduct effective coordinated rapid response to all snake sightings.
- Establish clear agency responsibilities and criteria for rapid response activities to ensure coordinated efforts.
- *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* HRS 194-2 (a) (4).

Response and Control
Measures of Effectiveness

- Number of species detected and evaluated for feasibility of eradication.
- Number and area of priority invasive species eradicated and/or controlled.
- Prioritization processes identified and in place.
- Implementation of the priority response and control actions of the Aquatic Invasive Species, West Nile Virus, coqui frog, and red imported fire ant plans.
- Number and names of species, habitats, ecosystems, agricultural, and managed areas protected because of control efforts.

Research and Technology

Chair of working group: UH
(Participating HISC members: DOA, DOT, DOH, DLNR, DBEDT)

If funds are available the working group will oversee a request for proposals (RFP) process to achieve the goals outlined in this document. This strategic plan indicates the types of research that are likely to be supported. The working group may make recommendations about specific projects that may be implemented by member agencies or outside providers, as well as provide scientific advice to the Council to address current issues.

Research and Technology Goals: 1) Encourage researchers to address the problems created by invasive species. 2) Encourage the development and implementation of new technology to prevent or control the establishment of invasive species. 3) Develop effective, science-based management approaches to control invasive species. 4) Effectively communicate and apply the results of research to the field. 5) Promote interagency collaboration and stimulate new partnerships.

The Research and Applied Technology Working Group will work with HISC support staff to oversee the RFP process and ensure that research and technology development will contribute to the effective management of invasive species in Hawai‘i. Support will be given to:

- The development and implementation of new and transferable technology (chemical, mechanical, biological) for large-scale treatment of priority invasive species (e.g., marine invasive algae, coqui frogs, ants, etc).
- Expanding off-site exploration and screening for high impact biocontrol agents targeting established invasive species (e.g. Miconia) already present in the State.
- Projects containing plans to effectively share with stakeholders any useful information, methods and practical tools that would assist in the management of invasive species in Hawai‘i.
- Increasing the knowledge base of target organisms and gaining an understanding of the economic impacts of invasive species, as well as the effectiveness of geographical information system tools and associated database management.
- Developing new tools for effective early detection and monitoring of terrestrial and aquatic invasive species.
- Providing taxonomic services for identification of terrestrial and aquatic invasive species in a timely manner.
- The implementation of assessment protocols not only for determining risks of introduction via various pathways but also for determining the invasiveness of taxa (screening) in conjunction with supporting and encouraging efforts to enforce or obtain voluntary compliance from local industry groups, government agencies and the public where necessary.
- Developing technology with the shipping industry for on-board treatment of ballast water and surface treatment to minimize hull fouling.
- Determination of the ecosystem impacts of invaders and restoration following removal of invaders.
- Addressing emerging and current issues (e.g., biofuels, outbreaks of new species, coqui frog management).
- Innovative projects unlikely to get funds from other sources.
- Projects that emphasize open interaction and communication with stakeholders throughout implementation.
- Projects that effectively leverage other non-HISC resources.

Research and Applied Technology
Measures of Effectiveness

It is important that proposals include measures of effectiveness so that the reviewers can judge the likelihood of project success. Outcomes or anticipated impacts of the research must be addressed. Some examples of measures of effectiveness are suggested:

- Number of new technologies developed and adopted for invasive species management.
- Number of biological control agents tested and introduced, as well as the effectiveness of control they provide.
- New technology developed for prevention and control of invasive marine species.
- Number of taxa screened using standardized science-based risk assessment systems.

Public Outreach

Chair of working group: DOT
(Participating HISC members: DLNR, DOH, DOA, UH, DCCA, DHHL, Counties)

Public Outreach Goal: Educate the public and private sector about invasive species to positively affect perception, action and funding for control and prevention.

Outreach Objectives:

- Foster awareness and concern in the general public about invasive species.
- Increase public and private support.
- Seek measurable changes in behavior.

Promote the following one sentence messages to the public:

- Protect Hawai‘i.
- Report a Pest to 643-PEST (7378).
- Don’t Dump Aquarium Pets or Plants.
- Don’t Plant a Pest.
- Don’t Pack a Pest.
- Report Dead Birds to 211.
- Don’t Sell or Buy a Pest.
- Keep Pets Contained.
- Buy Local.
- Plant Native Species (promote the value of biodiversity).

Priority Audiences include:

- Decision makers with the authority and means to offer support and/or enact regulations.
- Special Interest Groups that play an important role in introducing, promoting, or observing invasive species, e.g., transportation agencies and companies, plant and landscape trades.
- Students, who are the next generation of decision makers.
- The General Public, in order to raise awareness of, and concern for, invasive species issues.

Rats, Hawai‘i’s first invasive species, spread human diseases and ravage native plants and animals on even the most remote ecosystems in Hawai‘i. Offshore islands, many of them Hawai‘i State Seabird Sanctuaries, host thousands of magnificent seabirds. Rats attack nesting seabirds, their eggs and their fledglings, and feed on young plants and on seeds of rare and vulnerable native plants. Outreach efforts attempt to educate the public concerning eradication efforts. —photo by Jack Jeffrey

Outreach
Measures of Effectiveness

- Agency adoption of rules and policies against invasive species.
- Adoption of Codes of Conduct by businesses.
- Track number of print and broadcast media mentions.
- Number of “hits” on invasive species web page.
- Number of callers on pest hotline.
- Number of education materials produced.
- Number of people reached through talks and displays.
- Results from a public awareness survey.
- Number of invasive species educational programs and community events implemented by staff.
- Number of volunteers recruited and/or referred to invasive species projects.

Hawai'i Invasive Species Council
Support

DLNR may assign staff to administer the council's budget, its programmed activities and coordinate interagency meetings. The administering agency has to play an important role in the implementation of this strategy and the coordination of activities.

Hawai'i Invasive Species Council Support Goal: Provide administrative and technical support for the Hawai'i Invasive Species Council and its working groups.

HISC Support Objectives and Timeframe:

The multimillion dollar honey, queen bee and pollination industry in Hawai'i is threatened by the varroa mite. Approximately 99.5% of all monies generated by Hawai'i bees takes place on the Big Island and its approximately 8,000 hives. In early April 2007, an O'ahu beekeeper reported the first infestation in the state. On August 22, 2008, trapping surveillance detected varroa mites near Hilo Bay.
—photo courtesy HDOA

- *Advise, consult and coordinate invasive species-related efforts with and among the departments of agriculture, land and natural resources, health, transportation, University of Hawai'i, and other state, federal and private entities* HRS 194-2 (a) (2).
- Coordinate efforts and issues with the Federal Invasive Species Council, the National Invasive Species Management Plan, the Hawai'i Aquatic Invasive Species Advisory Council, Alien Aquatic Organism Task Force and any new proposed federal legislation.
- *Coordinate with the Counties in the fight against invasive species and support county-sponsored activities that involve invasive species* HRS 194-2 (a) (12).
- Develop a web-based mapping and communication system for partnership programs and agencies that will provide information on the distribution, on-going control work, and status of key invasive species.
- Support the Resources Working Group in its efforts to identify all federal and private funds available to the State to fight invasive species and advise and assist state departments to acquire these funds.
- Designate invasive vertebrate pests.
- *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* HRS 194-2 (a) (13).
- *Review the structure of fines and penalties to ensure maximum deterrence for invasive species-related crimes* HRS 194-2 (a) (14) *and suggest appropriate legislation to improve the State's administration of invasive species programs and policies* HRS 194-2 (a) (15).
- *Provide annual reports on budgetary and other related issues to the legislature twenty days prior to each regular session* HRS 194 (a) (11).

HISC Support
Measures of Effectiveness

- Active involvement of state agencies with the HISC.
- Reports in support of HISC objectives.
- Numbers of entities participating in HISC working groups.
- Successful administration of all HISC monies.
- Increased non-state funds for invasive species programs in Hawai'i.